V12



V14



V16



Series V12/V14/V16

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

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

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

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

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

Features

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

Applications

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

Optional equipment

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

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Bearing life

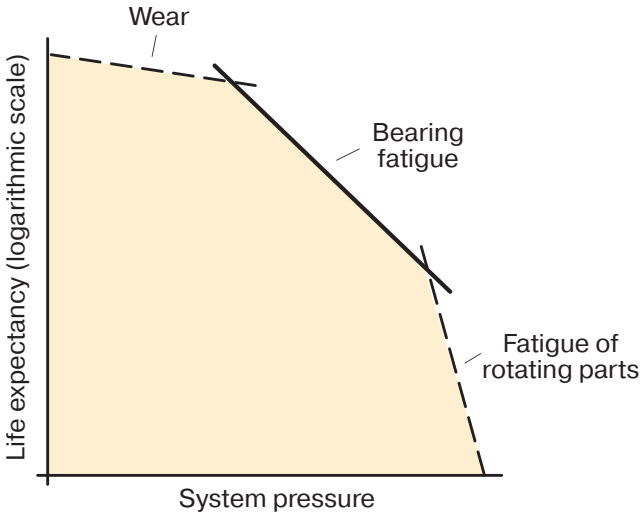
General information

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

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

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

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



Hydraulic motor life versus system pressure.

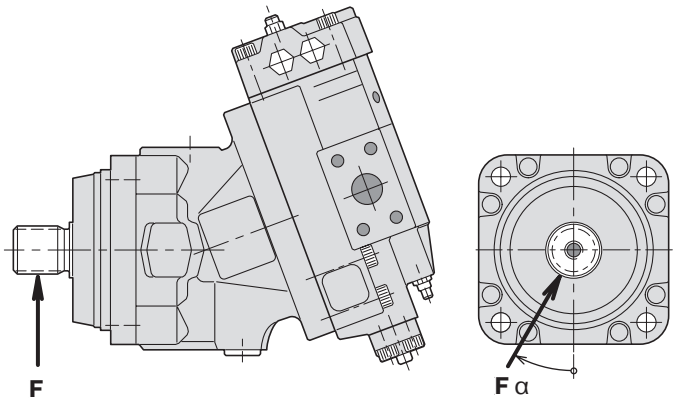
Bearing life calculation

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

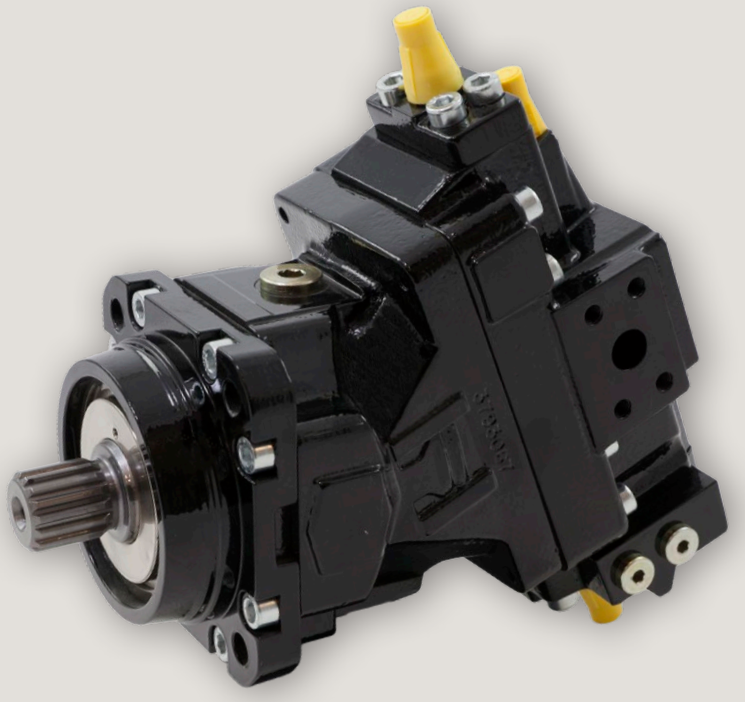
Required information

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

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



V12



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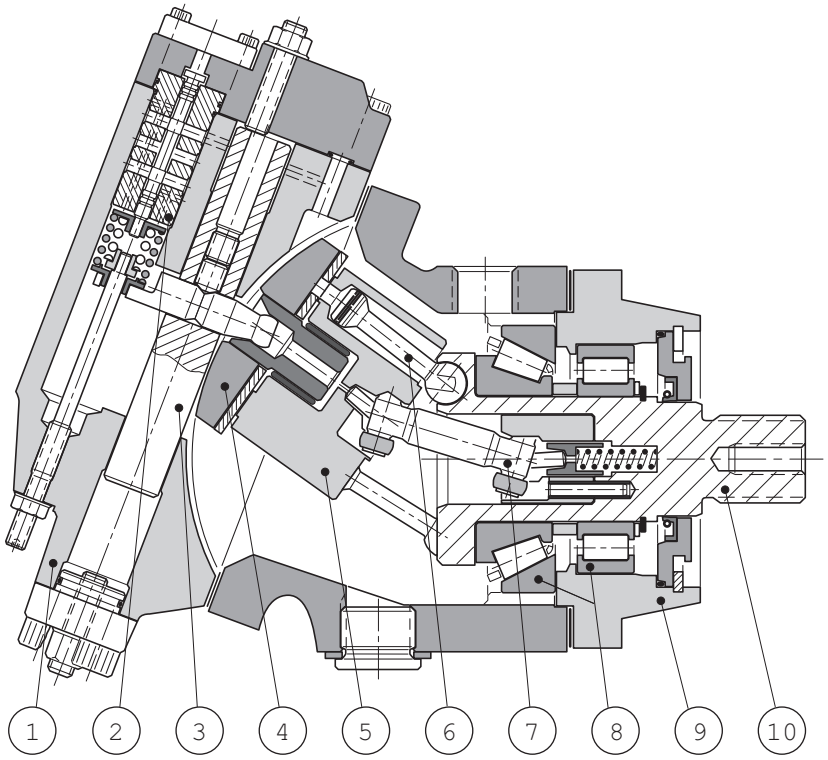
Valve and sensor options 94

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V12 cross section

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



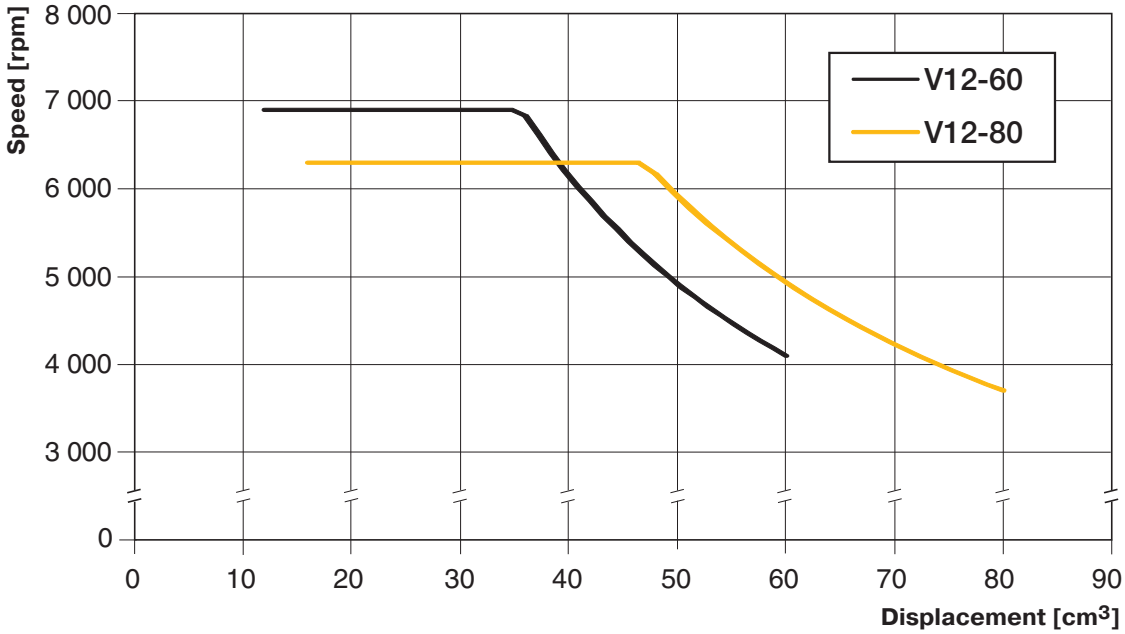
Specifications

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

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

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Continuous Speed vs. Displacement



Efficiency diagrams

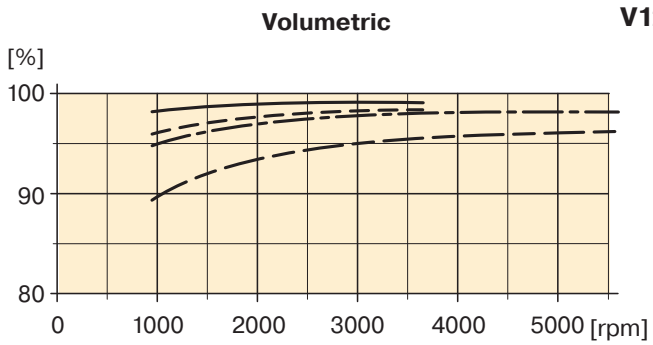
The following diagrams show volumetric and overall efficiencies versus shaft speed at 210 and 420 bar operating pressure, and at full (35°) and reduced (10°) displacements.

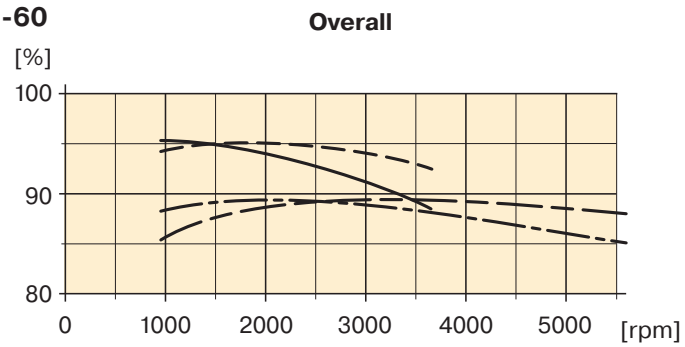
Information on efficiencies for a specific load condition can be made available from Parker Hannifin.

210 bar at full displacement
420 bar " " "

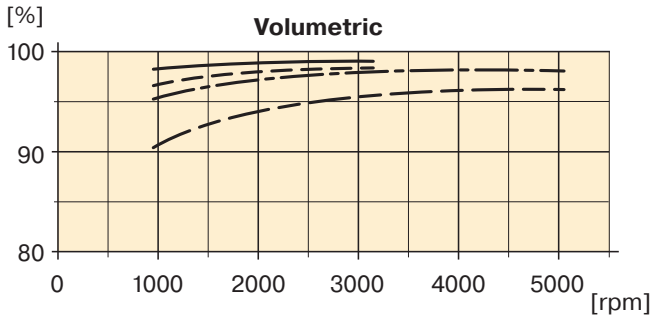
210 bar at reduced displacement
420 bar " " "

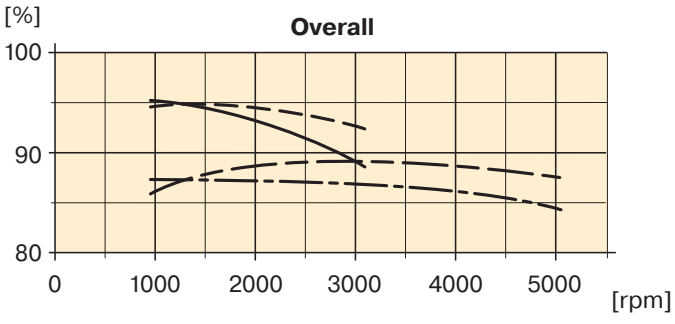
V12-60





V12-80





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Controls (general information)

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

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

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

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

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

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

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

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

AC pressure compensator

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

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

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

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

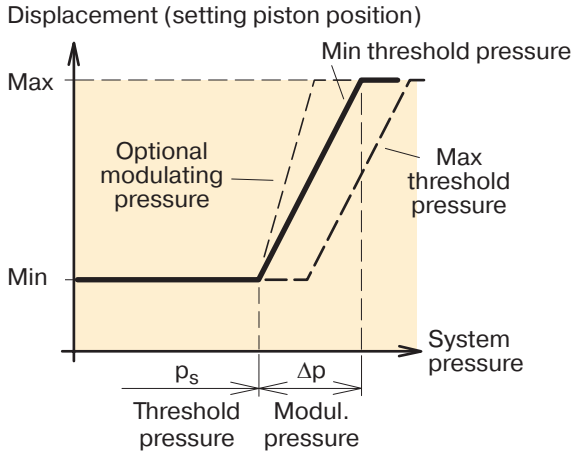
To satisfy specific hydraulic circuit requirements, a modulating pressure, Δp, of 15, 25 or 50 bar can be selected.

The AC compensator is available in two versions:

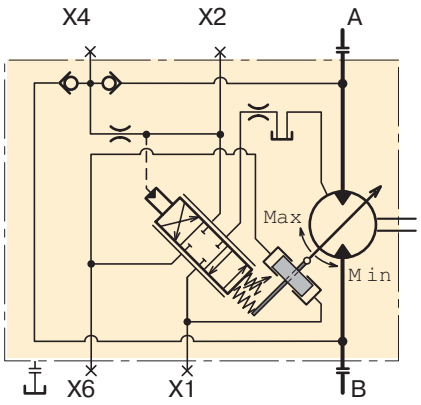
ACI 01 I - Internal pilot pressure

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

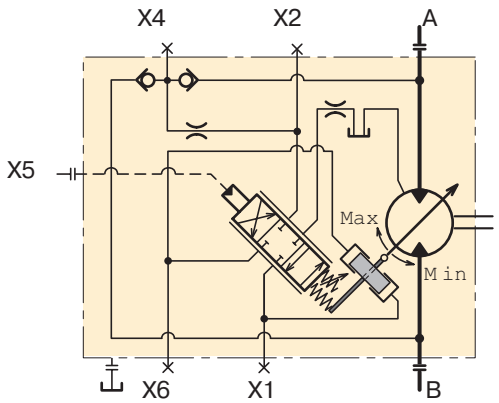
Gauge/pilot ports (AC compensator):	
X1	Setting piston pressure (increasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure
X6	Setting piston pressure (decreasing displ.)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18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



AC diagram.



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



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

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AH pressure compensator

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

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

The AH compensator is available in two versions:

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

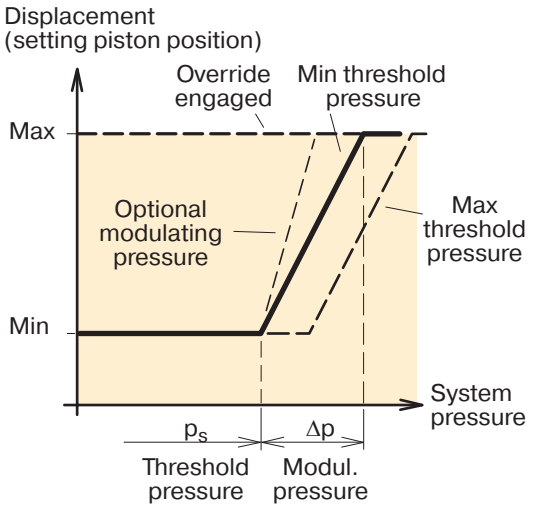
AHE 01 I – (optional) External pilot pressure (port X5; compare ACE, page 9).

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

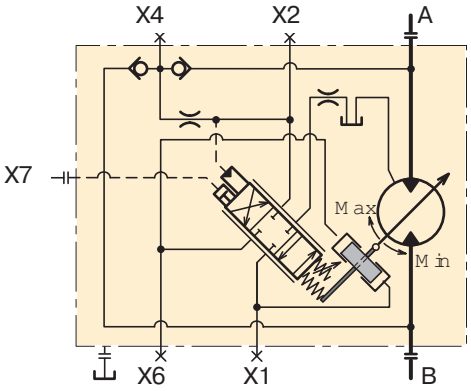
$$p_7 = \frac{p_S + \Delta p}{24} \quad [bar]$$

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

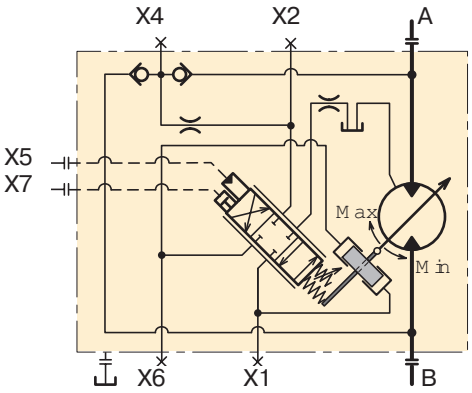
Gauge/pilot ports (AH compensator)	
X1	Setting piston pressure (increasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure
X6	Setting piston pressure (decreasing displ.)
X7	Override pressure
Port sizes:	
–	M14x1.5 (ISO and cartridge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



AH diagram.



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



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

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EO two-position control

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

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

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

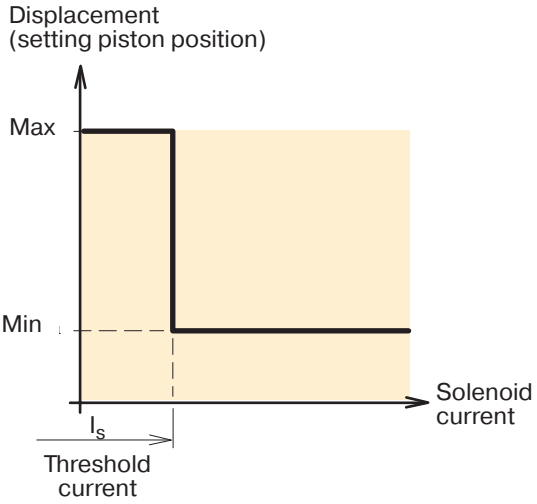
Servo pressure is supplied internally (through the shuttle valve from one of the main high pressure ports) or externally (port X4).

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

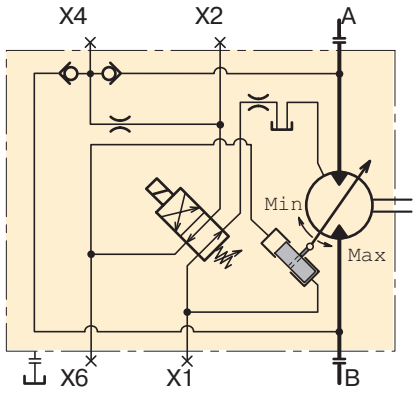
The EO two-position control is available in four versions:

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

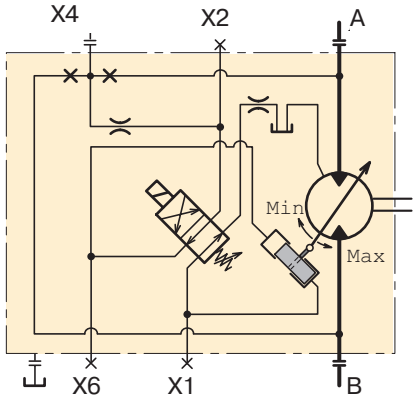
Gauge/pilot ports (EO control):	
X1	Setting piston pressure (max-to-min)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X6	Setting piston pressure (min-to-max)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).



EO diagram.



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



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

EP proportional control

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

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

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

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

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

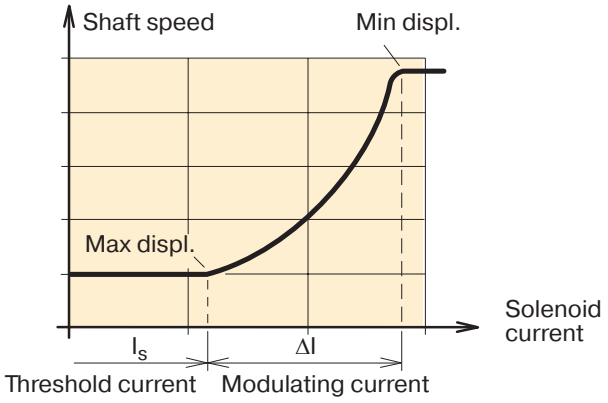
In order to minimize hysteresis, a pulse-width modulated control signal of 70 to 90 Hz should be utilized.
See also “Controls, Note” on page 9.

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

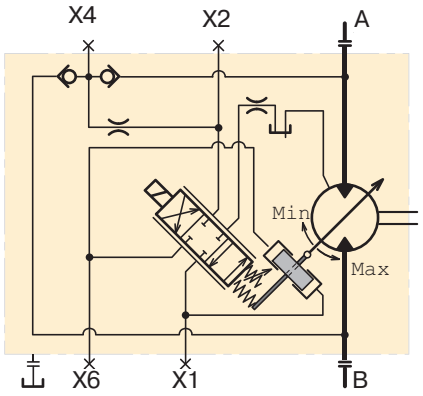
The EP control is available in four versions:

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

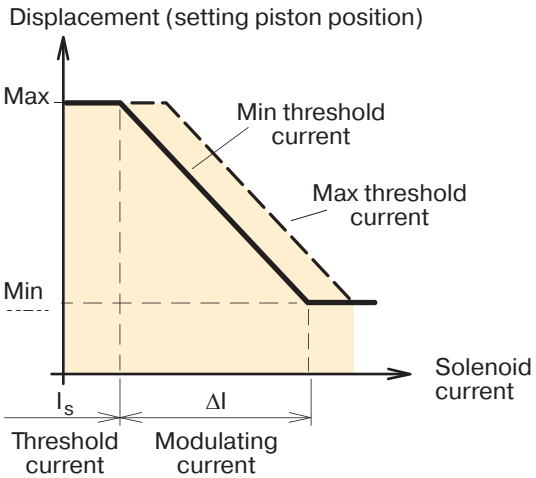
Gauge/pilot ports (EP control):	
X1	Setting piston pressure (decreasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X6	Setting piston pressure (increasing displ.)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).



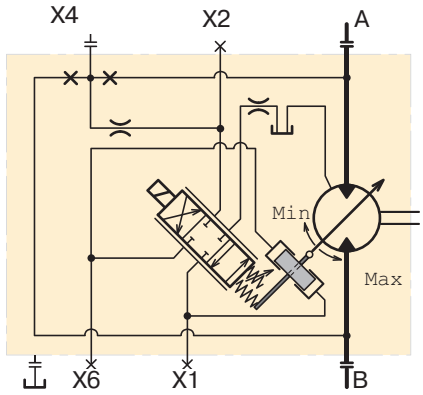
Shaft speed vs. solenoid current (EP control).



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



EP diagram.



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

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Trollhättan, Sweden

HO two-position control

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

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

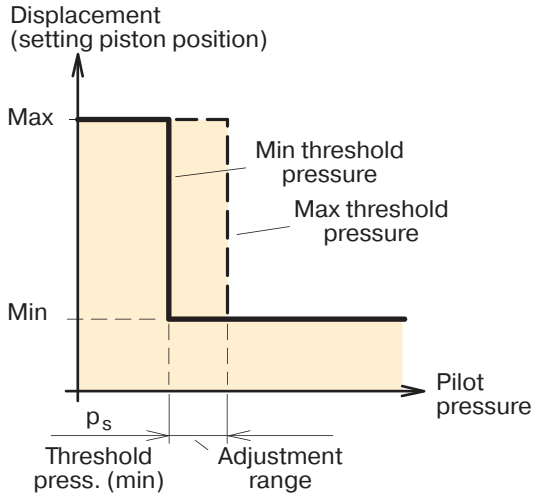
The threshold pressure is factory set at 10 bar but can be adjusted between 5 and 25 bar.

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

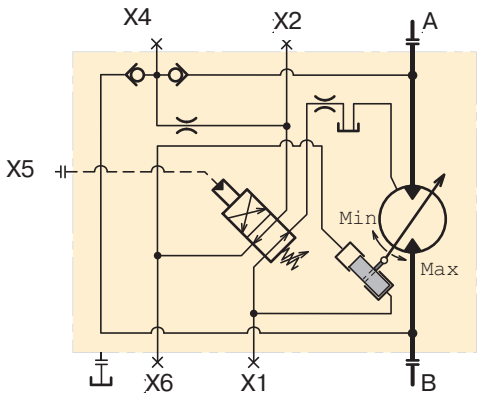
HO S 01 I – Internal servo supply

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

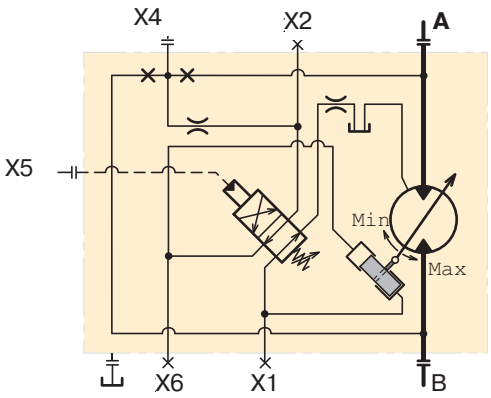
Gauge/pilot ports (HO control):	
X1	Setting piston pressure (max-to-min)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar)
X6	Setting piston pressure (min-to-max)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)
–	$^{9}/_{16}$"-18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



HO diagram.



HO S 01 I schematic (X5 not pressurized).



HO S 01 E schematic (X5 not pressurized).

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Trollhättan, Sweden

HP proportional control

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

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

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

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

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

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

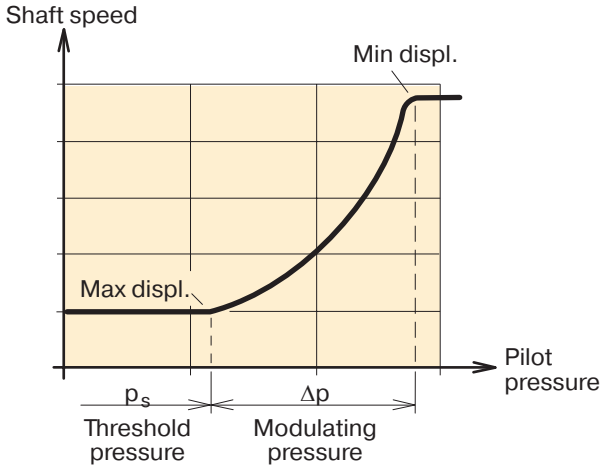
See also “Controls, Note” on page 9.

Two versions of the HP control are available:

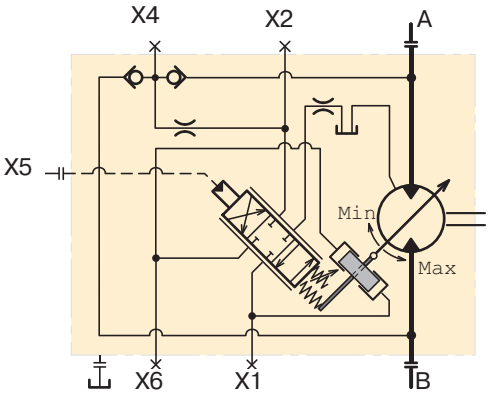
HPS 01 I – Internal servo supply

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

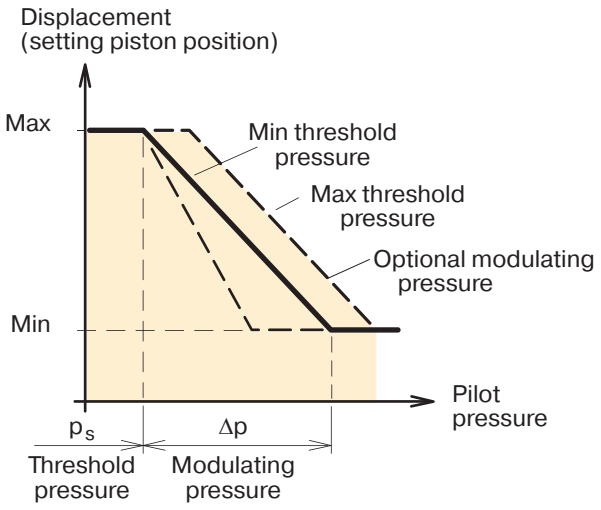
Gauge/pilot ports (HP control):	
X1	Setting piston pressure (decreasing displ.)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar)
X6	Seetting piston pressure (increasing displ.)
Port sizes:	
–	M14x1.5 (ISO and cartridge versions)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



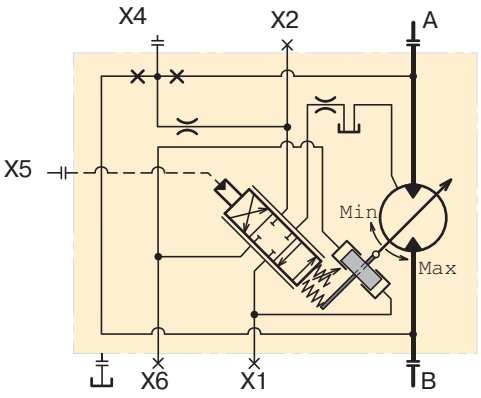
Shaft speed vs. pilot pressure (HP control).



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



HP diagram.



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

ISO version (basic configuration)

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

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

Max and min displacement
[cm^3/rev]

Code	Speed sensor*
P	Prepared for speed sensor
O	None

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

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

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

Version number
Factory assigned for special versions

* Note.
See information on page 97, Speed Sensor

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

Frame size		60	80
Code	Shaft seal		
V	PPS	x	x

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

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

Controls and flushing valve, see page 18

Cartridge version (basic configuration)

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

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

Max and min displacement
[cm^3/rev]

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

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

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

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

Version number
Factory assigned for special versions

* Note.
See information on page 97, Speed Sensor

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

Frame size		60	80
Code	Shaft seal		
V	PPS	x	x

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

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

Controls and flushing valve, see page 18

SAE version (basic configuration)

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

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

Max and min displacement
[cm^3/rev]

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

Code	Speed sensor*
P	Prepared for speed sensor
O	None

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

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

Version number
Factory assigned for special versions

* Note.
See information on page 97, Speed Sensor

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

Frame size		60	80
Code	Shaft seal		
V	PPS	x	x

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

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

Controls and flushing valve, see page 18

Controls and flushing valve

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

[ ] Control designation
[ ] Settings
[ ] Flushing valve

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

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

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

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

Control installation dimensions

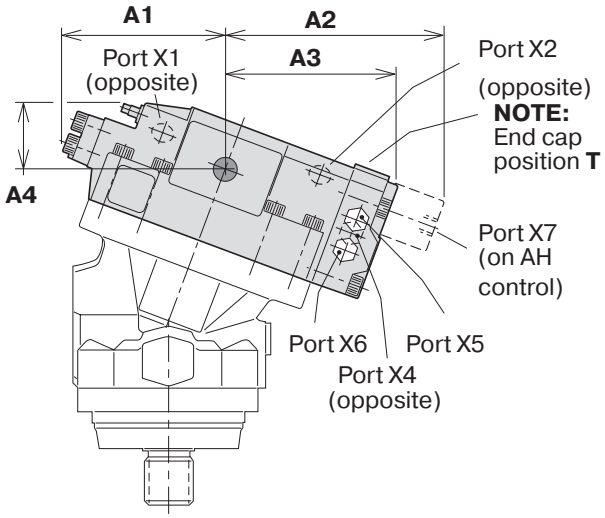
NOTE: - The basic motor side port locations are shown on pages 20, 22 and 24.

- End cap position: Refer to the ordering codes, pages 15 to 17.

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

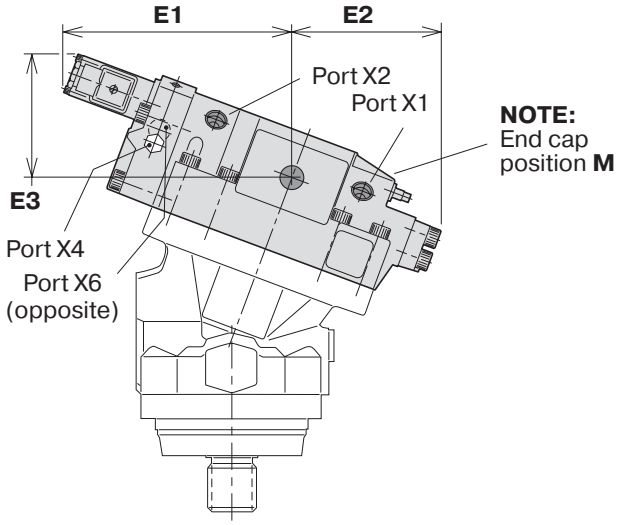
AC and AH compensators

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



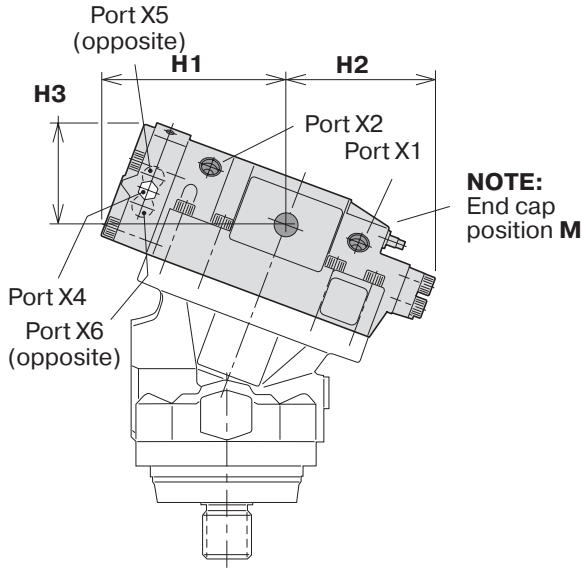
EO and EP controls

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

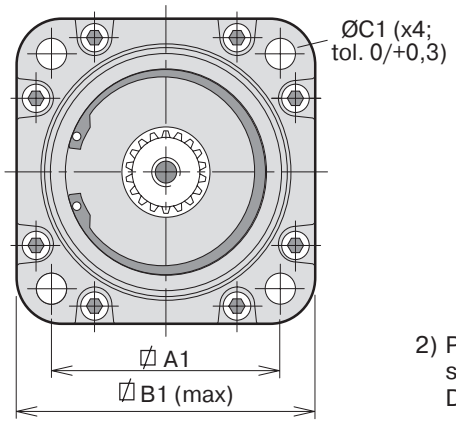


HO and HP controls

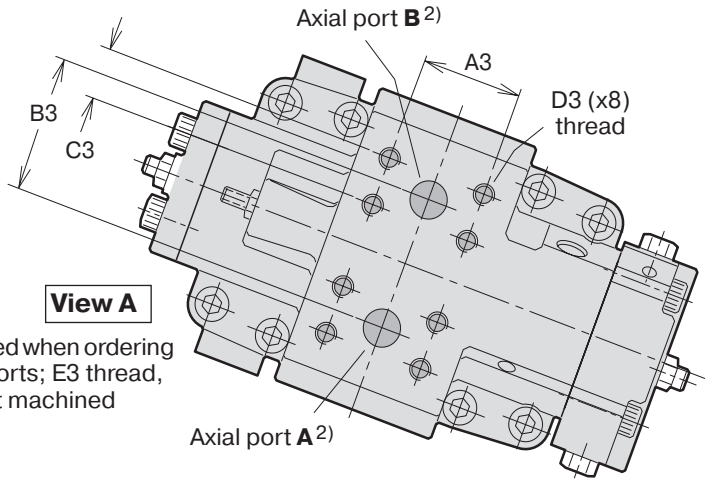
Dim.	V12-60	(inch)	V12-80	(inch)
H1	153	6.02	156	6.14
H2	121	4.76	125	4.92
H3	86	3.39	85	3.35



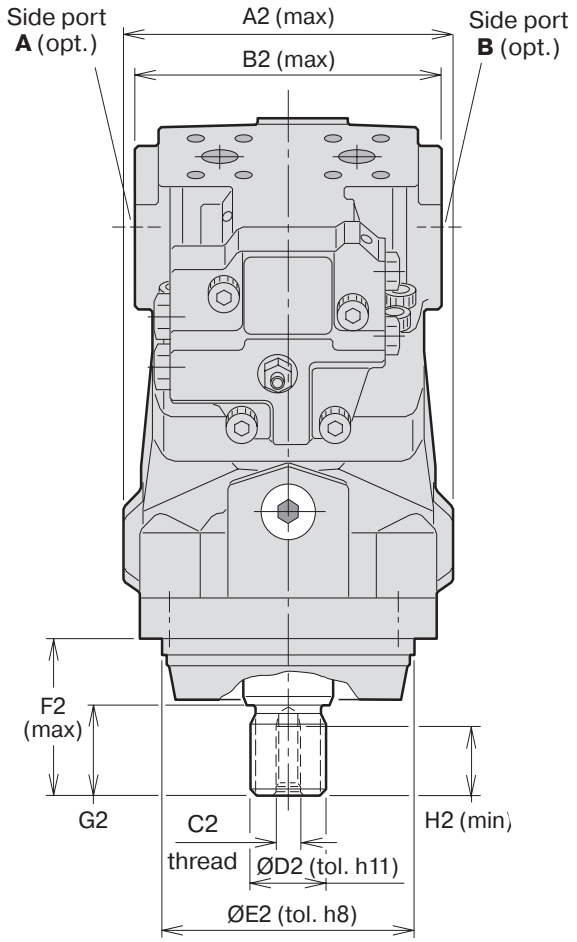
ISO version V12-60, V12-80

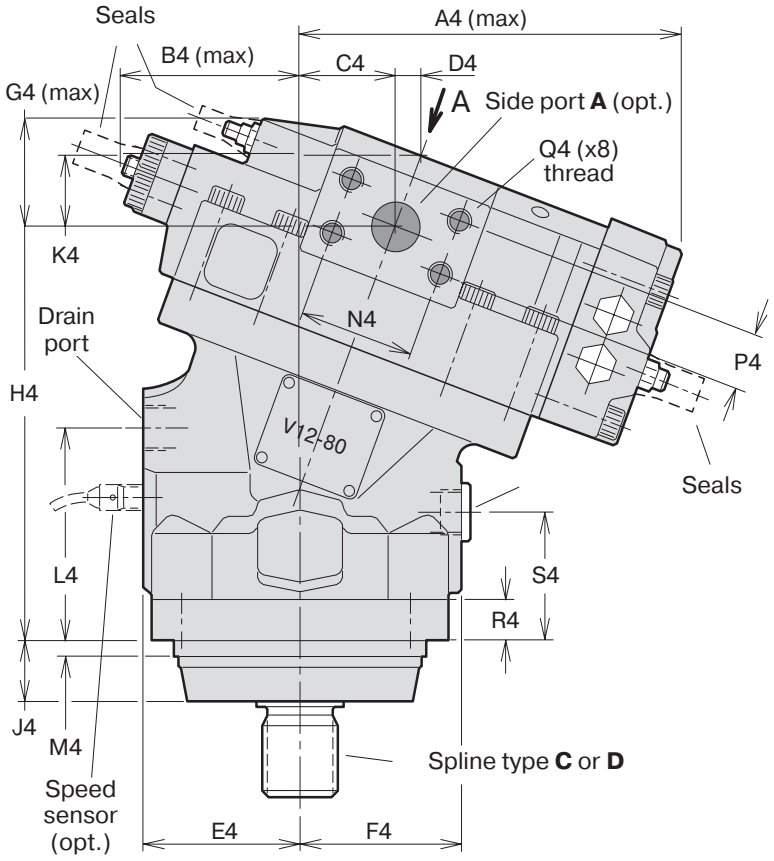


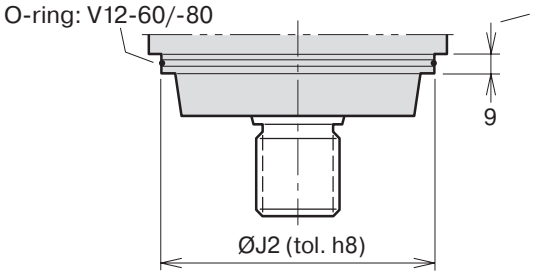
Mounting flange type **I** (ISO 3019/2)



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







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

Shown: V12-80 with AC compensator

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

Ports

Type	V12-60	V12-80
Axial	19 [$^3/_4$"]	19 [$^3/_4$"]
Side	19 [$^3/_4$"]	25 [1"]
Drain[2)]	M22 x 1.5	M22 x 1.5

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

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

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

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

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

Flange

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

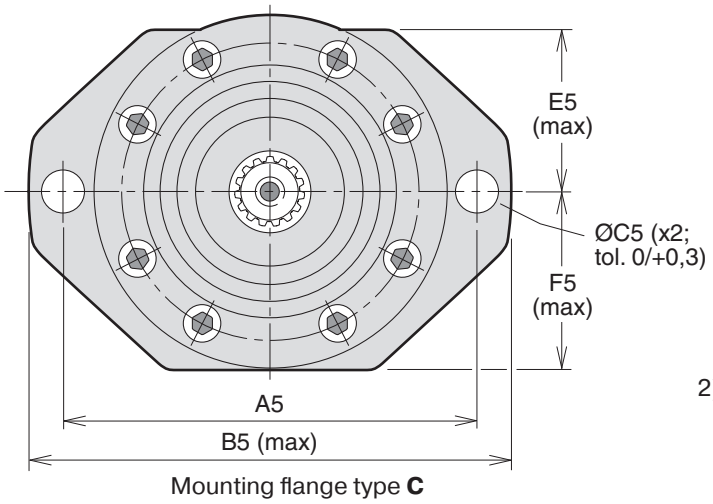
* Dimension for shaft type **D**. Shaft type **C** dimensions are 5 mm shorter than those of type D.

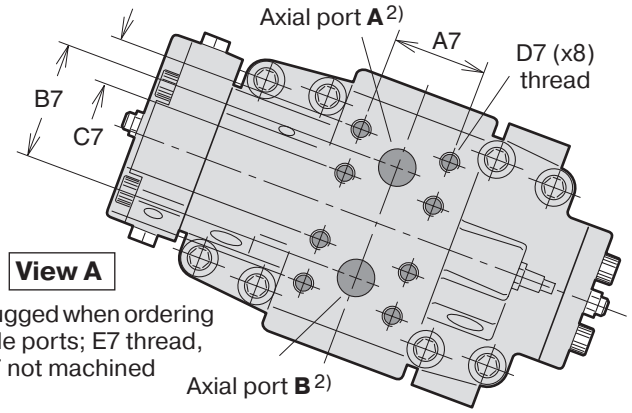
1) Metric thread x depth in mm

2) Metric thread x pitch in mm

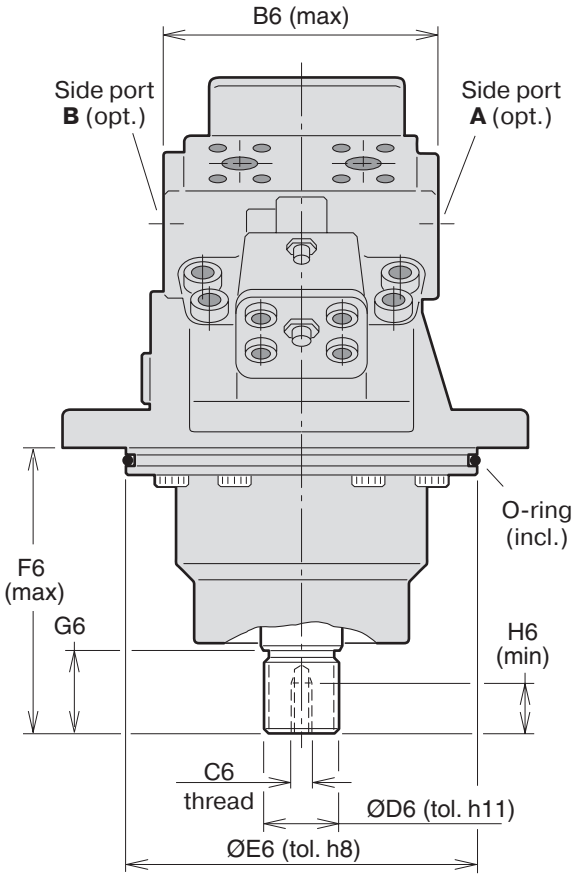
3) '30° involute spline, side fit'.

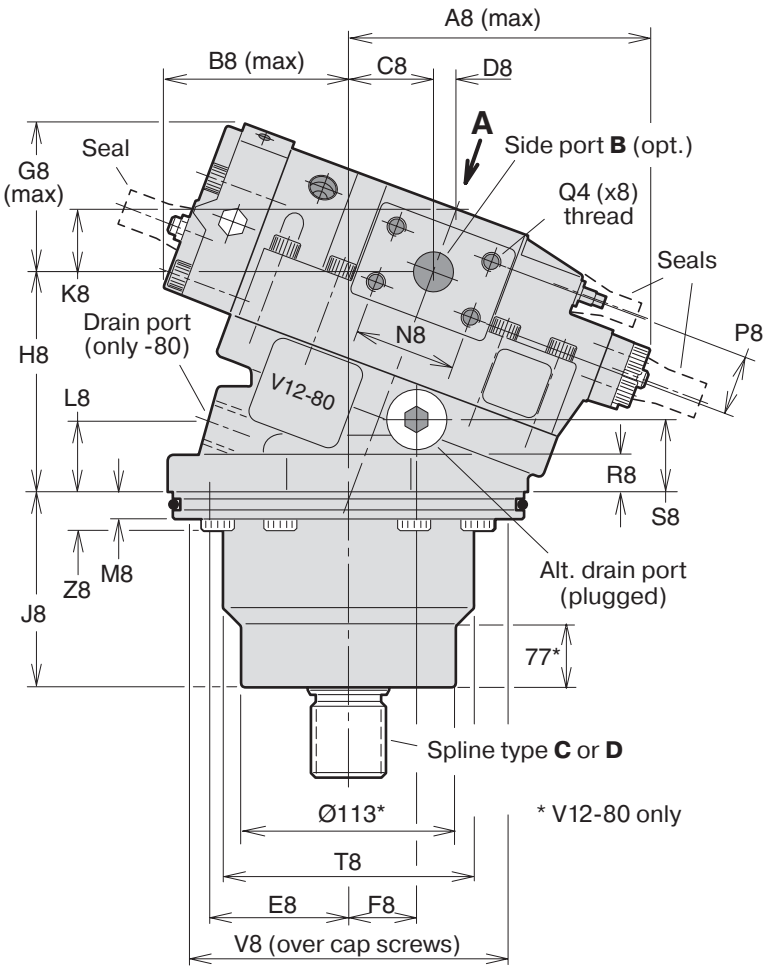
Cartridge version V12-60, V12-80





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





Shown: V12-80 with HO control

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

Ports

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

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

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

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

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

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

O-rings

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

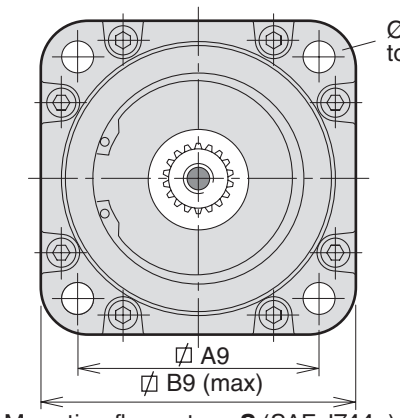
* Dimension for shaft type **D**. Shaft type **C** dimensions are 5 mm shorter than those of type D.

1) Metric thread x depth in mm

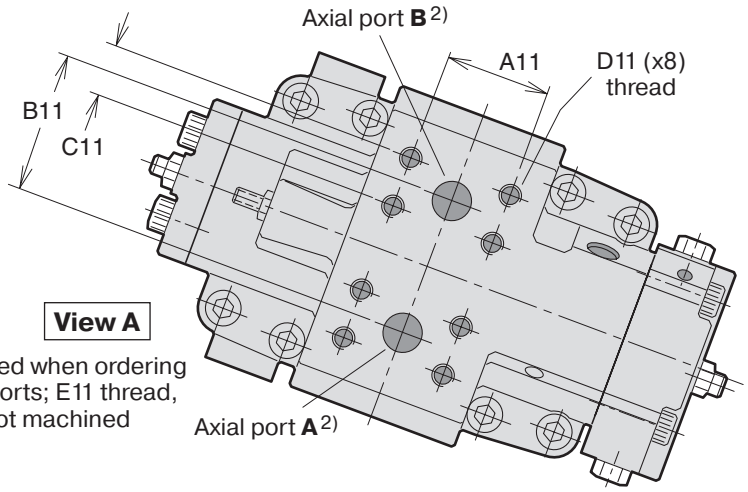
2) Metric thread x pitch in mm

3) '30° involute spline, side fit'.

SAE version V12-60, V12-80

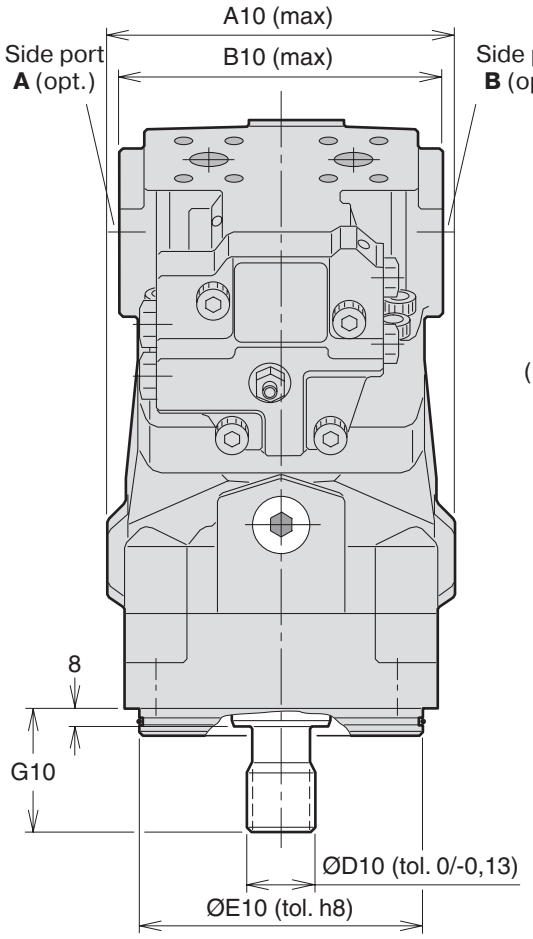


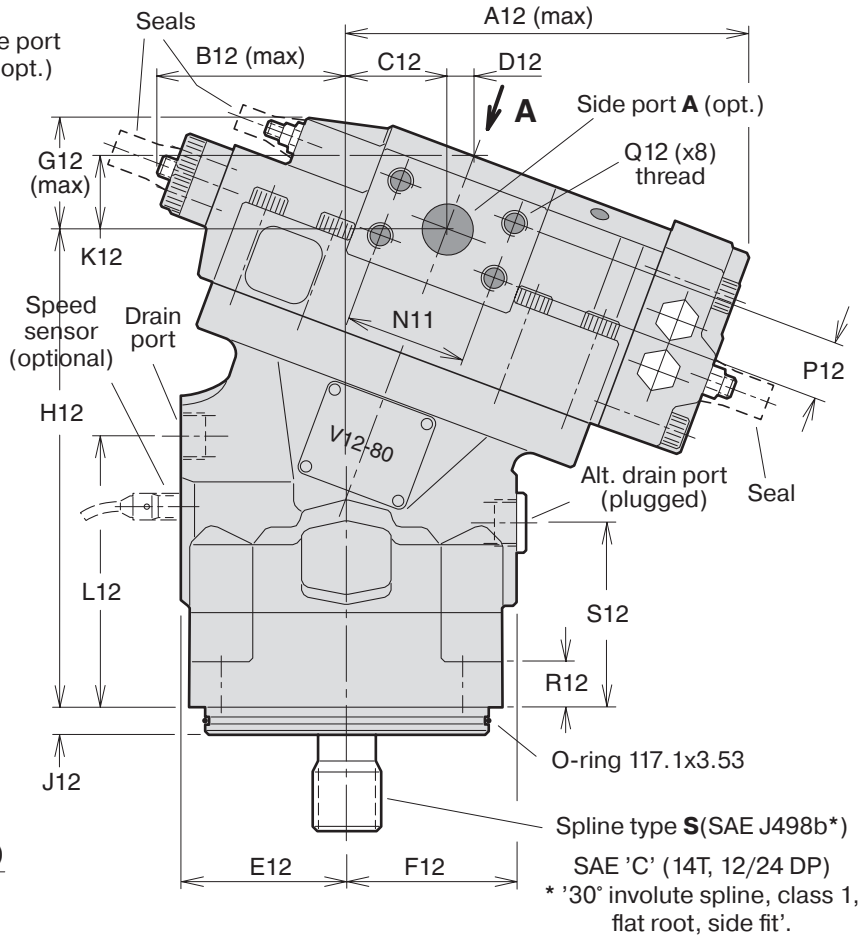
Mounting flange type **S** (SAE J744c)
Dimension SAE C



View A

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





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

Shown: V12-80 with AC compensator

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

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

Ports

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

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