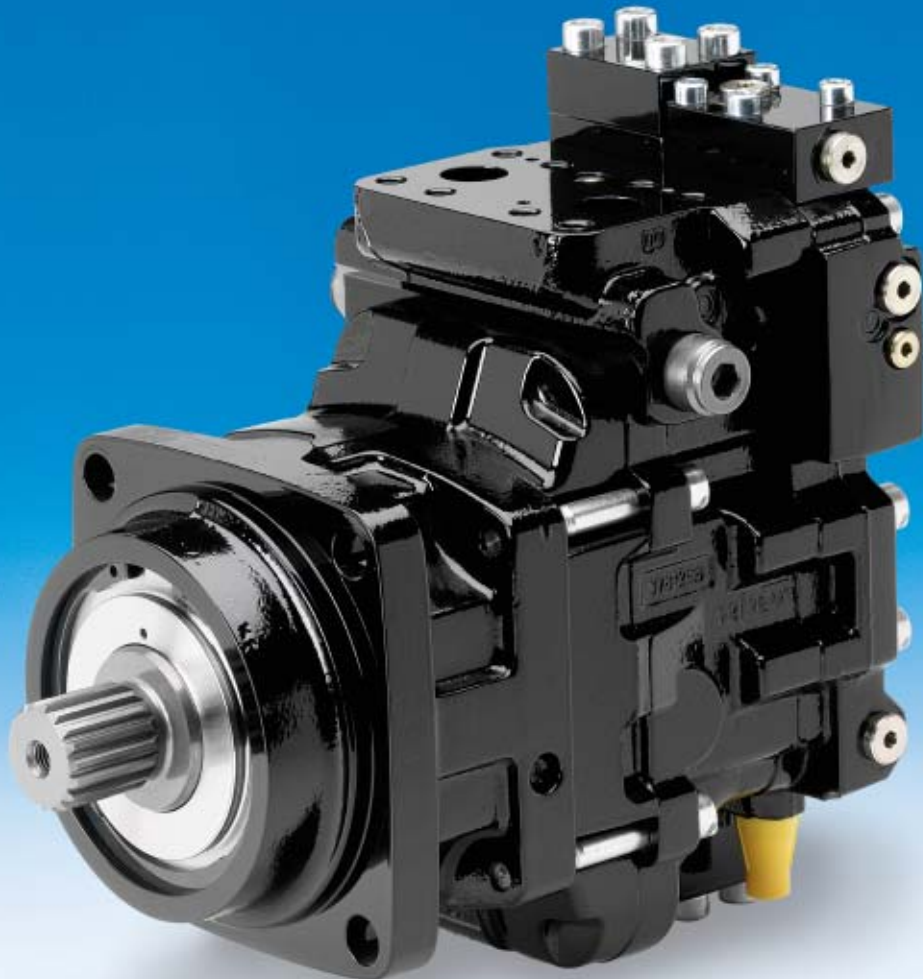




Hydraulic Motors Series V12, V14, T12

Variable Displacement

*Catalogue HY17-8223/UK
November 2004*



Basic formulas for hydraulic motors

- | | |
|---|---|
| <p>A) Displacement (D_α)</p> $D_\alpha = D_{35} \times \frac{\sin \alpha}{\sin 35^\circ} \text{ [cm}^3\text{/rev]}$ <p>α - displacement angle [°] (between 35° and 6.5°)</p> <p>D_{35} - max displ. at 35° [cm³/rev]</p> | <p>B) Flow (q)</p> $q = \frac{D \times n}{1000 \times \eta_v} \text{ [l/min]}$ <p>D - displacement [cm³/rev] n - shaft speed [rpm] η_v - volumetric efficiency</p> |
| <p>C) Torque (M)</p> $M = \frac{D \times \Delta p \times \eta_{hm}}{63} \text{ [Nm]}$ <p>Δp - differential pressure [bar] (between inlet and outlet)</p> <p>η_{hm} - mechanical efficiency</p> | <p>D) Power (P)</p> $P = \frac{q \times \Delta p \times \eta_t}{600} \text{ [kW]}$ <p>η_t - overall efficiency ($\eta_t = \eta_v \times \eta_{hm}$)</p> |

Conversion factors

- | | |
|---|------------------|
| 1 bar | 14.5 psi |
| 1 cm ³ | 0.061 cu in |
| 1 kg | 2.20 lb |
| 1 kW | 1.34 hp |
| 1 l | 0.264 US gallons |
| 1 mm | 0.039 in |
| 1 N..... | 0.225 lbf |
| 1 Nm..... | 0.738 lbf ft |
| $\frac{9}{5} \text{ }^\circ\text{C} + 32$ | $^\circ\text{F}$ |

Content

| | | |
|---|---|-----------------|
| <p>General information General information and design</p> | <p>General information Pages 5 - 6</p> | <p>1</p> |
| <p>Series V12 Variable displacement, axial piston motor</p> | <p>V12 Pages 7 - 30</p> | <p>2</p> |
| <p>Series V14 Variable displacement, axial piston motor</p> | <p>V14 Pages 31 - 56</p> | <p>3</p> |
| <p>Series T12 Two-displacement, axial piston motor</p> | <p>T12 Pages 57 - 62</p> | <p>4</p> |
| <p>Installation and start-up information V12, V14 and T12</p> | <p>Installation information Pages 63 - 67</p> | <p>5</p> |



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 sensors for speed and displacement
- Integrated flushing and 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.

(cont'd ...)



Available motors

| Model | Frame size | Version | Chapter |
|-------|------------|-----------|---------|
| V12 | 60 | ISO | 2 |
| | " | Cartridge | " |
| | " | SAE | " |
| | 80 | ISO | " |
| | " | Cartridge | " |
| | " | SAE | " |
| V14 | 160 | ISO | " |
| | " | Cartridge | " |
| | " | SAE | " |
| | 160 | ISO | " |
| T12 | 60 | SAE | " |
| | 80 | Cartridge | 4 |
| | | " | " |

Series T12

The T12 two-displacement motor is tailor-made for track drives. It allows a high ratio between high and low speed and installs as easily as a fixed displacement motor. Max speed ratio is 3.33-to-1.

The T12 is a cartridge motor based on the well proven V12 series. The specially designed end cap with dual side ports permits a very short installation.

A simple setting device moves the cylinder barrel to the maximum or minimum displacement position. The setting is controlled by an external hydraulic pilot signal. A brake valve can be fitted without increasing the axial length of the motor. The twin ports have the same mounting pattern as those of the F12 and V12 motors.

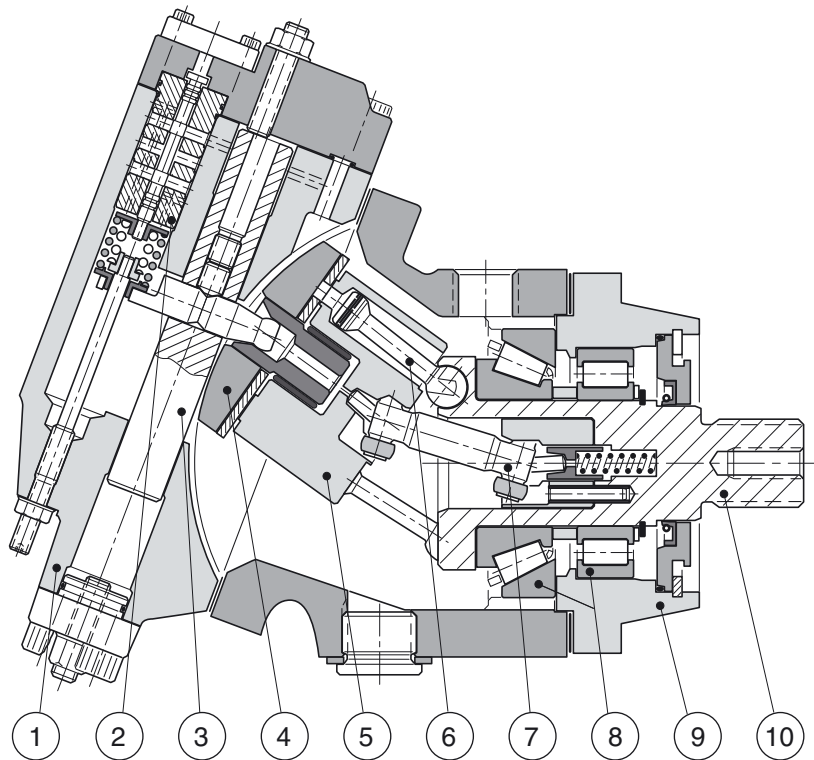
The F12/V12 accessory valve program also fits the T12 motor. As an option, integrated pressure relief valves can be included.



| Content | Page | Chapter |
|---|-------------|----------------|
| V12 cross section | 8 | |
| Specifications | 8 | |
| Efficiency diagrams | 9 | |
| Ordering codes | 10-13 | |
| V12 Installation dimensions: | 14 | |
| ISO version | 14-15 | |
| Cartridge version | 16-17 | |
| SAE version | 18-19 | |
| Bearing life | 20 | |
| Controls (general information) | 21 | |
| AC pressure compensator | 21 | |
| AH pressure compensator | 22 | |
| EO two-position control | 23 | |
| EP proportional control | 24 | |
| HO two-position control | 25 | |
| HP proportional control | 26 | |
| Control installation dimensions | 27 | |
| High speed operation | 28 | |
| Flushing valve | 28 | |
| Accessory valve blocks | 29 | |
| Speed sensor | 30 | |
| Installation and start-up information | 63 | 5 |

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 | 160* |
|--|-----------|-----------|-------------|
| Displacement [cm ³ /rev] | | | |
| - max, at 35° | 60 | 80 | 160 |
| - min, at 6.5° | 12 | 16 | 32 |
| Operating pressure [bar] | | | |
| - max intermittent ¹⁾ | 480 | 480 | 480 |
| - max continuous | 420 | 420 | 420 |
| Operating speed [rpm] | | | |
| - at 35°, max intermittent ¹⁾ | 4 400 | 4 000 | 3200 |
| max continuous | 3 600 | 3 100 | 2500 |
| - at 6.5°–20°, max intermittent ¹⁾ | 7 000 | 6 250 | 5000 |
| max continuous | 5 600 | 5 000 | 4000 |
| - min continuous | 50 | 50 | 50 |
| Flow [l/min] | | | |
| - max intermittent ¹⁾ | 265 | 320 | 510 |
| - max continuous | 215 | 250 | 400 |
| Torque (theor.) at 100 bar [Nm] | 95 | 127 | 255 |
| Output power [kW] | | | |
| - max intermittent ¹⁾ | 150 | 175 | 280 |
| - max continuous | 95 | 105 | 170 |
| Corner power [kW] | | | |
| - intermittent ¹⁾ | 335 | 400 | 640 |
| - continuous | 235 | 280 | 450 |
| Mass moment of inertia (x10 ⁻³) [kg m ²] | 3.1 | 4.4 | 14.6 |
| Weight [kg] | 28 | 33 | 58 |

1) Max 6 seconds in any one minute.

* Will be replaced by V14-160.

Efficiency diagrams

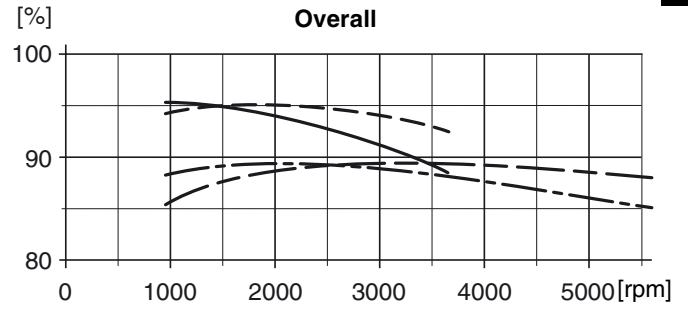
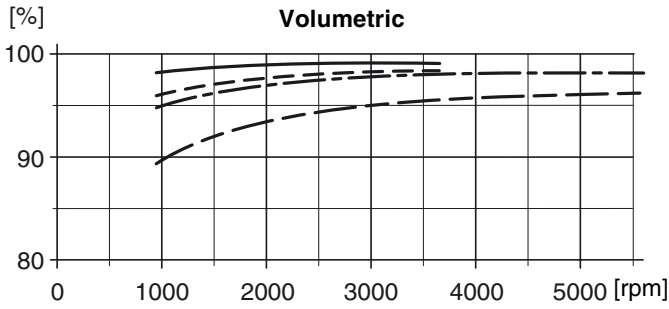
The following diagrams show volumetric and overall efficiencies versus shaft speed at 210 and 420 bar operating pressure, and at full (35°) and reduced (10°) displacements.

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

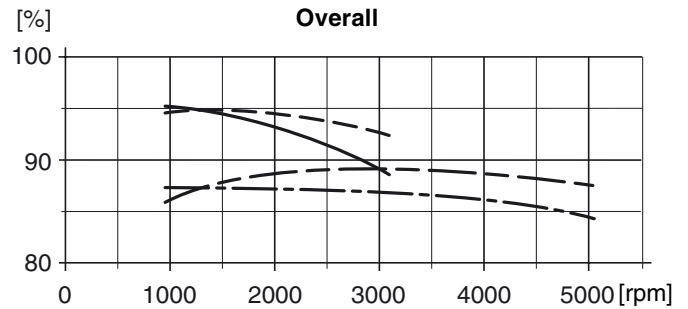
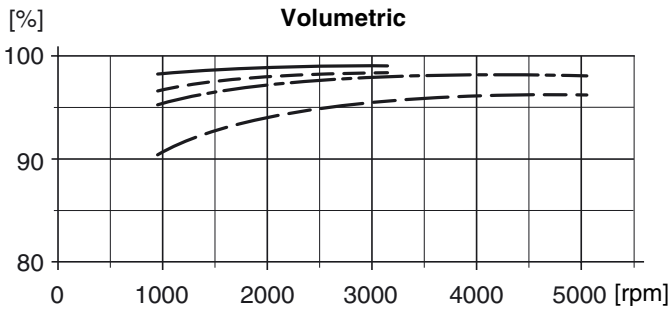
- 210 bar at full displacement
- - - - - 420 bar “ “ “
- · - · - 210 bar at reduced displacement
- - - - - 420 bar “ “ “



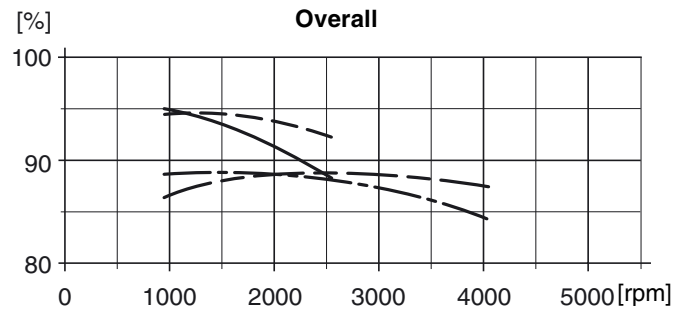
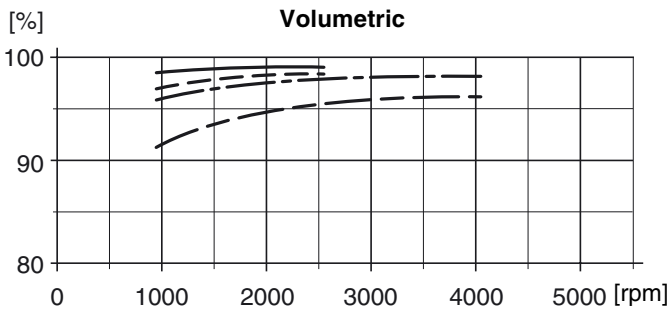
V12-60



V12-80

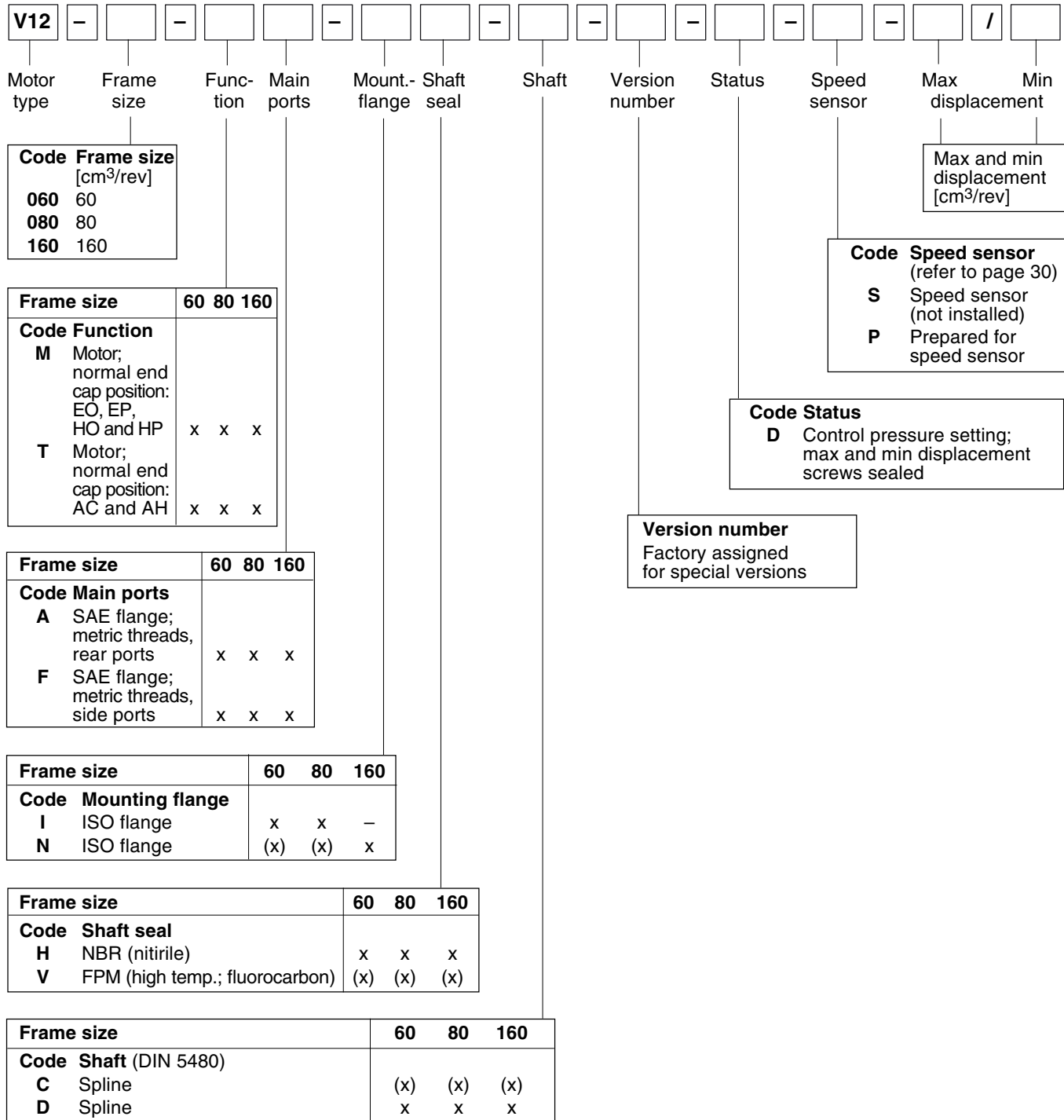


V12-160



Ordering codes

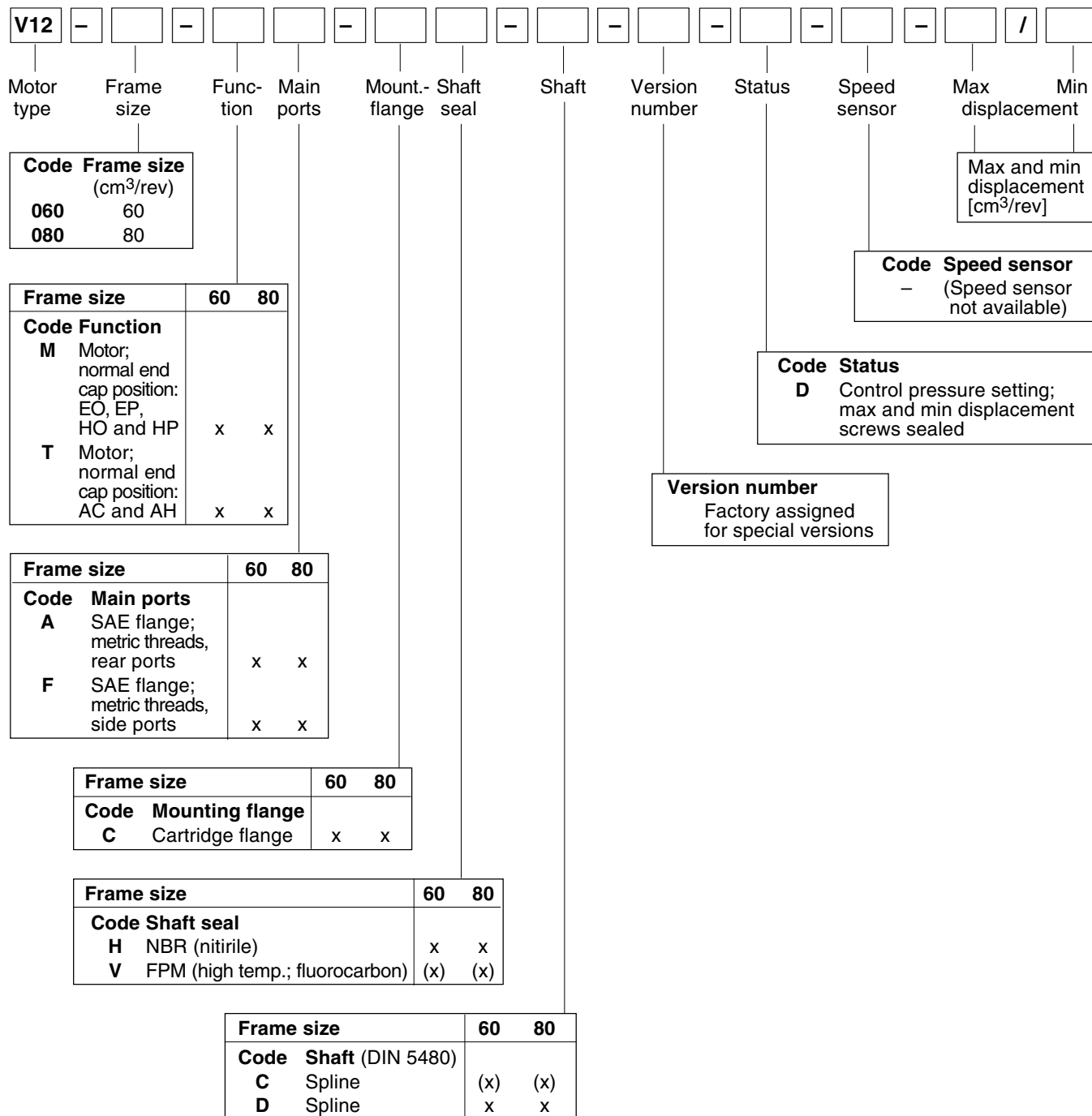
ISO version (basic configuration)



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

Ordering codes

Cartridge version (basic configuration)

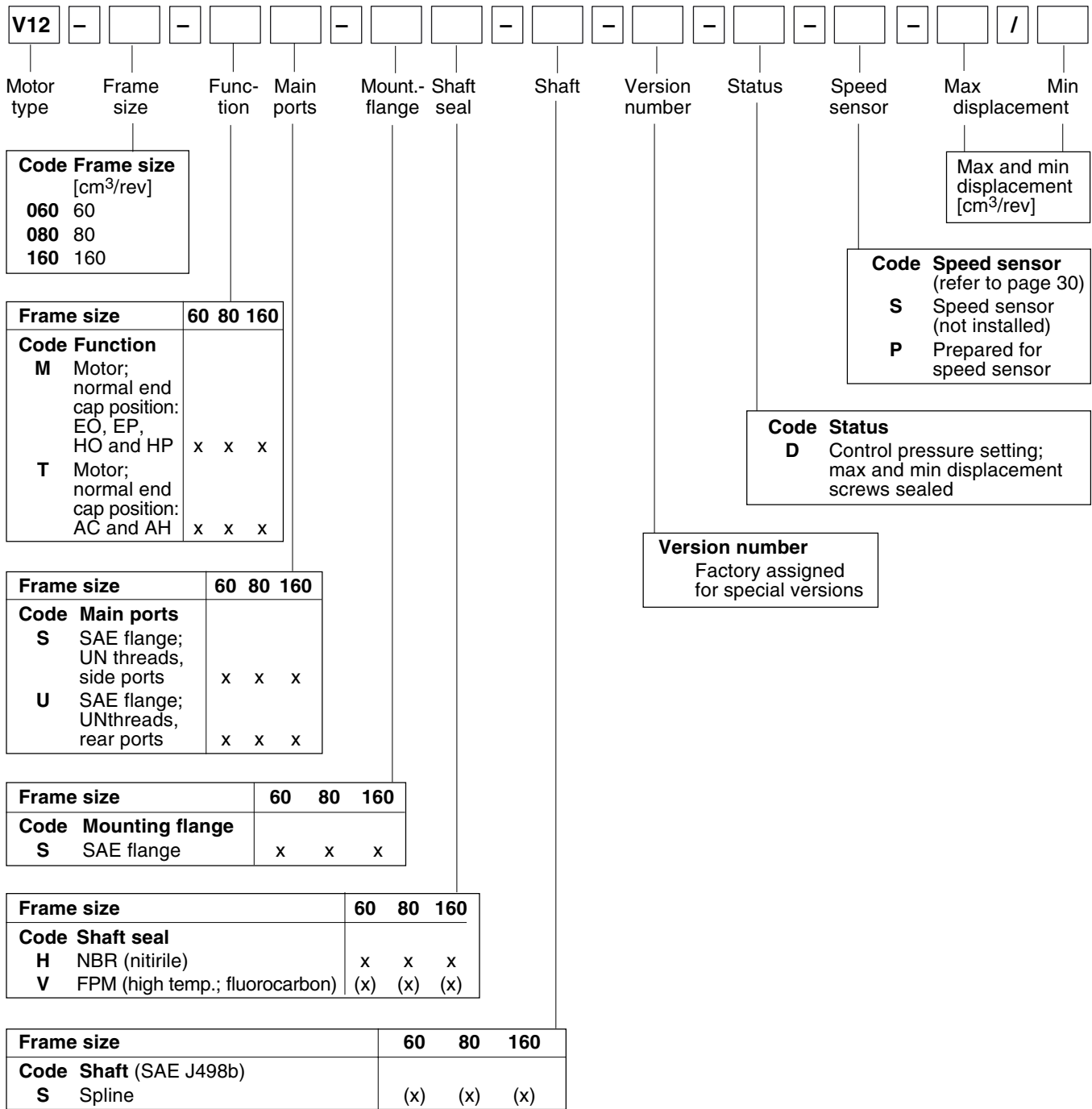


2

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

Ordering codes

SAE version (basic configuration)



Max and min displacement [cm³/rev]

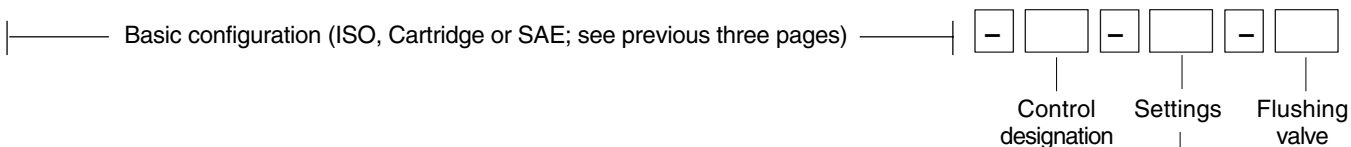
Code Speed sensor
(refer to page 30)
S Speed sensor (not installed)
P Prepared for speed sensor

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

Version number
Factory assigned for special versions

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

Controls and flushing valve



| Frame size | 60 | 80 | 160 |
|---|-----|-----|-----|
| Code Control designation | | | |
| AC I 01 I Pressure compensator, internal pilot pressure, internal servo supply | x | x | x |
| AC E 01 I Pressure compensator, external pilot pressure, internal servo supply | (x) | (x) | (x) |
| AH I 01 I Pressure compensator, hydraulic override, internal pilot pressure, internal servo supply | x | x | x |
| AH E 01 I Pressure compensator, hydraulic override, external pilot pressure, internal servo supply | (x) | (x) | (x) |
| EOL 01 I Electrohydraulic, two-position, 12 VDC, internal servo supply | x | x | x |
| EOL 01 E Electrohydraulic, two-position, 12 VDC, external servo supply | (x) | (x) | (x) |
| EOH 01 I Electrohydraulic, two-position, 24 VDC, internal servo supply | x | x | x |
| EOH 01 E Electrohydraulic, two-position, 24 VDC, external servo supply | (x) | (x) | (x) |
| EPL 01 I Electrohydraulic proportional, 12 VDC, internal servo supply | x | x | x |
| EPL 01 E Electrohydraulic, proportional, 12 VDC, external servo supply | (x) | (x) | (x) |
| EPH 01 I Electrohydraulic, proportional, 24 VDC, internal servo supply | x | x | x |
| EPH 01 E Electrohydraulic, proportional, 24 VDC, external servo supply | (x) | (x) | (x) |
| HOS 01 I Hydraulic two-position, standard version internal servo supply | x | x | x |
| HOS 01 E Hydraulic two-position, standard version external servo supply | (x) | (x) | (x) |
| HPS 01 I Hydraulic proportional, standard version internal servo supply | x | x | x |
| HPS 01 E Hydraulic proportional, standard version external servo supply | (x) | (x) | (x) |

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

Settings

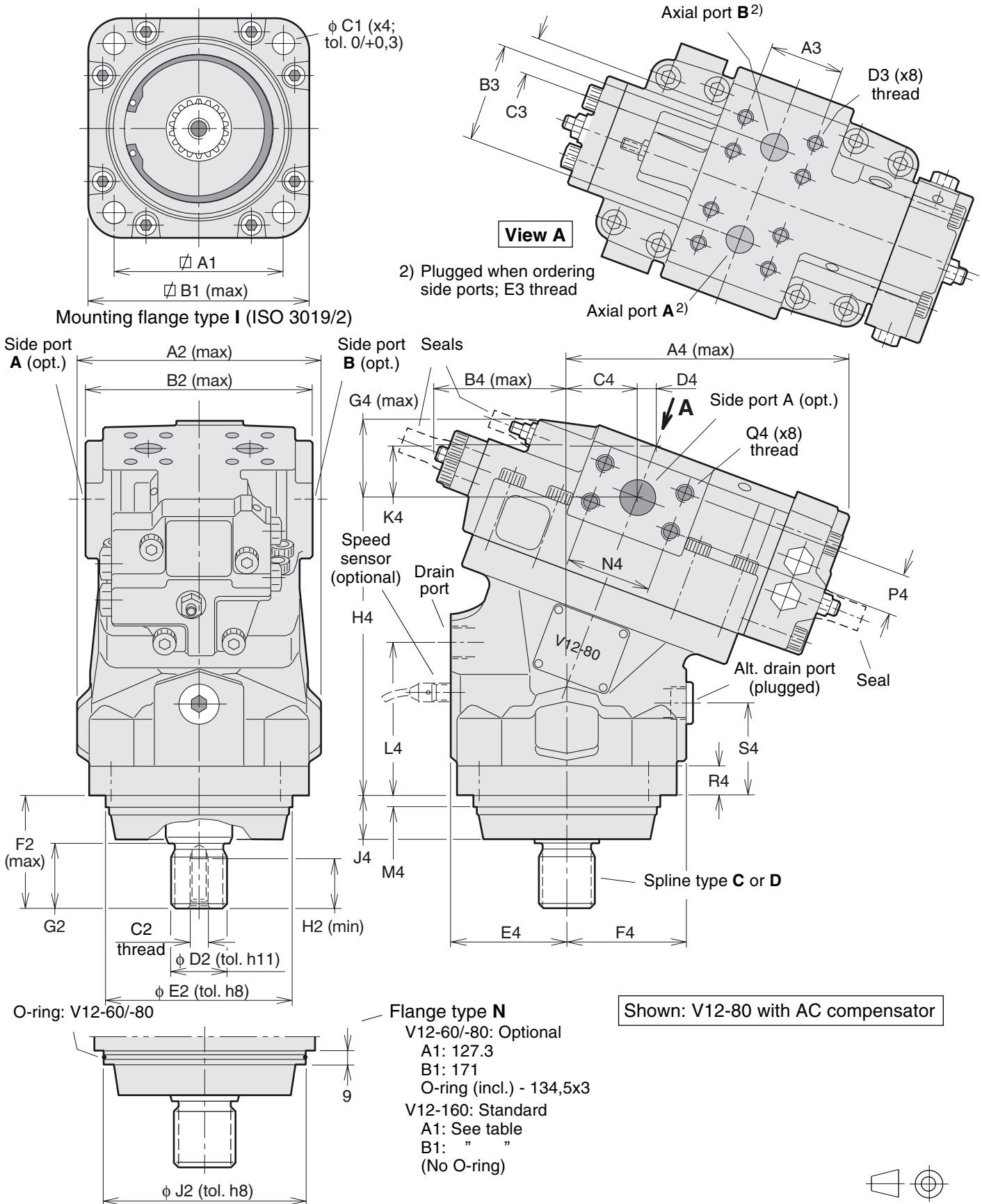
AC, AH: Threshold pressure: **150, 200** or **250** bar / Modulating pressure: **015, 025** or **050** bar
 EO, EP: Threshold current: 12 VDC - **400** mA; 24 VDC - **200** mA
 Modulating current: EO - **000**; EP, 12 VDC - **600** mA; EP, 24 VDC - **300** mA
 HO, HP: Threshold pressure: **010** bar / 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 28).

2

ISO version



| Size | V12-60 | V12-80 | V12-160 |
|------------------|---------|---------|---------|
| A1 | 113.2 | 113.2 | 158.4 |
| B1 | 151 | 151 | 212 |
| C1 | 14 | 14 | 18 |
| A2 | 159 | 165 | 197 |
| B2 | 146 | 154 | 179 |
| C2 | M12 | M12 | M12 |
| D2* | 34.6 | 39.6 | 49.6 |
| E2 | 125 | 125 | 180 |
| F2* | 73 | 78 | 96 |
| G2* | 40 | 45 | 55 |
| H2 | 28 | 24 | 24 |
| J2 | 140 | 140 | see E2 |
| A3 | 50.8 | 50.8 | 66.7 |
| B3 | 66 | 66 | 83 |
| C3 | 23.8 | 23.8 | 31.75 |
| D3 ¹⁾ | M10x20 | M10x20 | M14x23 |
| E3 ²⁾ | M22x1.5 | M22x1.5 | M22x1.5 |
| A4 | 188 | 193 | 218 |
| B4 | 87 | 90 | 114 |
| C4 | 45 | 48.3 | 56 |
| D4 | 13.4 | 13.1 | 14.2 |
| E4 | 76 | 78 | 94 |
| F4 | 77 | 80 | 94 |
| G4 | 55 | 57 | 67 |
| H4 | 188 | 199 | 243 |
| J4 | 31.5 | 31.5 | 39.5 |
| K4 | 35.5 | 34.6 | 37.4 |
| L4 | 94 | 101 | 125 |
| M4 | 9 | 9 | 9 |
| N4 | 50.8 | 57.2 | 66.7 |
| P4 | 23.8 | 27.8 | 31.75 |
| Q4 ¹⁾ | M10x20 | M12x23 | M14x23 |
| R4 | 20 | 20 | 22 |
| S4 | 57.5 | 60.5 | 77 |

* 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'.

Ports

| Type | V12-60 | V12-80 | V12-160 |
|---------------------|-------------------------------------|-------------------------------------|--------------------------------------|
| Axial | 19 [³ / ₄ "] | 19 [³ / ₄ "] | 32 [1 ¹ / ₄ "] |
| Side | 19 [³ / ₄ "] | 25 [1"] | 32 [1 ¹ / ₄ "] |
| Drain ²⁾ | M22x1.5 | M22x1.5 | M22x1.5 |

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

Spline type **C**³⁾ (DIN 5480)

| Size | Dimension |
|--------|-------------|
| V12-60 | W30x2x14x9g |
| -80 | W35x2x16x9g |
| -160 | W45x2x21x9g |

Spline type **D**³⁾ (DIN 5480)

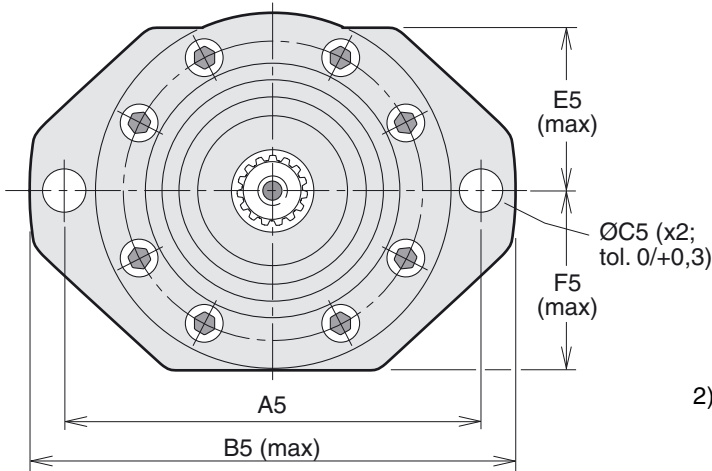
| Size | Dimension |
|--------|-------------|
| V12-60 | W35x2x16x9g |
| -80 | W40x2x18x9g |
| -160 | W50x2x24x9g |

Flange

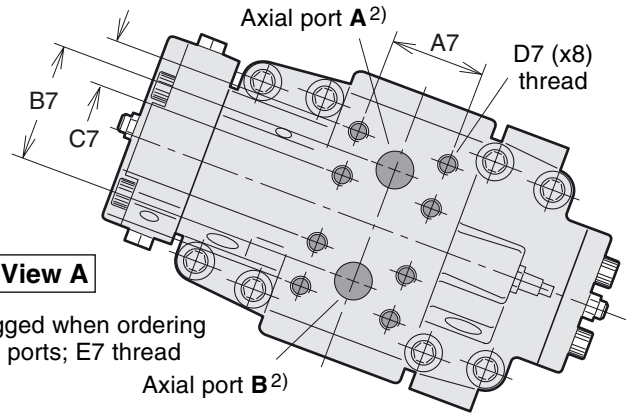
| Size | I | N |
|--------|----------|----------|
| V12-60 | standard | optional |
| -80 | standard | optional |
| -160 | - | standard |



Cartridge version

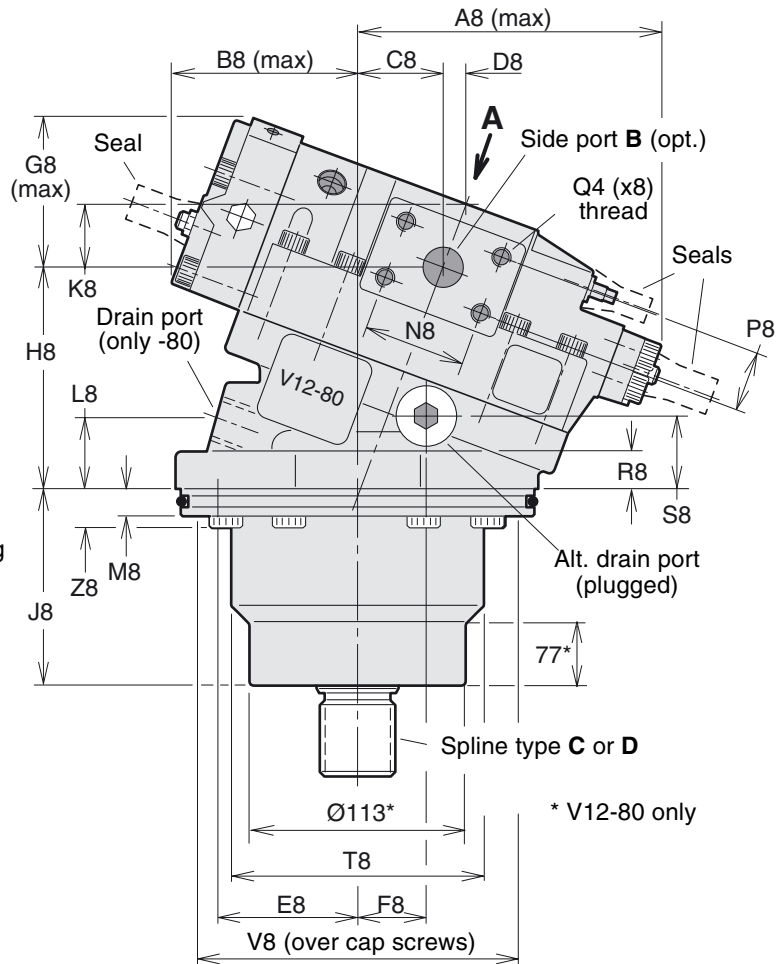
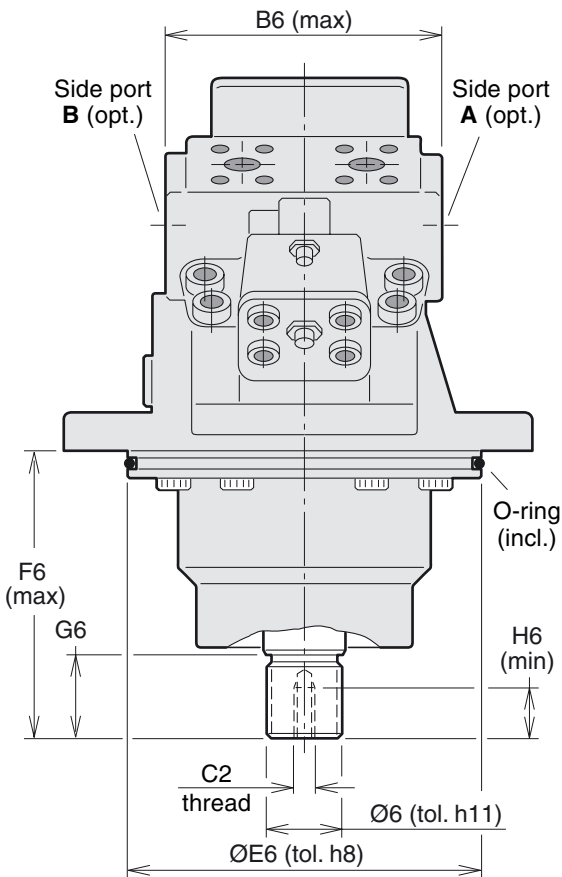


Mounting flange type C



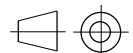
View A

2) Plugged when ordering side ports; E7 thread



* V12-80 only

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⁾ | M10x20 | M10x22 |
| E7 ²⁾ | M22x1.5 | M22x1.5 |
| 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⁾ | M10x20 | M12x23 |
| R8 | 20 | 20 |
| S8 | 39 | 39 |
| T8 | 121 | 139 |
| V8 | 151 | 177 |
| Z8 | 22 | 22 |

* 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'.

Ports

| Type | V12-60 | V12-80 |
|------------|-------------------------------------|-------------------------------------|
| Axial | 19 [³ / ₄ "] | 19 [³ / ₄ "] |
| Side | 19 [³ / ₄ "] | 25 [1"] |
| Drain | - | M22x1.5 |
| Alt. drain | M18x1.5 | M18x1.5 |

Main ports: ISO 6162, 41.5 MPa, type II
[SAE J518c, 6000 psi]

Spline type **C³⁾** (DIN 5480)

| Size | Dimension |
|--------|-------------|
| V12-60 | W30x2x14x9g |
| -80 | W35x2x16x9g |

Spline type **D³⁾** (DIN 5480)

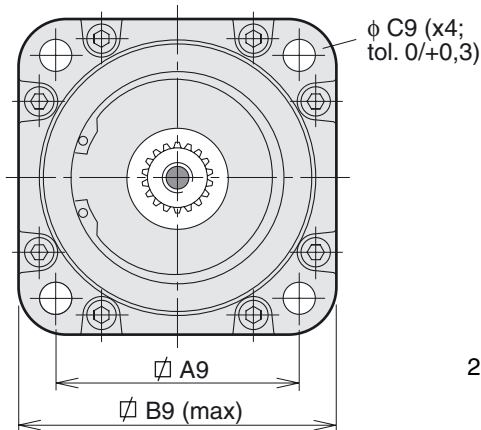
| Size | Dimension |
|--------|-------------|
| V12-60 | W35x2x16x9g |
| -80 | W40x2x18x9g |

O-rings (70° IRH)

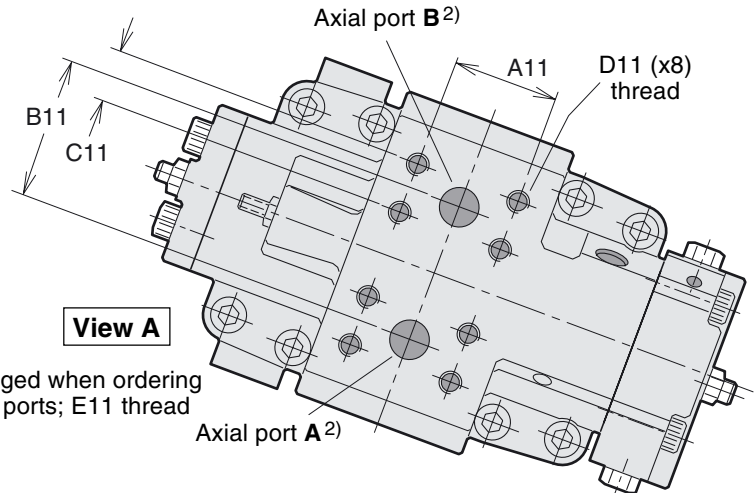
| Size | Dimension |
|--------|-----------|
| V12-60 | 150x4 |
| -80 | 180x4 |



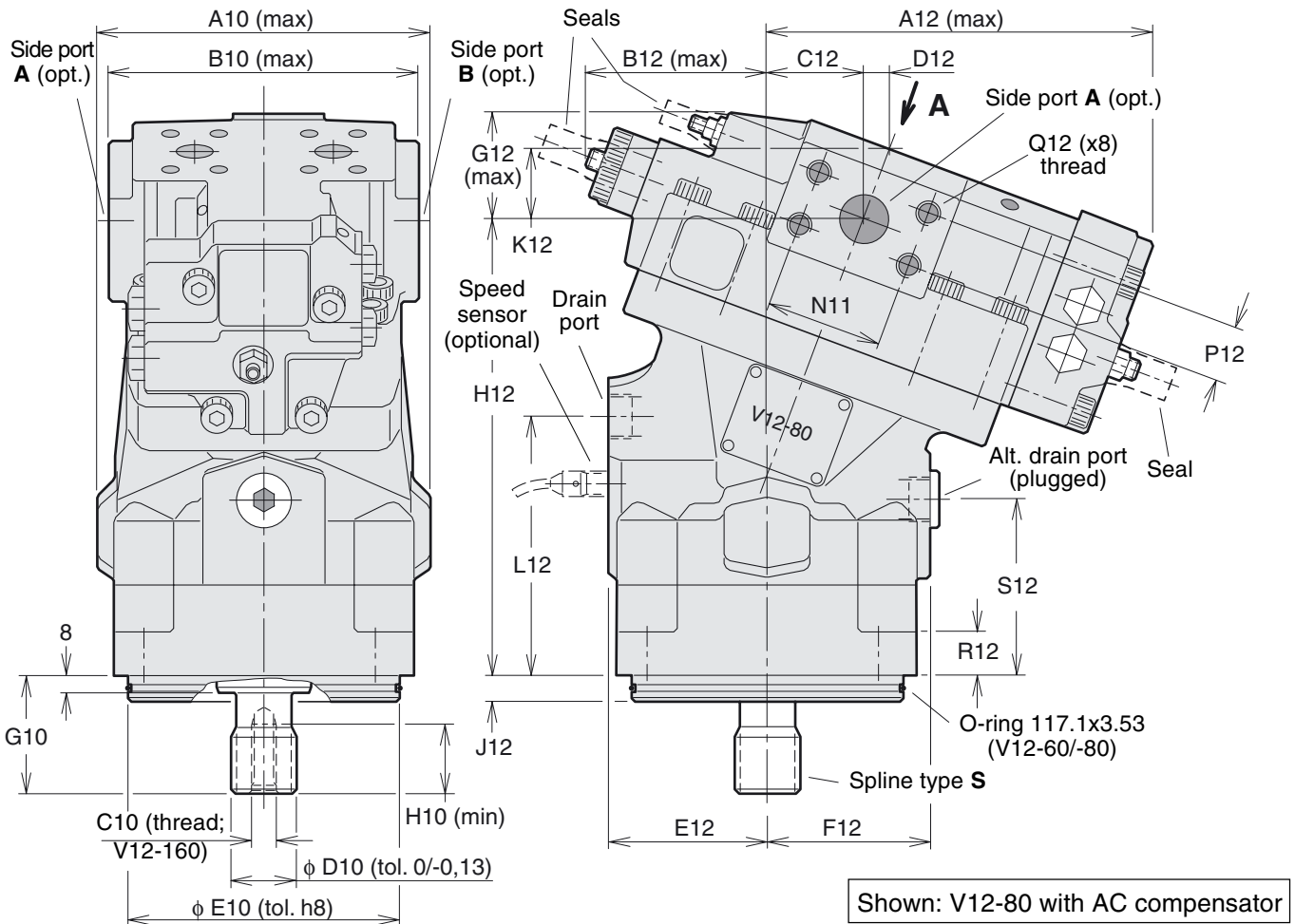
SAE version



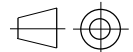
Mounting flange type **S** (SAE J744)



2) Plugged when ordering side ports; E11 thread



Shown: V12-80 with AC compensator



| Size | V12-60 | V12-80 | V12-160 |
|-------------------|----------------|-----------------|----------------|
| A9 | 114.5 | 114.5 | 161.6 |
| B9 | 149 | 149 | 200 |
| C9 | 14.3 | 14.3 | 20.6 |
| A10 | 159 | 165 | 197 |
| B10 | 146 | 154 | 179 |
| C10 | - | - | 1/2"-13 |
| D10 | 31.22 | 31.22 | 43.71 |
| E10 | 127.00 | 127.00 | 152.40 |
| G10 | 55.6 | 55.6 | 75 |
| H10 | - | - | 36 |
| A11 | 50.8 | 50.8 | 66.7 |
| B11 | 66 | 66 | 83 |
| C11 | 23.8 | 23.8 | 31.75 |
| D11 ¹⁾ | 3/8"-16 x20 | 3/8"-16 x20 | 1/2"-13 x23 |
| E11 ²⁾ | M22x1.5 | M22x1.5 | M22x1.5 |
| A12 | 188 | 193 | 218 |
| B12 | 87 | 90 | 114 |
| C12 | 45 | 48.3 | 56 |
| D12 | 13.4 | 13.1 | 14.2 |
| E12 | 76 | 78 | 94 |
| F12 | 77 | 80 | 94 |
| G12 | 55 | 57 | 67 |
| H12 | 212 | 223 | 276 |
| J12 | 12.7 | 12.7 | 12.7 |
| K12 | 35.5 | 34.6 | 37.4 |
| L12 | 118 | 125 | 157 |
| N12 | 50.8 | 57.2 | 66.7 |
| P12 | 23.8 | 27.8 | 31.75 |
| Q12* | 3/8"-16 x20 | 7/16"-14 x23 | 1/2"-13 x23 |
| R12 | 20 | 20 | 23.5 |
| S12 | 81.5 | 84.5 | 109 |

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

Ports

| Type | V12-60 | V12-80 | V12-160 |
|-------|---------|---------|------------|
| Axial | 3/4" | 3/4" | 1 1/4" |
| Side | 3/4" | 1" | 1 1/4" |
| Drain | 7/8"-14 | 7/8"-14 | 1 1/16"-12 |

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

Flange type **S** (SAE J744c)

| Size | Dimension |
|---------|-----------|
| V12 -60 | SAE 'C' |
| -80 | SAE 'C' |
| -160 | SAE 'D' |

Spline type **S** (SAE J498b*)

| Size | Dimension |
|---------|-------------------------|
| V12 -60 | SAE 'C' (14T, 12/24 DP) |
| -80 | SAE 'C' (14T, 12/24 DP) |
| -160 | SAE 'D' (13T, 8/16 DP) |

* '30° involute spline, class 1, flat root, side fit'.



Bearing life

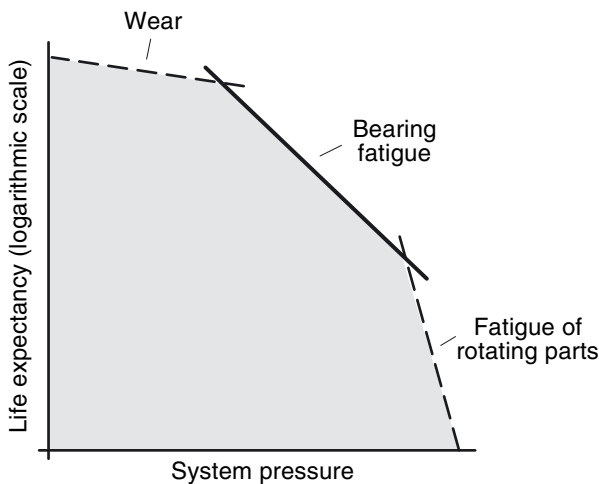
General information

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.

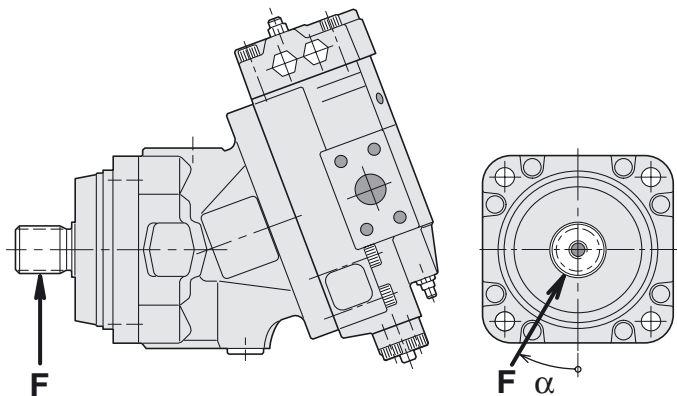
Bearing life is also dependent on external shaft loads, case fluid viscosity and fluid contamination.

Parker Hannifin has a computer program for bearing life calculation and will assist in determining life for specific V12 load conditions; refer to MI 170, 'V12 bearing life', available from Parker Hannifin.

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
- V12 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.



Controls (general information)

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

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

All controls utilize a setting piston that connects to the valve segment (refer to the picture on page 8).

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).

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 (' p_s '; 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 (p_s) 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 - 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.)

Ports are:

- M14x1.5 (ISO and cartridge versions)
- 9/16"-18 O-ring boss (SAE version).

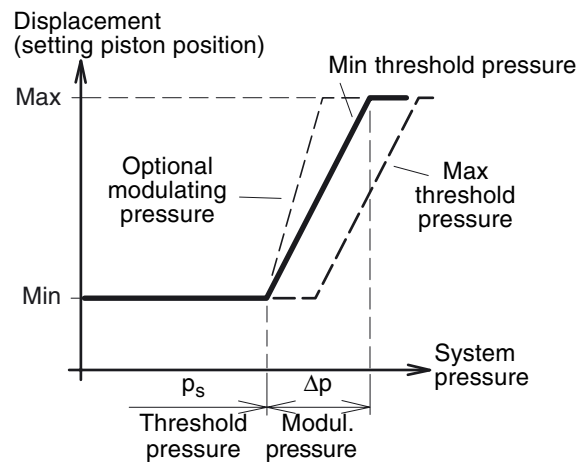
Servo supply pressure is usually obtained from the main high pressure port through the built-in shuttle valve.

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

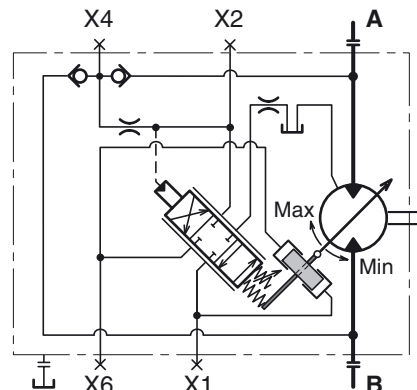
The response time (i.e. from max to min displacement) is determined by orifices in the servo valve supply and return lines.

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

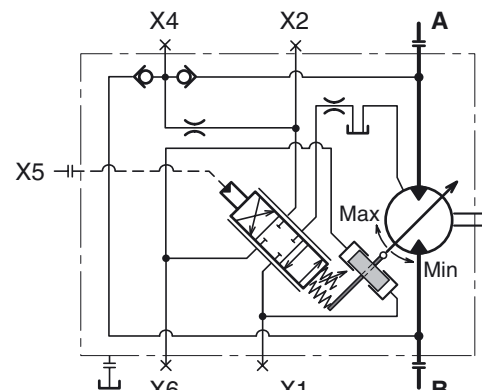
NOTE: Control ordering codes are shown on page 13 and installation dimensions on page 27.



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 21) 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 30 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 - External pilot pressure (port X5; compare (optional) ACE, page 21).

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

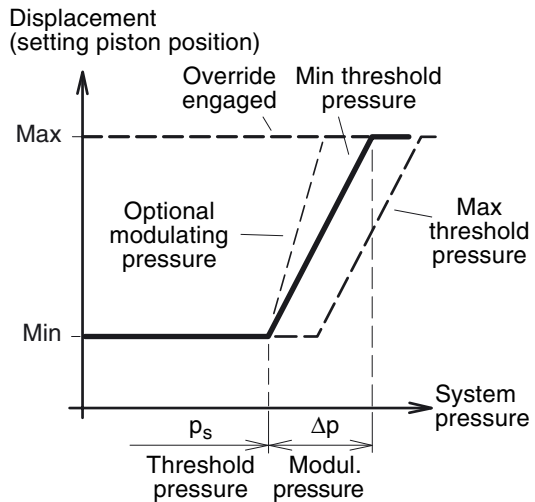
$$p_7 = \frac{p_s + \Delta p}{24} \text{ [bar]}$$

p_7 = Override pressure

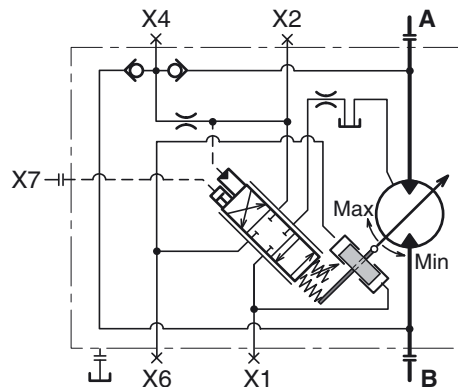
p_s = System pressure

Δp = Modulating pressure

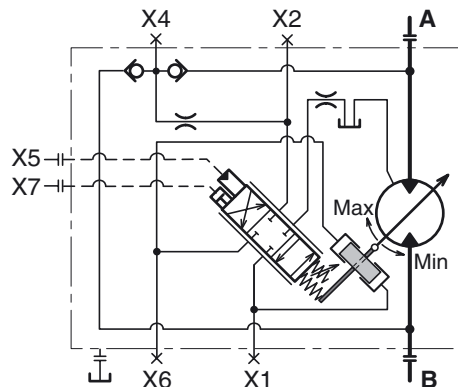
- Gauge/pilot ports (AH compensator):
- X1 Setting piston pressure (increasing displ.)
 - X2 Servo supply pressure (after orifice)
 - X4 Servo supply pressure (before orifice)
 - X5 External pilot pressure
 - X6 Setting piston pressure (decreasing displ.)
 - X7 Override pressure
- Ports are:
- M14x1.5 (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.).

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 1.2 and 0.6 A respectively. An electrical connector is included (DIN 43650/IP54).

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)

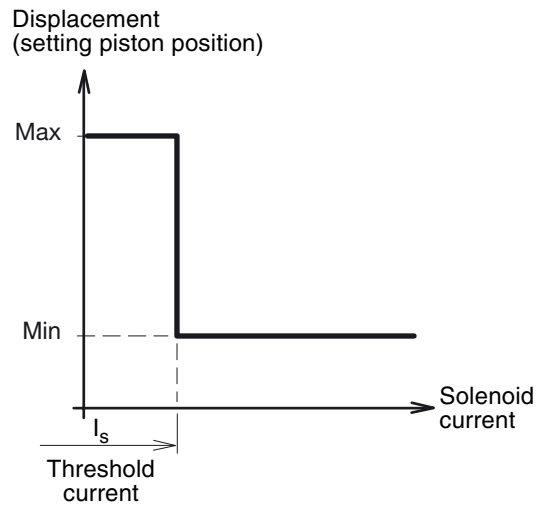
EOL 01 E - External servo supply, 12 VDC (optional)

Gauge ports (EO control):

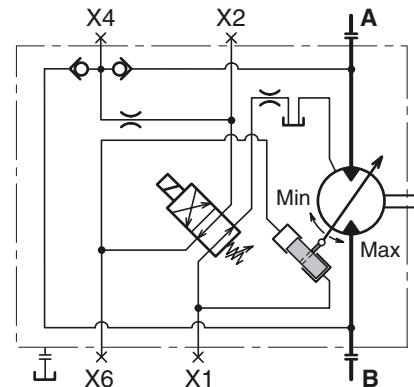
- X1 Setting piston pressure (max-to-min)
- X2 Servo supply pressure (after orifice)
- X4 Servo supply pressure (before orifice)
- X6 Setting piston pressure (min-to-max)

Ports are:

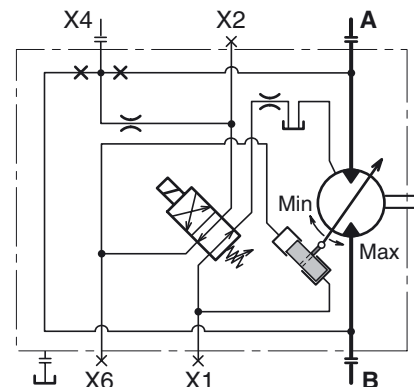
- M14x1.5 (ISO and cartridge versions)
- 9/16"-18 O-ring boss (SAE version).



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 servo valve 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. 1.1 and 0.55 A respectively.

The threshold current (I_s) is factory set (0.4 A at 12 VDC/ 0,2 A at 24 VDC) but is adjustable (12 VDC: 0.25–0.45 A; 24 VDC: 0.10–0.23 A).

When utilizing the full displacement range, the required modulating current (ΔI) is 0.6 and 0.3 A respectively. In order to minimize hysteresis, a pulse-width modulated control signal of 70 to 90 Hz should be utilized.

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

The EP control is available in four versions:

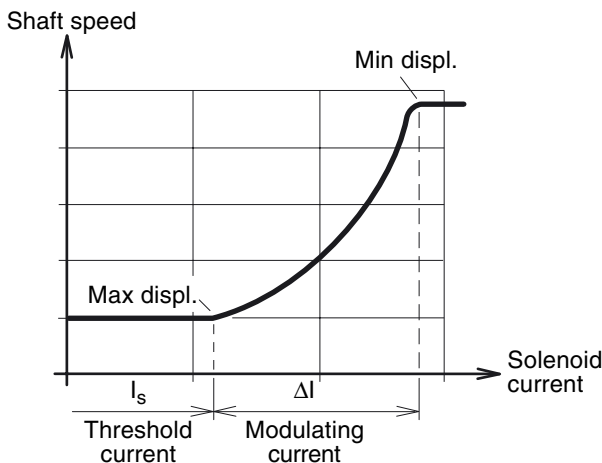
- EP H 01 I** - Internal servo supply, 24 VDC
- EP L 01 I** - Internal servo supply, 12 VDC
- EP H 01 E** - External servo supply, 24 VDC (optional)
- EP L 01 E** - External servo supply, 12 VDC (optional)

Gauge ports (EP control):

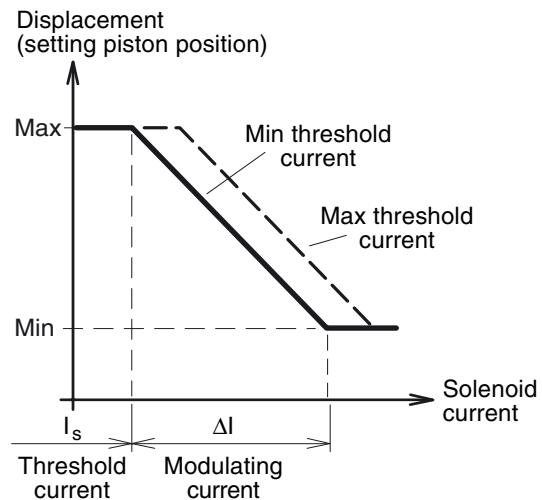
- X1 Setting piston pressure (decreasing displ.)
- X2 Servo supply pressure (after orifice)
- X4 Servo supply pressure (before orifice)
- X6 Setting piston pressure (increasing displ.)

Ports are:

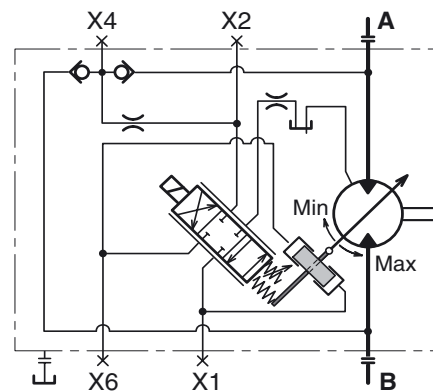
- M14x1.5 (ISO and cartridge versions)
- 9/16"-18 O-ring boss (SAE version).



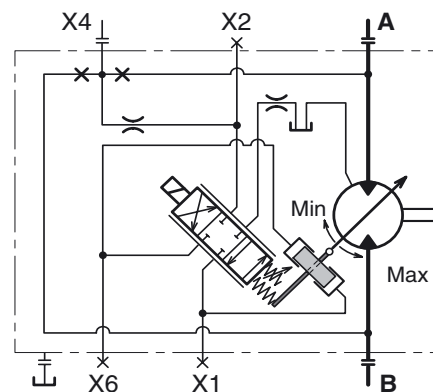
Shaft speed vs. solenoid current (EP control).



EP diagram.



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



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

HO two-position control

The two-position HO control is similar to the EO (page 23) 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 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:

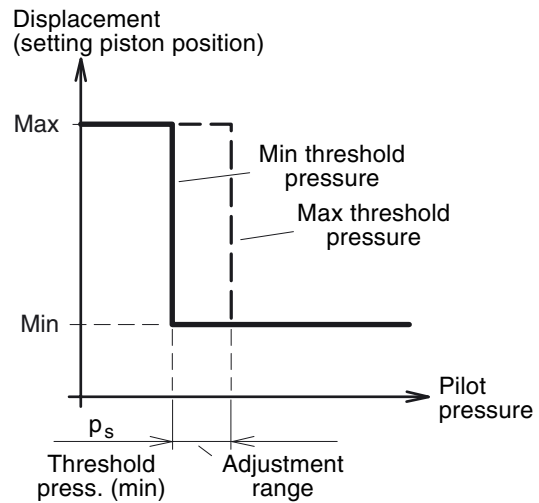
- HO S 01 I** - Internal servo supply
- HO S 01 E** - External servo supply (port X4) (optional)

Gauge/pilot ports (HO control):

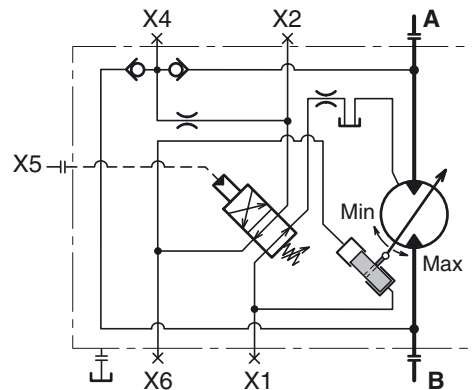
- X1 Setting piston pressure (max-to-min)
- X2 Servo supply pressure (after orifice)
- X4 Servo supply pressure (before orifice)
- X5 External pilot pressure (max 100 bar)
- X6 Setting piston pressure (min-to-max)

Ports are:

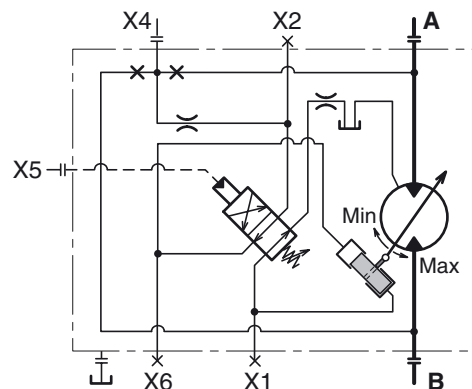
- M14x1.5 (ISO and cartridge versions)
- 9/16"-18 O-ring boss (SAE version).



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

Normally, the servo piston stays in the max displacement position. When a sufficiently high pilot pressure (p_s) is applied to port X5, the 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.

Two versions of the HP control are available:

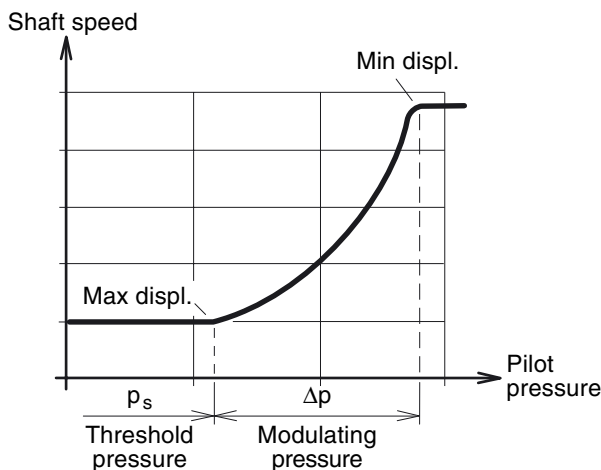
- HPS 01 I** - Internal servo supply
- HPS 01 E** - External servo supply (port X5) (optional)

Gauge/pilot ports (HP control):

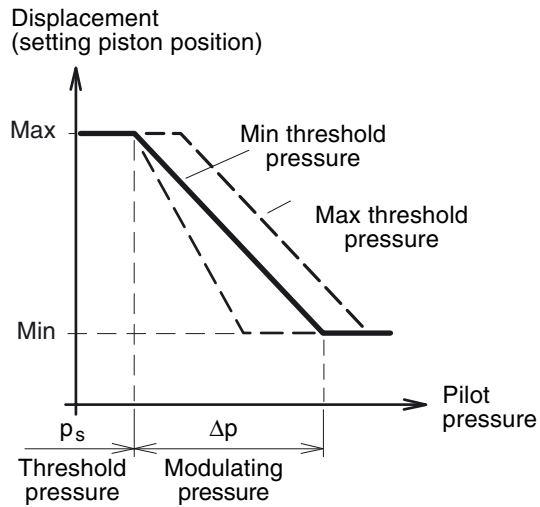
- X1 Servo piston pressure (decreasing displ.)
- X2 Servo supply pressure (after orifice)
- X4 Servo supply pressure (before orifice)
- X5 External pilot pressure (max 100 bar)
- X6 Servo piston pressure (increasing displ.)

Ports are:

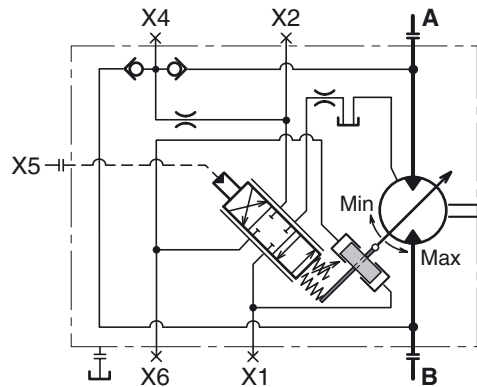
- M14x1.5 (ISO and Cartridge versions)
- 9/16"-18 O-ring boss (SAE version).



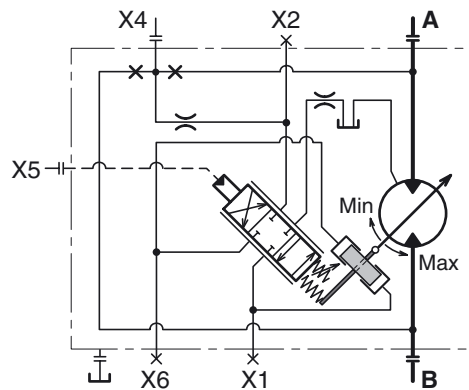
Shaft speed vs. pilot pressure (HP control).



HP diagram.



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



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

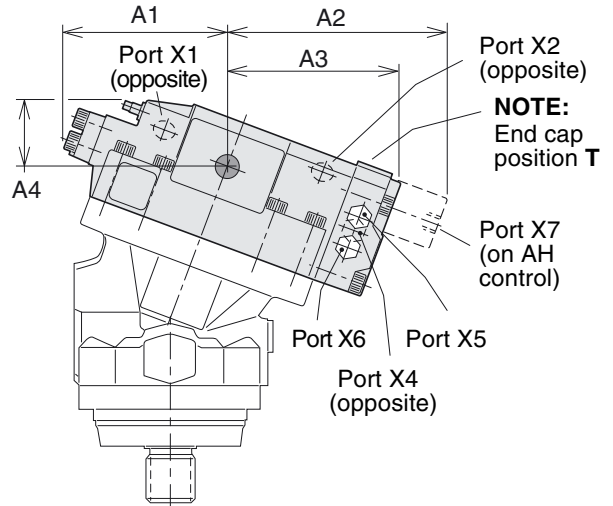
Control installation dimensions

NOTE: - The basic motor side port locations are shown on pages 14, 16 and 18.
 - End cap position: Refer to the ordering codes, pages 10-12.

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

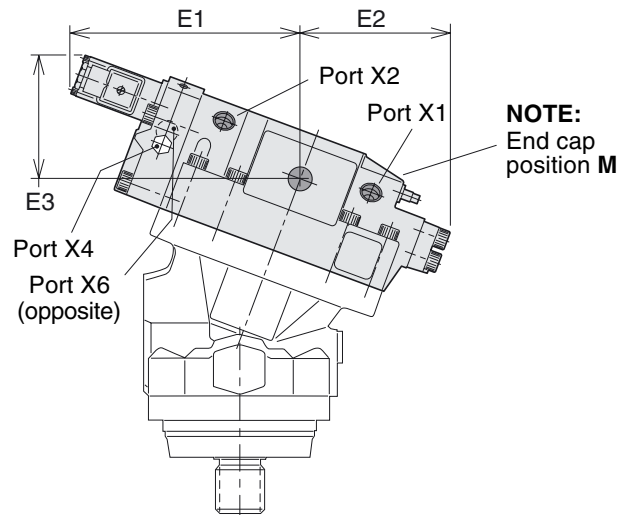
AC and AH compensators

| Dim. | V12-60 | -80 | -160 |
|------|--------|-----|------|
| A1 | 132 | 138 | 170 |
| A2 | 186 | 188 | 206 |
| A3 | 143 | 145 | 162 |
| A4 | 55 | 57 | 67 |



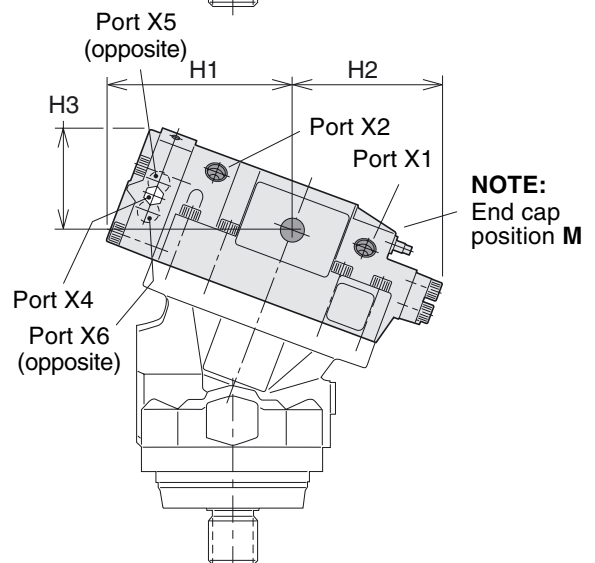
EO and EP controls

| Dim. | V12-60 | -80 | -160 |
|------|--------|-----|------|
| E1 | 190 | 192 | 208 |
| E2 | 121 | 125 | 155 |
| E3 | 106 | 106 | 115 |



HO and HP controls

| Dim. | V12-60 | -80 | -160 |
|------|--------|-----|------|
| H1 | 153 | 156 | 170 |
| H2 | 121 | 125 | 153 |
| H3 | 86 | 85 | 92 |



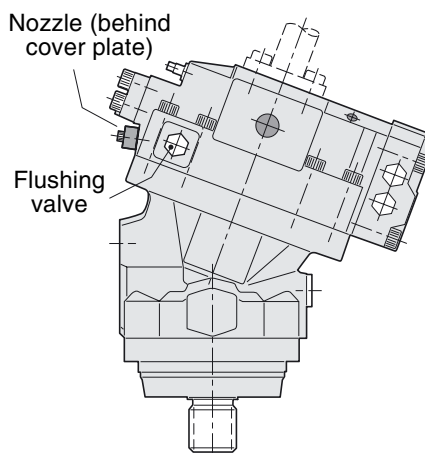
Flushing valve

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.

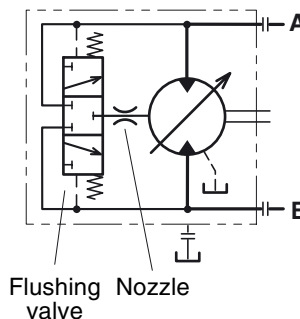
NOTE: The flushing valve ordering code is shown on page 13 ('L 01').



Available nozzles

| Nozzle design. | Orifice size [mm] | Status |
|----------------|-------------------|-----------------|
| L 01 | 1.3 | Standard |
| L 02 | 0.8 | Optional |
| L 03 | 1.0 | " |
| L 04 | 1.2 | " |
| L 05 | 1.5 | " |
| L 06 | 1.7 | " |
| L 07 | 2.0 | " |
| L 08 | 3.0 | " |

NOTE: - '00' - no nozzle



High speed operation

Contact Parker Hannifin for additional information.

Accessory valve blocks

SR pressure relief/check valve

To protect the main hydraulic circuit from unwanted pressure peaks, an add-on valve block, type SR, with two independent pressure relief cartridges and two large capacity check valves can be ordered for series V12.

The valve block is mounted on the motor end cap as shown to the right. The individual cartridge has a fixed, factory-set opening pressure.

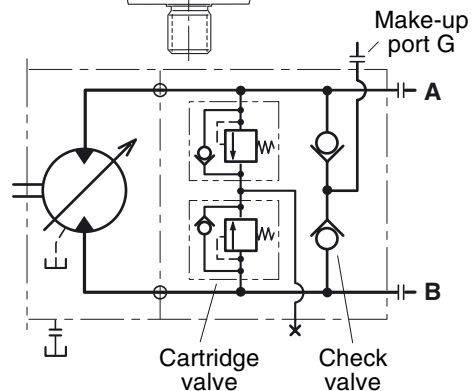
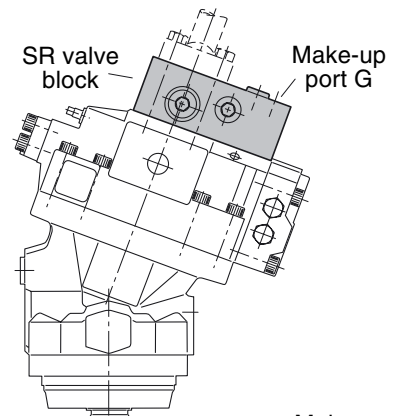
An external port for make-up fluid is provided. When sufficiently pressurized, it prevents motor cavitation due to pressure losses in the main circuit.

For additional information, refer to 'Mobile motor/pump accessories' (catalogue HY17-8258/UK).

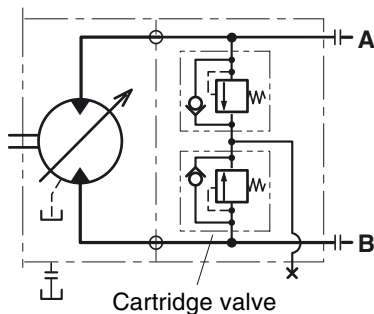
SV pressure relief valves

The SV relief valve block is an alternative to the SR valve block above.

The SV contains the same cartridge valves as the SR but lacks the two check valves; refer to the SV schematic, below, and to 'Mobile motor/pump accessories' (catalogue HY17-8258/UK).



V12 with SR relief valve block.



V12 with SV relief valve block.

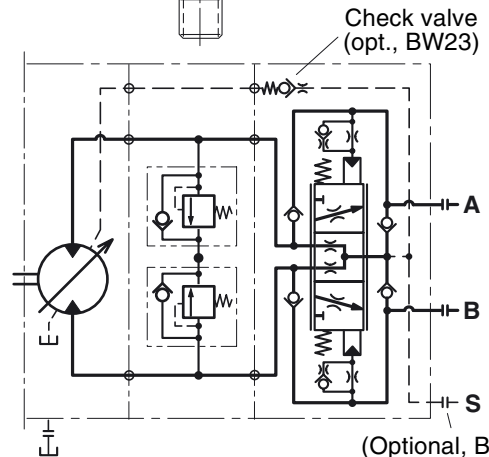
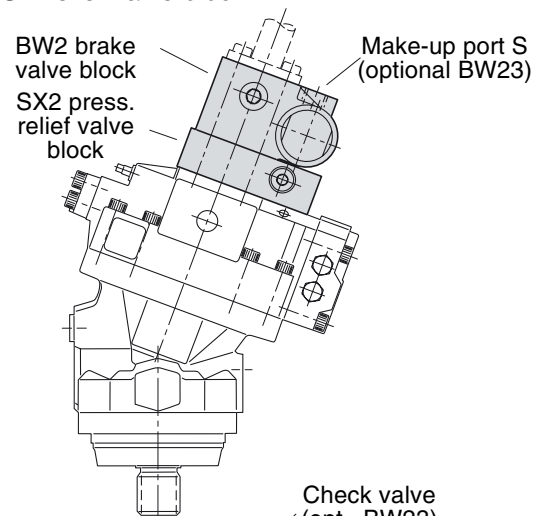
BW2/SX2 brake/relief valves

In applications, such as open circuit wheel drives, a counterbalance or 'brake' valve is required. It provides smooth braking and greatly reduces the risk of motor cavitation when coasting or braking.

Brake/relief valves, type BW2/SX2, are available for series V12 motors. The two valve blocks mount directly on the motor end cap as shown to the right.

As an option, size BW23 can be supplied with a make-up port; when sufficiently pressurized, motor cavitation due to pressure losses in the main circuit is being prevented.

For additional information, refer to 'Mobile motor/pump accessories' (catalogue HY17-8258/UK).



V12 with BW2/SX2 brake/relief valve blocks.

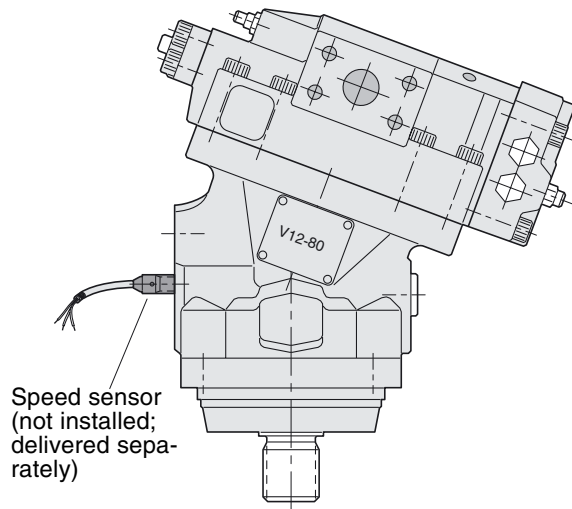
Speed sensor

A speed sensor kit is available for the **I** and **S** versions of series V12.

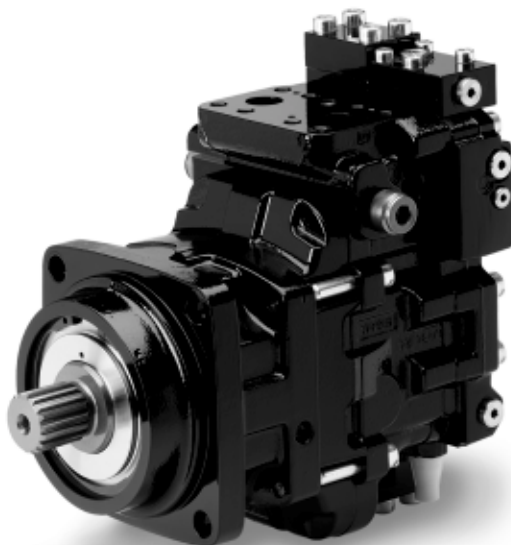
The ferrostat differential (Hall-effect) sensor installs in a separate, threaded hole in the V12 bearing housing. The speed sensor is directed towards the V12 shaft flange and outputs a square wave signal within a frequency range of 5 Hz to 20 kHz. Number of pulses per shaft rev is 36 which, at 5 Hz, corresponds to approx. 8 rpm.

When a 'Speed sensor' is ordered (refer to the ordering codes on pages 10 and 12), the housing is machined with the threaded hole; the speed sensor kit is delivered in a separate bag.

- NOTE:**
- The motor bearing housing must be prepared for the speed pick-up; refer to the V12 ordering codes on pg. 10 and 12.
 - Additional information is provided in our publication 'Mobile motor/pump accessories' (catalogue HY17-8258/UK); available from Parker Hannifin.
 - The speed sensor is also shown in the illustrations on pg. 14 and 18.



V14

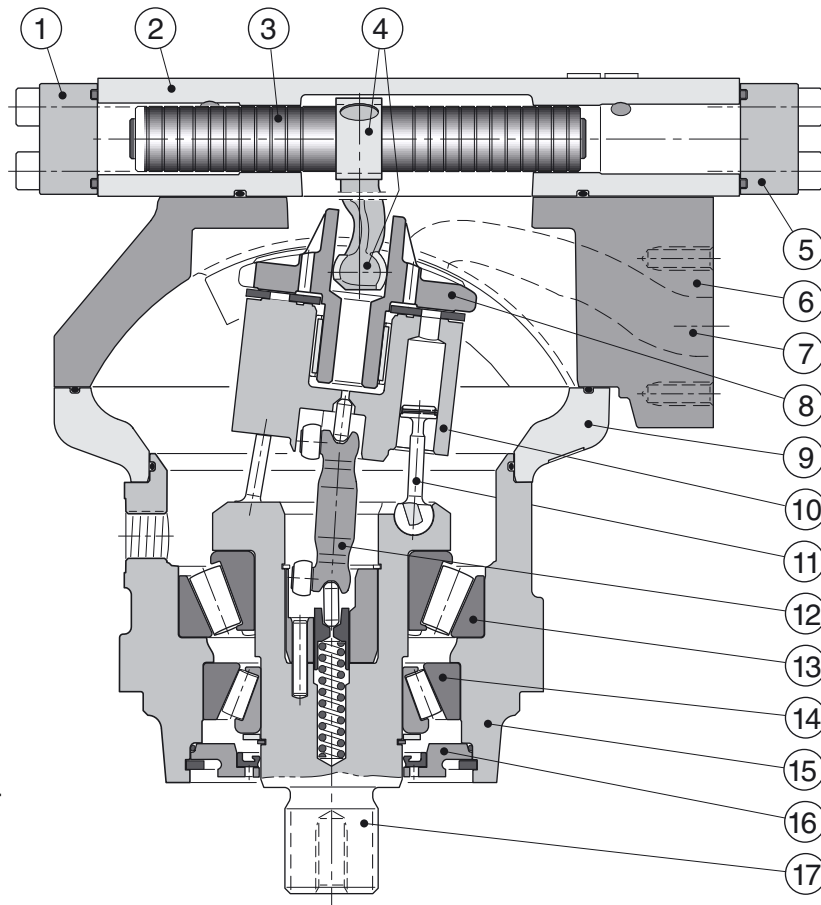


3

| Content | Page | Chapter |
|--|-------------|----------------|
| V14 cross section | 32 | |
| Specifications | 32 | |
| V14 Ordering codes | 33-35 | |
| Controls - general information | 36 | |
| AC pressure compensator | 36 | |
| AD pressure compensator | 39 | |
| AH pressure compensator | 40 | |
| EO, EP, HO and HP controls (general information) | 41 | |
| EO electric two-position control | 43 | |
| EP electrohydraulic proportional control | 44 | |
| HO hydraulic two-position control | 45 | |
| HP hydraulic proportional control | 46 | |
| Installation dimensions: | | |
| V14-110, ISO version | 47 | |
| V14-110, Cartridge version | 48 | |
| V14-110, SAE version | 49 | |
| V14-160, ISO version | 50 | |
| V14-160, SAE version | 51 | |
| Valve and sensor options (overview) | 52 | |
| Brake valve and pressure relief valves | 52 | |
| Shaft speed sensor (option S) | 53 | |
| Flushing valve (option L) | 53 | |
| Pressure relief valves (option P) | 54 | |
| Setting piston position sensor (option L) | 55 | |
| Installation and start-up information | 63 | 5 |

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



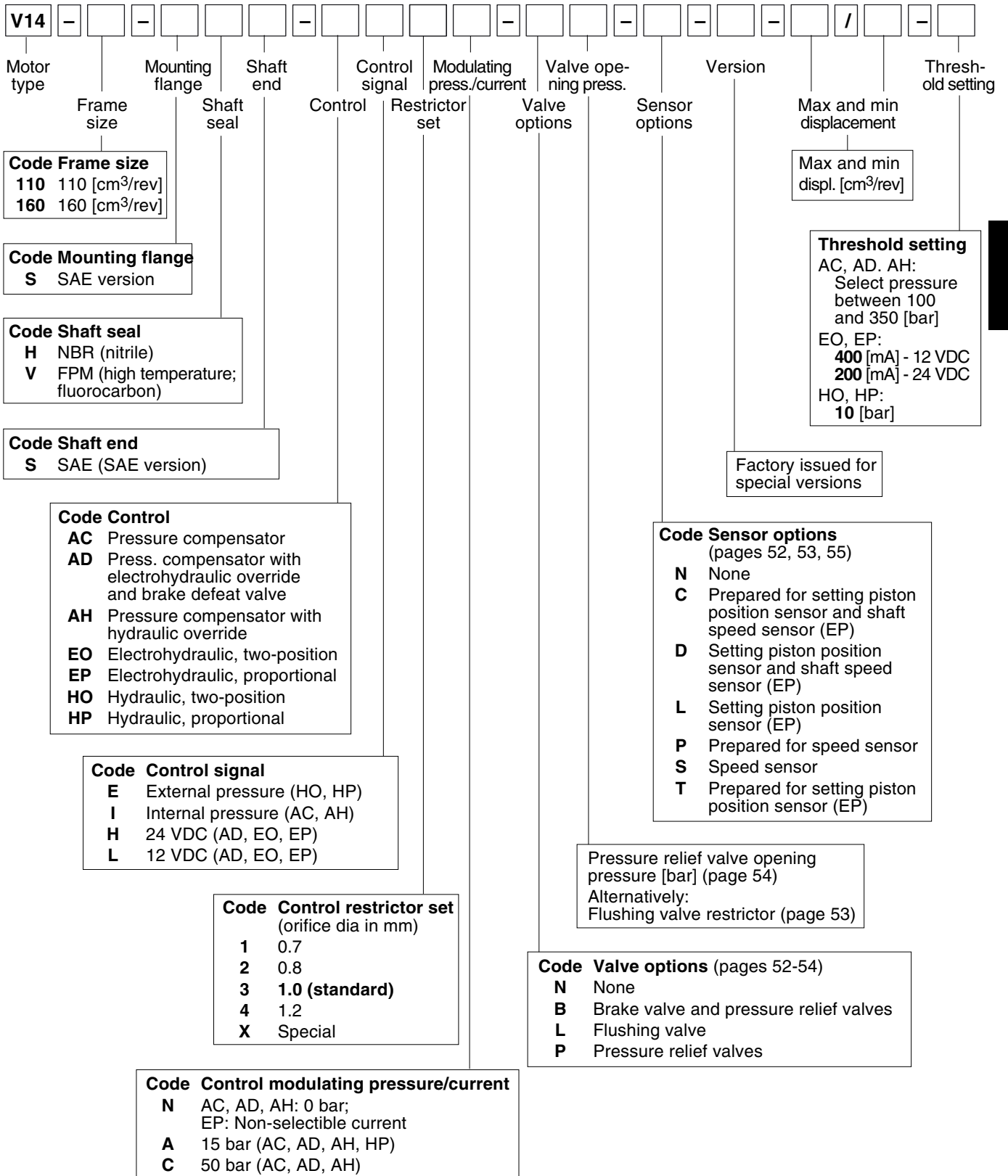
Specifications

| V14 frame size | 110 | 160 |
|--|-------|-------|
| Displacement [cm ³ /rev] | | |
| - at 35° (max) | 110 | 160 |
| - at 6.5° (min) | 22 | 32 |
| Operating pressure [bar] | | |
| - max intermittent ¹⁾ | 480 | 480 |
| - max continuous | 420 | 420 |
| Operating speed [rpm] | | |
| - max intermittent at 35° ¹⁾ | 3 900 | 3 400 |
| - max continuous at 35° | 3 400 | 3 000 |
| - max intermittent at 6.5°-20° ¹⁾ | 6 500 | 5 700 |
| - max continuous at 6.5°-20° | 5 700 | 5 000 |
| - min continuous | 50 | 50 |

| V14 frame size | 110 | 160 |
|--|-----|-----|
| Flow [l/min] | | |
| - max intermittent ¹⁾ | 430 | 550 |
| - max continuous | 375 | 480 |
| Output torque [Nm] | | |
| at 100 bar (theor.) | 175 | 255 |
| Max output power ¹⁾ [kW] | 262 | 335 |
| Corner power [kW] | | |
| - intermittent ¹⁾ | 570 | 730 |
| - continuous | 440 | 560 |
| Weight [kg] | 54 | 68 |

1) Max 6 seconds in any one minute.

SAE version



3

Controls - general information

The following V14 controls satisfy most application requirements:

- AC, AD and AH (automatic pressure compensators)
- EO and HO (two-position controls)
- EP and HP (proportional controls)

All controls utilize a servo piston that connects to the valve segment (refer to the illustration on page 32).

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

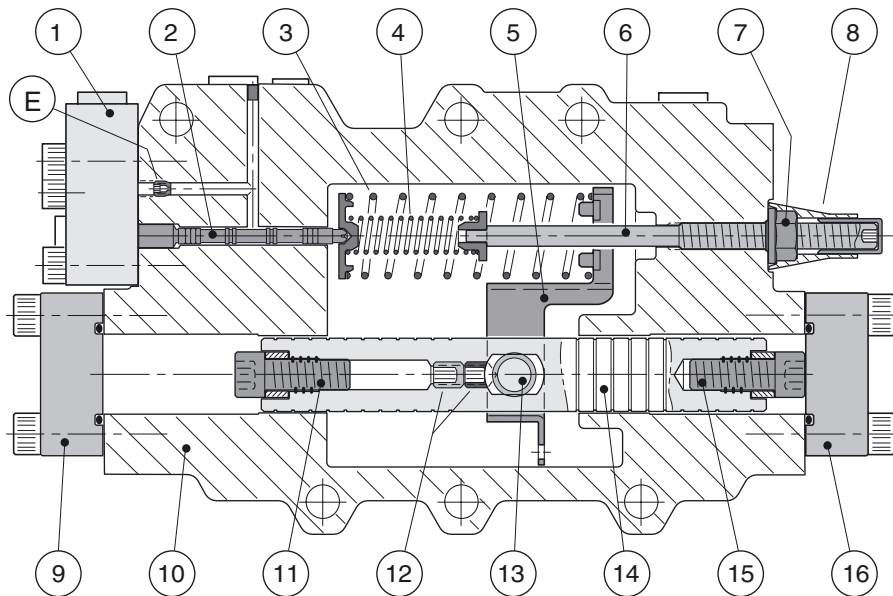
The displacement angle (between output shaft and cylinder barrel) ranges from 35° (max) to 6.5° (min).

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.

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

AC pressure compensator



Cross section of the AC pressure compensator module.

- | | |
|--|--|
| 1. AC control cover | 10. Control module housing |
| 2. Servo valve spool | 11. Max displ. limiting screw/bushing |
| 3. Modulating spring | 12. Set screws |
| 4. Threshold spring | 13. Connecting arm |
| 5. Feedback arm | 14. Setting piston |
| 6. Threshold adjustment screw | 15. Min displ. limiting screw/bushing |
| 7. Seal nut | 16. End cover (min displ.). |
| 8. Two-part seal (threshold adjustm't) | E. Nozzle location; refer to the hydraulic schematics, pag. 38-40. |
| 9. End cover (max displ.) | |

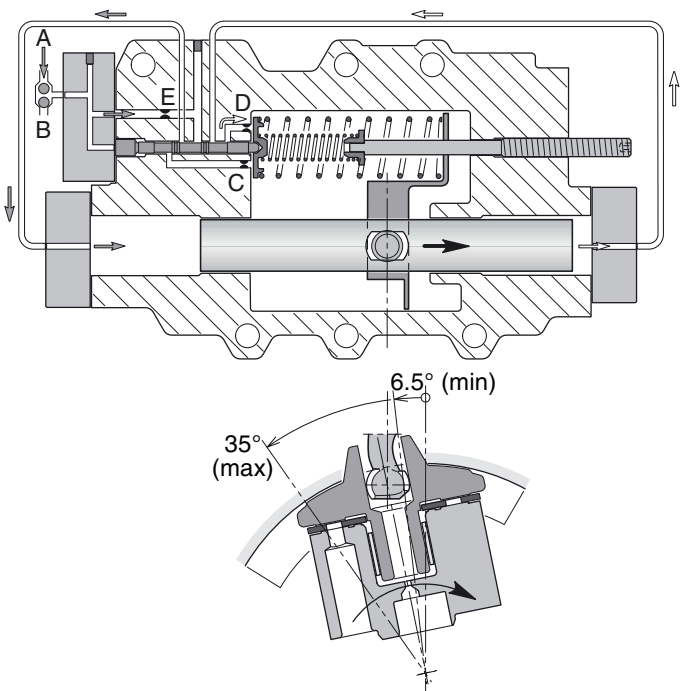
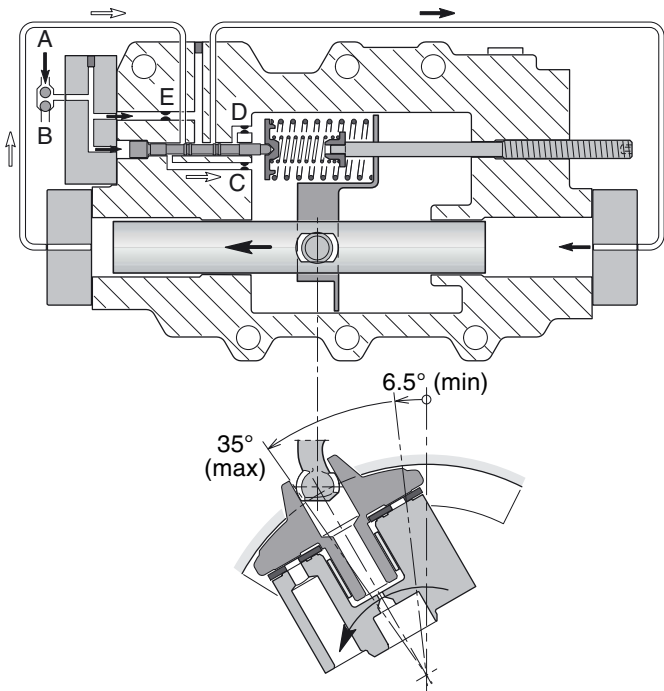
AC compensator function

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).

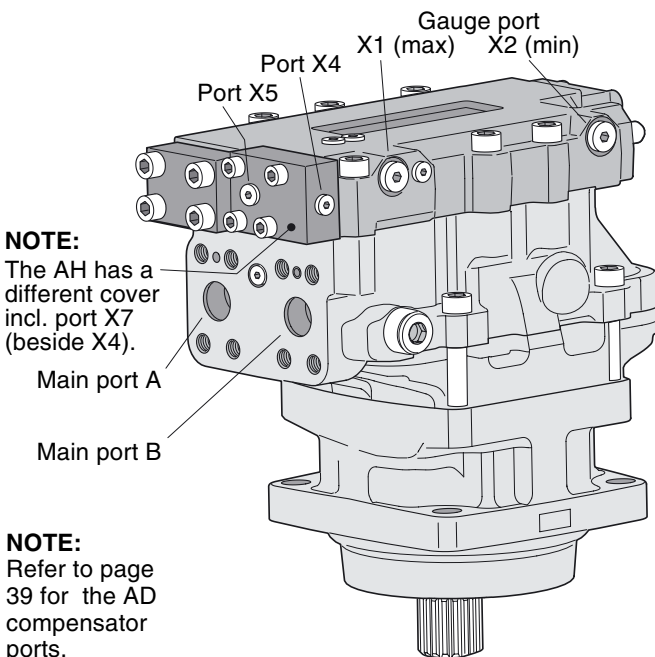
Refer to the illustration below (right):

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).



- 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
 - X7 Override pressure (on the AH)
- Port sizes:
- M14x1.5 (ISO and cartridge versions)
 - 9/16"-18 O-ring boss (SAE version)

NOTE:
 Refer to page 39 for the AD compensator ports.

Port locations - V14-110 with AC or AH compensator.

3

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.

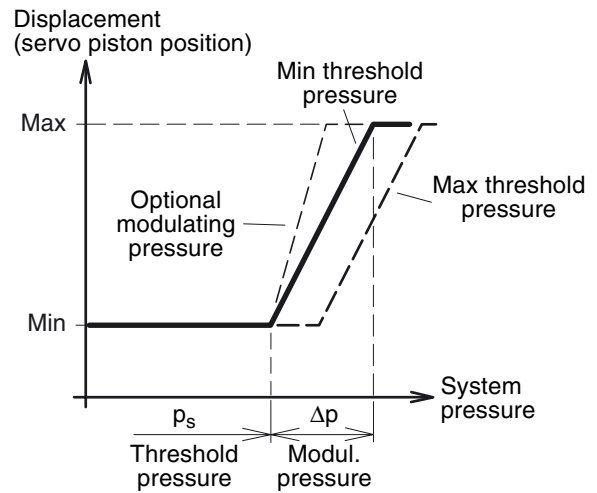
To satisfy specific hydraulic circuit requirements, a modulating pressure of 15 or 50 bar can be selected.

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.

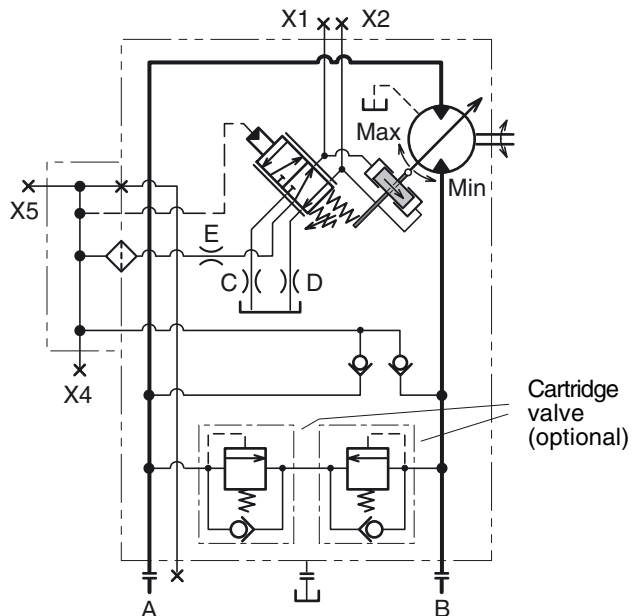
Gauge/pilot ports (AC and AH compensators):
 X1 Setting piston pressure (decreasing displ.)
 X2 Setting piston pressure (increasing displ.)
 X4 Servo supply pressure (before orifice and filter)
 X5 Pilot pressure

Port sizes:
 - 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.



AC diagram (displacement vs. system pressure).



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

AD pressure compensator

The AD control is similar to the AC (shown on previous pages) but incorporates a solenoid controlled override function and a brake defeat valve.

Override

- The override consists of a piston built into a special end cover and an external solenoid.
- When the solenoid is energized, system pressure is directed to the piston which in turn pushes on the spool of the servo control valve. This causes the motor to lock in the max displacement position, irrespective of system pressure (min 30 bar).
- Solenoids are available in 12 VDC (designated **L**) and 24 VDC (design. **H**); the required current is 2 and 1 A respectively.

Brake defeat valve

- The brake defeat function, which is also built into the special end cover, consist of a two-position, three-way valve. Ports X9 and X10 (refer to the schematic) are connected to the corresponding ports of the pump displacement control.
- The function prevents any pressure in the motor return port to influence the pressure compensator. Say, e.g., that motor port A is pressurized to move the vehicle 'forward'. Thus, back pressure in return port B, which develops in the braking mode, will not cause the compensator to move towards the max displacement position and vehicle braking will be smooth.
- Likewise, when port B is pressurized when the vehicle moves 'backward', braking pressure in port A will not influence the compensator.

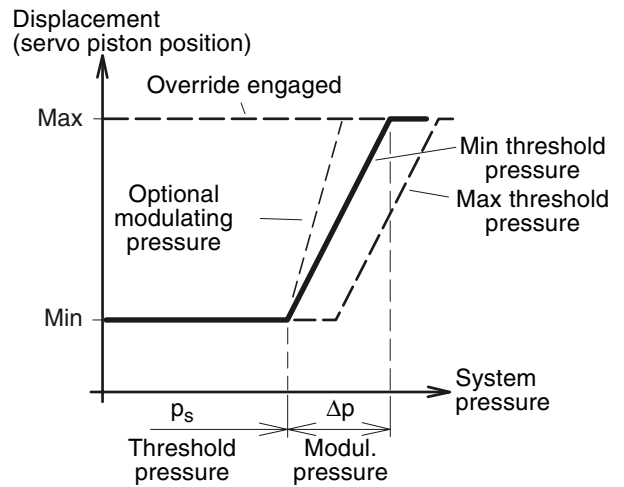
Gauge/pilot ports (AD compensator):

- X1 Servo piston pressure (decreasing displ.)
- X2 Servo piston pressure (increasing displ.)
- X9 Pressure (from the pump control) to the brake defeat valve (for port A)
- X10 Pressure (from the pump control) to the brake defeat valve (for port B)

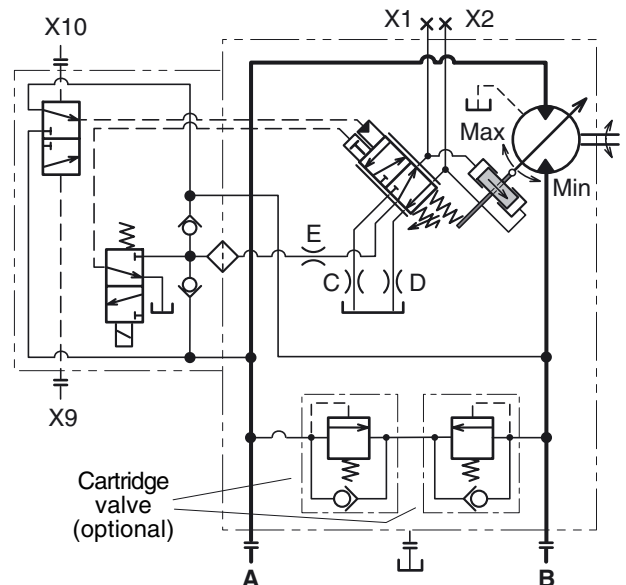
Port sizes:

- M14x1.5 (ISO version)
- 9/16"-18 O-ring boss (SAE version)

NOTE: Some of the ports are shown in the illustration on page 37.



AH diagram (displacement vs. system pressure).



AD schematic (shown: override solenoid not engaged; the compensator moves towards min displacement).

AH pressure compensator

The AH compensator is similar to the AD (shown on previous page) but incorporates only 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 30 bar.

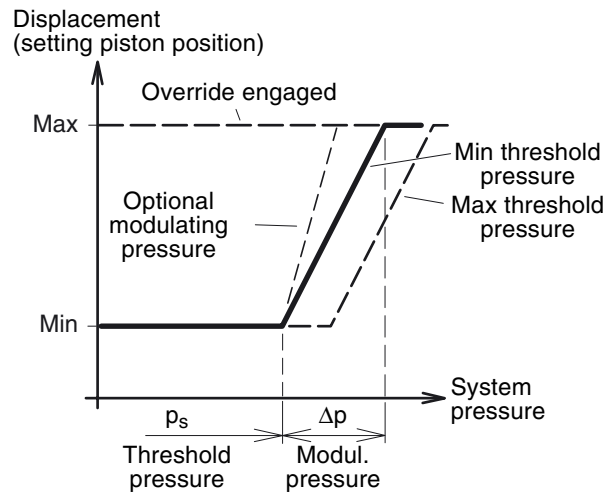
Required override pressure, port X7 (min 20 bar):

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

p_7 = Override pressure

p_s = System pressure

Δp = Modulating pressure



AH diagram (displacement vs. system pressure).

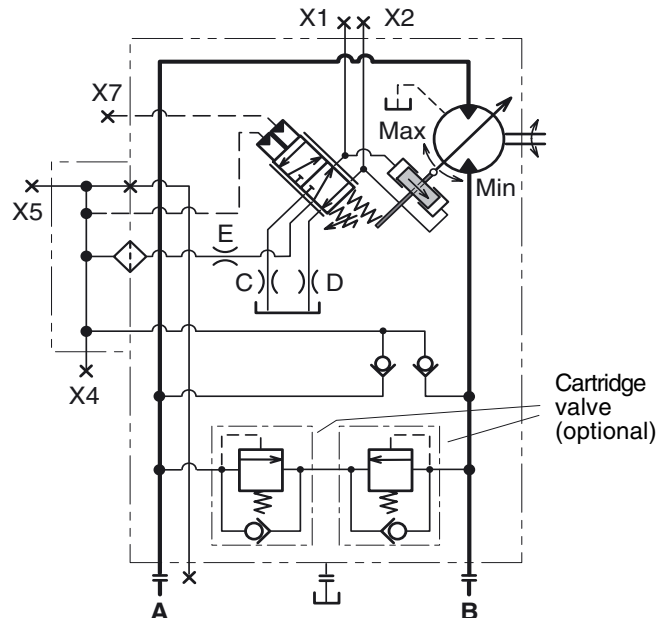
Gauge/pilot ports (AH compensator):

- X1 Servo piston pressure (decreasing displ.)
- X2 Servo piston pressure (increasing displ.)
- X4 Servo supply pressure (before orifice and filter)
- X5 Pilot pressure
- X7 Override pressure

Port sizes:

- M14x1.5 (ISO version)
- 9/16"-18 O-ring boss (SAE version)

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



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

EO, EP, HO and HP controls (general information)

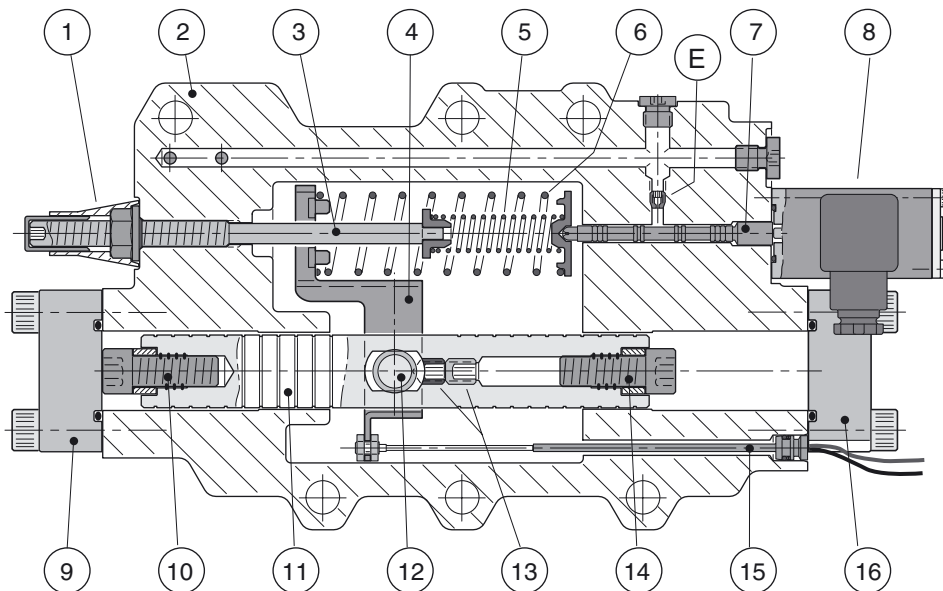
Basically, these controls function in a similar way.

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) | 10. Max displ. limiting screw/bushing |
| 2. Control module housing | 11. Setting piston |
| 3. Threshold adjustment screw | 12. Connecting arm |
| 4. Feedback arm | 13. Set screws |
| 5. Threshold spring | 14. Min displ. limiting screw/bushing |
| 6. Modulating spring (EP, HP only) | 15. Setting piston position sensor (EP and HP options) |
| 7. Servo valve spool | 16. End cover (min displ. limit) |
| 8. Solenoid (EO, EP only); cover on HO, HP | E. Nozzle location; refer to the hydraulic schematics. |
| 9. End cover (max displ. limit) | |

3

EP control function (solenoid current increasing)

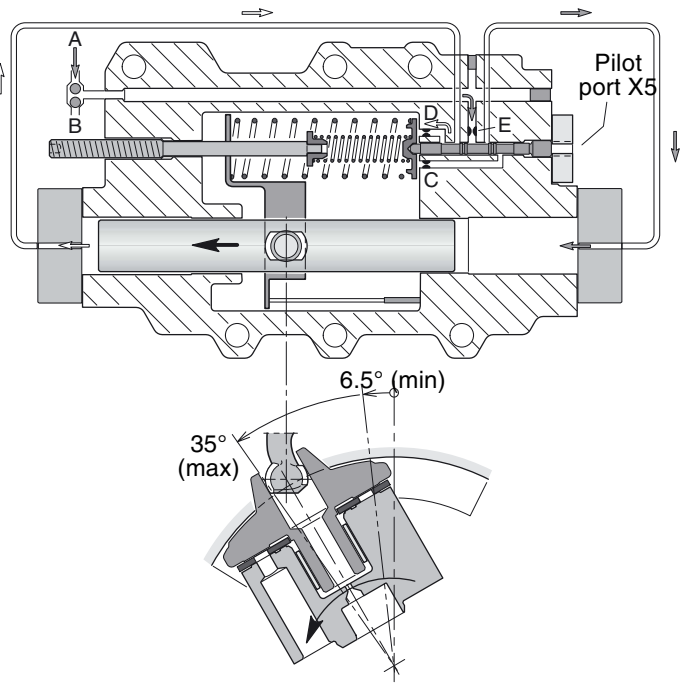
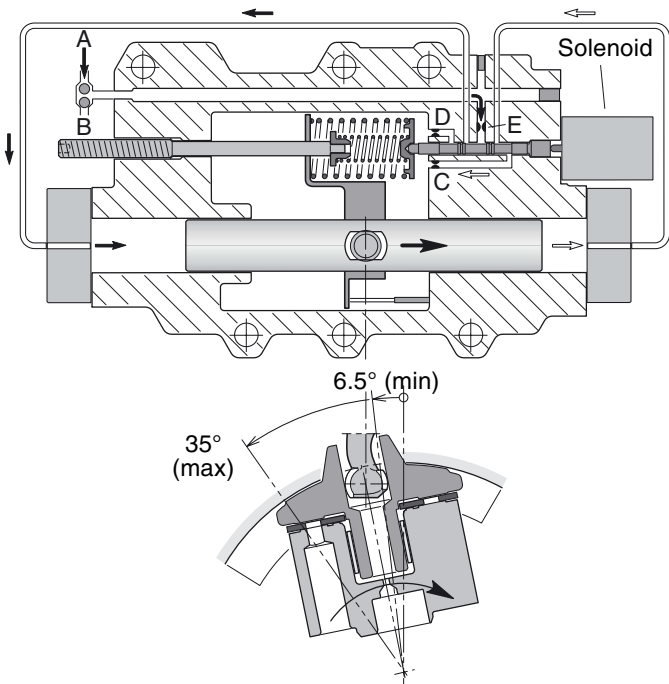
NOTE: Valid also for the HP at increasing pilot pressure.
 Refer to the illustration below left:

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 increases while the output torque decreases correspondingly (at a constant pump flow and system pressure).

HP control function (decreasing pilot pressure)

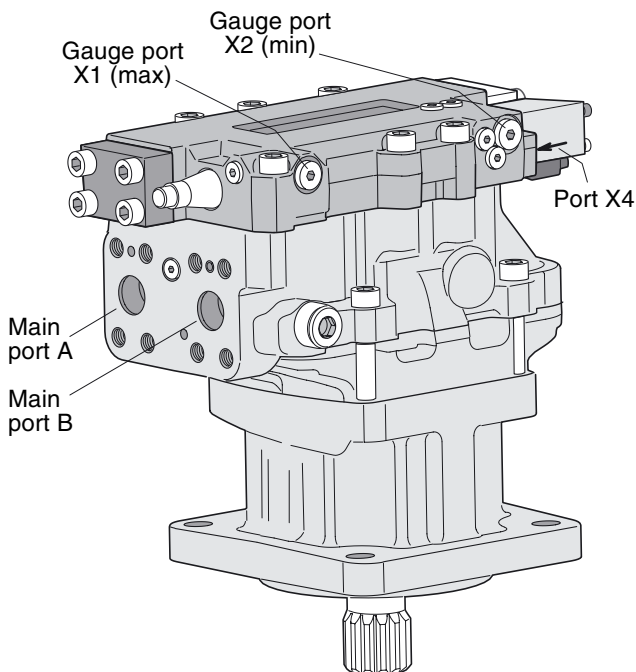
NOTE: Valid also for the EP at decreasing current.
 Refer to the illustration below right:

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. This means, that 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.).

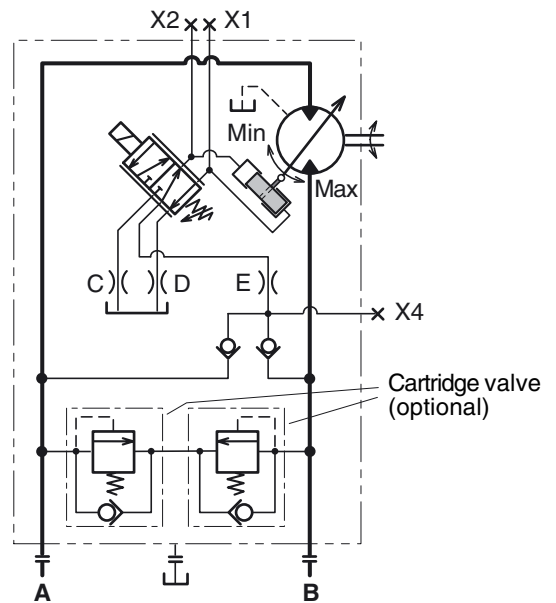
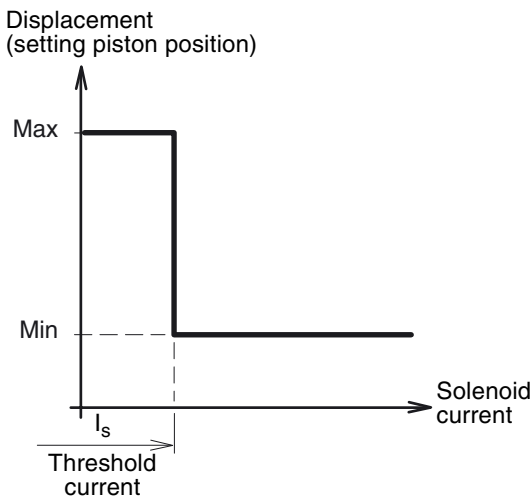


- | |
|--|
| <p>Gauge ports (EO and EP controls):</p> <ul style="list-style-type: none"> X1 Setting piston pressure (decreasing displ.) X2 Setting piston pressure (increasing displ.) X4 Servo supply pressure (before orifice) <p>Port sizes:</p> <ul style="list-style-type: none"> - M14x1.5 (ISO version) - 9/16"-18 O-ring boss (SAE version). |
|--|

Port locations - V14-110 with EO or EP control.

EO electric two-position control

- The EO is a two-position control where the max and min displacements are governed by a DC solenoid (acting on the servo spool) which is attached to the control module (refer to the illustration on page 42).
- The EO is utilized in transmissions where only two operating modes are required - low speed/high torque and high speed/low torque.
- The servo 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 1.2 and 0.6 A respectively. The male connector (type 'Junior Timer') is permanently installed on the solenoid. The corresponding female connector is available as a spare part, P/N 3781939.
- 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.



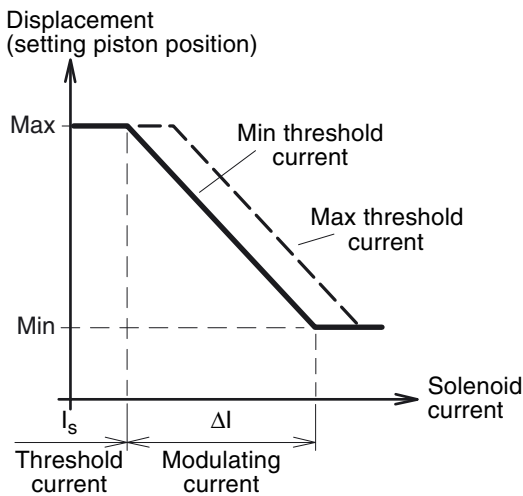
EO schematic (shown: non-activated solenoid; control in max displacement position).

3

EP electrohydraulic proportional control

- The EP electrohydraulic proportional control is used in hydrostatic transmissions requiring a continuously variable shaft speed. The servo valve is governed by a DC solenoid (acting on the servo spool), attached to the control module (refer to the illustration on page 42).
- When the solenoid current increases above the threshold value, the servo 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).

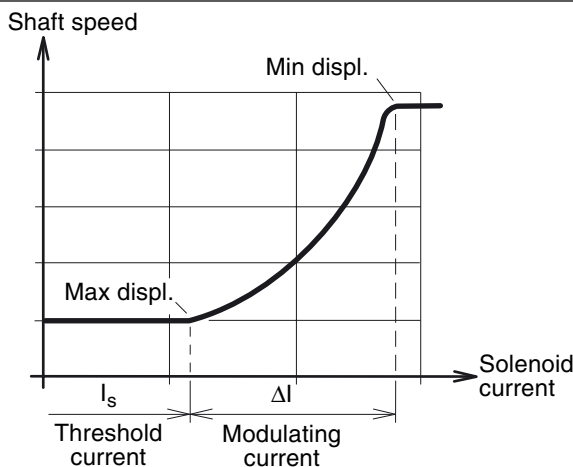
Gauge ports (EP control):

- X1 Setting piston pressure (decreasing displ.)
- X2 Setting piston pressure (increasing displ.)
- X4 Servo supply pressure (before orifice)

Port sizes:

- M14x1.5 (ISO version)
- 9/16"-18 O-ring boss (SAE version).

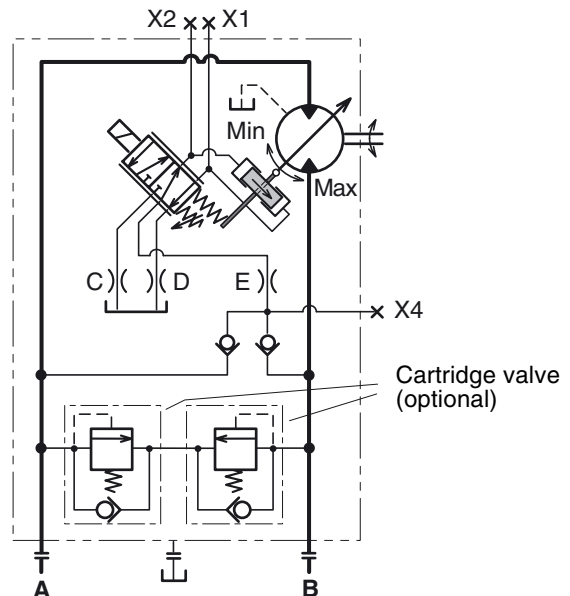
NOTE: Port locations are shown in the illustration on page 42.



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

- The solenoid (which is the same as the one used on the EO control) is either 12 or 24 VDC, requiring 1200 and 600 mA respectively.
- The male connector (type 'Junior Timer') is permanently installed on the solenoid. The corresponding female connector is available as a spare part: P/N 3781939.
- 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 0.6 and 0.3 A respectively. In order to minimize hysteresis, a pulse-width modulated control signal of 50 to 60 Hz should be provided.

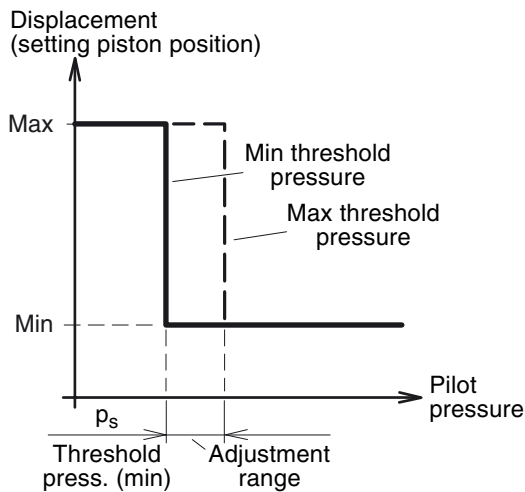
NOTE: The modulating current (ΔI) is not adjustable.



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 43) but the control signal is hydraulic. The position of the servo piston is governed by the built-in servo valve (same as on all controls).
- When the applied pilot pressure (port X5) exceeds the pre-set threshold value, the 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.



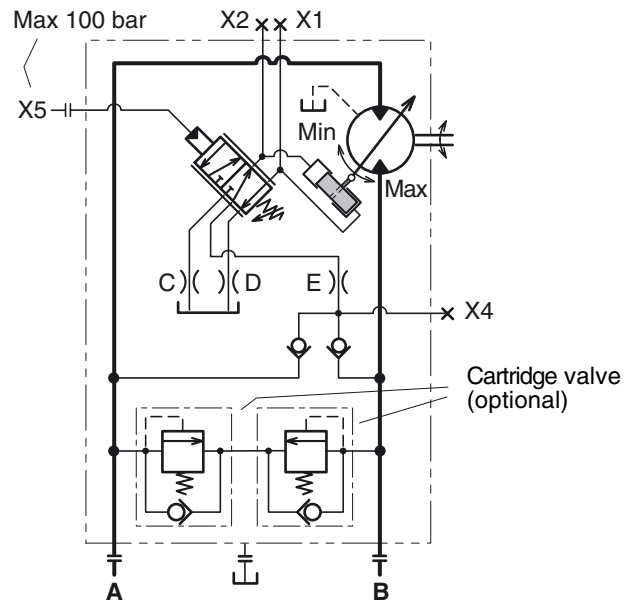
HO diagram (displacement vs. pilot pressure).

Gauge ports (HO and HP controls):

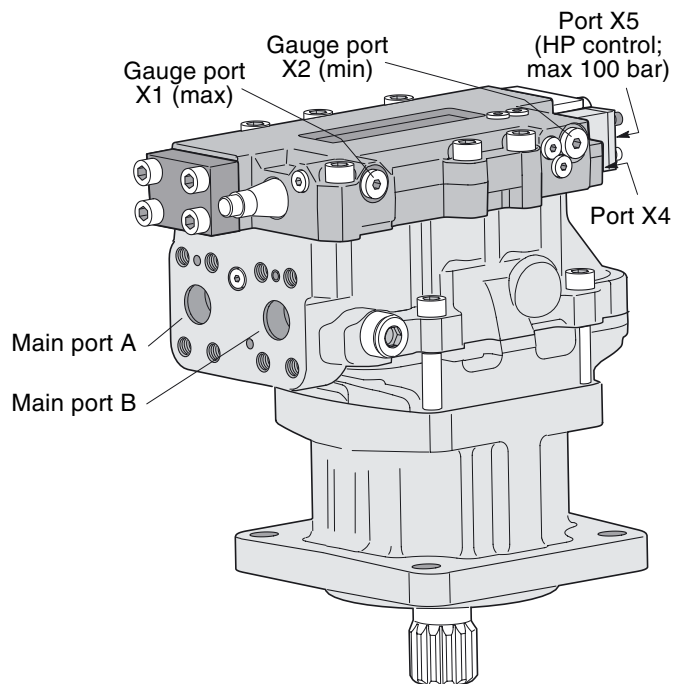
- X1 Setting piston pressure (decreasing displ.)
- X2 Setting piston pressure (increasing displ.)
- X4 Servo supply pressure (before orifice)
- X5 External pilot pressure (max 100 bar; HP control)

Port sizes:

- M14x1.5 (ISO version)
- 9/16"-18 O-ring boss (SAE version).



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



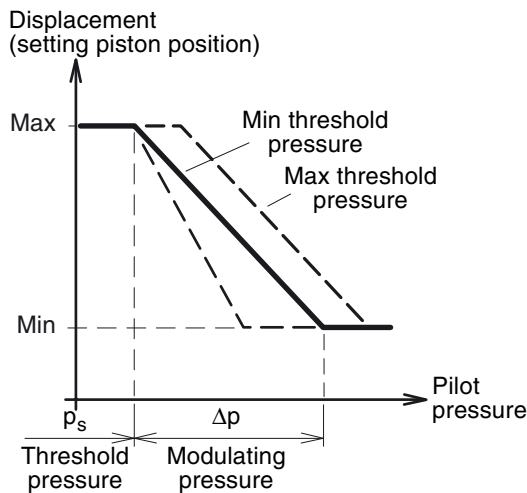
Port locations - V14-110 with HO or HP control.

3

HP hydraulic proportional control

- Like the EP described on page 44, the HP proportional control offers continuously variable displacement, but the controlling signal is hydraulic.
- Normally, the servo piston stays in the max displacement position. When a sufficiently high pilot pressure (p_s) is applied to port X5, the piston starts to move towards the min displacement position.

- 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.
- The modulating pressure (Δp) is factory set at 15 bar; the threshold pressure (p_s) is set at 10 bar but is adjustable between 5 and 25 bar.



HP diagram (displacement vs. pilot pressure).

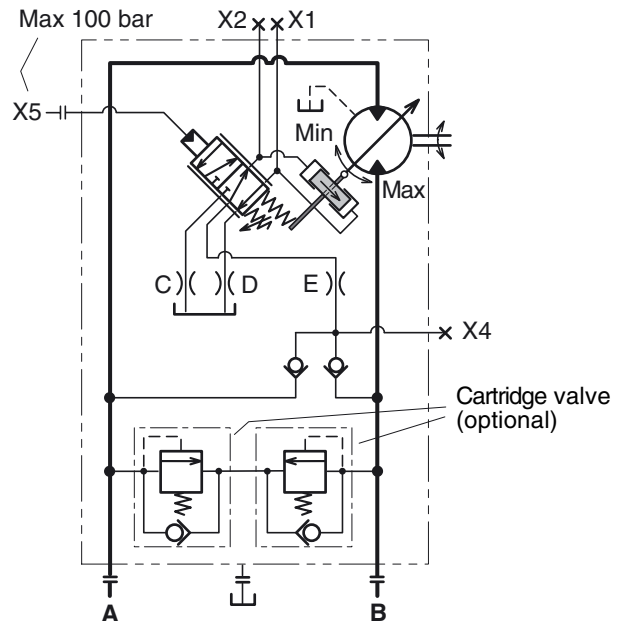
Gauge/pilot ports (HP control):

- 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)

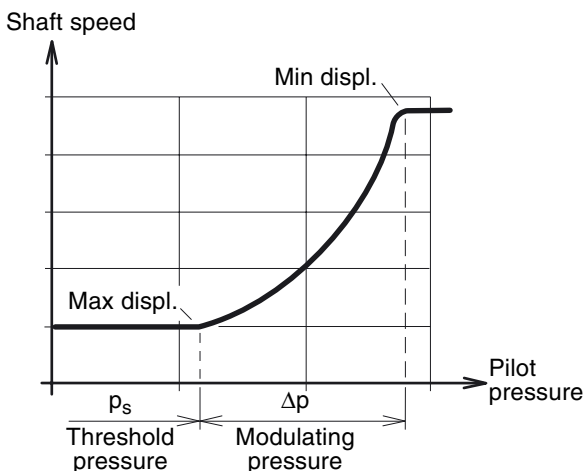
Port sizes:

- M14x1.5 (ISO version)
- $\frac{9}{16}$ "-18 O-ring boss (SAE version).

NOTE: Port locations are shown in the illustration on page 45.

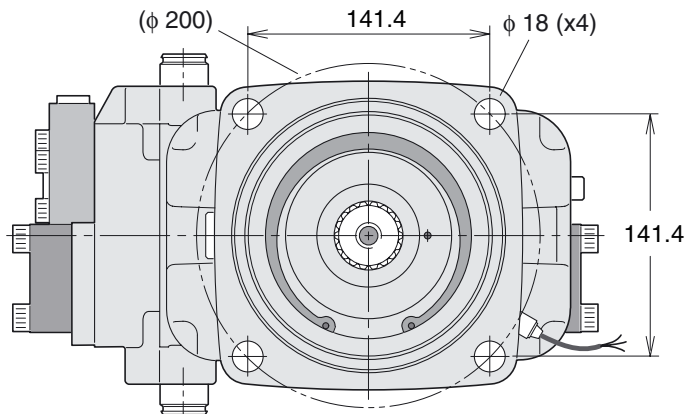


HP schematic (shown: port X5 not pressurized; control moving towards max displacement).

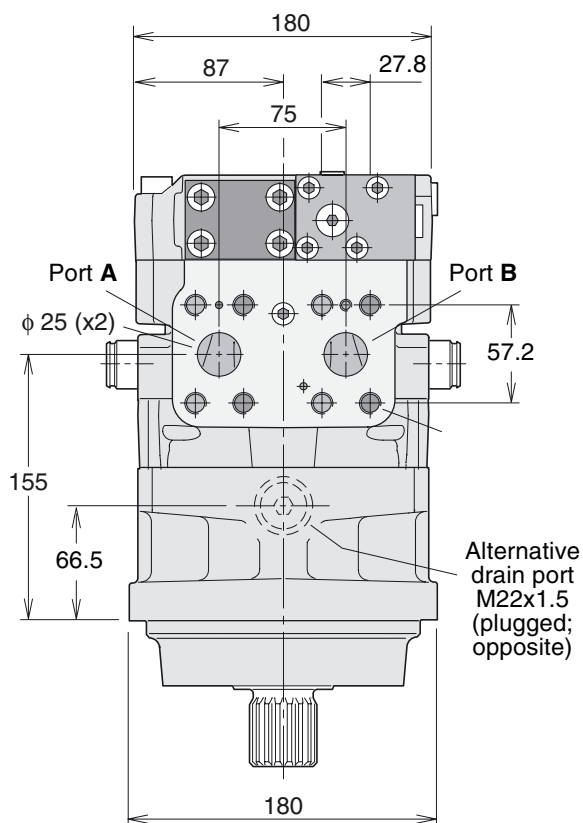
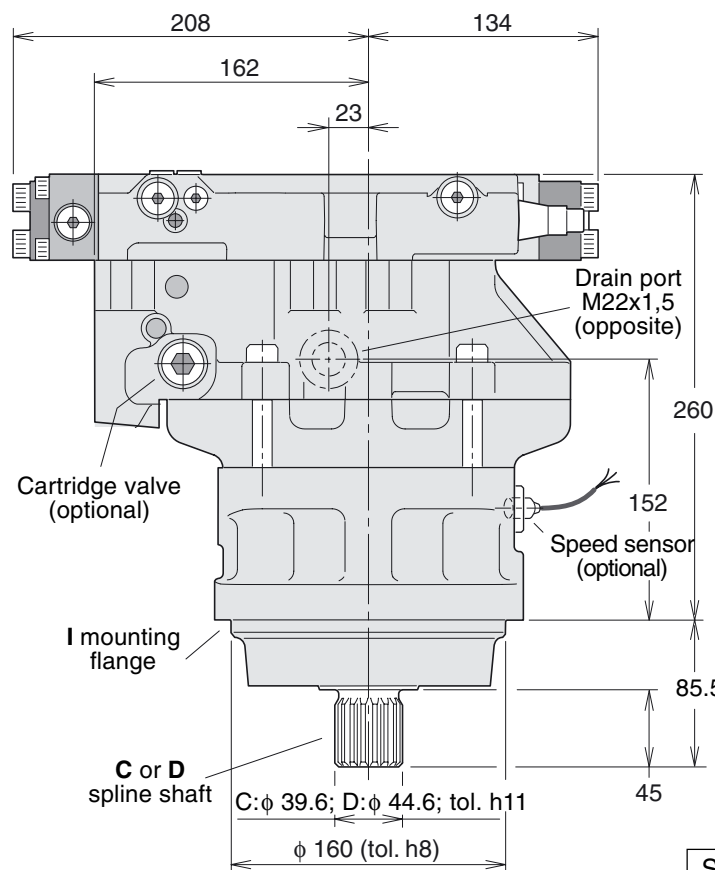


Please note: The shaft speed is **not** proportional to the pilot pressure.

V14-110, ISO version



Shown: V14-110-ISO with AC compensator



| | |
|---|-------------|
| Spline type C ¹⁾ (DIN 5480) | |
| V14-110 | W40x2x18x9g |

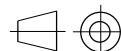
| | |
|---|-------------|
| Spline type D ¹⁾ (DIN 5480) | |
| V14-110 | W45x2x21x9g |

1) '30° involute spline, side fit'

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

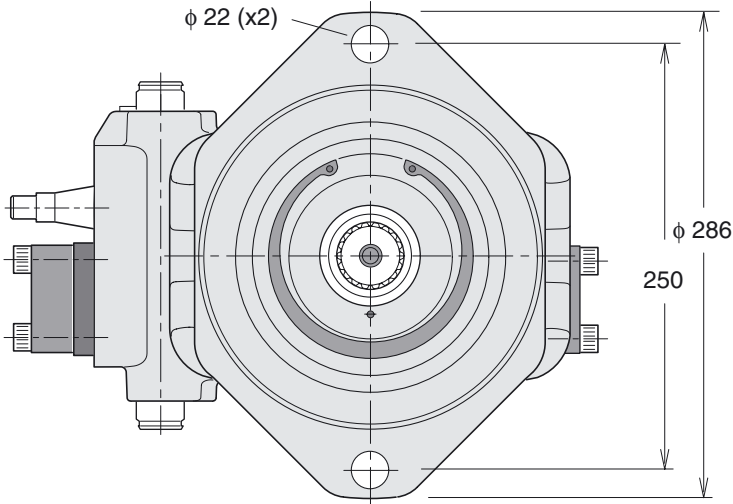
Main ports: ISO 6162, 41.5 MPa, type II

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

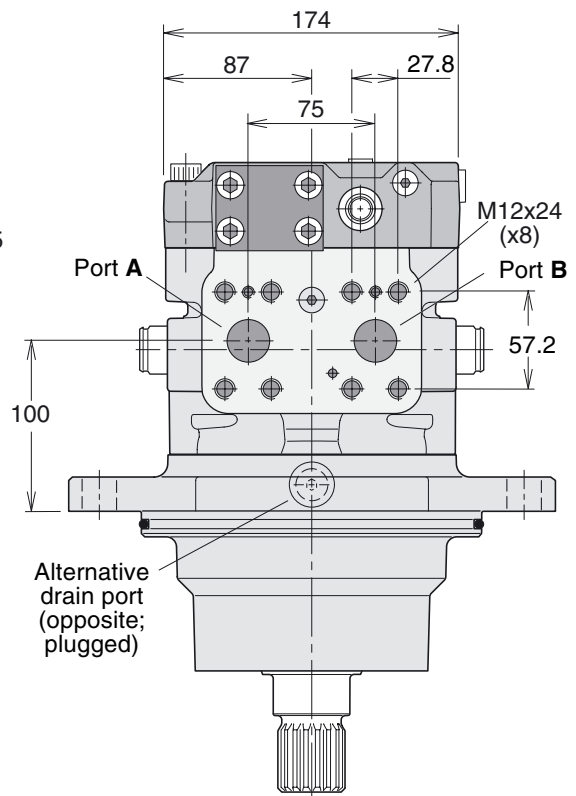
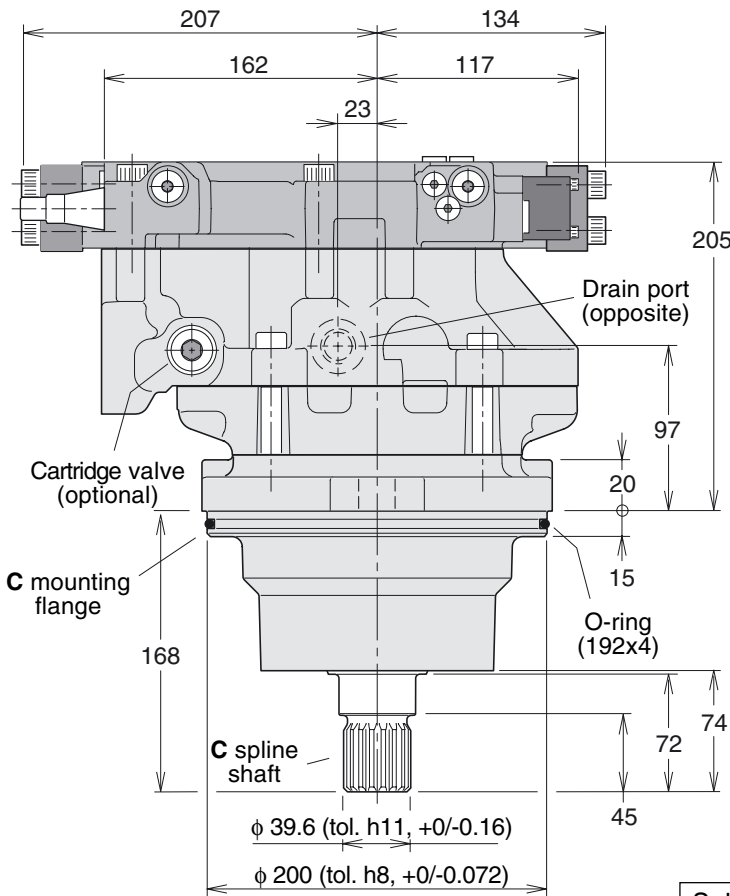


3

V14-110, Cartridge version



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

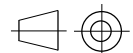


Spline type **C*** (DIN 5480)
V14-110 W40x2x18x9g

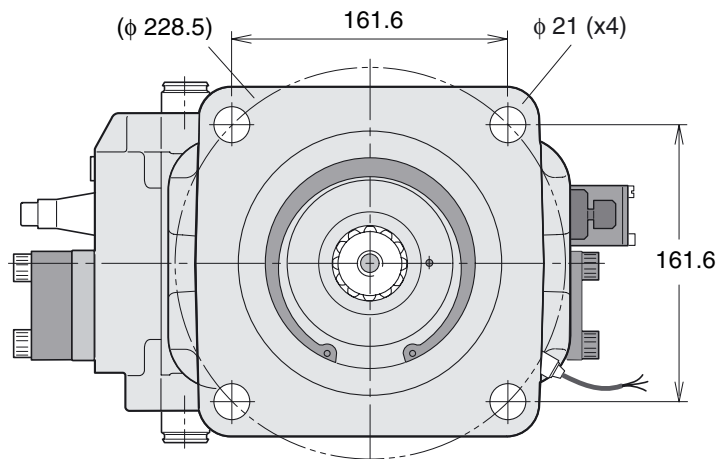
* '30° involute spline, side fit'.

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

Main ports: ISO 6162, 41.5 MPa, type II

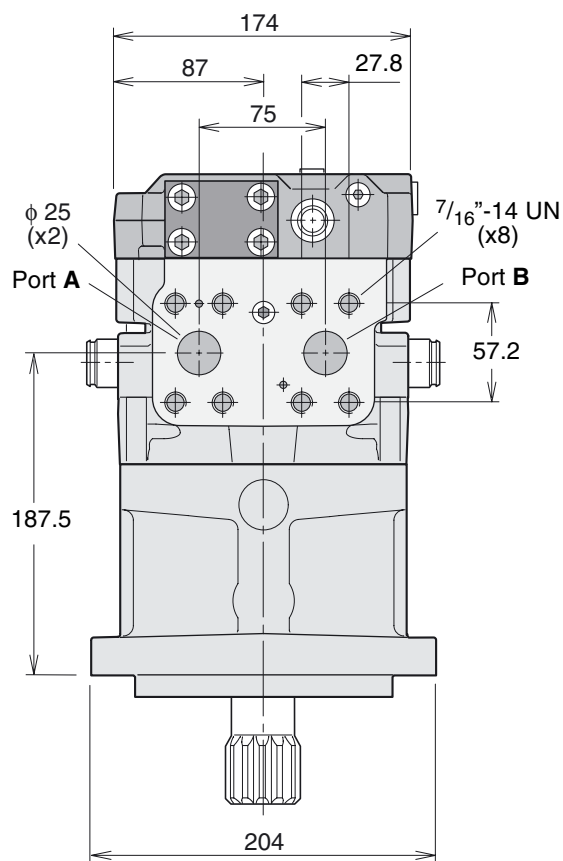
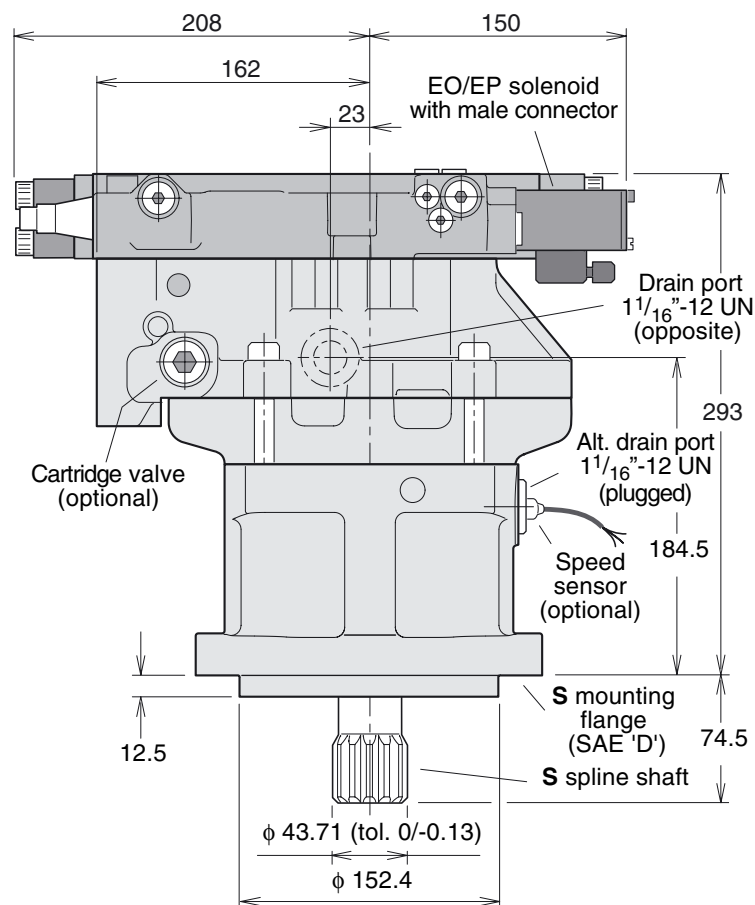


V14-110, SAE version



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

3

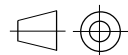


| Spline type S (SAE J498b*) | |
|-----------------------------------|---------------------------|
| V14-110 | SAE 'D' (13T, 8/16 DP) |

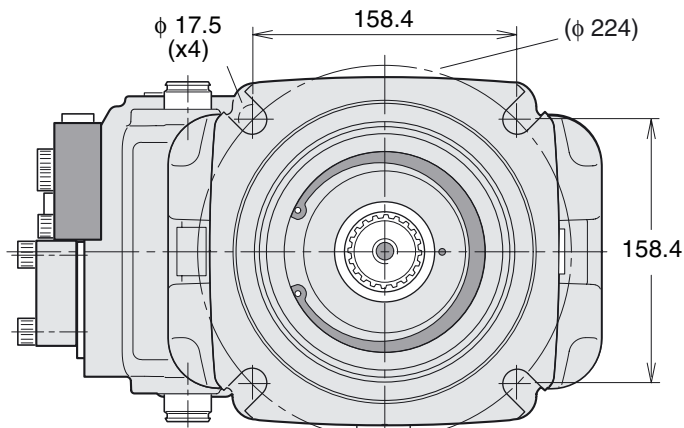
* 30° involute spline, side fit

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

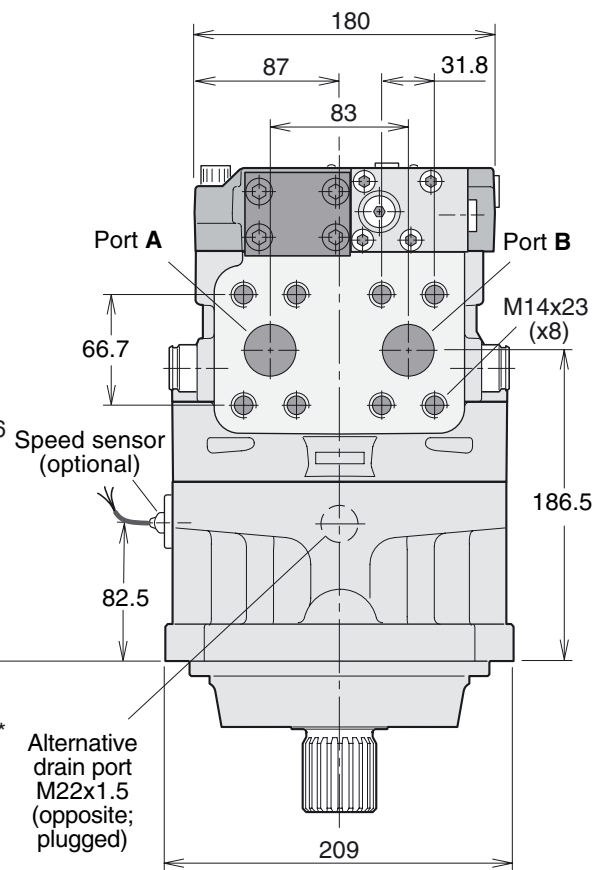
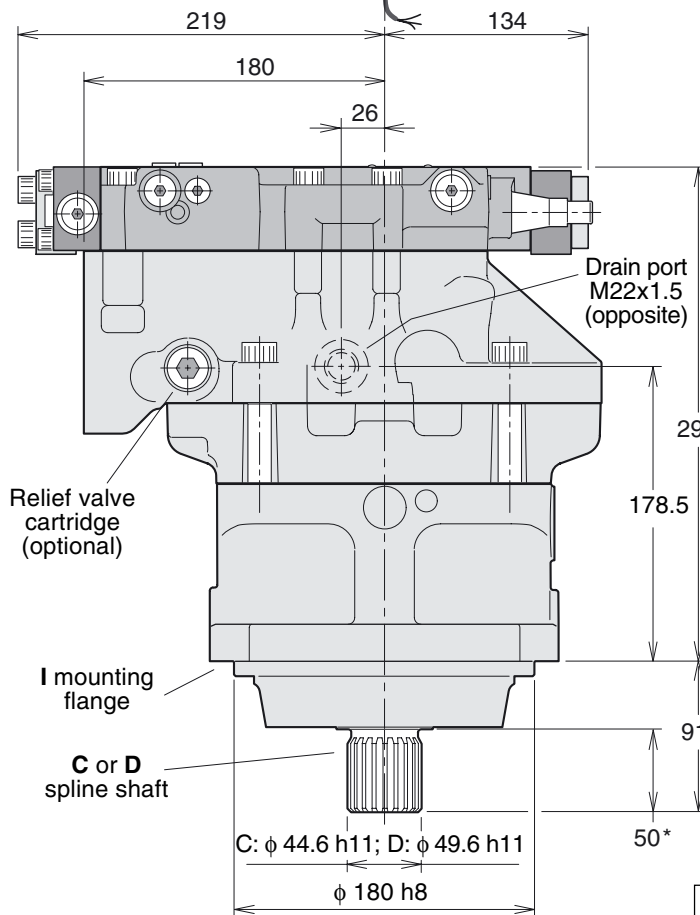
Main ports: SAE J518c, 6000 psi



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.

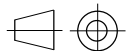
| | |
|---|-------------|
| Spline type C ¹⁾ (DIN 5480) | |
| V14-160 | W45x2x21x9g |

| | |
|-----------------------------------|-------------|
| Spline type D * (DIN 5480) | |
| V14-160 | W50x2x24x9g |

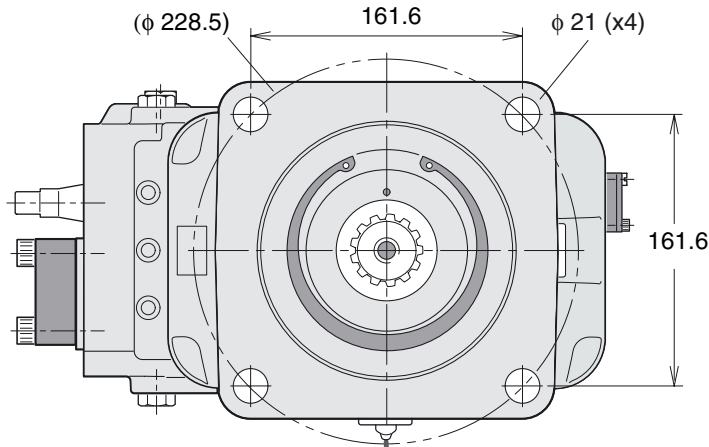
1) '30° involute spline, side fit'.

| | |
|-------------|---------------------------------------|
| Ports | V14-160 |
| Main ports | 32 [1 ¹ / ₄ "] |
| Drain ports | M22x1.5 |

Main ports: ISO 6162, 41.5 MPa, type II

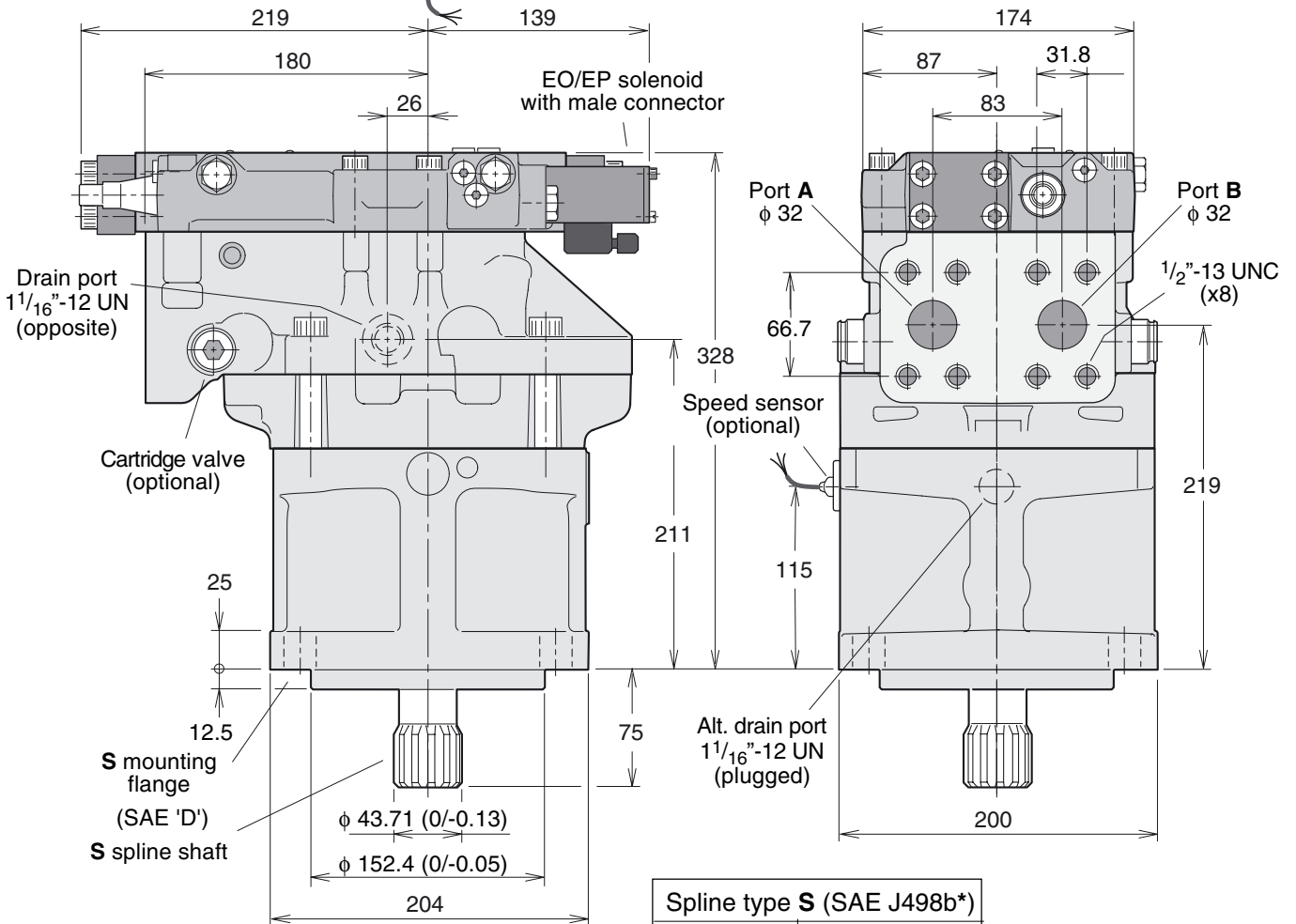


V14-160, SAE version



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

3

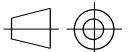


| Spline type S (SAE J498b*) | |
|----------------------------|---------------------------|
| V14-160 | SAE 'D' (13T, 8/16 DP) |

* '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



Valve options (overview)

- Brake valve and pressure relief valves (opt. **B**; below)
- Flushing valve (option **L**; page 53)
- Pressure relief valves (option **P**; page 54)

Sensor options (overview)

- Shaft speed sensor (option **S**; page 53)
- Setting piston position sensor (option **L**; page 55)

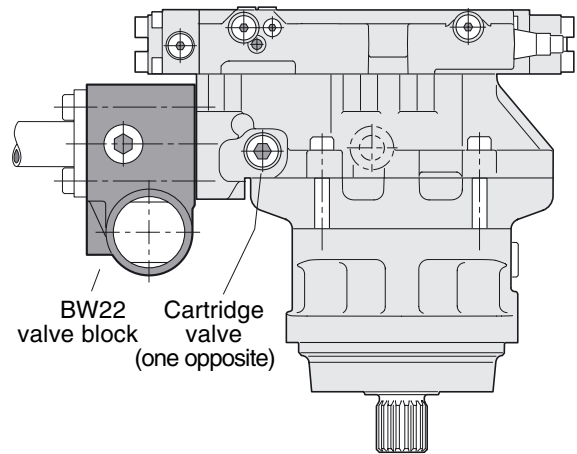
Brake valve and pressure relief valves

(option B)

In applications, such as open circuit excavator wheel drives, a counterbalance or 'brake' valve is normally required.

The BW22 brake valve provides smooth braking and reduces the risk of motor cavitation when the vehicle is in a coasting or braking mode.

The BW22 brake valve block installs directly on the motor connection module as shown in the illustration. The 'S' port is provided for supply of make-up fluid; when sufficiently pressurized, motor cavitation due to pressure losses in the main circuit is greatly reduced.



V14- 110 (AC control) with BW22 valve block.

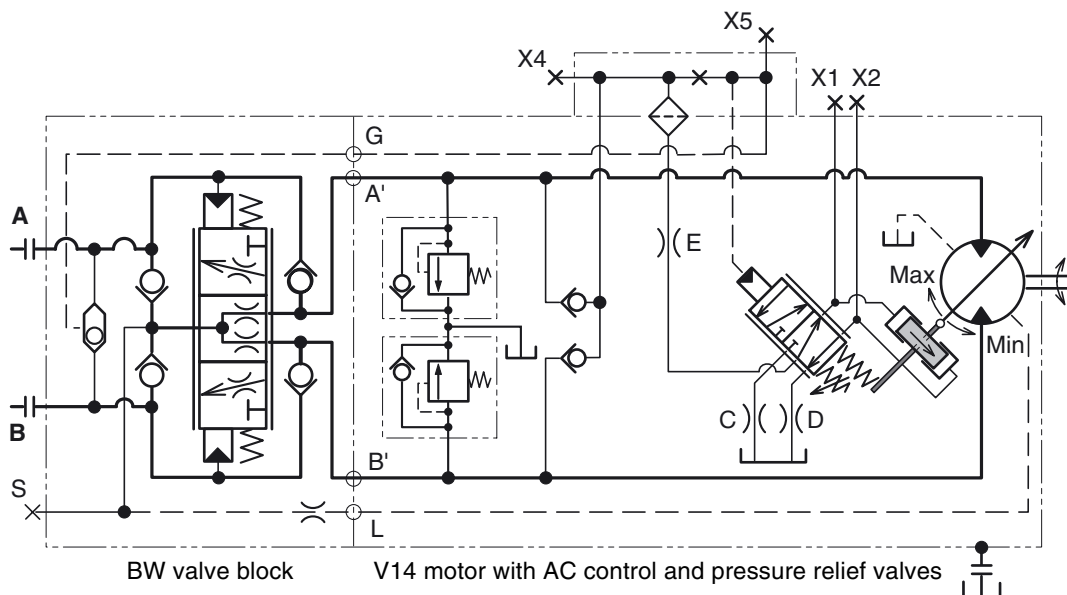
PLEASE NOTE:

1. In order to obtain the intended performance, the BW22 valve must be properly matched to the hydraulic system of a particular vehicle. When considering utilizing this valve, contact Parker Hannifin who will assist in the specification and testing.
2. As a first step, a 'BW2 brake valve specification form' (MI 118) should be requested, filled in and sent to Parker Hannifin. With this information, a valve, suitable for testing, can then be specified.

Additional BW22 brake valve information is available in 'Mobile motor/pump accessories', cat. HY17-8258/UK.

Pressure relief (cartridge) valves are included when ordering 'option B'. The relief valves are integrated in the V14 motor (as shown in the illustration above).

Detailed information is shown on page 54 ('option P').



Hydraulic schematic - V14 with BW22 valve block.

Flushing valve (option L)

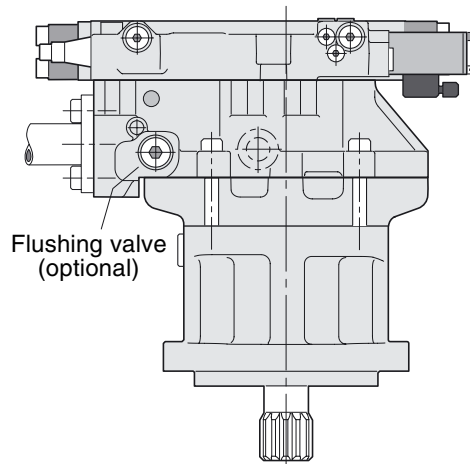
The V14 is available with a flushing (or shuttle) valve that supplies the motor with a cooling flow through the case. Cooling the motor may be required when operating at high speeds and/or power levels.

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.

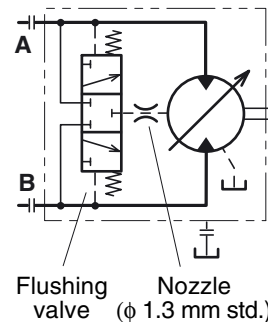
In a closed circuit transmission, the flushing valve removes part of the fluid in the main loop. The removed fluid is continuously being replaced by cool, filtered fluid from the low pressure charge pump on the main pump.

Available nozzles

| Ordering code | Orifice size [mm] | Status |
|---------------|-------------------|-----------------|
| L 010 | 1.0 | Optional |
| L 013 | 1.3 | Standard |
| L 015 | 1.5 | Optional |
| L 017 | 1.7 | " |
| L 020 | 2.0 | " |



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



Hydraulic schematic - V14 with built-in flushing valve.

Shaft speed sensor (option S)

A speed sensor kit is available for the V14.

The ferromat differential (Hall-effect) sensor installs in a separate, threaded hole in the V14 bearing housing.

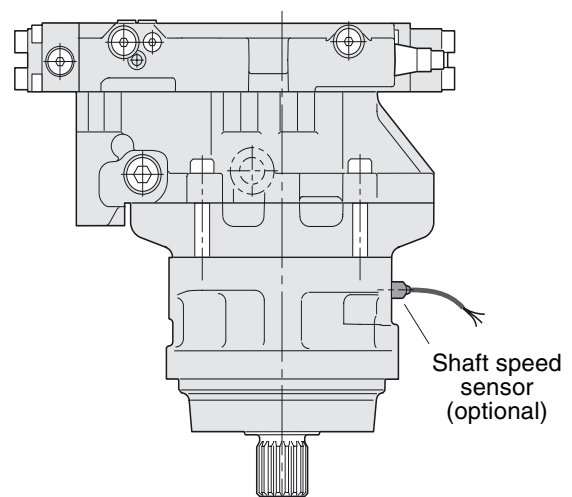
The speed sensor is directed towards the V14 shaft flange and outputs a square wave signal within a frequency range of 5 Hz to 20 kHz. Number of pulses per shaft rev is 36 which, at 5 Hz, corresponds to approx. 8 rpm.

Ordering information

(refer to the ordering codes on pages 33-35)

- N** - None
- C** - Prepared for setting piston position and shaft speed sensors
- D** - Shaft speed and setting piston position sensors
- P** - Prepared for shaft speed sensor
- S** - Shaft speed sensor.

NOTE: Additional information is provided in our publication MI 146, 'Speed sensor for series F12, V12 and V14', available from Parker Hannifin.



V14-110 (AC control) with speed sensor.

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.

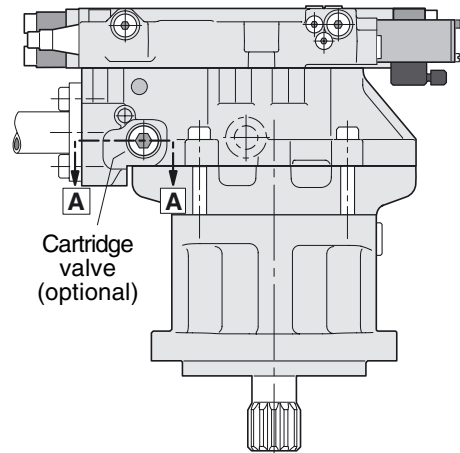
The individual cartridge (with integrated check valve function) has a non-adjustable, factory-set opening pressure, available in pressure settings shown below.

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.

PLEASE NOTE:

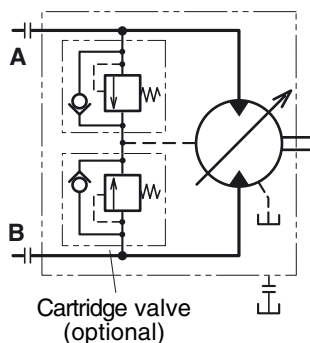
- The pressure relief cartridges should not be used as main pressure reliefs; in a motor application, they should only be relied on to limit short duration pressure peaks (or the temperature of the fluid which circulates through the motor will rapidly reach damaging high levels).
- The main pressure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



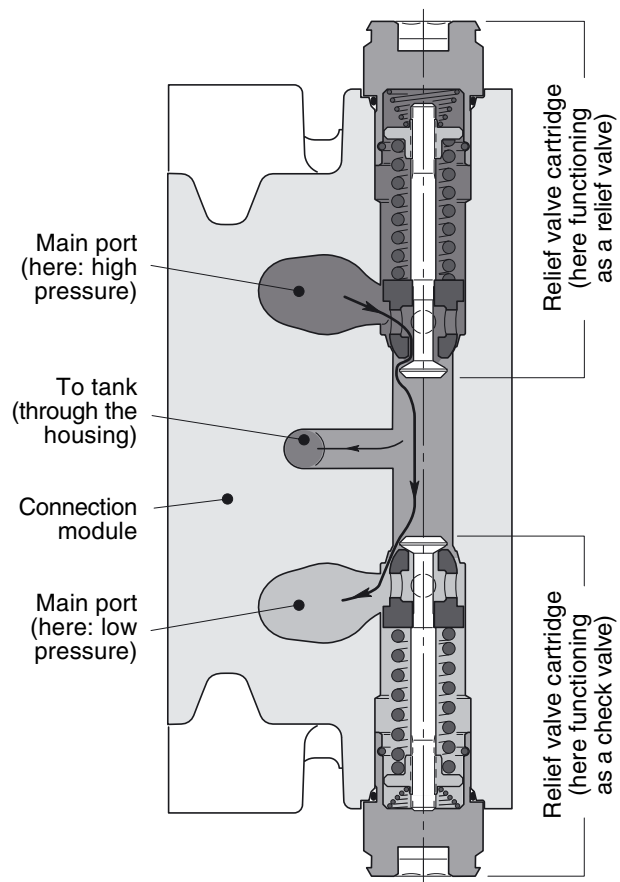
V14- 110 (EP control) with relief valve cartridges.

Available cartridges

| Ordering code | Pressure setting [bar] | Part number |
|---------------|------------------------|-------------|
| P250 | 250 | 3794614 |
| P300 | 300 | 3794616 |
| P350 | 350 | 3794618 |
| P400 | 400 | 3794620 |
| P420 | 420 | 3793529 |
| P450 | 450 | 3794622 |



Hydraulic schematic - V14 with cartridge valves.



Section A-A (showing pressure relief cartridges).



T12

4

| Content | Page | Chapter |
|---|-------------|----------------|
| Specifications | 58 | |
| Port and relief valve locations | 58 | |
| Ordering code | 58 | |
| Two-position control (HO T _ _ I) | 59 | |
| BT brake valve block (optional) | 59 | |
| Pressure relief valves (optional) | 59 | |
| FV flushing valve block (optional) | 59 | |
| T12-60, Installation dimensions | 60 | |
| T12-80, Installation dimensions | 61 | |
| Installation and start-up information | 63 | 5 |

Two-position control (HOT __ I)

The displacement is controlled by means of pilot pressure in port X5. When this pressure exceeds the threshold pressure, 15 bar, the displacement is switched to min.

The T12 motor can be ordered with max and/or min displacement limiters.

The control is available in two versions:

- **HO T 01 I** (with standard nozzles) provides a 'fast' control response (max-to-min and min-to-max)
- **HO T 02 I** (optional) with 'slow' control response.

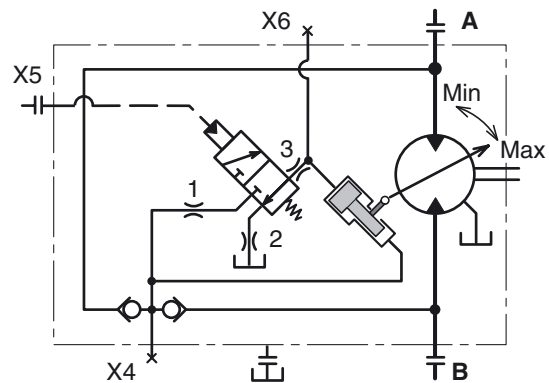
Gauge and pilot ports

- X4 Servo supply (before nozzle)
- X5 Pilot pressure (min 15 bar; standard)
- X6 Setting piston pressure (decreasing displ.)

Port size

- M14x1.5 (all)

NOTE: '1', '2' and '3' are nozzles.



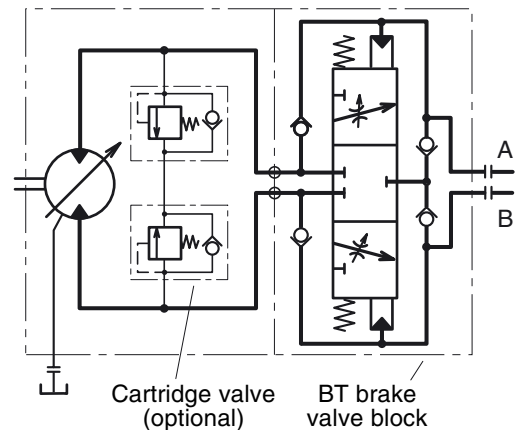
T12 schematic (no pilot pressure; the control is in max displacement position).

BT brake valve block (optional)

The BT brake (overcenter) valve is used to prevent overspeed in an open circuit (e.g. when the vehicle goes downhill).

The brake valve installs directly on the main port flange.

NOTE: For additional information refer to 'Mobile motor/pump accessories', catalogue HY17-8258/UK.



T12 with cartridge valves and brake valve block type BT.

Pressure relief valves (optional)

As an option, T12 motors can be ordered with pressure relief valves, designed to protect the motor and the main hydraulic system from short duration pressure peaks.

The non-adjustable cartridge valves are integrated in the motor end cap and available with the following pressure settings:

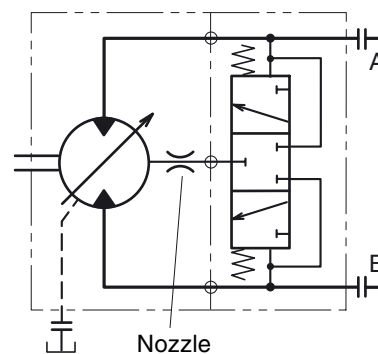
280, 300, 350, 380, 400 or 420 bar.

FV flushing valve block (optional)

The FV flushing valve supplies the T12 motor with a cooling flow usually required when the motor is operating at high speeds and/or high power levels.

The valve block mounts directly on the main port flange.

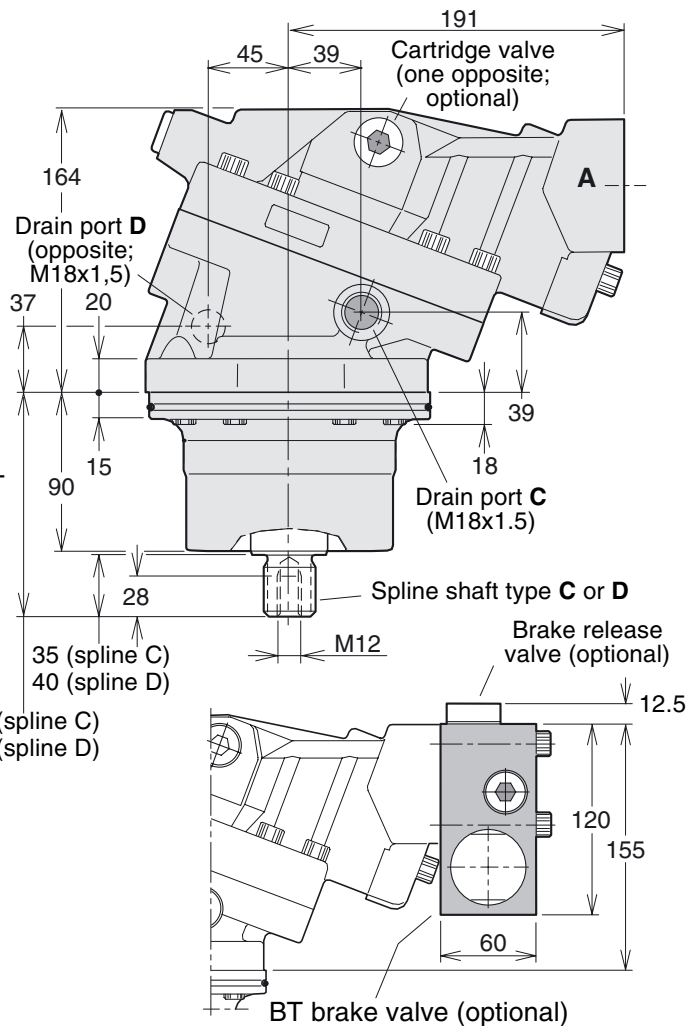
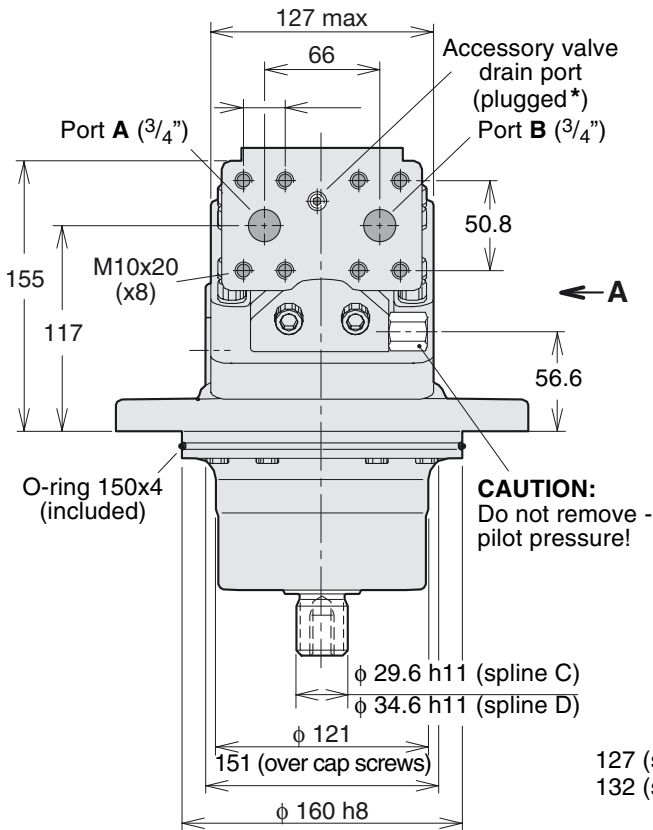
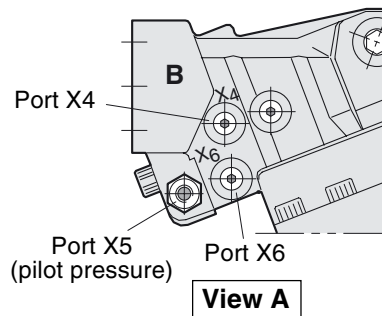
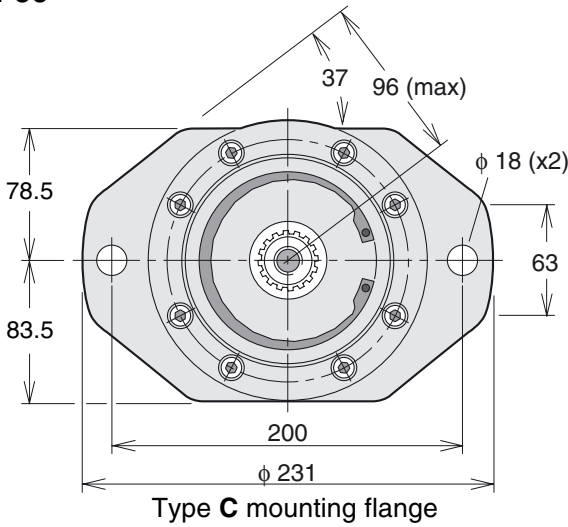
NOTE: For additional information refer to 'Mobile motor/pump accessories', catalogue HY17-8258/UK.



T12 with flushing valve block type FV.

4

T12-60



*** NOTE:**

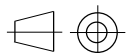
The accessory valve drain port plug **must be removed** before installing one of the following valves:

- **BT** brake valve (with flushing valve 'L' and/or brake release funktion 'B')
- **FV** flushing valve.

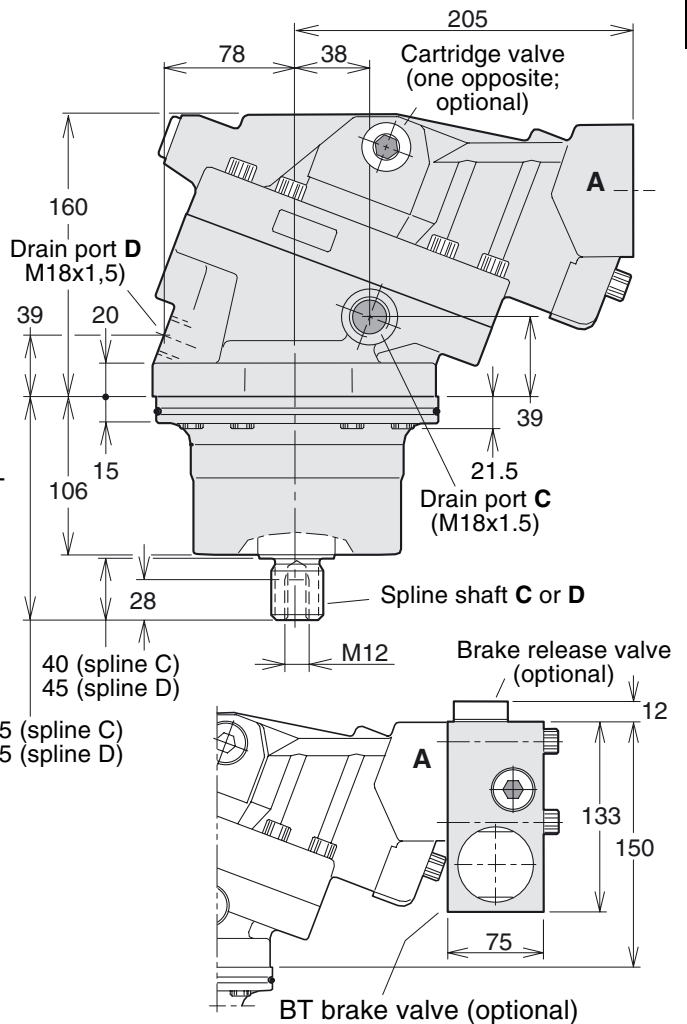
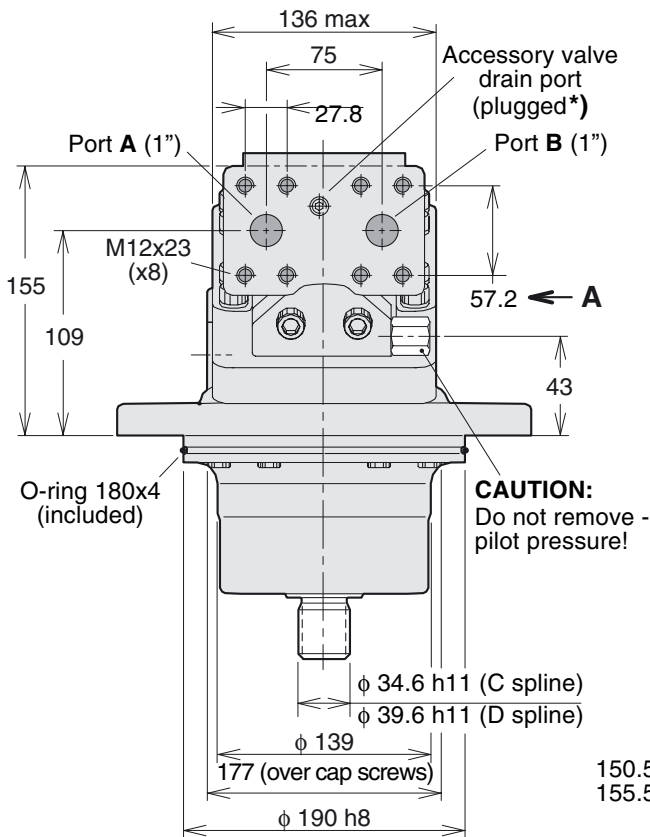
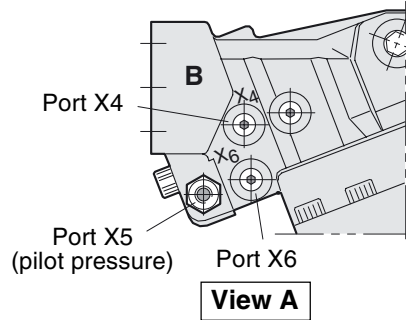
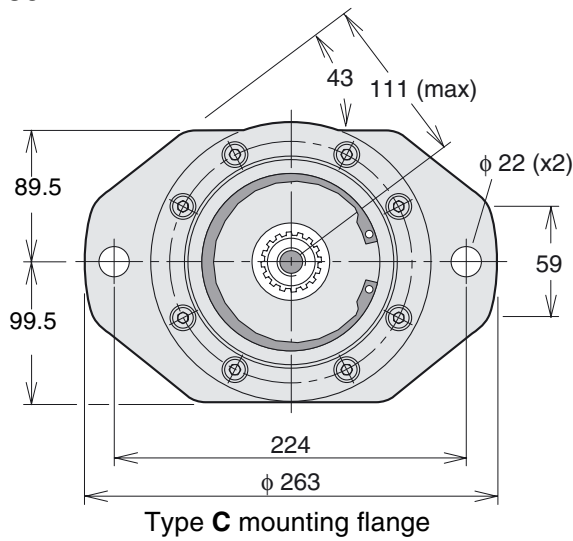
For further information, refer to 'Mobile motor/pumps accessories', catalogue HY17-8258/UK.

| Spline ¹⁾ | C (standard) | D (optional) |
|----------------------|--------------|--------------|
| T12-60 | W30x2x14x9g | W35x2x16x9g |

1) DIN 5480 ('30° involute spline, side fit').



T12-80



*** NOTE:**

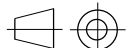
The accessory valve drain port plug **must be removed** before installing one of the following valves:

- **BT** brake valve (with flushing valve 'L' and/or brake release funktion 'B')
- **FV** flushing valve.

For further information, refer to 'Mobile motor/pumps accessories', catalogue HY17-8258/UK.

| Spline ¹⁾ | C (standard) | D (optional) |
|----------------------|--------------|--------------|
| T12-80 | W35x2x16x9g | W40x2x18x9g |

1) DIN 5480 ('30° involute spline, side fit').





| Content | Page |
|---|-------------|
| Direction of rotation versus flow | 64 |
| Filtration | 64 |
| Case pressure | 64 |
| Required inlet pressure | 64 |
| Operating temperatures | 64 |
| Drain ports | 65 |
| Hydraulic fluids | 65 |
| Before start-up | 65 |
| Split-flange kits | 66 |

Direction of rotation versus flow

NOTE: The V12, V14 and T12 motors are bi-directional.

V12 rotation:

- End cap position **T** (AC, AD 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).

T12 rotation:

- Refer to the V14 illustration below right.

NOTE: Before installing a V12, V14 or T12 motor in series (when both A and B ports can be subject to high pressures simultaneously) contact Parker Hannifin.

Filtration

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

Case pressure

The lowest and highest recommended case pressure (shaft seal type **H**) at selected shaft speeds is shown in the table below.

The min pressure secures sufficient lubrication, and the max pressure nominal seal life.

Case pressure should be measured in the drain port.

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].

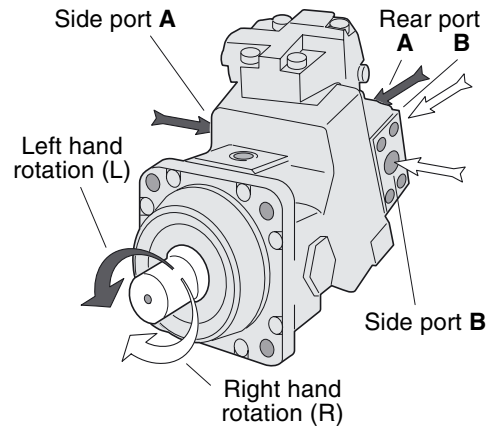
NOTE: Contact Parker Hannifin for information on other shaft seals.

Required inlet pressure

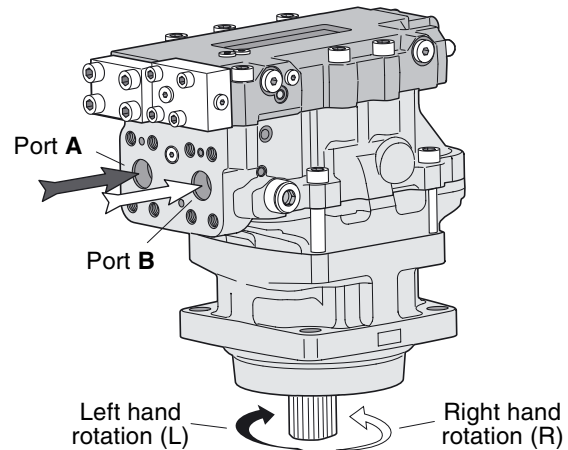
The motor may operate as a pump under certain conditions. When this occurs, a minimum pressure must be maintained at the inlet port; increased noise and gradually deteriorating performance due to cavitation may otherwise be experienced.

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.



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).

Operating temperatures

The following temperatures should not be exceeded (type **H** shaft seal):

Main circuit: 80 °C.

Drain fluid: 100 °C.

FPM shaft seals (fluorocarbon; type **V**) can be used to 115 °C drain fluid temperature.

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 28.
- V14: 'Flushing valve', page 53
- T12: 'Flushing valve block', page 59.

Drain ports

There are two drain ports on the V12, V14 and T12 motors. The uppermost drain port should always be utilized (see illustrations on the previous page).

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

When the motor is operating, the case must be filled with fluid to at least 50%.

NOTE: - A spring loaded check valve in the drain line (shown in the V14 illustrations to the right) may have to be installed in order to prevent oil from being siphoned out of the motor case. This can otherwise happen if, e.g., the reservoir is located below the utilized motor drain port.

- 'High speed operation' available from Parker Hannifin.

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 mm²/s (cSt).

At start-up, the viscosity should not exceed 1500 mm²/s.

The ideal operating range for the motor is 15 to 30 mm²/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.

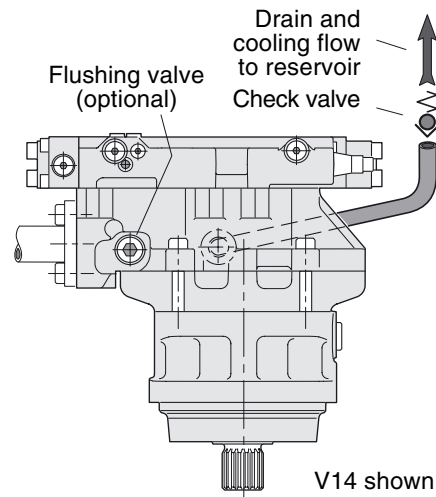


Fig. 1.

V14 shown

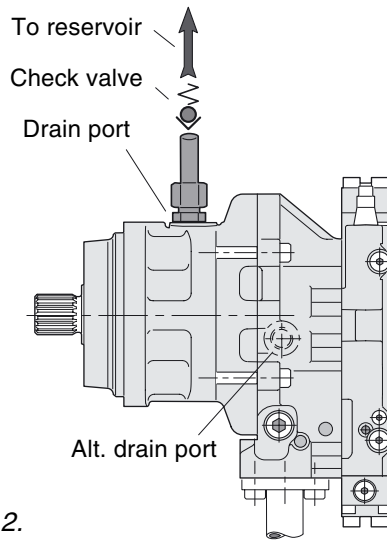


Fig. 2.

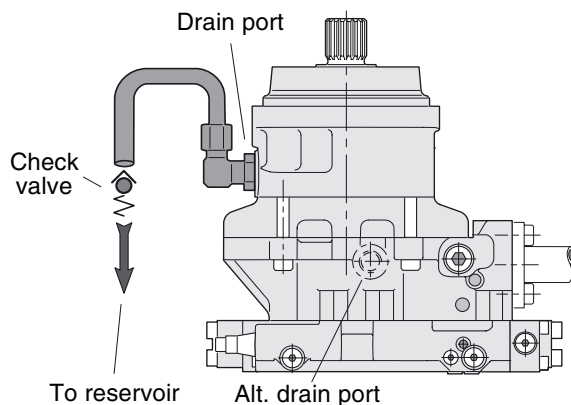
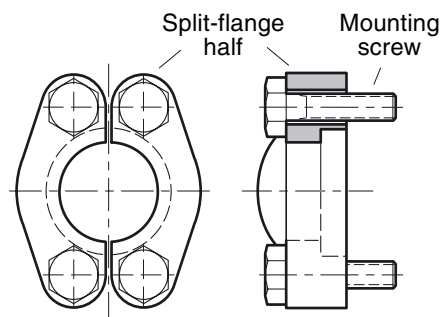


Fig. 3.

Split-flange kits

Metric split-flange kits, consisting of two split-flange halves and four mounting screws for use on V12 ISO and cartridge versions, are available from Parker Hannifin.

| Part no. | SAE size | For | Screw size |
|----------|----------|------------|------------|
| 3794405 | 3/4" | V12-60/-80 | M10x35 |
| 3704329 | 1" | V14-110 | M12x40 |
| 3704330 | 1 1/4" | V12-160 | M14x45 |
| 3704330 | 1 1/4" | V14-160 | M14x45 |
| 3794405 | 3/4" | T12-60/-80 | M10x35 |





WARNING

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

This document and other information from Parker Hannifin Corporation, its subsidiaries and authorized distributors provide product and/or system options for further investigation by users having technical expertise. It is important that you analyze all aspects of your application, including consequences of any failure, and review the information concerning the product or system in the current product catalogue. Due to the variety of operating conditions and applications for these products or systems, the user, through its own analysis and testing, is solely responsible for making the final selection of the products and systems and assuring that all performance, safety and warning requirements of the application are met.

The products described herein, including without limitation, product features, specifications, designs, availability and pricing, are subject to change by Parker Hannifin Corporation and its subsidiaries at any time without notice.

Offer of Sale

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

Hydraulics Group Sales Offices

Europe

Austria
Wiener Neustadt
Tel: +43 (0)2622 23501
Fax: +43 (0)2622 66212

Belgium
Nivelles
Tel: +32 (0)67 280 900
Fax: +32 (0)67 280 999

Czech Republic
Prague
Tel: +420 2 830 85 224
Fax: +420 2 830 85 360

Denmark
Ballerup
Tel: +45 4356 0400
Fax: +45 4373 8431

Finland
Vantaa
Tel: +358 (0)9 4767 31
Fax: +358 (0)9 4767 3200

France
Contamine-sur-Arve
Tel: +33 (0)450 25 80 25
Fax: +33 (0)450 03 67 37

Germany
Kaarst
Tel: +49 (0)2131 4016 0
Fax: +49 (0)2131 4016 9199

Hungary
Budapest
Tel: +36 (06)1 220 4155
Fax: +36 (06)1 422 1525

Ireland
Dublin
Tel: +353 (0)1 293 9999
Fax: +353 (0)1 293 9900

Italy
Corsico (MI)
Tel: +39 02 45 19 21
Fax: +39 02 4 47 93 40

The Netherlands
Oldenzaal
Tel: +31 (0)541 585000
Fax: +31 (0)541 585459

Norway
Ski
Tel: +47 64 91 10 00
Fax: +47 64 91 10 90

Poland
Warsaw
Tel: +48 (0)22 573 24 63
Fax: +48 (0)22 573 24 90

Portugal
Leca da Palmeira
Tel: +351 22 9997 360
Fax: +351 22 9961 527

Slovakia
Ref. Czech Republic

Spain
Madrid
Tel: +34 91 675 73 00
Fax: +34 91 675 77 11

Sweden
Spånga
Tel: +46 (0)8 597 950 00
Fax: +46 (0)8 597 951 10

United Kingdom
Warwick
Tel: +44 (0)1926 317 878
Fax: +44 (0)1926 317 855

International

Australia
Castle Hill
Tel: +61 (0)2-9634 7777
Fax: +61 (0)2-9899 6184

Canada
Milton, Ontario
Tel: +1 905-693-3000
Fax: +1 905-876-0788

China
Beijing
Tel: +86 10 6561 0520
Fax: +86 10 6561 0526

Asia Pacific Group
Hong Kong, Kowloon
Tel: +852 2428 8008
Fax: +852 2425 6896

India
Mumbai
Tel: +91 22 7907081
Fax: +91 22 7907080

Japan
Tokyo
Tel: +(81) 3 6408 3900
Fax: +(81) 3 5449 7201

Latin America Group
Brazil
Tel: +55 12 3954-5100
Fax: +55 12 3954-5266

South Africa
Kempton Park
Tel: +27 (0)11-961 0700
Fax: +27 (0)11-392 7213

USA
Cleveland (industrial)
Tel: +1 216-896-3000
Fax: +1 216-896-4031
Lincolnshire (mobile)
Tel: +1 847-821-1500
Fax: +1 847-821-7600

Parker Hannifin is the world's premier supplier of motion and control systems and solutions, with sales and manufacturing facilities throughout the world. For product information and details of your nearest Parker sales office, visit us at www.parker.com/euro_mcd or call free on 00800 2727 5374.



Catalogue HY17-8223/UK
PDF 11/04

© Copyright 2004
Parker Hannifin Corporation
All rights reserved.