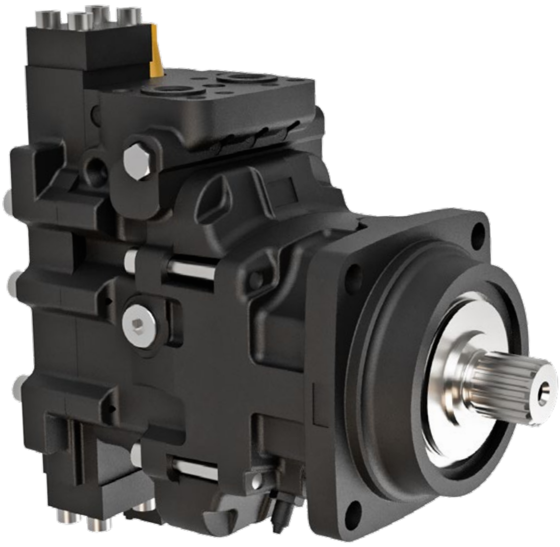
Visit our homepage for additional support **parker.com/pmde**



Hydraulic Motors

Series V12, V14, V16
Variable Displacement

ENGINEERING YOUR SUCCESS.

Basic formulas for hydraulic motors

Flow (q)

$$q = \frac{D \times n}{1000 \times \eta_v} \text{ [l/min]}$$

Torque (M)

$$M = \frac{D \times \Delta p \times \eta_{hm}}{63} \text{ [Nm]}$$

Power (P)

$$P = \frac{q \times \Delta p \times \eta_t}{600} \text{ [kW]}$$

D – displacement [cm^3/rev]

n – shaft speed [rpm]

η_v – volumetric efficiency

Δp – differential pressure [bar] (between inlet and outlet)

η_{hm} – mechanical efficiency

η_t – overall efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

Basic formulas for hydraulic pumps

Flow (q)

$$q = \frac{D \times n \times \eta_v}{1000} \text{ [l/min]}$$

Torque (M)

$$M = \frac{D \times \Delta p}{63 \times \eta_{hm}} \text{ [Nm]}$$

Power (P)

$$P = \frac{q \times \Delta p}{600 \times \eta_t} \text{ [kW]}$$

D – displacement [cm^3/rev]

n – shaft speed [rpm]

η_v – volumetric efficiency

Δp – differential pressure [bar] (between inlet and outlet)

η_{hm} – mechanical efficiency

η_t – overall efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

Conversion factors

1 kg	2.20 lb
1 N	0.225 lbf
1 Nm	0.738 lbf ft
1 bar	14.5 psi
1 l	0.264 US gallon
1 cm^3	0.061 cu in
1 mm	0.039 in
1°C	$^5/_9$(°F-32)
1 kW	1.34 hp

Conversion factors

1 lb	0.454 kg
1 lbf	4.448 N
1 lbf ft	1.356 Nm
1 psi	0.068948 bar
1 US gallon	3.785 l
1 cu in	16.387 cm^3
1 in	25.4 mm
1°F	$^9/_5$°C + 32
1 hp	0.7457 kW

Content

Series V12/V14/V16

Series V12/V14/V16 is a bent-axis, variable displacement motor.

Parker Variable Bent-axis motors are designed for both open and closed circuit transmissions with focus on high performance machines.

V12 series is available in displacement 60 and 80 cc, Max intermittent pressure 480 bar, continuous pressure to 420 bar.

V14 series is available in displacement 110 and 160 cc, Max intermittent pressure 480 bar, continuous pressure to 420 bar.

V16 series is available in displacement 220 and 270 cc, Max intermittent pressure 550 bar, continuous pressure to 500 bar.

Features

- Thanks to low weight pistons with laminated piston rings and a compact design of the rotating parts, the Variable motors tolerates very high speeds
- High allowable speeds and operating pressures means high output power; the overall efficiency remains high throughout the entire displacement range
- The 9-piston design provides high start-up torque and smooth motor operation
- Wide displacement ratio (up to 5,5:1)
- Zero displacement capability V16
- Broad range of controls and accessory valves for most applications
- Small envelop size and a high power-to-weight ratio
- ISO, cartridge and SAE versions
- Low noise levels due to a very compact and sturdy design with smooth fluid passages
- Positive piston locking, strong synchronizing shaft, heavy-duty bearings and small number of parts add up to a compact and robust motor with long service life and proven reliability.

Applications

- Excavators
- Forestry machines
- Mining and drilling machines
- Wheel loaders
- Mobile winch drives
- Drill motor Oil&Gas
- Earth drilling Mobile
- Transmission Agriculture

Optional equipment

- Integrated sensor for speed and direction
- Integrated flushing or pressure relief valves
- Displacement sensor

Bearing life

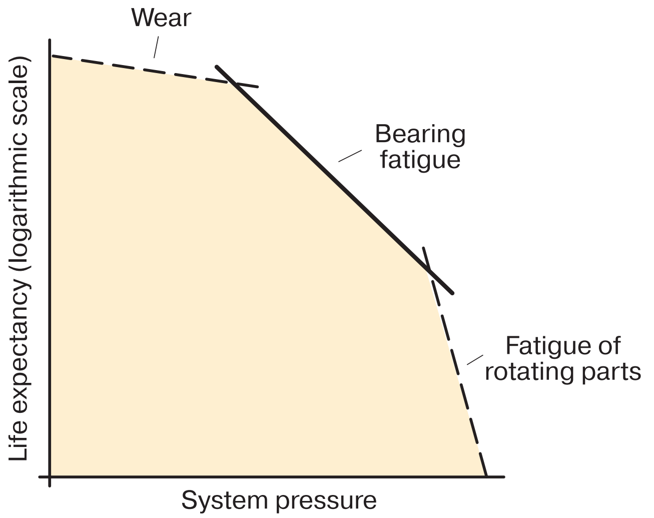
General information

Bearing life can be calculated for that part of the load/life curve (shown below) that is designated 'Bearing fatigue'. 'Fatigue of rotating parts' and 'Wear' caused by fluid contamination, etc., should also be taken into consideration when estimating the service life of a motor/pump in a specific application.

In reality, bearing life can vary considerably due to the quality of the hydraulic system (fluid condition, cleanliness, etc.)

Bearing life calculations are mainly used when comparing different motor frame sizes. Bearing life, designated B_{10} (or L_{10}), depends of system pressure, operating speed, external shaft loads, fluid viscosity in the motor case, and fluid contamination level.

The B_{10} value means that 90 % of the bearings survive at least the number of hours calculated. Statistically, 50 % of the bearings will survive at least five times the B_{10} life.



Hydraulic motor life versus system pressure.

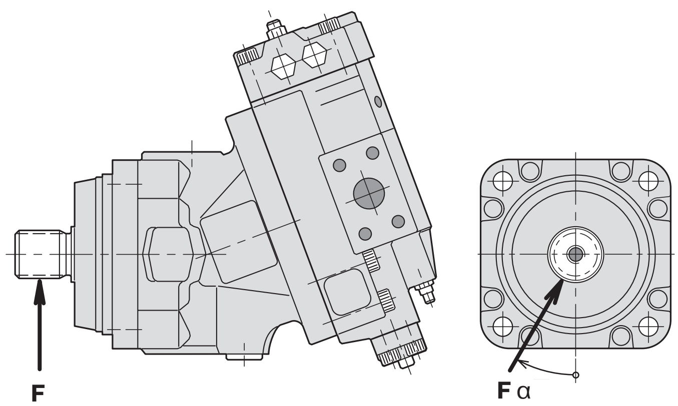
Bearing life calculation

An application is usually governed by a certain duty or work cycle where pressure, speed and displacement vary with time during the cycle.
Bearing life is also dependent on external shaft loads, case fluid viscosity and fluid contamination.

Required information

When requesting a bearing life calculation from Parker Hannifin, the following information (where applicable) should be provided:

- A short presentation of the application
- Motor size and version
- Duty cycle (pressure and speed versus time at specified displacements)
- Low pressure
- Case fluid viscosity
- Life probability (B_{10}, B_{20}, etc.)
- Direction of rotation (L or R)
- Axial load
- Fixed or rotating radial load
- Distance between flange and radial load
- Angle of attack (α) as defined below.



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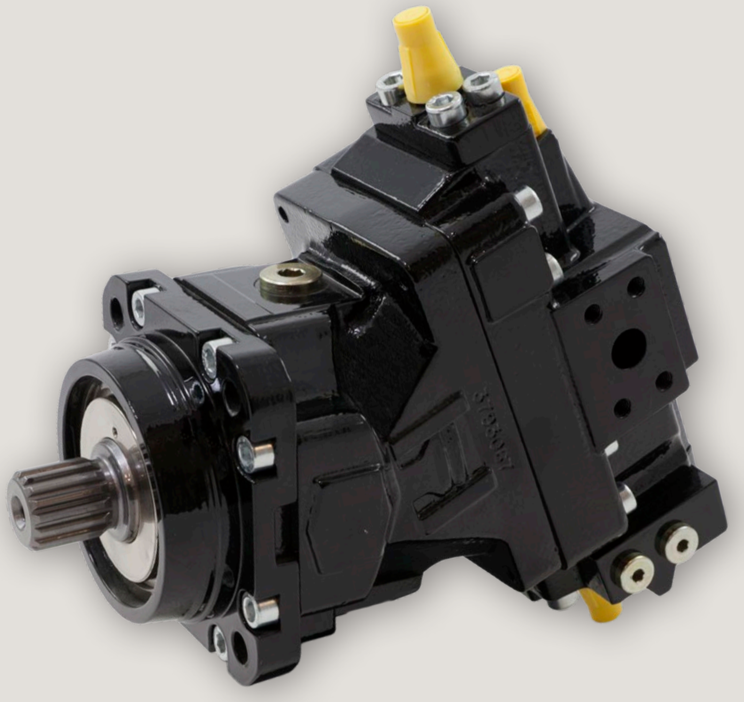
Trollhättan, Sweden

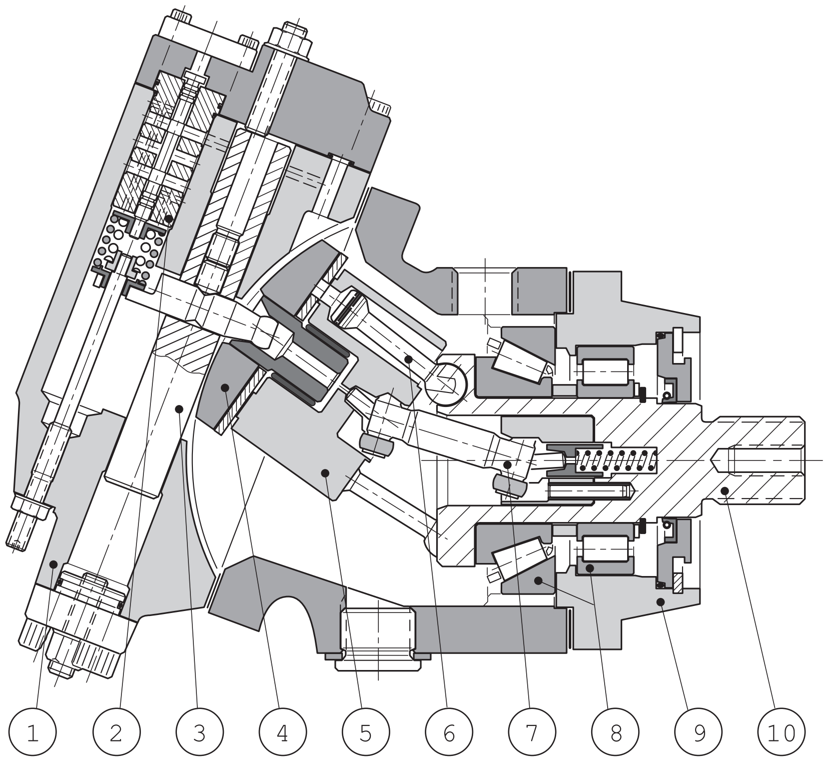
V12



Content **Page**

V12 cross section

1. End cap
2. Servo control valve
3. Setting piston
4. Valve segment
5. Cylinder barrel
6. Spherical piston with laminated piston ring
7. Synchronizing shaft
8. Heavy-duty roller bearings
9. Bearing housing
10. Output shaft

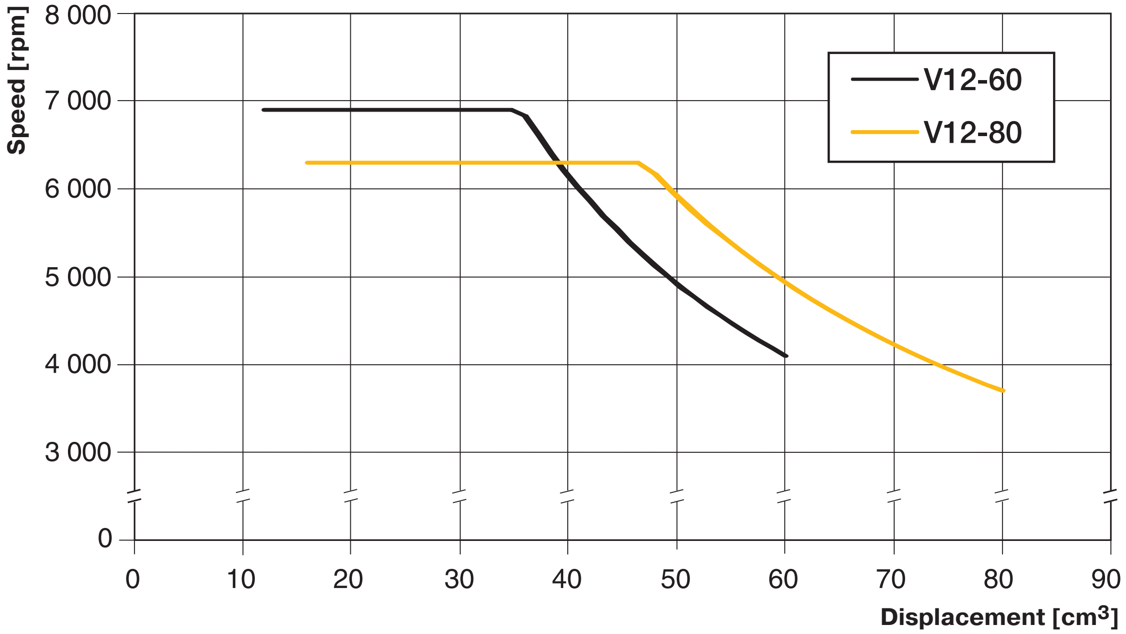


Specifications

V12 frame size	**60**	**80**
Displacement [cm³/rev]		
- max, at 35°	60	80
- min, at 6.5°	12	16
Operating pressure [bar]		
- max intermittent [1)]	480	480
- max continuous	420	420
Operating speed [rpm]		
- at 35°, max intermittent [1)]	4700	4300
- at 35°, max continuous	4100	3700
- at 6.5° – 20°, max intermittent [1)]	7900	7200
- at 6.5° – 20°, max continuous	6900	6300
- min continuous	50	50
Flow [l/min]		
- max intermittent [1)]	282	344
- max continuous	246	296
Torque (theor.) at 100 bar [Nm]	95	127
Max Output power [1)] [kW]	170	205
Corner power [kW]		
- intermittent [1)]	380	460
- continuous	290	350
Mass moment of inertia		
($x10^{-3}$) [kg m^2]	3.1	4.4
Weight [kg]	28	33

[1)] Max 6 seconds in any one minute.

Continuous Speed vs. Displacement



Efficiency diagrams

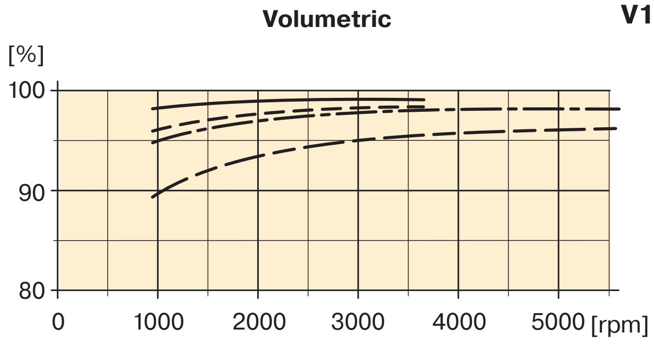
The following diagrams show volumetric and overall efficiencies versus shaft speed at 210 and 420 bar operating pressure, and at full (35˚) and reduced (10˚) displacements.

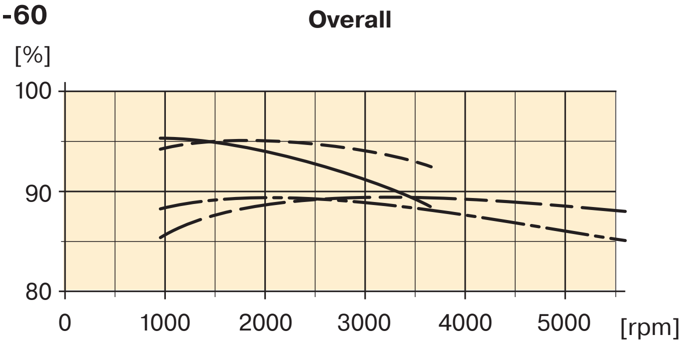
Information on efficiencies for a specific load condition can be made available from Parker Hannifin.

210 bar at full displacement
420 bar " " "

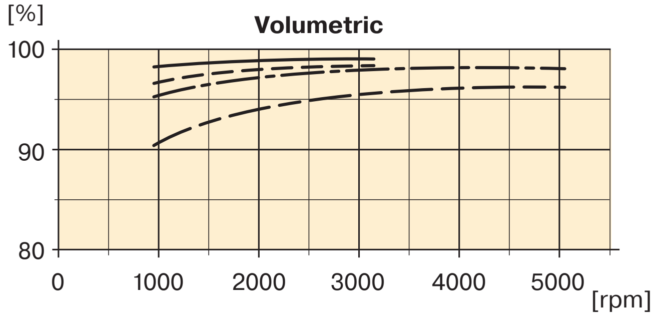
210 bar at reduced displacement
420 bar " " "

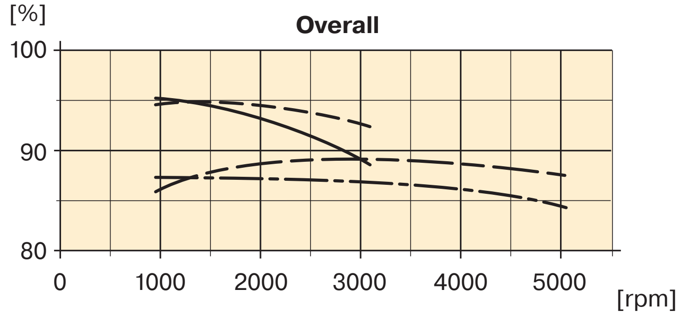
V12-60





V12-80





Controls (general information)

The following six V12 controls described below satisfy most application requirements:

- **AC** and **AH** (Pressure compensator)
- **EO** and **HO** (Two-position controls)
- **EP** and **HP** (Proportional controls).

All controls utilize a setting piston that connects to the valve segment (refer to the picture on page 7).

The built-in four-way servo valve acts on the setting piston and determines the displacement which can vary between 35˚ (max) and 6.5˚ (min).

Servo supply pressure is usually obtained from the main high pressure port through the built-in shuttle valve.

When using external servo supply, the servo pressure should be at least 30 bar.

The response time (i.e. from max to min displacement) is determined by orifices in the servo valve supply and return lines.

NOTE: The modulating pressure/current, Δp/ΔI values are valid for motors that are not displacement limited.

AC pressure compensator

The AC compensator is used in off-road vehicle hydrostatic transmissions; it automatically adjusts motor displacement to the output torque requirement (up to max available system pressure).

Normally, the motor stays in the minimum displacement position. When there is a demand for additional torque, i.e. when the vehicle enters an upgrade, the displacement increases (providing more torque) while the motor shaft speed decreases proportionally.

The threshold pressure (‘ps’; refer to the AC diagram) where displacement starts to increase, is adjustable between 150 and 400 bar.

To reach max displacement, an additional modulating pressure (Δp) above the threshold pressure (ps) is required.

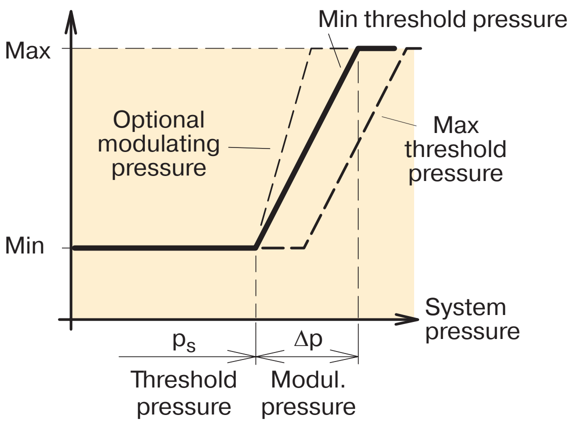
To satisfy specific hydraulic circuit requirements, a modulating pressure, Δp, of 15, 25 or 50 bar can be selected.

The AC compensator is available in two versions:

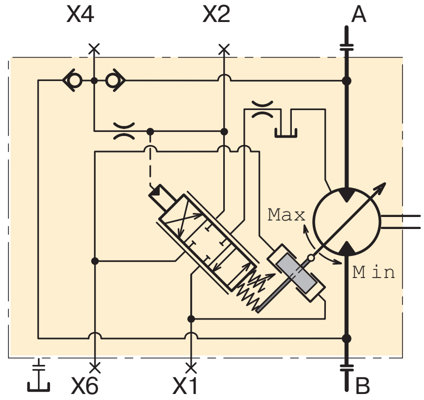
ACI 01 I - Internal pilot pressure

ACE 01 I (optional) - External pilot pressure; port X5 can, for example, be connected to the ’forward drive’ pressure line of a vehicle transmission to prevent motor displacement increase when the vehicle is going downhill.

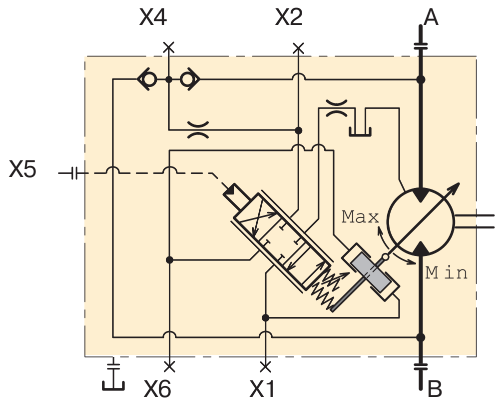
Gauge/pilot ports (AC compensator):	
X1	Setting piston pressure (increasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure
X6	Setting piston pressure (decreasing displ.)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	9/16"-18 O-ring boss (SAE version).



AC diagram.



ACI 01 I schematic (spool in a balanced, mid-pos.).



ACE 01 I schematic (spool in a balanced, mid-pos.).

AH pressure compensator

The AH compensator is similar to the AC (page 9) but incorporates an hydraulic override device. It is utilized in hydrostatic transmissions where a high degree of manoeuvrability at low vehicle speeds is desirable.

When the override is pressurized, the servo piston moves to the max displacement position irrespective of system pressure, provided the servo supply pressure is at least 20 bar.

The AH compensator is available in two versions:

AHI 01 I – Same as the ACI except for the override; internal pilot pressure.

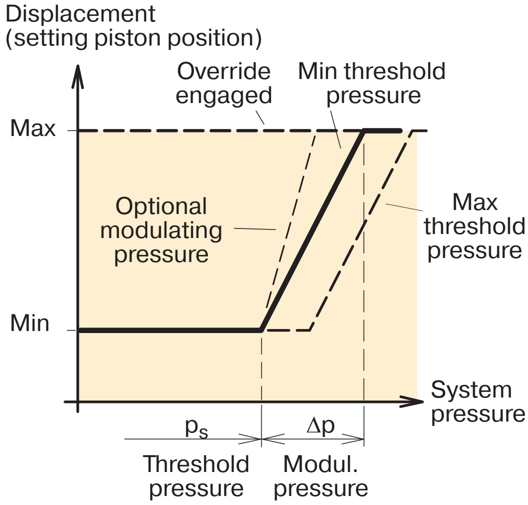
AHE 01 I – (optional) External pilot pressure (port X5; compare ACE, page 9).

Required override pressure, port X7 (min 20 bar):

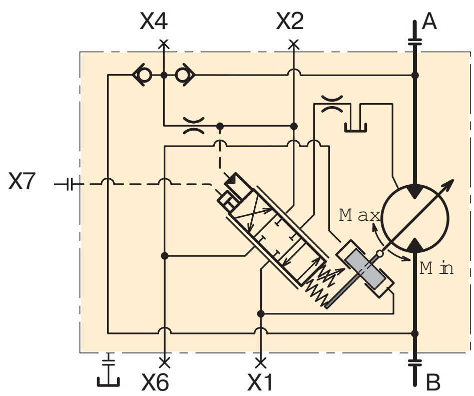
$$p_7 = \frac{p_S + \Delta p}{24} \quad [bar]$$

p_7 = Override pressure
p_s = System pressure
Δp = Modulating pressure

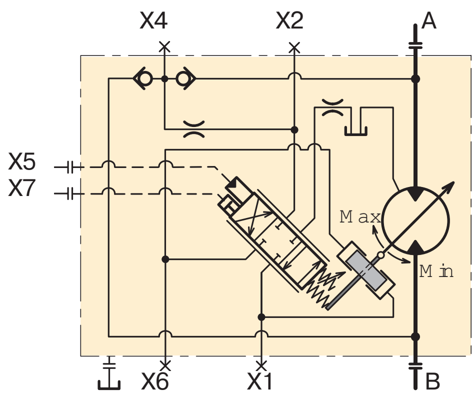
Gauge/pilot ports (AH compensator)	
X1	Setting piston pressure (increasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure
X6	Setting piston pressure (decreasing displ.)
X7	Override pressure
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^9/_{16}$"-18 O-ring boss (SAE version).



AH diagram.



AHI 01 I schematic (spool in a balanced, mid-pos.).



AHE 01 I schematic (spool in a balanced, mid-pos.).

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EO two-position control

The EO is a two-position control, where max and min displacements are governed by a DC solenoid attached to the control cover

The EO control is utilized in transmissions where only two operating modes are required: Low speed/high torque or high speed/low torque.

The servo piston, normally in the max displacement position, shifts to the min displacement position when the solenoid is activated. Intermediate displacements cannot be obtained with this control.

Servo pressure is supplied internally (through the shuttle valve from one of the main high pressure ports) or externally (port X4).

The solenoid is either 12 or 24 VDC, requiring 1200 and 600 mA respectively. The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The female connector is available as spare part, P-N 3787488.

The EO two-position control is available in four versions:

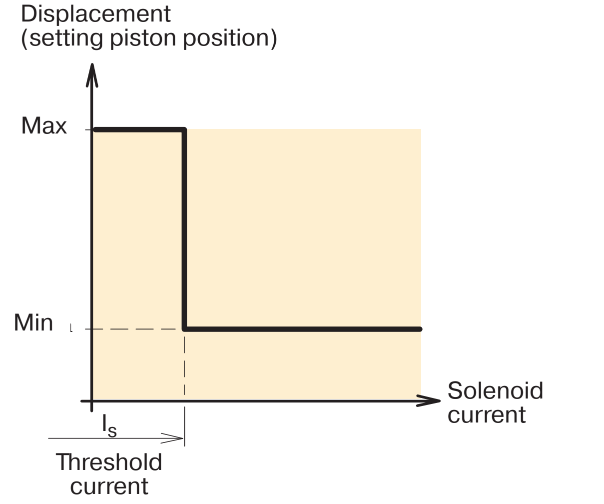
EOH 01 I – Internal servo supply, 24 VDC

EOL 01 I – Internal servo supply, 12 VDC

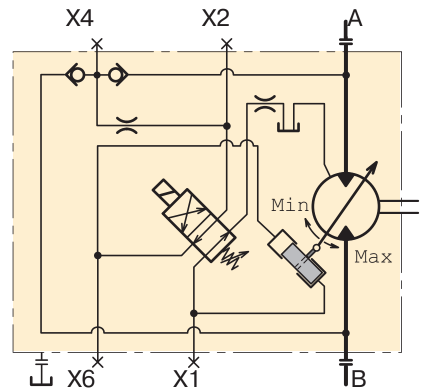
EOH 01 E (optional) – External servo supply, 24 VDC

EOL 01 E (optional) – External servo supply, 12 VDC

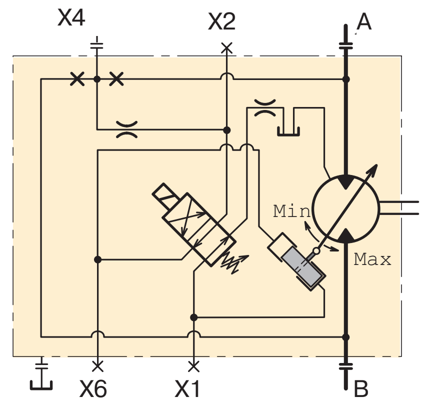
Gauge/pilot ports (EO control):	
X1	Setting piston pressure (max-to-min)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X6	Setting piston pressure (min-to-max)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^9/_{16}$"-18 O-ring boss (SAE version).



EO diagram.



EO H 01 I schematic (non-activated solenoid).



EO H 01 E schematic (non-activated solenoid).

EP proportional control

The EP electrohydraulic proportional control is used in hydrostatic transmissions requiring a continuously variable shaft speed. The position of the setting piston is governed by a DC solenoid attached to the control cover.

When the solenoid current increases above the threshold current, the servo piston starts to move from the max towards the min displacement position. The displacement vs. solenoid current is shown in the diagram to the right. Please note, that the shaft speed vs. current is non-linear; refer to the diagram below.

Solenoids are available in 12 and 24 VDC versions, requiring a max current of approx. 1100 and 550 mA respectively. The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The female connector is available as spare part, P-N 3787488.

The threshold current (I_S) is factory set 400 mA at 12 VDC/200 mA at 24 VDC) but is adjustable (12 VDC: 250 – 450 mA; 24 VDC: 100 – 230 mA).

When utilizing the full displacement range, the required modulating current (ΔI) is 600 and 300 mA respectively.

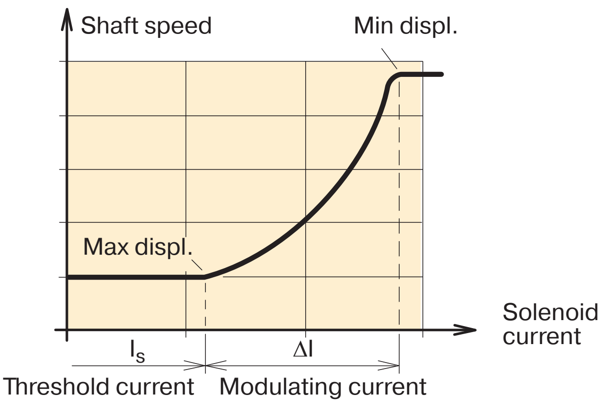
In order to minimize hysteresis, a pulse-width modulated control signal of 70 to 90 Hz should be utilized.
See also “Controls, Note” on page 9.

NOTE: The modulating current (ΔI) is not adjustable.

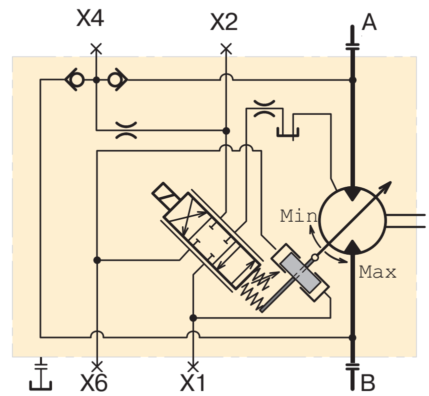
The EP control is available in four versions:

EP H 01 I – Internal servo supply, 24 VDC
EP L 01 I – Internal servo supply, 12 VDC
EP H 01 E – External servo supply, 24 VDC (optional)
EP L 01 E – External servo supply, 12 VDC (optional)

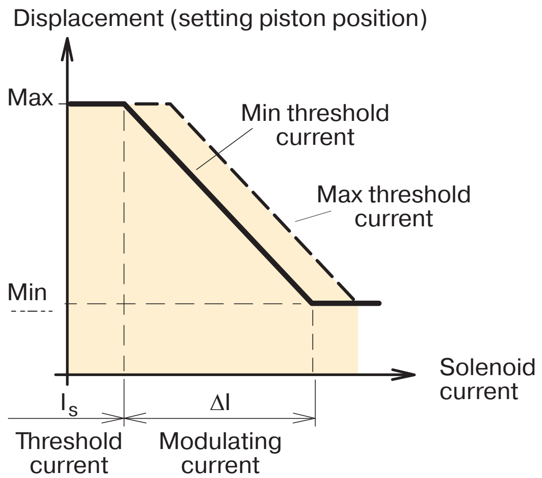
Gauge/pilot ports (EP control):	
X1	Setting piston pressure (decreasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X6	Setting piston pressure (increasing displ.)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^9/_{16}$"-18 O-ring boss (SAE version).



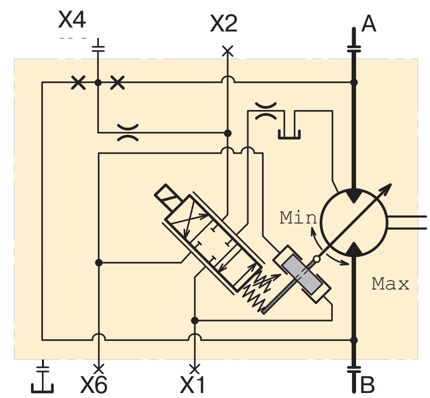
Shaft speed vs. solenoid current (EP control).



EP H 01 I schematic (spool in a balanced, mid-pos.).



EP diagram.



EP H 01 E schematic (spool in a balanced, mid-pos.).

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HO two-position control

The two-position HO control is similar to the EO (page 11) but the pilot signal is hydraulic. The position of the setting piston is governed by the built-in servo valve (same on all compensators and controls).

When the applied pilot pressure (port X5) exceeds the pre-set threshold pressure, the setting piston moves from the max to the min displacement position.

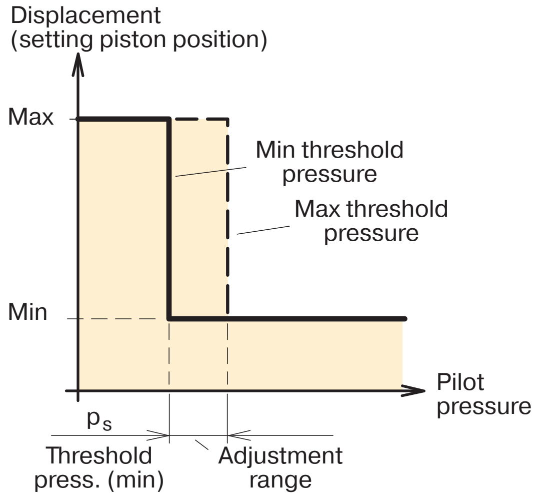
The threshold pressure is factory set at 10 bar but can be adjusted between 5 and 25 bar.

The HO two-position control is available in two versions:

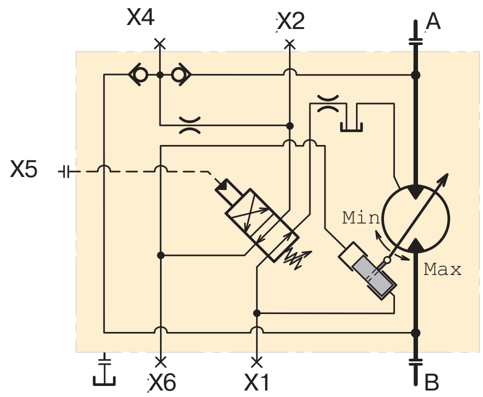
HO S 01 I – Internal servo supply

HO S 01 E – External servo supply (port X4) (optional)

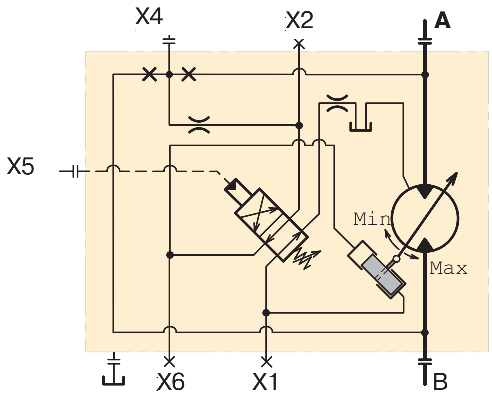
Gauge/pilot ports (HO control):	
X1	Setting piston pressure (max-to-min)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar)
X6	Setting piston pressure (min-to-max)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	9/16"-18 O-ring boss (SAE version).



HO diagram.



HO S 01 I schematic (X5 not pressurized).



HO S 01 E schematic (X5 not pressurized).

HP proportional control

Like the EP control described on page 12, the HP proportional control offers continuously variable displacement, but the pilot signal is hydraulic.

Normally, the setting piston stays in the max displacement position. When a sufficiently high pilot pressure (p_S) is applied to port X5, the setting piston starts to move towards the min displacement position.

As can be seen in the diagram to the right, the displacement changes in proportion to the applied modulating pressure.

In contrast, shaft speed vs. pilot pressure is non-linear; refer to the diagram below.

The following modulating pressures (Δp) can be selected: 15 or 25 bar.

The threshold pressure (p_S) is factory set at 10 bar but is adjustable between 5 and 25 bar.

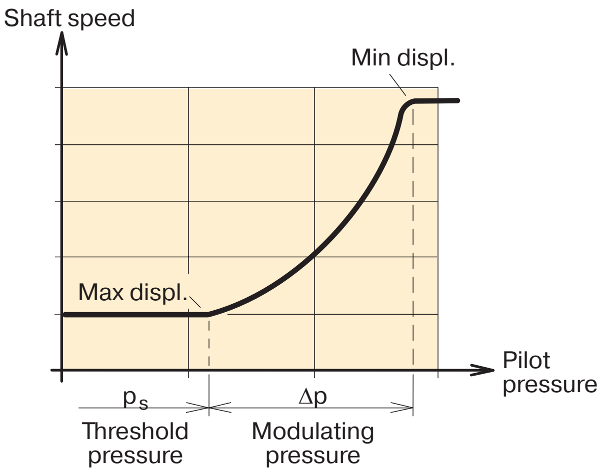
See also “Controls, Note” on page 9.

Two versions of the HP control are available:

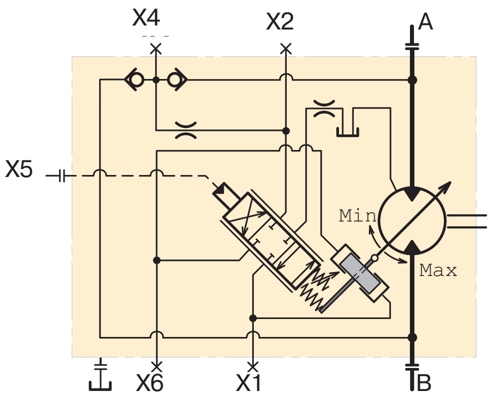
HPS 01 I – Internal servo supply

HPS 01 E – External servo supply (port X4) (optional)

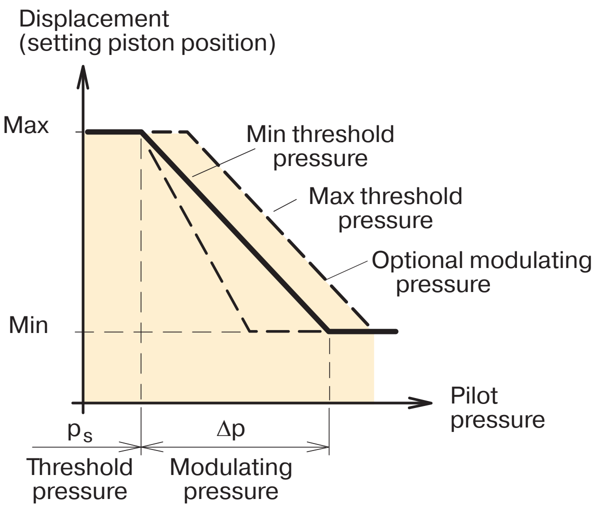
Gauge/pilot ports (HP control):	
X1	Setting piston pressure (decreasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar)
X6	Seetting piston pressure (increasing displ.)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).



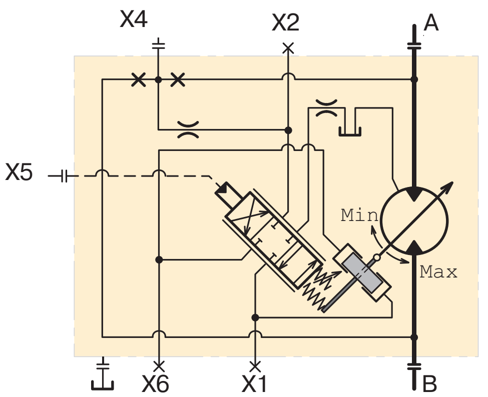
Shaft speed vs. pilot pressure (HP control).



HP S 01 I schematic (spool in a balanced, mid-pos.).



HP diagram.



HP S 01 E schematic (spool in a balanced, mid-pos.).

ISO version (basic configuration)

V12	–		–			–		V	–		–		–	D	–		–		/	
Motor type		Frame size		Function	Main ports		Mount. flange	Shaft seal		Shaft		Version number		Status		Speed sensor		Max displacement		Min displacement

Frame size	
Code	Displacem. (cm^3/rev)
060	60
080	80

Frame size		60	80
Code	Function		
M	Motor; normal end cap position: EO, EP, HO and HP	x	x
T	Motor; normal end cap position: AC and AH	x	x

Frame size		60	80
Code	Main ports		
A	SAE flange; metric threads, rear ports	x	x
F	SAE flange; metric threads, side ports	x	x

Frame size		60	80
Code	Mounting flange		
I	ISO flange	x	x
N	ISO flange	(x)	(x)

Frame size		60	80
Code	Shaft seal		
V	PPS	x	x

Frame size		60	80
Code	Shaft (DIN 5480)		
C	Spline	(x)	(x)
D	Spline	x	x

Max and min displacement
[cm^3/rev]

Code	Speed sensor*
P	Prepared for speed sensor
O	None

Code	Status
D	Control pressure setting; max and min displacement screws sealed

Version number
Factory assigned for special versions

* Note.
See information on page 97, Speed Sensor

x: Available (x): Optional – : Not available

Controls and flushing valve, see page 18

Cartridge version (basic configuration)

V12	–		–			–	C	V	–		–		–	D	–		–		/	
Motor type		Frame size		Func-tion	Main ports		Mount.-flange	Shaft seal		Shaft		Version number		Status		Speed sensor		Max displacement		Min displacement

Frame size	
Code	Displacem. (cm^3/rev)
060	60
080	80

Frame size		60	80
Code	Function		
M	Motor; normal end cap position: EO, EP, HO and HP	x	x
T	Motor; normal end cap position: AC and AH	x	x

Frame size		60	80
Code	Main ports		
A	SAE flange; metric threads, rear ports	x	x
F	SAE flange; metric threads, side ports	x	x

Frame size		60	80
Code	Mounting flange		
C	Cartridge flange	x	x

Frame size		60	80
Code	Shaft seal		
V	PPS	x	x

Frame size		60	80
Code	Shaft (DIN 5480)		
C	Spline	(x)	(x)
D	Spline	x	x

Max and min displacement
[cm^3/rev]

Code	Speed sensor*
P	(Speed sensor only available for V12-60)
O	None

Code	Status
D	Control pressure setting; max and min displacement screws sealed

Version number
Factory assigned for special versions

* Note.
See information on page 97, Speed Sensor

x: Available (x): Optional – : Not available

Controls and flushing valve, see page 18

SAE version (basic configuration)

V12	–		–			–	S	V	–	S	–		–	D	–		–		/	
Motor type		Frame size		Function	Main ports		Mount. flange	Shaft seal		Shaft		Version number		Status		Speed sensor		Max displacement		Min displacement

Frame size	
Code	Displacem. (cm^3/rev)
060	60
080	80

Frame size		60	80
Code	Function		
M	Motor; normal end cap position: EO, EP, HO and HP	x	x
T	Motor; normal end cap position: AC and AH	x	x

Frame size		60	80
Code	Main ports		
S	SAE flange; UN threads, side ports	x	x
U	SAE flange; UN threads, rear ports	x	x

Frame size		60	80
Code	Mounting flange		
S	SAE flange	x	x

Frame size		60	80
Code	Shaft seal		
V	PPS	x	x

Frame size		60	80
Code	Shaft (SAE J498b)		
S	Spline	x	x

Max and min displacement
[cm^3/rev]

Code	Speed sensor*
P	Prepared for speed sensor
O	None

Code	Status
D	Control pressure setting; max and min displacement screws sealed

Version number
Factory assigned for special versions

* Note.
See information on page 97, Speed Sensor

x: Available (x): Optional – : Not available

Controls and flushing valve, see page 18

Controls and flushing valve

Basic configuration (ISO, Cartridge or SAE; see previous three pages) – [ ] – [ ] – [ ]

Control designation | Settings | Flushing valve

Frame size		60	80
Code	**Control designation**		
AC I 01 I	Pressure compensator, internal pilot pressure, internal servo supply	x	x
AC E 01 I	Pressure compensator, external pilot pressure, internal servo supply	(x)	(x)
AH I 01 I	Pressure compensator, hydraulic override, internal pilot pressure, internal servo supply	x	x
AH E 01 I	Pressure compensator, hydraulic override, external pilot pressure, internal servo supply	(x)	(x)
EOL 01 I	Electrohydraulic, two-position, 12 VDC, internal servo supply	x	x
EOL 01 E	Electrohydraulic, two-position, 12 VDC, external servo supply	(x)	(x)
EOH 01 I	Electrohydraulic, two-position, 24 VDC, internal servo supply	x	x
EOH 01 E	Electrohydraulic, two-position, 24 VDC, external servo supplyv	(x)	(x)
EPL 01 I	Electrohydraulic proportional, 12 VDC, internal servo supply	x	x
EPL 01 E	Electrohydraulic, proportional, 12 VDC, external servo supply	(x)	(x)
EPH 01 I	Electrohydraulic, proportional, 24 VDC, internal servo supply	x	x
EPH 01 E	Electrohydraulic, proportional, 24 VDC, external servo supply	(x)	(x)
HOS 01 I	Hydraulic two-position, standard version internal servo supply	x	x
HOS 01 E	Hydraulic two-position, standard version external servo supply	(x)	(x)
HPS 01 I	Hydraulic proportional, standard version internal servo supply	x	x
HPS 01 E	Hydraulic proportional, standard version external servo supply	(x)	(x)

NOTE: '01' - Standard nozzles x: Available (x): Optional – : Not available

Settings	
AC, AH:	Threshold pressure: 150 to 400 bar / Modulating pressure: 015, 025 or 050 bar
EO, EP:	Threshold current: 12 VDC – 400 mA; 24 VDC - 200 mA Modulating current: EO – 000; EP, 12 VDC - 600 mA; EP, 24 VDC – 300 mA
HO, HP:	Threshold pressure: 010 bar / Modulating pressure: HO - 000; HP – 015 or 025 bar

Code	Flushing valve
L 01	Integrated flushing valve; 01 – std. nozzle 1.3 mm (option; refer to page 93).

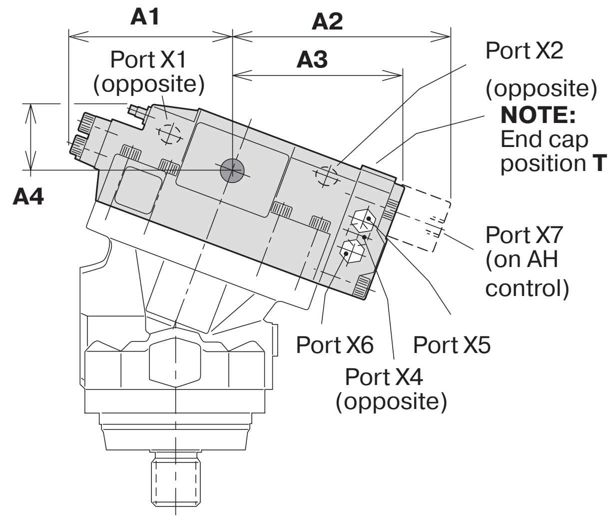
Control installation dimensions

NOTE: - The basic motor side port locations are shown on pages 20, 22 and 24.
- End cap position: Refer to the ordering codes, pages 15 to 17.

- Control/gauge ports are:
  - M14x1.5 (ISO and cartridge versions).
  - $^{9}/_{16}$"-18 UNF (SAE version).
- All dimensions are max.

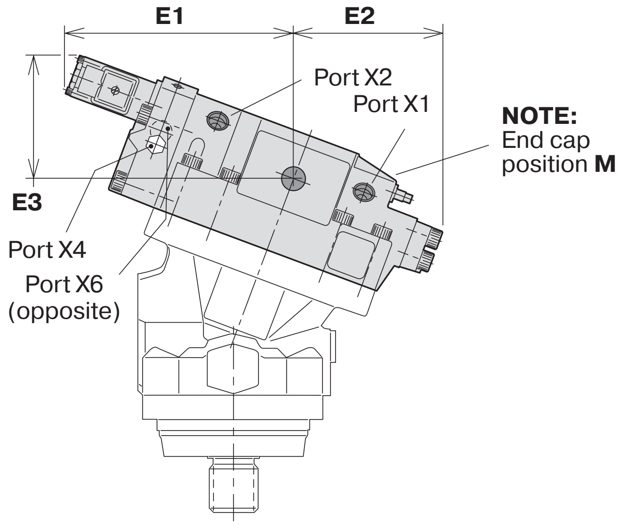
AC and AH compensators

Dim.	V12-60	(inch)	V12-80	(inch)
A1	132	5.20	138	5.43
A2	186	7.32	188	7.40
A3	143	5.63	145	5.71
A4	55	2.17	57	2.24



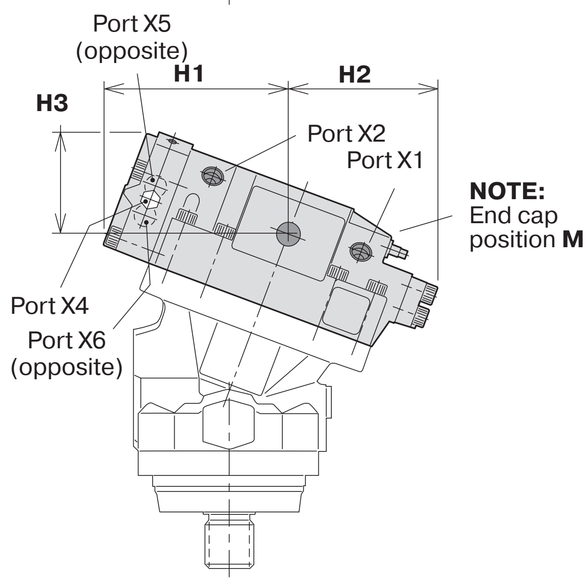
EO and EP controls

Dim.	V12-60	(inch)	V12-80	(inch)
E1	190	7.48	192	7.56
E2	121	4.76	125	4.92
E3	106	4.17	106	4.17

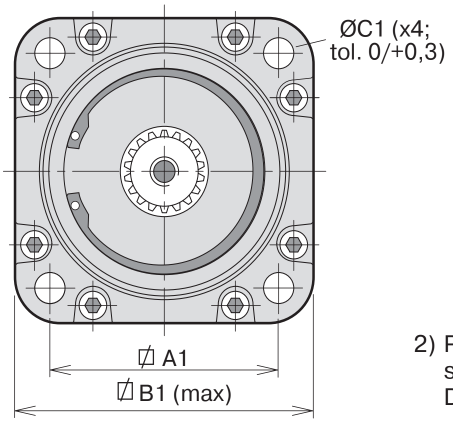


HO and HP controls

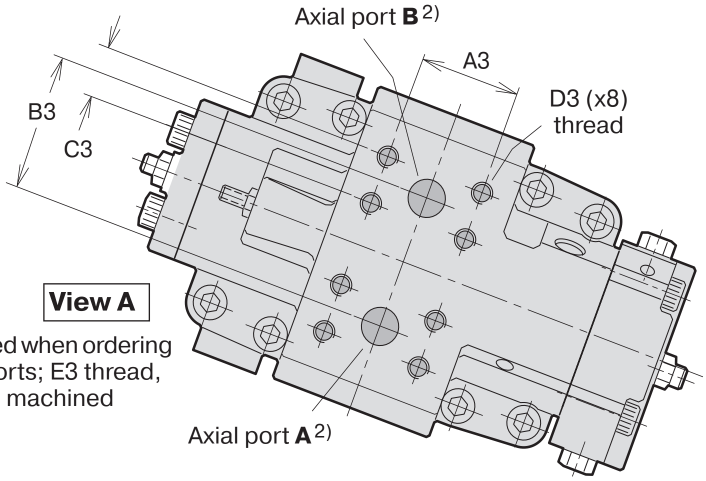
Dim.	V12-60	(inch)	V12-80	(inch)
H1	153	6.02	156	6.14
H2	121	4.76	125	4.92
H3	86	3.39	85	3.35



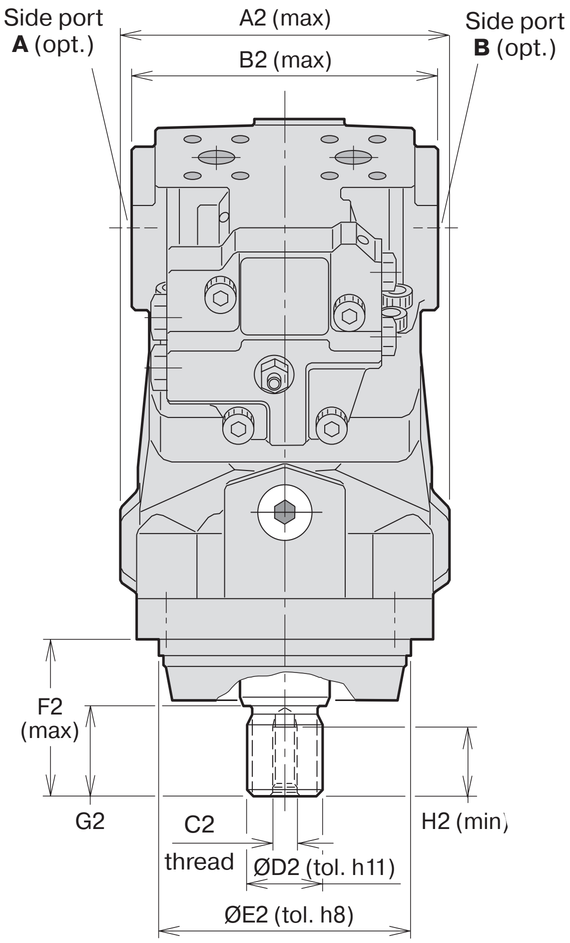
ISO version V12-60, V12-80

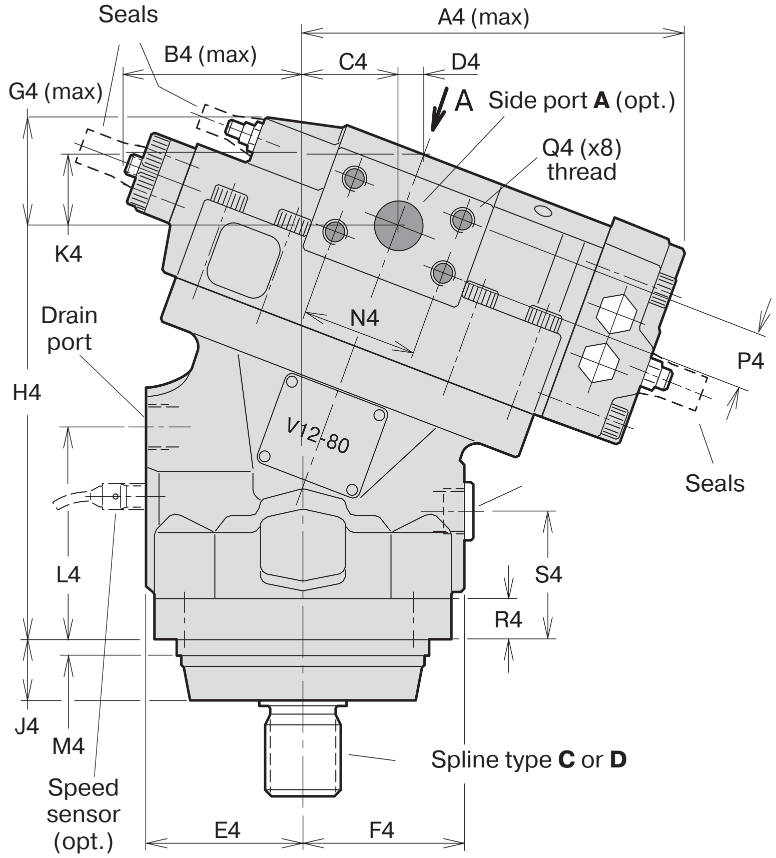


Mounting flange type **I** (ISO 3019/2)

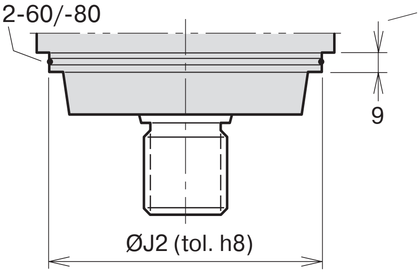


2) Plugged when ordering side ports; E3 thread, D3 not machined





O-ring: V12-60/-80



Flange type **N**
V12-60/-80: Optional
A1: 127.3
B1: 171
O-ring (incl.) - 132x3

Shown: V12-80 with AC compensator

Size	V12-60	V12-80
A1	113.2	113.2
B1	151	151
C1	14	14
A2	159	165
B2	146	154
C2	M12	M12
D2*	34.6	39.6
E2	125	125
F2*	73	78
G2*	40	45
H2	28	24
J2	140	140
A3	50.8	50.8
B3	66	66
C3	23.8	23.8
D3 1)	M10 x 20	M10x 20
E3 2)	M22 x 1.5	M22 x 1.5
A4	188	193
B4	87	90
C4	45	48.3
D4	13.4	13.1
E4	76	78
F4	77	80
G4	55	57
H4	188	199
J4	31.5	31.5
K4	35.5	34.6
L4	94	101
M4	9	9
N4	50.8	57.2
P4	23.8	27.8
Q4 1)	M10 x 20	M12 x 23
R4	20	20
S4	57.5	60.5

Ports

Type	V12-60	V12-80
Axial	19 [3/4"]	19 [3/4"]
Side	19 [3/4"]	25 [1"]
Drain 2)	M22 x 1.5	M22 x 1.5

Main ports: ISO 6162, 41.5 MPa, type II
(SAE J518c, 6000 psi)

Spline type **C** 3) (DIN 5480)

Size	Dimension
V12-60	W30 x 2 x 14 x 9 g
V12-80	W35 x 2 x 16 x 9 g

Spline type **D** 3) (DIN 5480)

Size	Dimension
V12-60	W35 x 2 x 16 x 9 g
V12-80	W40 x 2 x 18 x 9 g

Flange

Size	I	N
V12-60	standard	optional
V12-80	standard	optional

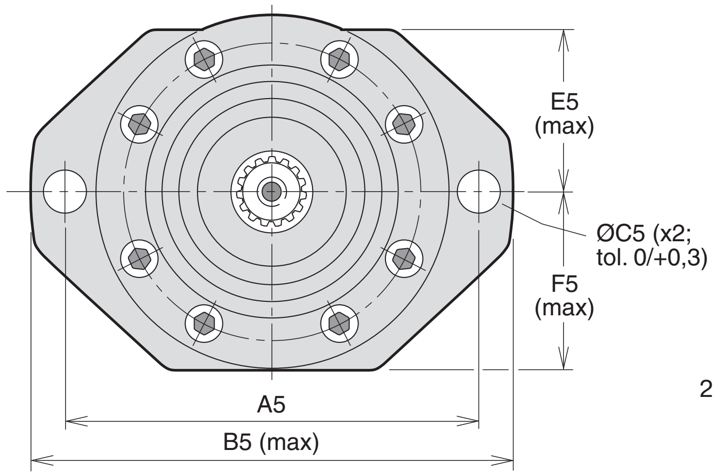
* Dimension for shaft type **D**. Shaft type **C** dimensions are 5 mm shorter than those of type D.

1) Metric thread x depth in mm

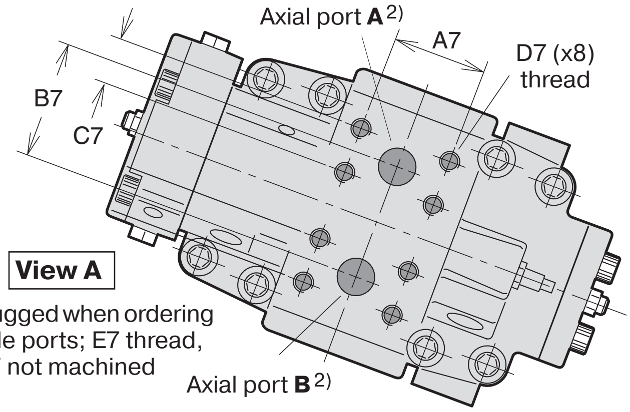
2) Metric thread x pitch in mm

3) '30° involute spline, side fit'.

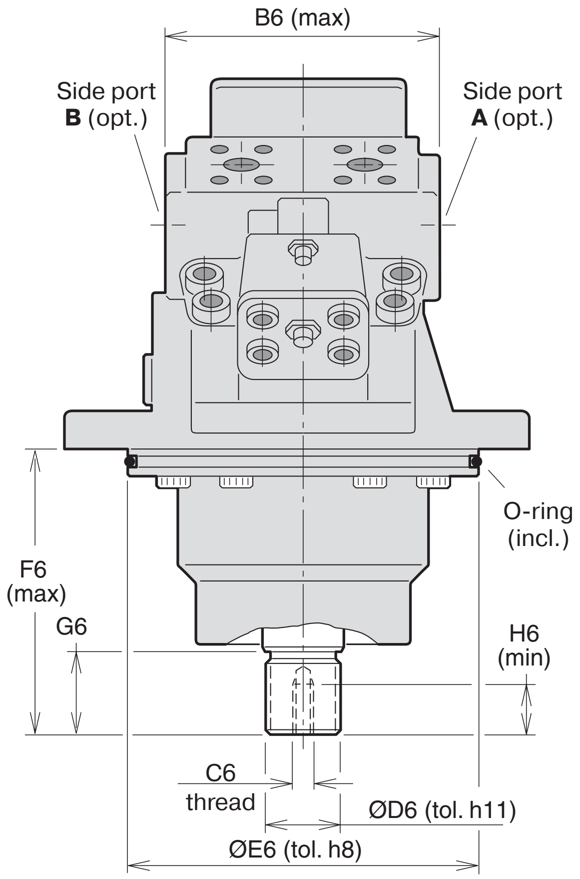
Cartridge version V12-60, V12-80

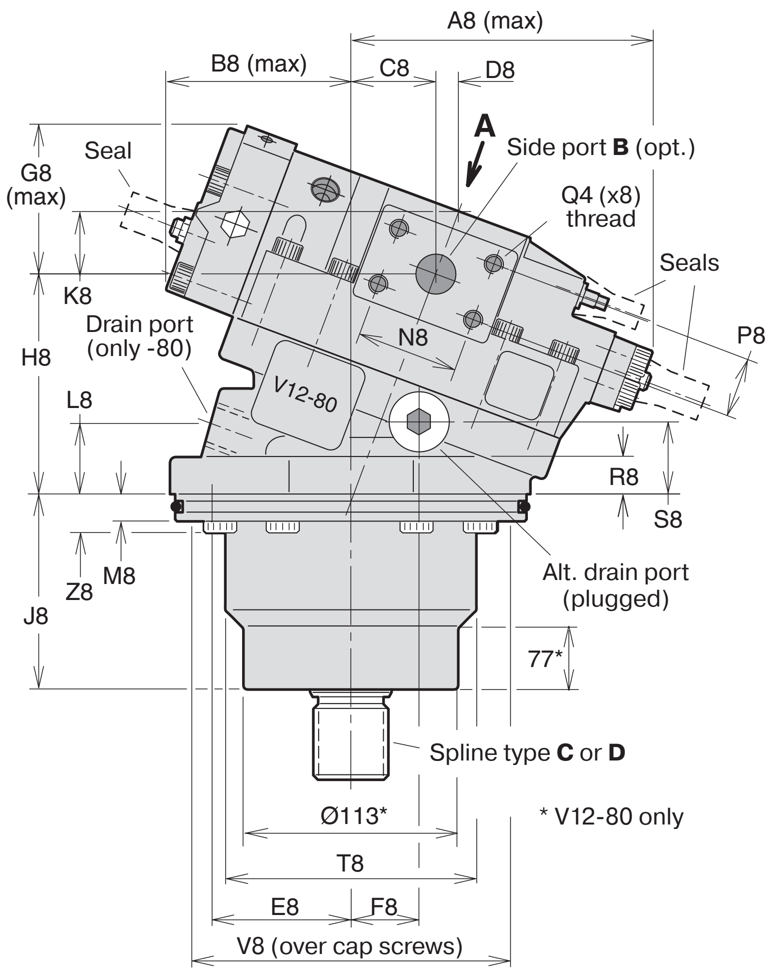


Mounting flange type **C**



2) Plugged when ordering side ports; E7 thread, D7 not machined





Shown: V12-80 with HO control

Size	V12-60	V12-80
A5	200	224
B5	238	263
C5	18	22
E5	78.5	89.5
F5	83	99.5
B6	146	154
C6	M12	M12
D6*	34.6	39.6
E6	160	190
F6	133	156.5
G6*	40	45
H6	28	28
A7	50.8	50.8
B7	66	66
C7	23.8	23.8
D7[1)]	M10 x 20	M10 x 22
E7[2)]	M22 x 1.5	M22 x 1.5
A8	166	173
B8	108	108
C8	45	48.3
D8	13.4	13.1
E8	77	77.5
F8	39	38
G8	86	85
H8	127	120.5
J8	90	106
K8	35.5	34.6
L8	39	39
M8	15	15
N8	50.8	57.2
P8	23.8	27.8
Q8[1)]	M10 x 20	M12 x 23
R8	20	20
S8	39	39
T8	121	139
V8	151	177
Z8	22	22

Ports

Type	V12-60	V12-80
Axial	19 [$^3/_4$"]	19 [$^3/_4$"]
Side	19 [$^3/_4$"]	25 [1"]
Drain	–	M22x1.5
Alt. drain	M18 x 1.5	M18 x 1.5

Main ports: ISO 6162, 41.5 MPa, type II
(SAE J518c, 6000 psi)

Spline type **C** [3)] (DIN 5480)

Size	Dimension
V12-60	W30 x 2 x 14 x 9 g
V12-80	W35 x 2 x 16 x 9 g

Spline type **D** [3)] (DIN 5480)

Size	Dimension
V12-60	W35 x 2 x 16 x 9 g
V12-80	W40 x 2 x 18 x 9 g

O-rings

Size	Dimension
V12-60	150 x 4
V12-80	180 x 4

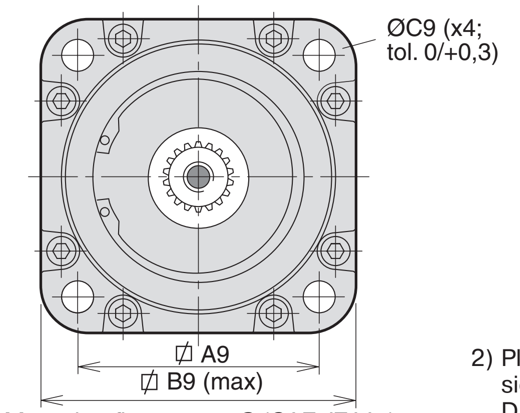
* Dimension for shaft type **D**. Shaft type **C** dimensions are 5 mm shorter than those of type D.

1) Metric thread x depth in mm

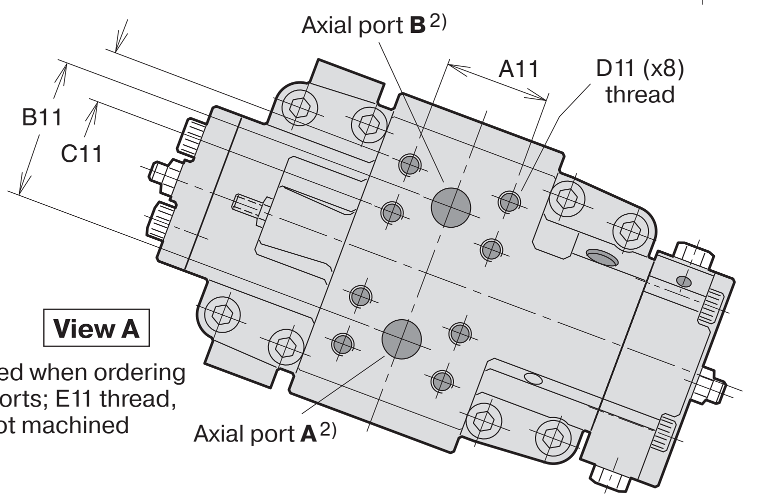
2) Metric thread x pitch in mm

3) ’30˚ involute spline, side fit’.

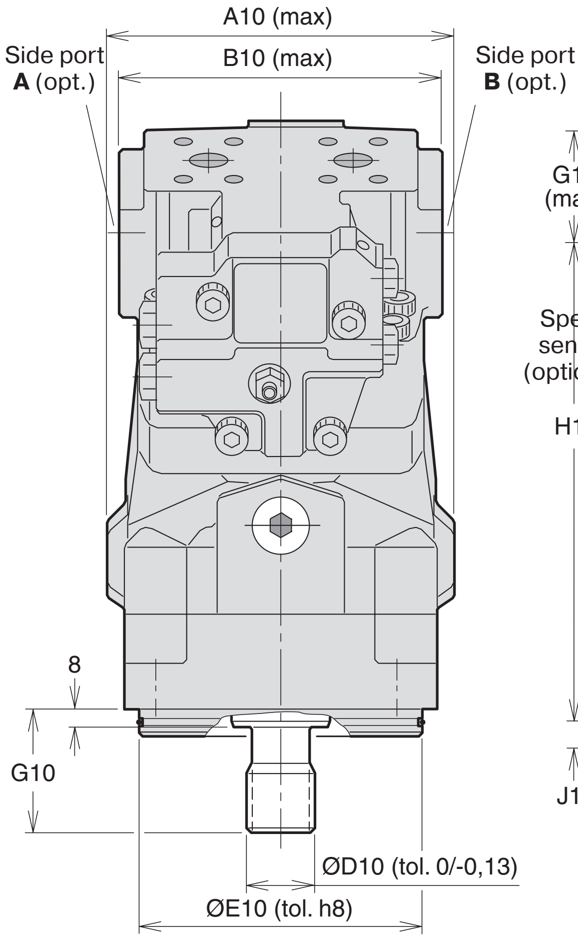
SAE version V12-60, V12-80

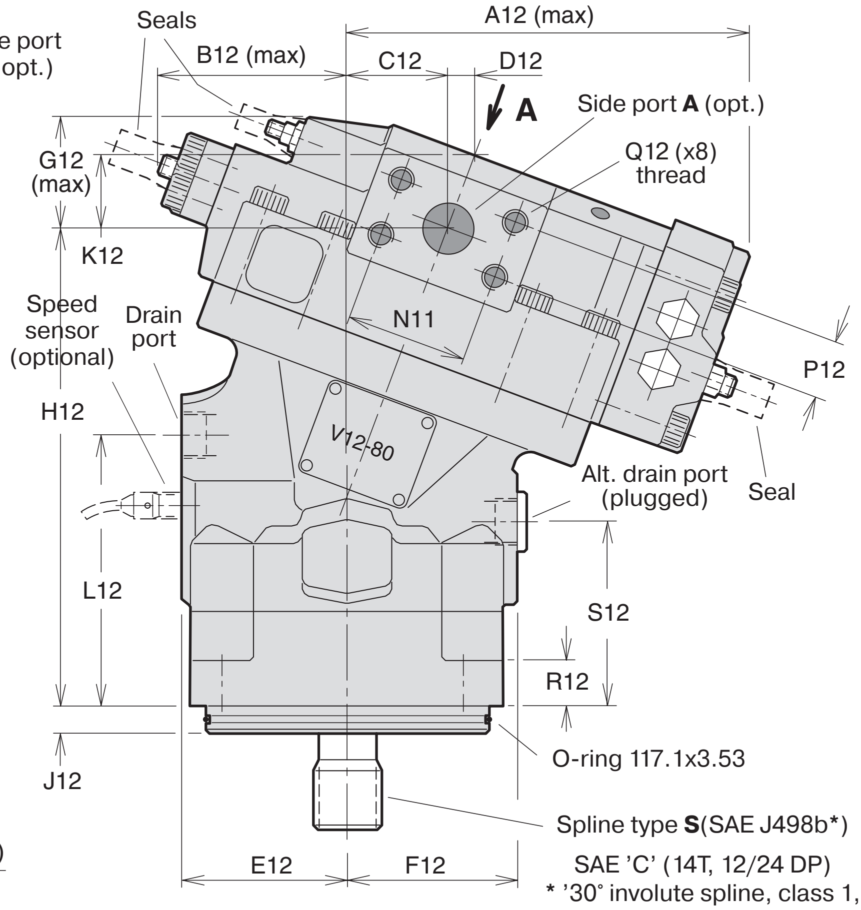


Mounting flange type **S** (SAE J744c)
Dimension SAE C



2) Plugged when ordering side ports; E11 thread, D11 not machined





Spline type **S**(SAE J498b*)
SAE 'C' (14T, 12/24 DP)
* '30° involute spline, class 1, flat root, side fit'.

Shown: V12-80 with AC compensator

Size	V12-60	(inch)	V12-80	(inch)
A9	114.5	4.51	114.5	4.51
B9	149	5.87	149	5.87
C9	14.3	0.56	14.3	0.56
A10	159	6.26	165	6.50
B10	146	5.75	154	6.06
D10	31.22	1.23	31.22	1.23
E10	127.00	5.00	127.00	5.00
G10	55.6	2.19	55.6	2.19
A11	50.8	2.00	50.8	2.00
B11	66	2.60	66	2.60
C11	23.8	0.98	23.8	0.98
D11[1)]	3/8"-16 x 20	3/8"-16 x 0.79	3/8"-16 x 20	3/8"-16 x 0.79
E11[2)]	M22 x 1.5	-	M22 x 1.5	-
A12	188	7.40	193	7.60
B12	87	3.43	90	3.54
C12	45	1.77	48.3	1.90
D12	13.4	0.53	13.1	0.52
E12	76	2.99	78	3.07
F12	77	3.03	80	3.15
G12	55	2.17	57	2.24
H12	212	8.35	223	8.78
J12	12.7	0.50	12.7	0.50
K12	35.5	1.40	34.6	1.36
L12	118	4.65	125	4.92
N12	50.8	2.00	57.2	2.25
P12	23.8	0.93	27.8	1.09
Q12*	3/8"-16 x 20	3/8"-16 x 0.79	7/16"-14 x 20	7/16"-14 x 0.79
R12	20	0.79	20	0.79
S12	81.5	3.21	84.5	3.33

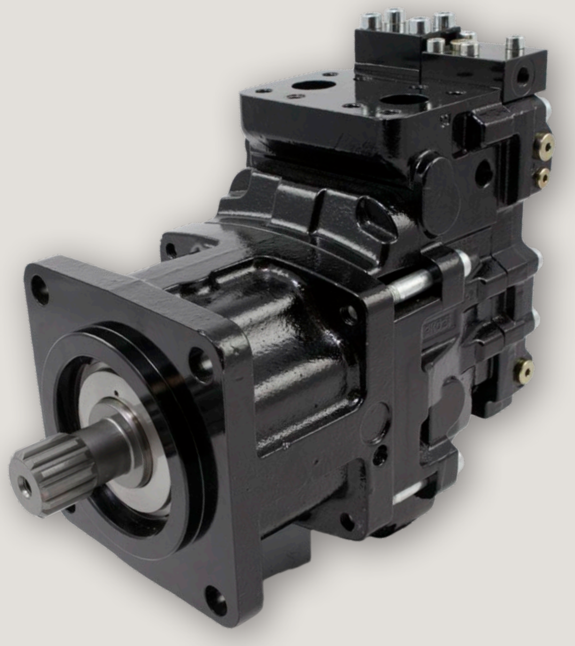
1) UNC thread x depth in mm
2) Metric thread x pitch in mm.

Ports

Type	V12-60	V12-80
Axial	3/4"	3/4"
Side	3/4"	1"
Drain	7/8"-14	7/8"-14

Main ports: 6000 psi (SAE J518c).
Drain ports: O-ring boss, UNF thread (SAE 514).

V14

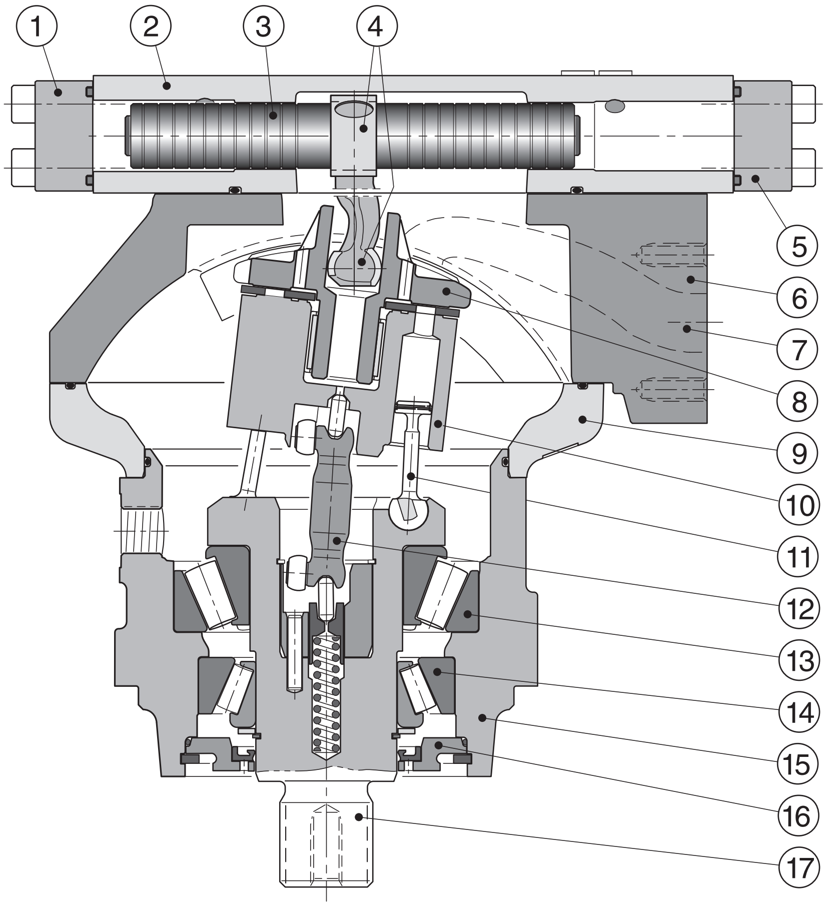


Content

Page

V14 cross section

1. End cover, min displ.
2. Control module
3. Setting piston
4. Connecting arm
5. End cover, max displ.
6. Connection module
7. Main pressure port
8. Valve segment
9. Intermediate housing
10. Cylinder barrel
11. Spherical piston with laminated piston ring
12. Synchronizing shaft
13. Inner roller bearing
14. Outer roller bearing
15. Bearing housing
16. Shaft seal with retainer
17. Output shaft



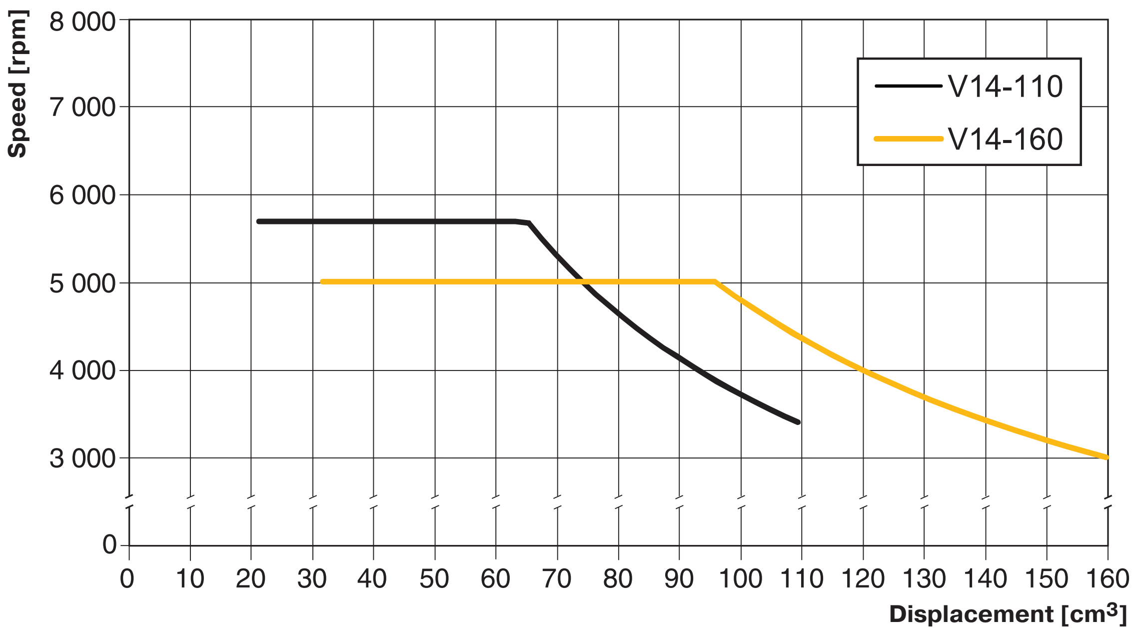
Specifications

V14 frame size	110	160
Displacement [cm³/rev]		
- max, at 35°	110	160
- min, at 6.5°	22	32
Operating pressure [bar]		
- max intermittent [1)]	480	480
- max continuous	420	420
Operating speed [rpm]		
- at 35°, max intermittent [1)]	3900	3400
- at 35°, max continuous	3400	3000
- at 6.5° – 20°, max intermittent [1)]	6500	5700
- at 6.5° – 20°, max continuous	5700	5000
- min continuous	50	50

V14 frame size	110	160
Flow [l/min]		
- max intermittent [1)]	430	550
- max continuous	375	480
Torque (theor.) at 100 bar [Nm]	175	255
Max otput power [1)] [kW]	262	335
Corner power [kW]		
- intermittent [1)]	570	730
- continuous	440	560
Mass moment of inertia		
($x10^{-3}$) [kg m^2]	8.2	14.5
Weight [kg]	54	68

1) Max 6 seconds in any one minute.

Continuous Speed vs. Displacement



Efficiency diagrams

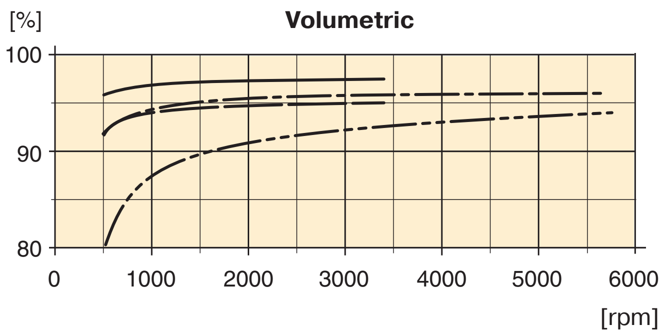
The following diagrams show volumetric, mechanical and overall efficiencies versus shaft speed at 210 and 420 bar operating pressure, and at full (35˚) and reduced (10˚) displacements.

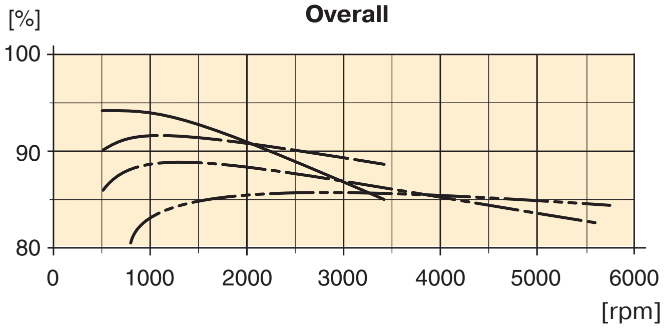
Information on efficiencies for a specific load condition can be made available from Parker Hannifin.

210 bar at full displacement
420 bar " "

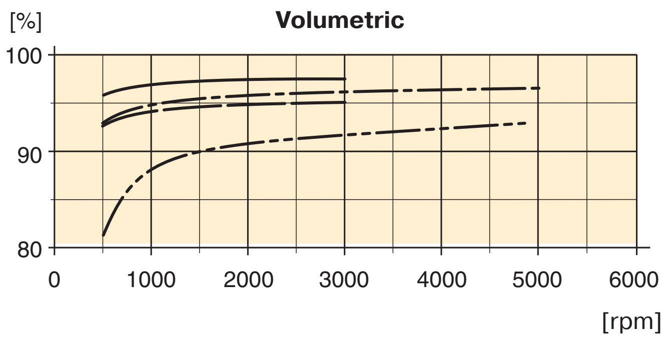
210 bar at reduced displacement
420 bar " "

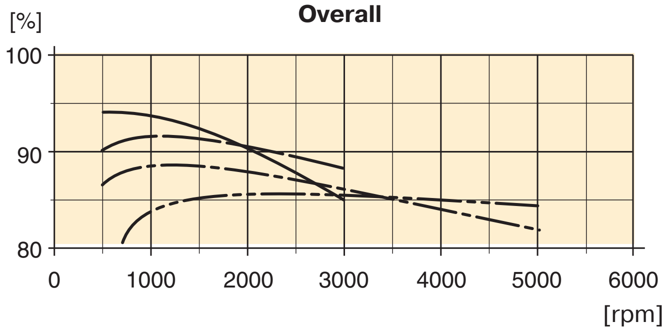
V14-110





V14-160





Controls – general information

The following V14 controls satisfy most application requirements:

- **AC** and **AH** (automatic pressure compensators)
- **EO** and **HO** (two-position controls)
- **EP** and **HP** (proportional controls)
- **HPC/EPC** (HP/EP control with pressure cut off, see page 39)

All controls utilize a servo piston that connects to the valve segment (refer to the illustration on page 27).

The built-in four-way servo valve determines the position of the servo piston and, in turn, the displacement.

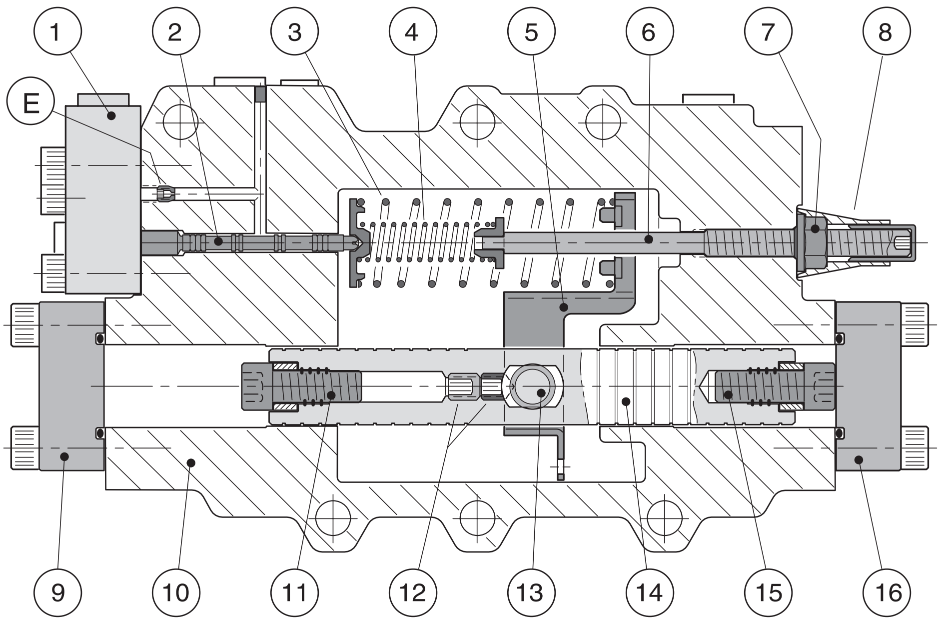
The displacement angle (between output shaft and cylinder barrel) ranges from 35˚ (max) to 6.5˚ (min).

Servo supply pressure is obtained from the pressurized, main port through the corresponding, built-in shuttle valve.

The response time (i.e. from max-to-min or from min-to-max displacement) is determined by restrictor nozzles in the servo valve supply and return lines; refer to the schematics.

NOTE: The modulating pressure/current, $\Delta p/\Delta I$ values are valid for motors that are not diplacement limited.

AC pressure compensator



Cross section of the AC pressure compensator module.

1. AC control cover
2. Servo valve spool
3. Modulating spring
4. Threshold spring
5. Feedback arm
6. Threshold adjustment screw
7. Seal nut
8. Two-part seal (threshold adjustm't)*
9. End cover (max displ.)
10. Control module housing
11. Max displ. limiting screw/bushing
12. Set screws
13. Connecting arm
14. Setting piston
15. Min displ. limiting screw/bushing
16. End cover (min displ.).

E. Orifice location; refer to the hydraulic schematics, pages 31 to 32.

* Yellow cap = factory set.
Red cap 3797065 available as spare part

AC compensator function

Refer to the illustration below (left):

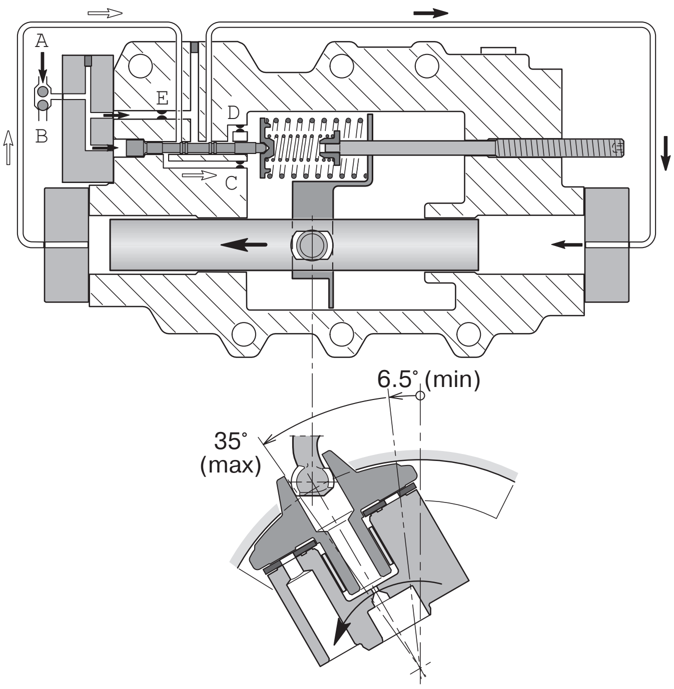
When pressure in port A (or B) increases, the servo valve spool is pushed to the right, directing flow to the right hand setting chamber – the setting piston moves to the left; displacement and output torque increases.

At the same time, the shaft speed decreases correspondingly (at a constant pump flow to the motor).

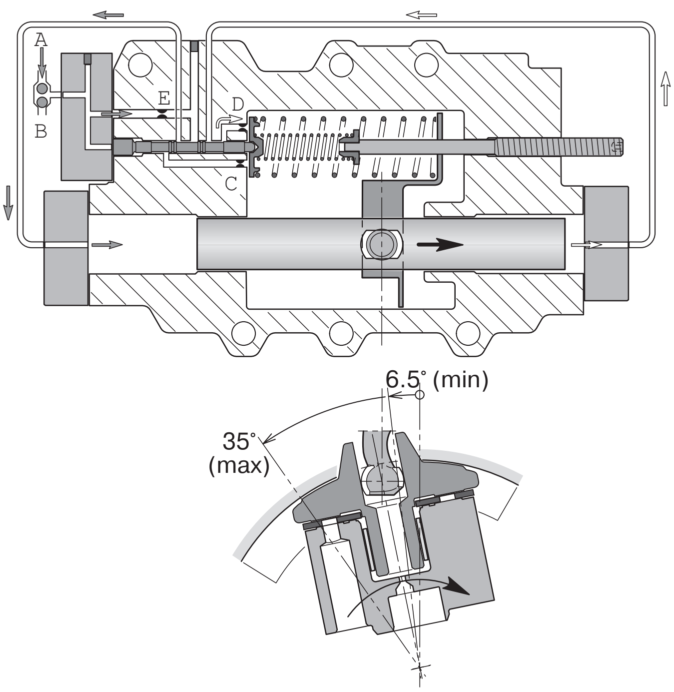
Refer to the illustration below (right):

When pressure in port A (or B) decreases, the servo valve spool moves to the left, directing flow to the left hand setting chamber – the setting piston moves to the right; displacement and output torque decreases.

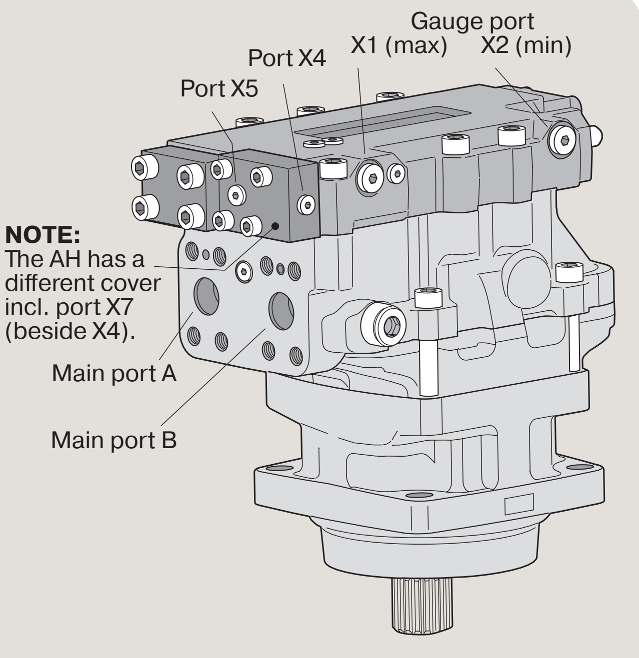
At the same time, the shaft speed increases correspondingly (at a constant pump flow to the motor).



AC function (displ. increases at increasing system pressure).



AC function (displ. decreases at decreasing system pressure).



Port locations – V14- with AC or AH compensator.

Gauge/pilot ports (AH compensator)	
X1	Setting piston pressure (decreasing displ.)
X2	Setting piston pressure (increasing displ.)
X4	Servo supply pressure (before orifice and filter)
X5	Pilot pressure
X7	Override pressure (on the AH)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

AC compensator function (cont'd)

The AC compensator is used in off-road vehicle hydrostatic propel transmissions. The compensator automatically adjusts motor displacement between available max and min to the output torque requirement (up to max available system pressure).

Normally, the motor stays in the minimum displacement position. When there is a demand for additional torque, e.g. when the vehicle enters an upgrade, the displacement increases (providing more torque) while the motor shaft speed decreases proportionally.

The threshold pressure, where displacement starts to increase ('p_S'; refer to the AC diagram), is adjustable between 100 and 400 bar.

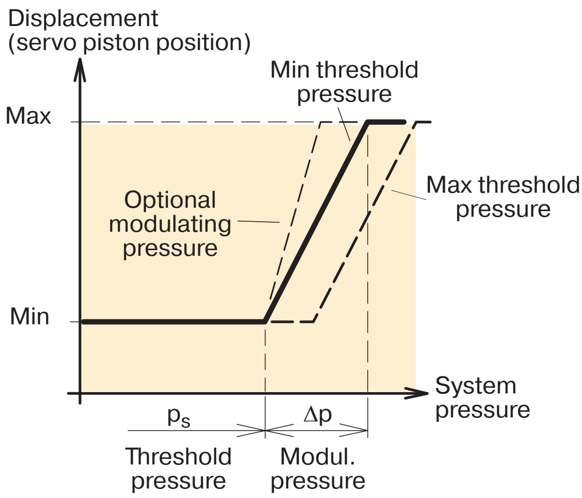
To reach max displacement, an additional modulating pressure (Δp) above the threshold pressure is required.

To satisfy specific hydraulic circuit requirements, a modulating pressure of 15, 25, 50 or 80 bar can be selected.

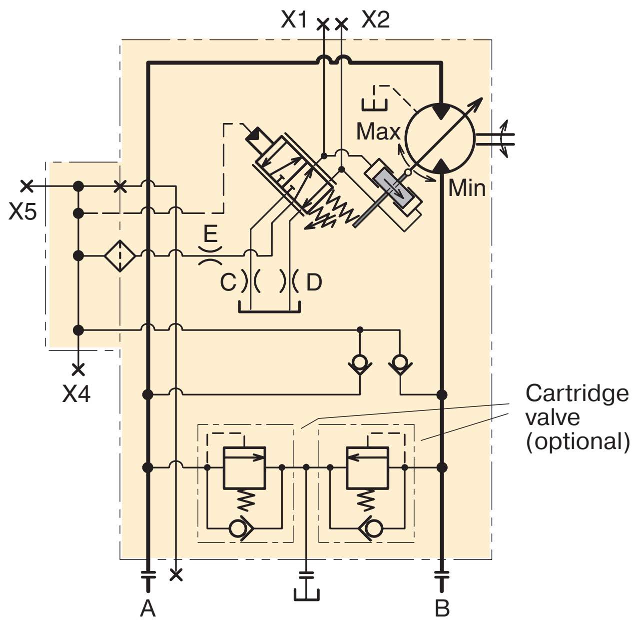
The pressure compensator is supplied with a small filter installed in the AC control cover (between ports X4 and X5); refer to the schematic below right.

Gauge/pilot ports (AC and AH compensators):	
X1	Setting piston pressure (decreasing displ.)
X2	Setting piston pressure (increasing displ.)
X4	Servo supply pressure (before orifice and filter)
X5	Pilot pressure
Port sizes:	
–	M14 x 1.5 (ISO and cartridge versions)
–	9/16"-18 O-ring boss (SAE version).

NOTE: Port locations are shown in the illustration on page 30.



AC diagram (displacement vs. system pressure).



AC schematic (shown: control moving towards min displ.)

AH pressure compensator

The AH compensator incorporates an hydraulic over-ride device. It is utilized in hydrostatic transmissions where a high degree of manoeuvrability at low vehicle speeds is desirable.

When the override is pressurized, the setting piston moves to the max displacement position irrespective of system pressure, provided the servo supply pressure is at least 30 bar.

Required override pressure, port X7 (min 20 bar):

$$p_7 = \frac{p_S + \Delta p}{24} \text{ [bar]}$$

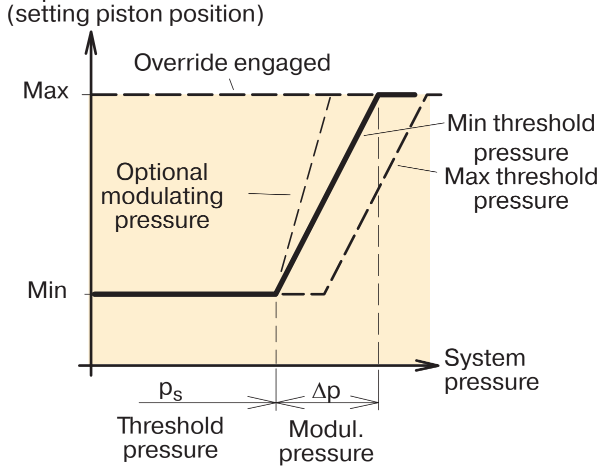
p_7 = Override pressure

p_S = System pressure

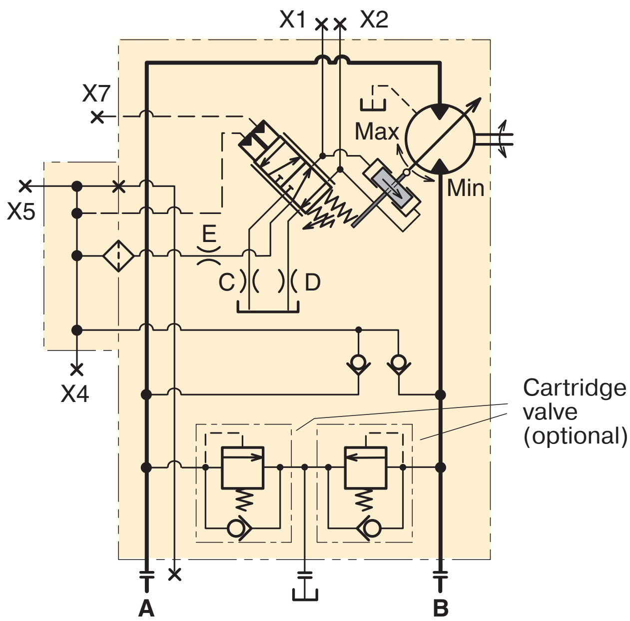
Δp = Modulating pressure

Gauge/pilot ports (AH compensator):	
X1	Setting piston pressure (decreasing displ.)
X2	Setting piston pressure (increasing displ.)
X4	Servo supply pressure (before orifice and filter)
X5	Pilot pressure
X7	Override pressure
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

NOTE: Port locations are shown in the illustration on page 30.



AH diagram (displacement vs. system pressure).



AH schematic (shown: override port X7 not pressurized; the compensator is moving towards min displacement).

EO, EP, HO and HP controls

(general information)

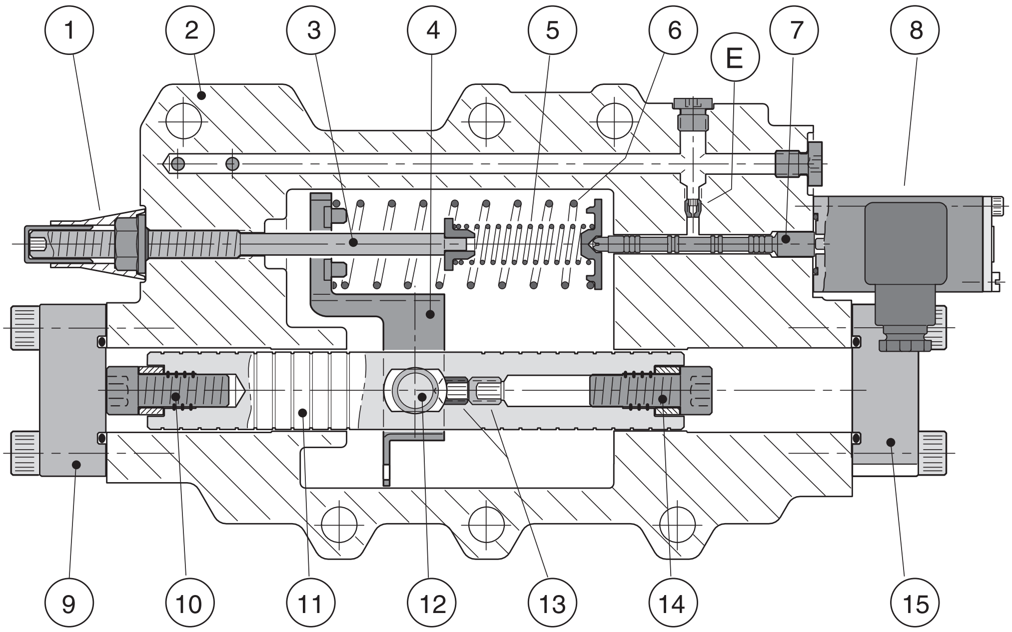
Basically, these controls function in a similar way.

At increasing solenoid current (EP) or increasing pilot pressure (HP) the control moves towards the min displacement position.

At decreasing current or pilot pressure, the control retracts towards max displacement.

In comparison with EP and HP, the EO and HO controls have no modulating spring; this means that only min and max displacements can be obtained with these controls.

Max and min displacements can be limited by a screw with spacer bushing as shown below.



Cross section of the EP control module.

1. Two-part seal (threshold adjustm't) *
2. Control module housing
3. Threshold adjustment screw
4. Feedback arm
5. Threshold spring
6. Modulating spring (EP, HP only)
7. Servo valve spool
8. Solenoid (EO, EP only); cover on HO, HP
9. End cover (max displ. limit)
10. Max displ. limiting screw/bushing
11. Setting piston
12. Connecting arm
13. Set screws
14. Min displ. limiting screw/bushing
15. End cover (min displ. limit)

E. Orifice location; refer to the hydraulic schematics, pages 35 to 38.

* Yellow cap = factory set.
Red cap 3797065 available as spare part

EP control function (solenoid current increasing)

NOTE: Valid also for the HP at increasing pilot pressure.

Refer to the illustration below left:

At an increasing current (above the threshold value), the solenoid spool pushes left on the servo valve spool, and flow is directed to the left hand setting chamber - the setting piston moves to the right and the displacement decreases. This means, that the shaft speed in-creases while the output torque decreases correspondingly (at a constant pump flow and system pressure).

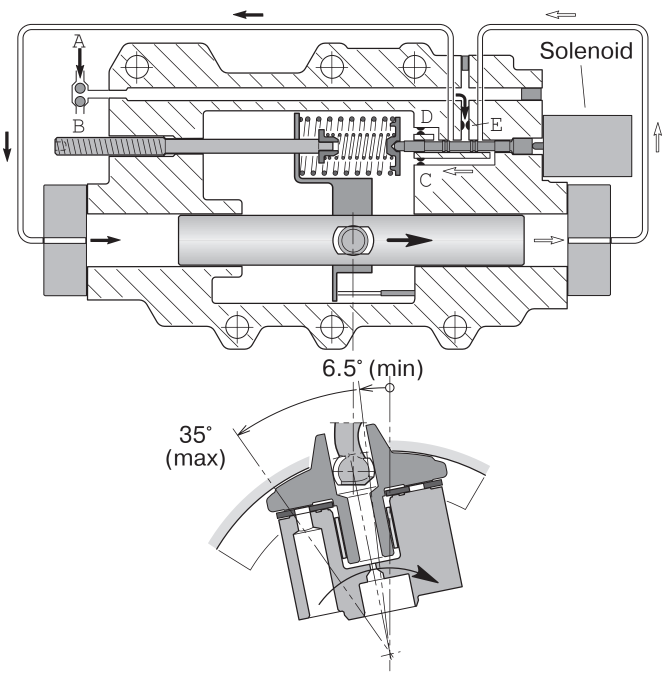
HP control function (decreasing pilot pressure)

NOTE: Valid also for the EP at decreasing current.

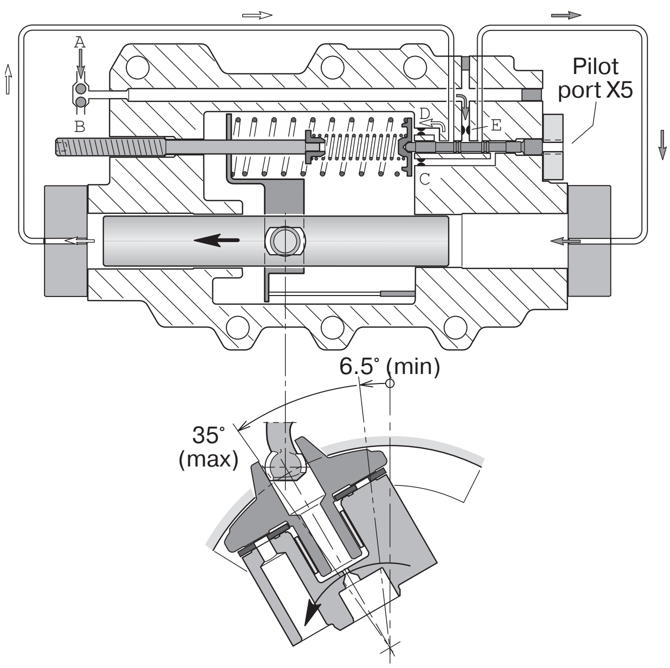
Refer to the illustration below right:

When the pilot pressure decreases, the servo valve spool moves to the right and flow is directed to the right hand setting chamber – the setting piston moves to the left and the displacement increases.

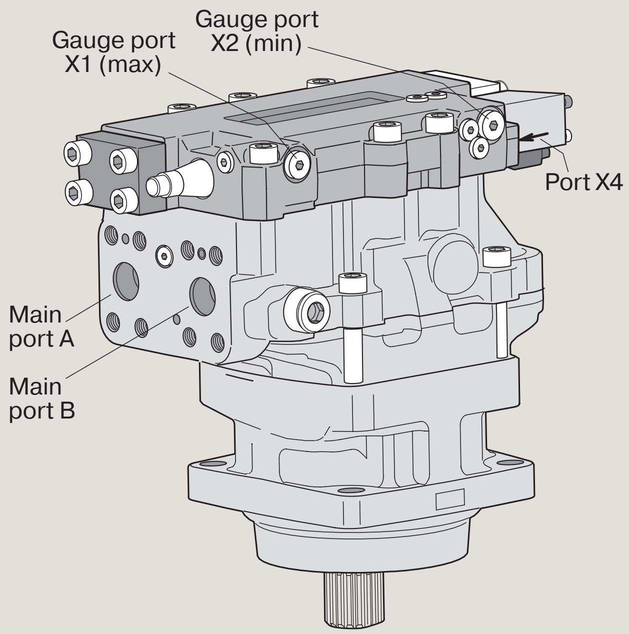
The shaft speed now decreases and the available output torque increases correspondingly (at a constant pump flow and system pressure).



EP control function (displ. decrease at increasing current).



HP control function (displ. increase at decreasing pilot press.).

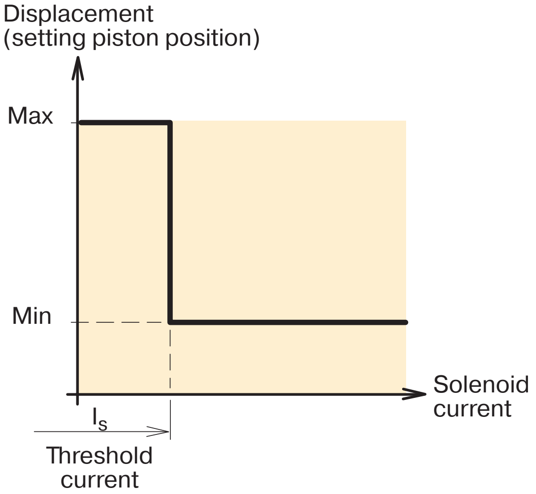


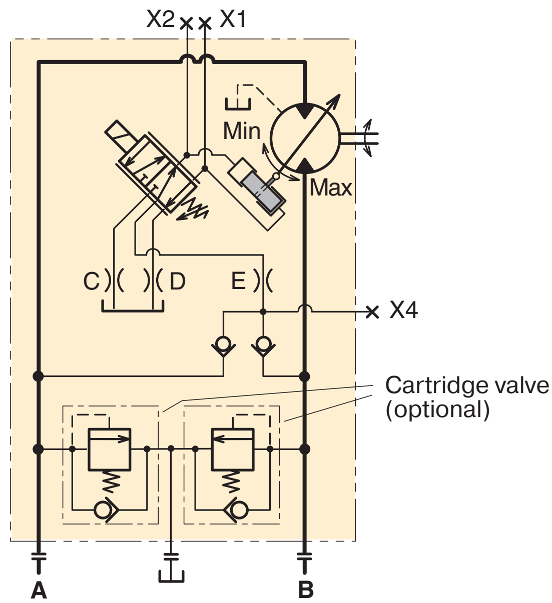
Port locations – V14- with EO or EP control.

Gauge/pilot ports (EO and EP controls):	
X1	Setting piston pressure (decreasing displ.)
X2	Setting piston pressure (increasing displ.)
X4	Servo supply pressure (before orifice)
Port sizes:	
–	M14 x 1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

EO electric two-position control

- The EO is a two-position control where the position of the setting piston is governed by a DC solenoid (acting on the servo spool) which is attached to the control module (refer to the illustration on page 34).
- The EO is utilized in transmissions where only two operating modes are required - low speed/high torque and high speed/low torque.
- The setting piston, normally in the max displacement position, shifts to min displacement as soon as the solenoid is activated.
- Intermediate displacements cannot be obtained with this control.
- Servo pressure is supplied internally (through a check valve from the utilized high pressure port); refer to the schematic below.
- The solenoid is either 12 or 24 VDC, requiring 1 200 mA and 600 mA respectively.
- The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The corresponding female connector is not included. **Note:** The female connector is available as spare part P-N 3787488.
- The threshold current of the 12 VDC solenoid is factory set at 400 mA; it is adjustable between 200 and 500 mA. The 24 VDC solenoid is factory set at 200 mA and is adjustable between 100 and 250 mA.





EO schematic (shown: non-activated solenoid; control in max displacement position).

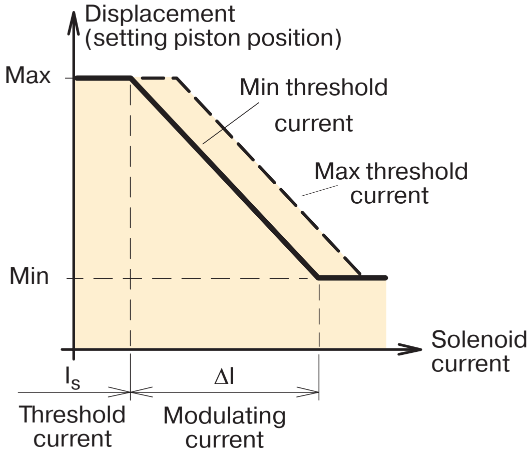
Gauge/pilot ports (EO and EP controls):	
X1	Setting piston pressure (decreasing displ.)
X2	Setting piston pressure (increasing displ.)
X4	Servo supply pressure (before orifice)
Port sizes:	
–	M14 x 1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

NOTE: Port locations are shown in the illustration on page 34.

EP electrohydraulic proportional control

- The EP electrohydraulic proportional control is used in hydrostatic transmissions requiring a continuously variable shaft speed. The position of the setting piston is governed by a DC solenoid (acting on the servo valve spool), attached to the control module (refer to the illustration on page 34).
- When the solenoid current increases above the threshold value, the setting piston starts to move from max towards min displacement. The displacement vs. solenoid current is shown in the diagram below.

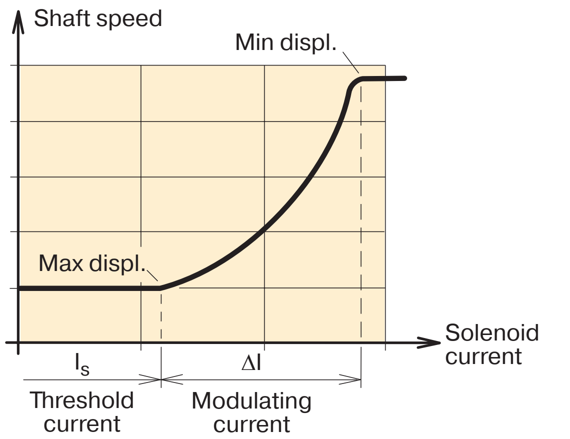
NOTE: The shaft speed is **not** proportional to the solenoid current; refer to the bottom diagram.



EP diagram (displacement vs. solenoid current).

Gauge/pilot ports (EO and EP controls):	
X1	Setting piston pressure (decreasing displ.)
X2	Setting piston pressure (increasing displ.)
X4	Servo supply pressure (before orifice)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

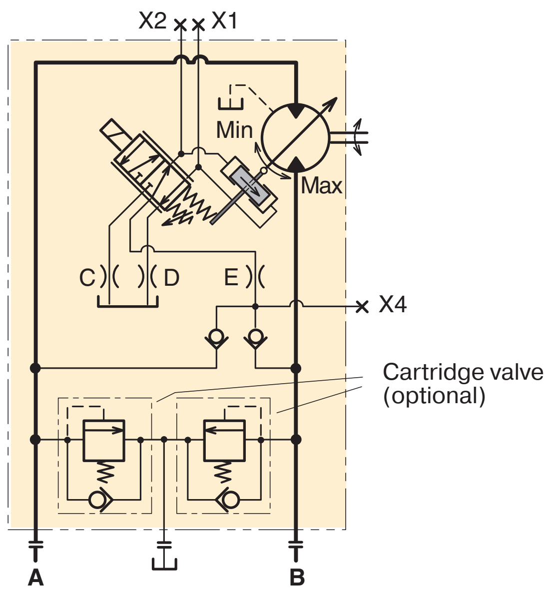
NOTE: Port locations are shown in the illustration on page 34.



Note: The shaft speed is **not** proportional to the solenoid current.

- The solenoid is either 12 or 24 VDC, requiring 1 200 and 600 mA respectively.
- The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The corresponding female connector is not included. **Note:** The female connector is available as spare part P-N 3787488.
- The threshold current of the 12 VDC solenoid is factory set at 400 mA; it is adjustable between 200 and 500 mA. The 24 VDC solenoid is factory set at 200 mA and is adjustable between 100 and 250 mA.
- When utilizing the full displacement range, the required modulating current (ΔI) is 600 mA (12V solenoid) and 300 mA (24 V solenoid) for V14-110, 345 mA (24 V solenoid) for V14-160 respectively. In order to minimize hysteresis, a pulse-width modulated control signal of 50 to 60 Hz should be provided.

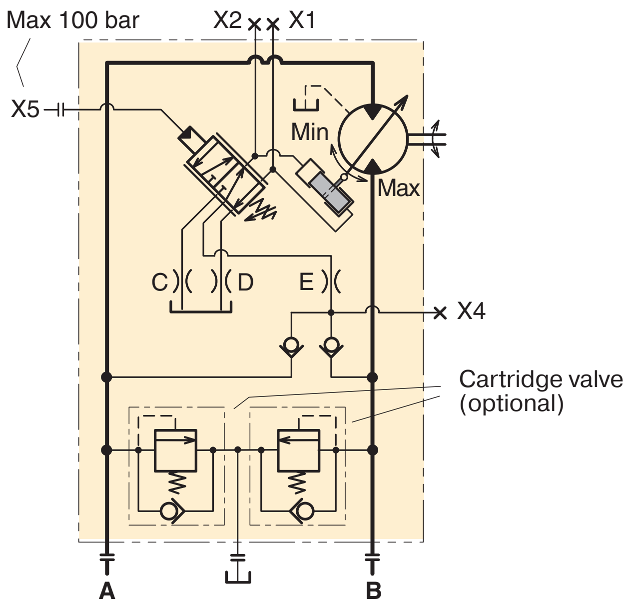
NOTE: The modulating current (ΔI) is not adjustable.



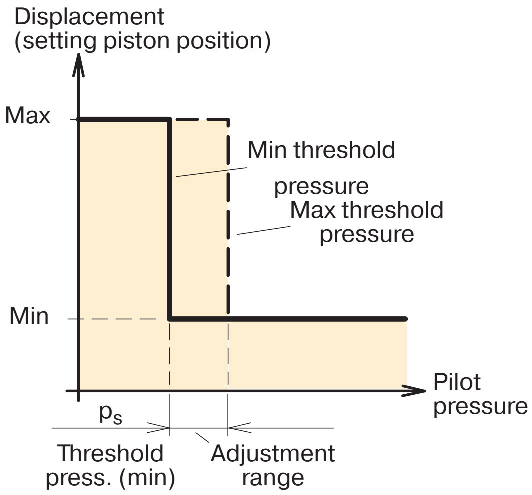
EP schematic (shown: non-activated solenoid; control moving towards max displacement).

HO hydraulic two-position control

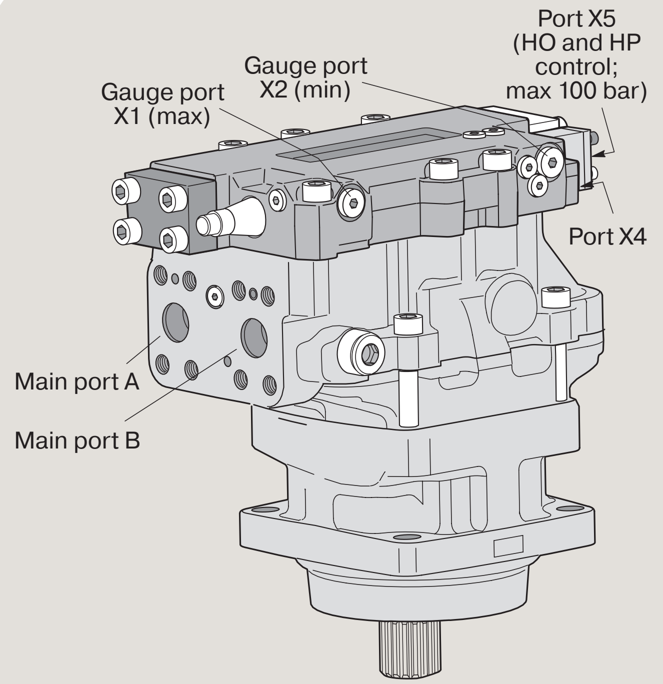
- The two-position HO control is similar to the EO (page 35) but the control signal is hydraulic. The position of the setting piston is governed by the built-in servo valve spool (same as on all controls).
- When the applied pilot pressure (port X5) exceeds the pre-set threshold value, the setting piston moves from the max to the min displacement position.
- Positions between max and min cannot be obtained with this control.
- The threshold pressure is factory set at 10 bar but is adjustable between 5 and 25 bar.



HO schematic (shown: port X5 not pressurized; control in max displ. position).



HO diagram (displacement vs. pilot pressure).

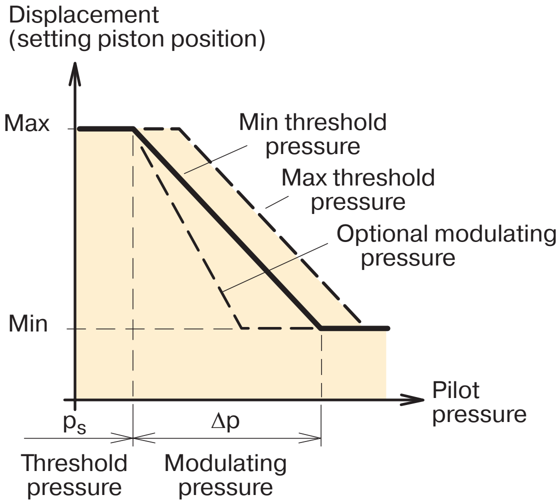


Port locations – V14-110 with HO or HP control.

Gauge/pilot ports (HO and HP controls):	
X1	Setting piston pressure (decreasing displ.)
X2	Setting piston pressure (increasing displ.)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar; HO and HP control)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

HP hydraulic proportional control

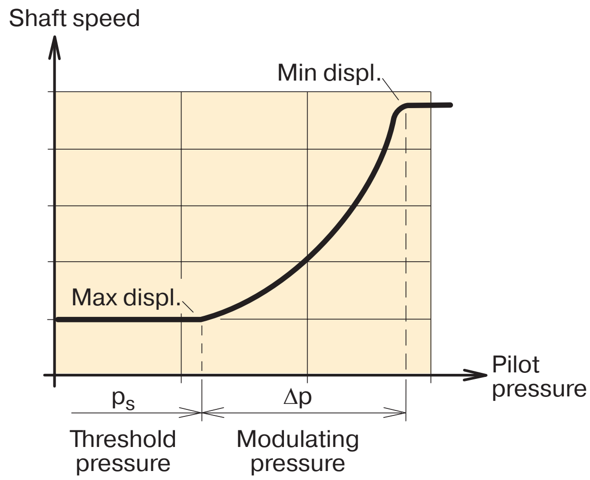
- Like the EP described on page 34, the HP proportional control offers continuously variable displacement, but the controlling signal is hydraulic.
- Normally, the setting piston stays in the max displacement position. When a sufficiently high pilot pressure (p_s) is applied to port X5, the setting piston starts to move towards the min displacement position.



HP diagram (displacement vs. pilot pressure).

Gauge/pilot ports (HP control):	
X1	Setting piston pressure (decreasing displ.)
X2	Setting piston pressure (increasing displ.)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar)
Port sizes:	
–	M14 x 1.5 (ISO and cartridge versions)
–	$^9/_{16}$"-18 O-ring boss (SAE version).

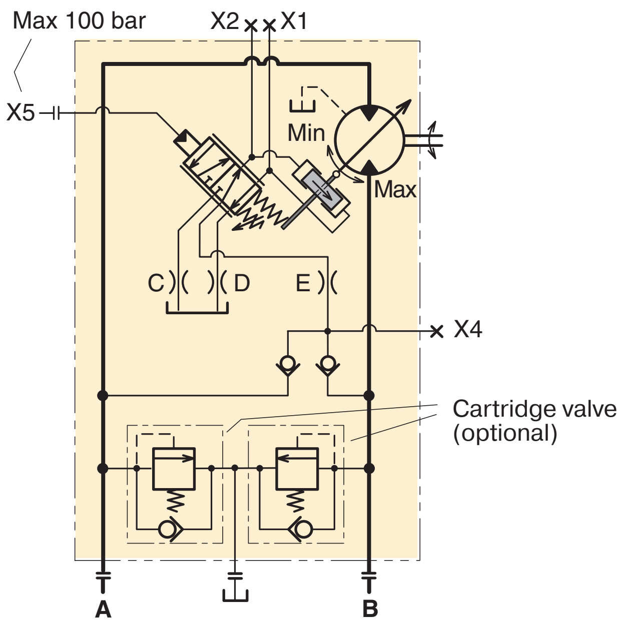
NOTE: Port locations are shown in the illustration on page 37.



Please note: The shaft speed is **not** proportional to the pilot pressure.

- As can be seen from the pilot pressure/displacement diagram below, the displacement changes in proportion to the applied modulating pressure.
- In contrast, the shaft speed is not proportional to the pilot pressure; refer to the bottom left diagram.
- To satisfy specific hydraulic circuit requirements, a modulating pressure of 15 or 25 bar can be selected; the threshold pressure (p_s) is set at 10 bar but is adjustable between 5 and 25 bar.

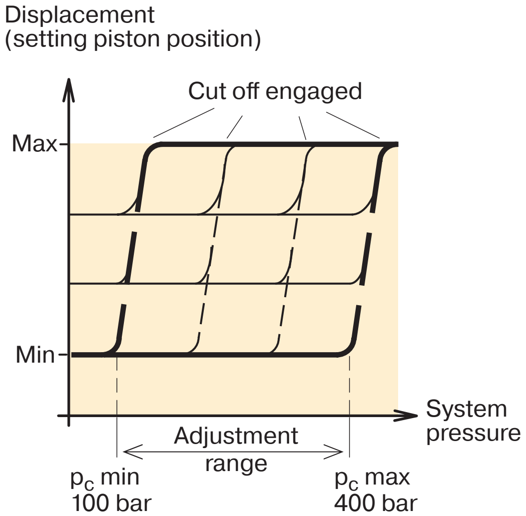
See also “Controls, Note” on page 29.



HP schematic (shown: port X5 not pressurized; control moving towards max displacement).

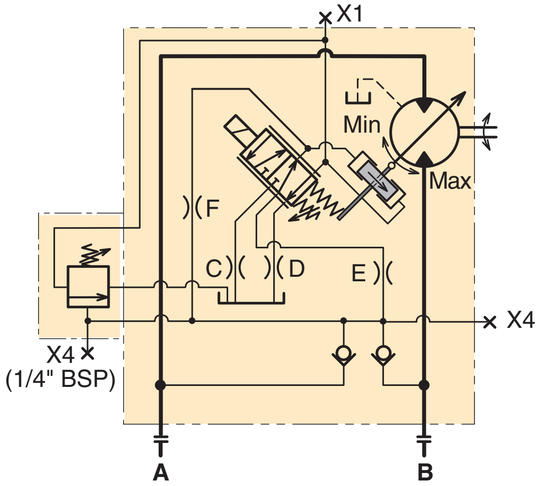
EPC/HPC, EP/HP control with pressure cut off

- The pressure cut off overlays the EP/HP control.
- If the system pressure increase, due to the load or reduced motor displacement to the setting of the pressure cut off valve, the control increases displacement. When displacement increases, the available torque increases as well but the system pressure remains constant.
- Pressure cut off setting range is 100 – 400 bar. One revolution corresponds to 48 bar (696 psi)
- Threshold pressure is preset from factory to 10 bar but is adjustable between 5 and 25 bar.
- For EPC the threshold current of the 12 VDC solenoid is factory set at 400 mA; it is adjustable between 200 and 500 mA. The 24 VDC solenoid is factory set at 200 mA and is adjustable between 100 and 250 mA.

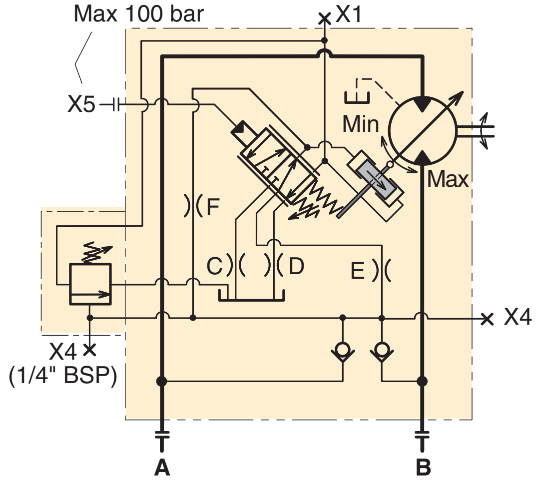


Gauge/pilot ports (EPC control):	
X1	Setting piston pressure (decreasing displ.)
X4	Servo supply pressure (before orifice)
X4	Servo supply pressure (on EPC) BSP¼” only
Port sizes:	
–	M14 x 1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

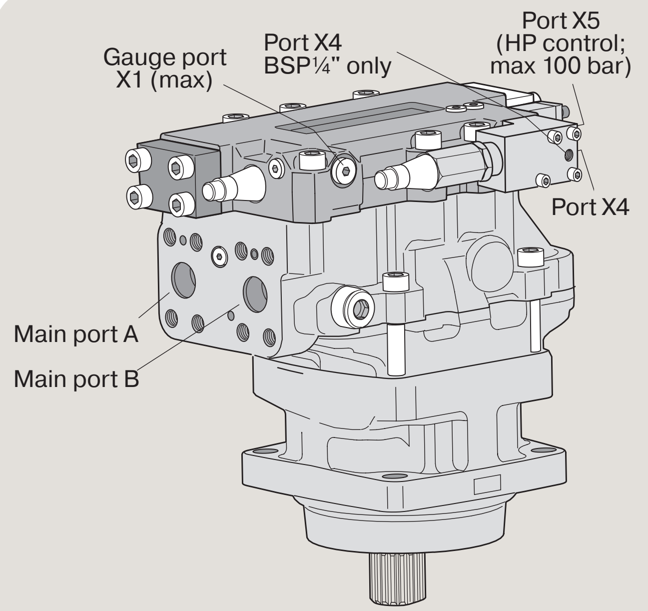
Gauge/pilot ports (HPC control):	
X1	Setting piston pressure (decreasing displ.)
X4	Servo supply pressure (before orifice)
X4	Servo supply pressure (on HPC) BSP¼” only
X5	External pilot pressure (max 100 bar)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).



EPC schematic (control moving towards max displacement).



HPC schematic (shown: port X5 not pressurized; control moving towards max displacement).



Port locations – V14-110 with EPC/HPC control. (HPC shown)

Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

ISO version

V14	–		–	I	V		–					–			–		–		–		/		–		

Motor type · Frame size · Mounting flange · Shaft seal · Shaft end · Control · Control signal · Restrictor set · Modulating press./current · Valve options · Valve opening pressure · Sensor options · Version · Max and min displacement · Threshold setting · Pressure cut off EPC/HPC

Frame size	
Code	**Displacem.**
110	110 (cm³/rev)
160	160 (cm³/rev)

Code	Mounting flange
I	ISO flange
Z	ISO (optional)

Code	Shaft seal
V	PPS

Code	Shaft end
C	DIN (ISO version)
D	DIN (ISO version)

Code	Control
AC	Pressure compensator
AH	Pressure compensator with hydraulic override
EO	Electrohydraulic, two-position
EP	Electrohydraulic, proportional
HO	Hydraulic, two-position
HP	Hydraulic, proportional

Code	Pilot control signal
C	Pressure cut off (EP, HP)
E	External pressure (AC, AH, HO, HP)
I	Internal pressure (AC, AH)
H	24 VDC (EO, EP)
L	12 VDC (EO, EP)

Code	Control orifice set and solenoid for EPC (orifice dia in mm)
1	0.7
2	0.8
3	**1.0 (standard)**
4	1.2
5*	HPC
L*	EPC 12 V
H*	EPC 24 V
X	Special

Code	Control modulating pressure/current
N	AC, AD, AH, EO, HO: 0 bar; EP, EPC: Non-selectible current
A	15 [bar] (AC, AH, HP, HPC)
B	25 [bar] (AC, AH, HP, HPC)
C	50 [bar] (AC, AH)
D	80 [bar] (AC, AH)

Max and min displ. [cm³/rev]

Threshold setting
AC, AH: Select pressure between 100 and 350 [bar]
EO, EP: 400 [mA] – 12 [VDC] 200 [mA] – 24 [VDC]
HO, HP: 10 [bar]

Factory issued for special versions

Code	Sensor options (page 97)
N	None
P	Prepared for speed sensor

Code	Valve opening pressure
000	without pressure relief valve Pressure relief valve opening pressure [bar] (page 96)*
	Alternatively: Flushing valve orifice (page 95)*

Code	Valve options (pages 95 to 96)
N	None
B	Brake valve and pressure relief valves**
L	Flushing valve
P	Pressure relief valves
W	Load hold valve (for EPC/HPC only) ***

Note:
* Control orifice set is not selectable for HPC, EPC
** Contact Parker Hannifin for additional information
*** Possible to combined with pressure relief valve
Contact Parker Hannifin for additional information

Cartridge version

V14	–		–	C	V		–					–			–		–		–		/		–		

Motor type · Frame size · Mounting flange · Shaft seal · Shaft end · Control · Control signal · Restrictor set · Modulating press./current · Valve options · Valve opening pressure · Sensor options · Version · Max and min displacement · Threshold setting · Pressure cut off EPC/HPC

Frame size	
Code	**Displacem.**
110	110 (cm³/rev)
160	160 (cm³/rev)

Code	Mounting flange
C	Cartridge version

Code	Shaft seal
V	PPS

Frame size		110	160
Code	**Shaft end**		
C	DIN (ISO version)	x	-
D	DIN (ISO version)	-	x

Code	Control
AC	Pressure compensator
AH	Pressure compensator with hydraulic override
EO	Electrohydraulic, two-position
EP	Electrohydraulic, proportional
HO	Hydraulic, two-position
HP	Hydraulic, proportional

Code	Pilot control signal
C	Pressure cut off (EP, HP)
E	External pressure (AC, AH, HO, HP)
I	Internal pressure (AC, AH)
H	24 VDC (EO, EP)
L	12 VDC (EO, EP)

Code	Control orifice set and solenoid for EPC (orifice dia in mm)
1	0.7
2	0.8
3	**1.0 (standard)**
4	1.2
5*	HPC
L*	EPC 12 V
H*	EPC 24 V
X	Special

Code	Control modulating pressure/current
N	AC, AH, EO, HO: 0 bar; EP, EPC: Non-selectible current
A	15 [bar] (AC, AH, HP, HPC)
B	25 [bar] (AC, AH, HP, HPC)
C	50 [bar] (AC, AH)
D	80 [bar] (AC, AH)

Max and min displ. [cm³/rev]

Threshold setting
AC, AH: Select pressure between 100 and 350 [bar]
EO, EP: 400 [mA] – 12 [VDC] 200 [mA] – 24 [VDC]
HO, HP: 10 [bar]

Version
Factory issued for special versions

Code	Sensor options (page 97)
N	None
P	Prepared for speed sensor

Code	Valve opening pressure
000	without pressure relief valve Pressure relief valve opening pressure [bar] (page 96)*
	Alternatively: Flushing valve orifice (page 95)*

Code	Valve options (pages 95 to 96)
N	None
B	Brake valve and pressure relief valves**
L	Flushing valve
P	Pressure relief valves
W	Load hold valve (for EPC/HPC only) ***

Note:
* Control orifice set is not selectable for HPC, EPC
** Contact Parker Hannifin for additional information
*** Possible to combined with pressure relief valve Contact Parker Hannifin for additional information

Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

SAE version

V14	–		–	S	V	S	–					–			–		–		–		/		–		
Motor type		Frame size		Mounting flange	Shaft seal	Shaft end		Control	Control signal	Restrictor set	Modulating press./current		Valve options	Valve opening pressure		Sensor options		Version		Max and min displacement				Threshold setting	Pressure cut off EPC/HPC

Frame size	
Code	**Displacem.**
110	110 (cm³/rev)
160	160 (cm³/rev)

Code	Mounting flange
S	SAE version

Code	Shaft seal
V	PPS

Code	Shaft end
S	SAE (SAE version)

Code	Control
AC	Pressure compensator
AH	Pressure compensator with hydraulic override
EO	Electrohydraulic, two-position
EP	Electrohydraulic, proportional
HO	Hydraulic, two-position
HP	Hydraulic, proportional

Code	Pilot control signal
C	Pressure cut off (EP, HP)
E	External pressure (AC, AH, HO, HP)
I	Internal pressure (AC, AH)
H	24 VDC (EO, EP)
L	12 VDC (EO, EP)

Code	Control orifice set and solenoid for EPC (orifice dia in mm)
1	0.7
2	0.8
3	**1.0 (standard)**
4	1.2
5*	HPC
L*	EPC 12 V
H*	EPC 24 V
X	Special

Code	Control modulating pressure/current
N	AC, AH, EO, HO: 0 bar; EP, EPC: Non-selectible current
A	15 [bar] (AC, AH, HP, HPC)
B	25 [bar] (AC, AH, HP, HPC)
C	50 [bar] (AC, AH)
D	80 [bar] (AC, AH)

Max and min displ. [cm³/rev]

Threshold setting
AC, AH: Select pressure between 100 and 350 [bar]
EO, EP: 400 [mA] – 12 [VDC] 200 [mA] – 24 [VDC]
HO, HP: 10 [bar]

Factory issued for special versions

Code	Sensor options (page 97)
N	None
P	Prepared for speed sensor

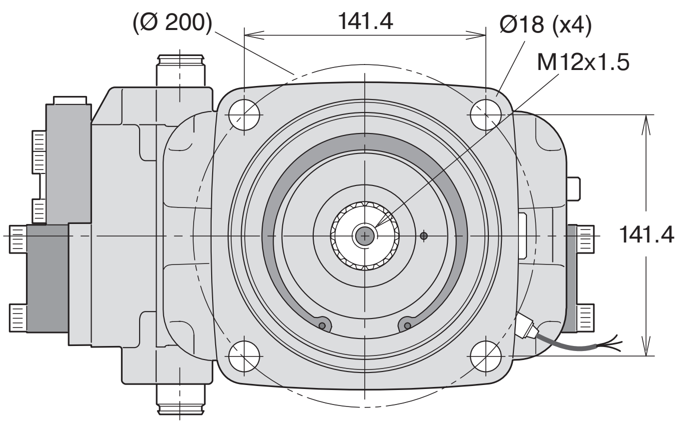
Code	Valve opening pressure
000	without pressure relief valve Pressure relief valve opening pressure [bar] (page 96)*
	Alternatively: Flushing valve orifice (page 95)*

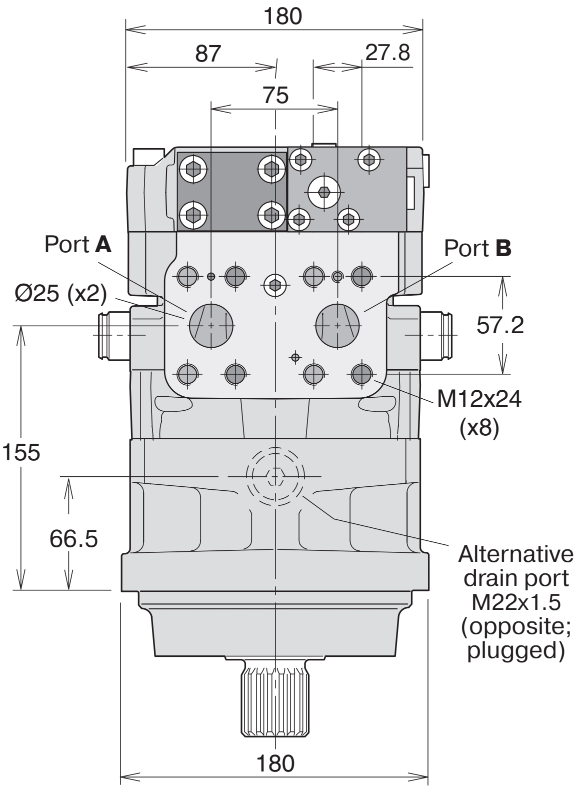
Code	Valve options (pages 93 to 94)
N	None
B	Brake valve and pressure relief valves **
L	Flushing valve
P	Pressure relief valves
W	Load hold valve (for EPC/HPC only) ***

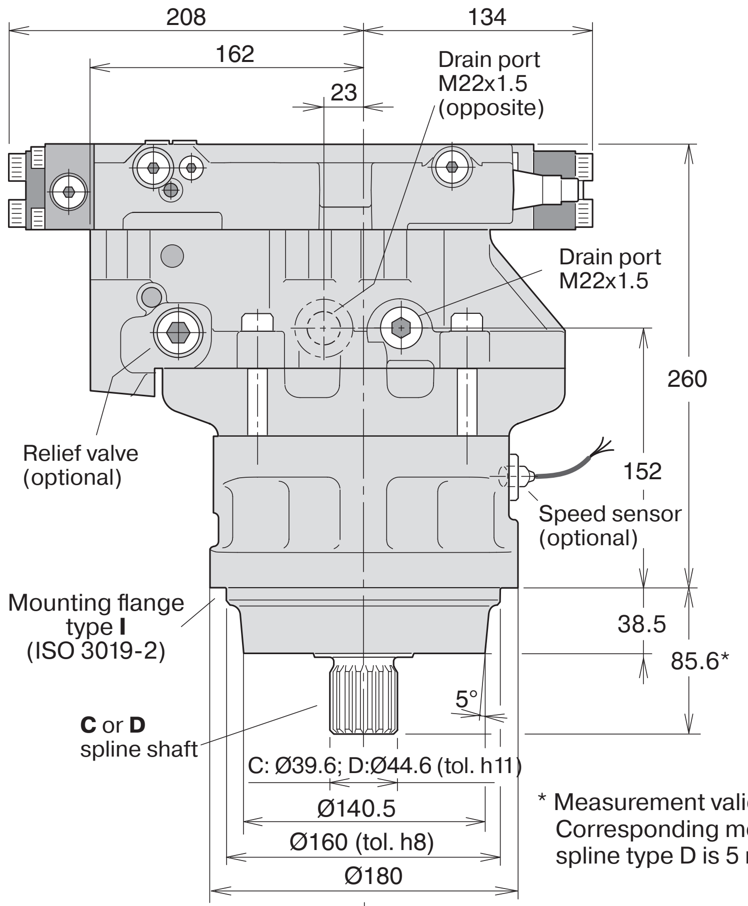
Note:
* Control orifice set is not selectable for HPC, EPC
** Contact Parker Hannifin for additional information
*** Possible to combined with pressure relief valve
Contact Parker Hannifin for additional information

V14-110, ISO version

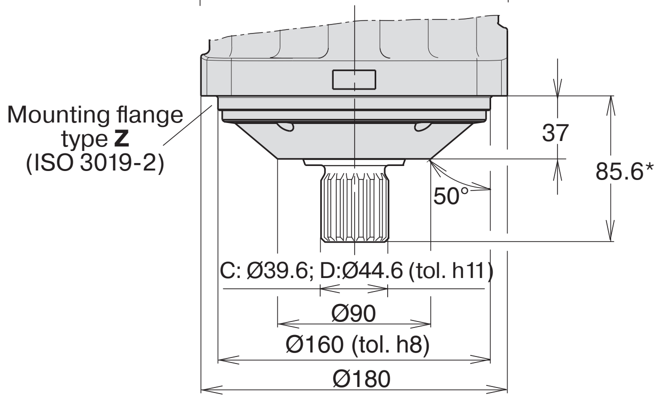
Shown: V14-110-ISO with AC compensator







* Measurement valid for spline type C. Corresponding measurement for spline type D is 5 mm longer.



Spline type C 1) (DIN 5480)	
V14-110	W40 x 2 x 18 x 9 g

Spline type D1) (DIN 5480)	
V14-110	W45 x 2 x 21 x 9 g

1) '30° involute spline, side fit'
C:Ø 39.6; D:Ø 44.6; tol. h11

Ports	V14-110
Main ports	25 [1"]
Drain ports	M22 x 1.5

Main ports: ISO 6162, 41.5 MPa, type II

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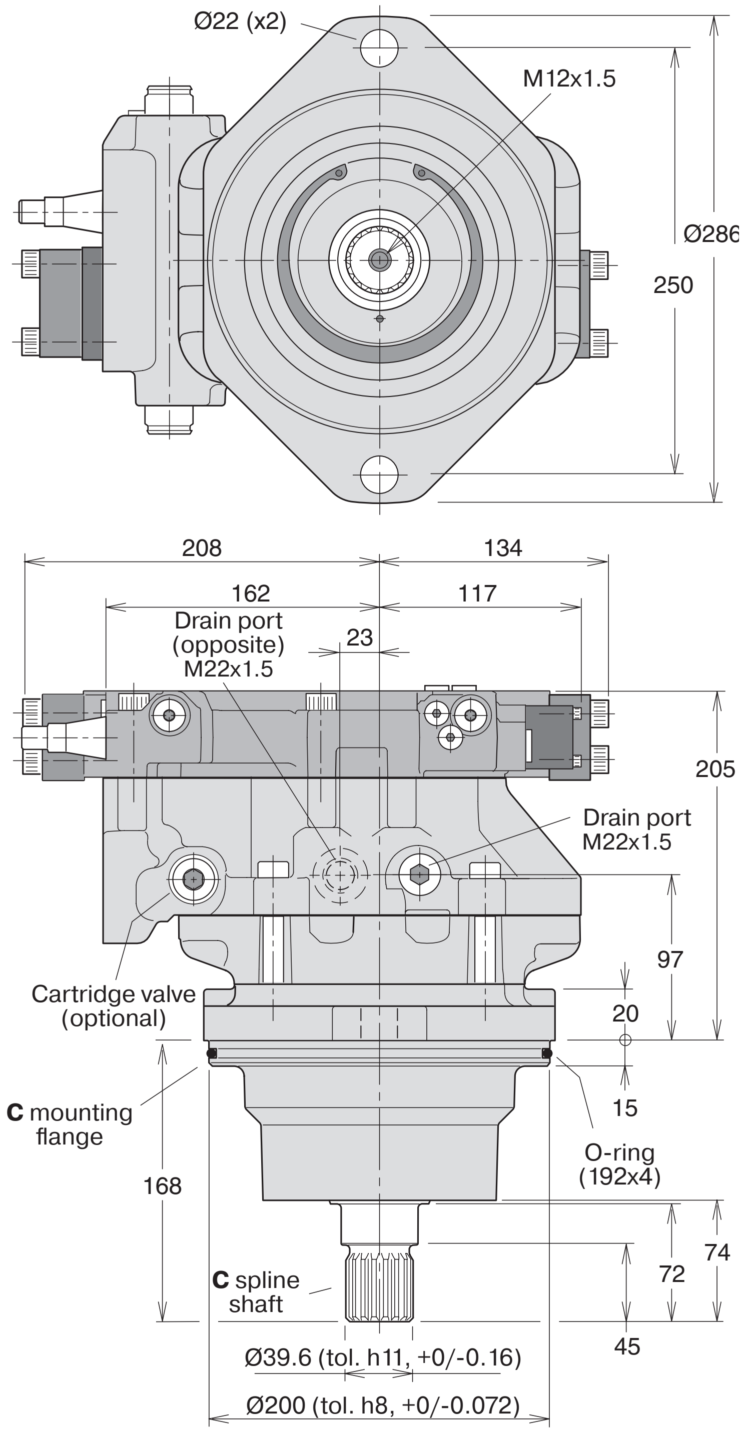
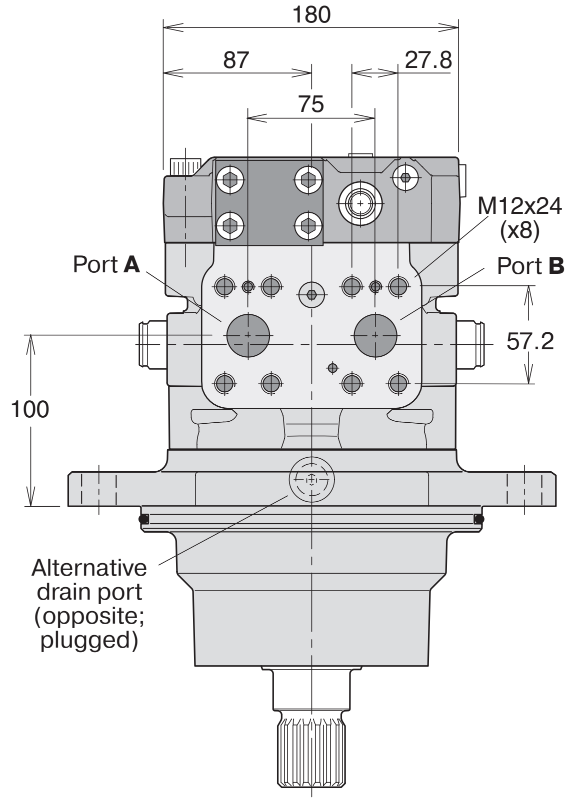
Trollhättan, Sweden

V14-110, Cartridge version

Shown: V14-110-cartridge with HO/HP control





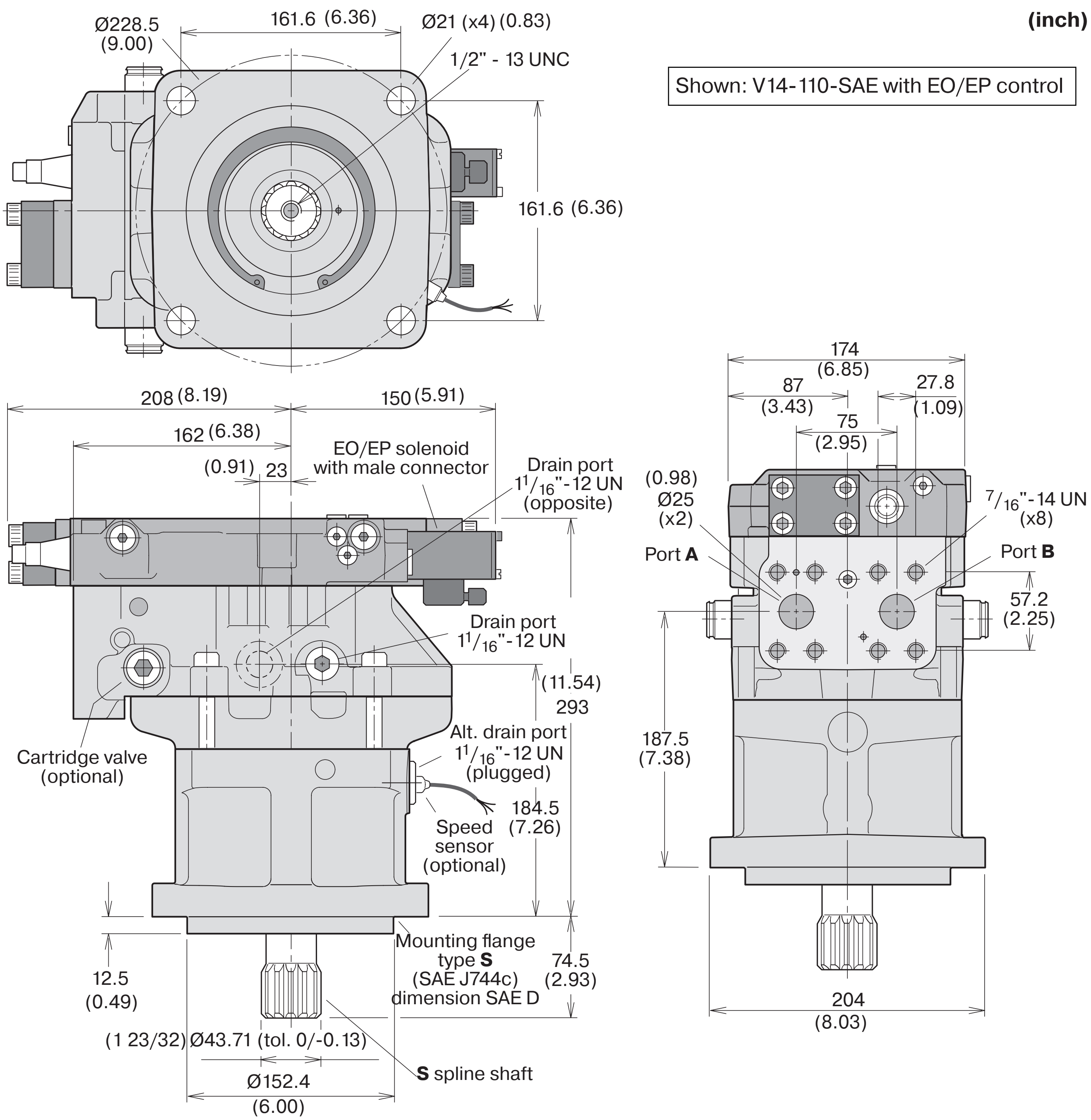
Spline type C[1] (DIN 5480)	
V14-110	W40 x 2 x 18 x 9 g

[1] '30° involute spline, side fit'.

Ports	V14-110
Main ports	25 [1"]
Drain ports	M22 x 1.5

Main ports: ISO 6162, 41.5 MPa, type II

V14-110, SAE version



Spline type S1) (SAE J498b)	
V14-110	SAE 'D' (13T, 8/16 DP)

1) '30° involute spline, side fit'.

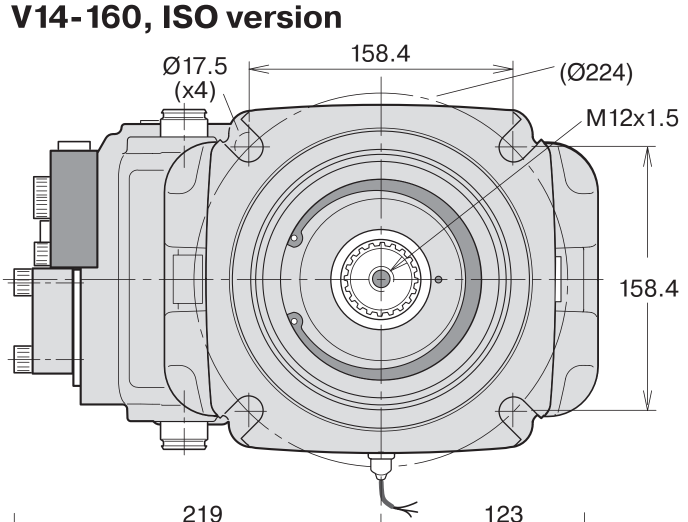
Ports	V14-110
Main ports	25 [1"]
Drain ports	1 1/16"-12 UN

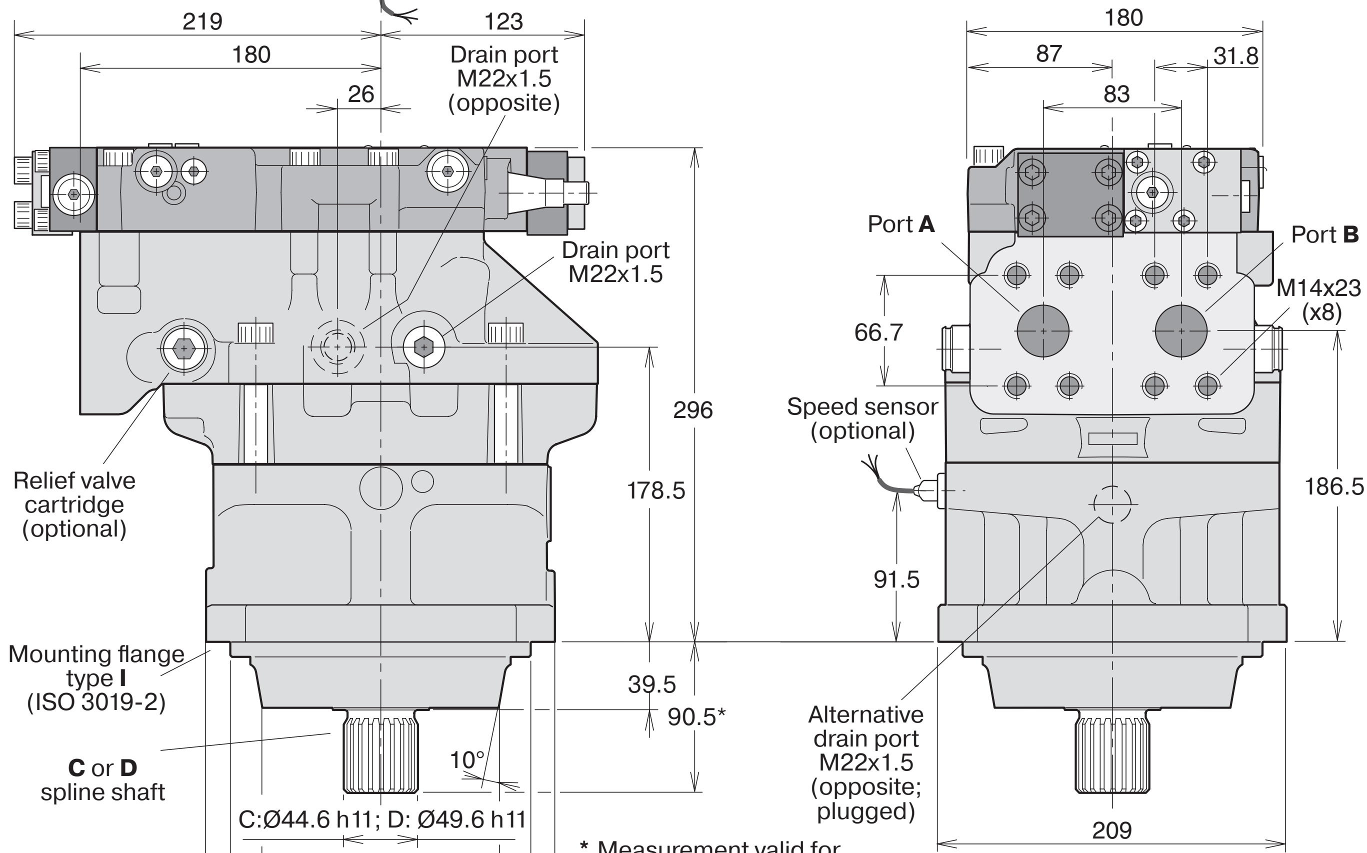
Main ports: SAE J518c, 6000 psi

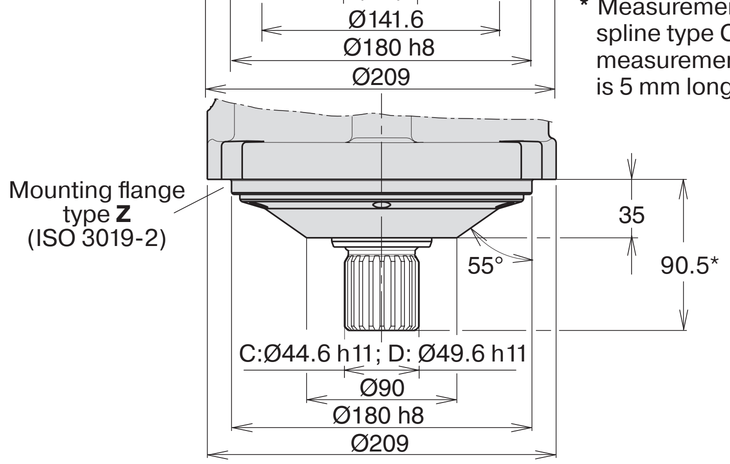
Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

V14-160, ISO version

Shown: V14-160-ISO with AC compensator







* Measurement valid for spline type C. Corresponding measurement for spline type D is 5 mm longer.

Spline type C[1] (DIN 5480)	
V14-160	W45 x 2 x 21 x 9 g

Spline type D[1] (DIN 5480)	
V14-160	W50 x 2 x 24 x 9 g

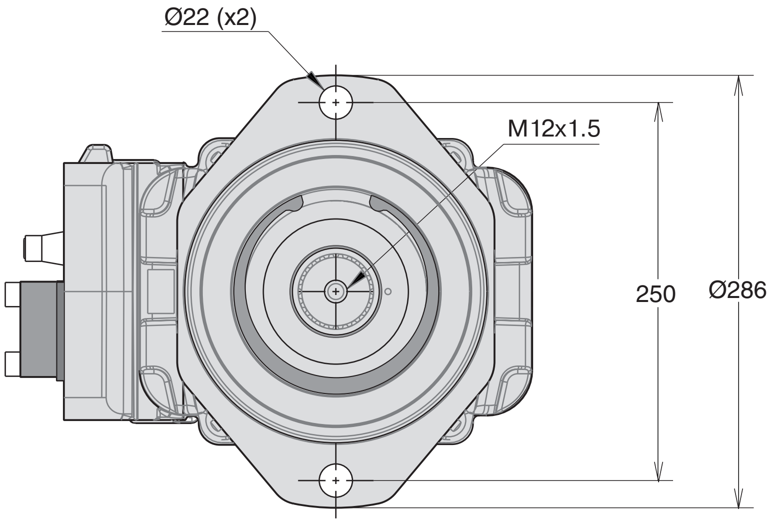
[1] '30° involute spline, side fit'.

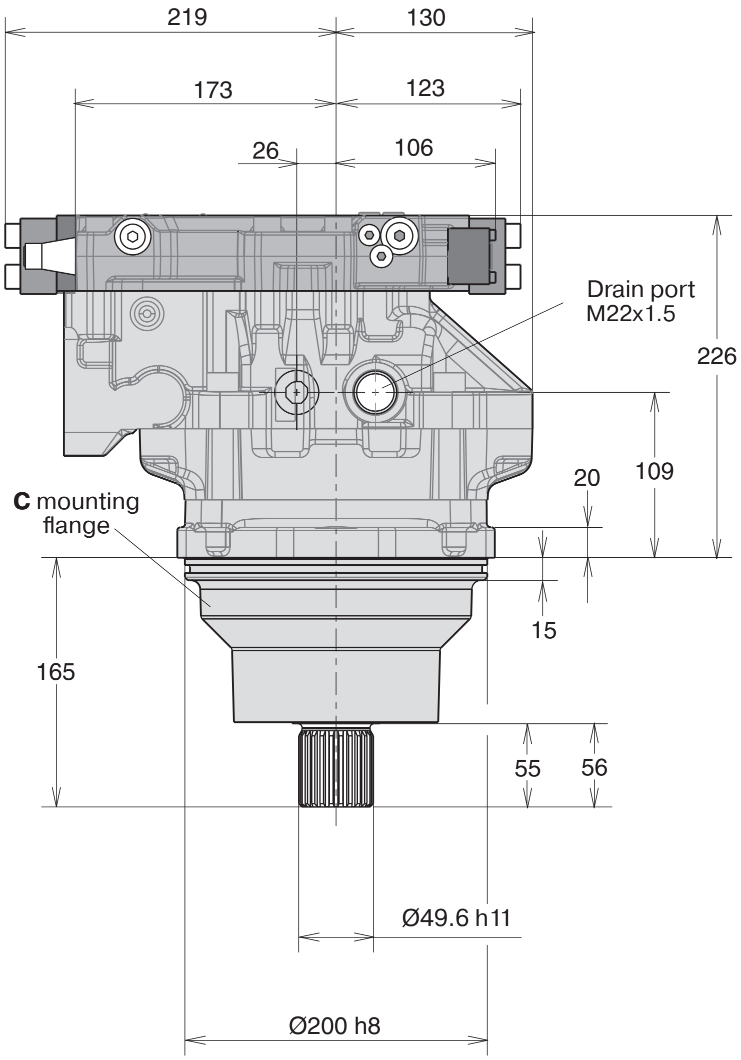
Ports	**V14-160**
Main ports	32 [1¹/₄"]
Drain ports	M22 x 1.5

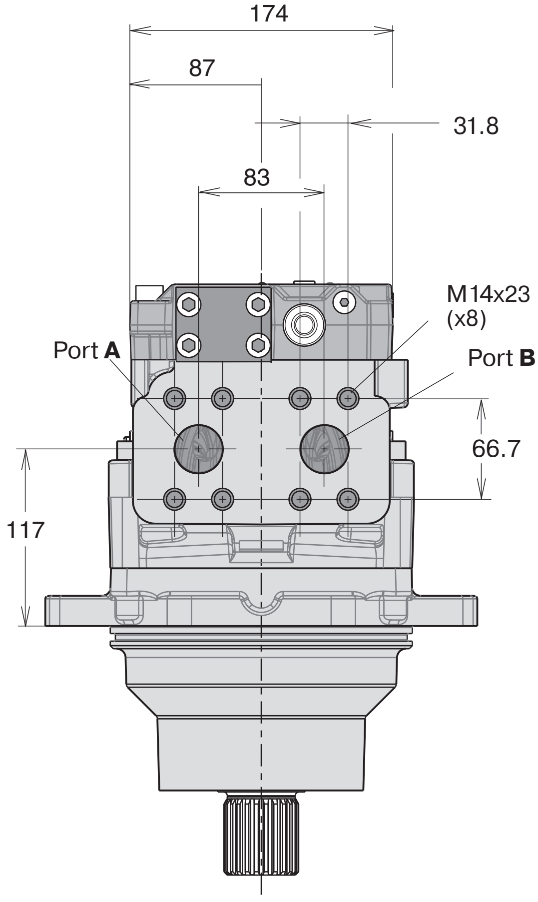
Main ports: ISO 6162, 41.5 MPa, type II

V14-160, Cartridge version

Shown: V14-160-cartridge with HO/HP control







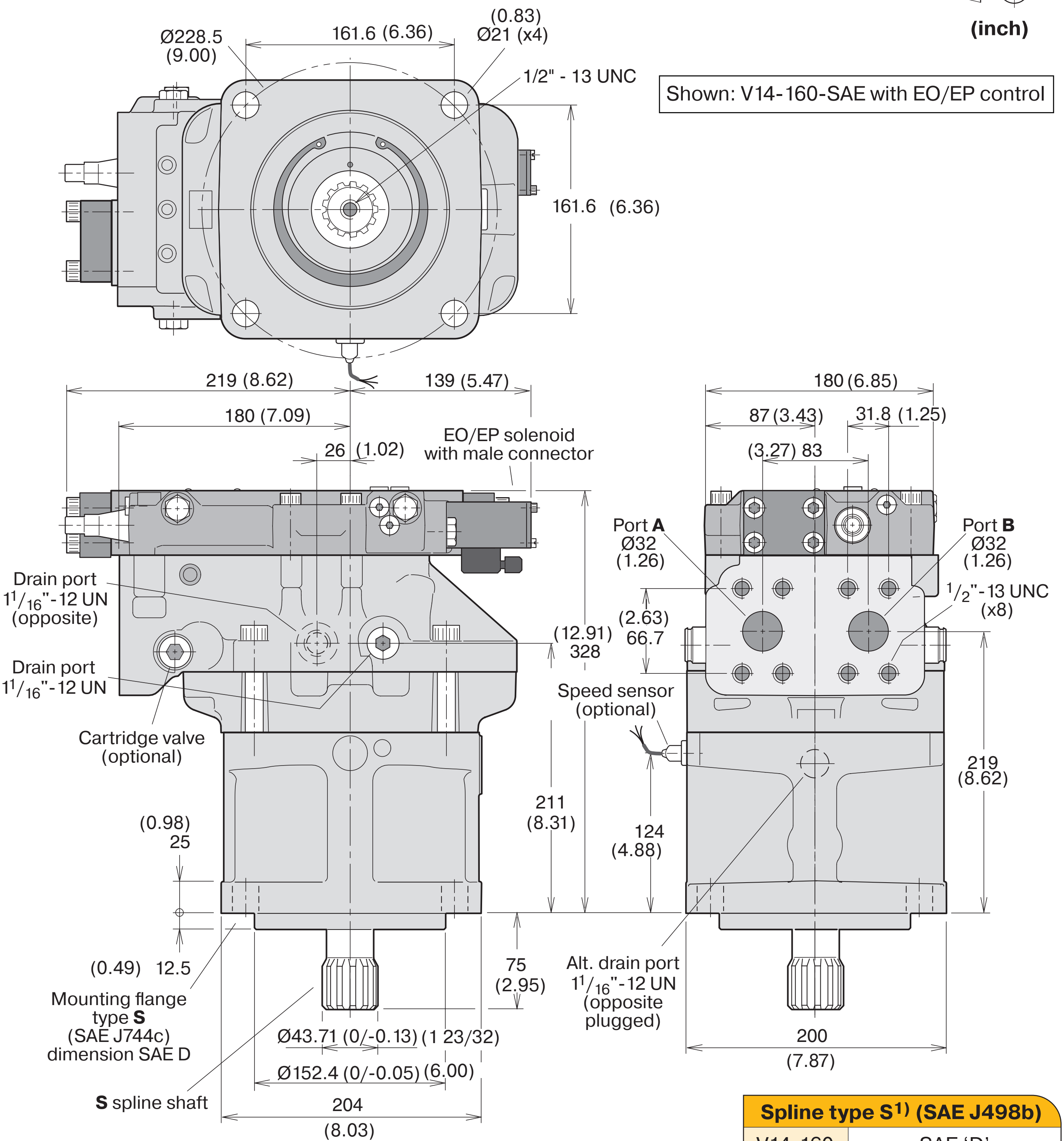
Spline type D[1] (DIN 5480)	
V14-160	W50 x 2 x 24 x 9 g

[1] '30° involute spline, side fit'.

Ports	V14-160
Main ports	32 [$1^1/_4$"]
Drain ports	M22 x 1.5

Main ports: ISO 6162, 41.5 MPa, type II

V14-160, SAE version



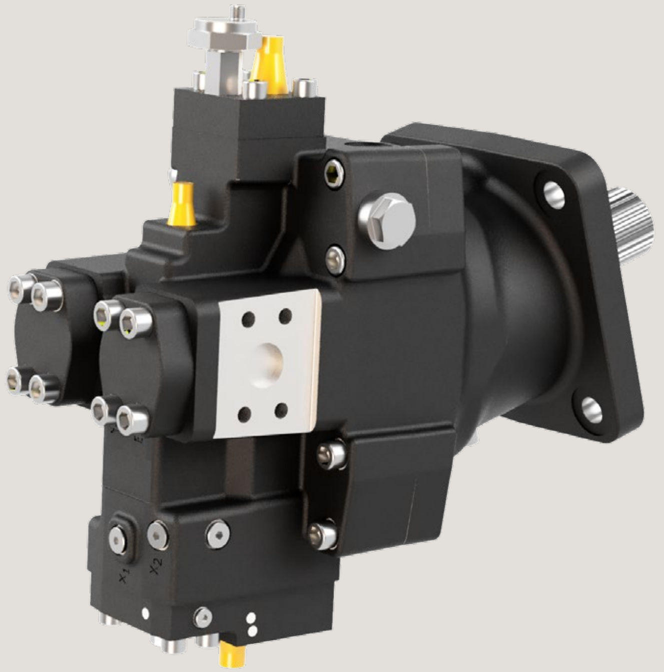
Spline type S[1] (SAE J498b)	
V14-160	SAE 'D' (13T, 8/16 DP)

[1] '30° involute spline, side fit'.

Ports	V14-160
Main ports	32 [1 1/4"]
Drain ports	1 1/16"-12 UN

Main ports: SAE J518c, 6000 psi

V16

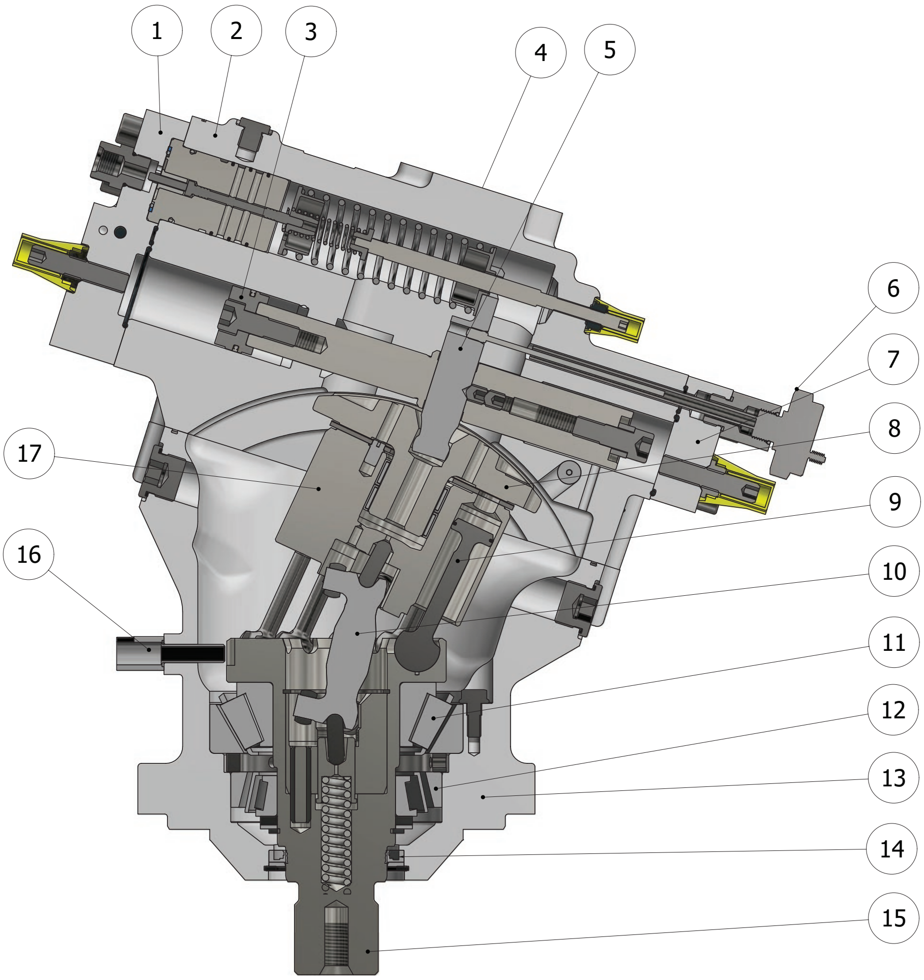


Content

Page

V16 cross section

1. Control cover
2. End cap
3. Setting piston
4. Main pressure ports (axial and radial ports)
5. Connecting arm
6. Displacement sensor
7. Cover
8. Valve segment
9. Spherical piston with laminated piston ring
10. Synchronizing shaft
11. Inner tap. rol. bearing
12. Outer tap. rol. bearing
13. Bearing housing
14. Shaft seal
15. Output shaft
16. Plug in speed sensor
17. Cylinder barrel



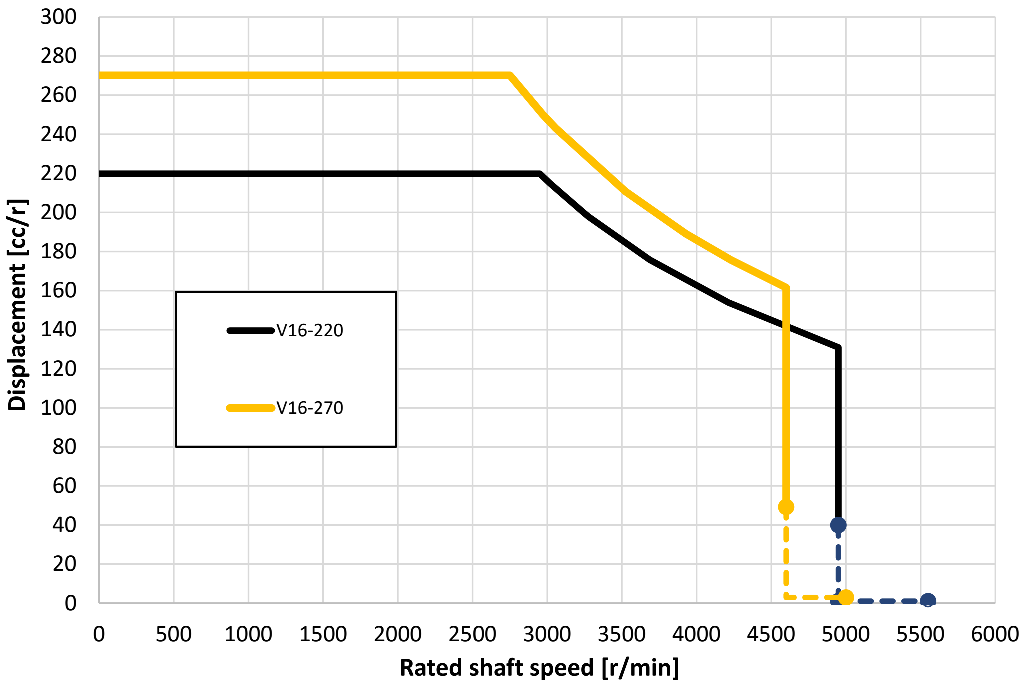
Specifications

V16 frame size	220	270
Displacement [cm^3/rev]		
- max, at 35°	220	270
- min, at 6°	40	49
Operating pressure [bar]		
- max intermittent 1)	550	550
- max continuous	450	450
Operating speed [rpm]		
- at 35°, max continuous	2950	2750
- at 6° – 20°, max continuous	4950	4600
- at 0°, max continuous	5550	5000
- min continuous	50	50

V16 frame size	220	270
Flow [l/min]		
- max continuous	648	743
Torque (theor.) at 100 bar [Nm]	350	430
Max otput power 1) [kW]	486	557
Corner power [kW]		
- intermittent 1)	997	1139
- continuous	816	932
Mass moment of inertia		
(x10^{-3}) [kg m^2]	20	21
Weight [kg]	95	97

1) Max 6 seconds in any one minute.

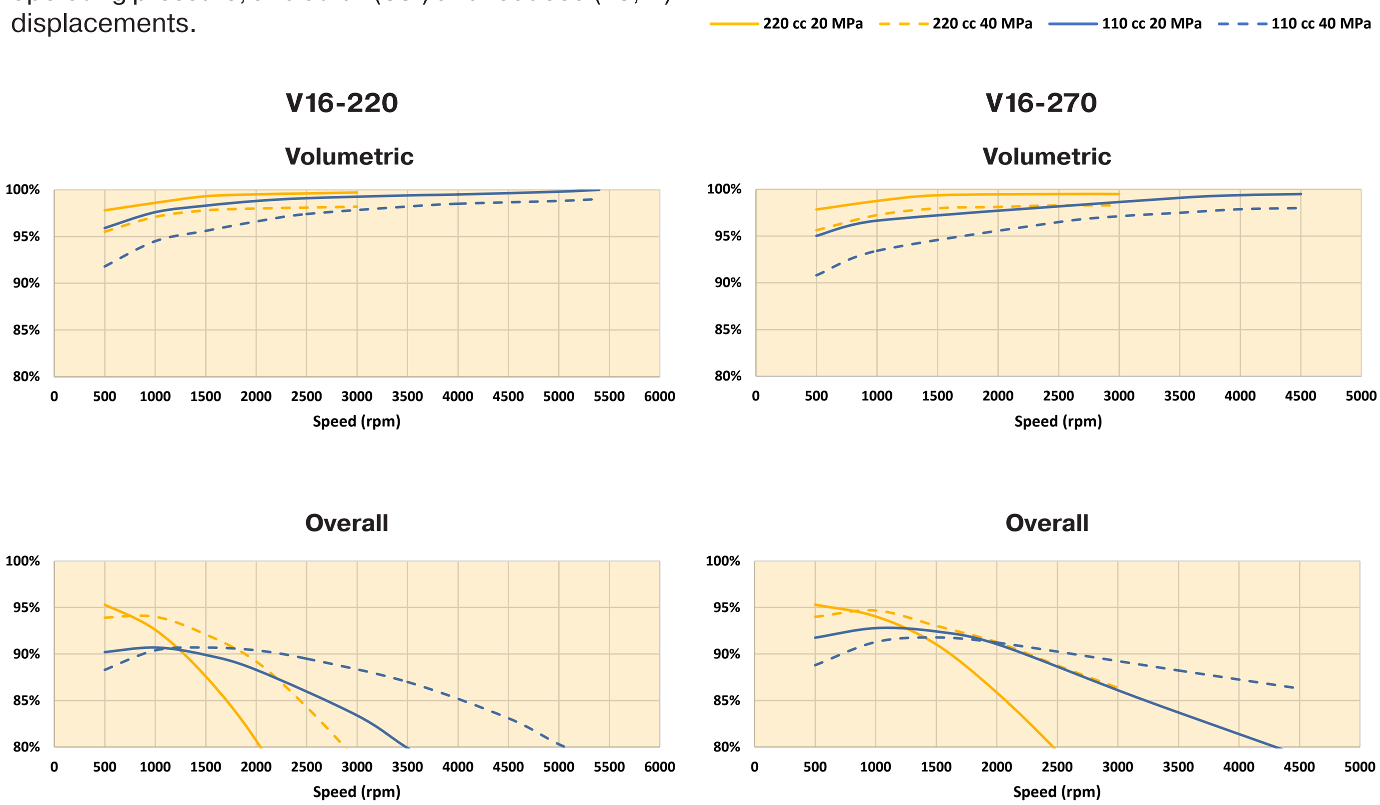
Continous Speed vs Displacement, V16-220 & 270



Efficiency diagrams

The following diagrams show volumetric and total efficiencies versus shaft speed at 200 and 400 bar operating pressure, and at full (35˚) and reduced (16,7˚) displacements.

Information on efficiencies for a specific load condition can be made available from Parker Hannifin.



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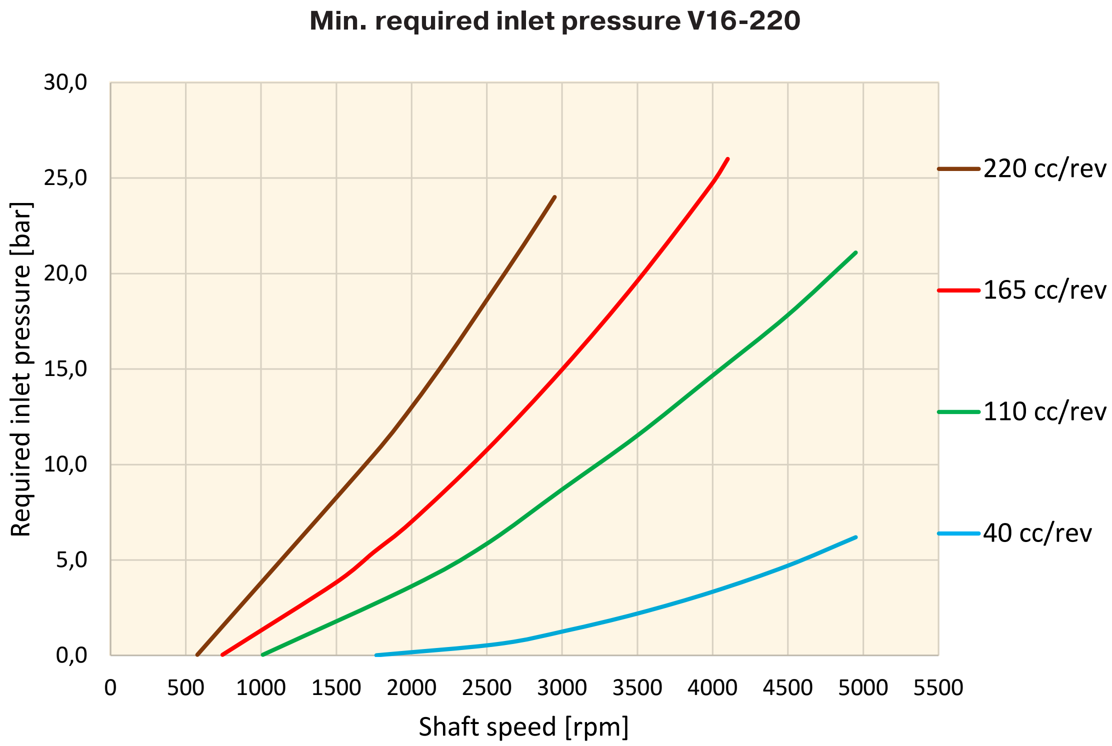
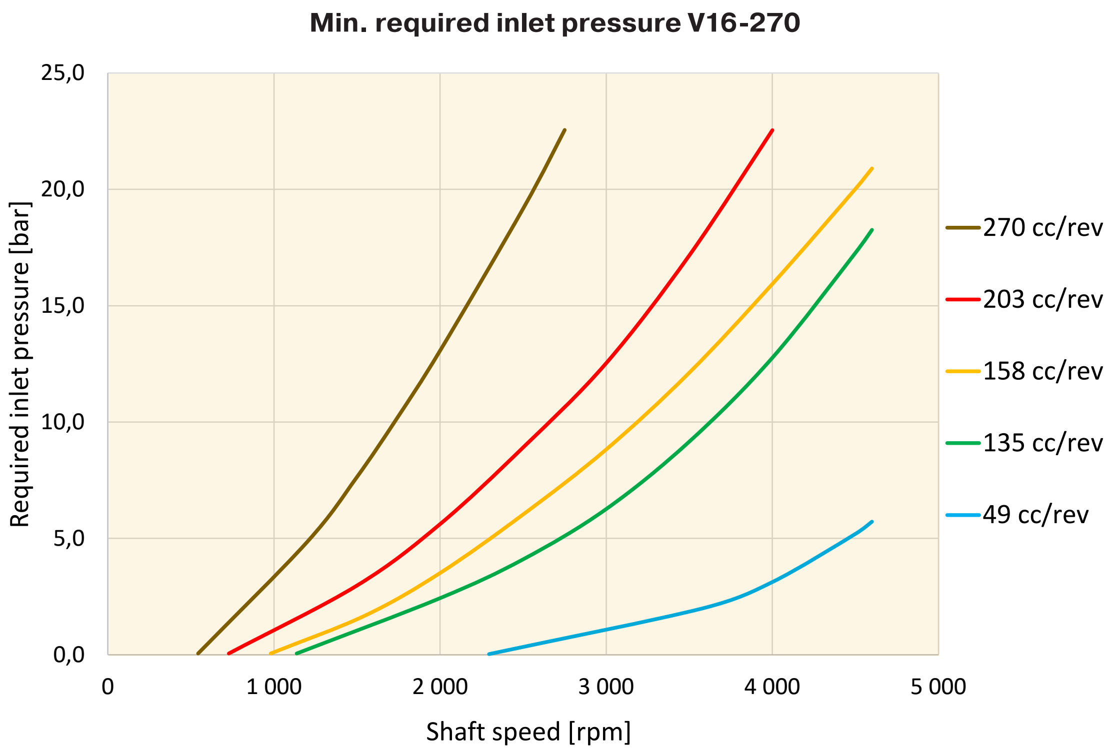
Required inlet pressure

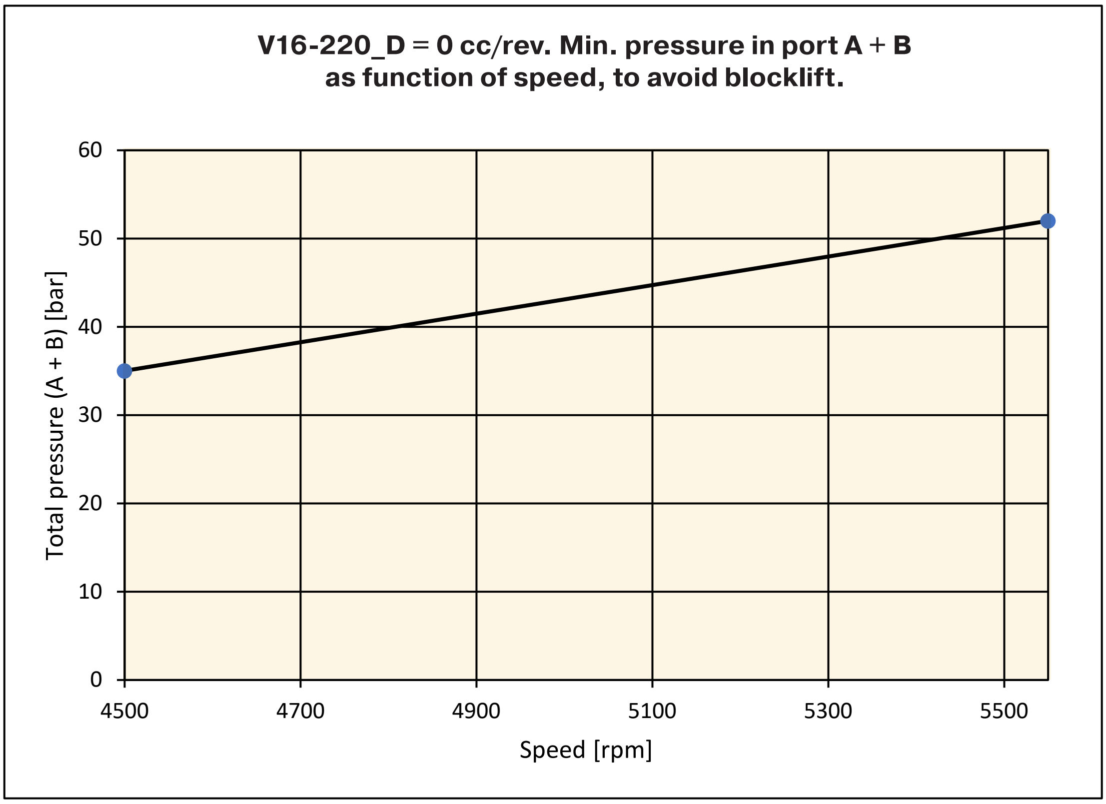
Required inlet pressure ensures that the cylinder block will be properly filled. By having sufficient inlet pressure cavitation and block lift will not occur in the hydraulic system.

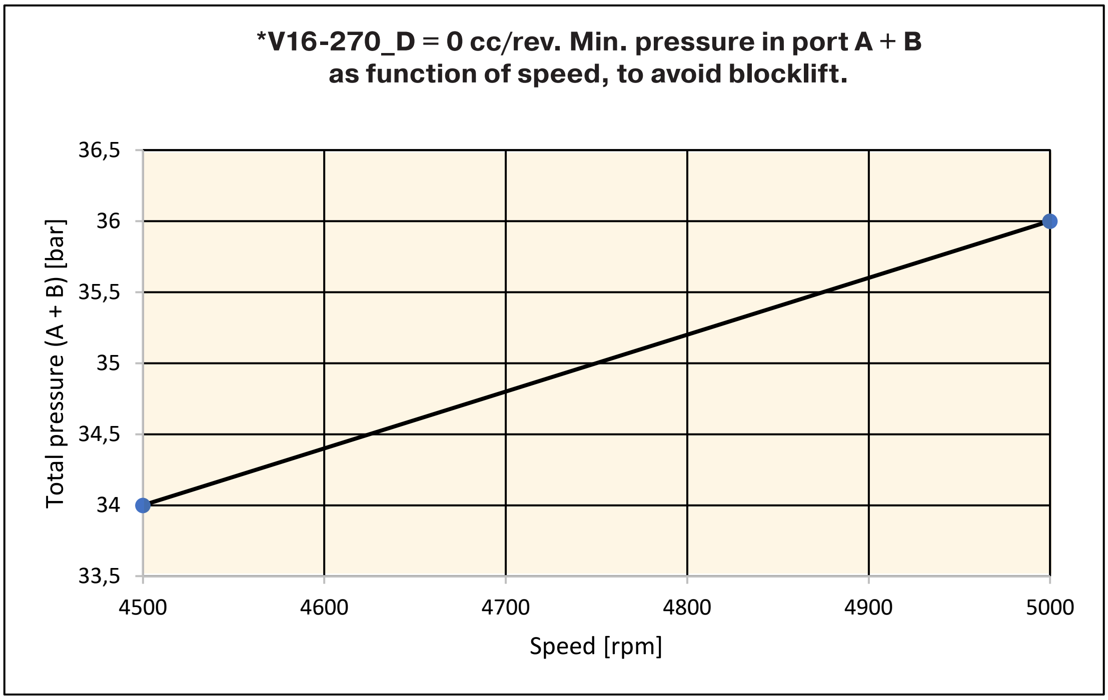




Recommendations at zero displacement

To avoid cavitation and cylinder barrel lift off when the motor is used at zero displacement the total pressure (A+B) must be above below curve.





* Max pressure at Occ/rev is Δp 400 bar/5800 psi

Starting torque efficiency

The maximum and minimum starting torque shows actual motor torque as a percentage of the theoretical torque versus pressure at 1 rpm. Starting torque is usually important to consider e.g. in winch drives with 'hanging loads' and similar applications.

The output torque vs. inlet pressure increases rapidly already at a small increase in shaft speed, which is important in many applications.

The starting torque diagrams is valid with an accuracy of ± 2% and the following test conditions:

- Fluid	Shell Tellus 32
- Temperature	35-60 ˚C (95-140 ˚F)
- Viscosity	~30 mm^2/s (cSt) (145 SUS)
- Shaft speed	1 rpm

The output shaft torque varies between maximum and minimum depending on the position of the pistons relative to the valve segement; refer to fig. 1.

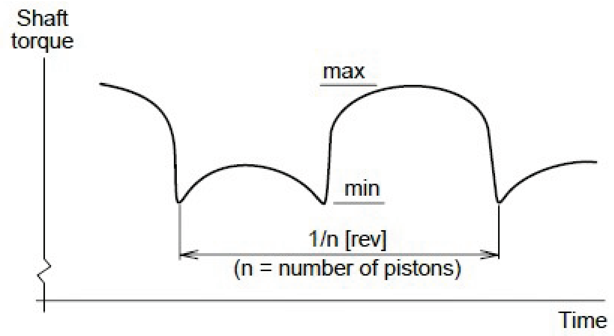
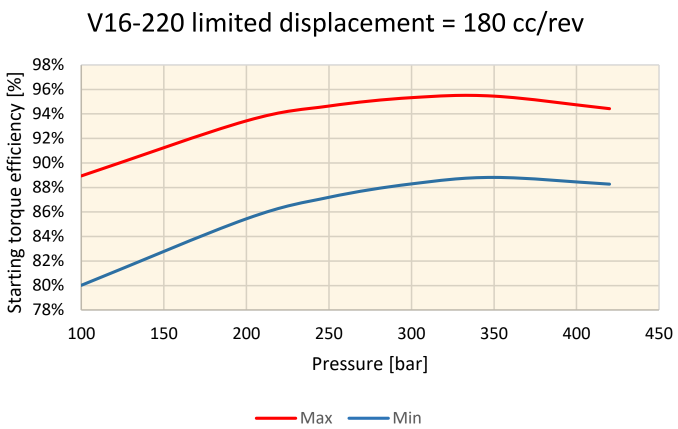
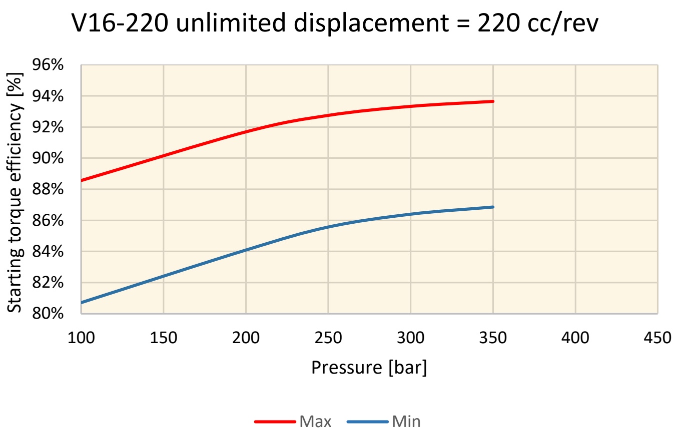
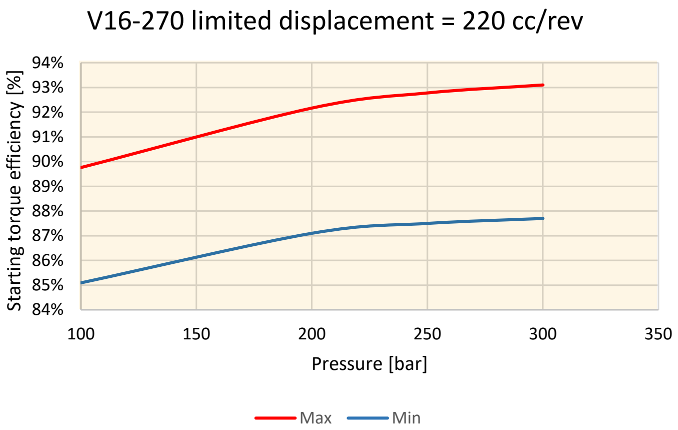
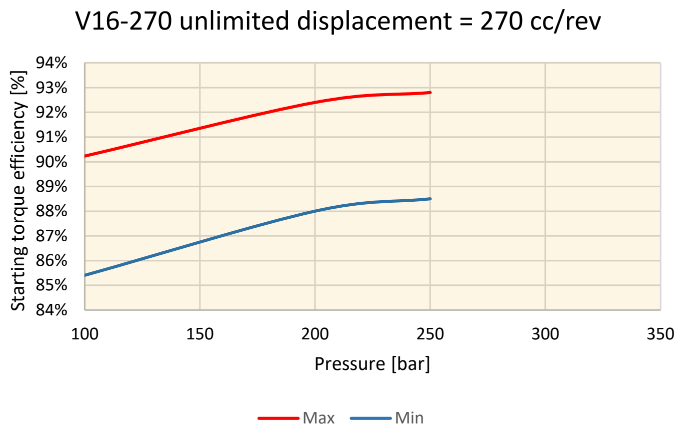


Fig. 1. V16 shaft torque vs. time at 1 rpm









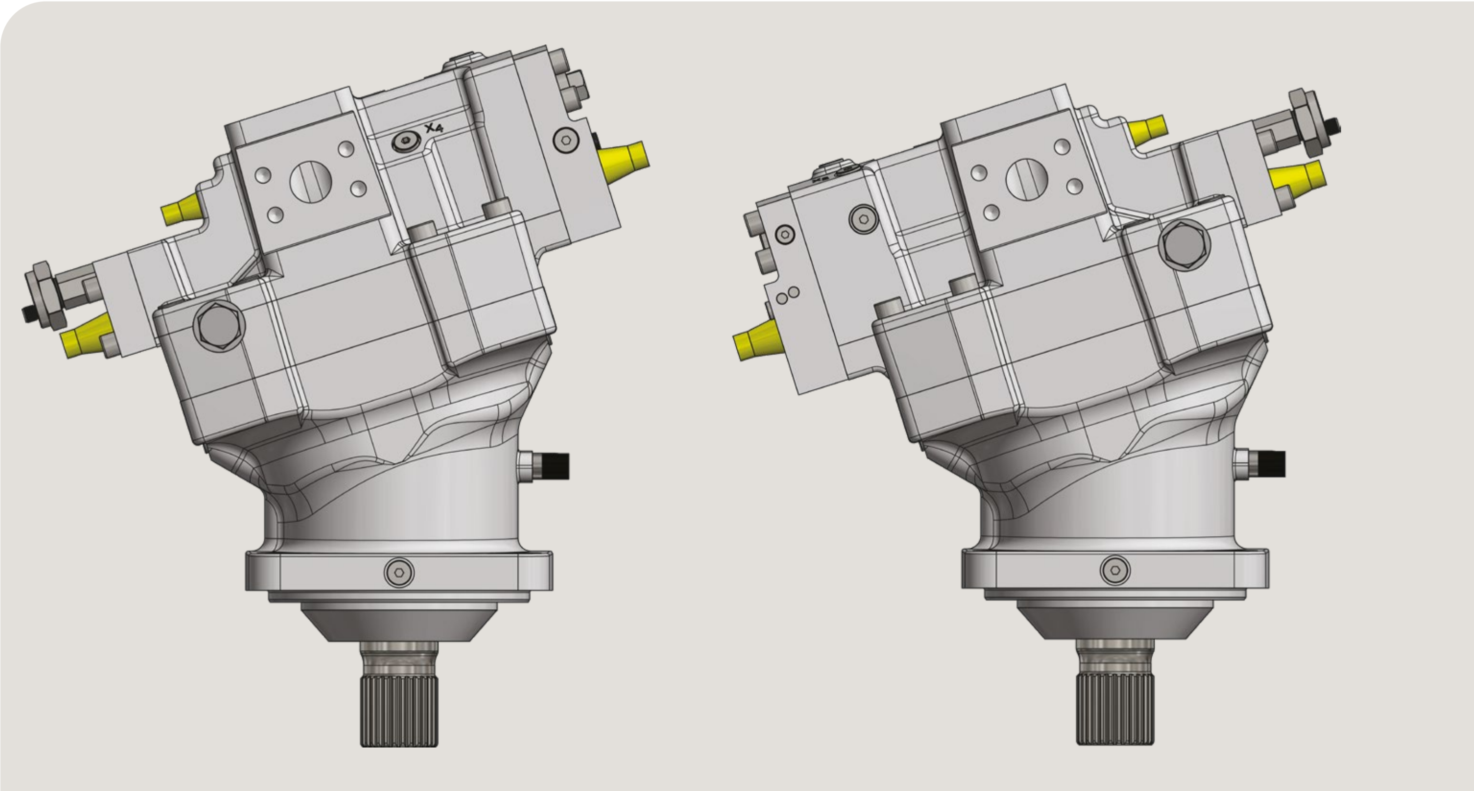
Controls – general information

M version, negative control characteristics

Motor starts in max displacement, standard for EO, EOA, EOB, EP, EPA, EPB, HO, HOC, HP and HPC.

T version, positive control characteristics

Motor starts in min displacement, standard for AC; optional for EO, EOA, EOB, EP, EPA, EPB, HO, HOC, HP and HPC.



The following V16 controls satisfy most application requirements:

- **AC** (automatic pressure compensator)
- **EO** and **HO** (two-position controls)
- **EP** and **HP** (proportional controls)
- **HPC**/**EPA**/**EPB** (HP/EP control with pressure cut off)
- **HOC**/**EOA**/**EOB** (HO/EO control with pressure cut off

All controls utilize a servo piston that connects to the valve segment.

The built-in three-way servo valve determines the position of the setting piston and, in turn, the displacement.

The displacement angle (between output shaft and cylinder barrel) ranges from 35° (max) to 6° (min), to 0°(zero).

Servo supply pressure is obtained from the pressurized, main port through the corresponding, built-in shuttle valve.

The response time (i.e. from max-to-min or from min-to-max displacement) is determined by restrictor nozzles in the servo valve supply and return lines; refer to the schematics.

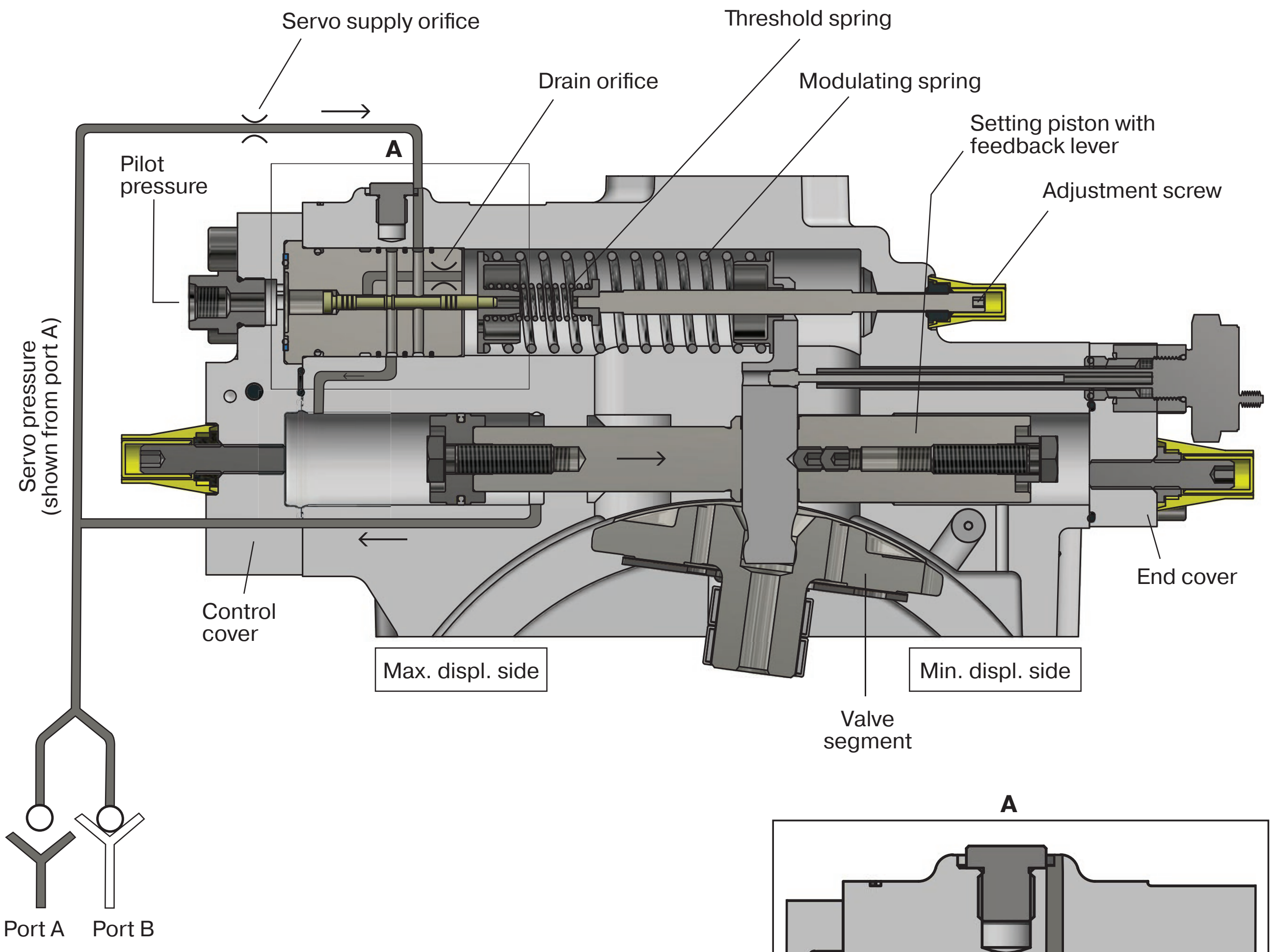
NOTE: The modulating pressure/current, $\Delta p/\Delta I$ values are valid for motors that are not displacement limited.

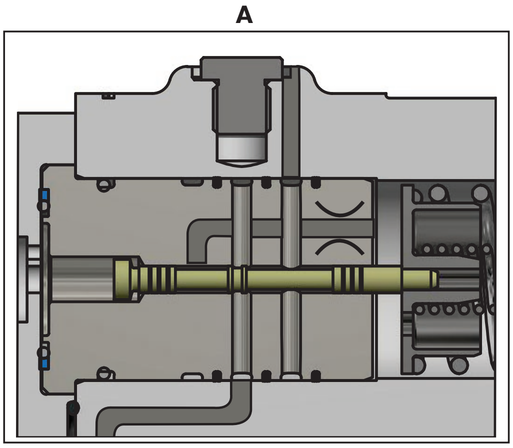
NOTE: To secure control function under most operating conditions, the servo pressure should be at least 30 bar (435 psi).

AC control function

In the AC compensator control, the system pressure is used as pilot pressure. Two versions are available. One version with external pilot pressure (ACE) and one with internal pilot pressure (ACI). The pilot pressure acts directly on a three-way valve spool.

The setting piston and rotating group move to change the displacement to the point where the pressure on the servo is in balance with the force from the feedback spring.





ACE control function, positive control (T code).*

Positive control characteristics (T* code)

When not pressurized the motor will be kept at minimum displacement. When pressurized, the valve spool will move and drain oil (pressure) from the larger diameter of the setting piston.

The motor will stroke between minimum displacement at zero pressure and maximum displacement at maximum pilot pressure.

*(ref. Controls page 55)

AC compensator function

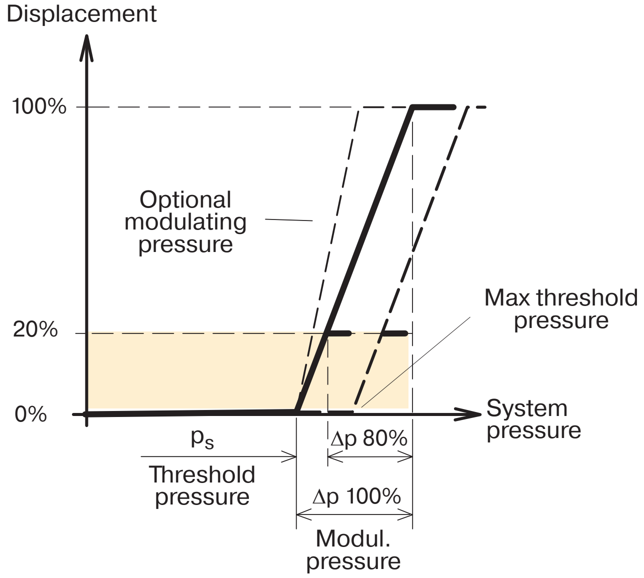
The AC compensator is often used in off-road vehicle hydrostatic propel transmissions. The compensator automatically adjusts motor displacement between available max and min to the output torque requirement (up to max available system pressure).

Normally, the motor stays in the minimum displacement position. When there is a demand for additional torque, e.g. when the vehicle enters an upgrade, the displacement increases (providing more torque) while the motor shaft speed decreases proportionally.

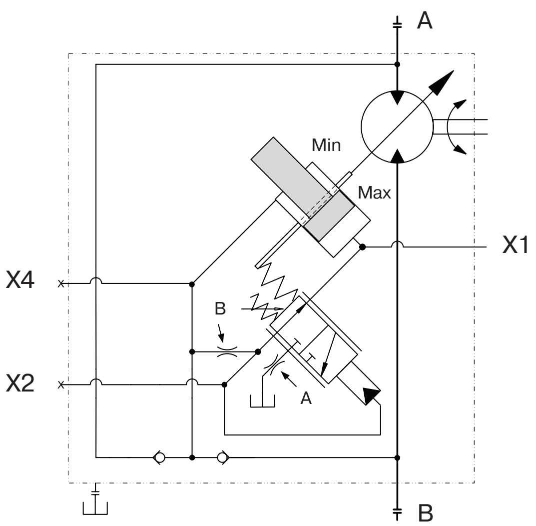
The threshold pressure, where displacement starts to increase ('p_S'; refer to the AC diagram), is adjustable between 100 and 400 bar.

To reach max displacement, an additional modulating pressure range (Δp) above the threshold pressure is required.

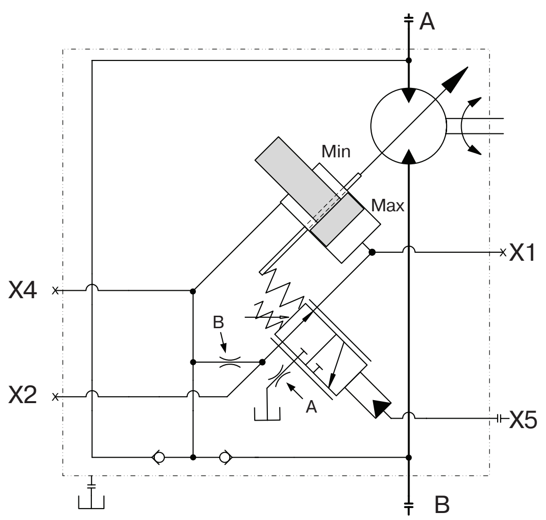
To satisfy specific hydraulic circuit requirements, a modulating pressure range of 15, 25, 35, 50 or 100 bar can be selected.



AC diagram (displacement vs. system pressure).



ACI control, type T, positive control (begin in min. displacement)



ACE control, type T, positive control (begin in min. displacement)

WARNING **Zero degree capability can result in a high risk of overspeed and efficiency drop, if the motor operates between 0 – 20% displacement.**

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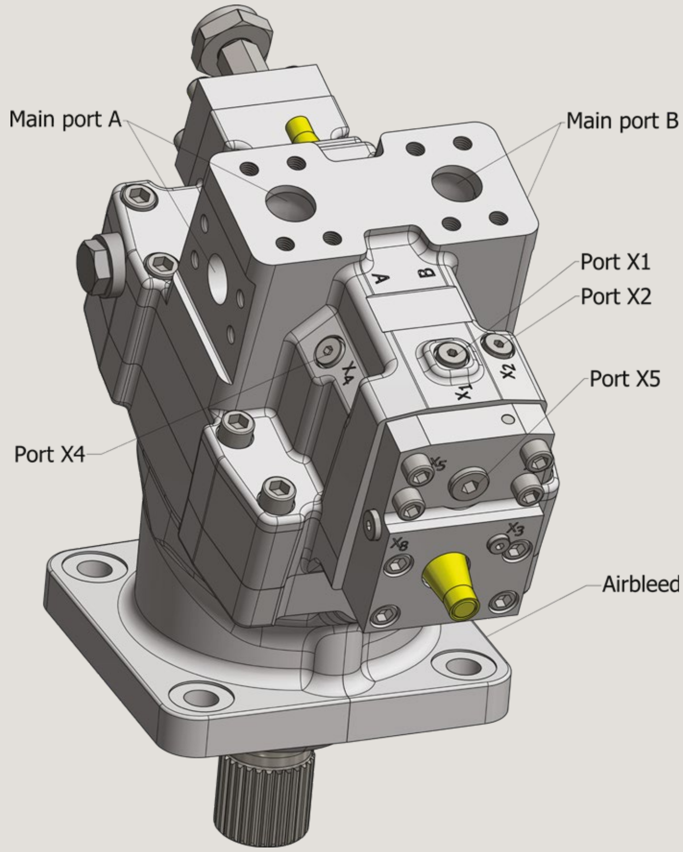
Gauge ports AC compensator



Port locations – V16- with AC compensator.

Gauge/pilot ports (ACI compensator)	
X1	Setting piston pressure (large setting piston area)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
Port sizes:	
–	M14x1.5 (ISO version)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

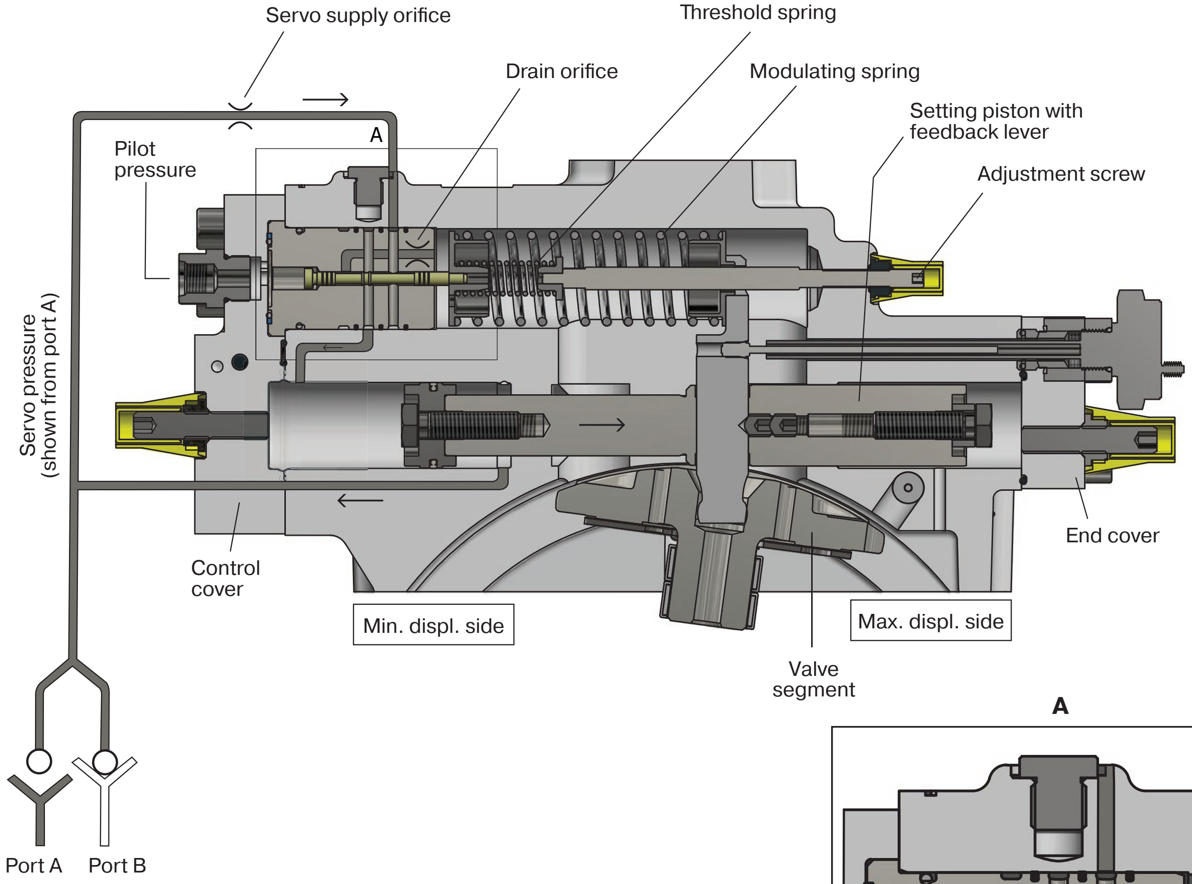
Gauge/pilot ports (ACE compensator)	
X1	Setting piston pressure (large setting piston area)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	Pilot pressure
Port sizes:	
–	M14x1.5 (ISO version)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

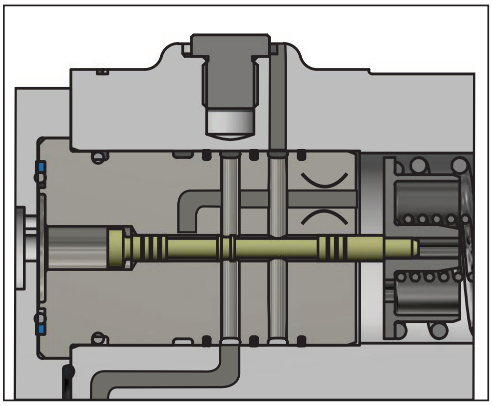
EP control function

The electric proportional control consists of a proportional solenoid which acts directly on a three-way valve spool. When activated, the solenoid pushes the valve spool which drains oil (pressure) from the larger diameter of the setting piston. The setting piston and rotating group move to change the displacement to the point where the pressures on the servo are in balance with the force from the feedback spring.

HP control function

In the hydraulic proportional control, an external pilot pressure acts directly on a three-way valve spool. When activated, the pilot pressure push on the valve spool which drain oil (pressure) from the larger diameter of the setting piston. The setting piston and rotating group move to change the displacement to the point where the pressures on the servo are in balance with the force from the feedback spring.





HP control function (displ. increase at decreasing pilot press.), negative control (M code).*

Negative control characteristics (M* code)

With a de-energized solenoid (EP) or not pressurized (HP), the motor will be kept at maximum displacement. When energized, the solenoid or the pressure pushes the valve spool which drains oil (pressure) from the larger diameter of the setting piston. Depending on solenoid current or pilot pressure, the motor will stroke between maximum displacement at zero current/pressure and minimum displacement at maximum current/pressure.

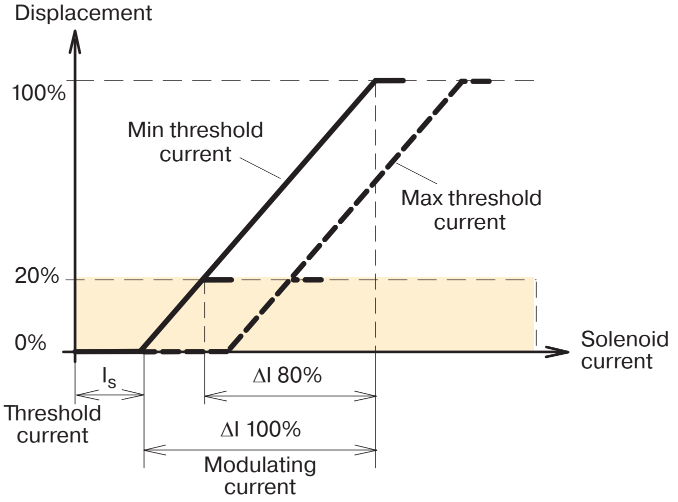
*(ref. Controls page 55)

Positive control characteristics (T* code)

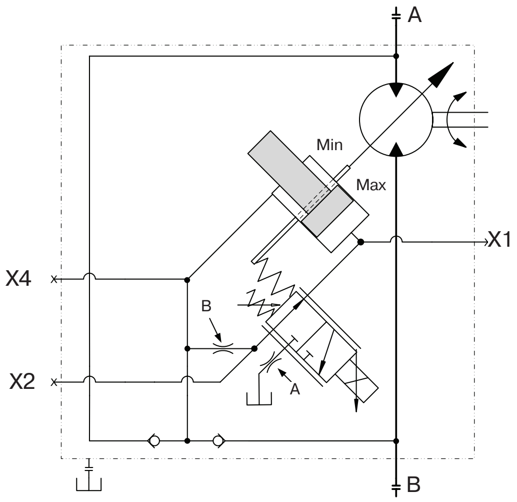
With a de-energized solenoid (EP) or not pressurized (HP), the motor will be kept at minimum displacement. When energized, the solenoid or the pressure pushes the valve spool which drains oil (pressure) from the larger diameter of the setting piston. Depending on solenoid current or pilot pressure, the motor will stroke between minimum displacement at zero current/pressure and maximum displacement at maximum current/pressure.

EP control function

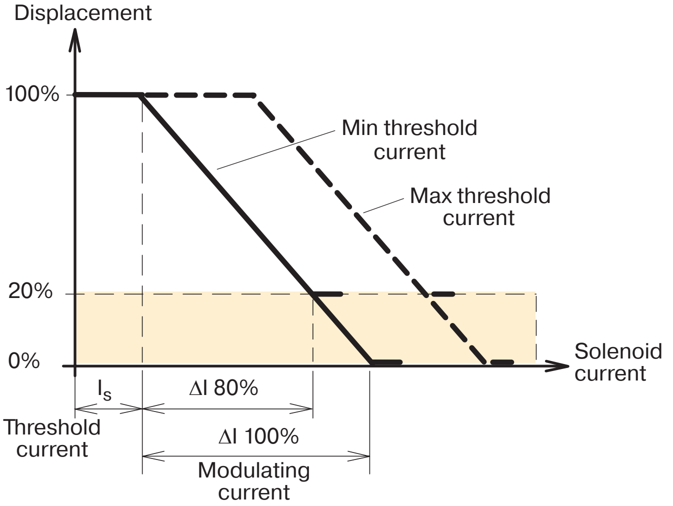
The solenoid is either 12 or 24 VDC, requiring 900 and 450 mA respectively.
The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The correspon-ding female connector is not included.
Note: The female connector is available as spare part P-N 3787488.
The threshold current of the 12 VDC solenoid is factory set at 500 mA; (ref. chart 1 and 2, on pages 79 and 80).
The 24 VDC solenoid is factory set at 250 mA; (ref. chart 1 and 2, on on pages 81 and 82).
When utilizing the full displacement range, the required modulating current range (ΔI) is 900 mA (12V solenoid) and 450 mA (24 V solenoid).
In order to minimize hysteresis, a pulse-width modulated (PWM) control signal of 50 to 60 Hz should be provided.
Note: The modulating current range (ΔI) is not adjus-table.



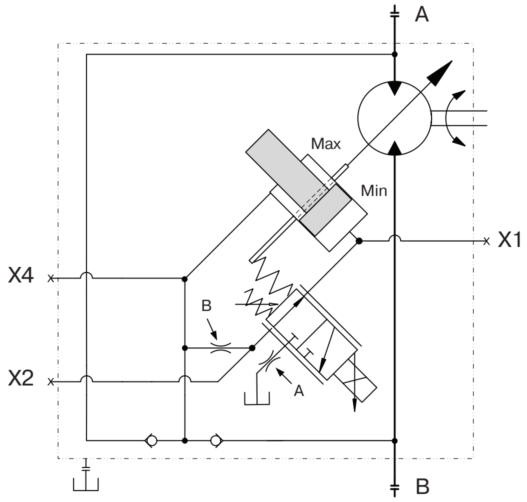
EP diagram (displacement vs. solenoid current). (type T, positive control)



EP control, type T, positive control (begins at min. displacement)



EP diagram (displacement vs. solenoid current). (type M, negative control)



EP control, type M, negative control (begins at max. displacement)

WARNING **Zero degree capability can result in a high risk of overspeed and efficiency drop, if the motor operates between 0 – 20% displacement.**

EP control (also valid for EPA/EPB)

Control type	Start/end point	Displacement [%]	Current [mA]
EP 12V neg. (M type)	Start point	from 100 %	500
		from D_y	$(1\text{-}D_y / D_{max}) \times 900 + 500$
	End point	at 0 %	1400
		at D_x	$(1\text{-}D_x / D_{max}) \times 900 + 500$
	Max allowed current		1760
EP 24V neg. (M type)	Start point	from 100 %	250
		from D_y	$(1\text{-}D_y / D_{max}) \times 450 + 250$
	End point	at 0 %	700
		at D_x	$(1\text{-}D_x / D_{max}) \times 450 + 250$
	Max allowed current		880
EP 12V pos. (T type)	Start point	from 0 %	500
		from D_x	$(D_x / D_{max}) \times 900 + 500$
	End point	at 100 %	700
		at D_y	$(D_y / D_{max}) \times 900 + 500$
	Max allowed current		1760
EP 24V pos. (T type)	Start point	from 0 %	250
		from D_x	$(D_x / D_{max}) \times 450 + 250$
	End point	at 100 %	1400
		at D_y	$(D_y / D_{max}) \times 450 + 250$
	Max allowed current		880

Fig. 1. Formula for calculating start and input command (mA) dependent of displacement limitations.

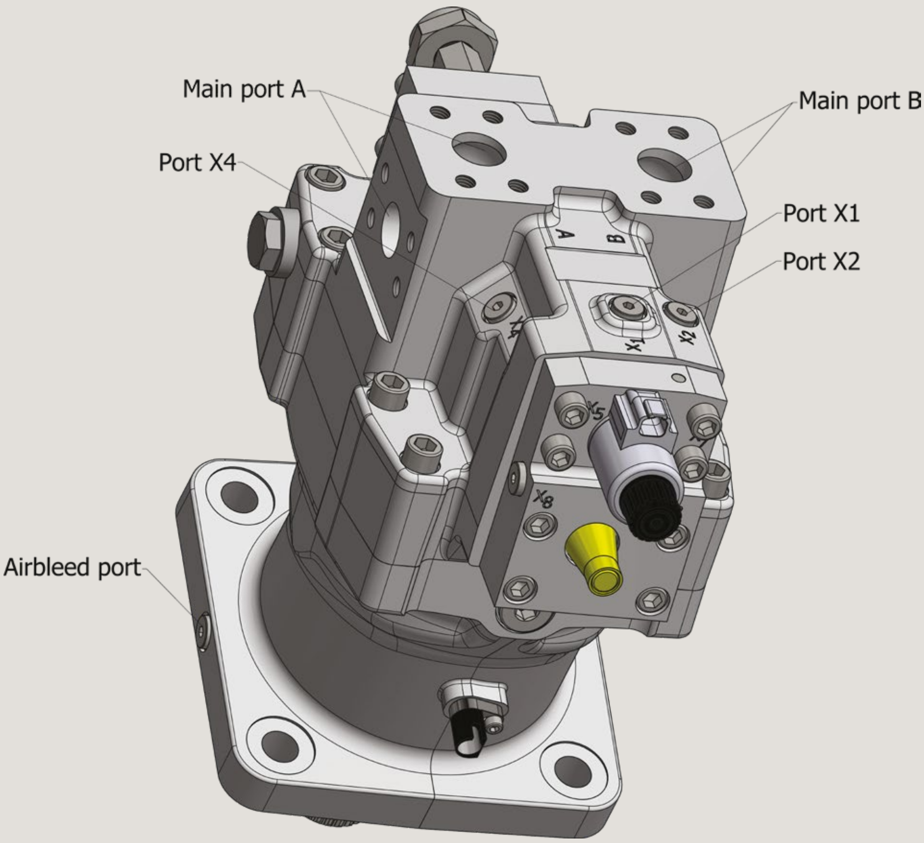
D_{max}	Max theoretic displacement [cm^3/rev]
D_x	Min displacement limitation [cm^3/rev]
D_y	Max displacement limitation [cm^3/rev]
x	Min displacement [%]
y	Max displacement [%]
12V: Delta I [mA]	900
24V: Delta I [mA]	450
12V: Start current [mA]	500
24V: Start current [mA]	250

Fig. 2. Definitions.

Coil temperature influence on solenoid force

when the coil temperature increases the coil resistance also increases. The increased coil resistance will lead to a lower solenoid force for a constant current.

Gauge ports EP control



Port locations – V16- with EP control.

Gauge/pilot ports (EP control):	
X1	Setting piston pressure (large setting piston area)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
Port sizes:	
–	M14x1.5 (ISO version)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

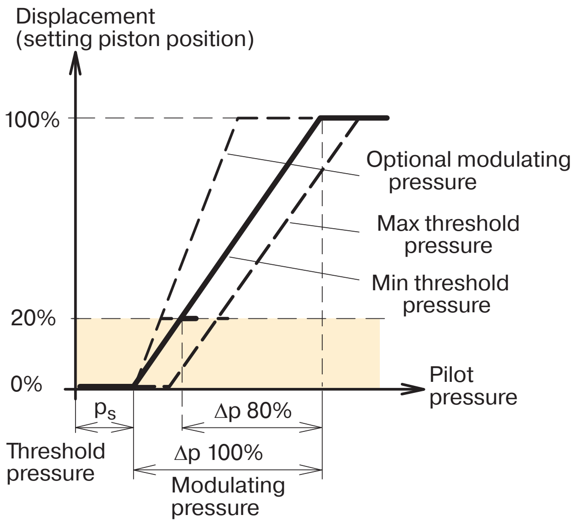
HP hydraulic proportional control

The HP proportional control offers continuously variable displacement, the pilot signal is hydraulic.

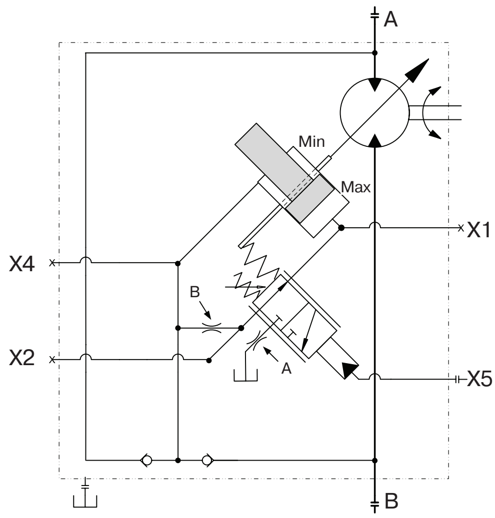
Normally, the setting piston stays in the max or min displacement position. When a sufficiently high pilot pressure (p_S) is applied to port X5, the setting piston starts to move towards the max (type T) or min (type M) displacement position.

As shown by the HP diagrams, the displacement vs. pilot pressure gradient is proportional to the selected modulating pressure range.

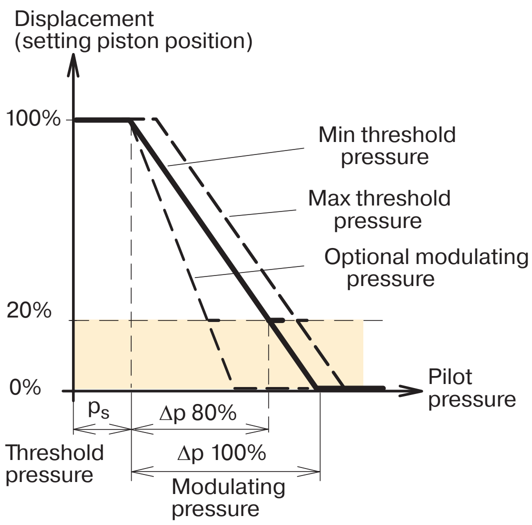
To satisfy specific hydraulic circuit requirements, a modulating pressure range of 15, 25 or 35 bar can be selected. The threshold pressure (p_S) is factory set at 10 bar, but can be adjusted between 10-25 bar; (ref. chart 1 and 2, pages 81 and 82).



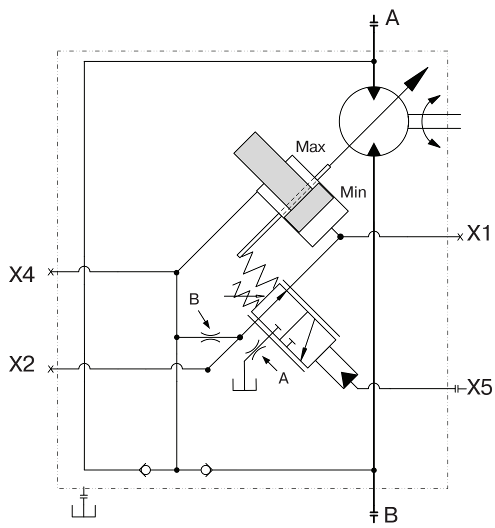
*HP diagram (displacement vs. pilot pressure).
(type T, positive control)*



*HP control, type T, positive control
(begins at min. displacement)*



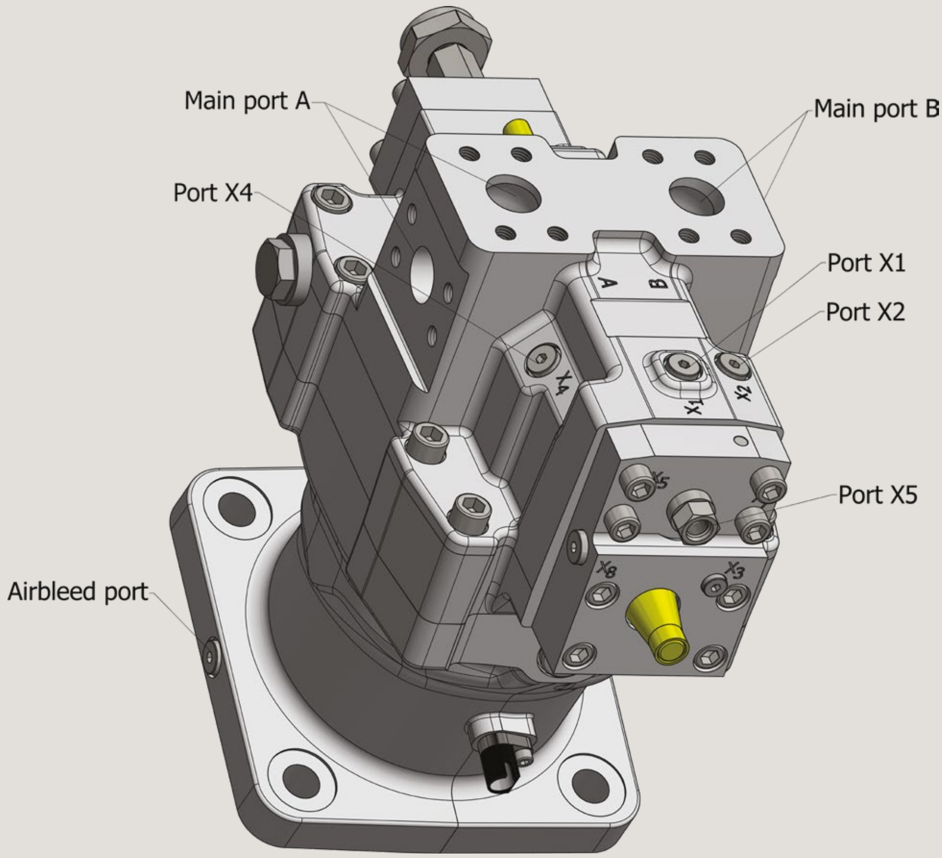
*HP diagram (displacement vs. pilot pressure).
(type M, negative control)*



*HP control, type M, negative control
(begins at max. displacement)*

WARNING **Zero degree capability can result in a high risk of overspeed and efficiency drop, if the motor operates between 0 – 20% displacement.**

Gauge ports HP control



Port locations – V16-220/270 with HP control.

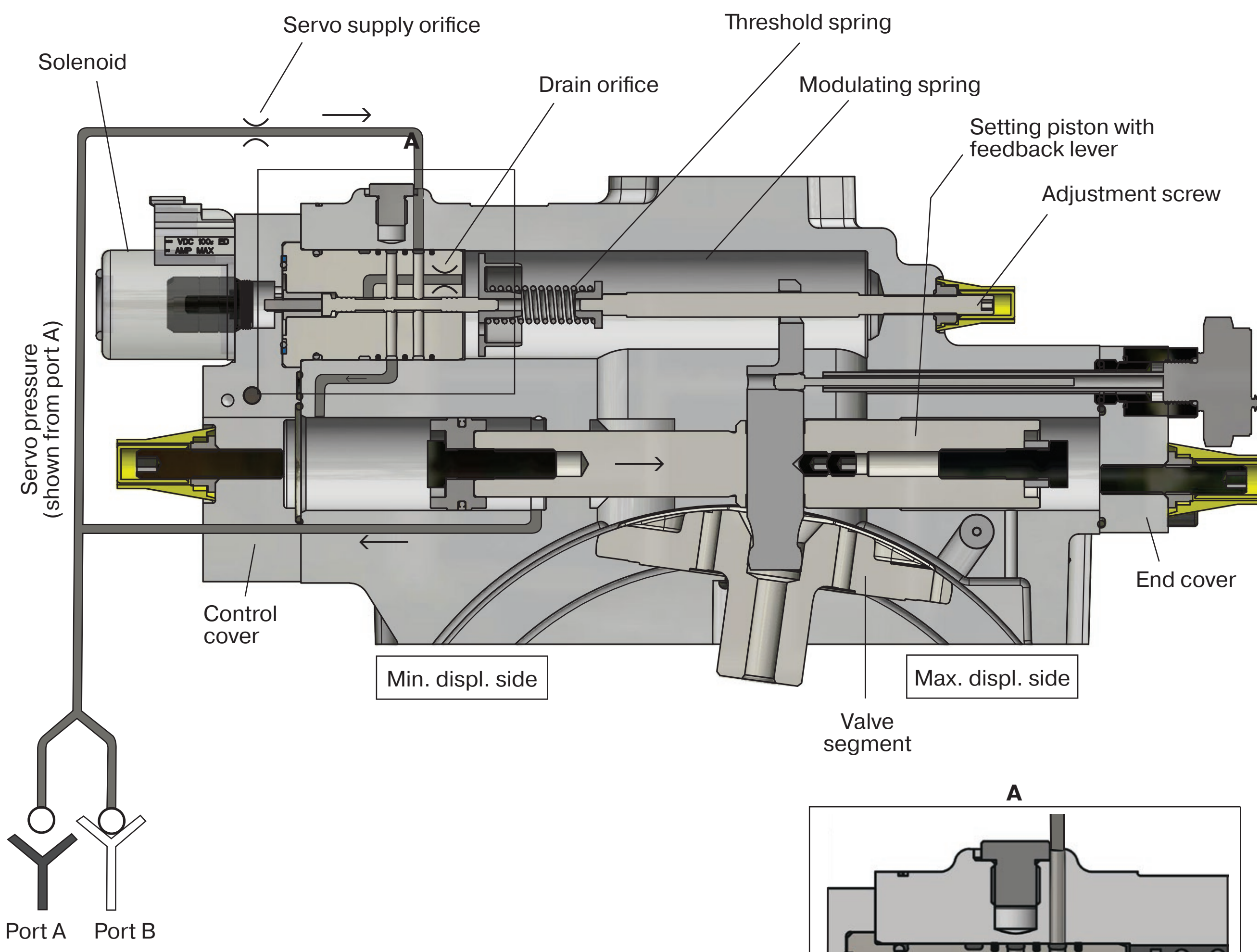
Gauge/pilot ports (HP control):	
X1	Setting piston pressure (large setting piston area)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar; HO and HP control)
Port sizes:	
–	M14x1.5 (ISO version)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version)

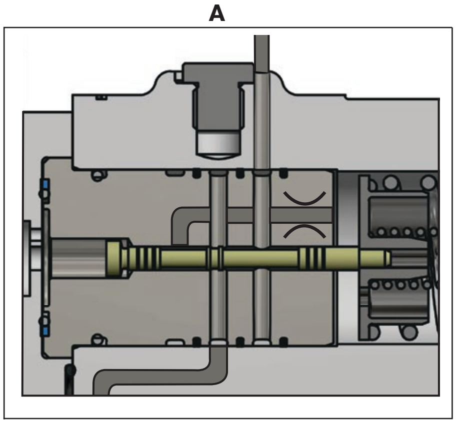
EO control function

The electric two-position control consists of an on/off solenoid which acts directly on a three-way valve spool. Servo pressure is internally supplied to the two-position porting spool by an internal shuttle valve.

HO control function

In the hydraulic two-position control, an external pilot pressure acts directly on a three-way valve spool. Servo pressure is internally supplied to the two-position porting spool by an internal shuttle valve.





EO control function (displ. increase at decreasing solenoid current), negative control (M code).*

EO,HO negative control characteristics (M* code)

With a de-energized solenoid (EO) or not pressurized (HO), the motor will be kept at maximum displacement. When energized, the solenoid or pressure pushes on the valve spool which drains oil (pressure) from the larger diameter of the setting piston and strokes the motor to minimum displacement.

EO,HO positive control characteristics (T* code)

With a de-energized solenoid (EO) or not pressurized (HO), the motor will be kept at minimum displacement. When energized, the solenoid or pressure pushes on the valve spool which drains oil (pressure) from the larger diameter of the setting piston and strokes the motor to maximum displacement.

EO electric two-position control

The EO is utilized in transmissions where only two operating modes are required – low speed/high torque and high speed/low torque.

Intermediate displacements cannot be obtained with this control.

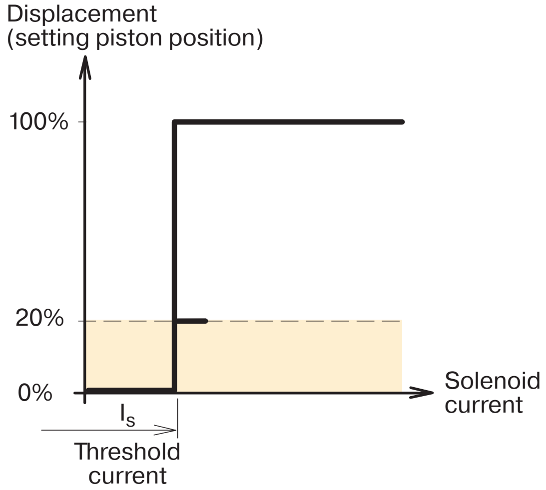
Servo pressure is supplied internally (through a check valve from the utilized high pressure port); refer to the schematic below.

The solenoid is either 12 or 24 VDC, requiring 900 mA and 450 mA respectively.

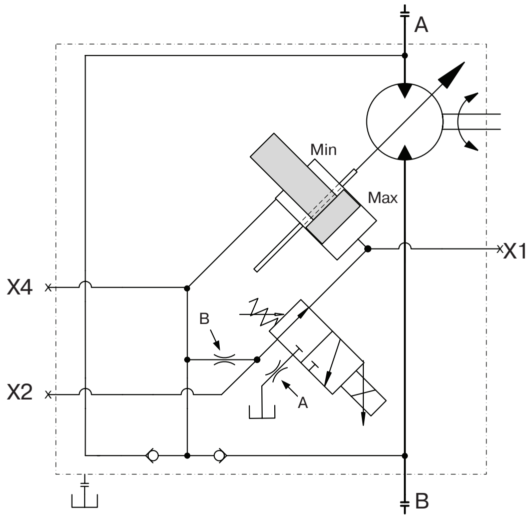
The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The corresponding female connector is not included.

Note: The female connector is available as spare part P-N 3787488.

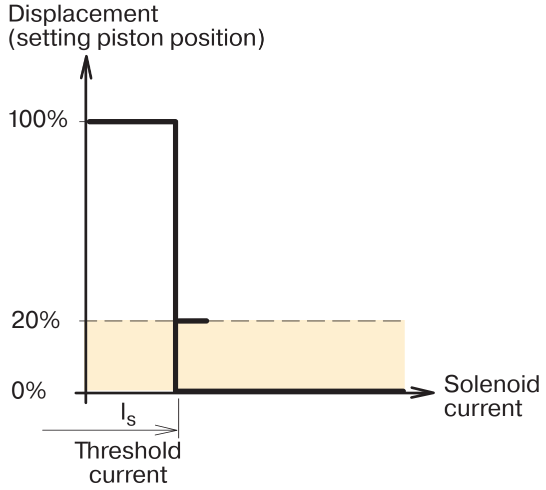
The threshold current of the 12 VDC solenoid is factory set at 500 mA. The 24 VDC solenoid is factory set at 250 mA. (Ref. charts 1 and 2, on pages 81 and 82).



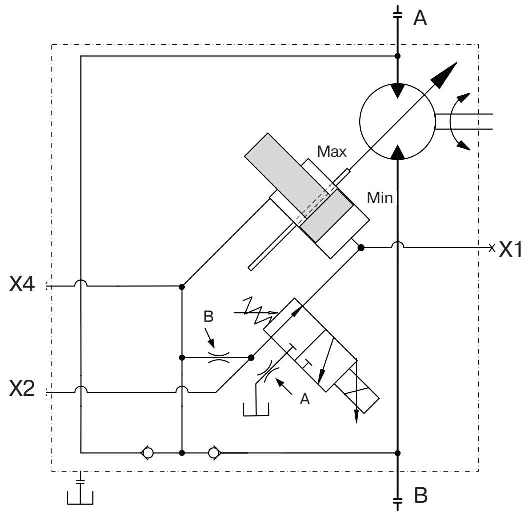
*EO diagram (displacement vs. solenoid current).
(type T, positive control)*



*EO control, type T, positive control
(begins at min. displacement)*



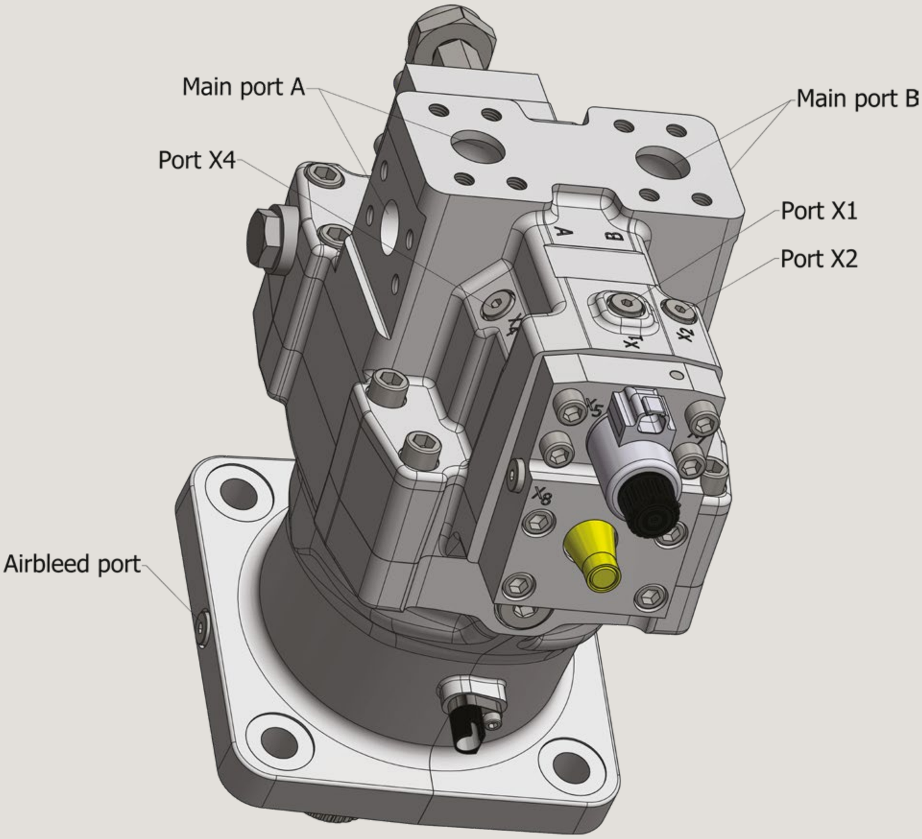
*EO diagram (displacement vs. solenoid current).
(type M, negative control)*



*EO control, type M, negative control
(begins at max. displacement)*

WARNING **Zero degree capability can result in a high risk of overspeed and efficiency drop, if the motor operates between 0 – 20% displacement.**

Gauge ports EO control



Port locations – V16-220/270 with EO control.

Gauge/pilot ports (EO control):	
X1	Setting piston pressure (large setting piston area)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
Port sizes:	
–	M14x1.5 (ISO version)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

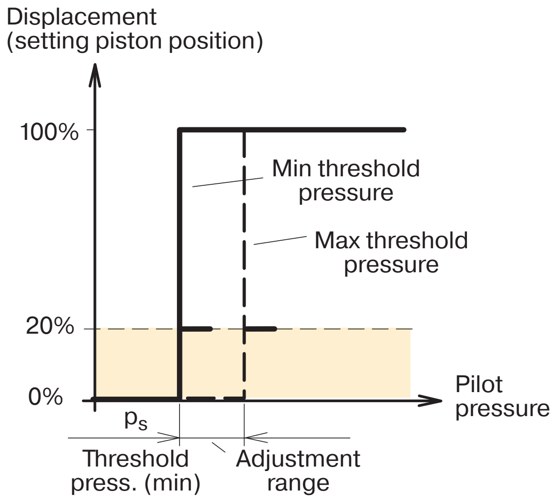
HO hydraulic two-position control

The two-position HO control is similar to the EO but the control signal is hydraulic. The position of the setting piston is governed by the built-in servo valve spool (same on all controls).

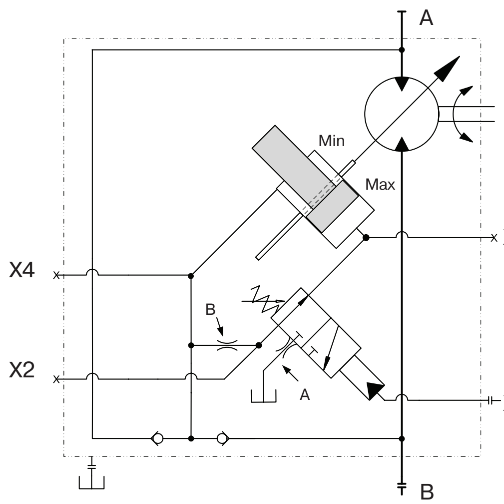
When the applied pilot pressure (port X5) exceeds the pre-set threshold value, the setting piston moves from min to max (type T) or from max to min (type M) displacement position.

Positions between max and min cannot be obtained with this control.

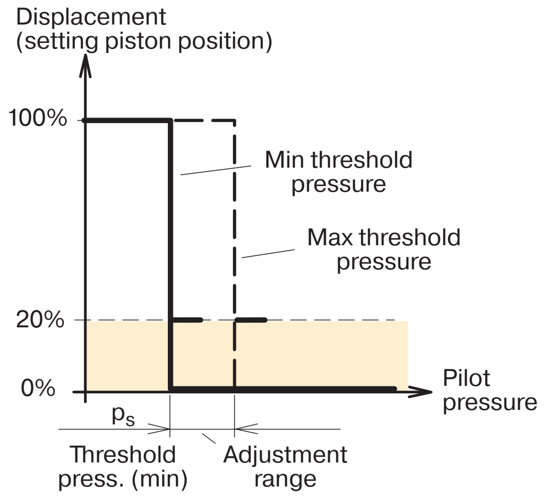
The threshold pressure is factory set at 10 bar, but can be adjusted between 10-25 bar; (ref. charts 1 and 2, on pages 81 and 82).



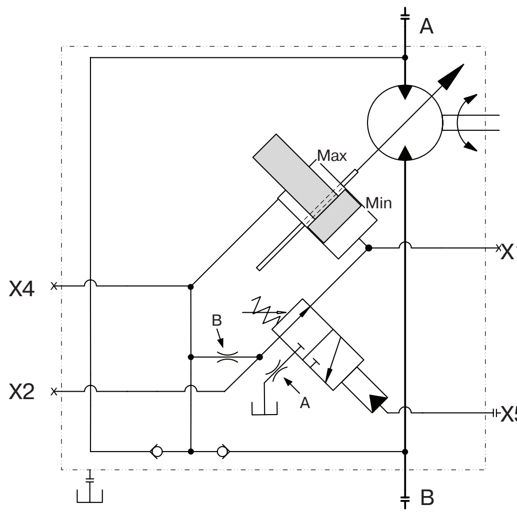
HO diagram (displacement vs. pilot pressure).
(type T, positive control)



HO control, type T, positive control
(begins at min. displacement)



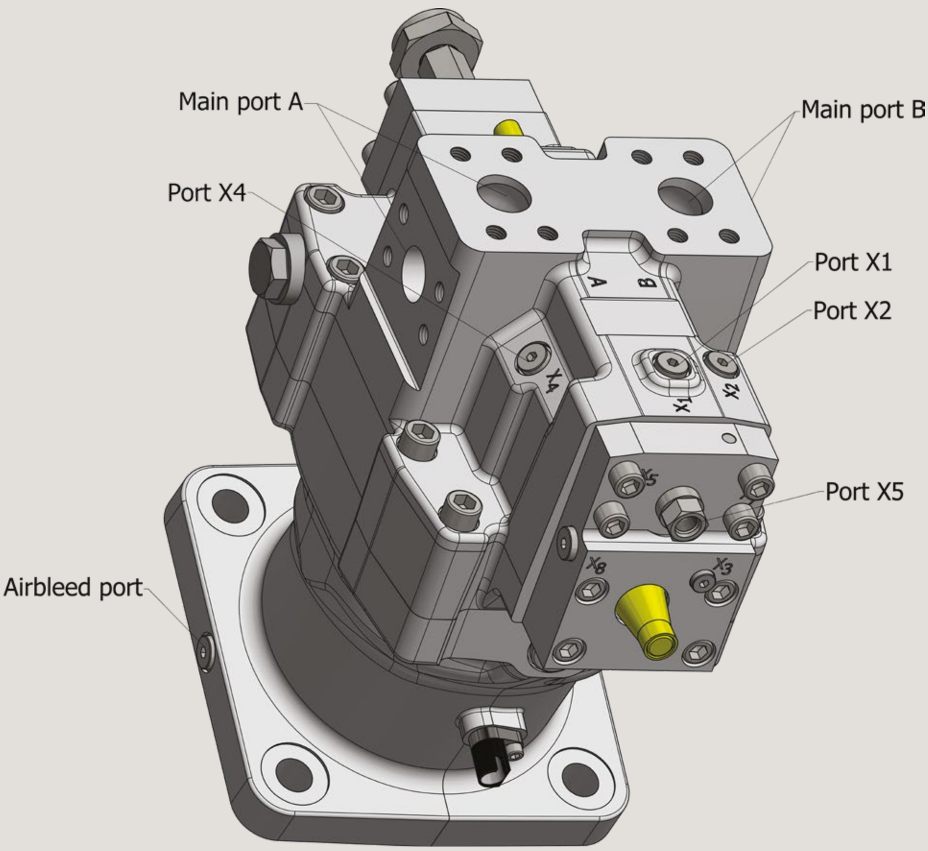
HO diagram (displacement vs. pilot pressure).
(type M, negative control)



HO control, type M, negative control
(begins at max. displacement)

WARNING **Zero degree capability can result in a high risk of overspeed and efficiency drop, if the motor operates between 0 – 20% displacement.**

Gauge ports HO control



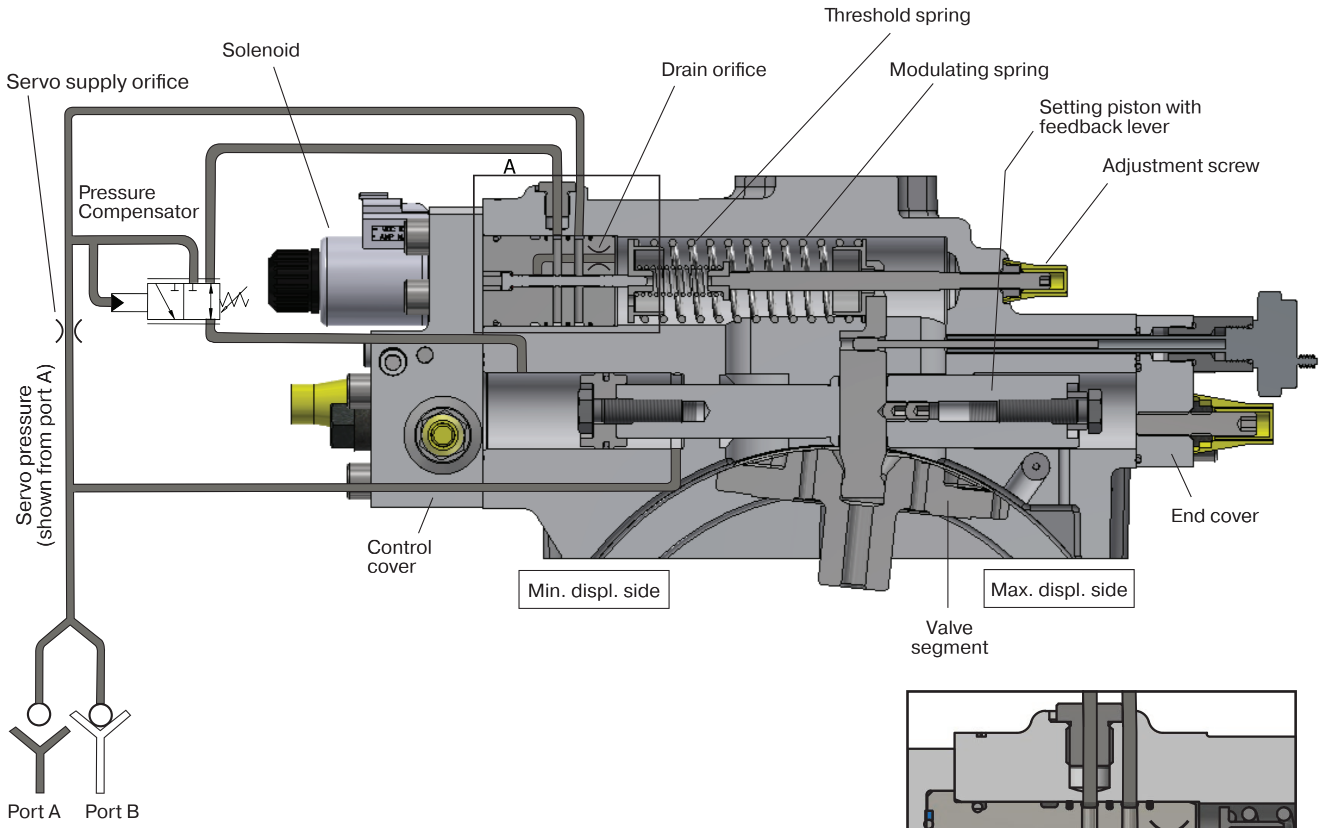
Port locations – V16-220/270 with HO control.

Gauge/pilot ports (HO control):	
X1	Setting piston pressure (large setting piston area)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar; HO and HP control)
Port sizes:	
–	M14x1.5 (ISO version)
–	9/16"-18 O-ring boss (SAE version)

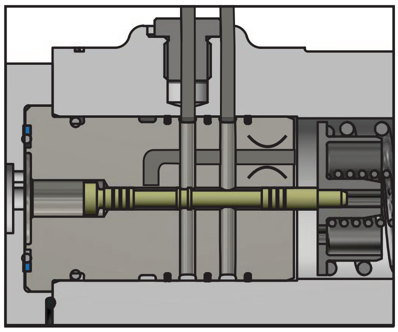
EPA/EPB/HPC/EOA/EOB/HOC control function

The electric, hydraulic proportional and two-position controls, can be overridden by the pressure compensator using the system pressure. When pressure rises above the pressure compensator setting, the pressure compensator will be activated.

The motor displacement is then controlled automatically by the system pressure in such way that slightly increased system pressure increases the motor displacement towards maximum.



EPA/EPB control function (displ. increases at decreasing solenoid current), negative control (M code).*



A

Negative control characteristics (M code)

With a de-energized solenoid (EP/EO) or not pressurized (HP/HO), the motor will be kept at maximum displacement. When energized, the solenoid current or the pilot pressure pushes the valve spool which drains oil (pressure) from the larger diameter of the setting piston. Depending on solenoid current or pilot pressure, the motor will stroke between maximum displacement at zero current/pressure and minimum displacement at maximum current/pressure. When pressure rises above the pressure compensator setting the displacement is controlled automatically by the system pressure.

Positive control characteristics (T code)

With a de-energized solenoid (EP/EO) or not pressurized (HP/HO), the motor will be kept at minimum displacement. When energized, the solenoid or the pressure pushes the valve spool which drains oil (pressure) from the larger diameter of the setting piston. Depending on the solenoid current or pilot pressure, the motor will stroke between minimum displacement at zero current/pressure and maximum displacement at maximum current/pressure. When pressure rises above the pressure compensator setting the displacement is controlled automatically by the system pressure.

*(ref. Controls page 55)

EPA/EPB control with pressure cutoff

The pressure cutoff overrides the EP control.

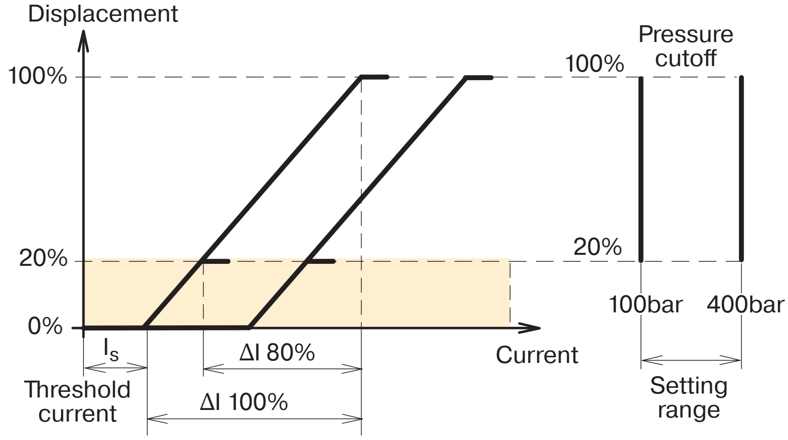
If the system pressure increase, due to the load or reduced motor displacement to the setting of the pressure cutoff valve, the control increases displacement. When displacement increases, the available torque increases as well but the system pressure remains constant.

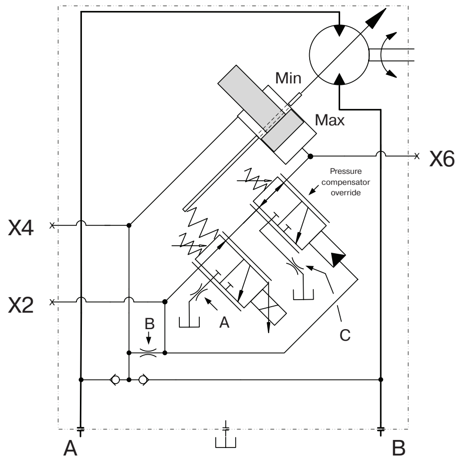
Pressure cutoff setting range is 100 – 400 bar. One revolution corresponds to 48 bar (696 psi)

The threshold current of the 12 VDC solenoid is factory set at 500 mA. The 24 VDC solenoid is factory set at 250 mA. (Ref. charts 1 and 2, on pages 81 and 82).

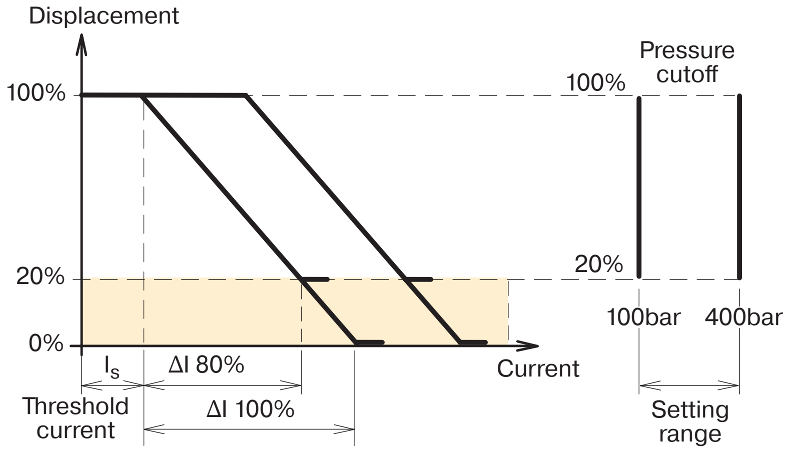
The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The corresponding female connector is not included.

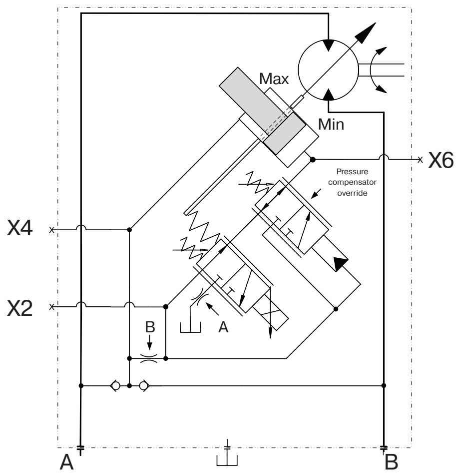
Note: The female connector is available as spare part P-N 3787488.





EPA/B control, type T, positive control (begins at min. displacement)





EPA/B control, type M, negative control (begins at max. displacement)

WARNING **Zero degree capability can result in a high risk of overspeed and efficiency drop, if the motor operates between 0 – 20% displacement.**

EOA/EOB control with pressure cutoff

The pressure cutoff overrides the EO control.

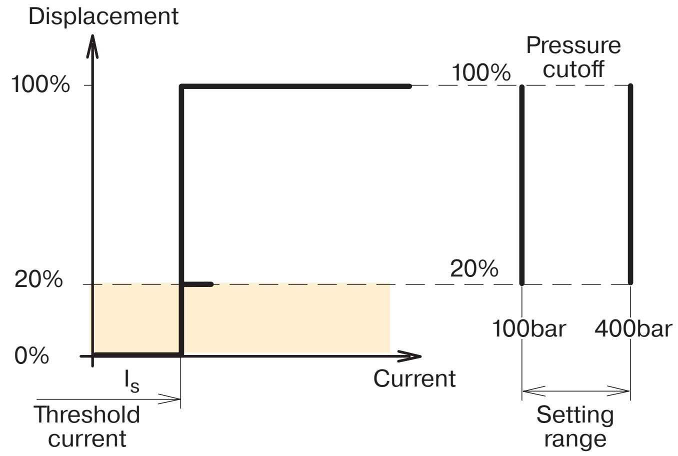
If the system pressure increase, due to the load or reduced motor displacement, to the setting of the pressure cutoff valve, the control increases displacement. When displacement increases, the available torque increases as well but the system pressure remains constant.

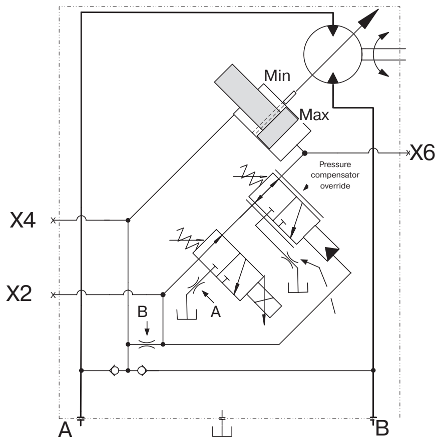
Pressure cutoff setting range is 100 – 400 bar. One revolution corresponds to 48 bar (696 psi)

The threshold current of the 12 VDC solenoid is factory set at 500 mA. The 24 VDC solenoid is factory set at 250 mA. (Ref. charts 1 and 2, on pages 81 and 82).

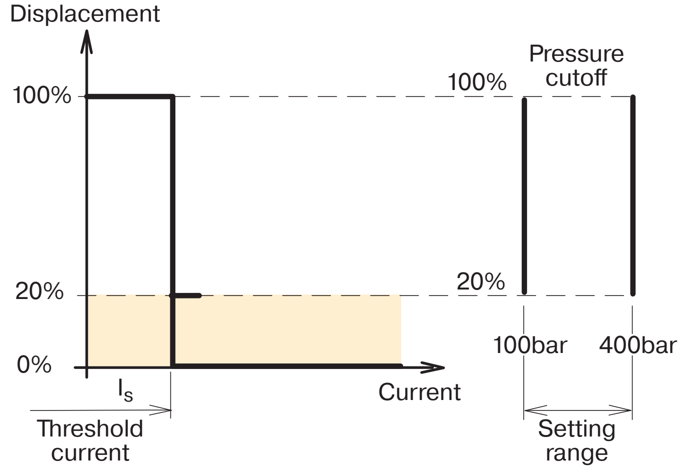
The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The corresponding female connector is not included.

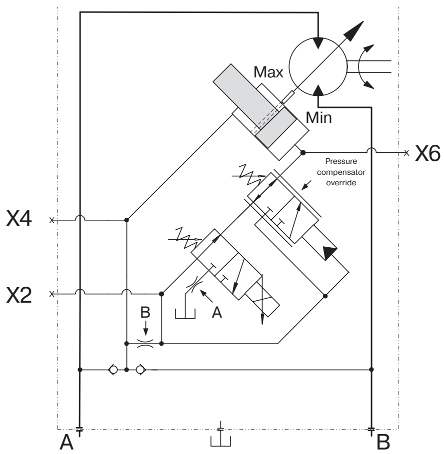
Note: The female connector is available as spare part P-N 3787488.





EOA/B control, type T, positive control (begins at min. displacement)

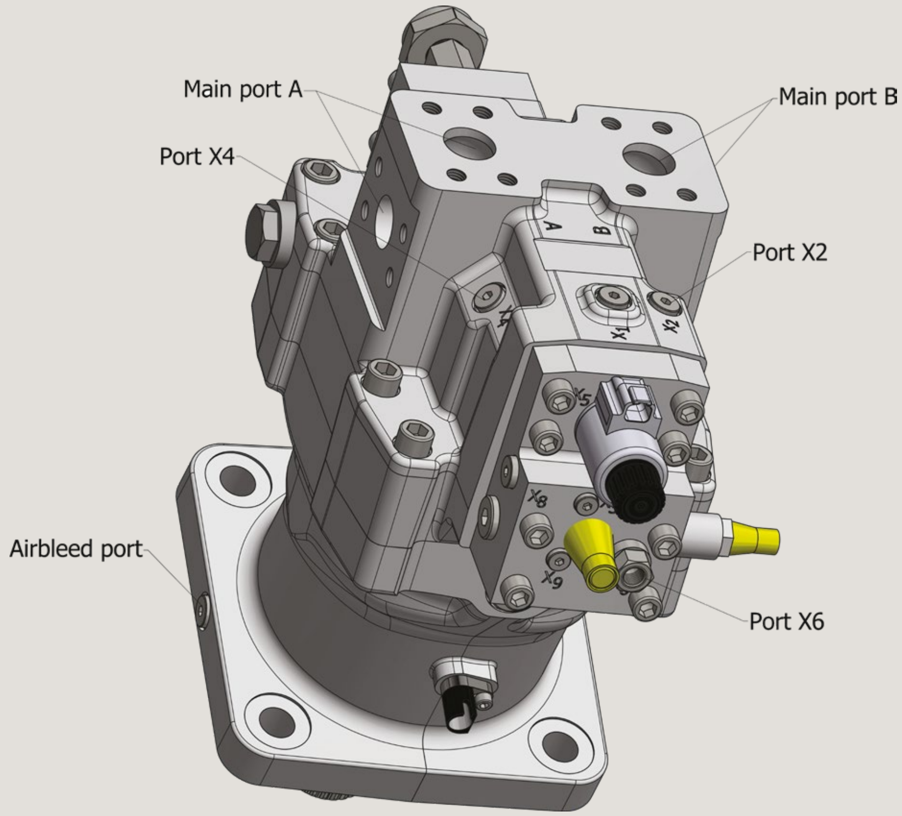




EOA/B control, type M, negative control (begins at max. displacement)

WARNING **Zero degree capability can result in a high risk of overspeed and efficiency drop, if the motor operates between 0 – 20% displacement.**

Gauge ports EPA/EPB/EOA/EOB control



Port locations – V16-220/270 with EPA/EPB/EOA/EOB control.

Gauge/pilot ports (EPA/EPB/EOA/EOB control):	
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X6	Setting piston pressure (large setting piston area)
Port sizes:	
–	M14x1.5 (ISO version)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

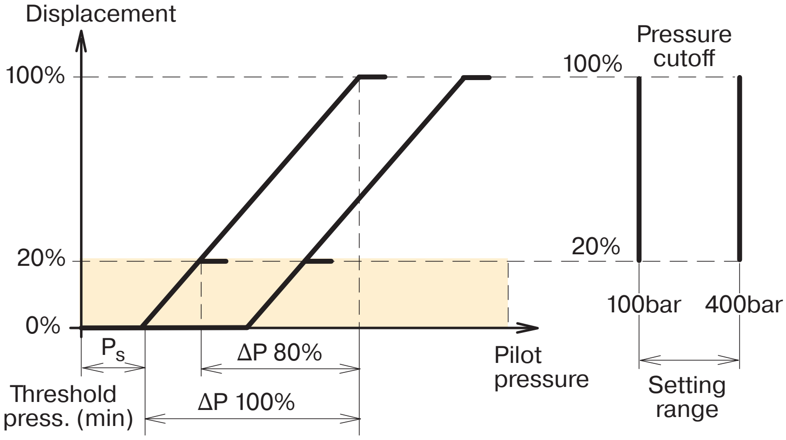
HPC control with pressure cutoff

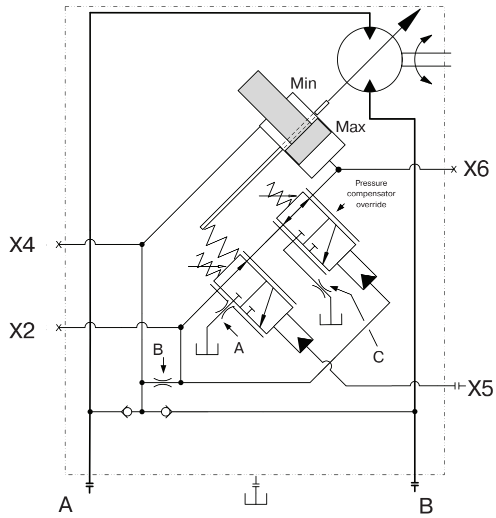
The pressure cutoff overrides the HP control.

If the system pressure increase, due to the load or reduced motor displacement, to the setting of the pressure cutoff valve, the control increases displacement. When displacement increases, the available torque increases as well but the system pressure remains constant.

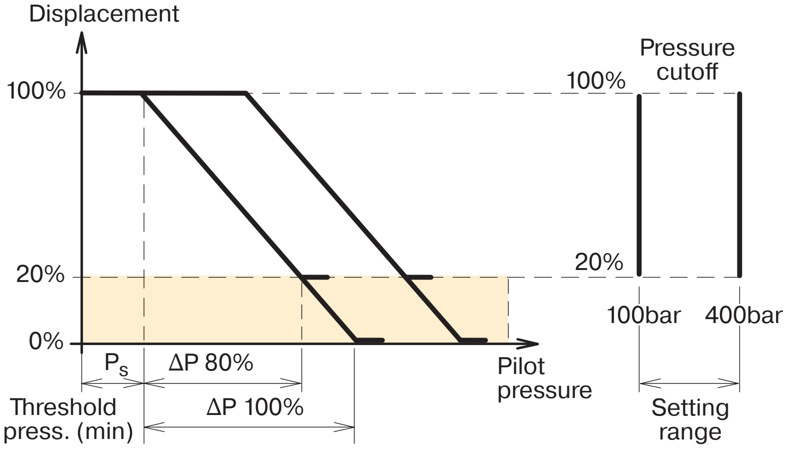
Pressure cutoff setting range is 100 – 400 bar. One revolution corresponds to 48 bar (696 psi)

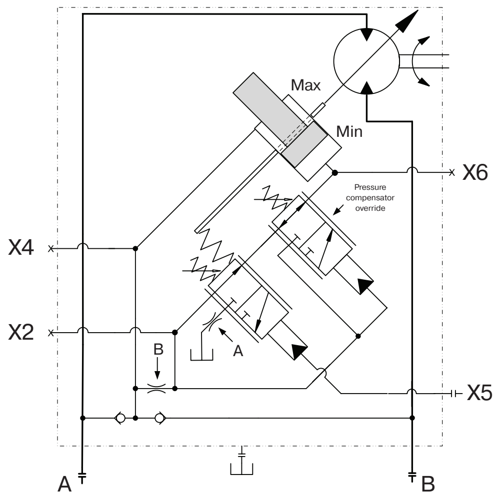
Threshold pressure is preset from factory to 10 bar; (ref. charts 1 and 2, on pages 81 and 82).





HPC control, type T, positive control (begins at min. displacement)





HPC control, type M, negative control (begins at max. displacement)

WARNING **Zero degree capability can result in a high risk of overspeed and efficiency drop, if the motor operates between 0 – 20% displacement.**

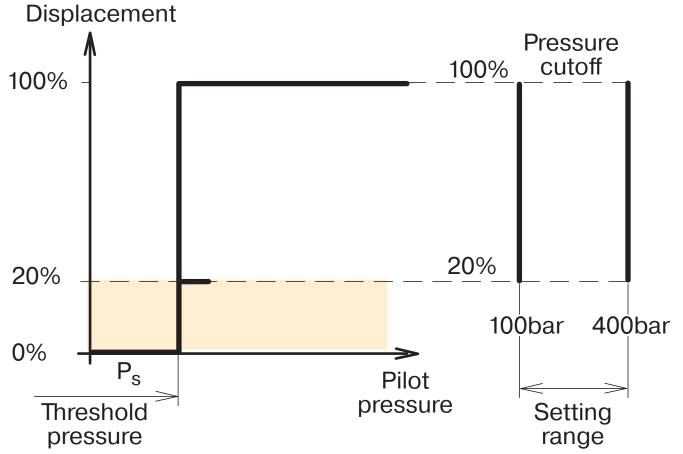
HOC control with pressure cutoff

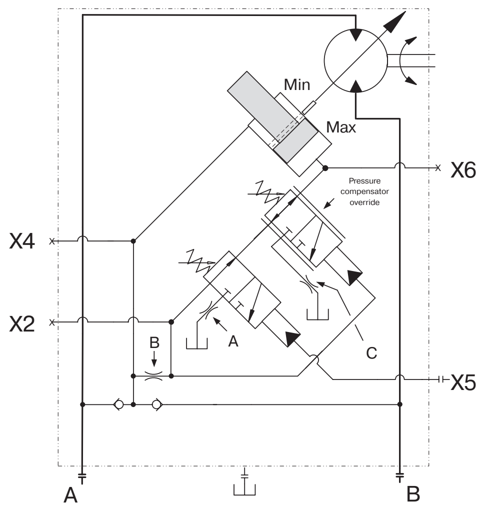
The pressure cutoff overrides the HO control.

If the system pressure increase, due to the load or reduced motor displacement to the setting of the pressure cutoff valve, the control increases displacement. When displacement increases, the available torque increases as well but the system pressure remains constant.

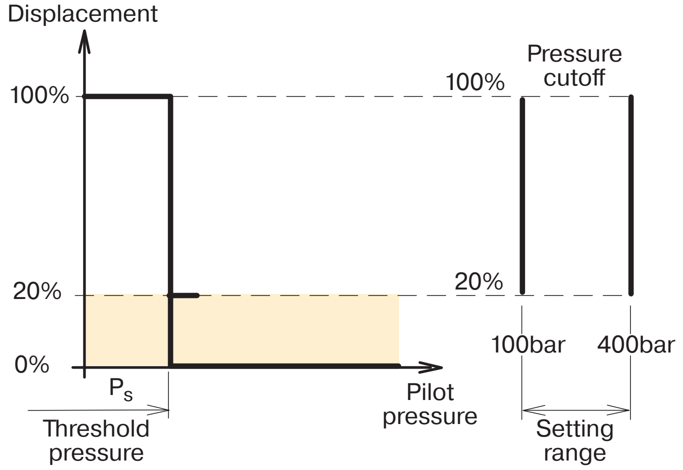
Pressure cut off setting range is 100 – 400 bar. One revolution corresponds to 48 bar (696 psi)

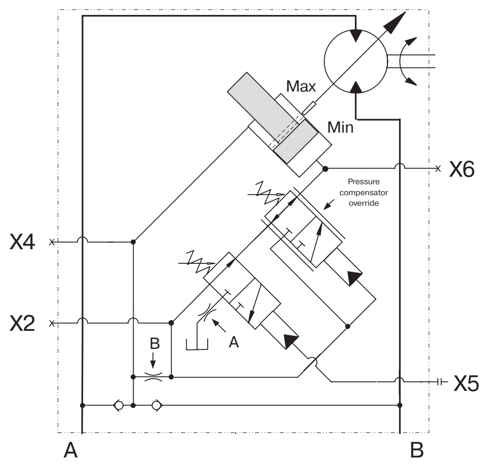
Threshold pressure is preset from factory to 10 bar; (ref. charts 1 and 2, on pages 81 and 82).





HOC control, type T, positive control (begins at min. displacement)

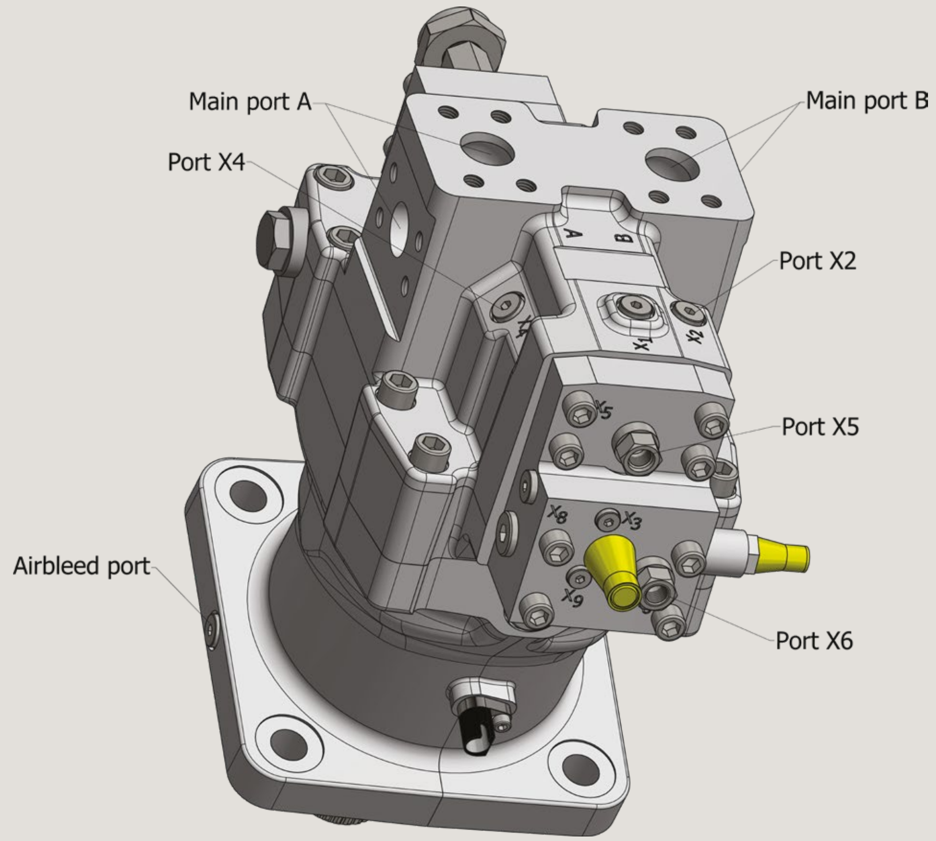




HOC control, type M, negative control (begins at max. displacement)

WARNING **Zero degree capability can result in a high risk of overspeed and efficiency drop, if the motor operates between 0 – 20% displacement.**

Gauge ports HPC/HOC control



Port locations – V16-220/270 with HPC/HOC control.

Gauge/pilot ports (HPC/HOC control):	
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar)
X6	Setting piston pressure (large setting piston area)
Port sizes:	
–	M14x1.5 (ISO version)
–	$^9/_{16}$"-18 O-ring boss (SAE version).

Product code V16

Example:

V16	–	220	–	T	–	S	AA	S	–	AC	E	3	B	–	P
Motor type		Frame size		Function		Mount.-flange & ports	Main-ports	Shaft end		Control	Control signal	Control orifice set	Control modulation		Valve options

Frame Size	
Code	Displacem.(cm³/rev)
220	220
270	270

Frame size		220	270
Code	Function		
M	Motor starts in max displacement, std. for EO, EP, HO, HP	x	x
T	Motor starts in min displacement, std. for AC; optional for EO, EP, HO, HP	x	x

Frame size		220	270
Code	Mounting flange & ports		
I	ISO version	x	x
S	SAE version	x	x

Frame size		220	270
Code	Main ports [4], see Fig. 2		
00	Axial and radial ports	x	x
AA	Axial ports	x	x
RR	Radial ports	x	x
AR	Axial port on A-side Radial port on B-side	x	x
RA	Radial port on A-side Axial port on B-side	x	x
A0	Axial port on A-side Radial and axial port on B-side	x	x
0A	Radial and axial port on A-side Axial port on B-side	x	x
R0	Radial port on A-side Radial and axial port on B-side	x	x
0R	Radial and axial port on A-side Radial port on B-side	x	x

Frame size		220	270
Code	Shaft end, see Chart 5		
D (std.)	DIN spline W50, see Fig. 6	x	-
	DIN spline W60, see Fig. 6	-	x
Z (option)	DIN spline W50, see Fig 7	-	x
G (option)	DIN spline W50 "long", see Fig 8	-	x
S (std.)	SAE spline 2" T15, see Fig. 9	x	-
	SAE spline 2.25" T17, see Fig 9	-	x
U (option)	SAE spline 2" T15, see Fig. 10	-	x
H (option)	SAE spline 2.25" T17 "long", see Fig. 11	-	x

Code	Control
AC	Pressure compensator
EO	Electro hydraulic, two-position
EP	Electro hydraulic, proportional
HO	Hydraulic, two-position
HP	Hydraulic, proportional

Code	Control signal
A	Pressure cutoff, EO, EP 12 VDC
B	Pressure cutoff, EO, EP 24 VDC
C	Pressure cutoff, HO, HP
E	External pressure (AC, HO, HP)
I	Internal pressure (AC)
L	12 VDC (EO, EP)
H	24 VDC (EO, EP)

Code	Control orifice set (mm)
1	0.6
2	0.8
3	**1.0 (standard)**
4	1.2
5	EOA/EPA/EOB/EPB/HOC/HPC
X	Special

420	–	DT	–	000	–	220	/	054	–	200	/	070	–	250	–	000	–	0
Pressure Valve		Optional		Version relief		Max. displacement		Min. internal		Max. displacement		Min. external		Tresshold pressure		Pressure cut off		Seal/protection cap

Code	Pressure relief valve opening pressure Flushing valve orifice
000	No valves (N)
XXX	Pressure setting of catridge valve [bar] (see Chart 3)
0XX	Flushing valve orifice or plug (see Chart 4)

Version number
Factory assigned (000 = standard)

Threshold pressure / current 3)
[bar] alt. [mA]

Max./Min displacement internal [cm^3/rev]
Non-adustable

Max. displacement external [cm^3/rev]
Adustable ⩽ internal limitation

Min. displacement external [cm^3/rev]
Adustable ⩾ internal limitation

Code	Valve options
N	None
P	Pressure relief valves
L	Flushing valve two-sided
C	Flushing valve one-sided Flushing from A side, see Fig. 2
D	Flushing valve one-sided Flushing from B side, see Fig. 2

Code	Optional
00	None 2)
S0	Speed sensor NPN (see Fig. 5)
H0	Speed sensor PNP (see Fig. 5)
P0	Position sensor
D0	Speed sensor NPN + Position sensor
B0	Speed sensor PNP + Position sensor
0T	Painted black (INTERGARD 345 RAL9005 / 2-component)
OX	optional painting

Pressure cut off EPA / EPB / HPC
[bar] (000 = without pressure cut off)

Code	Seal/protection cap on adjustment screws
0	Standard seal cap in plastic
S	Protection cap in steel

Code	Control modulating range (pressure/current) 1)
N	AC, EO, HO: 0 [bar] EP, EPA 12 VDC: 900 [mA] EP, EPB, 24 VDC: 450 [mA]
A	15 [bar] (AC, HP, HPC)
B	25 [bar] (AC, HP, HPC)
C	35 [bar] (AC, HP, HPC)
D	50 [bar] (AC)
E	100 [bar] (AC)

1) All values in pressure/current control range apply to motors without displacement limitations (0 - 35°).
2) All V16 motors are prepared for speed sensor.
3) Threshold pressure/current depends on the «displacement limitation group» to which the motor belongs, see Chart 1 and Chart 2, on pages 79 and 80).
4) All motors have both axial and radial ports. Options at ‘Main ports’ applies to which ports shall not have cover caps.

Product code V16

Note: In addition to the product code the label shows:

- Part number «2-D bar code»
- Serial number

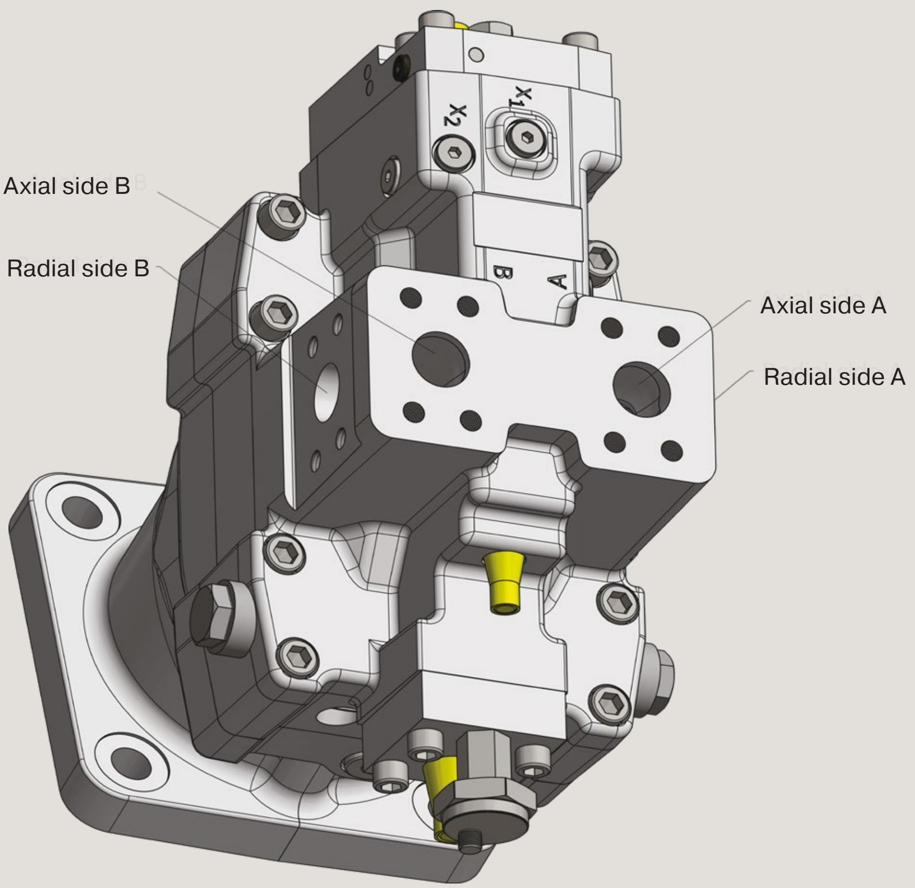


Fig. 2. Definitions: Axial/Radial main ports and A/B side of the motor.

Product code V16

Max. displacement limited motor with control starting at max. displacement (code M)				
V16-220 max. displ. [cc/rev]	**V16-270 max. displ. [cc/rev]**	**Min. threshold current EP_12V [mA]**	**Min. threshold current EP_24V [mA]**	**Min. threshold pressure HP_ΔP = 15 bar [bar]**
220 - 176	270 - 216	500	250	10
176 - 132	216 - 162	680	340	13
132 - 88	162 - 108	860	430	16

Chart 1. Displacement limit groups for motors with control starting at max. displacement (code M), see example in Fig. 3.

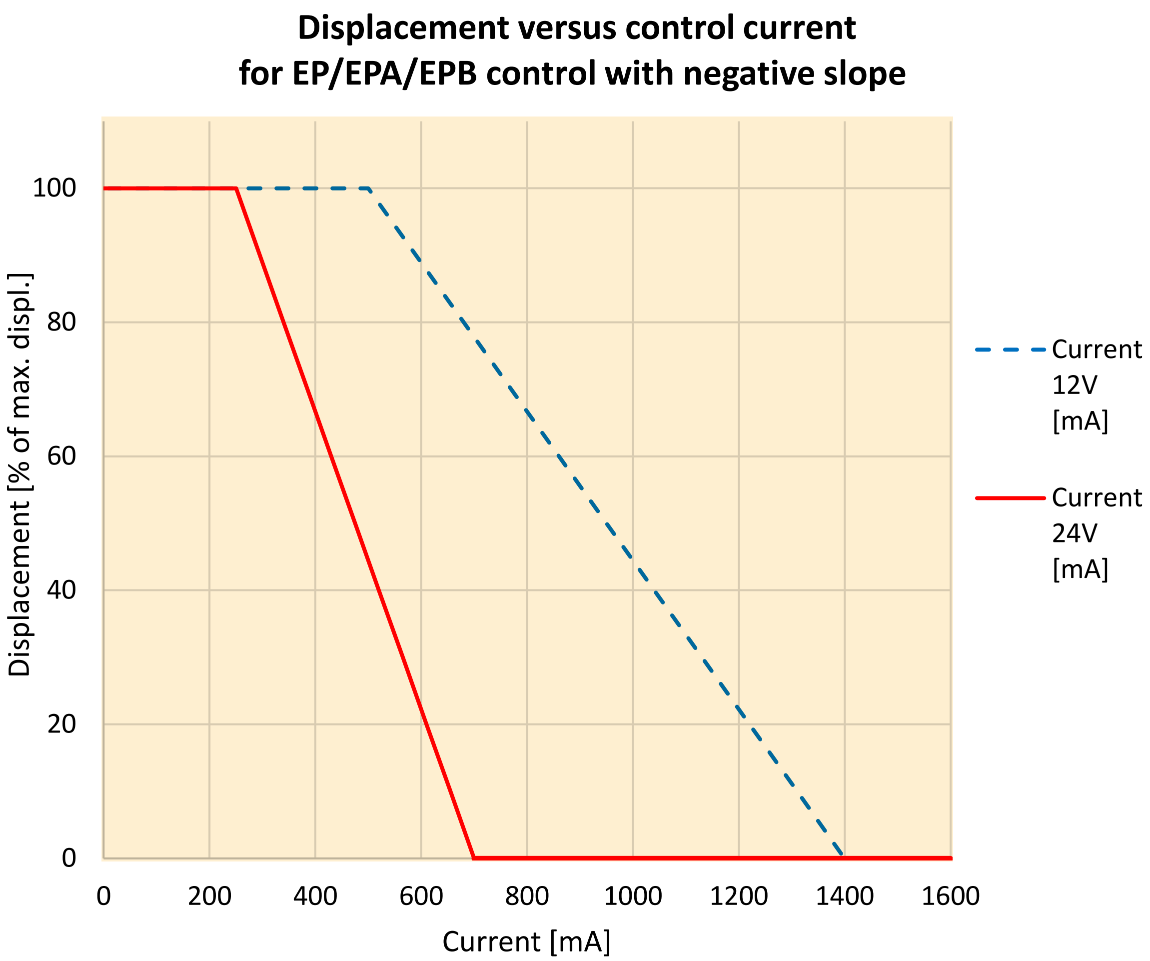


Fig. 3. Characteristics of EP control with negative slope control curve (control starts at max. displacement).

Product code V16

Min. displacement limited motor with control starting at min. displacement (code T)				
V16-220 max. displ. [cc/rev]	**V16-270 max. displ. [cc/rev]**	**Min. threshold current EP_12V [mA]**	**Min. threshold current EP_24V [mA]**	**Min. threshold pressure HP_ΔP = 15 bar [bar]**
0 - 44	0 - 54	500	250	10
44 - 88	54 - 108	680	340	13
88 - 132	108 - 162	860	430	16

Chart 2. Displacement limit groups for motors with control starting at min. displacement (code T), see example in Fig. 4.

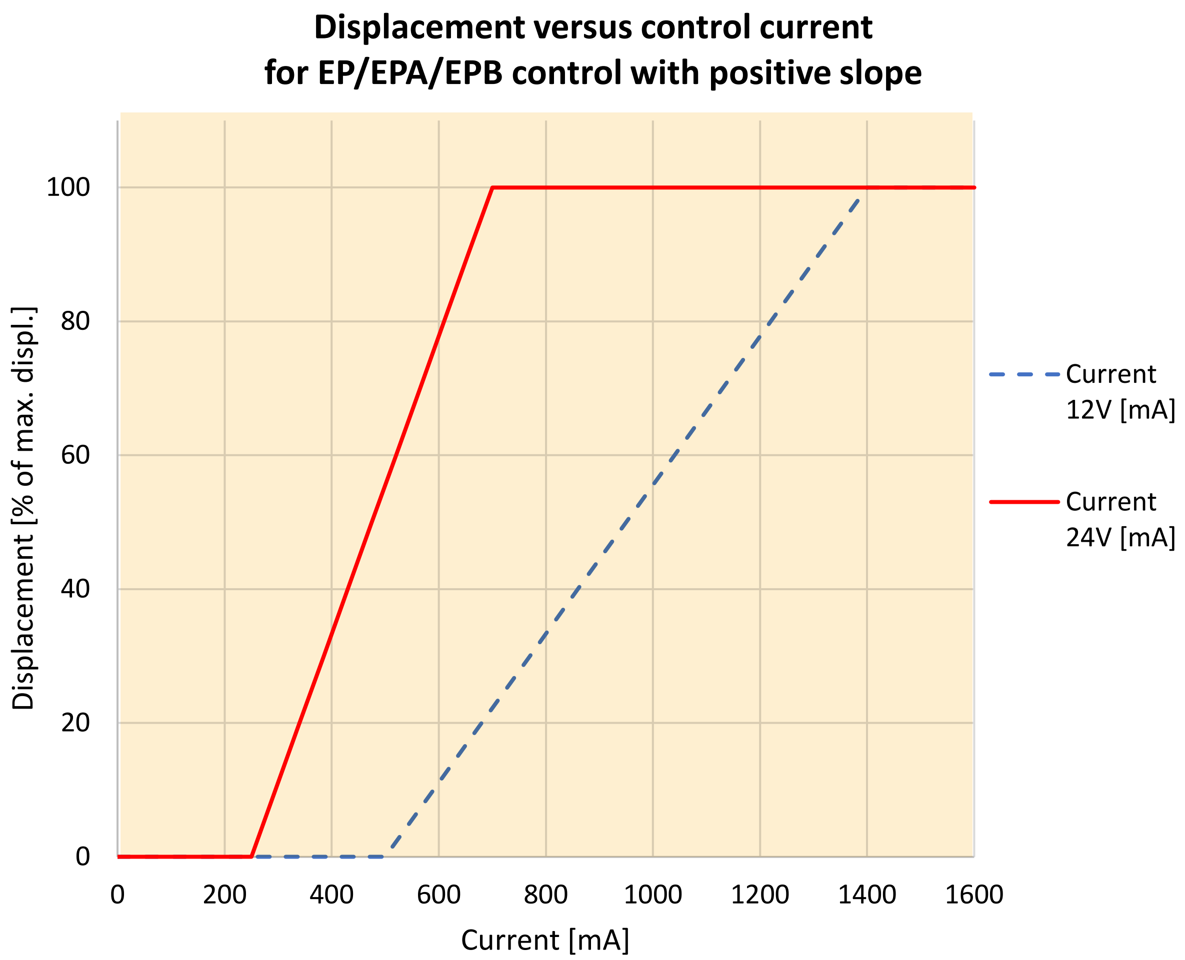


Fig. 4. Characteristics of EP control with positive slope control curve (control starts at min. displacement).

Product code V16

Order Code	Pressure setting, with a flow of 20 lpm passing through the valve. [bar]
230	**230**
250	250
280	280
300	300
350	350
380	380
420	420

Chart 3. Available cartridge valves.

Order Code	*Orifice [mm]*	*Flushing flow [lpm] at*		
		15 bar	*20 bar*	*25 bar*
000	Plug	-	-	-
010	1	2.3	2.7	3.0
013	1.3	3.9	4.5	5.0
015	1.5	5.2	6.0	6.7
017	1.7	6.6	7.7	8.6
020	2.0	9.2	10.6	11.9
030	3.0	20.0	23.1	25.8

Chart 4. Available flushing orifices.

	Spline shaft (DIN 5480)	*Mounting flange (Brg. Hsg)*	*Dimension, flange to shaft shoulder*
	Code **D** (std.)		[mm]
V16-220	W50x2x30x24	ISO 200	40
V16-220	W50x2x30x24	SAE 165.1	8
V16-270	W60x2x30x28	ISO 200	50

	Spline shaft (SAE J498b)	*Mounting flange (Brg. Hsg)*	*Dimension, flange to shaft shoulder*
	Code **S** (std.)		[mm]
V16-220	2" 15T 8/16DP	SAE 165.1	8
V16-220	2" 15T 8/16DP	ISO 200	40
V16-270	2 1/4" 17T 8/16DP	SAE 165.1	8
V16-270	2 1/4" 17T 8/16DP	ISO 200	40

	Spline shaft (DIN 5480)	*Mounting flange (Brg. Hsg)*	*Dimension, flange to shaft shoulder*
	Code **Z** (opt.)		[mm]
V16-270	W50x2x30x24	ISO 200	40
V16-270	W50x2x30x24	SAE 165.1	8

	Spline shaft (SAE J498b)	*Mounting flange (Brg. Hsg)*	*Dimension, flange to shaft shoulder*
	Code **U** (opt.)		[mm]
V16-270	2" 15T 8/16DP	SAE 165.1	8
V16-270	2" 15T 8/16DP	ISO 200	40

	Spline shaft (DIN 5480)	*Mounting flange (Brg. Hsg)*	*Dimension, flange to shaft shoulder*
	Code **G** (opt.)		[mm]
V16-270	W50x2x30x24	ISO 200	50

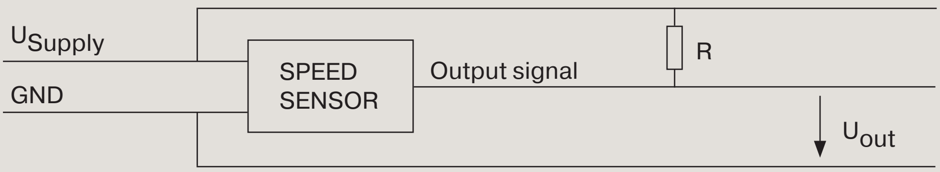
	Spline shaft (DIN 5480)	*Mounting flange (Brg. Hsg)*	*Dimension, flange to shaft shoulder*
	Code **H** (opt.)		[mm]
V16-270	2 1/4" 17T 8/16DP	ISO 200	50

Chart 5. Compilation of selectable shaft variants.

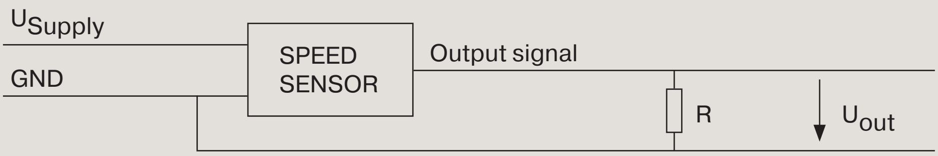
Product code V16

- **NPN** With pull-up resistor (for R=2200 Ω): U_{low} <1.5V; U_{high} >0.92*U_{supply}
- **PNP** With pull-down resistor (for R=560 Ω): U_{low} <0.1V; U_{high} > U_{supply} -3.5V

Configuration with pull-up resistor (for each output channel):



Configuration with pull-down resistor (for each output channel):



The outputs are short circuit proof and protected against reverse polarity.

Fig. 5. Available speed sensor types.

Shaft Code D

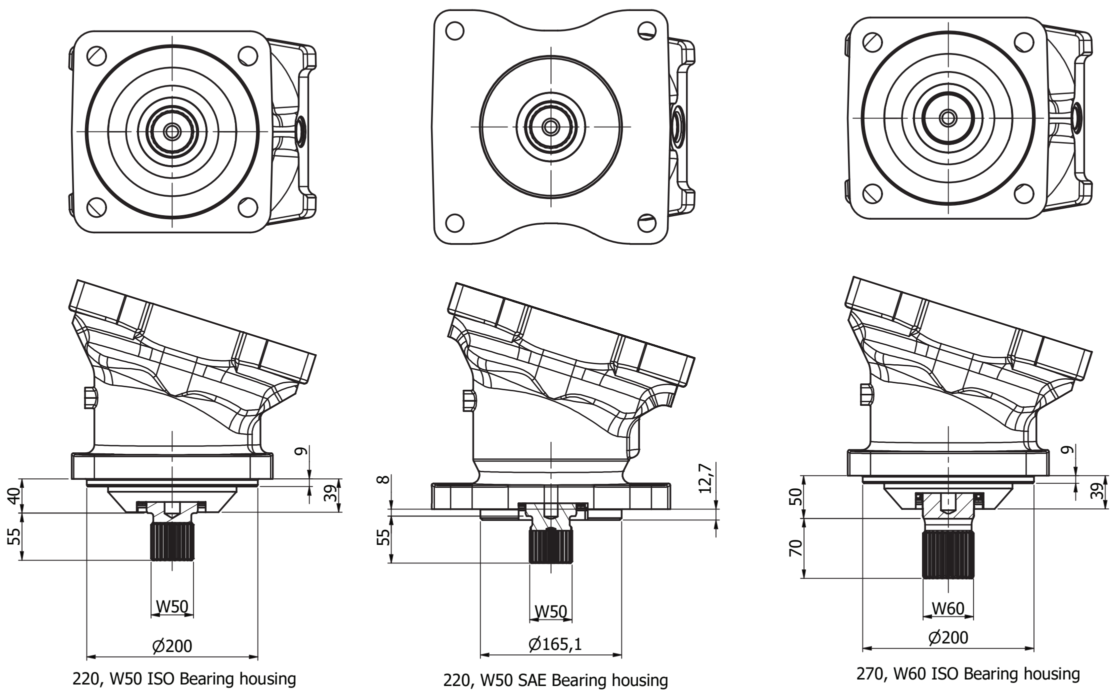
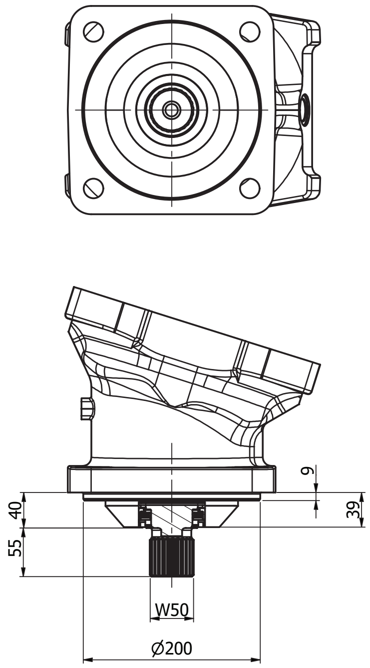
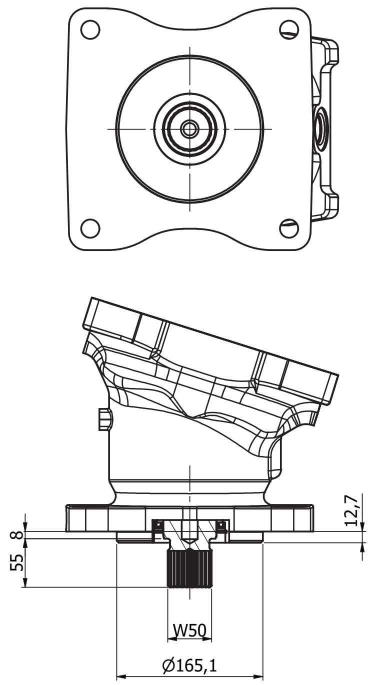


Fig. 6. Dimensional drawings, shaft end code D.

Shaft Code Z



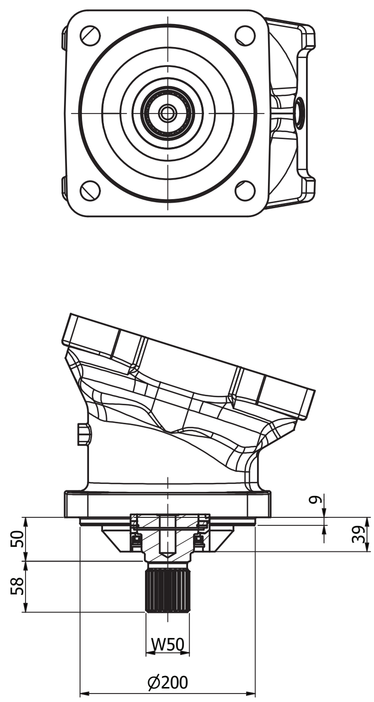
270, W50 ISO Bearing housing



270, W50 SAE Bearing housing

Fig. 7. Dimensional drawings, shaft end code Z.

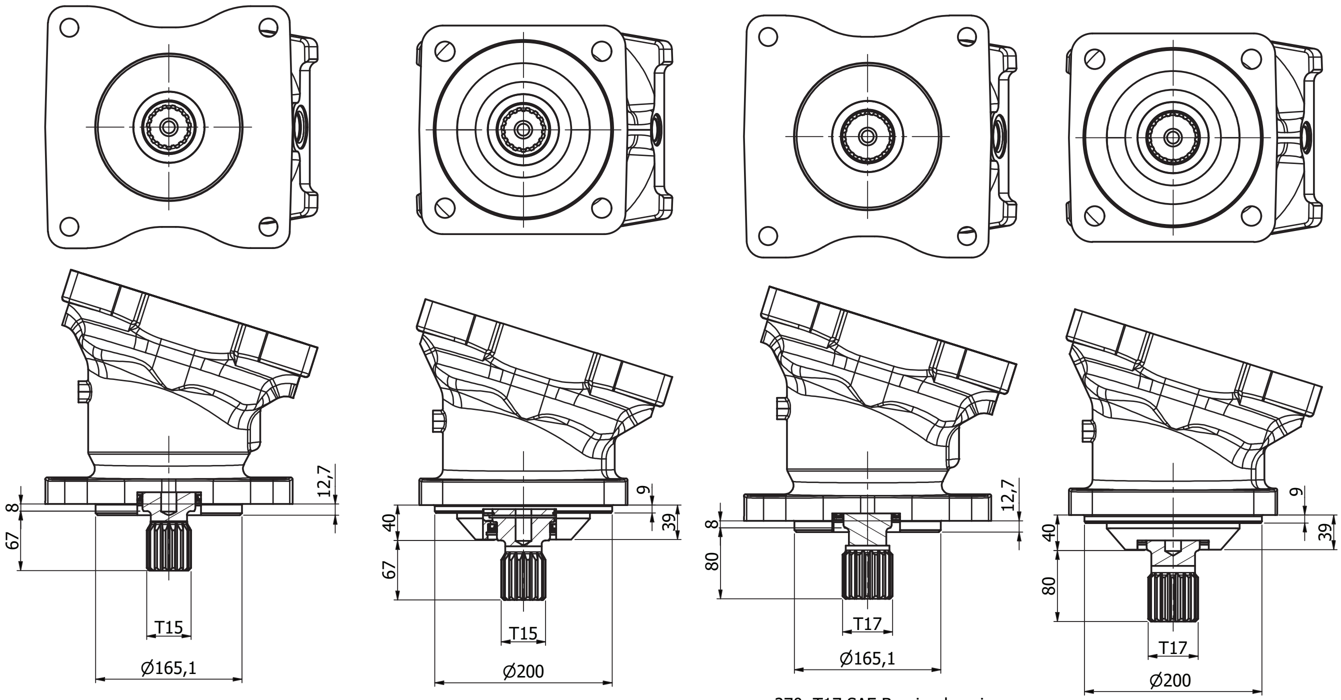
Shaft Code G



270, W50 ISO Bearing housing

Fig. 8. Dimensional drawings, shaft end code G.

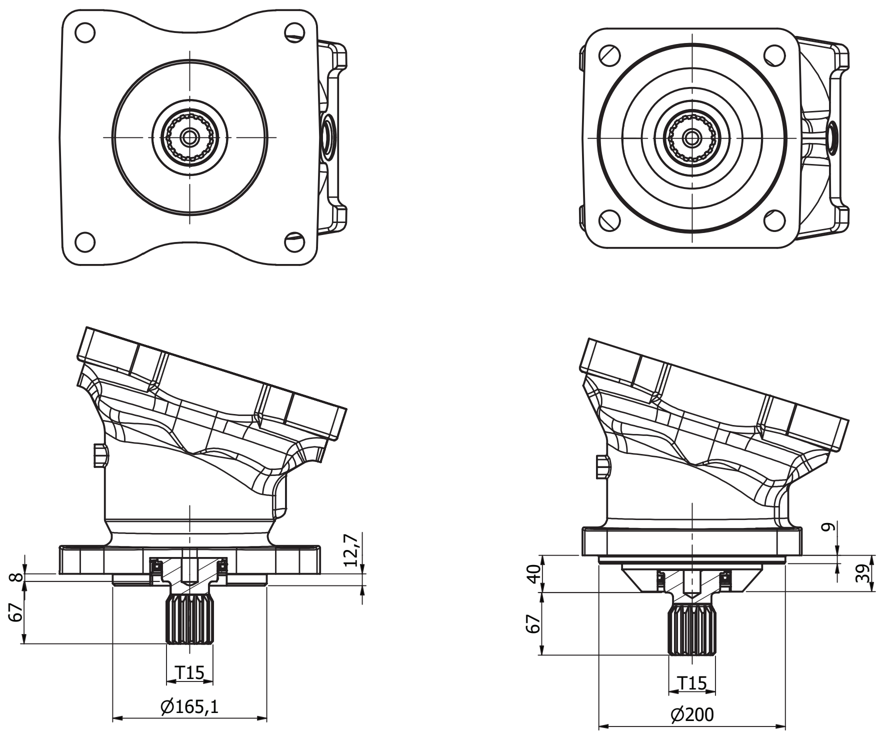
Shaft Code S



220, SAE T15 SAE Bearing housing | 220, T15 ISO Bearing housing | 270, T17 SAE Bearing housing | 270, T17 ISO Bearing housing

Fig. 9. Dimensional drawings, shaft end code S.

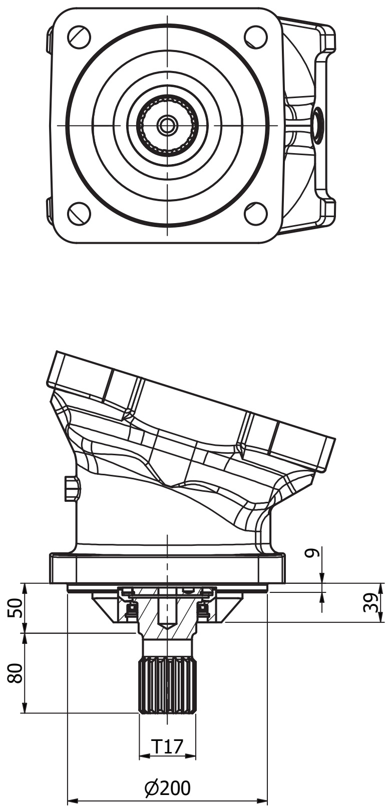
Shaft Code U



270, T15 SAE Bearing housing | 270, T15 ISO Bearing housing

Fig. 10. Dimensional drawings, shaft end code U.

Shaft Code H

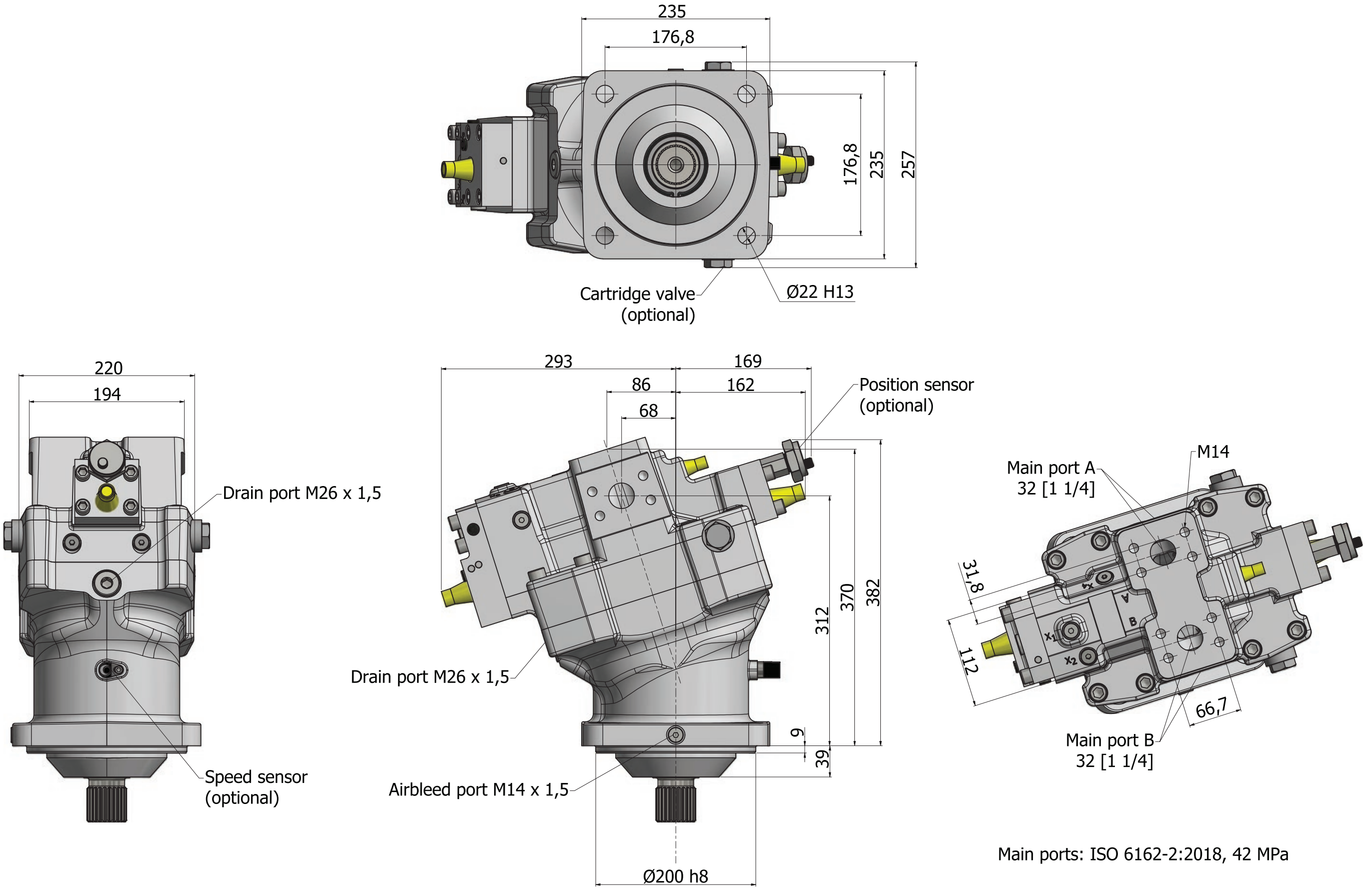


270, T17 ISO Bearing housing

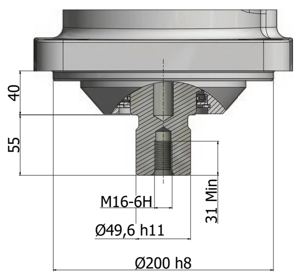
Fig. 11. Dimensional drawings, shaft end code H.

V16-220, ISO version, type T positive control

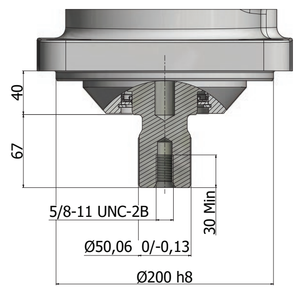
Shown: V16-220-ISO with AC compensator



Shaft code D, -220

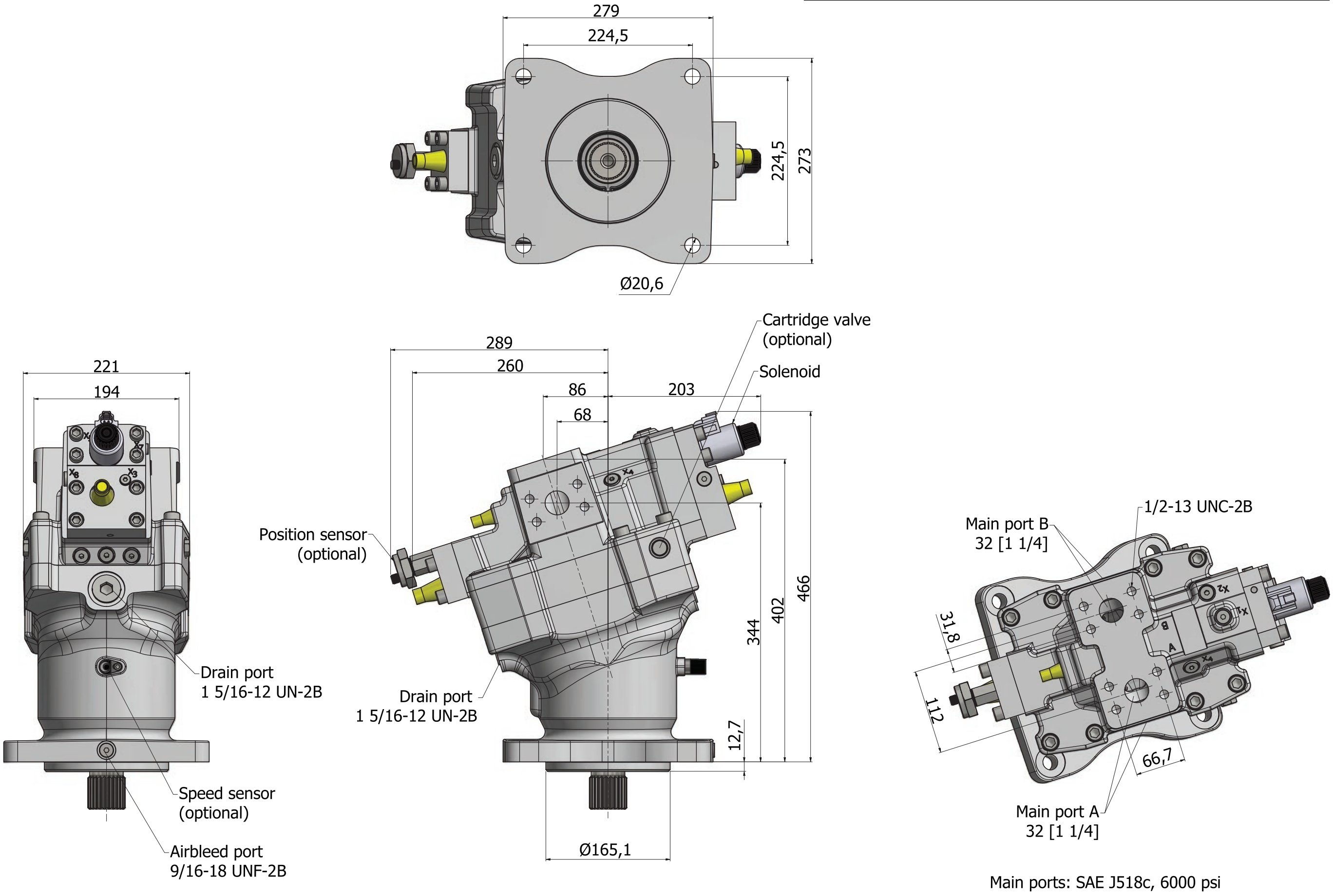


Shaft code S, -220



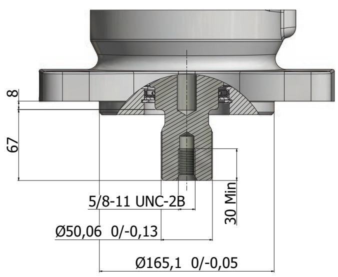
V16-220, SAE version, type M negative control

Shown: V16-220-SAE with EP control

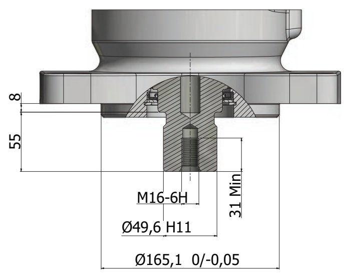


Main ports: SAE J518c, 6000 psi

Shaft code S, -220

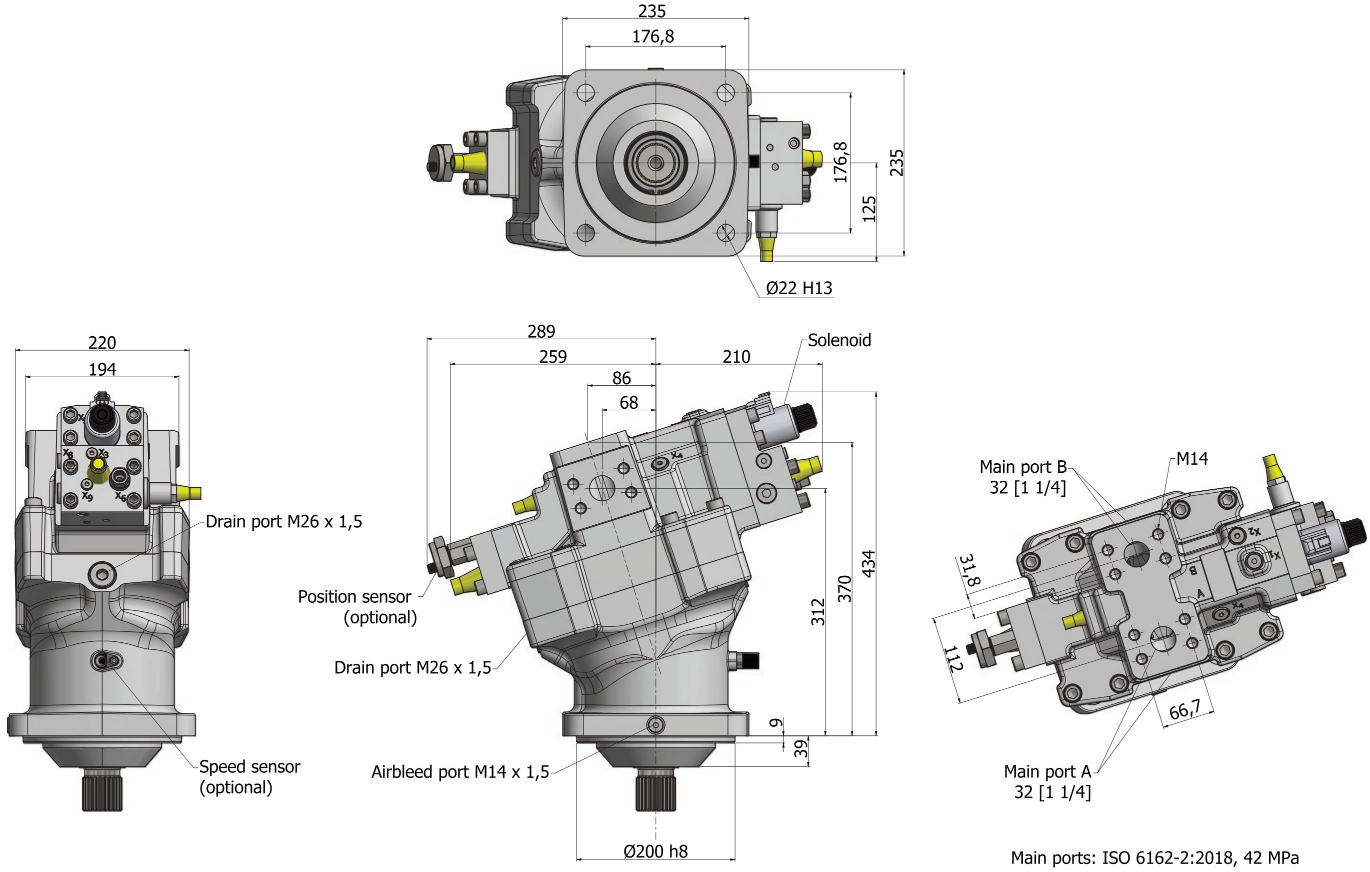


Shaft code D, -220

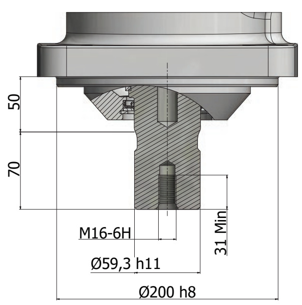


V16-270, ISO version, type M negative control

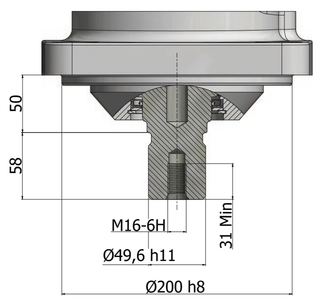
Shown: V16-270-ISO with EPA control



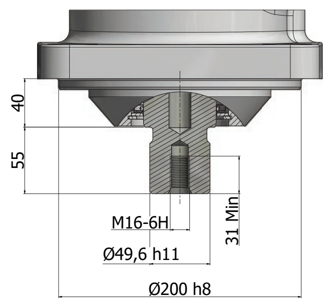
Shaft code D, -270



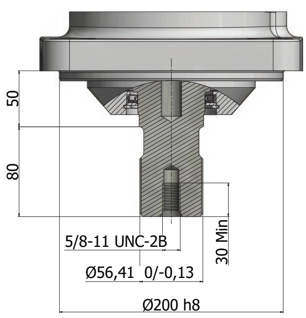
Shaft code G -270



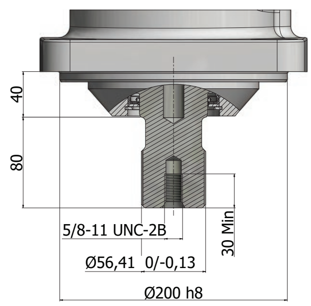
Shaft code Z, -270



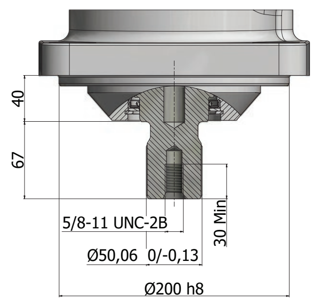
Shaft code H, -270



Shaft code S, -270

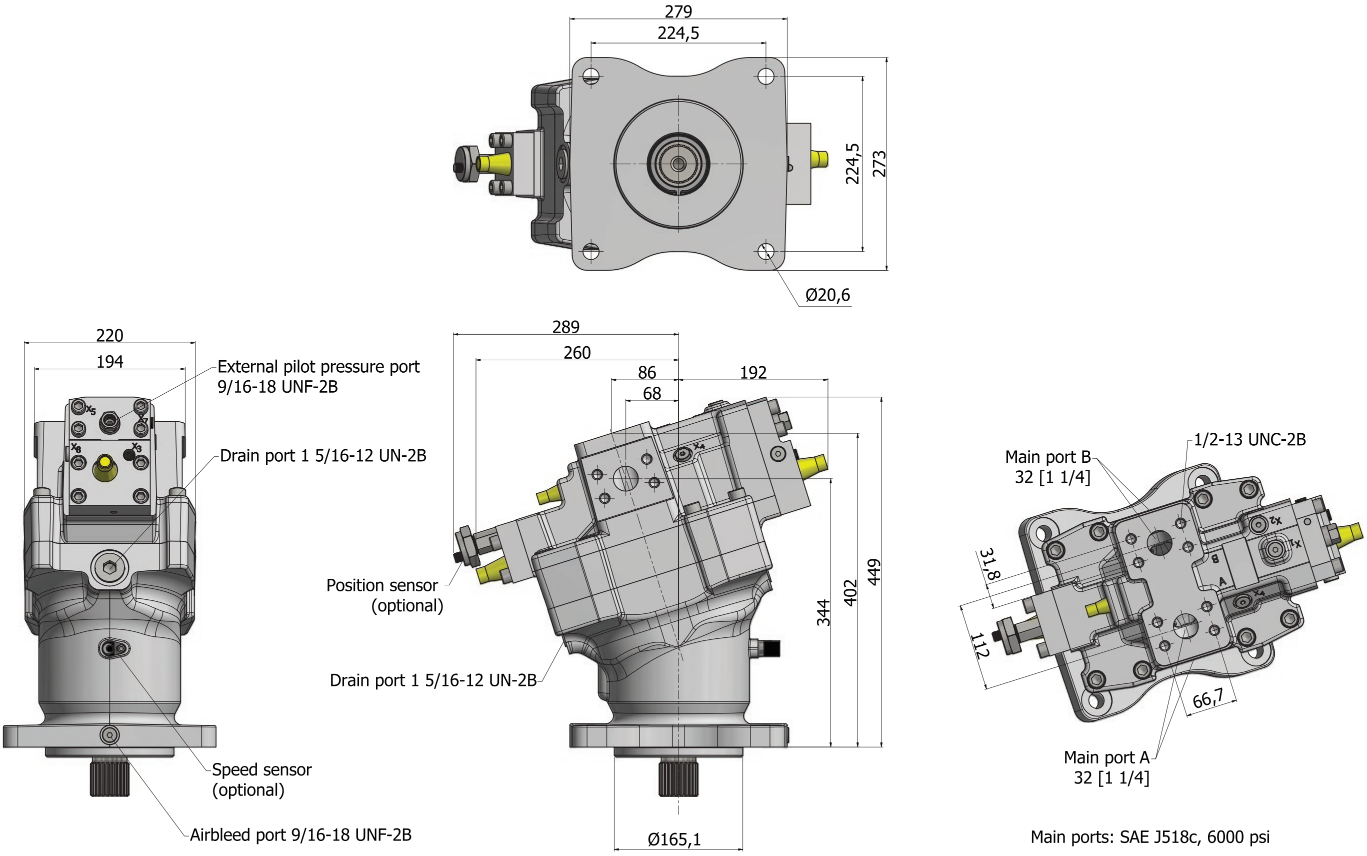


Shaft code U, -270



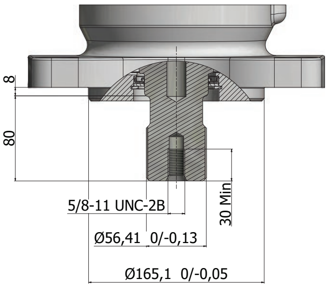
V16-270, SAE version, type M negative control

Shown: V16-270-SAE with HP control

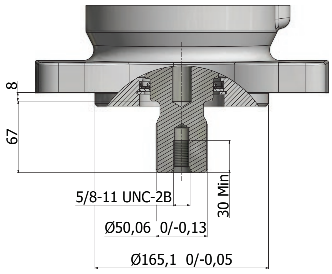


Main ports: SAE J518c, 6000 psi

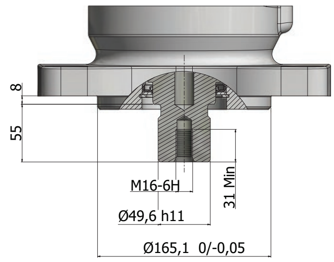
Shaft code S, -270



Shaft code U, -270



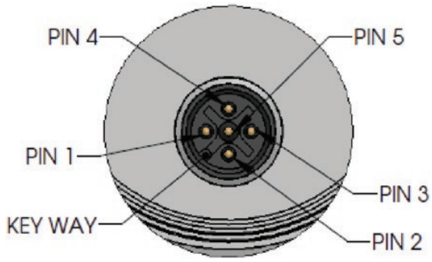
Shaft code Z, -270



Position sensor

The position sensor offers an unmatched combination of ruggedness and long life. The non-contacting, inductive sensing design provides superior resistance to shock and vibration that other technologies, such as magnetostrictive, simply can't match; as well as eliminating the potential reliability issues related to contacting parts used in potentiometer based products.

M12 connector



1	Output
2	Vsupply
3	GND (0V)
4	Not connected
5	Not connected

Specifications on page 91.

Environmental

OPERATING TEMPERATURE RANGE	-40°C to 125°C
STORAGE TEMPERATURE RANGE	-40°C to 80°C
LIFE	Contactless
MTTFd	203 years
VELOCITY MAX.	2 m/s in hydraulic applications (ISO VG32 mineral oil)
VIBRATION	EN 60068-2-4 (9gn rms)
SHOCK	2500g survival
WORKING PRESSURE	670 bar
BURST PRESSURE	1000 bar
PULSED PRESSURE	0-470 bar in 1s (tested to 100 000 cycles)
WORKING FLUID	Compatible with a wide range of hydraulic fluids, including retardant and ECO based fluids
EMC	Directive 2004/108/EC
SEALING	M12 connector (C01) IP67
	Cable with gland (BXX) IP69K Flying leads (FXX) IP66

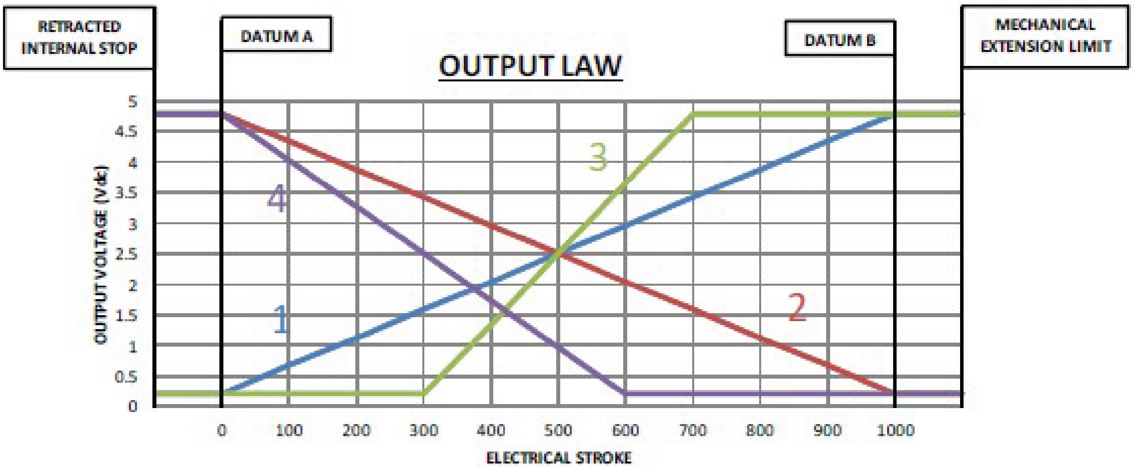
Specifications

Electrical

SUPPLY VOLTAGE	5Vdc ± 0.1 Vdc and 8-30 Vdc unregulated – auto-selects
SUPPLY CURRENT	< 80 mA
SUPPLY REVERSE POLARITY PROTECTION	Yes
OVER-VOLTAGE PROTECTION	40 Vdc max
POWER-ON SETTLEMENT TIME	<1s

Voltage Output – ICT800

ACTUAL ELECTRICAL STROKE	= High Voltage Position – Low Voltage Position

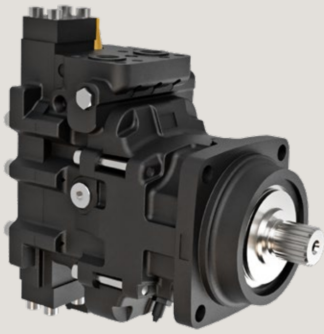


	Low Voltage Output Position	High Voltage Output Position	Actual Electrical Stroke
1	0000	0000	1000
2	1000	0000	1000
3	0300	0700	0400
4	0600	0000	0600

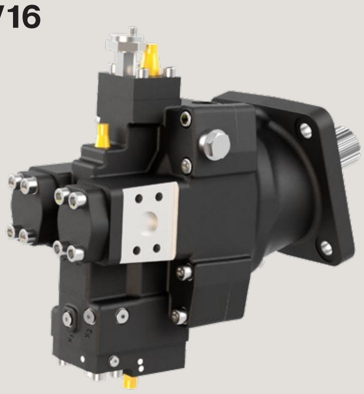
OUTPUT RANGE A1 @ 5Vdc SUPPLY	10 - 90 % ± 1 % of Vsupply over measurement range
OUTPUT RANGE A1 @ 8-30Vdc SUPPLY	0 - 5 - 4.5 V ± 3 % absolute
OUTPUT RANGE A5 @ 5Vdc SUPPLY	4 - 96 % ± 1 % of Vsupply over measurement range
OUTPUT RANGE A5 @ 8-30Vdc SUPPLY	0.2 - 4.8 V ± 3 % absolute
LOAD RESISTANCE	1kΩ min. (resistive to GND)
LINEARTY	<± 0.1 %

V12

V14



V16



Content Page

Valve options (overview)

- Flushing valve (option **L**; below)
- Pressure relief valves (option **P**; page 96)

* Always consult with Pump and Motor division when specifying option B and W

Sensor options (overview)

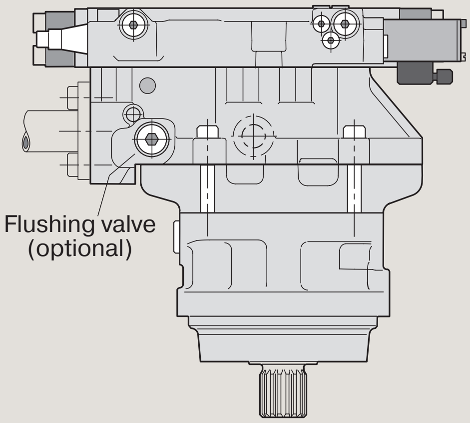
- Shaft speed sensor V14 (option **P**; page 97)
  Shaft speed sensor V16 (option **S0** or **H0**; page 97)

Flushing valve (option L)

The Variable motors are available with a flushing (or shuttle) valve that supplies the motor with a cooling flow through the case. Cooling the motor may be required when operating at high speeds and/or power levels.

The flushing valve consists of a three-position, three-way spool valve built into the connection module. It connects the low pressure side of the main circuit to a nozzle (optional sizes below) that flush fluid into the motor case.

In a closed circuit transmission, the flushing valve removes part of the fluid in the main loop. The removed fluid is continuously being replaced by cool, filtered fluid from the low pressure charge pump on the main pump.

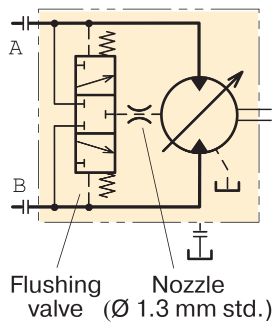


V14-110 (EP control) with built-in flushing valve.

Available nozzles V12

Ordering code	Orifice size [mm]	Status	Flow [l/min] at		
			15 bar	20 bar	25 bar
L01	**1.3**	**Standard**	**3.9**	**4.5**	**5.0**
L02	0.8	Optional	1.5	1.7	1.9
L03	1.0	Optional	2.3	2.7	3.0
L04	1.2	Optional	3.2	3.7	4.1
L05	1.5	Optional	5.2	6.0	6.7
L06	1.7	Optional	6.6	7.7	8.6
L07	2.0	Optional	9.2	10.6	11.9
L08	3.0	Optional	20.0	23.1	25.8

NOTE: 'L00' = plug



Hydraulic schematic – V14 and V16 with built-in flushing valve.

Available nozzles V14 and V16

Ordering code	Orifice size [mm]	Status	Flow [l/min] at		
			15 bar	20 bar	25 bar
L010	1.0	Optional	2.3	2.7	3.0
L013	**1.3**	**Standard**	**3.9**	**4.5**	**5.0**
L015	1.5	Optional	5.2	6.0	6.7
L017	1.7	Optional	6.6	7.7	8.6
L020	2.0	Optional	9.2	10.6	11.9
L030	3.0	Optional	20.0	23.1	25.8

NOTE: 'L000' = plug

Pressure relief valves (option P)

To protect the motor (and the main hydraulic circuit) from unwanted, high pressure peaks, the V14 and V16 can be supplied with relief valve cartridges.
The individual cartridge (with integrated check valve function) has a non-adjustable, factory-set opening pressure, available in pressure settings shown below.
The cross section (below right) shows a situation, where the upper cartridge has opened because of high fluid pressure. This, in turn, forces the opposite cartridge to open to the low pressure area (this cartridge now acting as a check valve).
As shown, a small part of the flow may go directly to the reservoir.

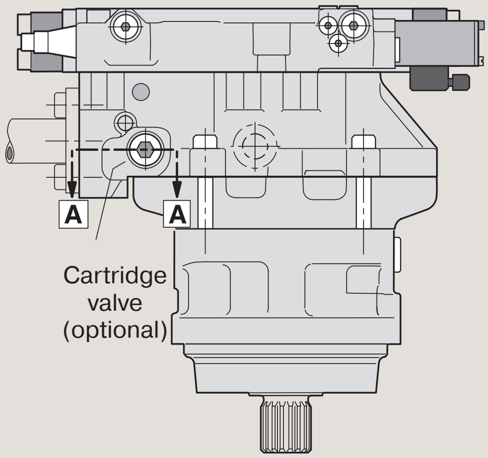
NOTE:
- The pressure relief cartridges should not be used as main pressure reliefs; in a motor application, they should only be relied on to limit short duration pressure peaks (or the temperature of the fluid which circulates through the motor will rapidly reach damaging high levels).
- The main pressure relief is usually installed in the main pump or in the directional control valve, or is line mounted between pump and motor.

Available cartridges V14

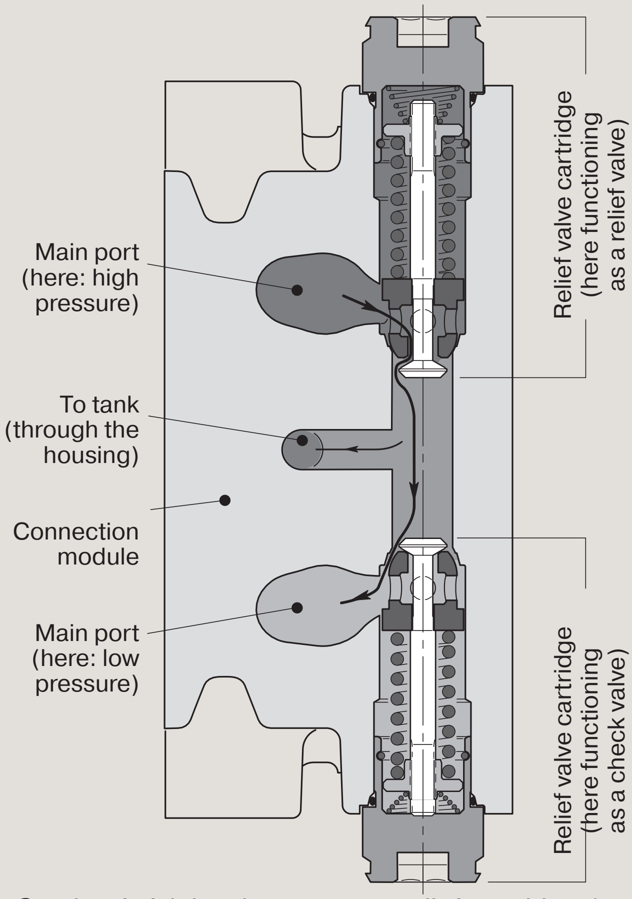
Ordering code	Pressure setting [bar]	Partnumber
P300	300	9120029264
P330	330	9120029265
P350	350	9120029266
P380	380	9120029267
P400	400	9120029268
P420	420	9120029269
P480	480	3768548

Available cartridges V16

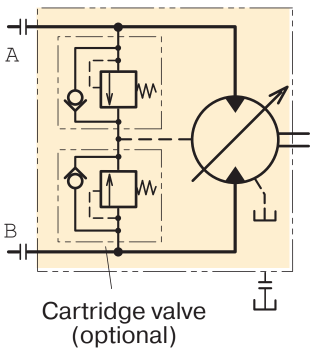
Ordering code	Pressure setting [bar]	Partnumber
P230	230	20006727
P250	250	20004981
P280	280	20007439
P300	300	20005798
P350	350	20000990
P380	380	20006115
P420	420	00153491



V14-110 (EP control) with relief valve cartridges.



Section A-A (showing pressure relief cartridges).



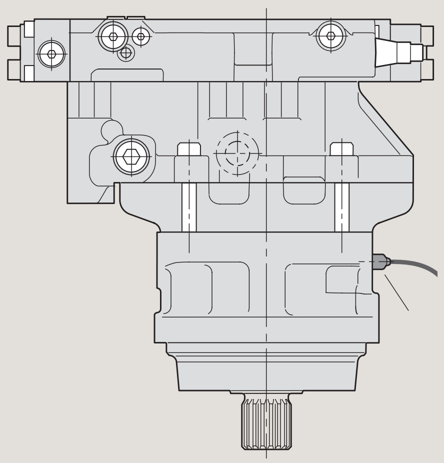
Hydraulic schematic

Speed sensor

A wide range of speed sensor kits are available for series V12/V14/V16.

The sensors are ferrostat differential (Hall-effect)
The sensor output is a square wave signal within a frequency range of 0 Hz to 15 kHz.

NOTE:
- V12 series must be specified in the ordering code refer to pages 15 to 18.
- V14 series must be specified in the ordering code refer to pages 40 to 42.
- V16 series must be specified in the ordering code refer to pages 78 to 83.



V14-160 (AC control) with speed sensor.

Order number	Electronic	Signals	Installation	Connector	Cable lenght	Installation instruction
3785190	NPN	2	M12*1 adjustable	Free leads	1000 mm	MSG30-8301-INST
3722481	NPN	2	M12*1 adjustable	M12 4 pin	260 mm	MSG30-8303-INST
3722480	NPN	1	M12*1 adjustable	AMP 3 pin	338 mm	MSG30-8304-INST
3724736*	NPN	2	Plug-in	M12 4 pin	260 mm	MSG30-5525-INST
3724737*	PNP	2	Plug-in	M12 4 pin	260 mm	MSG30-5525-INST

** Only for V16.*

High Speed/High Power operation Running in procedure at mid. displacement

Running in procedure Parker Motors

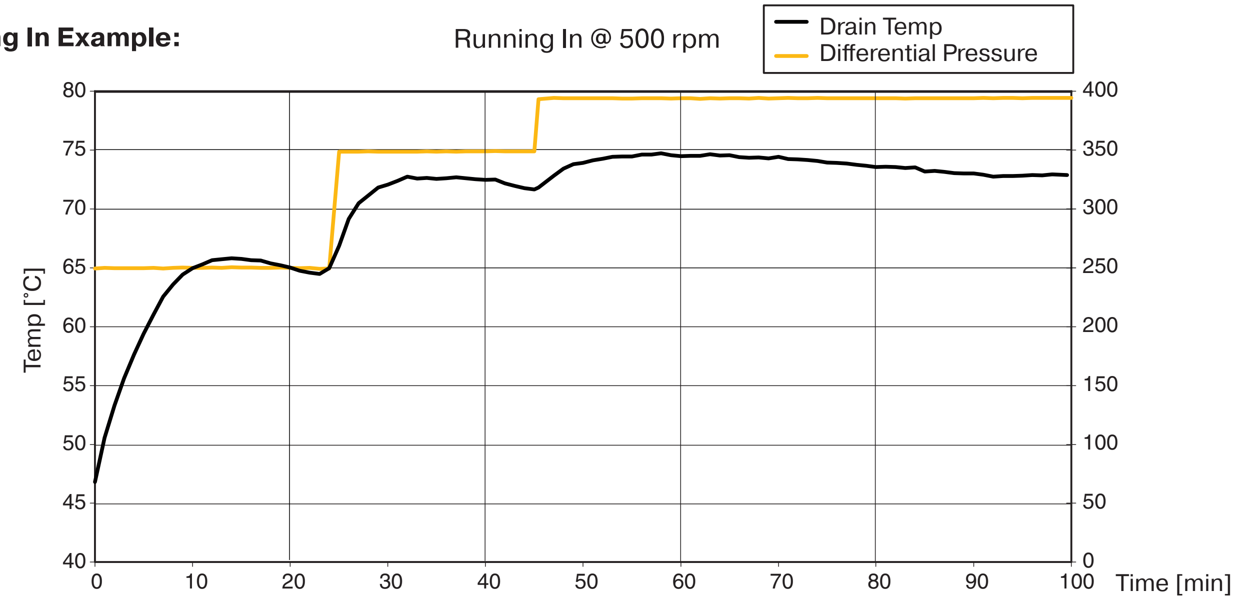
We suggest the following procedure to run in the Variable motors.

1. Start @ 500 rpm, differential pressure 250 bar, outlet 10 – 15 bar.
2. Run until the drain temperature has passed its maximum* and has decreased 1 – 2 °C
3. Increase differential pressure to 350 bar
4. Run until the drain temperature has passed its maximum* and has decreased 1 – 2 °C
5. Increase differential pressure to 400 bar
6. Run until the drain temperature has passed its maximum* and has stabilized.

*If, at any point, the temperature tends to pass 100 °C, decrease the pressure at once.

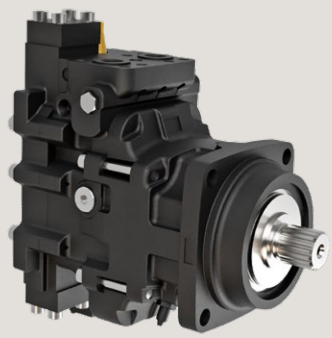
Please make sure the drain temperature probe is in the drain oil flow to measure the correct temp.

Running In Example:



V12

V14



V16

Content

Direction of rotation versus flow

NOTE: The V12 and V14 and V16 motors are bi-directional.

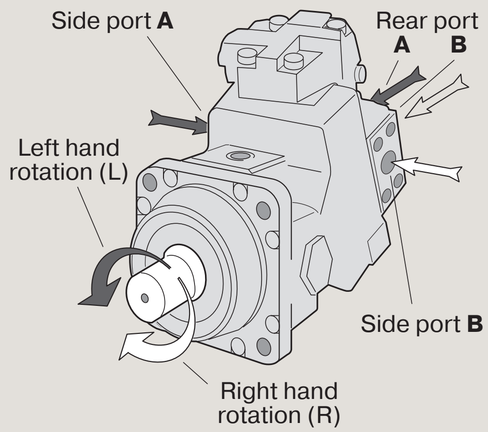
V12, V16 rotation:

- End cap position T (AC and AH controls): When port B (open arrow) is pressurized, the motor rotates clockwise (right hand; R), and when port A (black arrow) is pressurized, the motor turns counter clockwise (left hand; L)
- End cap position M (EO, EP, HO and HP controls): A and B port positions interchange (A-to-B, B-to-A).

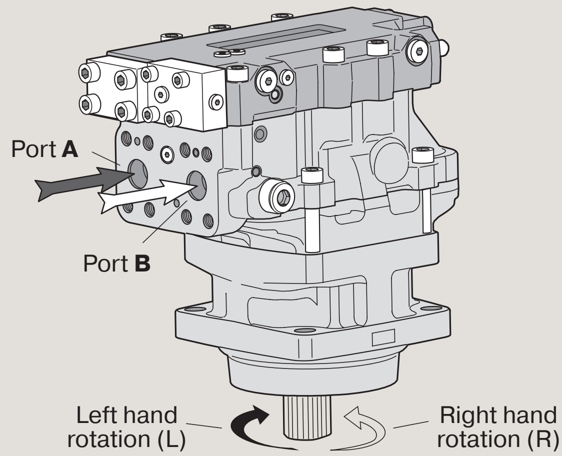
V14 rotation:

- Refer to the V14 illustration below right (valid for all compensators and controls).

NOTE: Before installing a V12, V14 or V16 motor in series (when both A and B ports can be subject to high pressures simultaneously) contact Parker Hannifin.



Direction of rotation vs. flow for the V12, V16 motor (here shown with AC-compensator; end cap position T).



Direction of rotation vs. flow for the V14 motor (shown with AC-compensator).

Filtration

Maximum motor sevice life is obtained when the fluid cleanliness meets or exceeds ISO code 20/18/13 (ISO 4406). A 10 µm (absolute) filter is recommended.

Case pressure

To secure correct case pressure and lubrication, a spring loaded check valve, 1 – 3 bar, in the drain line (shown on next page) is recommended.

NOTE: Contact Parker Hannifin for information when operating at high speeds.

Frame size	1500	3000	4000	5000	6000
V12-60	max 12	0.5–7	1–5.5	1.5–5	2–5
V12-80	max 12	0.5–7	1–5.5	1.5–5	2.5–5
V14-110	max 10	1–6	1.5–5	2–4.5	3–5
V14-160	max 10	1–6	2–5.5	2.5–5.5	-
V16-220	max 8	2 – 6	3 – 5.5	4 – 5	-
V16-270	max 8	2 – 6	3 – 5.5	4 – 5	-

Min and max case pressure [bar] vs. shaft speed [rpm].

Required inlet pressure

The motor may operate as a pump under certain conditions. When this occurs, a minimum pressure must be maintained at the inlet port; increased noise and gradually deteriorating performance due to cavitation may otherwise be experienced.
A 15 bar inlet pressure, measured at the motor inlet port, satisfies most operating conditions.
Contact Parker Hannifin for more specific information on inlet pressure requirements.

Operating temperatures

The following temperatures should not be exceeded

Main circuit: 80 °C.
Drain fluid: 115 °C.

Continuous operation at high power levels usually requires case flushing in order for the fluid to stay above the minimum viscosity requirement. A flushing valve and restricting nozzle, available as an option, provide the necessary main circuit flushing flow.

Refer to fig. 1 (next page), and to:
- V12, V14, V16: ‘Flushing valve’, page 95.

Drain ports

There are two drain ports on the V12, V16 and three on the V14 motors. The uppermost drain port should always be utilized.

In order to avoid excessively high case pressure, the drain line should be connected directly to the reservoir.

Hydraulic fluids

Ratings and performance data for the motors are valid when a good quality, contamination-free, petroleum-based fluid is used in the hydraulic system.

Hydraulic fluids type HLP (DIN 51524), automatic transmission fluids type A, or API CD engine oils can be used.

When the hydraulic system has reached full operating temperature, the motor drain oil viscosity should be above 8 mm^2/s (cSt).

At start-up, the viscosity should not exceed 1500 mm^2/s.

The ideal operating range for the motor is 15 to 30 mm^2/s.

Fire resistant fluids, when used under modified operating conditions, and synthetic fluids are also suitable.

Contact Parker Hannifin for additional information about:

– Hydraulic fluid specifications

– Fire resistant fluids.

Before start-up

Make sure the motor case as well as the entire hydraulic system is filled with hydraulic fluid.

The internal leakage, especially at low operating pressures, is not sufficient to provide lubrication at start-up.

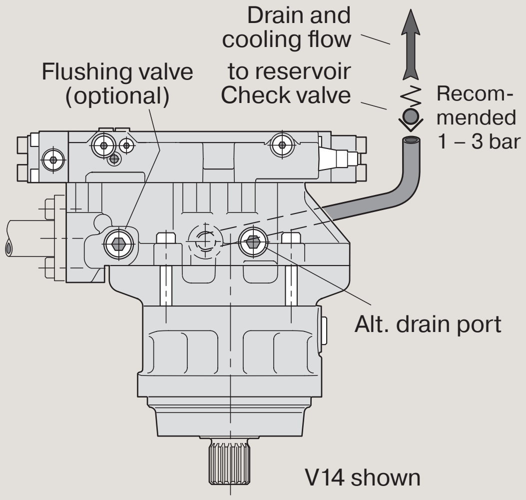


Fig. 1.

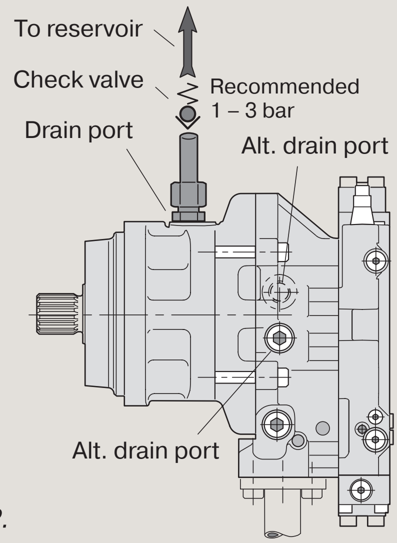


Fig. 2.

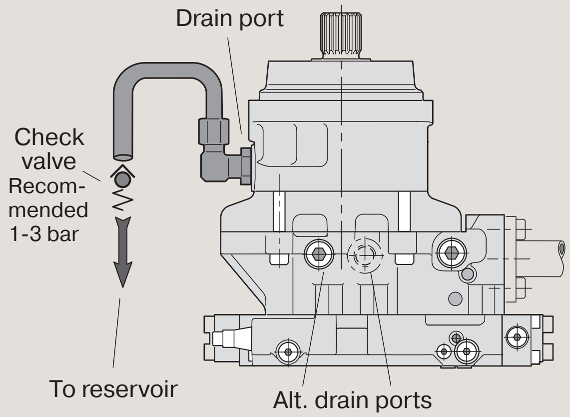


Fig. 3.

additional support documents:

Installation and start-up information Hydraulic Motors Series V12, V14, V16
MSG30-8223-INST/UK

Speed Sensor Series V16
MSG30-5525-M1/UK

Service/Spare Parts Manual
Series V14
MSG30-5510-M1/UK

Service/Spare Parts Manual
Series V12
MSG30-5506-M1/UK

Service/Spare Parts Manual
Series V16
MSG30-5526-M1/UK

Offer of Sale

Please contact your Parker representation for a detailed ”Offer of Sale”.

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Your authorized Distributor

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