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Hydraulic Motors

Series V12, V14
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

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Pump & Motor Division Europe
Trollhättan, Sweden

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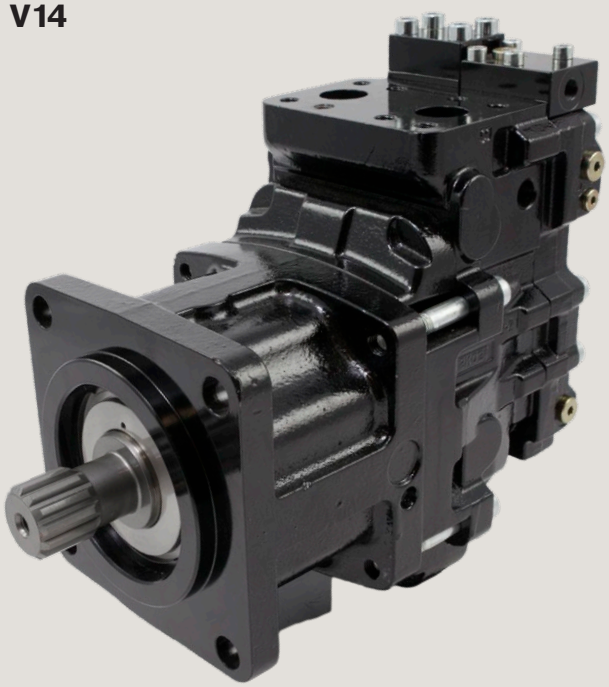


Series V12

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

It is intended for both open and closed circuits, mainly in mobile applications, but the V12 can also be utilized in a wide variety of other applications.

Features

- Max intermittent pressure to 480 bar and continuous operating pressure to 420 bar
- Thanks to low weight pistons with laminated piston rings and a compact design of the rotating parts, the V12 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 (5:1)
- 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.

Series V14

Series V14 is a new generation of variable displacement, bent-axis motors, a further development of our well known V12 motor.

It is designed for both open and closed circuit transmissions with focus on high performance machines.

Applications

- Excavators
- Forestry machines
- Mining and drilling machines
- Wheel loaders
- Winch drives

Optional equipment

- Integrated sensor for speed
- Integrated flushing or pressure relief valves

Additional benefits (compared to those of the V12)

- Improved speed capability
- Improved control performance
- Reduced number of parts
- Stronger shaft bearing support.

Bearing life

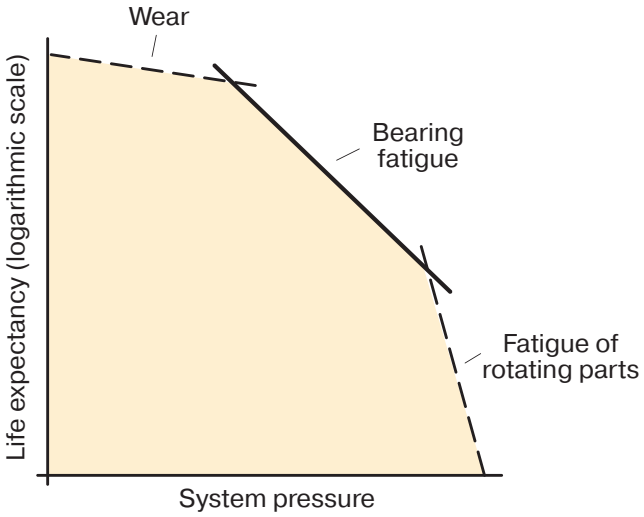
General information

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.

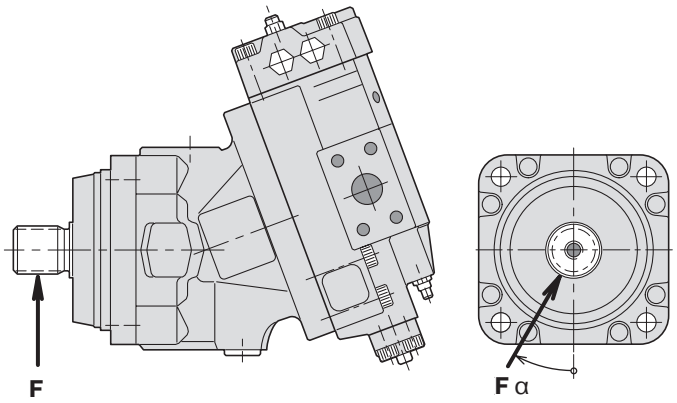
Bearing life calculation

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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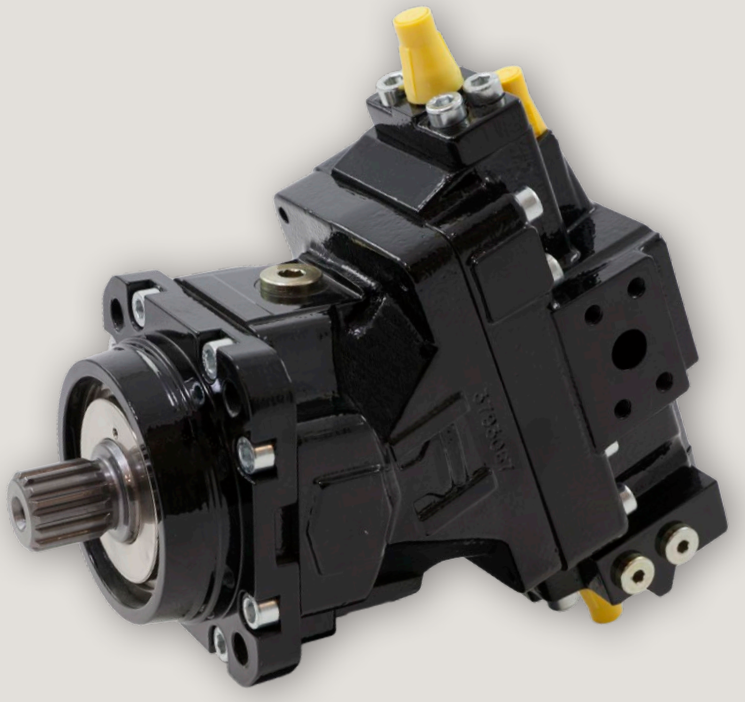
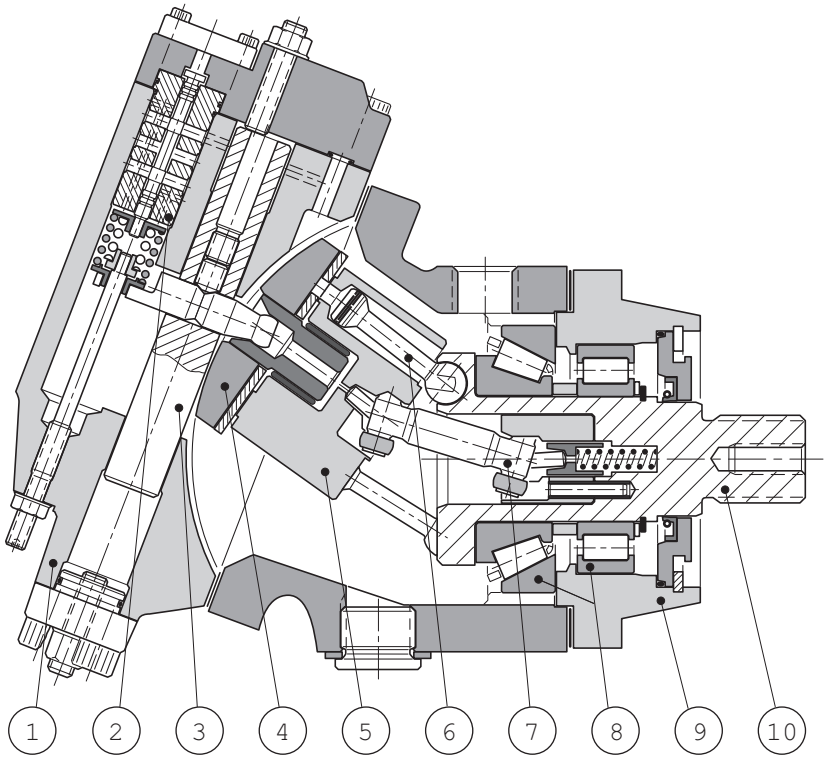
V12



Content

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

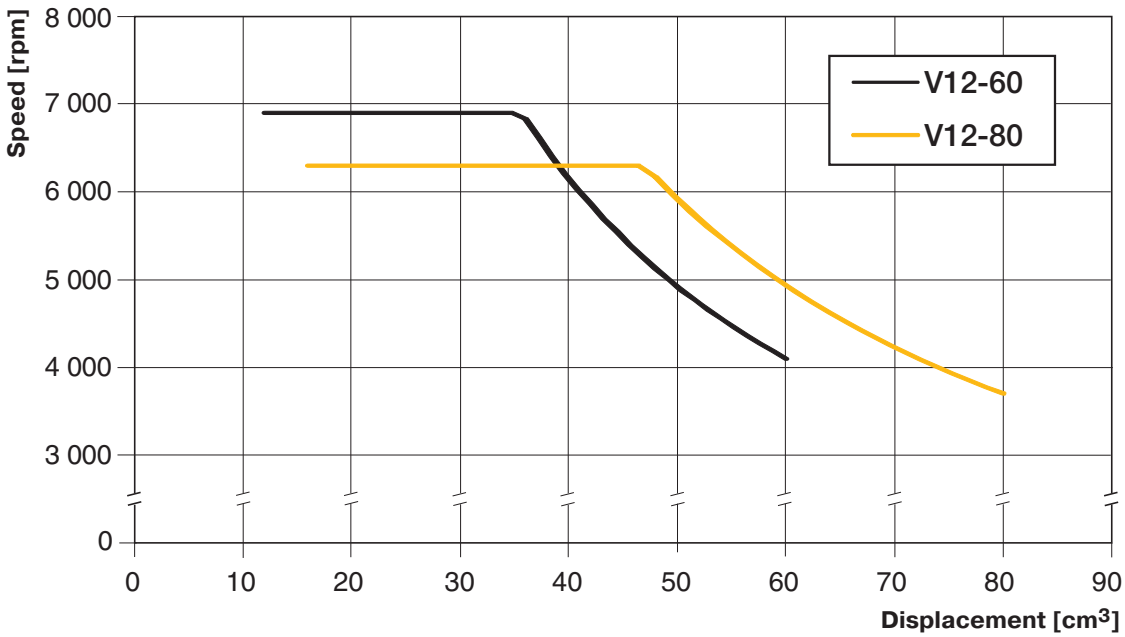


Specifications

V12 frame size	**60**	**80**
Displacement [cm^3/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

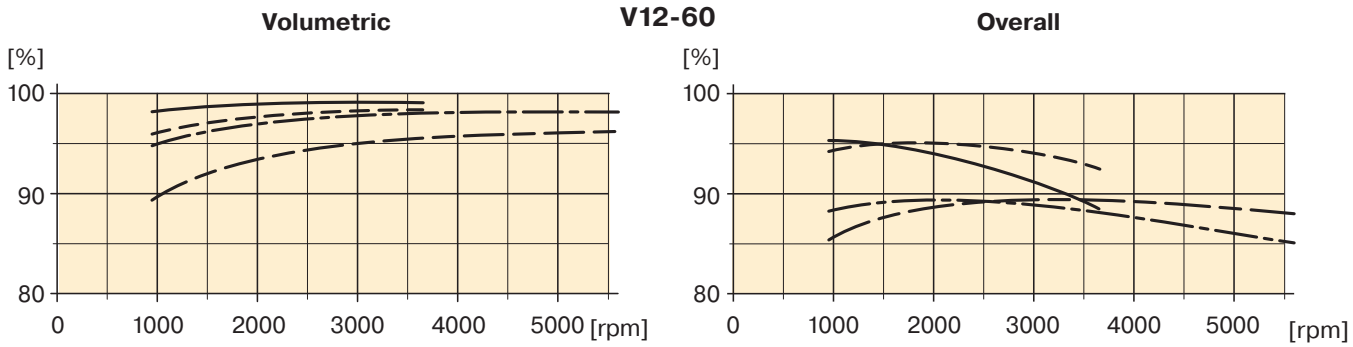
The following diagrams show volumetric and overall efficiencies versus shaft speed at 210 and 420 bar operating pressure, and at full (35°) and reduced (10°) displacements.

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

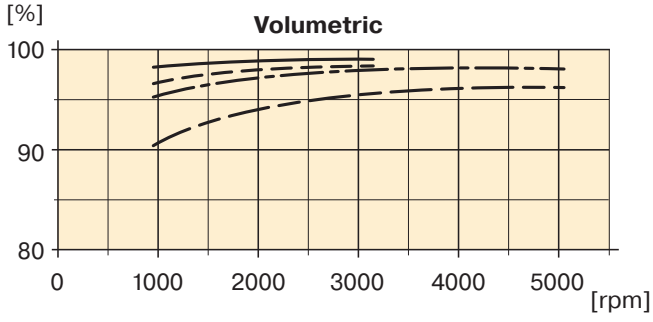
210 bar at full displacement
420 bar " " "

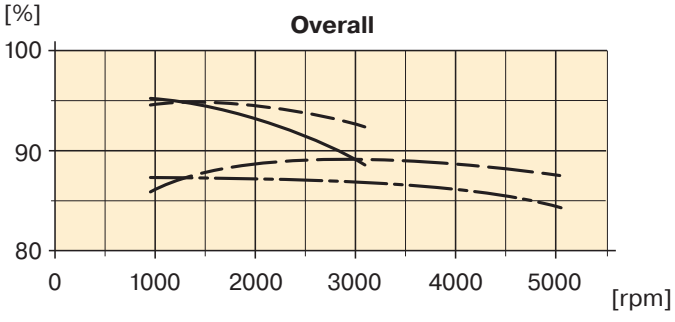
210 bar at reduced displacement
420 bar " " "

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, $\Delta p/\Delta I$ 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.

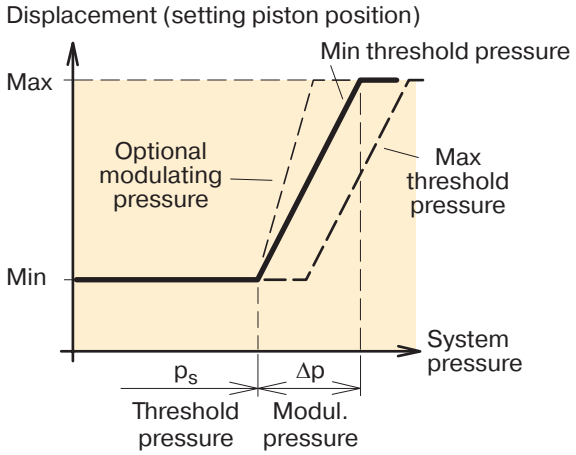
To satisfy specific hydraulic circuit requirements, a modulating pressure, Δp, of 15, 25 or 50 bar can be selected.

The AC compensator is available in two versions:

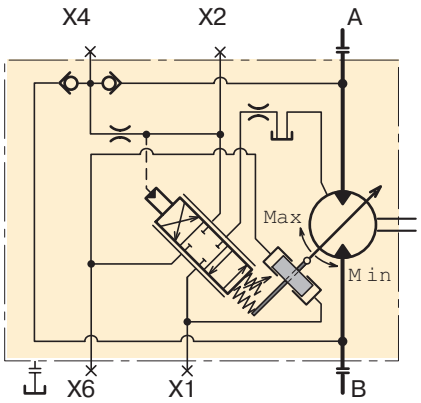
ACI 01 I - Internal pilot pressure

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.

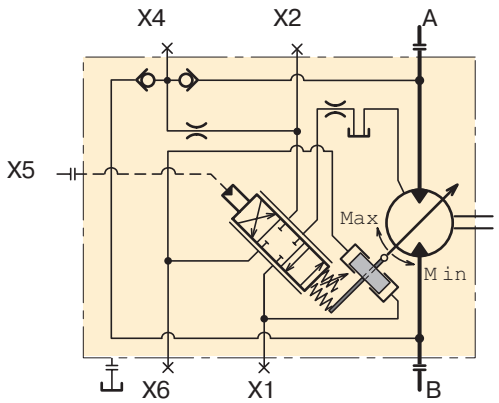
Gauge/pilot ports (AC compensator):	
X1	Setting piston pressure (increasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure
X6	Setting piston pressure (decreasing displ.)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18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

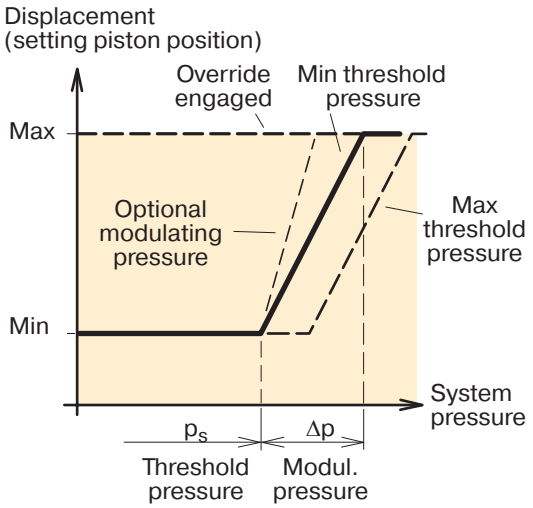
AHE 01 I – (optional) External pilot pressure (port X5; compare ACE, page 9).

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

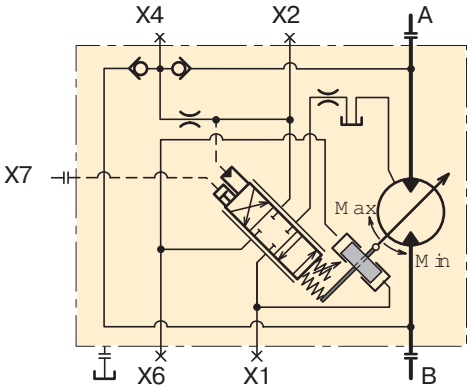
$$p_7 = \frac{p_S + \Delta p}{24} \quad [bar]$$

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

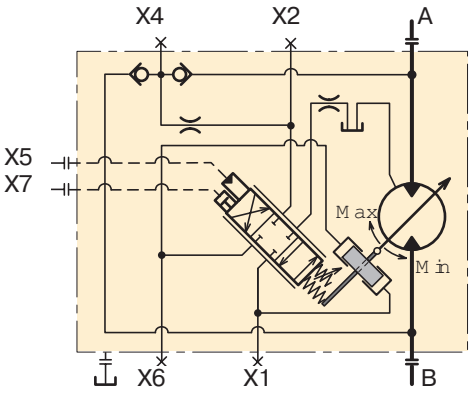
Gauge/pilot ports (AH compensator)	
X1	Setting piston pressure (increasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure
X6	Setting piston pressure (decreasing displ.)
X7	Override pressure
Port sizes:	
–	M14x1.5 (ISO and cartridge 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 (refer to the installation drawing on page 27).

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.

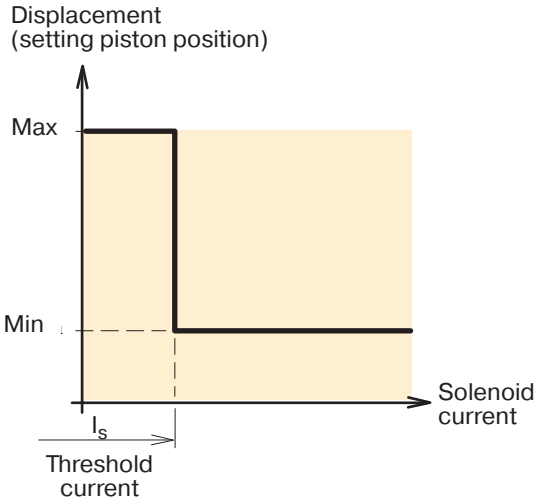
Servo pressure is supplied internally (through the shuttle valve from one of the main high pressure ports) or externally (port X4).

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.

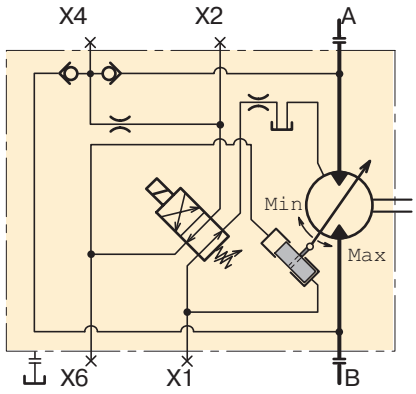
The EO two-position control is available in four versions:

EOH 01 I – Internal servo supply, 24 VDC
EOL 01 I – Internal servo supply, 12 VDC
EOH 01 E – External servo supply, 24 VDC (optional)
EOL 01 E – External servo supply, 12 VDC (optional)

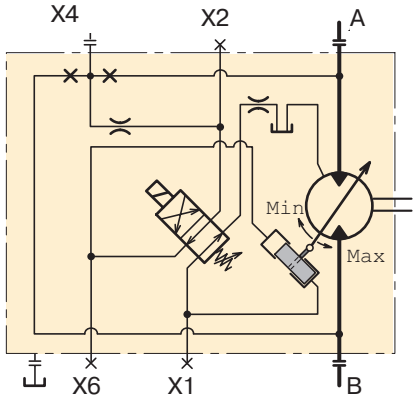
Gauge/pilot ports (EO control):	
X1	Setting piston pressure (max-to-min)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X6	Setting piston pressure (min-to-max)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).



EO diagram.



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



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

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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.

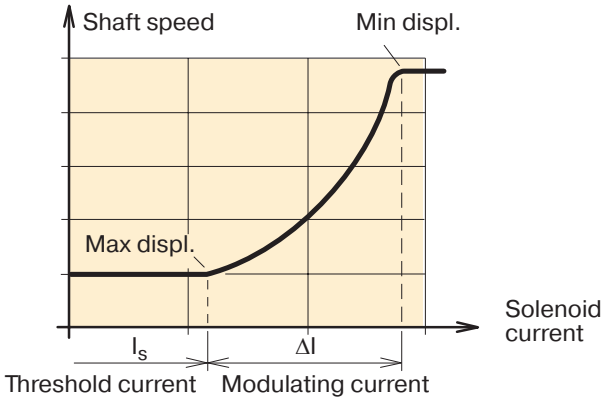
In order to minimize hysteresis, a pulse-width modulated control signal of 70 to 90 Hz should be utilized.
See also “Controls, Note” on page 9.

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

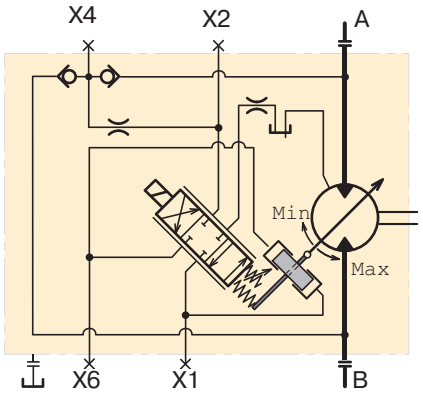
The EP control is available in four versions:

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)

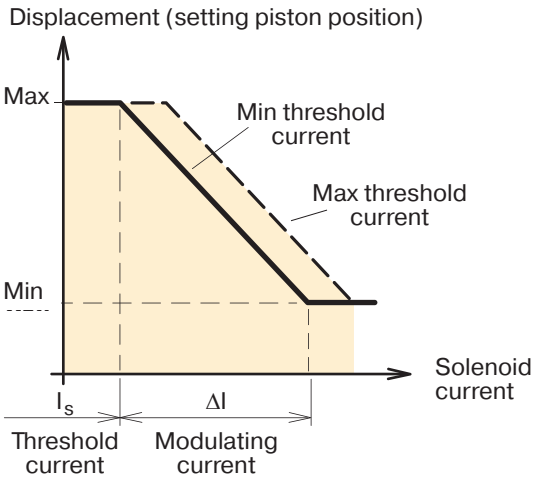
Gauge/pilot ports (EP control):	
X1	Setting piston pressure (decreasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X6	Setting piston pressure (increasing displ.)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).



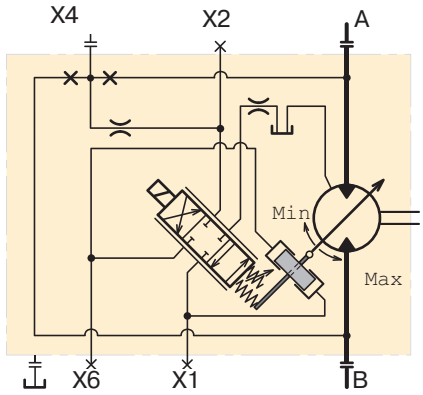
Shaft speed vs. solenoid current (EP control).



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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Trollhättan, Sweden

HO two-position control

The two-position HO control is similar to the EO (page 12) 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.

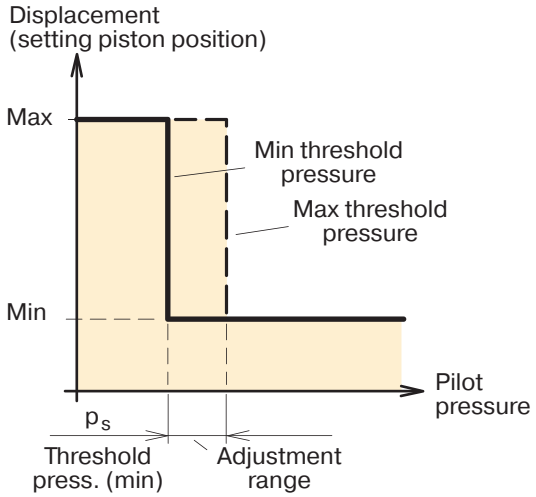
The threshold pressure is factory set at 10 bar but can be adjusted between 5 and 25 bar.

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

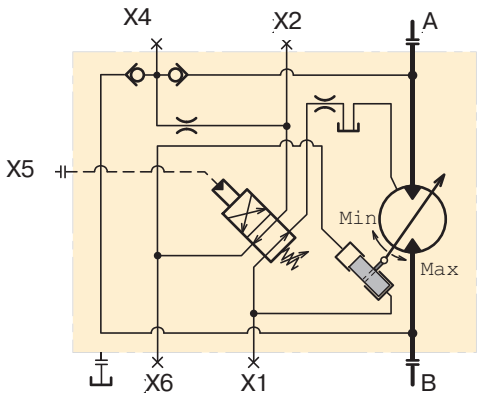
HO S 01 I – Internal servo supply

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

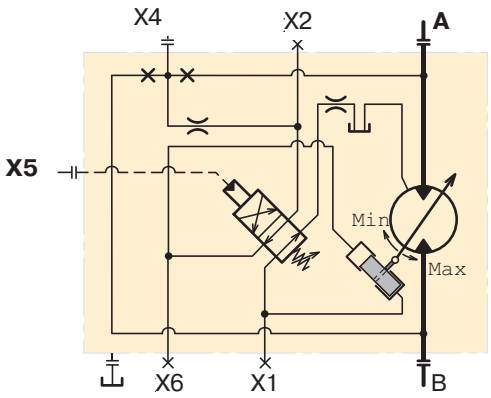
Gauge/pilot ports (HO control):	
X1	Setting piston pressure (max-to-min)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar)
X6	Setting piston pressure (min-to-max)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18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



HO diagram.



HO S 01 I schematic (X5 not pressurized).



HO S 01 E schematic (X5 not pressurized).

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HP proportional control

Like the EP control described on page 13, 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.

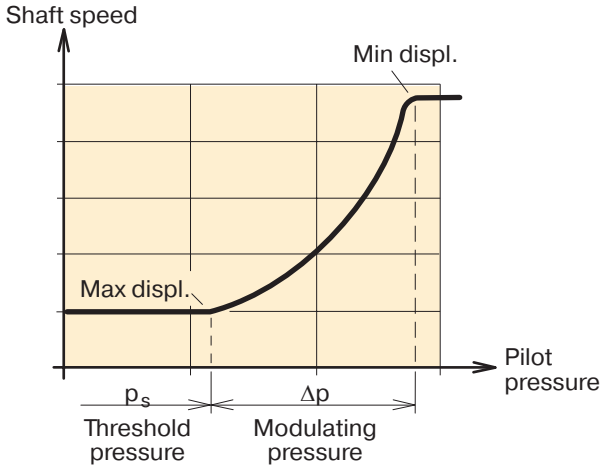
See also “Controls, Note” on page 9.

Two versions of the HP control are available:

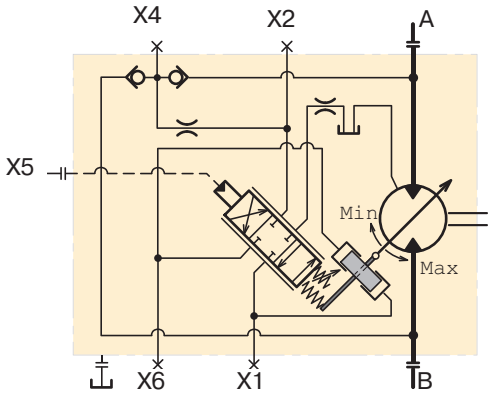
HPS 01 I – Internal servo supply

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

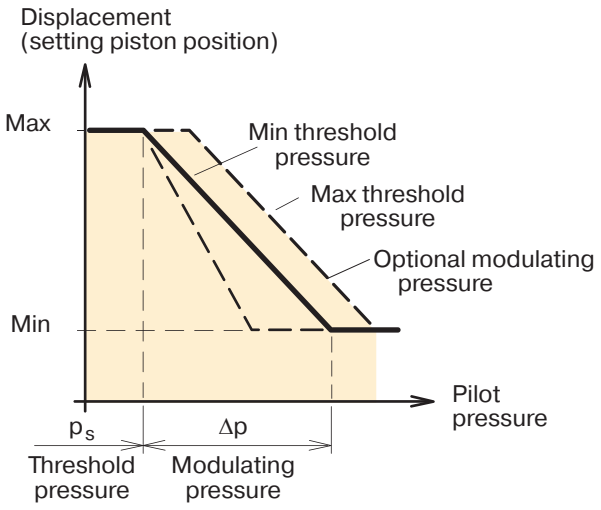
Gauge/pilot ports (HP control):	
X1	Setting piston pressure (decreasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar)
X6	Seetting piston pressure (increasing displ.)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)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



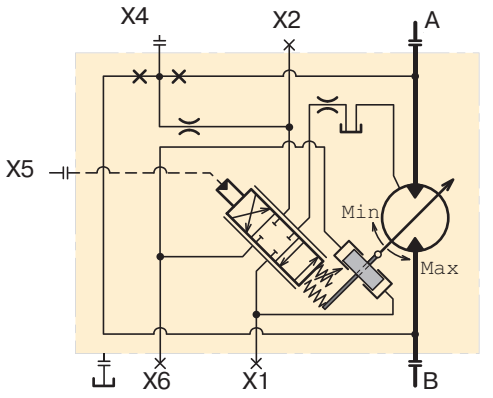
Shaft speed vs. pilot pressure (HP control).



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



HP diagram.



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

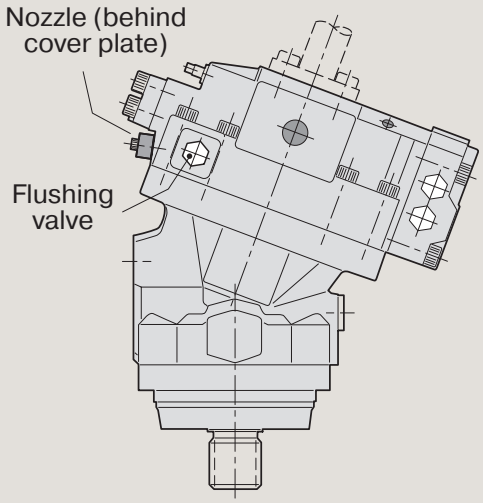
Flushing valve

As an option, **L**, the V12 is 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 a special end cap. It connects the low pressure side of the main circuit to a nozzle (optional size) that empties 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.

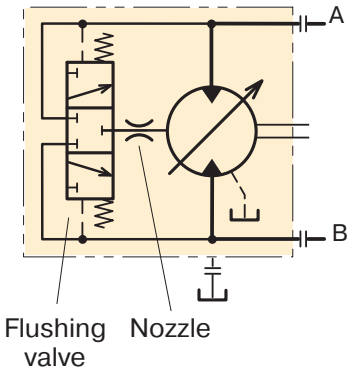
NOTE: The flushing valve ordering code is shown on page 21 (‘L 01’).



V12 with flushing valve

Nozzle design.	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

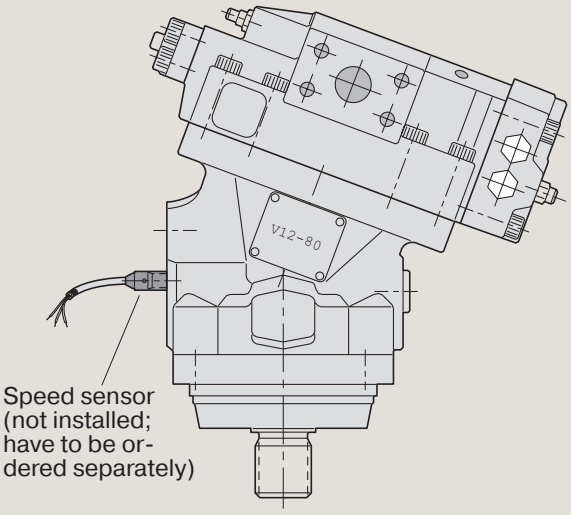


Speed sensor

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

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 17 to 19.
- The speed sensor is also shown in the illustrations on pages 22 to 26.



V12 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

High Speed/High Power operation

Running in procedure at mid. displacement

Running in procedure Parker Motors

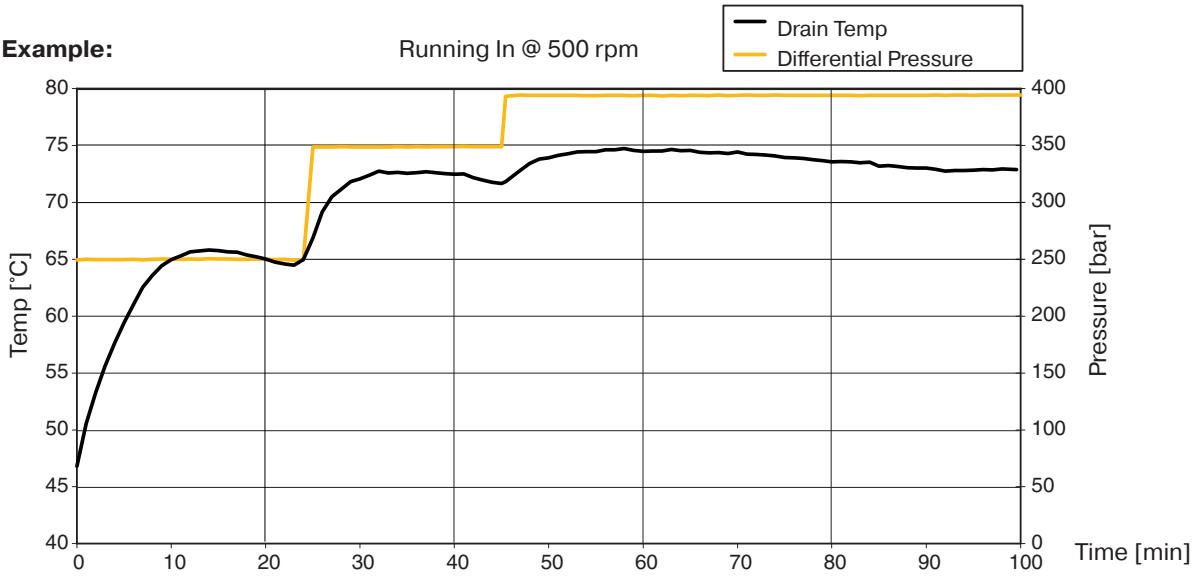
We suggest the following procedure to run in the V12 motors.

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.

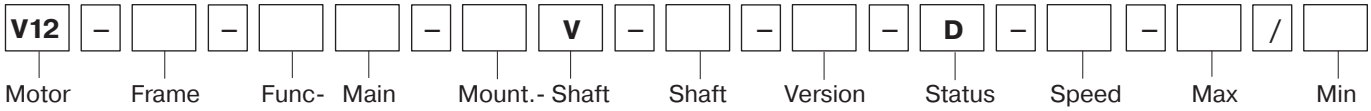
Please make sure the drain temperature probe is in the drain oil flow to measure the correct temp.

Running In Example:



Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

ISO version (basic configuration)



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

Max and min displacement
[cm^3/rev]

Code	Speed sensor*
P	Prepared for speed sensor
O	None

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

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

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

Version number
Factory assigned for special versions

* Note.
See information on page 16, Speed Sensor

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

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

Controls and flushing valve, see page 20

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

Max and min displacement
[cm^3/rev]

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

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

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

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

Version number
Factory assigned for special versions

* Note.
See information on page 16, Speed Sensor

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

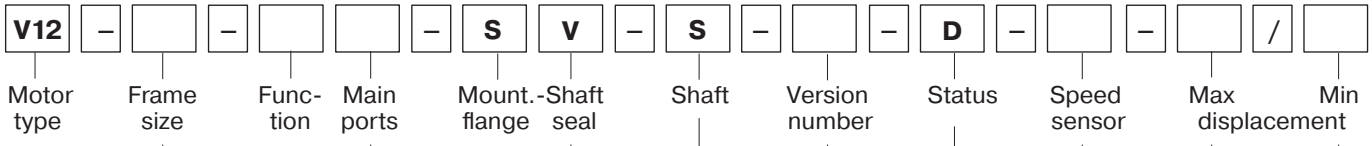
Frame size		60	80
Code	Shaft seal		
V	PPS	x	x

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

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

Controls and flushing valve, see page 20

SAE version (basic configuration)



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

Max and min displacement
[cm^3/rev]

Code	Speed sensor*
P	Prepared for speed sensor
O	None

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

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

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

Version number
Factory assigned for special versions

* Note.
See information on page 16, Speed Sensor

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

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

Controls and flushing valve, see page 20

Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

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 15).

Control installation dimensions

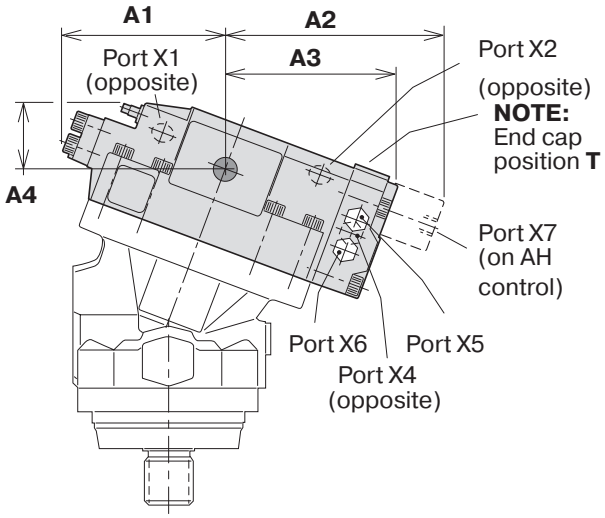
NOTE: - The basic motor side port locations are shown on pages 22, 24 and 26.

- End cap position: Refer to the ordering codes, pages 17 to 19.

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

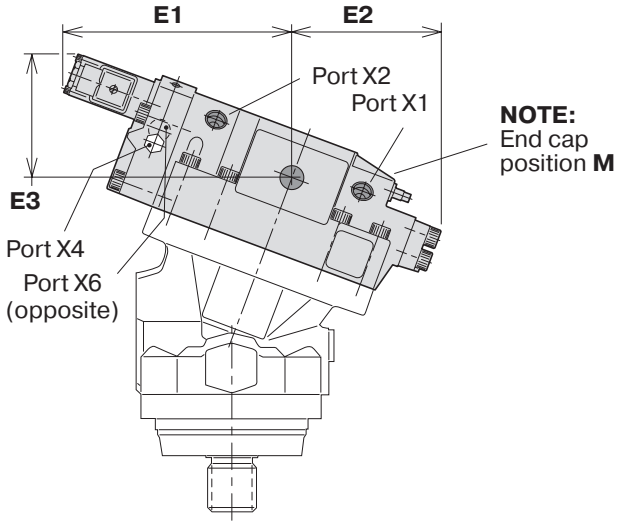
AC and AH compensators

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



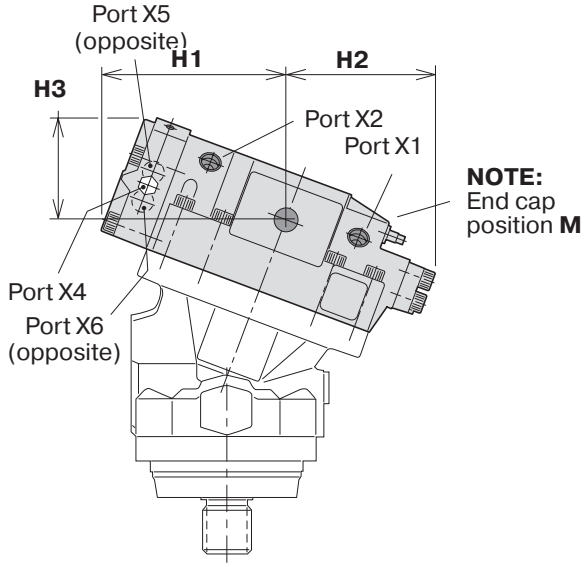
EO and EP controls

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

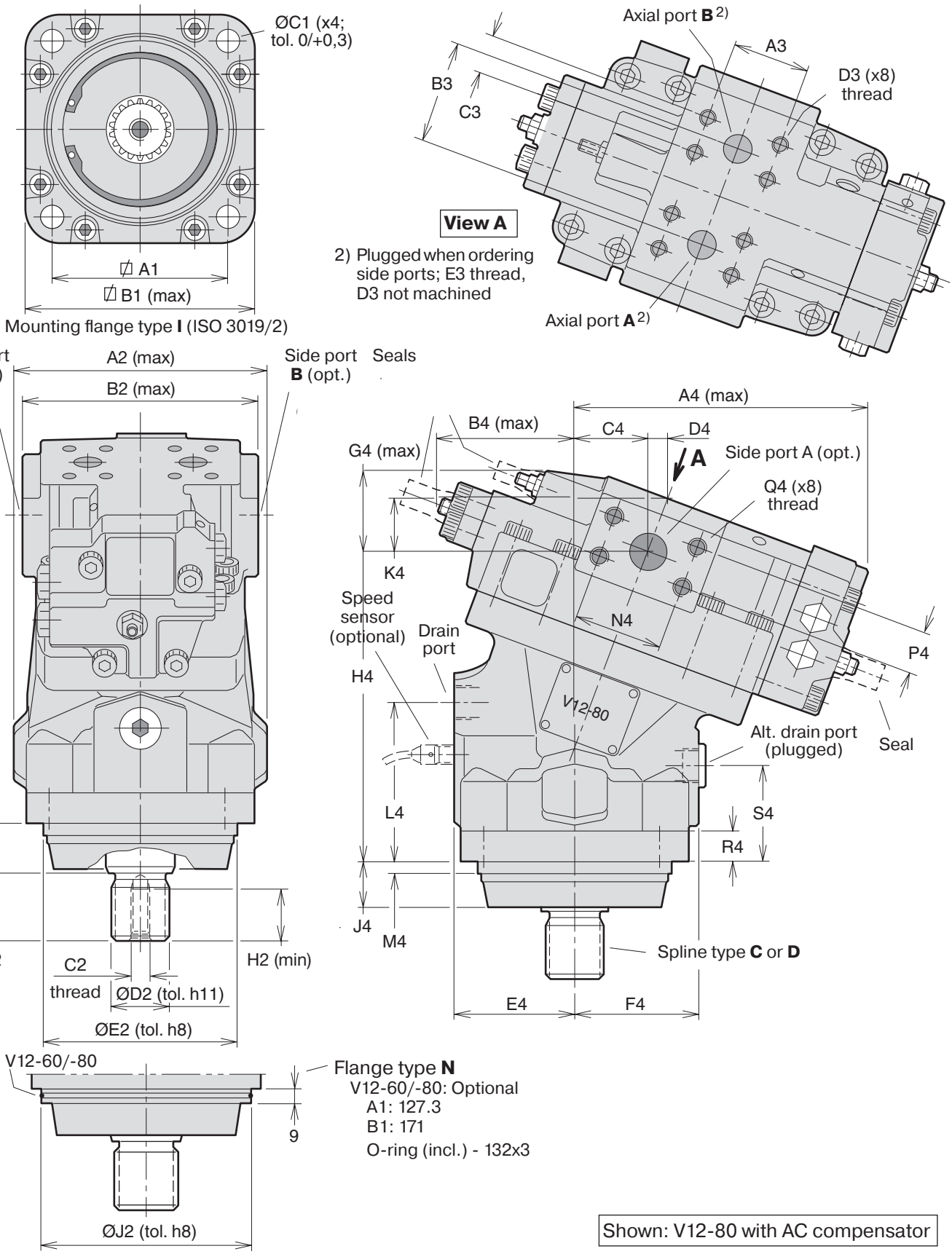


HO and HP controls

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



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

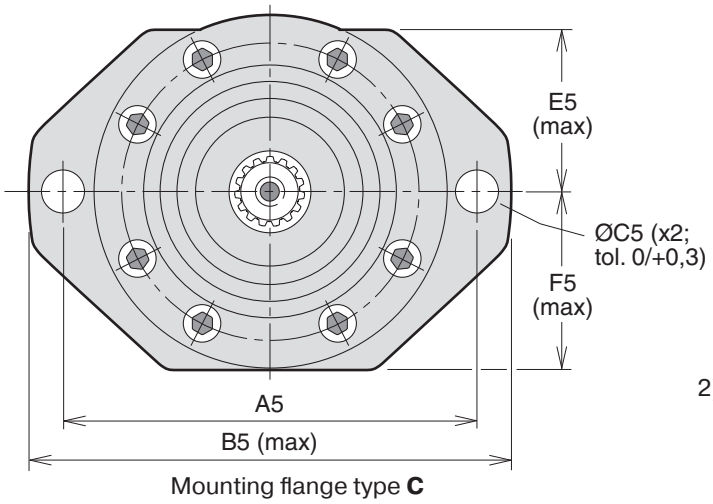
* Dimension for shaft type **D**. Shaft type **C** dimensions are 5 mm shorter than those of type D.

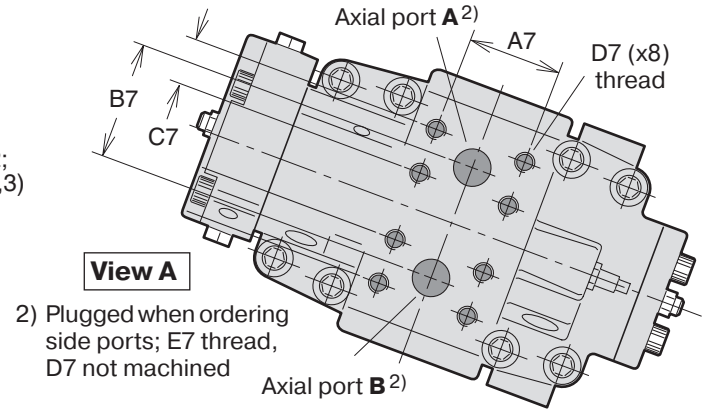
1) Metric thread x depth in mm

2) Metric thread x pitch in mm

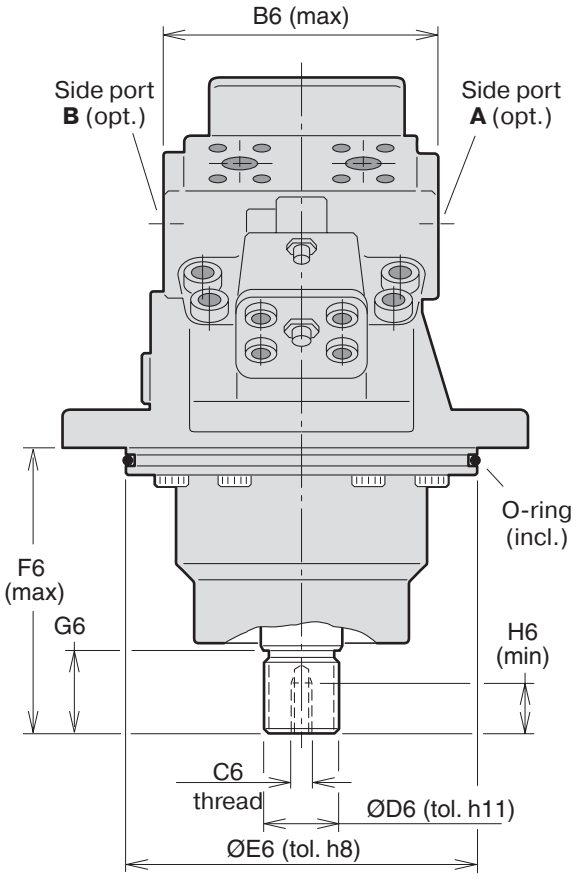
3) '30° involute spline, side fit'.

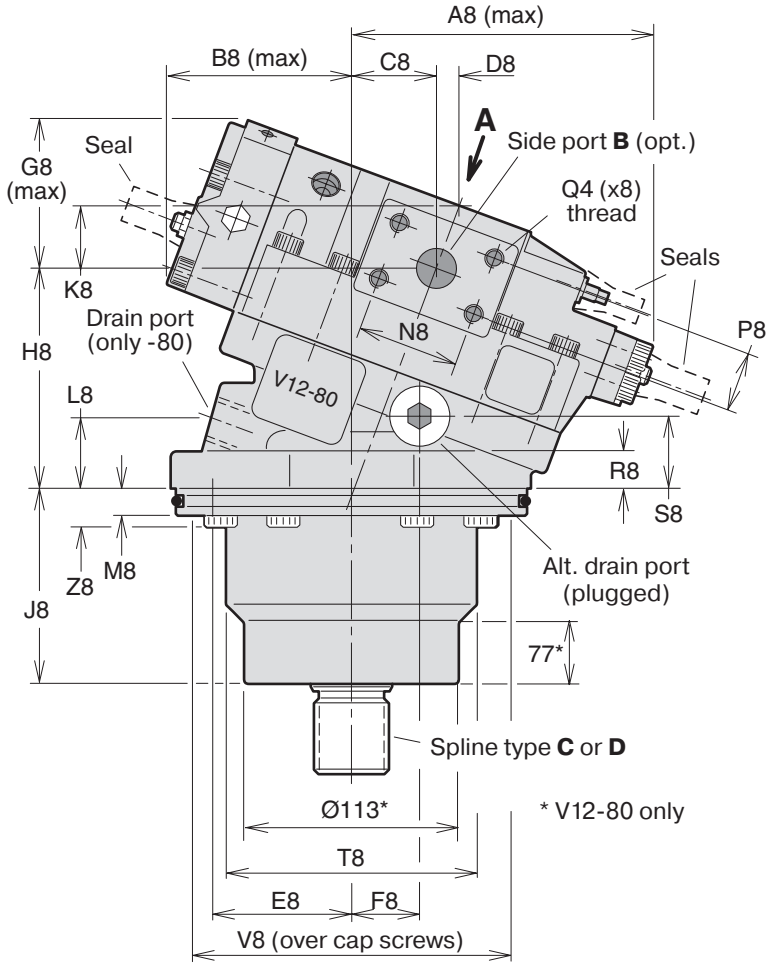
Cartridge version





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

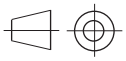
* Dimension for shaft type **D**. Shaft type **C** dimensions are 5 mm shorter than those of type D.

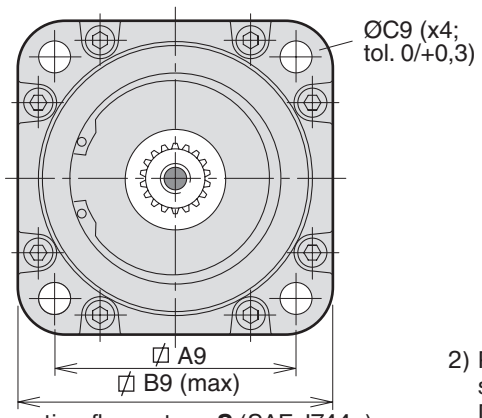
1) Metric thread x depth in mm

2) Metric thread x pitch in mm

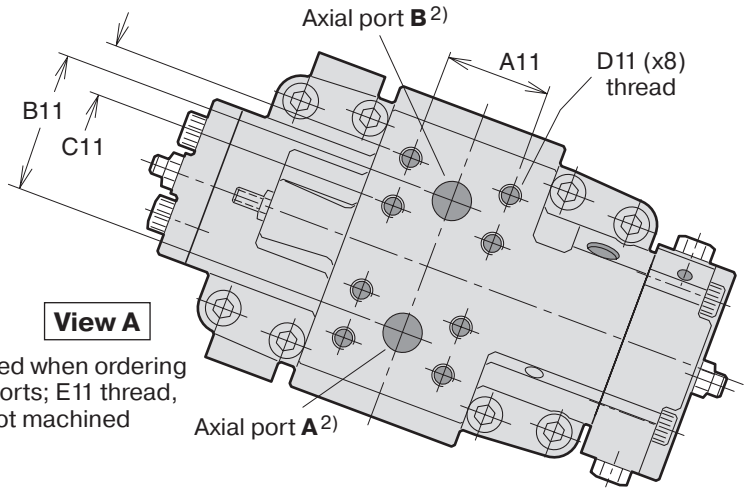
3) '30° involute spline, side fit'.

SAE version



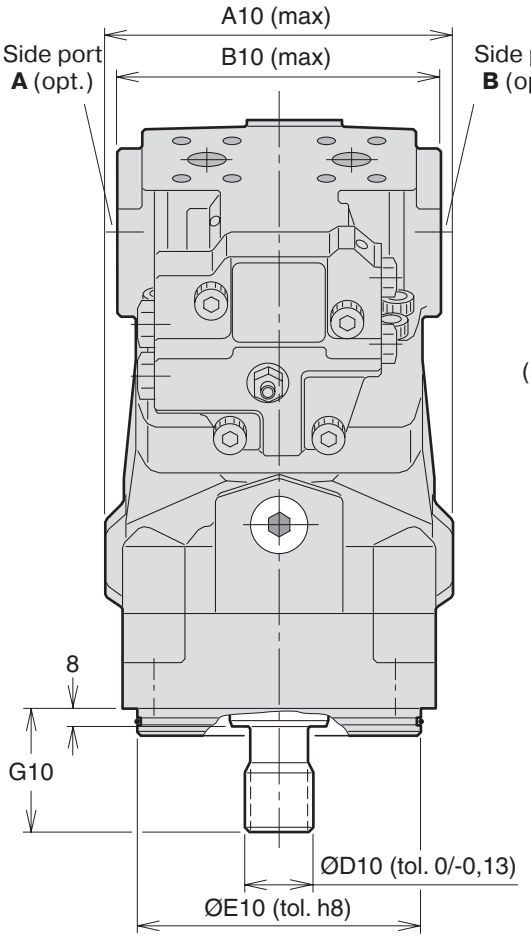


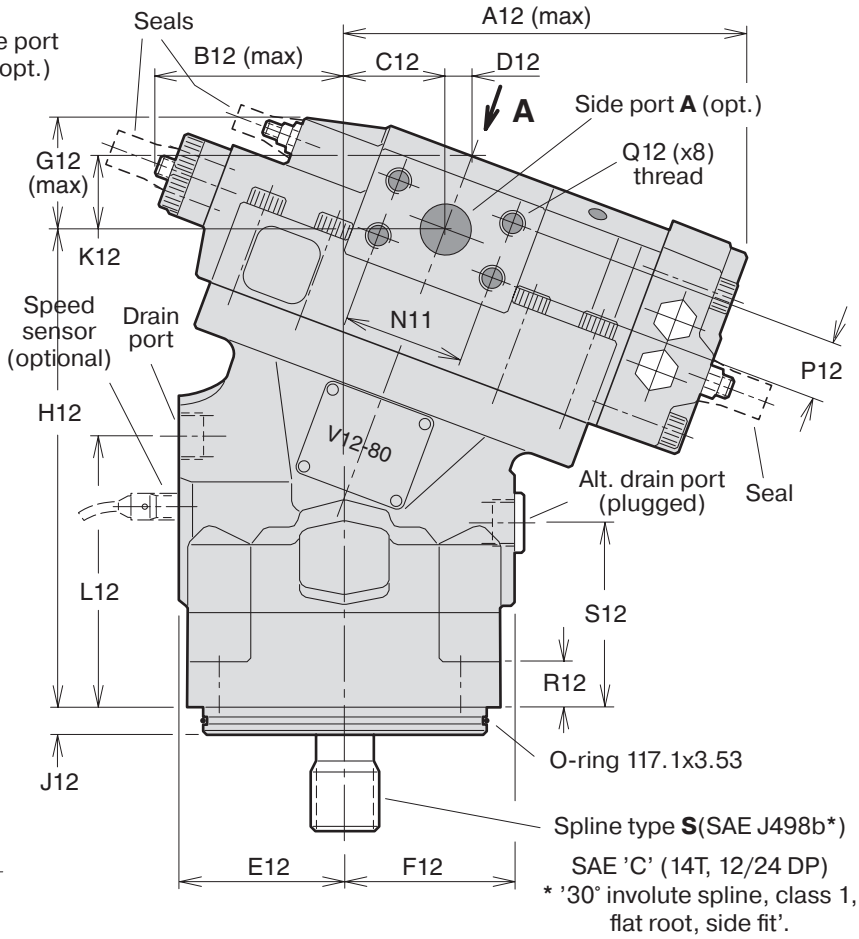
Mounting flange type **S** (SAE J744c)
Dimension SAE C



View A

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





* '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

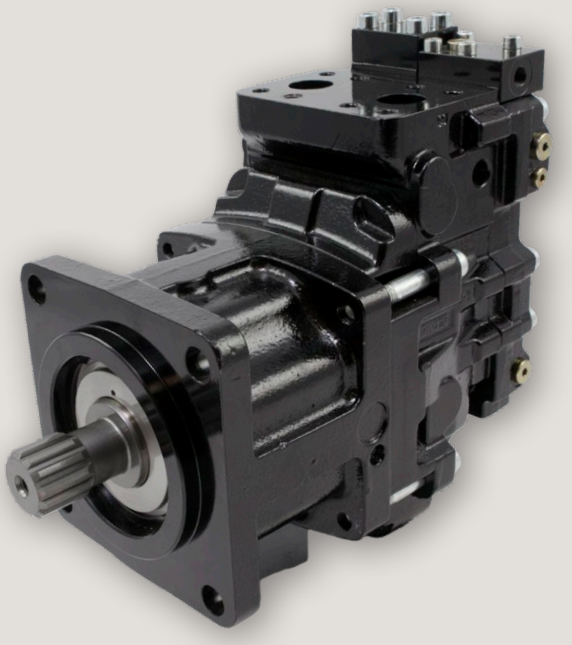
1) UNC thread x depth in mm
2) Metric thread x pitch in mm.

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

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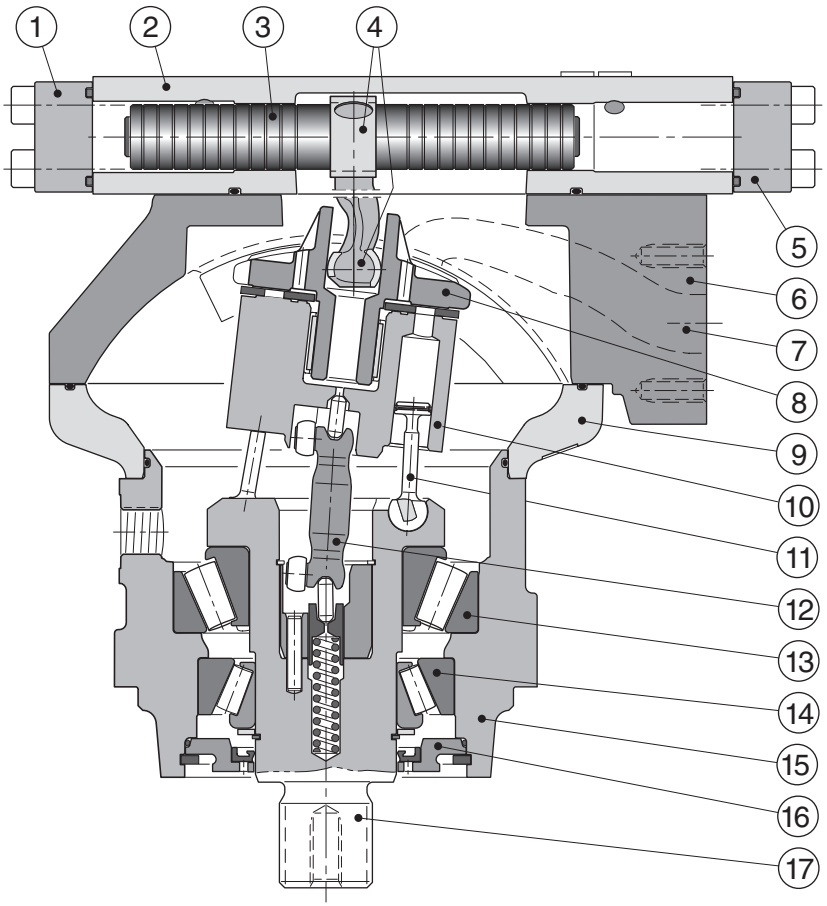
Pump & Motor Division Europe
Trollhättan, Sweden

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



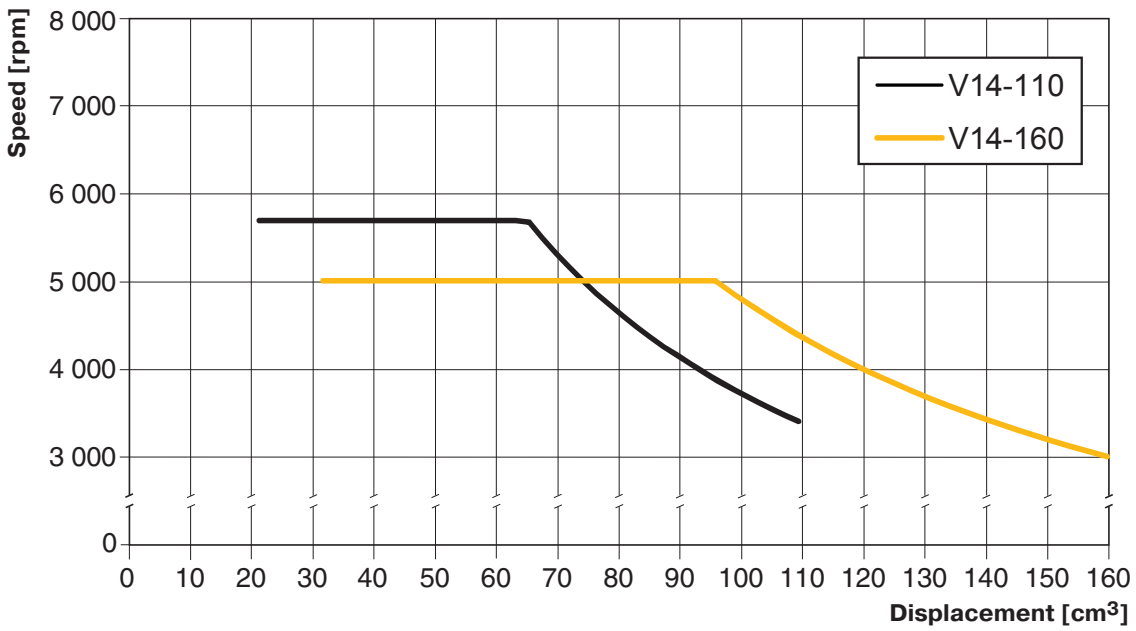
Specifications

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 m²]	8.2	14.5
Weight [kg]	54	68

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

Continuous Speed vs. Displacement



Efficiency diagrams

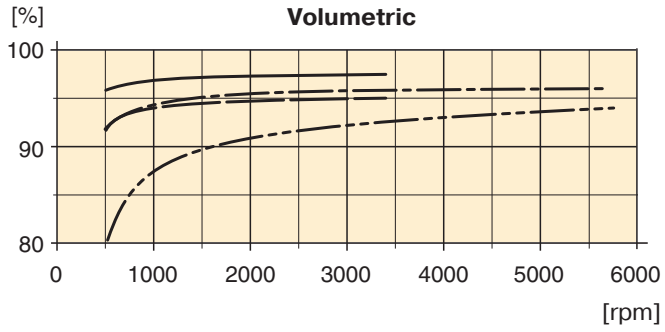
The following diagrams show volumetric, mechanical and overall efficiencies versus shaft speed at 210 and 420 bar operating pressure, and at full (35°) and reduced (10°) displacements.

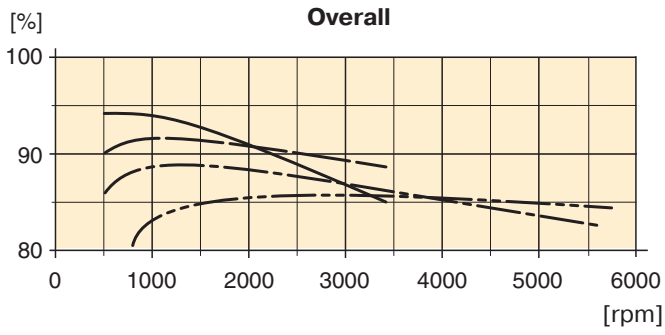
Information on efficiencies for a specific load condition can be made available from Parker Hannifin.

210 bar at full displacement
420 bar " " "

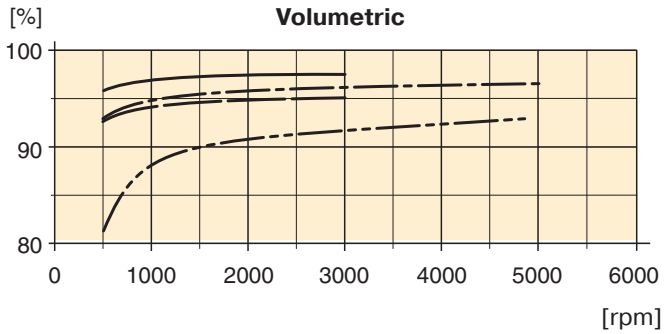
210 bar at reduced displacement
420 bar " " "

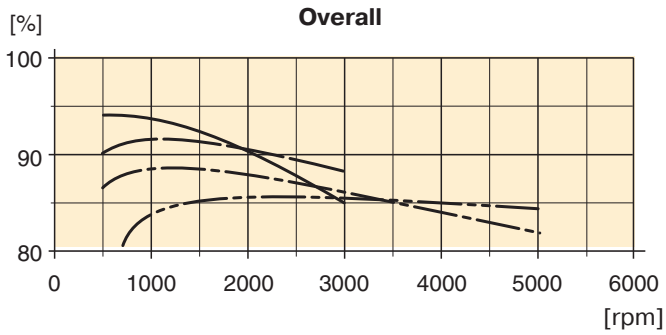
V14-110





V14-160





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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 41)

All controls utilize a servo piston that connects to the valve segment (refer to the illustration on page 29).

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

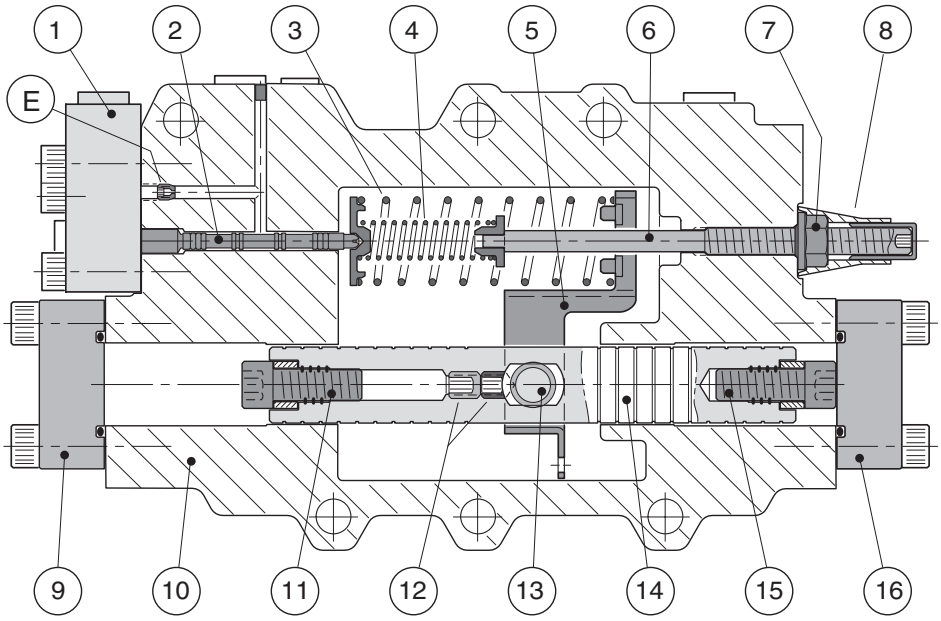
The displacement angle (between output shaft and cylinder barrel) ranges from 35° (max) to 6.5° (min).

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 32 to 35.

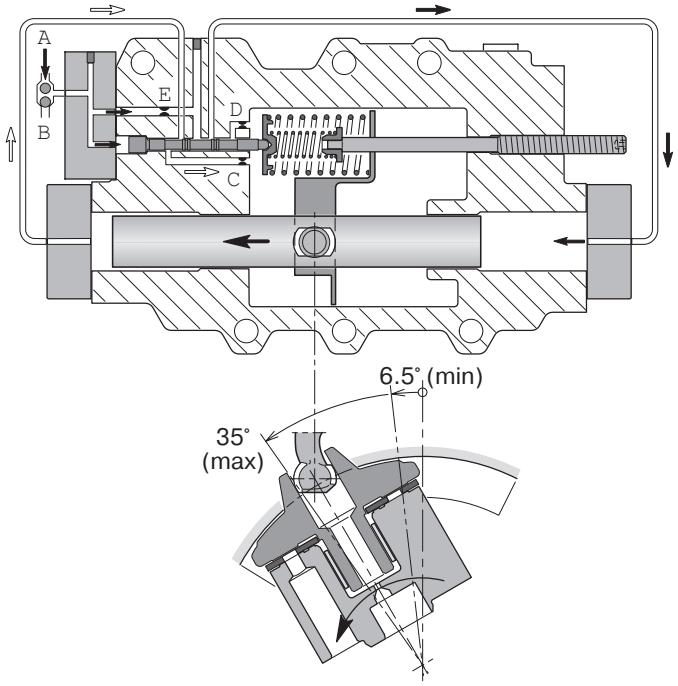
* Yellow cap = factory set.
Red cap 3797065 available as spare part

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).

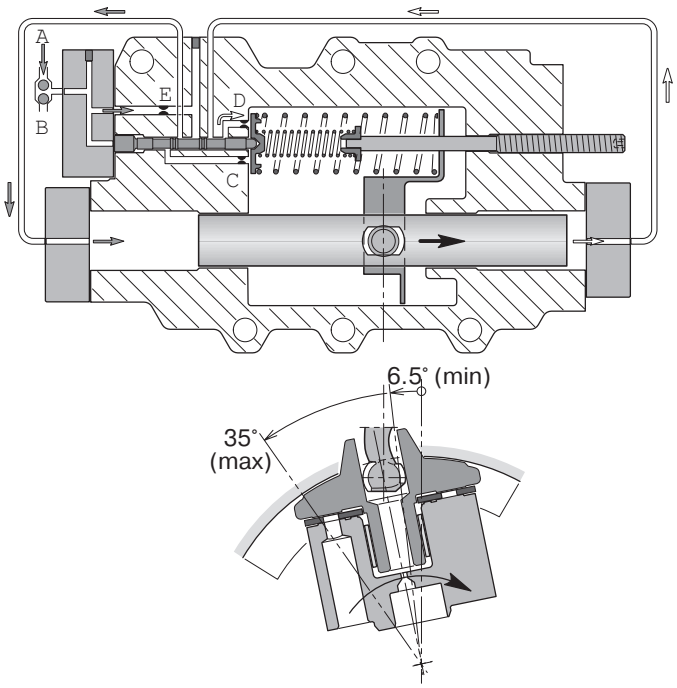


AC function (displ. increases at increasing system pressure).

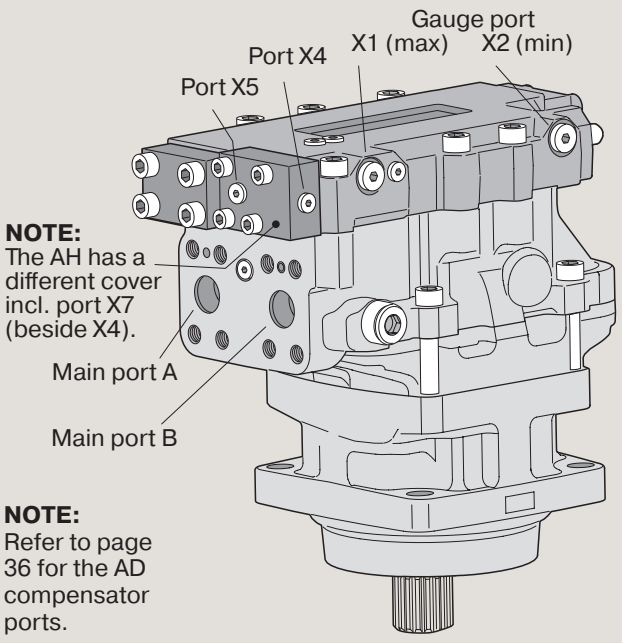
Refer to the illustration below (right):

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. decreases at decreasing system pressure).



NOTE:
The AH has a different cover incl. port X7 (beside X4).

NOTE:
Refer to page 36 for the AD compensator ports.

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.

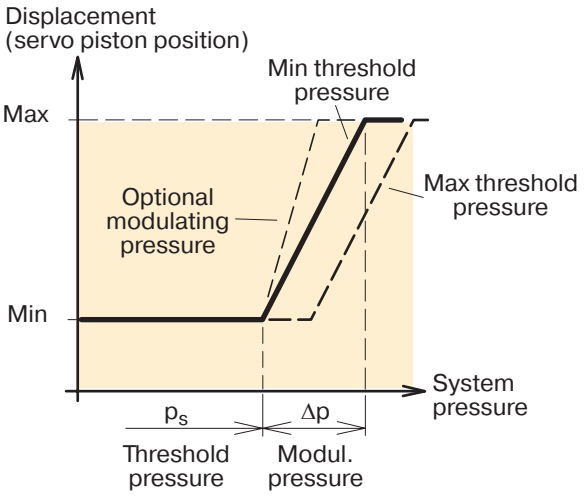
To reach max displacement, an additional modulating pressure (Δp) above the threshold pressure is required.

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

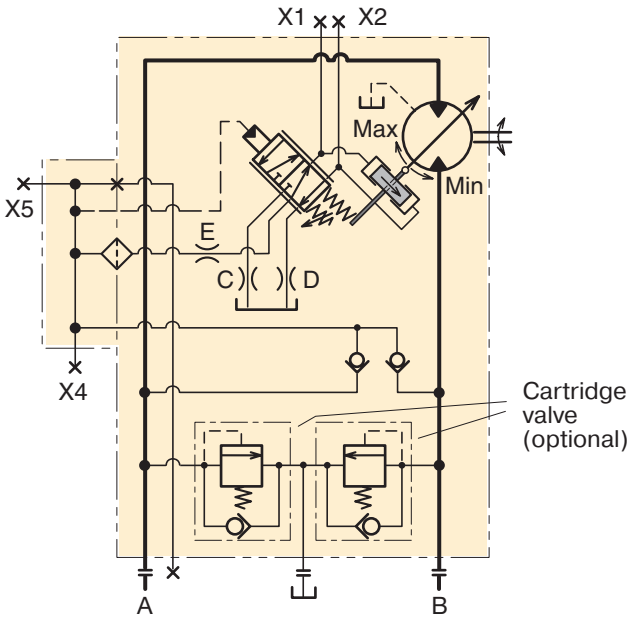
The pressure compensator is supplied with a small filter installed in the AC control cover (between ports X4 and X5); refer to the schematic below right.

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 32.



AC diagram (displacement vs. system pressure).



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

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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):

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

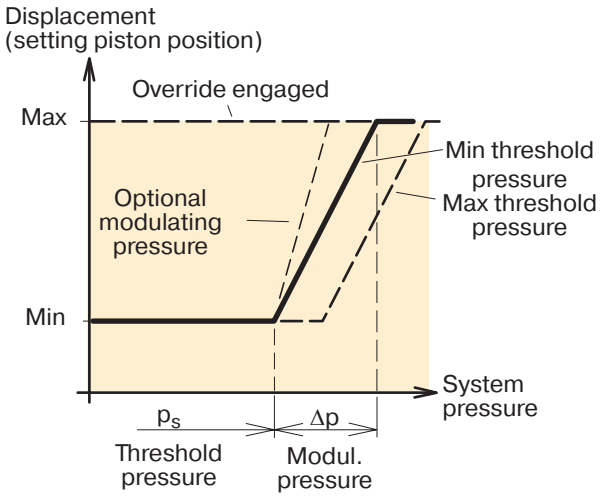
p_7 = Override pressure

p_s = System pressure

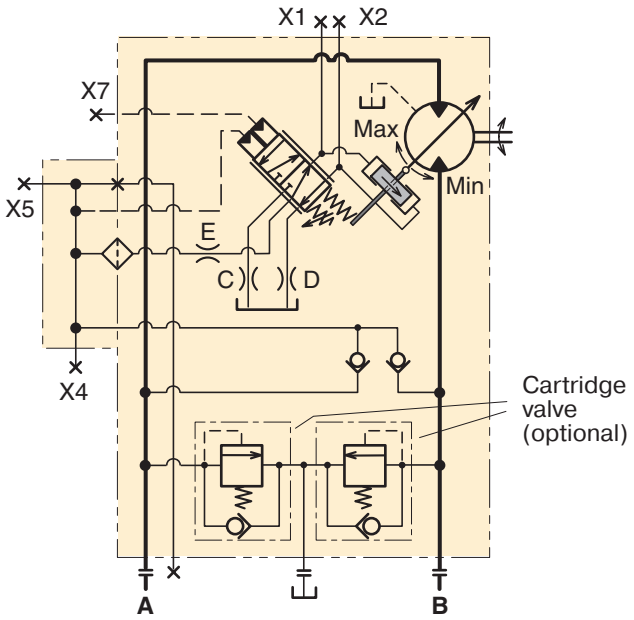
Δp = Modulating pressure

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 32.



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)

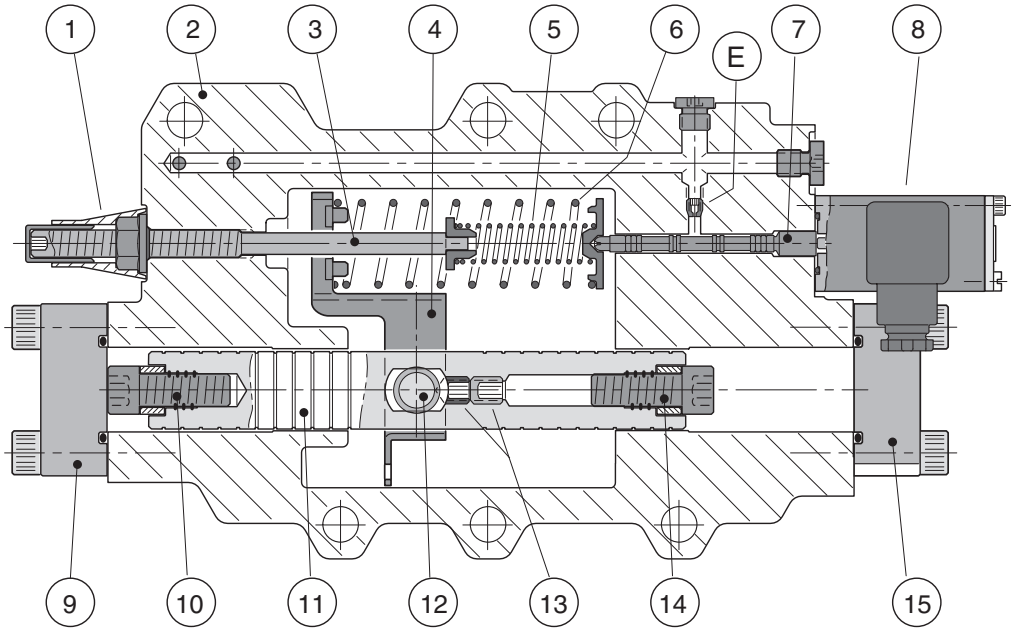
Basically, these controls function in a similar way.

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 36 to 41.

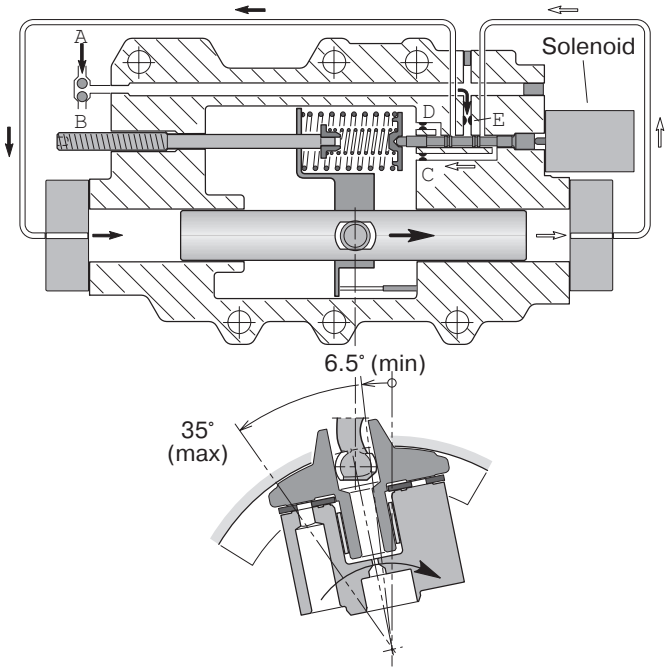
* Yellow cap = factory set.
Red cap 3797065 available as spare part

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).



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

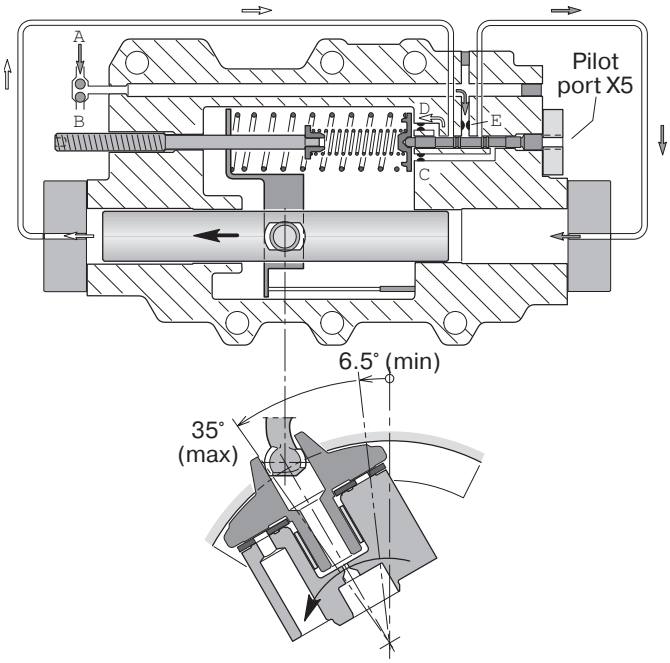
HP control function (decreasing pilot pressure)

NOTE: Valid also for the EP at decreasing current.

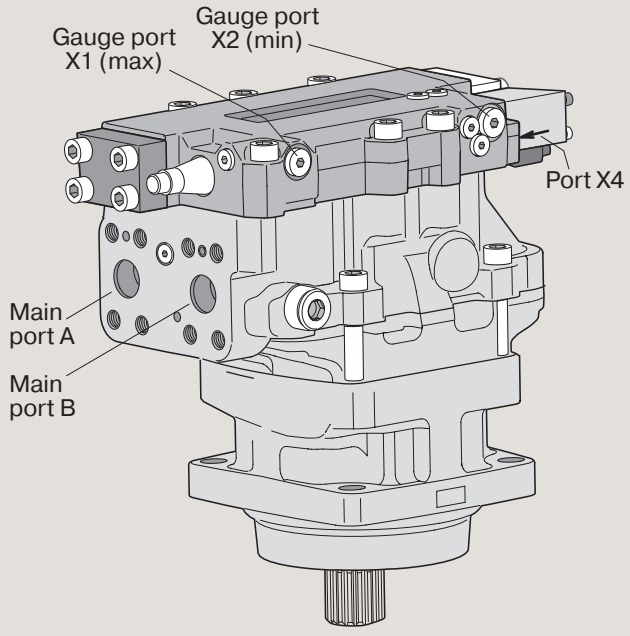
Refer to the illustration below right:

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).



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

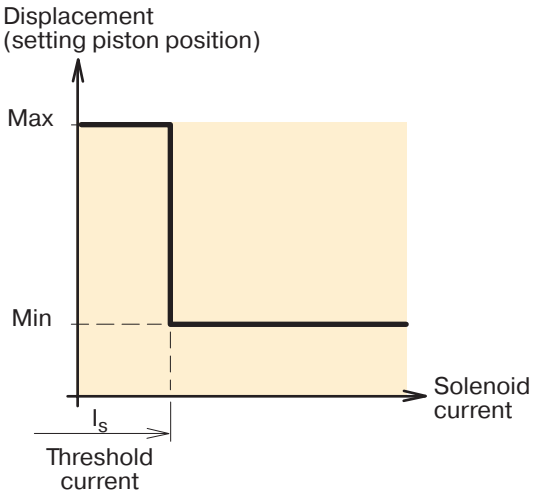


Port locations – V14- with EO or EP control.

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:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

EO electric two-position control

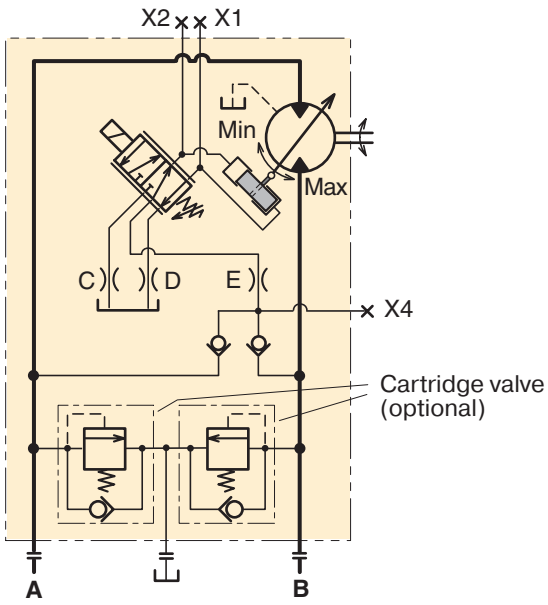
- The EO is a two-position control where the position of the setting piston is governed by a DC solenoid (acting on the servo spool) which is attached to the control module (refer to the illustration on page 36).
- The EO is utilized in transmissions where only two operating modes are required - low 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.



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 36.

- 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.

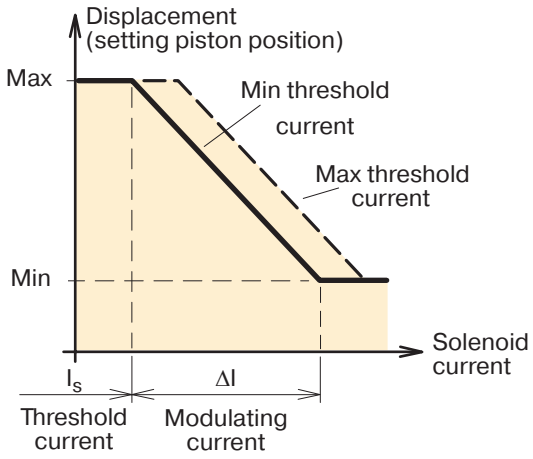


EO schematic (shown: non-activated solenoid; control in max displacement position).

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 36).
- 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.

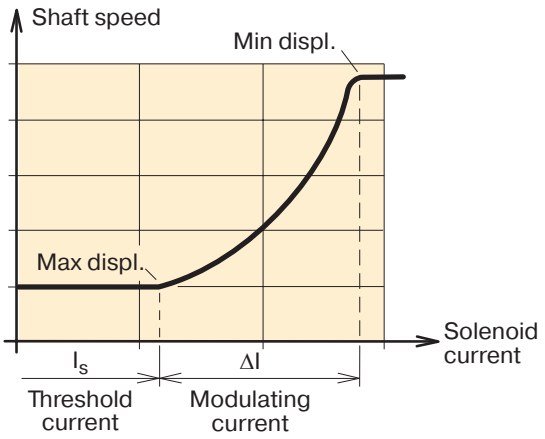
NOTE: The shaft speed is **not** proportional to the solenoid current; refer to the bottom diagram.



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).

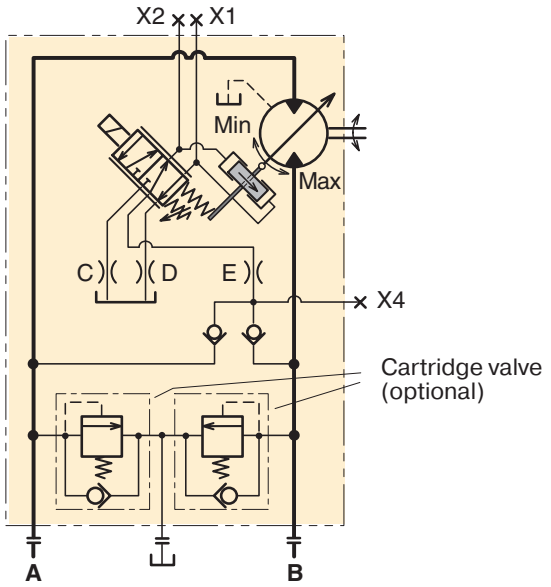
NOTE: Port locations are shown in the illustration on page 37.



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.

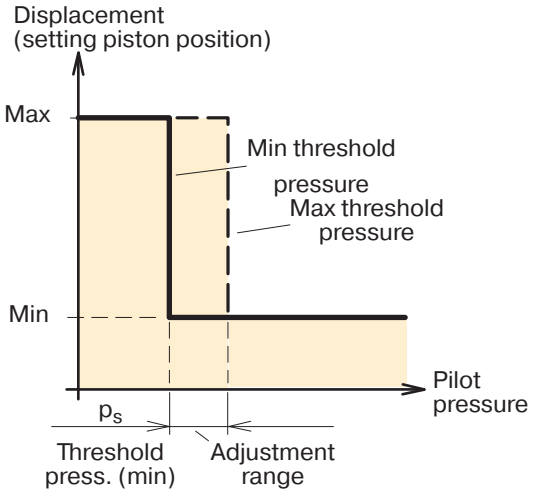
NOTE: The modulating current (ΔI) is not adjustable.



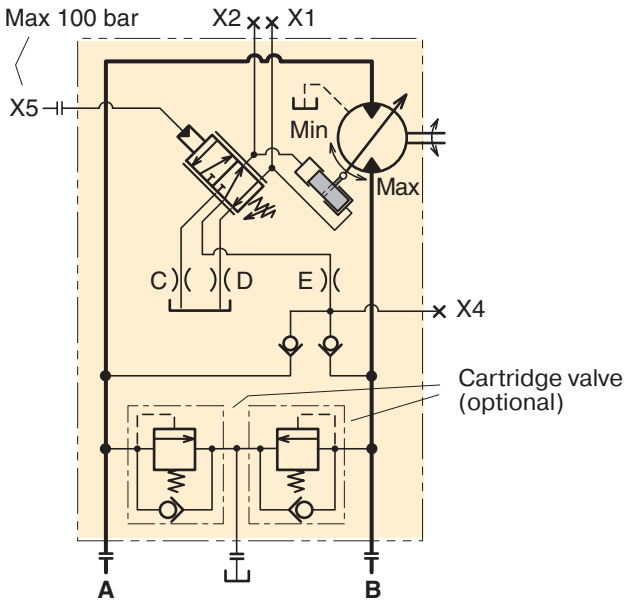
EP schematic (shown: non-activated solenoid; control moving towards max displacement).

HO hydraulic two-position control

- The two-position HO control is similar to the EO (page 37) 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.

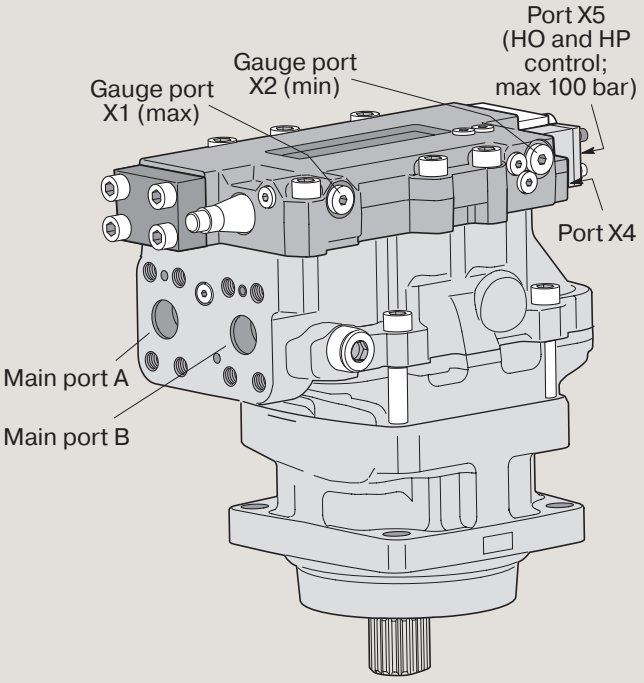


HO diagram (displacement vs. pilot pressure).



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

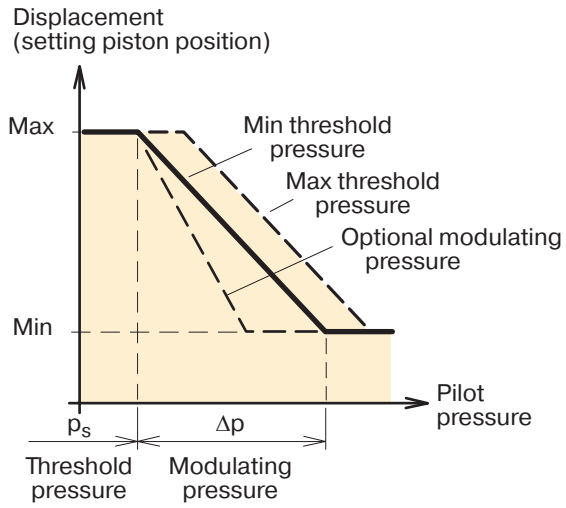
Gauge/pilot ports (HO and HP controls):	
X1	Setting piston pressure (decreasing displ.)
X2	Setting piston pressure (increasing displ.)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar; HO and HP control)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18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



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

HP hydraulic proportional control

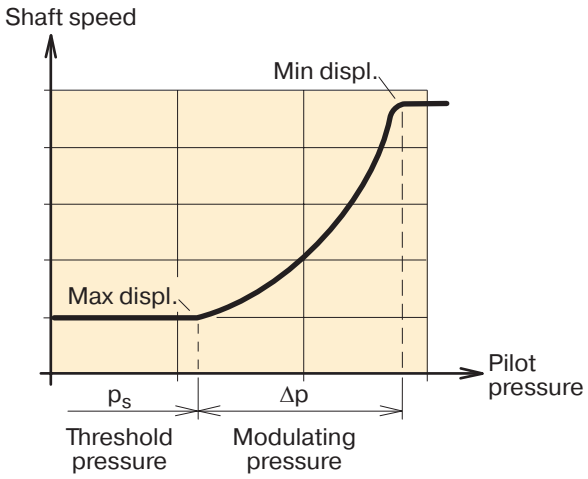
- Like the EP described on page 36, the HP proportional control offers continuously variable displacement, but the controlling signal is hydraulic.
- Normally, the setting piston stays in the max displacement position. When a sufficiently high pilot pressure (p_s) is applied to port X5, the setting piston 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:	
–	M14x1.5 (ISO and cartridge versions)
–	$^9/_{16}$"-18 O-ring boss (SAE version).

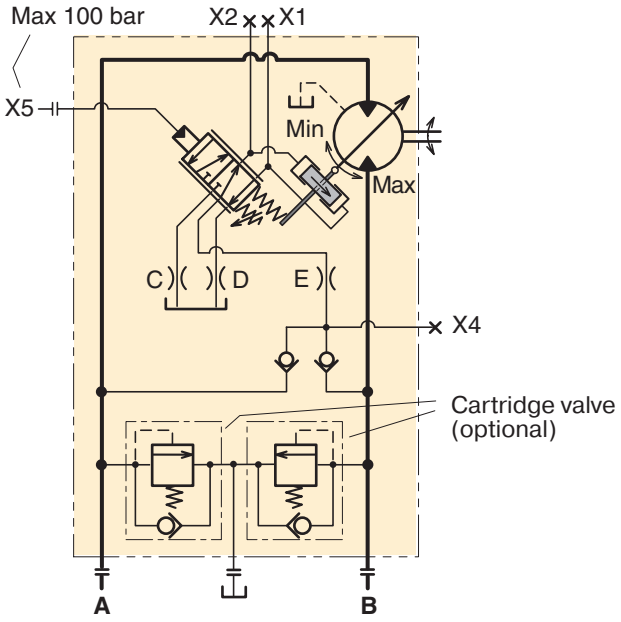
NOTE: Port locations are shown in the illustration on page 39.



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 31.



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

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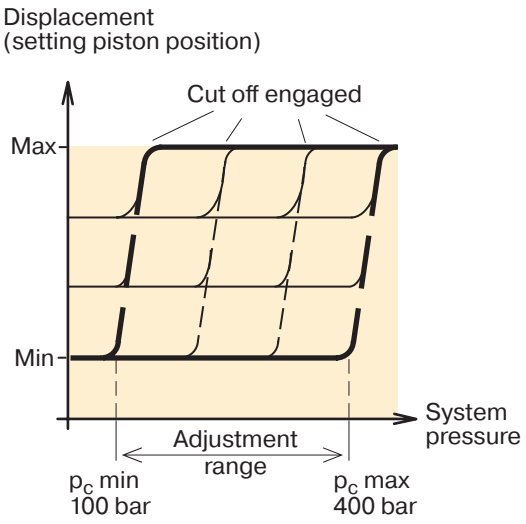
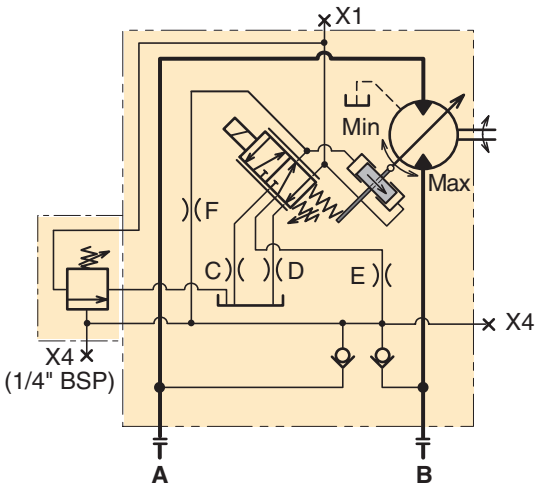
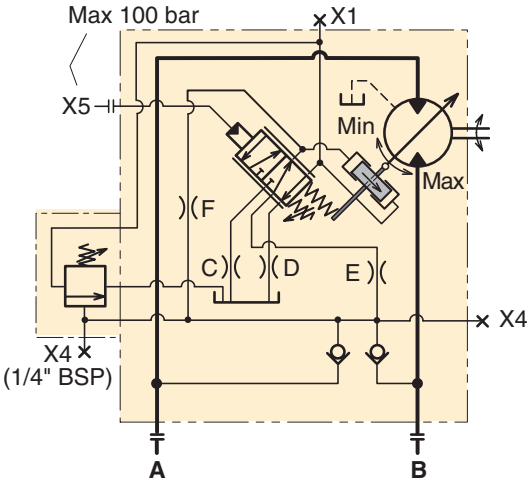
EPC/HPC, EP/HP control with pressure cut off

- 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.





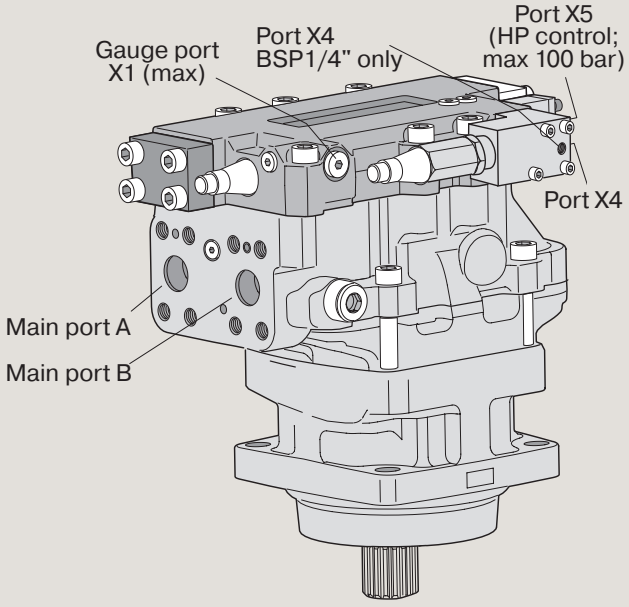
EPC schematic (control moving towards max displacement).



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

Gauge/pilot ports (EPC control):	
X1	Setting piston pressure (decreasing displ.)
X4	Servo supply pressure (before orifice)
X4	Servo supply pressure (on EPC) BSP1/4” only
Port sizes:	
–	M14x1.5 (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) BSP1/4” only
X5	External pilot pressure (max 100 bar)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).



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

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V14-110/-160

Valve options (overview)

- Brake valve and pressure relief valves (opt. **B**;)*
- Flushing valve (option **L**; below)
- Pressure relief valves (option **P**; page 43)
- Load holding valve (option **W**)*

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

Sensor options (overview)

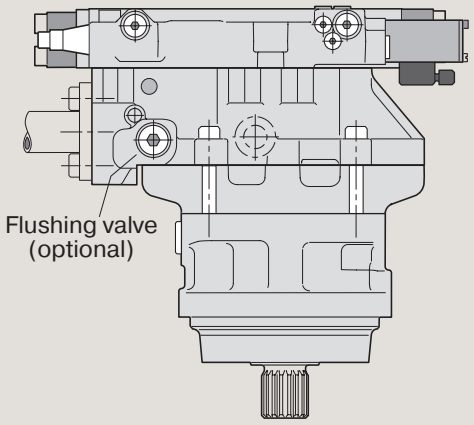
- Shaft speed sensor (option **P**; page 44)

Flushing valve (option L)

The V14 is 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 empties fluid into the motor case.

In a closed circuit transmission, the flushing valve re-moves 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.

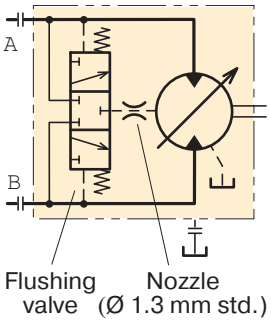


V14-110 (EP control) with built-in flushing valve.

Available nozzles

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



Hydraulic schematic – V14 with built-in flushing valve.

Pressure relief valves (option P)

To protect the motor (and the main hydraulic circuit) from unwanted, high pressure peaks, the V14 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.

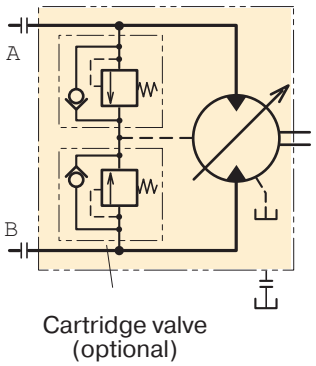
The cross section (below right) shows a situation, where the upper cartridge has opened because of high fluid pressure. This, in turn, forces the opposite cartridge to open to the low pressure area (this cartridge now acting as a check valve).

As shown, a small part of the flow may go directly to the reservoir.

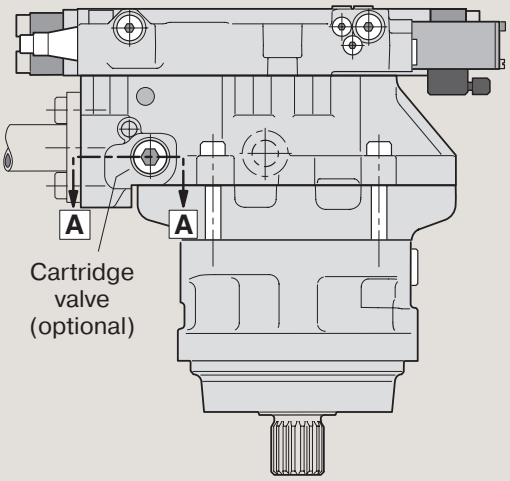
NOTE:
- The pressure relief cartridges should not be used as main pressure reliefs; in a motor application, they should only be relied on to limit short duration pressure peaks (or the temperature of the fluid which circulates through the motor will rapidly reach damaging high levels).
- The main pressure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

Available cartridges

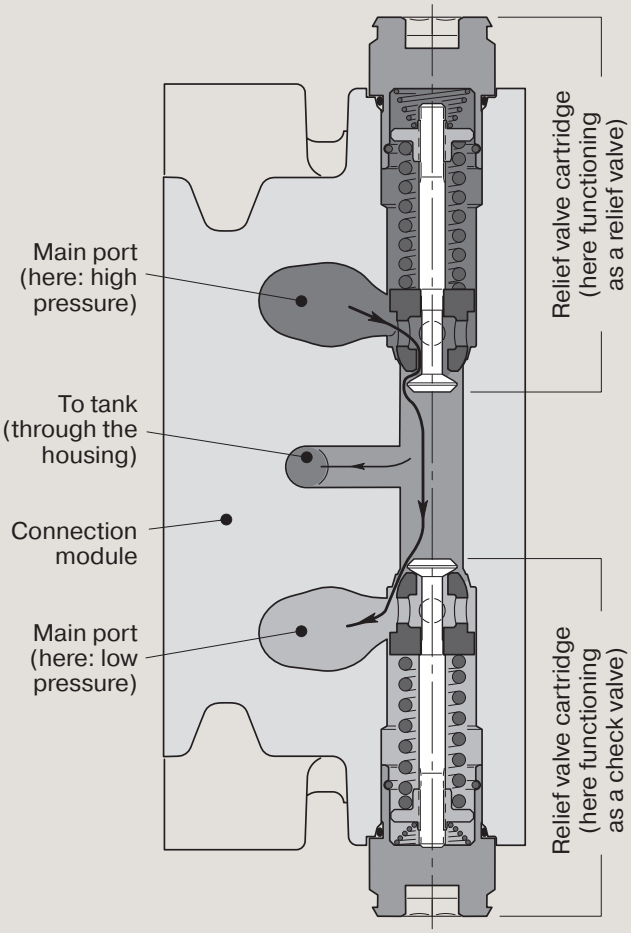
Ordering code	Pressure setting [bar]	Partnumber
P300	300	9120029264
P330	330	9120029265
P350	350	9120029266
P380	380	9120029267
P400	400	9120029268
P420	420	9120029269
P450	450	3766886



Hydraulic schematic – V14 with cartridge valves.



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



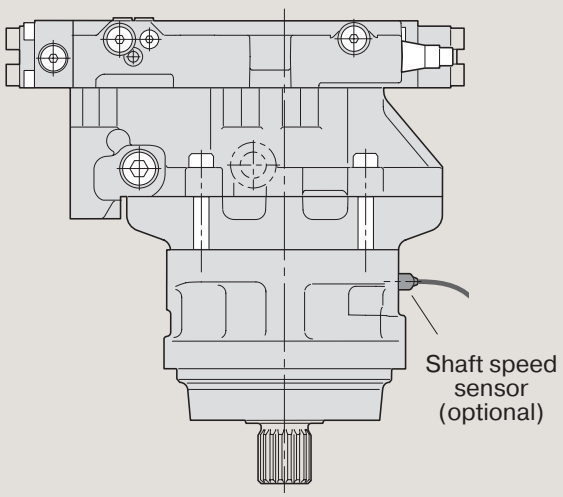
Section A-A (showing pressure relief cartridges).

Speed sensor

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

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: - V14 series must be specified in the ordering code refer to pages 45 to 47.
- The speed sensor is also shown in the illustrations on pages 48 to 54.



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

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

Running in procedure Parker Motors

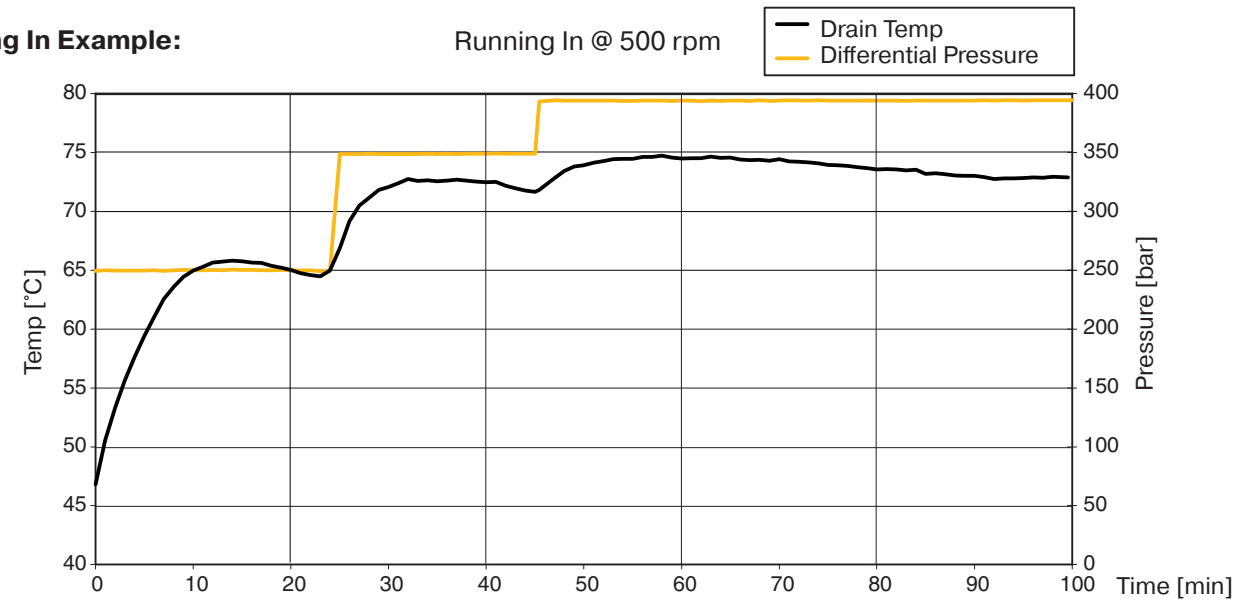
We suggest the following procedure to run in the V14 motors.

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:



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Trollhättan, Sweden

ISO version

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

Shaft seal: Control: Restrictor set: Valve options: Sensor options:

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)

Code	Valve opening pressure
000	without pressure relief valve Pressure relief valve opening pressure [bar] (page 43)
	Alternatively: Flushing valve orifice (page 42)

Code	Valve options (pages 42 to 43)
N	None
B	Brake valve and pressure relief valves**
L	Flushing valve
P	Pressure relief valves
W	Load hold valve (for EPC/HPC only) ***

Code	Sensor options (page 44)
N	None
P	Prepared for speed sensor

Factory issued for special versions

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]

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)

Code	Valve options (pages 42 to 43)
N	None
B	Brake valve and pressure relief valves**
L	Flushing valve
P	Pressure relief valves
W	Load hold valve (for EPC/HPC only) ***

Code	Valve opening pressure
000	without pressure relief valve Pressure relief valve opening pressure [bar] (page 43)
	Alternatively: Flushing valve orifice (page 42)

Code	Sensor options (page 44)
N	None
P	Prepared for speed sensor

Factory issued for special versions

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]

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

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)

Code	Valve options (pages 42 to 43)
N	None
B	Brake valve and pressure relief valves **
L	Flushing valve
P	Pressure relief valves
W	Load hold valve (for EPC/HPC only) ***

Code	Valve opening pressure
000	without pressure relief valve Pressure relief valve opening pressure [bar] (page 43)
	Alternatively: Flushing valve orifice (page 42)

Code	Sensor options (page 44)
N	None
P	Prepared for speed sensor

Factory issued for special versions

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]

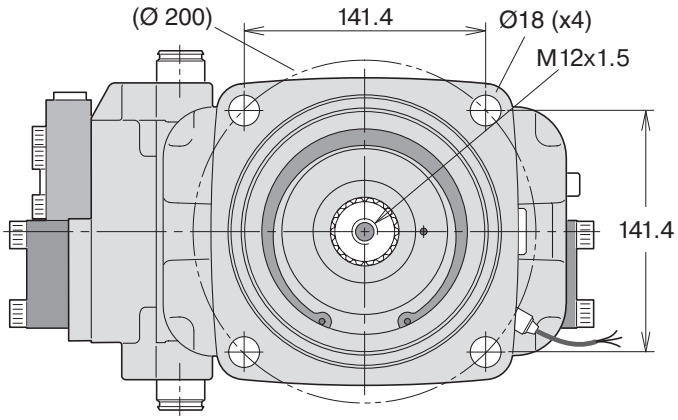
Note:

* Control orifice set is not selectable for HPC, EPC

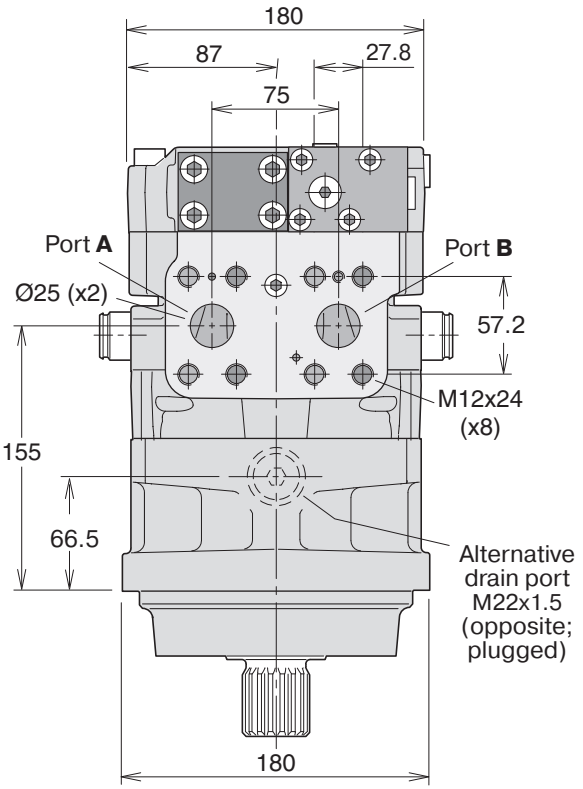
** Contact Parker Hannifin for additional information

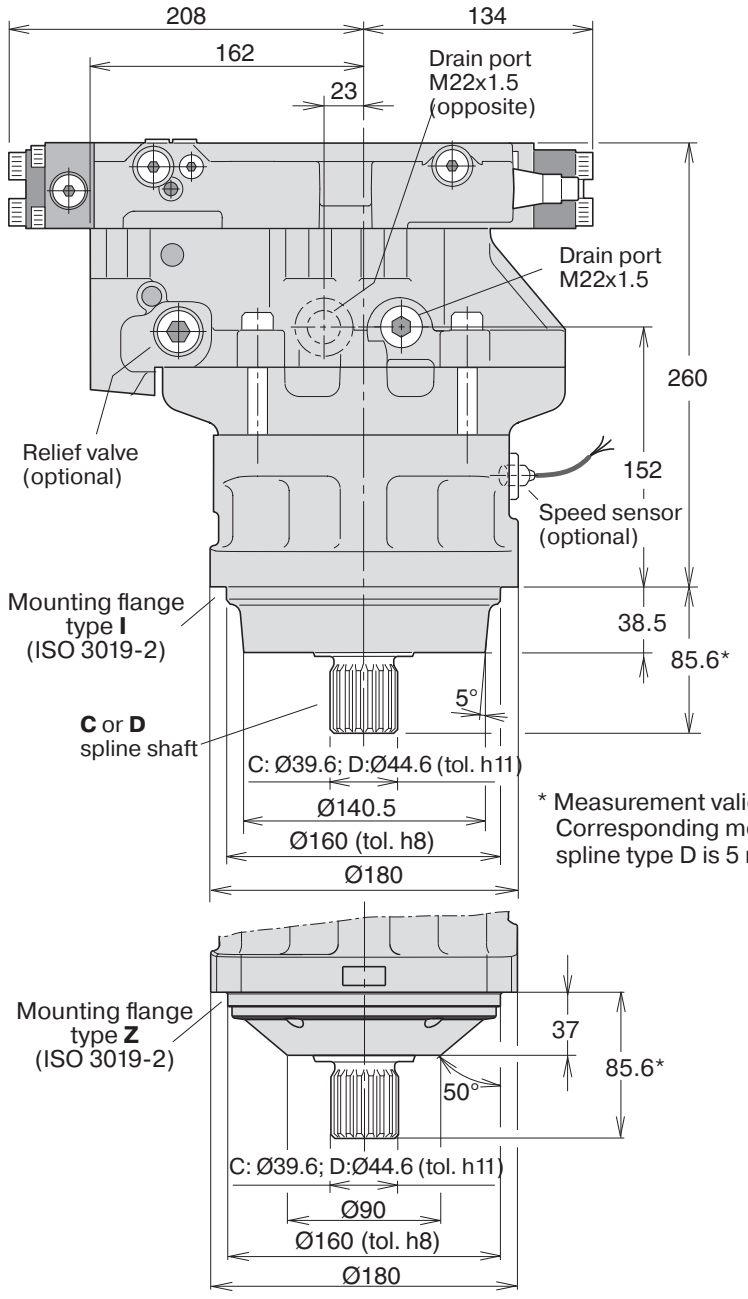
*** Possible to combined with pressure relief valve
Contact Parker Hannifin for additional information

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

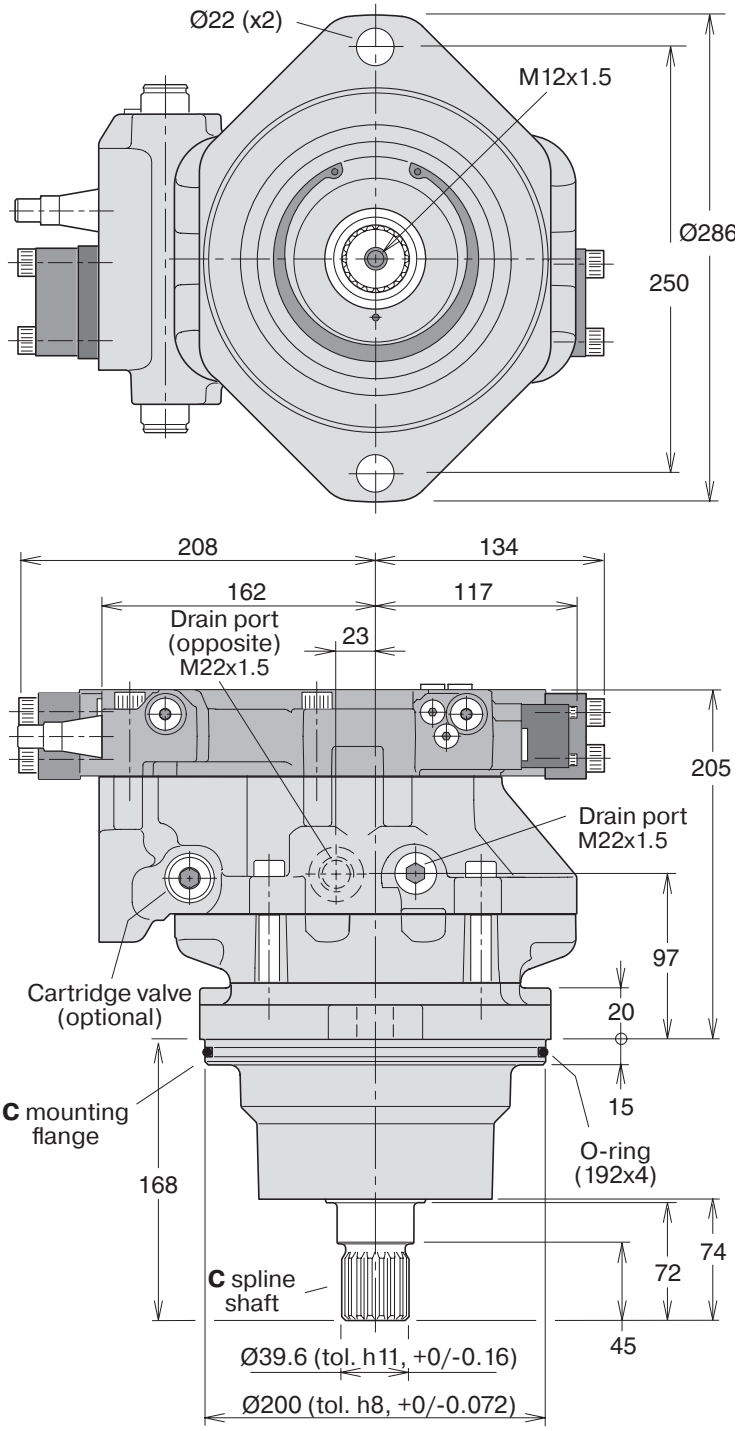
Spline type D[1] (DIN 5480)	
V14-110	W45 x 2 x 21 x 9 g

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

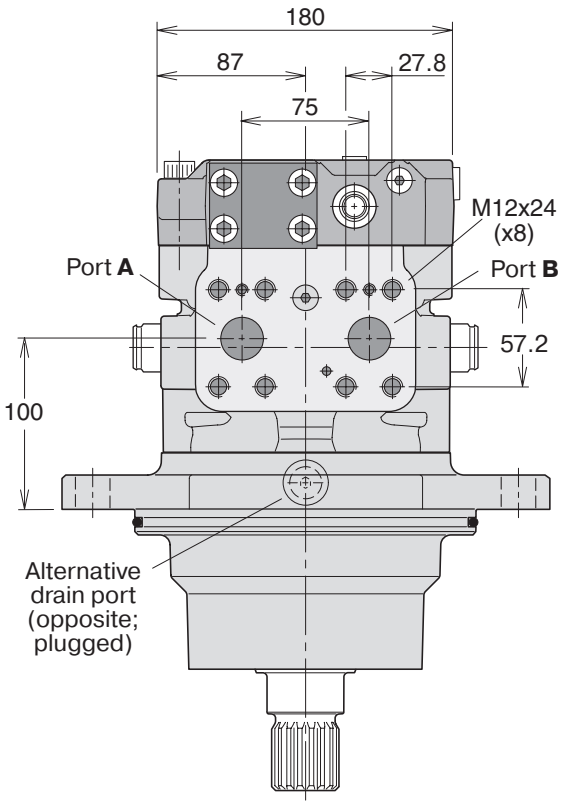
Ports	V14-110
Main ports	25 [1"]
Drain ports	M22x1.5

Main ports: ISO 6162, 41.5 MPa, type II

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	M22x1.5

Main ports: ISO 6162, 41.5 MPa, type II

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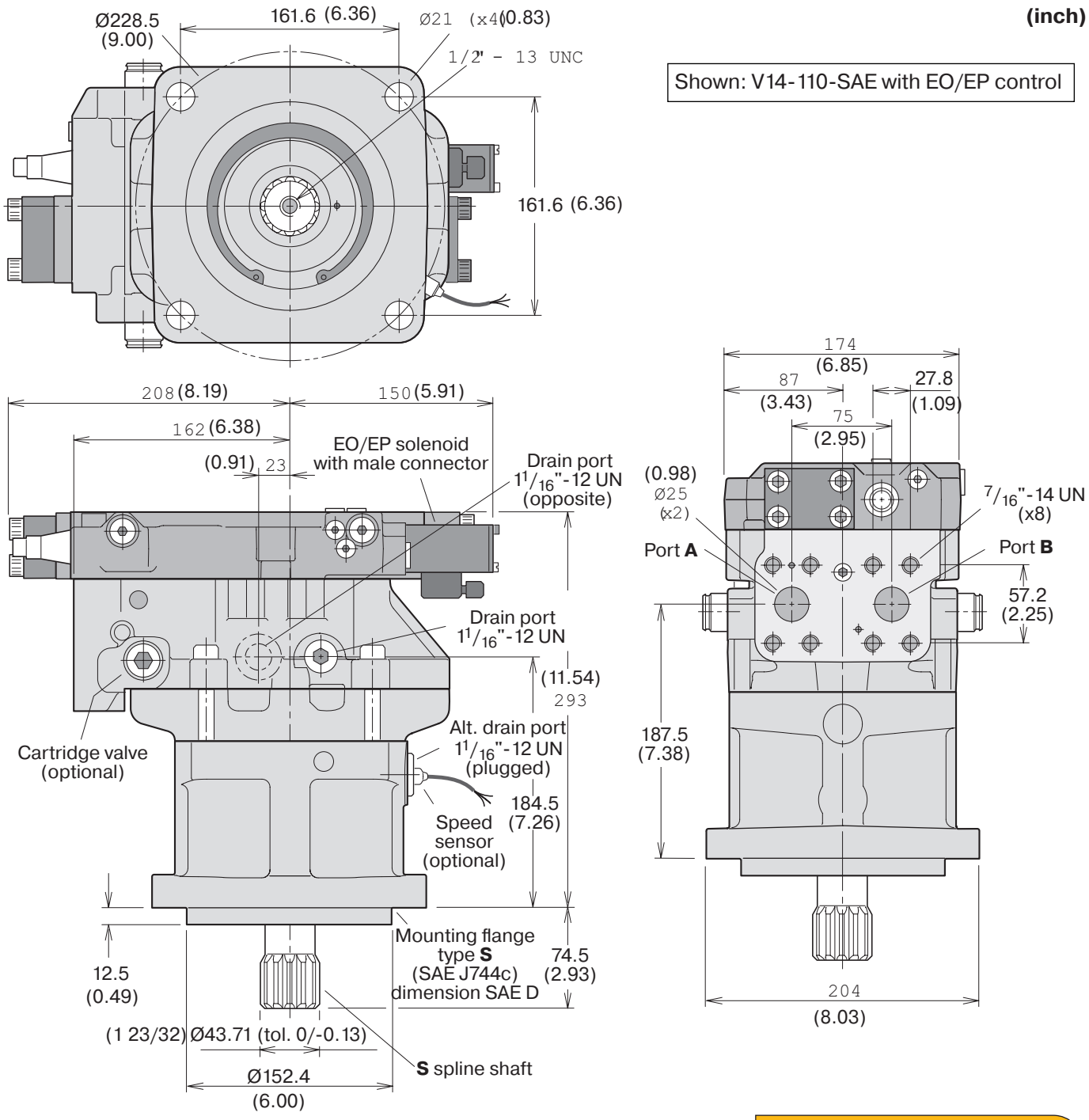
V14-110, SAE version

(inch)



Shown: V14-110-SAE with EO/EP control

Spline type S[1] (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

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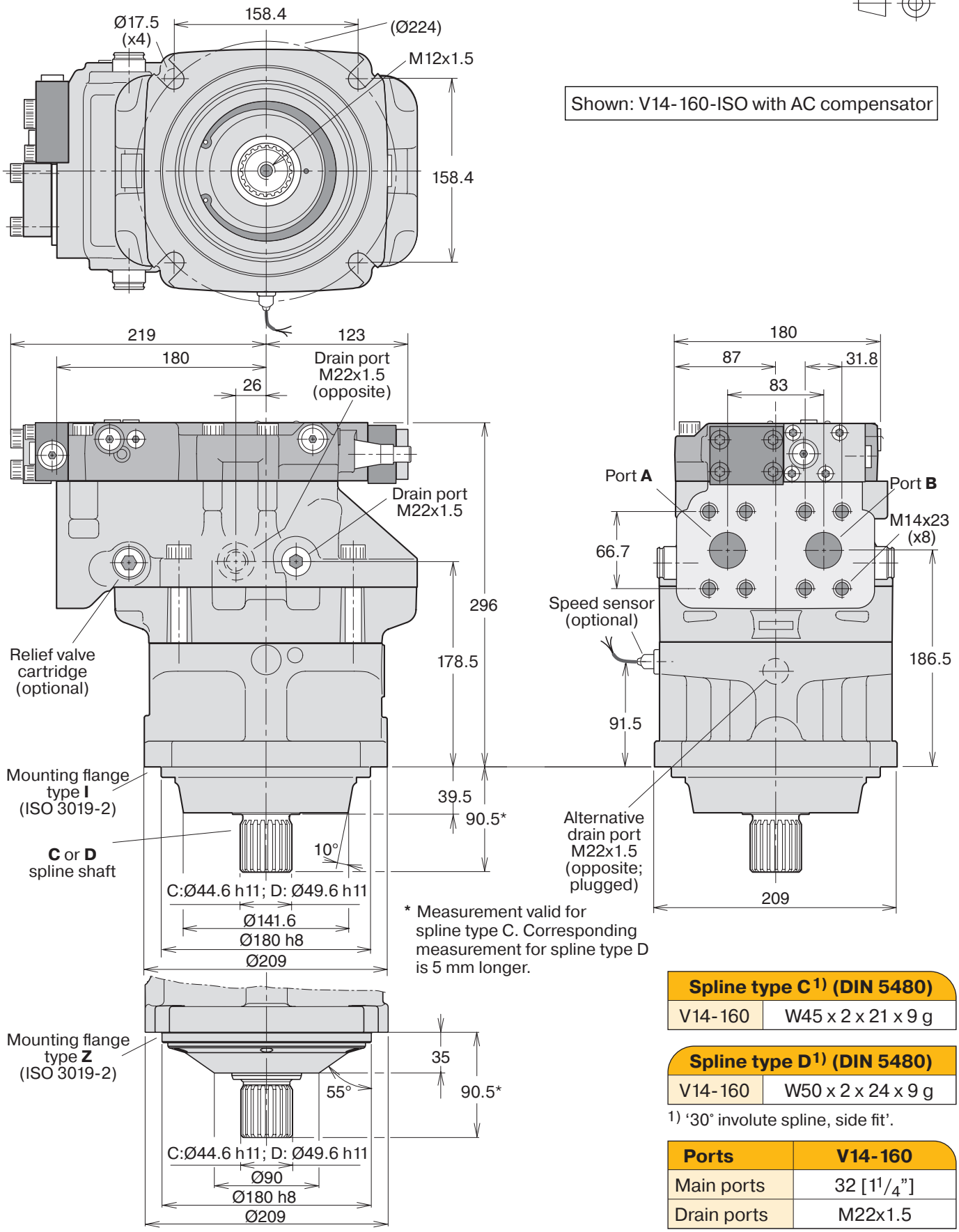
V14-160, ISO version



* 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 [$1^1/_4$"]
Drain ports	M22x1.5

Main ports: ISO 6162, 41.5 MPa, type II

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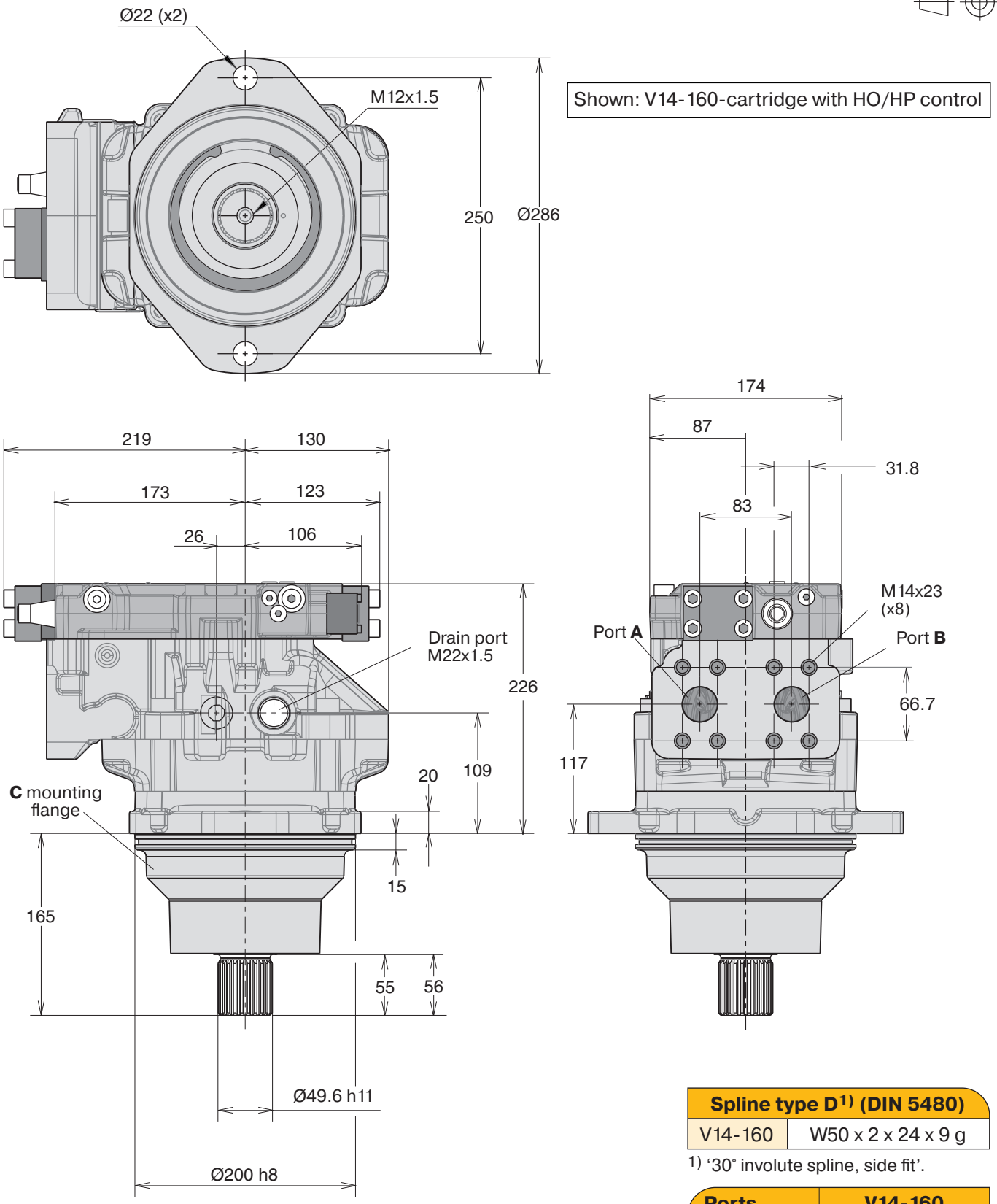
V14-160, Cartridge version



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	M22x1.5

Main ports: ISO 6162, 41.5 MPa, type II

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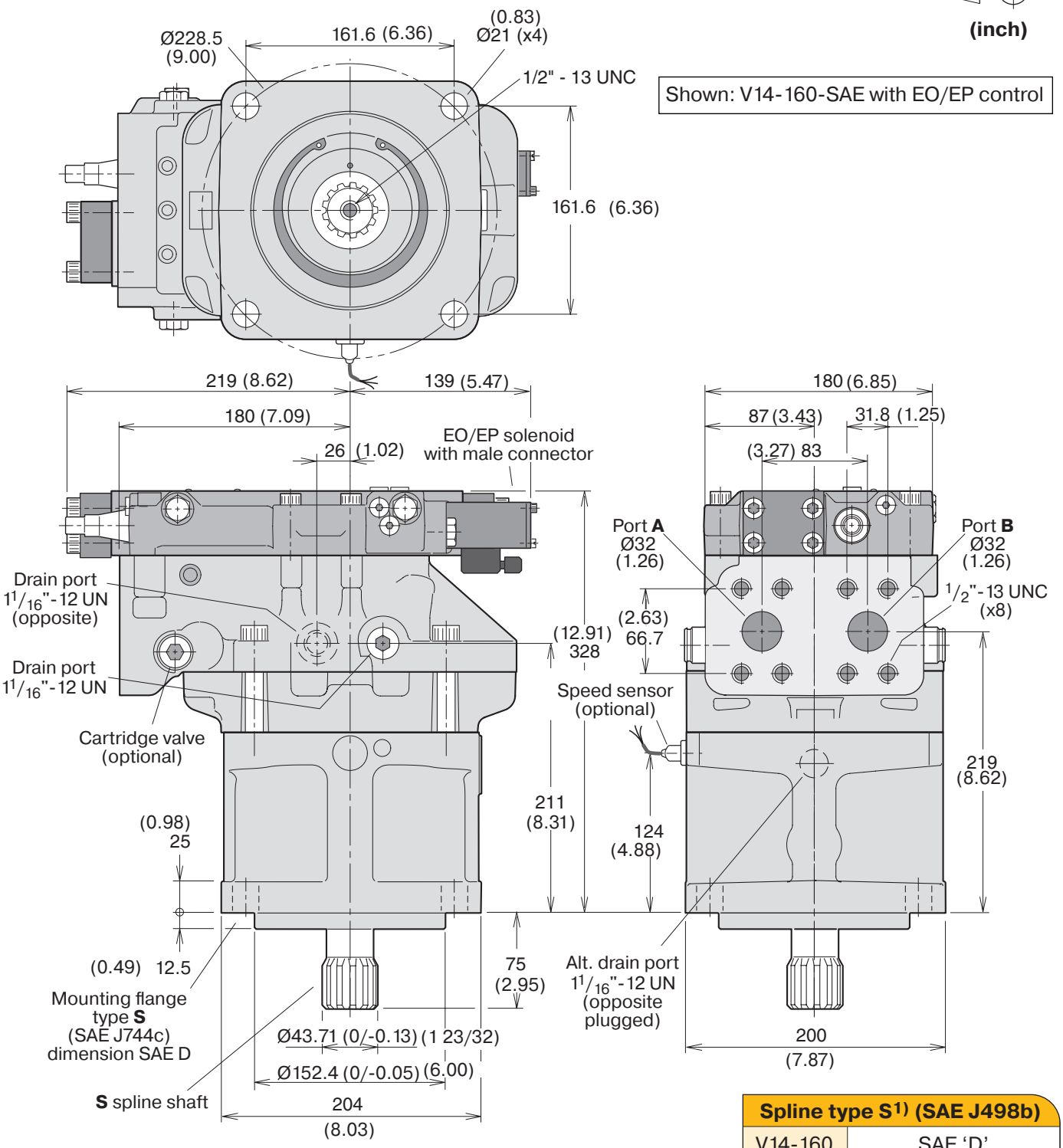
Trollhättan, Sweden

V14-160, SAE version

(inch)



Shown: V14-160-SAE with EO/EP control

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

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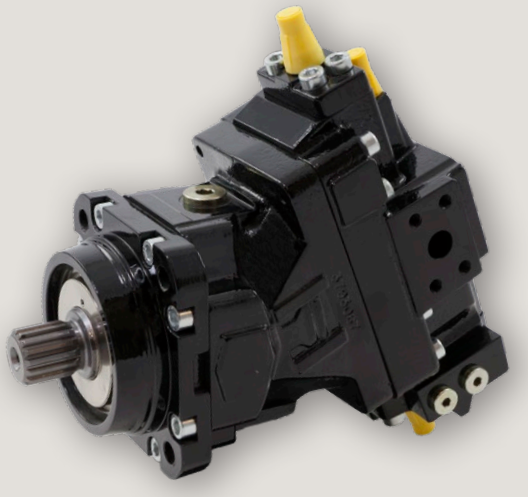
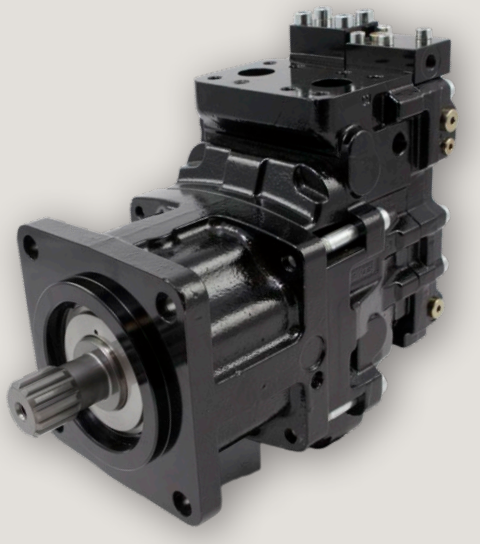
Pump & Motor Division Europe
Trollhättan, Sweden

V12



V14



Content

Direction of rotation versus flow

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

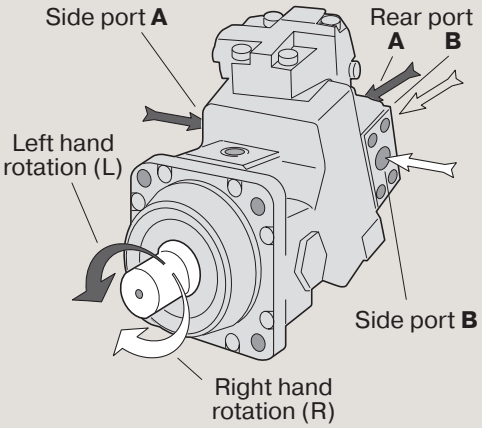
V12 rotation:

- 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).

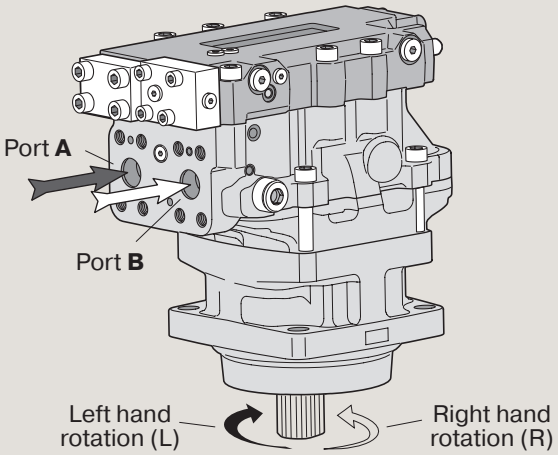
V14 rotation:

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

NOTE: Before installing a V12 or V14 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 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 cleanlineness 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	-

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: ‘Flushing valve’, page 15.
- V14: ‘Flushing valve’, page 42.

Drain ports

There are two drain ports on the V12 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.

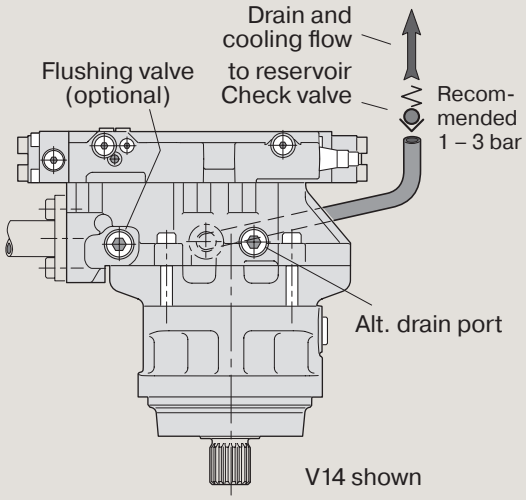


Fig. 1.

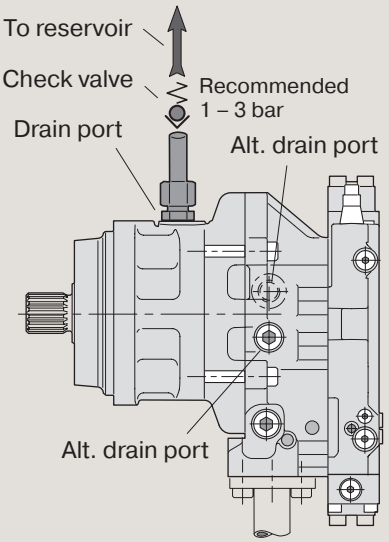


Fig. 2.

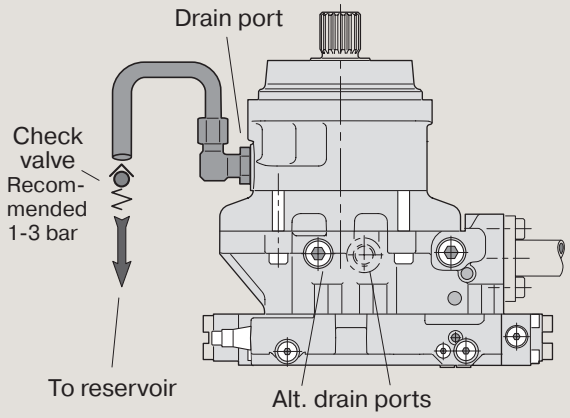


Fig. 3.

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WARNING – USER RESPONSIBILITY

FAILURE OR IMPROPER SELECTION OR IMPROPER USE OF THE PRODUCTS DESCRIBED HEREIN OR RELATED ITEMS CAN CAUSE DEATH, PERSONAL INJURY AND PROPERTY DAMAGE.

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