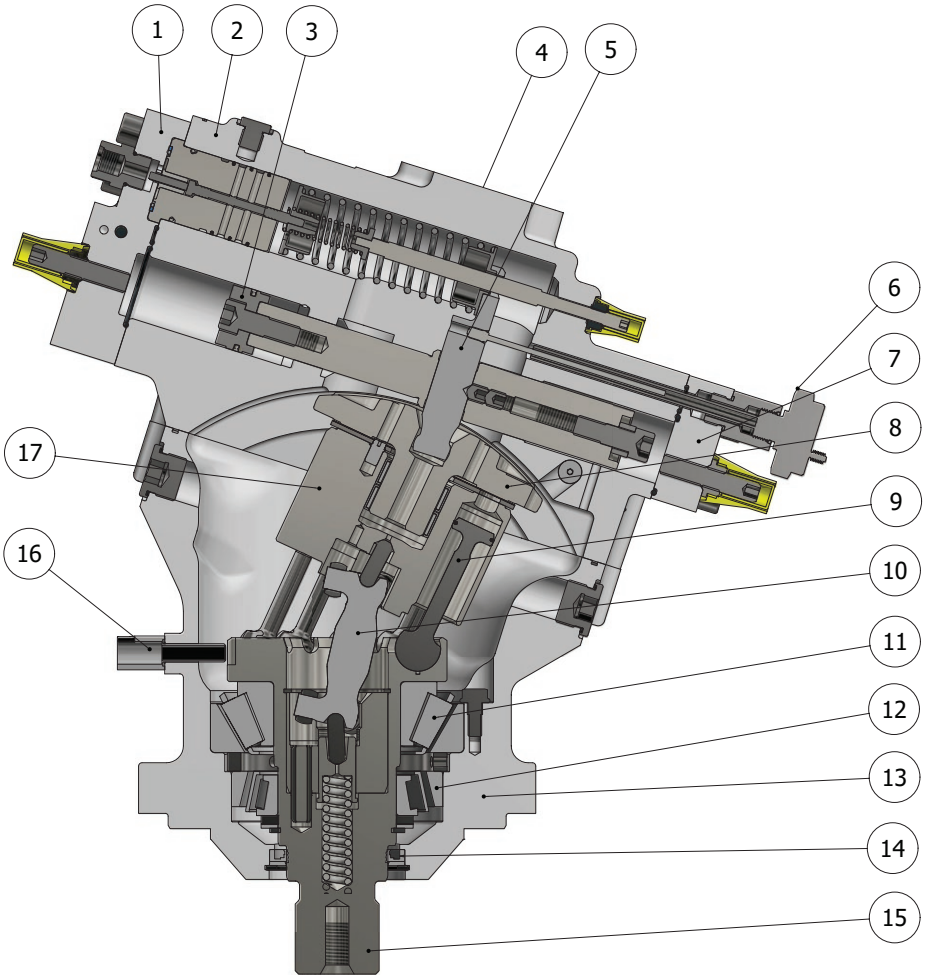
V16 cross section

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



Specifications

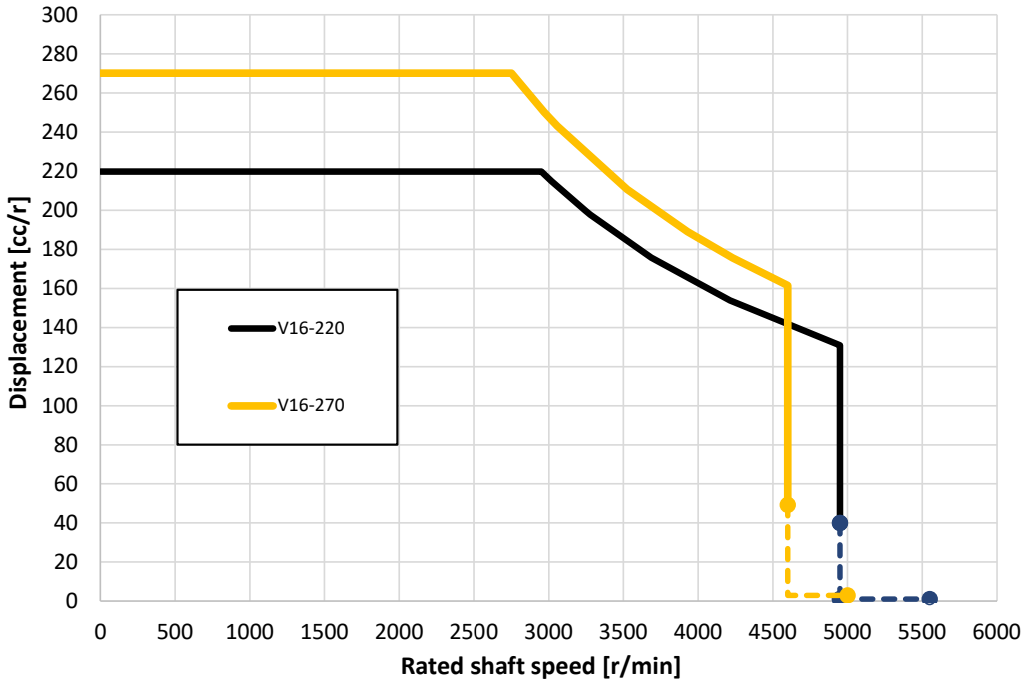
V16 frame size	220	270
Displacement [cm³/rev]		
- max, at 35°	220	270
- min, at 6°	40	49
Operating pressure [bar]		
- max intermittent [1)]	550	550
- max continuous	450	450
Operating speed [rpm]		
- at 35°, max continuous	2950	2750
- at 6° – 20°, max continuous	4950	4600
- at 0°, max continuous	5550	5000
- min continuous	50	50

V16 frame size	220	270
Flow [l/min]		
- max continuous	648	743
Torque (theor.) at 100 bar [Nm]	350	430
Max otput power [1)] [kW]	486	557
Corner power [kW]		
- intermittent [1)]	997	1139
- continuous	816	932
Mass moment of inertia		
(x10⁻³) [kg m²]	20	21
Weight [kg]	95	97

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

Parker Hannifin
Pump & Motor Division Europe
Trollhättan, Sweden

Continous Speed vs Displacement, V16-220 & 270



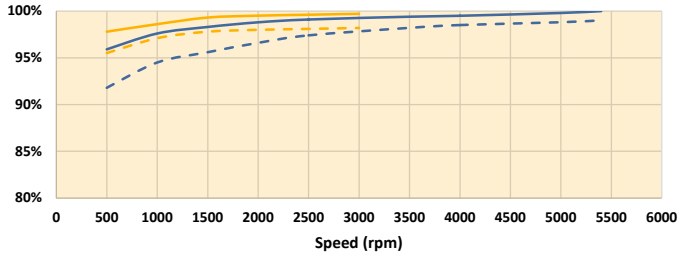
Efficiency diagrams

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

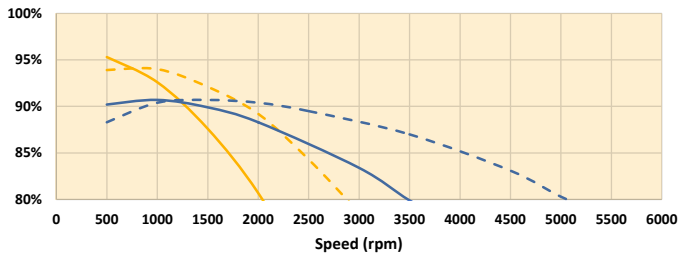
Information on efficiencies for a specific load condition can be made available from Parker Hannifin.

V16-220

Volumetric

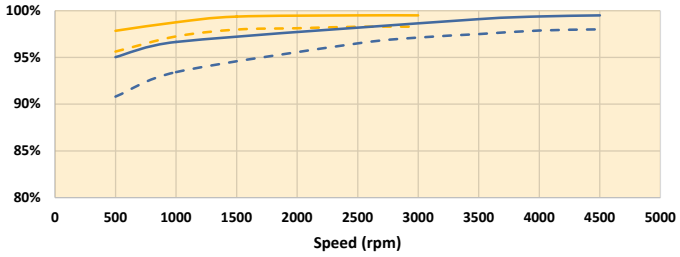


Overall

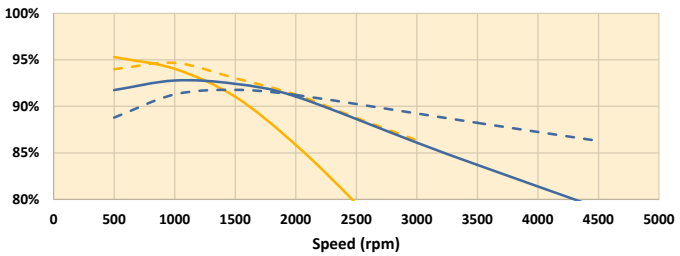


V16-270

Volumetric



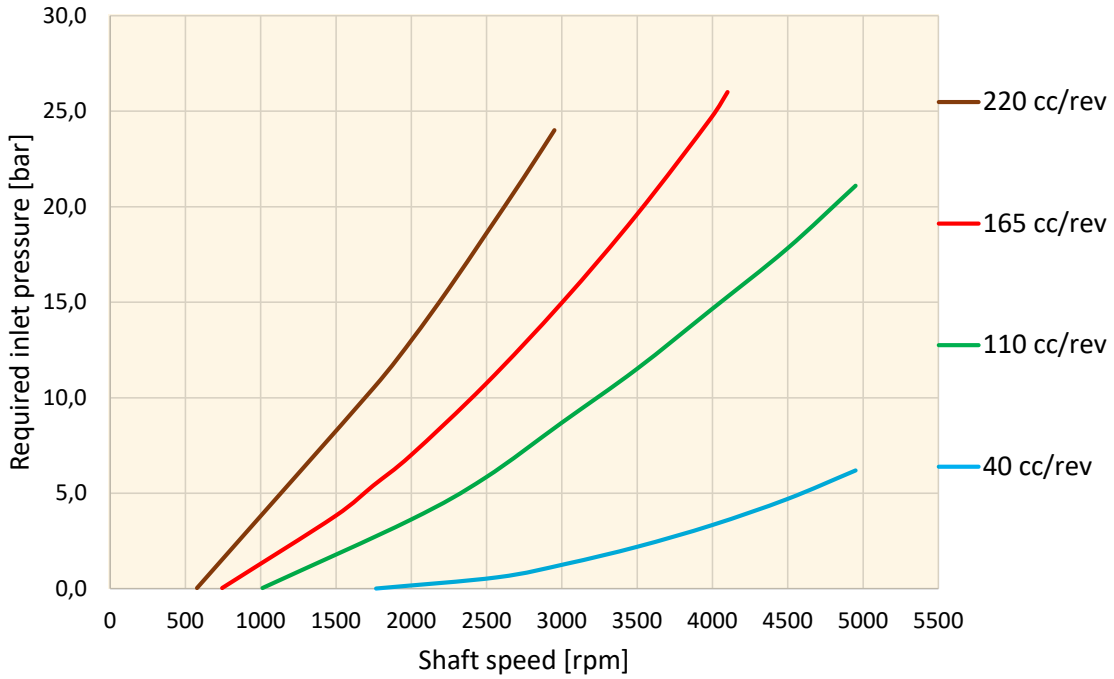
Overall



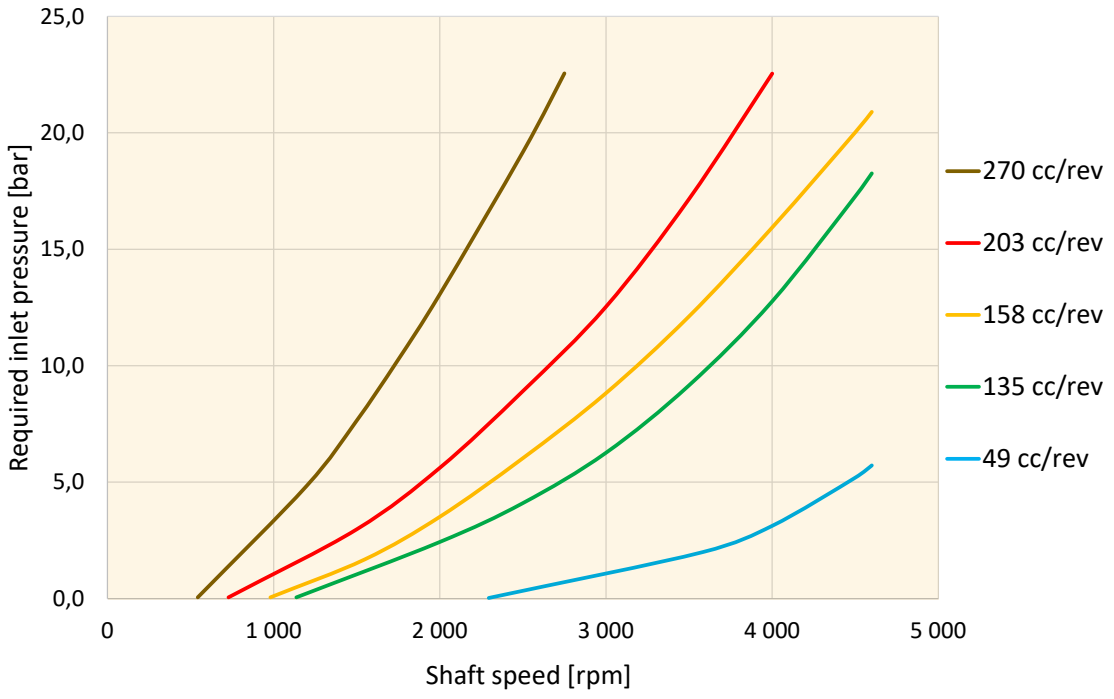
Required inlet pressure

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

Min. required inlet pressure V16-220



Min. required inlet pressure V16-270



Starting torque efficiency

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

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

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

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

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

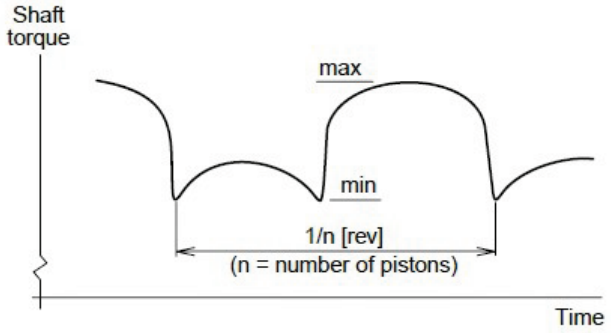
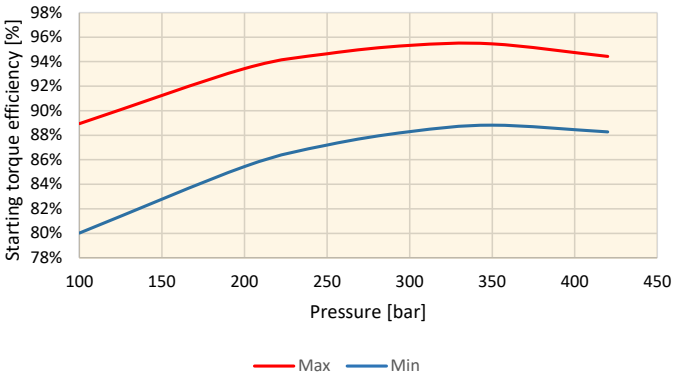
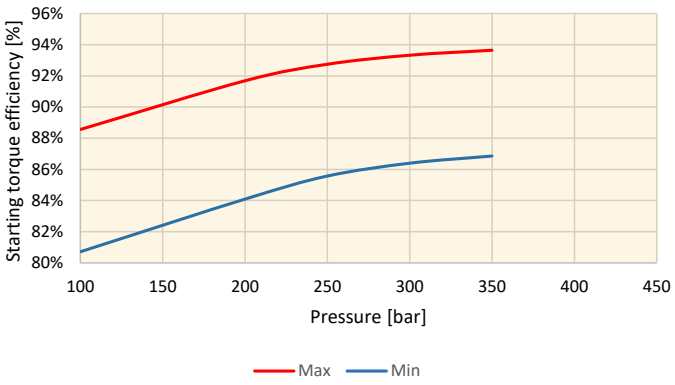


Fig. 1. V16 shaft torque vs. time at 1 rpm

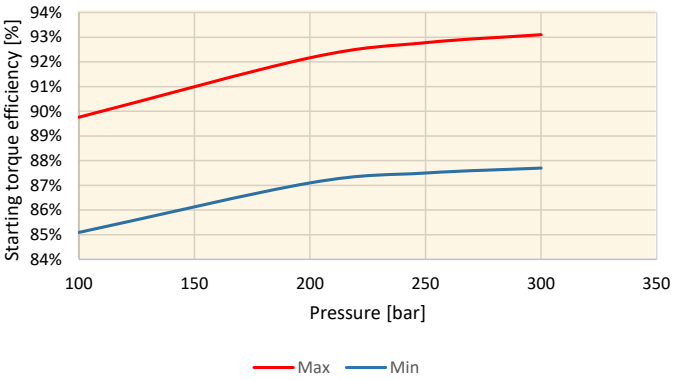
V16-220 limited displacement = 180 cc/rev



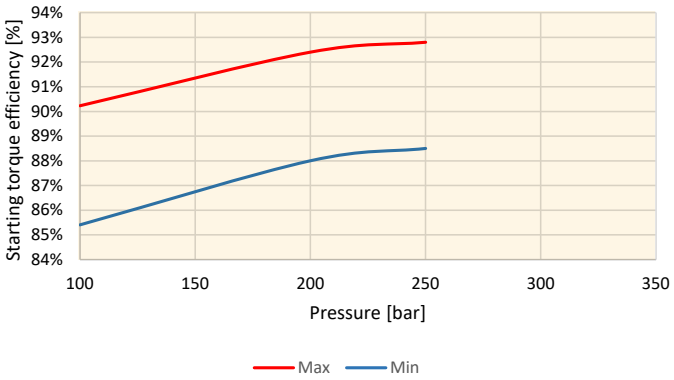
V16-220 unlimited displacement = 220 cc/rev



V16-270 limited displacement = 220 cc/rev



V16-270 unlimited displacement = 270 cc/rev



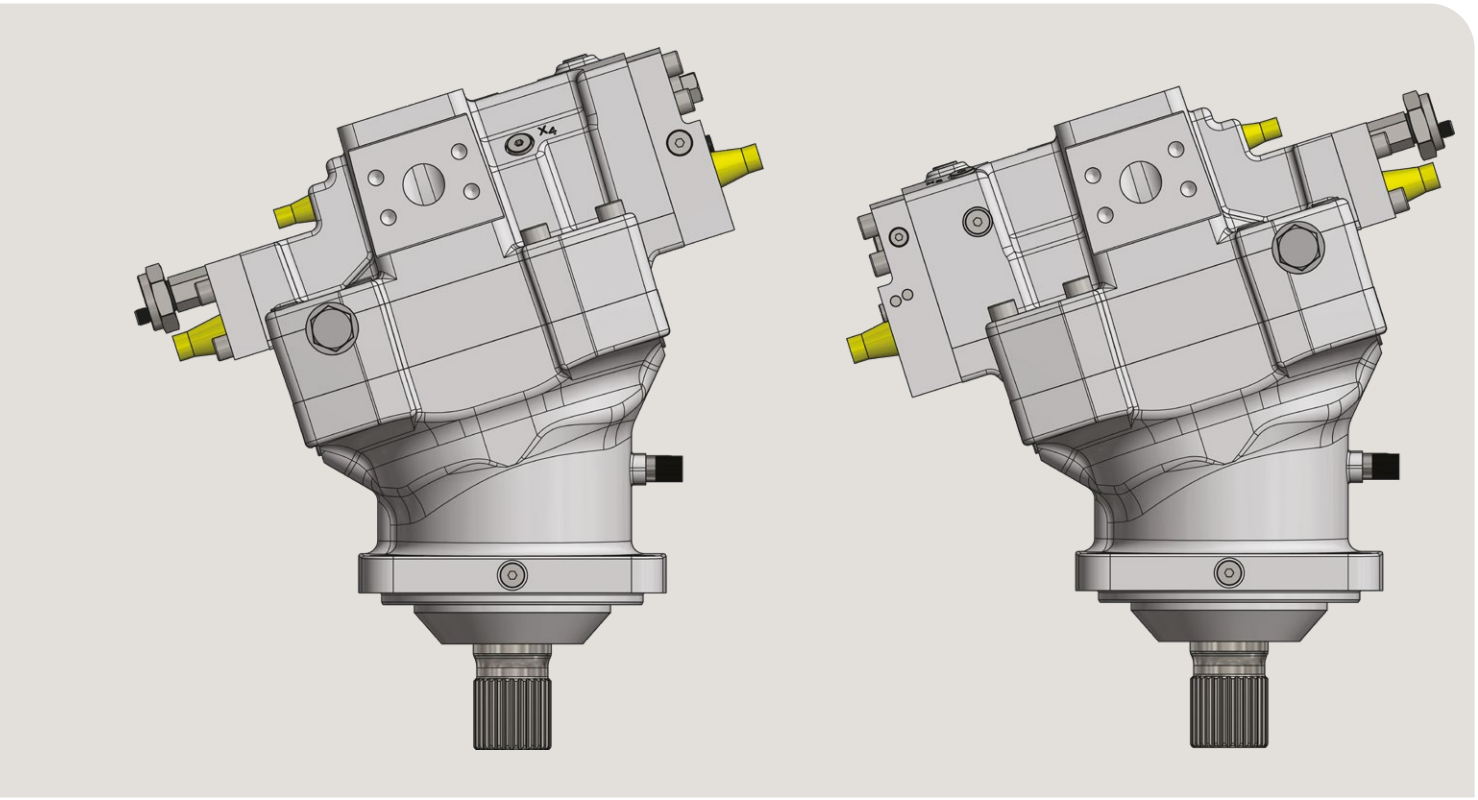
Controls – general information

M version, negative control characteristics

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

T version, positive control characteristics

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



The following V16 controls satisfy most application requirements:

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

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

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

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

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

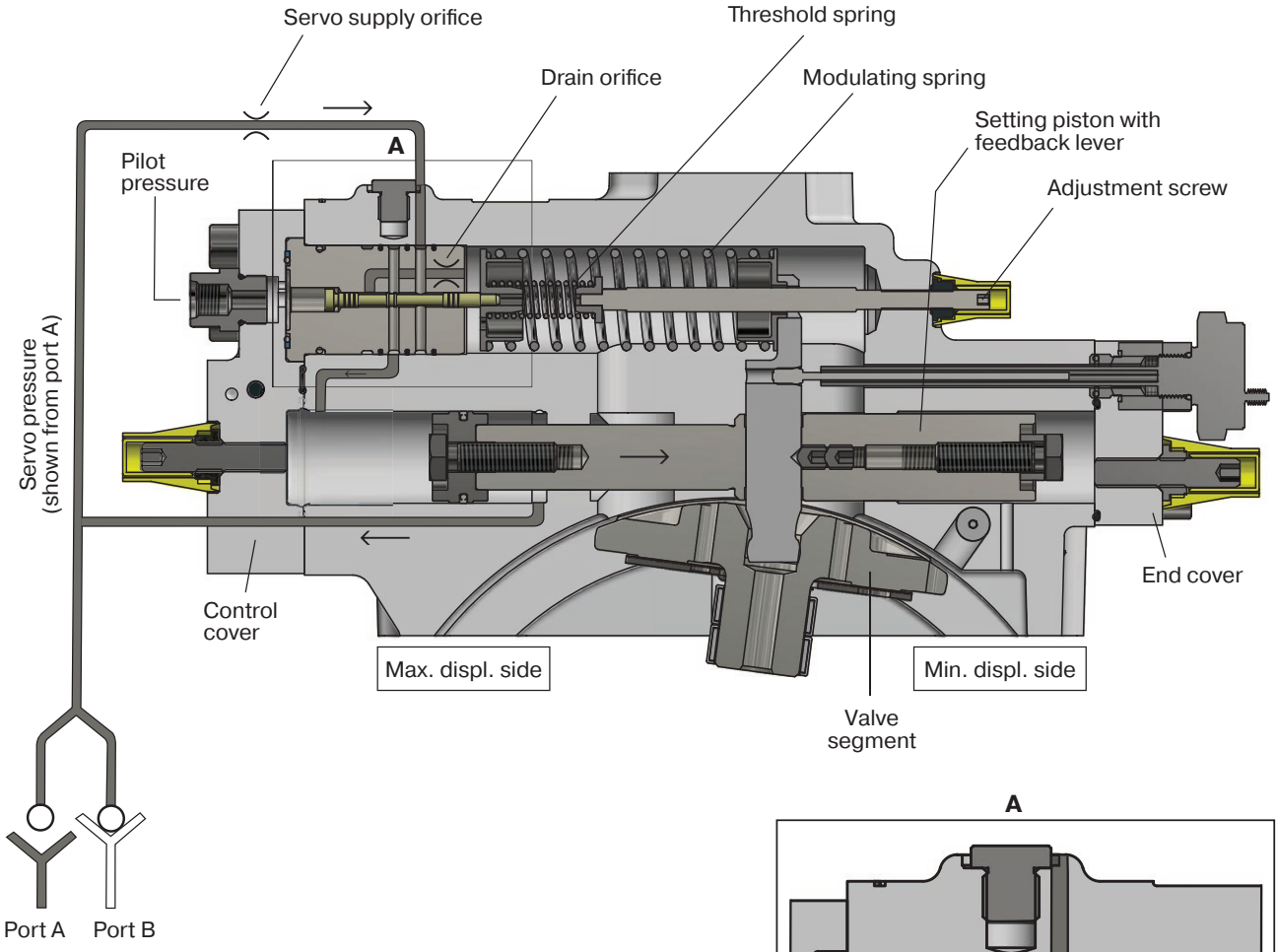
The response time (i.e. from max-to-min or from min-to-max displacement) is determined by restrictor nozzles in the servo valve supply and return lines; refer to the schematics.

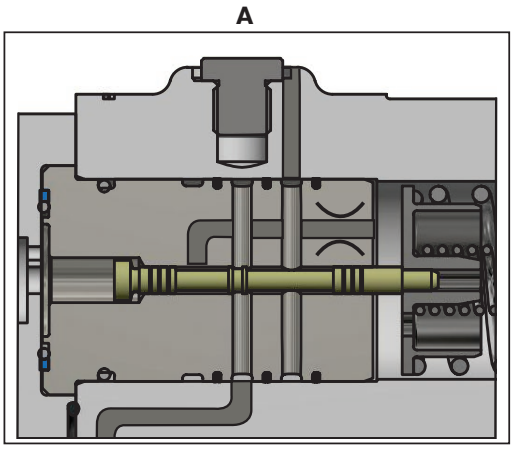
NOTE: The modulating pressure/current, $\Delta p/\Delta I$ values are valid for motors that are not displacement limited.

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

AC control function

In the AC compensator control, the system pressure is used as pilot pressure. Two versions are available. One version with external pilot pressure (ACE) and one with internal pilot pressure (ACI). The pilot pressure acts directly on a three-way valve spool. The setting piston and rotating group move to change the displacement to the point where the pressure on the servo is in balance with the force from the feedback spring.





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

Positive control characteristics (T* code)

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

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

*(ref. Controls page 54)

AC compensator function

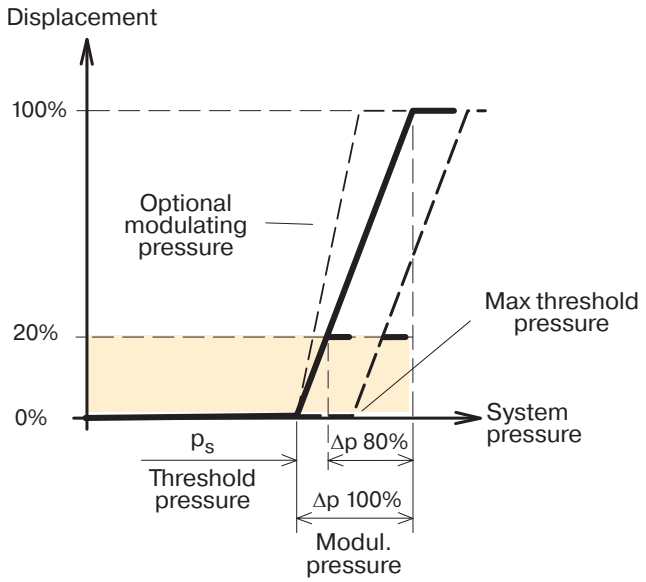
The AC compensator is often used in off-road vehicle hydrostatic propel transmissions. The compensator automatically adjusts motor displacement between available max and min to the output torque requirement (up to max available system pressure).

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

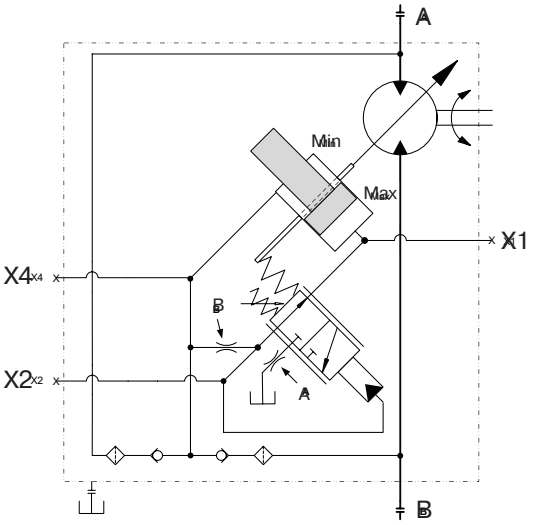
The threshold pressure, where displacement starts to increase ('p_s'; refer to the AC diagram), is adjustable between 100 and 400 bar.

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

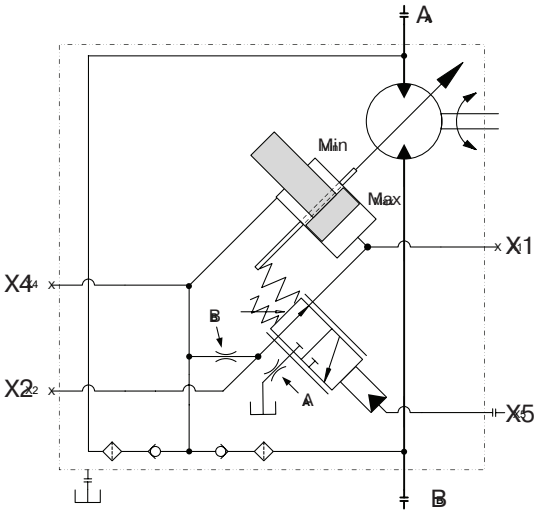
To satisfy specific hydraulic circuit requirements, a modulating pressure range of 15, 25, 35, 50 or 100 bar can be selected.



AC diagram (displacement vs. system pressure).



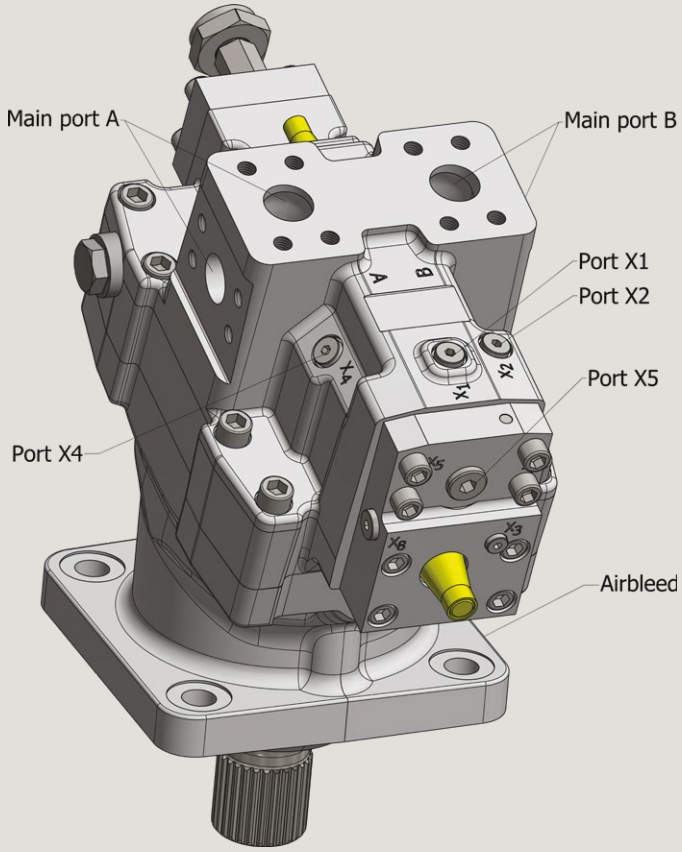
ACI control, type T, positive control (begin in min. displacement)



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

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

Gauge ports AC compensator



Port locations – V16- with AC compensator.

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

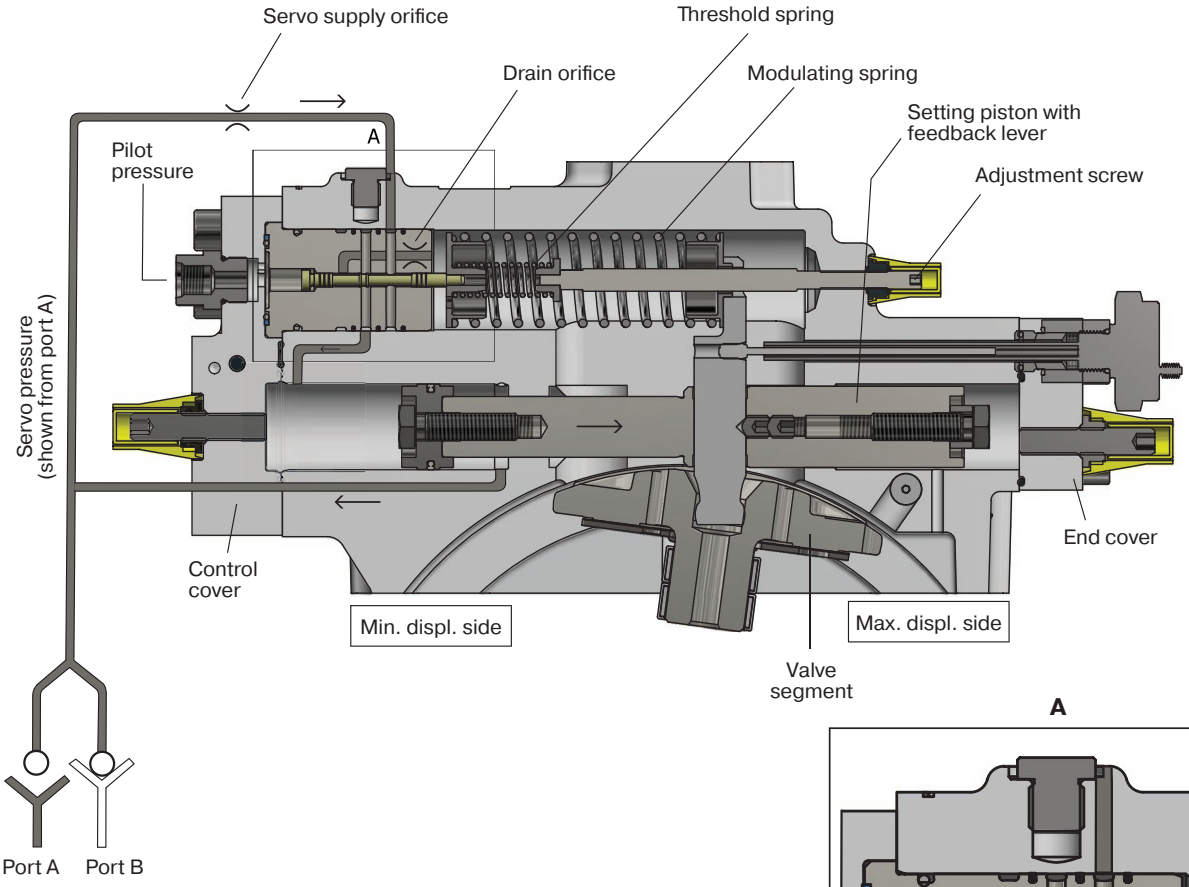
Gauge/pilot ports (ACE compensator)	
X1	Setting piston pressure (large setting piston area)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	Pilot pressure
Port sizes:	
–	M14x1.5 (ISO version)
–	$^{9}/_{16}$"-18 O-ring boss (SAE version).

EP control function

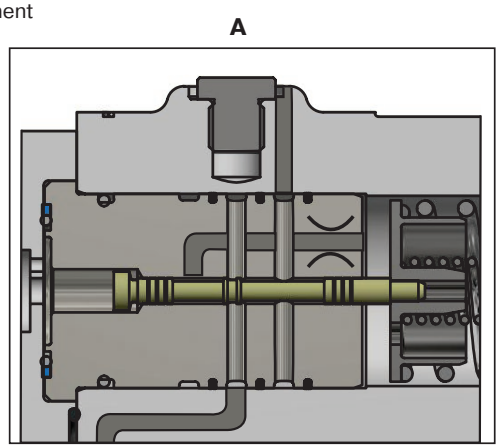
The electric proportional control consists of a proportional solenoid which acts directly on a three-way valve spool. When activated, the solenoid pushes the valve spool which drains oil (pressure) from the larger diameter of the setting piston. The setting piston and rotating group move to change the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

HP control function

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



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



Negative control characteristics (M* code)

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

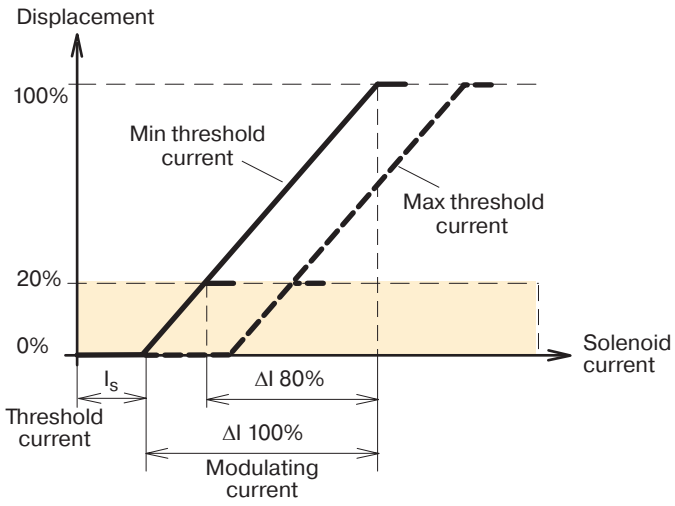
*(ref. Controls page 54)

Positive control characteristics (T* code)

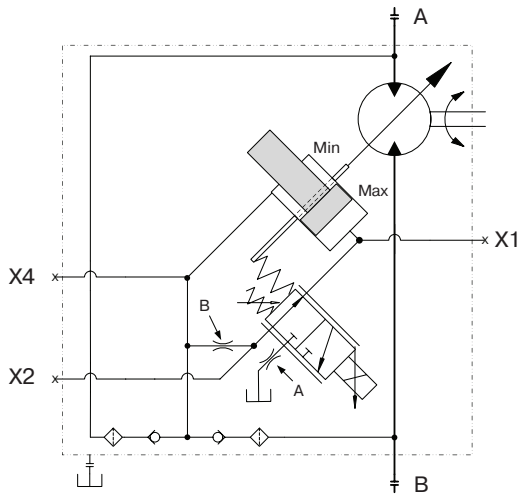
With a de-energized solenoid (EP) or not pressurized (HP), the motor will be kept at minimum displacement. When energized, the solenoid or the pressure pushes the valve spool which drains oil (pressure) from the larger diameter of the setting piston. Depending on solenoid current or pilot pressure, the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

EP control function

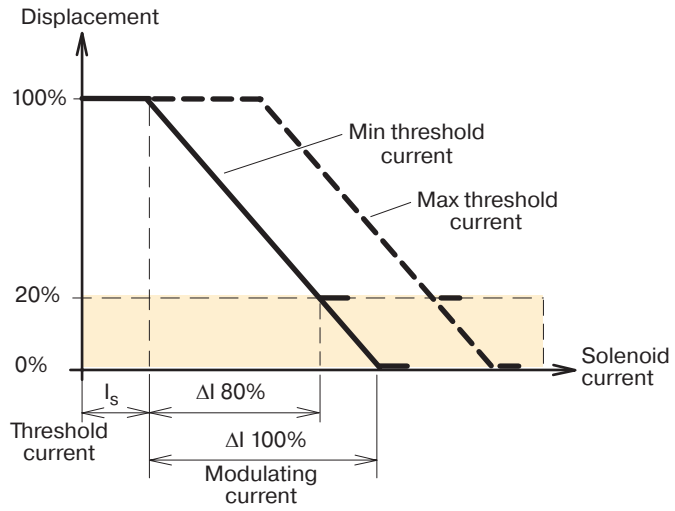
The solenoid is either 12 or 24 VDC, requiring 900 and 450 mA respectively.
The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The corresponding female connector is not included.
Note: The female connector is available as spare part P-N 3787488.
The threshold current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



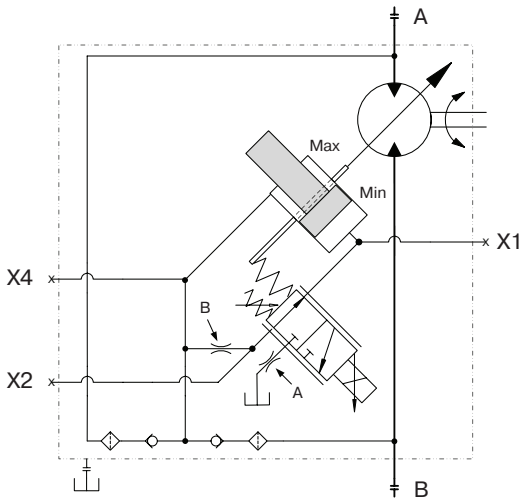
EP diagram (displacement vs. solenoid current). (type T, positive control)



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



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



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

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

EP control (also valid for EPA/EPB)

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

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

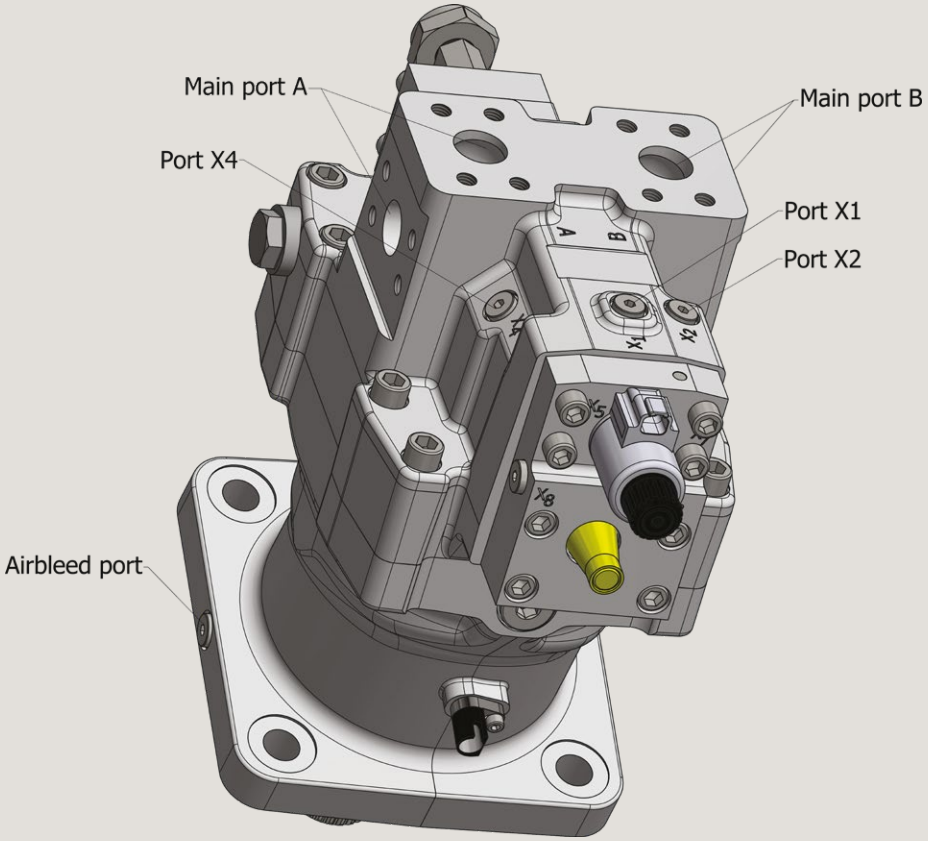
D_{max}	Max theoretic displacement [cm^3/rev]
D_x	Min displacement limitation [cm^3/rev]
D_y	Max displacement limitation [cm^3/rev]
x	Min displacement [%]
y	Max displacement [%]
12V: Delta I [mA]	900
24V: Delta I [mA]	450
12V: Start current [mA]	500
24V: Start current [mA]	250

Fig. 2. Definitions.

Coil temperature influence on solenoid force

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

Gauge ports EP control



Port locations – V16- with EP control.

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

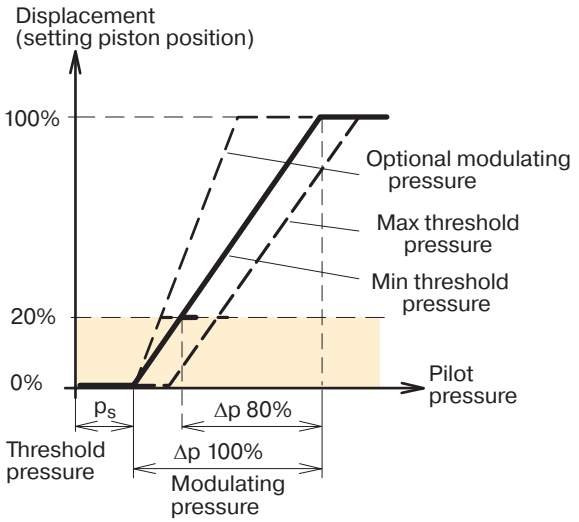
HP hydraulic proportional control

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

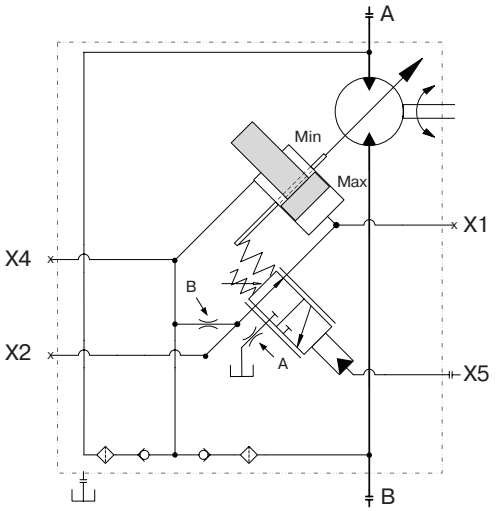
Normally, the setting piston stays in the max or min displacement position. When a sufficiently high pilot pressure (p_s) is applied to port X5, the setting piston starts to move towards the max (type T) or min (type M) displacement position.

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

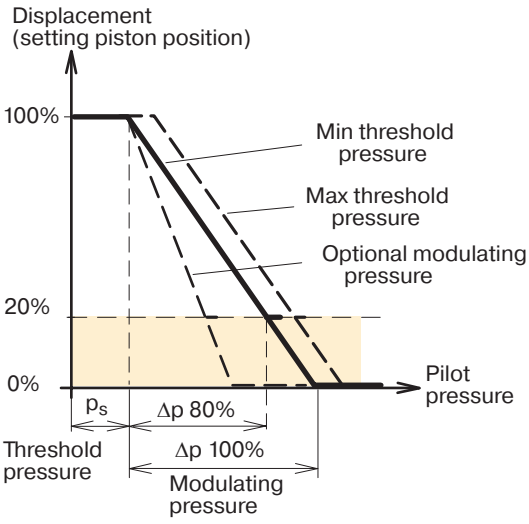
To satisfy specific hydraulic circuit requirements, a modulating pressure range of 15, 25 or 35 bar can be selected. The threshold pressure (p_s) is factory set at 10 bar, but can be adjusted between 5-25 bar; (ref. chart 1 and 2, pages 79 and 80).



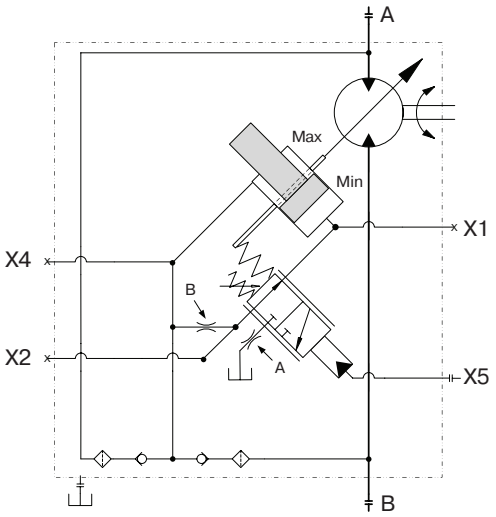
HP diagram (displacement vs. pilot pressure). (type T, positive control)



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



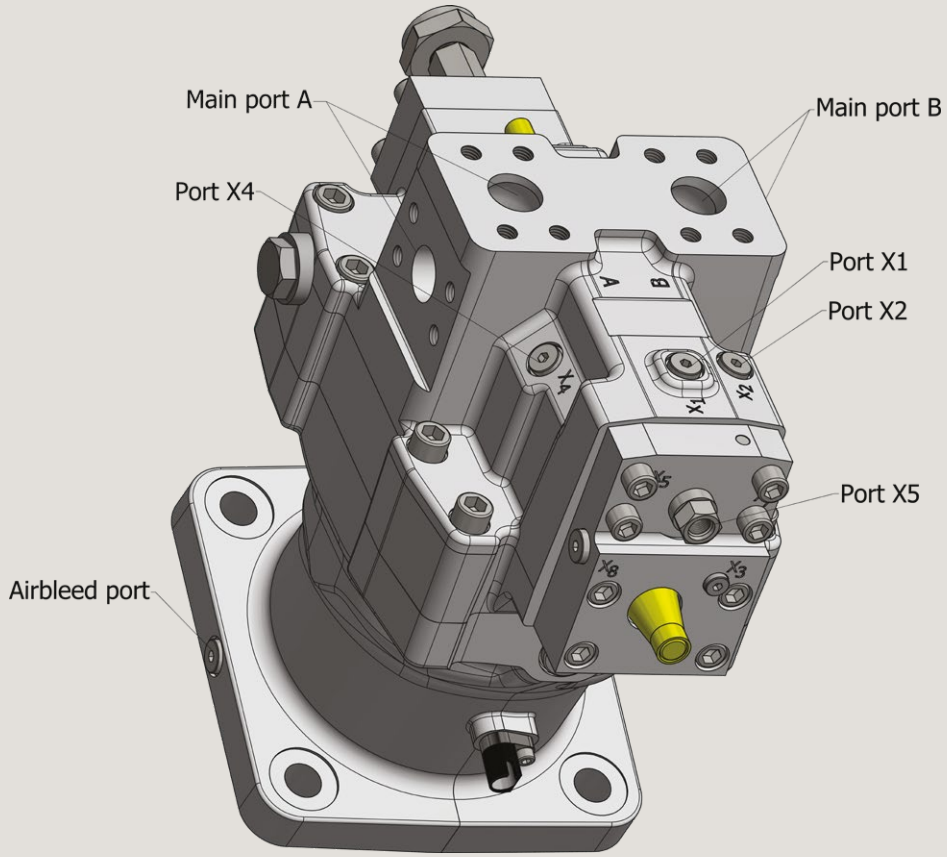
HP diagram (displacement vs. pilot pressure). (type M, negative control)



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

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

Gauge ports HP control



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

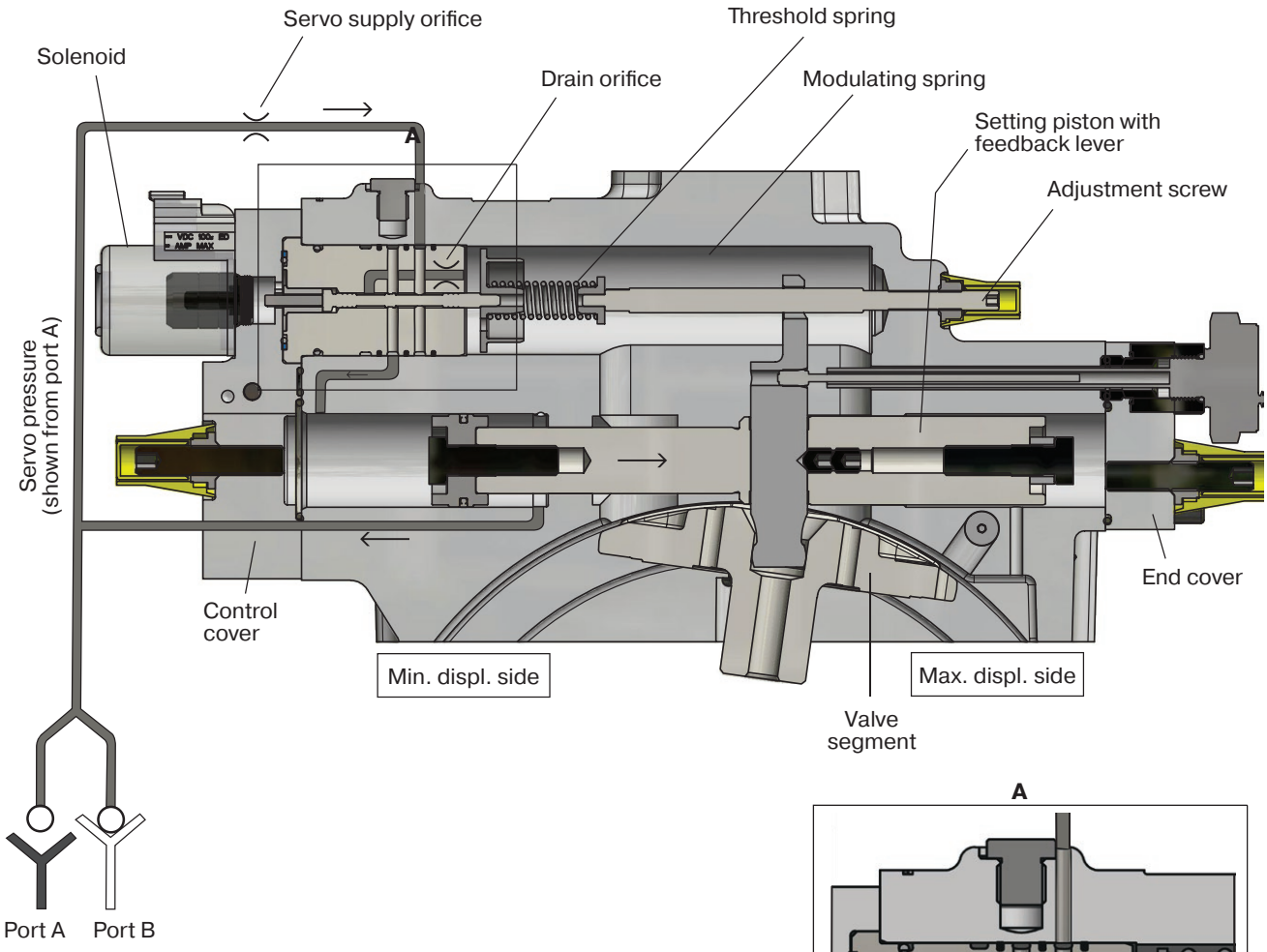
Gauge/pilot ports (HP control):	
X1	Setting piston pressure (large setting piston area)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar; HO and HP control)
Port sizes:	
–	M14x1.5 (ISO version)
–	$^{9}/_{16}$"-18 O-ring boss (SAE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

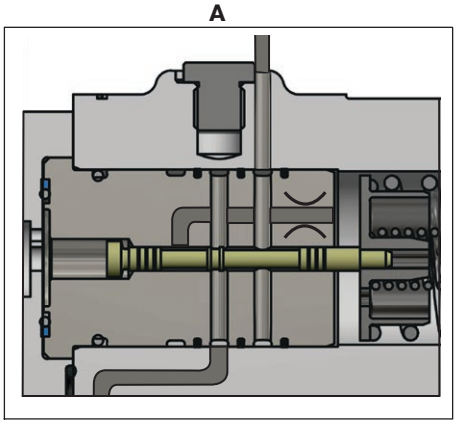
EO control function

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

HO control function

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





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

EO,HO negative control characteristics (M* code)

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

EO,HO positive control characteristics (T* code)

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

EO electric two-position control

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

Intermediate displacements cannot be obtained with this control.

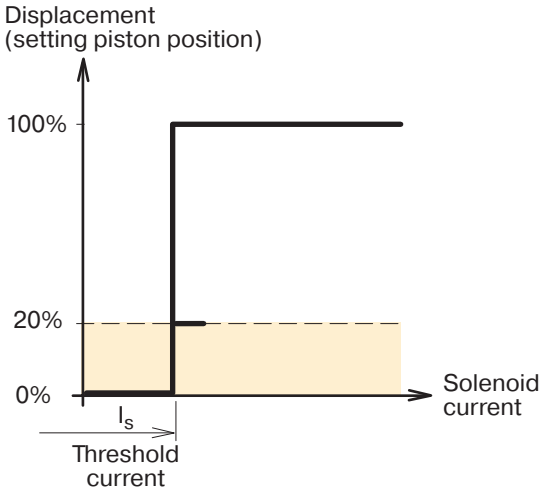
Servo pressure is supplied internally (through a check valve from the utilized high pressure port); refer to the schematic below.

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

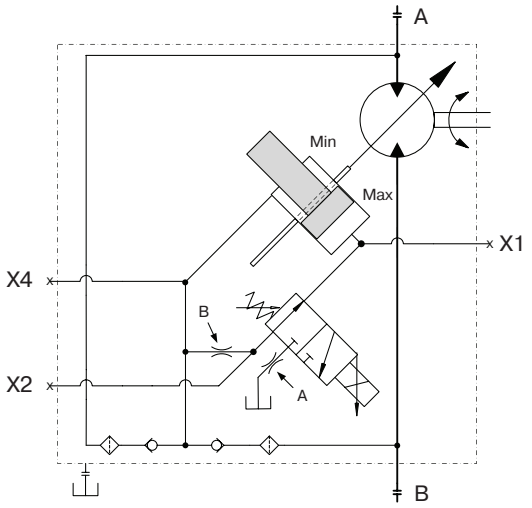
The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The corresponding female connector is not included.

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

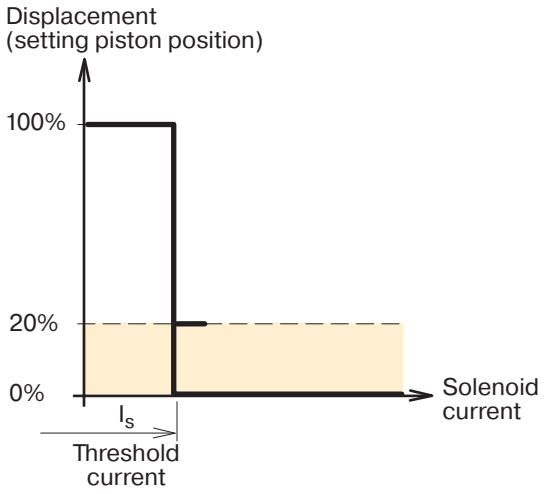
The threshold current of the 12 VDC solenoid is factory set at 500 mA. The 24 VDC solenoid is factory set at 250 mA. (Ref. charts 1 and 2, on pages 79 and 80).



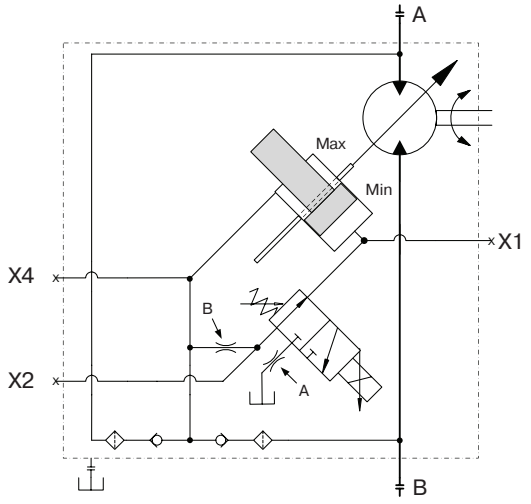
EO diagram (displacement vs. solenoid current). (type T, positive control)



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



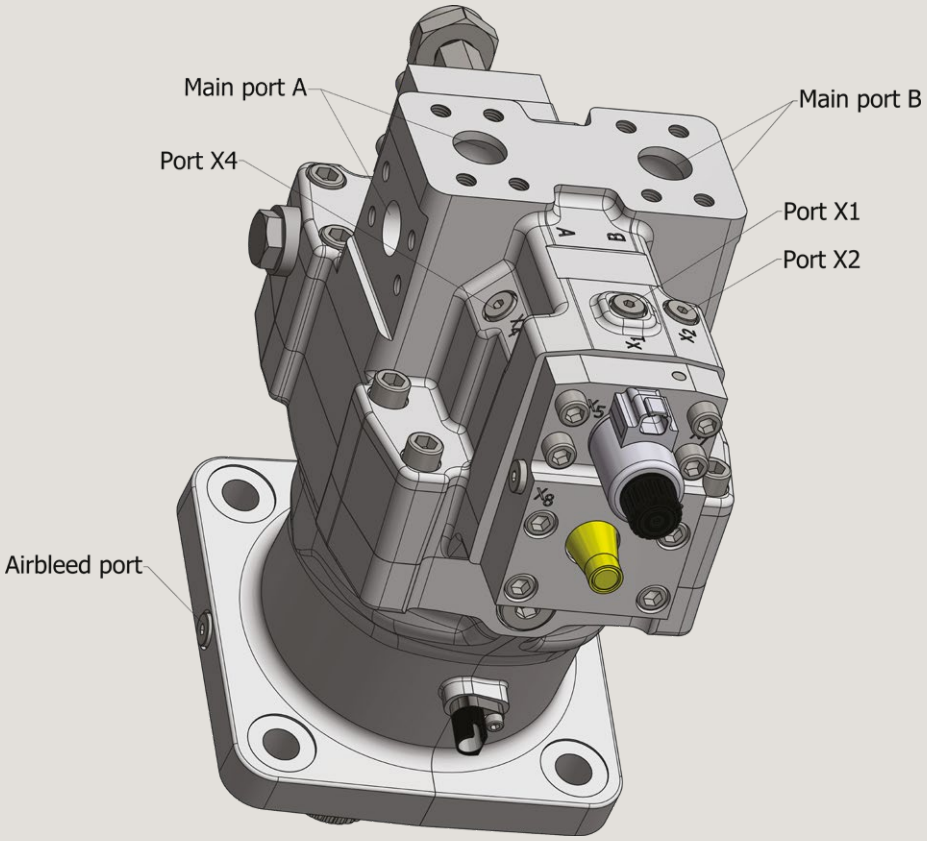
EO diagram (displacement vs. solenoid current). (type M, negative control)



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

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

Gauge ports EO control



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

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

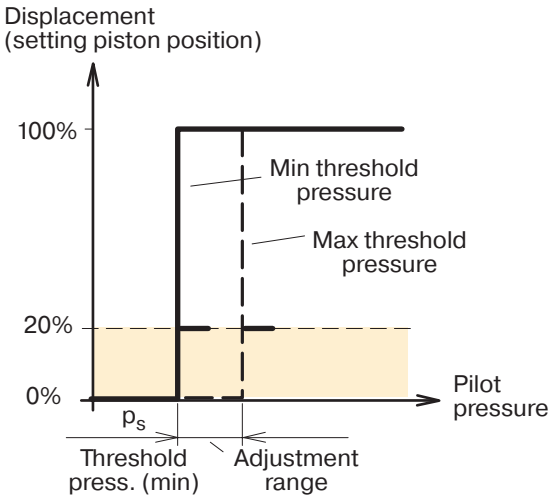
HO hydraulic two-position control

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

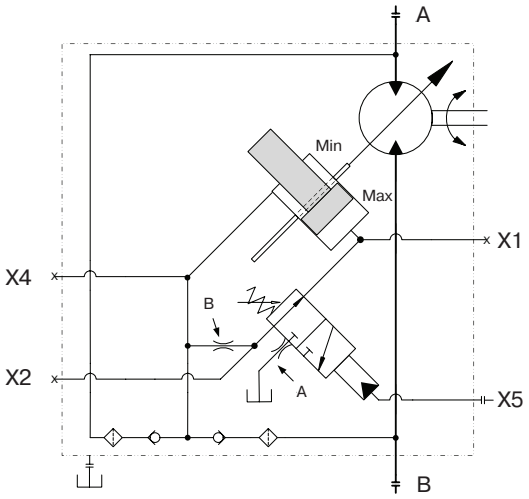
When the applied pilot pressure (port X5) exceeds the pre-set threshold value, the setting piston moves from min to max (type T) or from max to min (type M) displacement position.

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

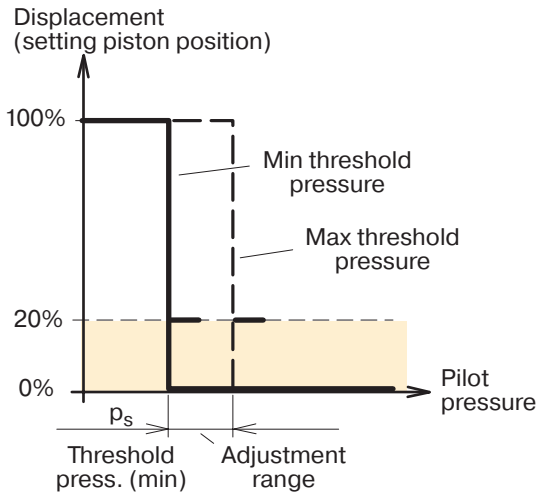
The threshold pressure is factory set at 10 bar, but can be adjusted between 5-25 bar; (ref. charts 1 and 2, on pages 79 and 80).



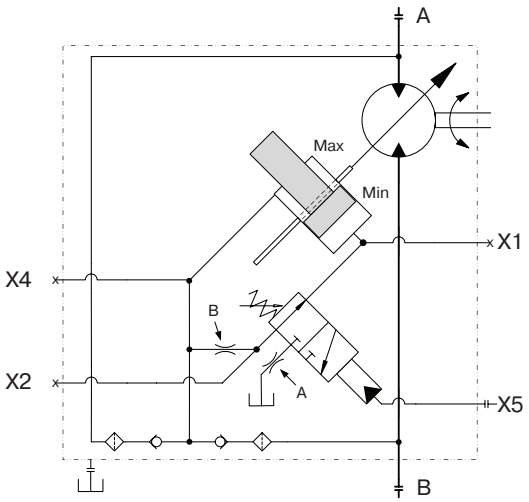
HO diagram (displacement vs. pilot pressure). (type T, positive control)



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



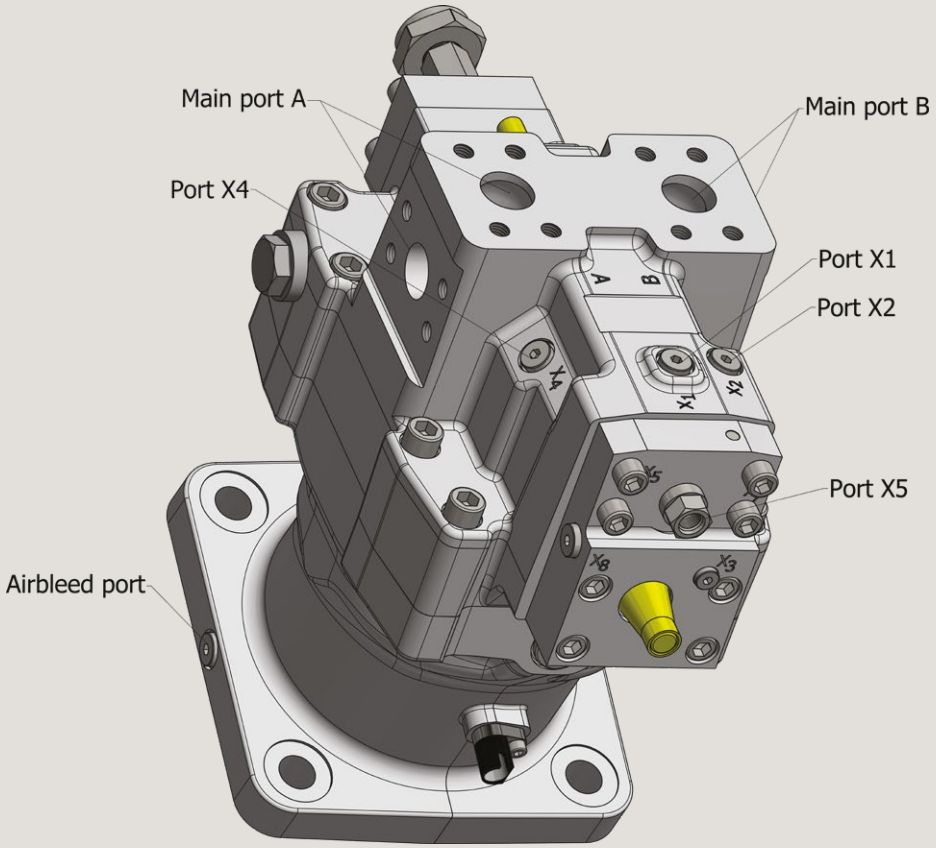
HO diagram (displacement vs. pilot pressure). (type M, negative control)



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

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

Gauge ports HO control



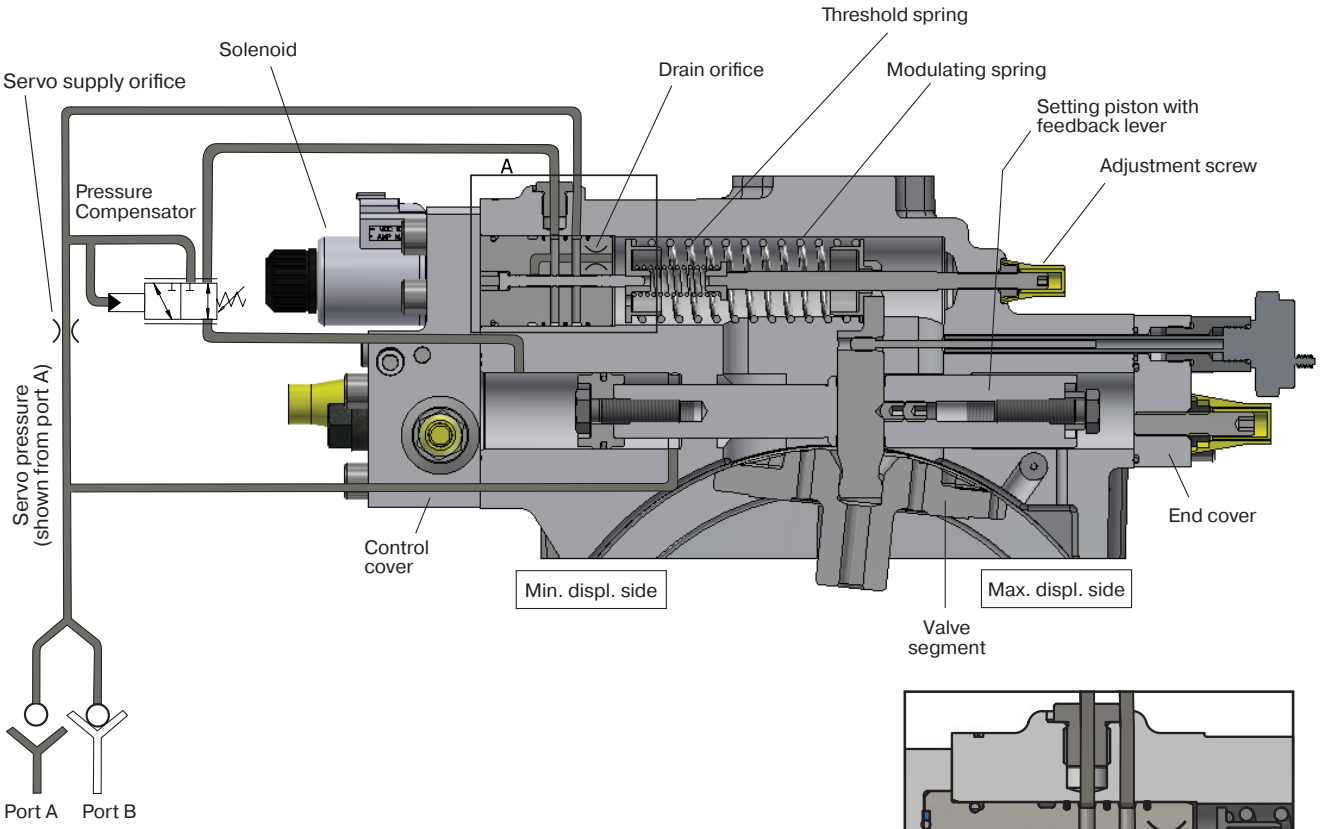
Port locations – V16-220/270 with HO control.

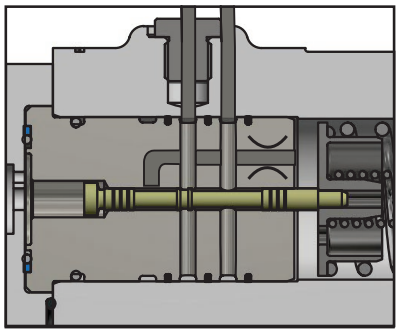
Gauge/pilot ports (HO control):	
X1	Setting piston pressure (large setting piston area)
X2	Servo supply pressure (after orifice)
X4	Servo supply pressure (before orifice)
X5	External pilot pressure (max 100 bar; HO and HP control)
Port sizes:	
–	M14x1.5 (ISO version)
–	$^{9}/_{16}$"-18 O-ring boss (SAE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

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

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

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





A

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

Negative control characteristics (M code)

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

Positive control characteristics (T code)

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

*(ref. Controls page 54)

EPA/EPB control with pressure cutoff

The pressure cutoff overrides the EP control.

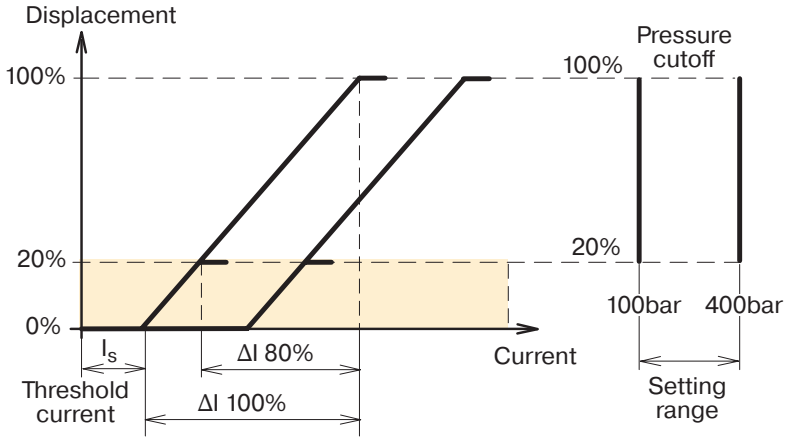
If the system pressure increase, due to the load or reduced motor displacement to the setting of the pressure cutoff valve, the control increases displacement. When displacement increases, the available torque increases as well but the system pressure remains constant.

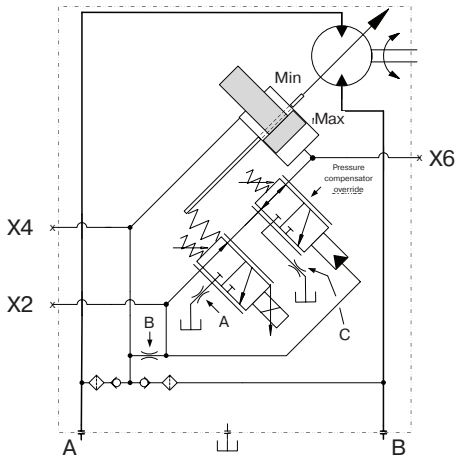
Pressure cutoff setting range is 100 – 400 bar. One revolution corresponds to 48 bar (696 psi)

The threshold current of the 12 VDC solenoid is factory set at 500 mA. The 24 VDC solenoid is factory set at 250 mA. (Ref. charts 1 and 2, on pages 79 and 80).

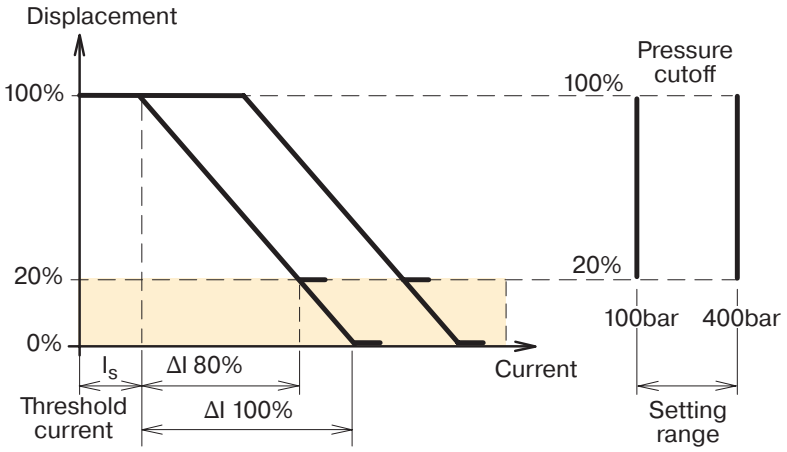
The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The corresponding female connector is not included.

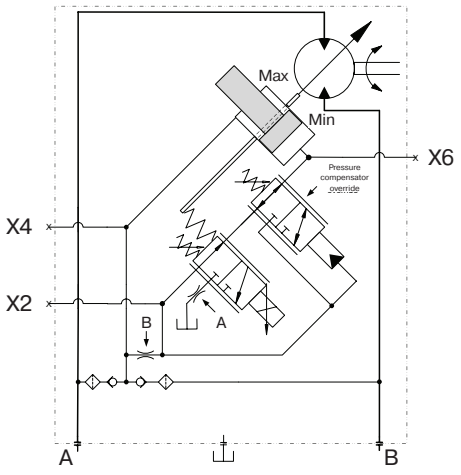
Note: The female connector is available as spare part P-N 3787488.





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





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

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

EOA/EOB control with pressure cutoff

The pressure cutoff overrides the EO control.

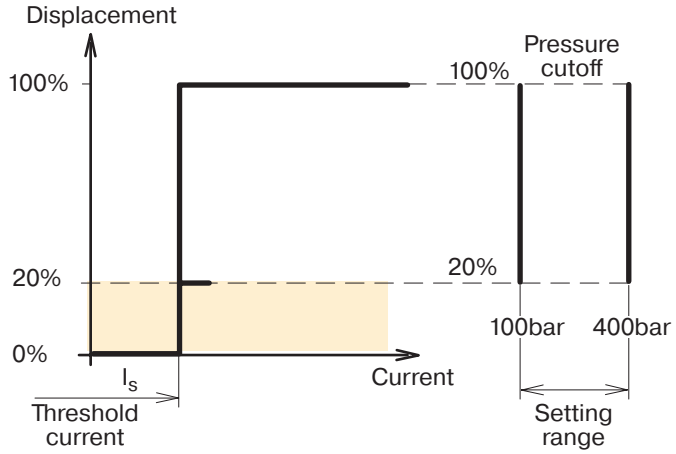
If the system pressure increase, due to the load or reduced motor displacement, to the setting of the pressure cutoff valve, the control increases displacement. When displacement increases, the available torque increases as well but the system pressure remains constant.

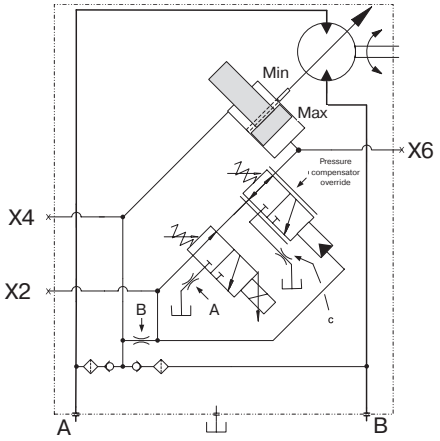
Pressure cutoff setting range is 100 – 400 bar. One revolution corresponds to 48 bar (696 psi)

The threshold current of the 12 VDC solenoid is factory set at 500 mA. The 24 VDC solenoid is factory set at 250 mA. (Ref. charts 1 and 2, on pages 79 and 80).

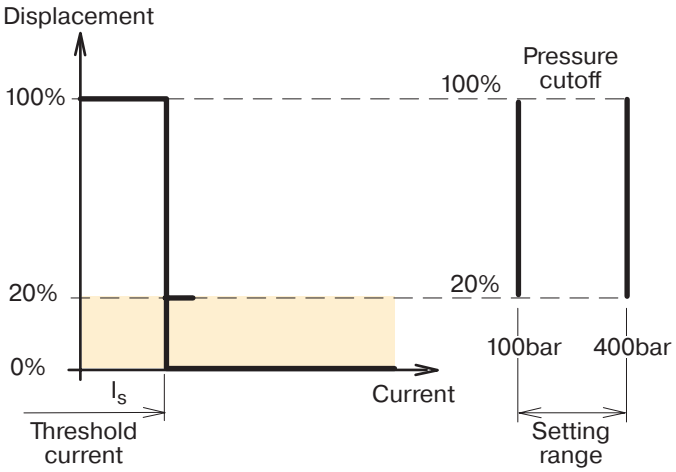
The male connector, type Deutsch DT04-2P (IP67) is permanently installed on the solenoid. The corresponding female connector is not included.

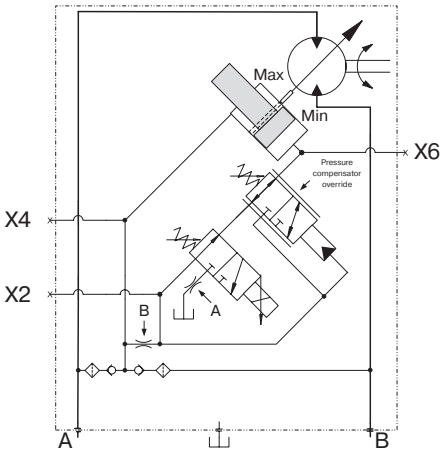
Note: The female connector is available as spare part P-N 3787488.





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

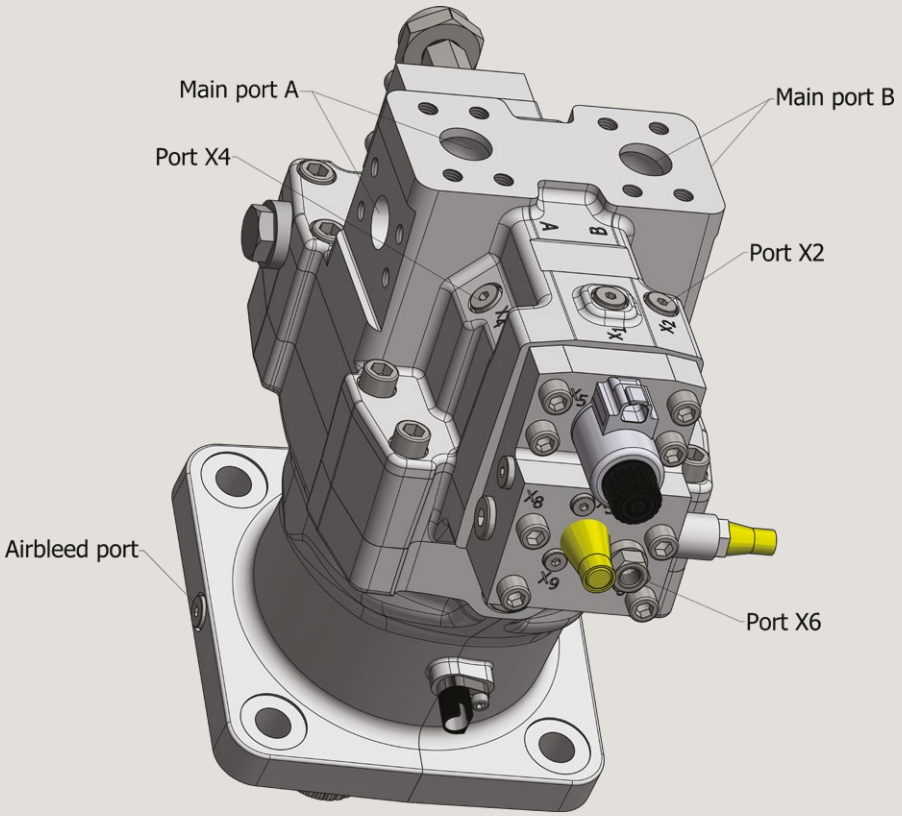




EOA/B control, type M, negative control (begins at max. displacement)

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

Gauge ports EPA/EPB/EOA/EOB control



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

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

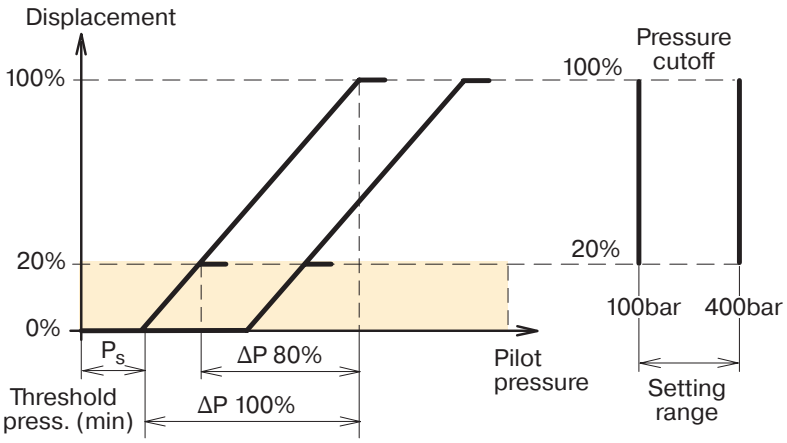
HPC control with pressure cutoff

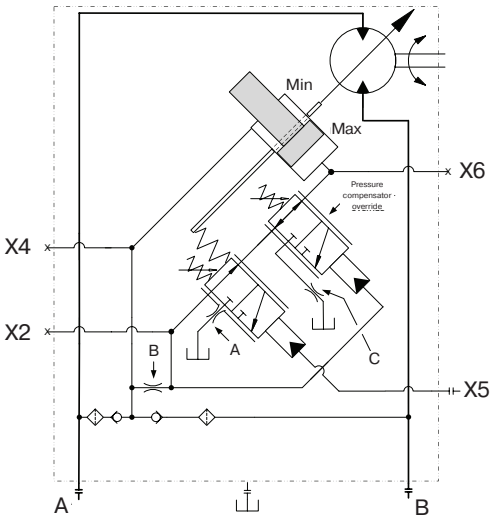
The pressure cutoff overrides the HP control.

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

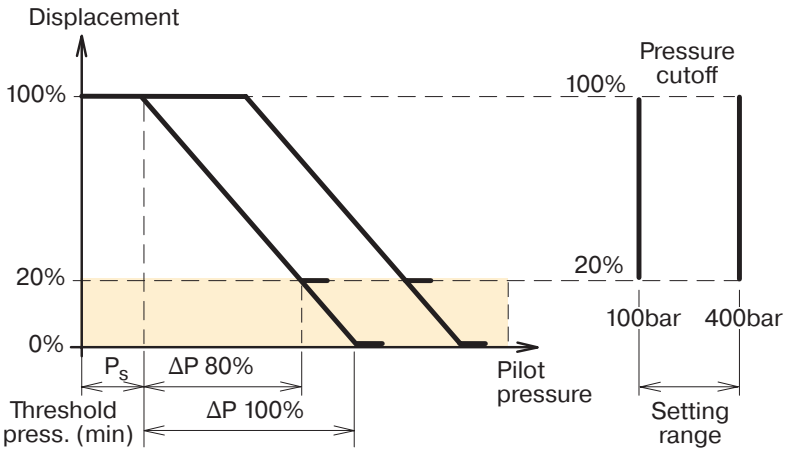
Pressure cutoff setting range is 100 – 400 bar. One revolution corresponds to 48 bar (696 psi)

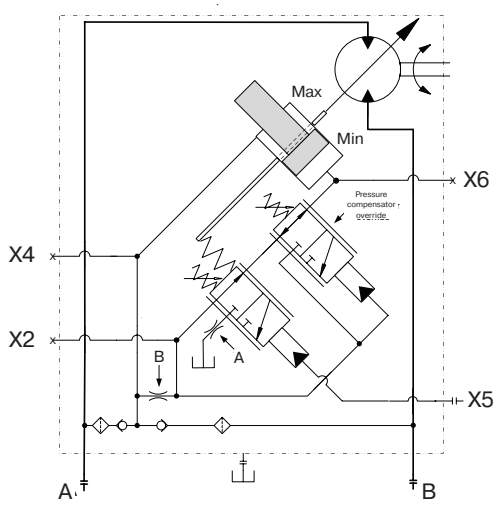
Threshold pressure is preset from factory to 10 bar; (ref. charts 1 and 2, on pages 79 and 80).





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





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

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

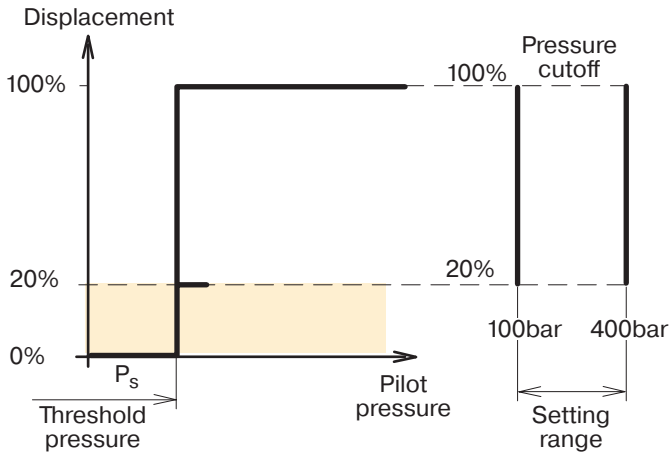
HOC control with pressure cutoff

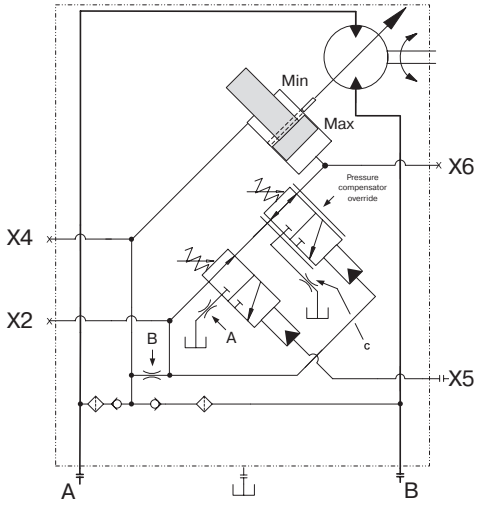
The pressure cutoff overrides the HO control.

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

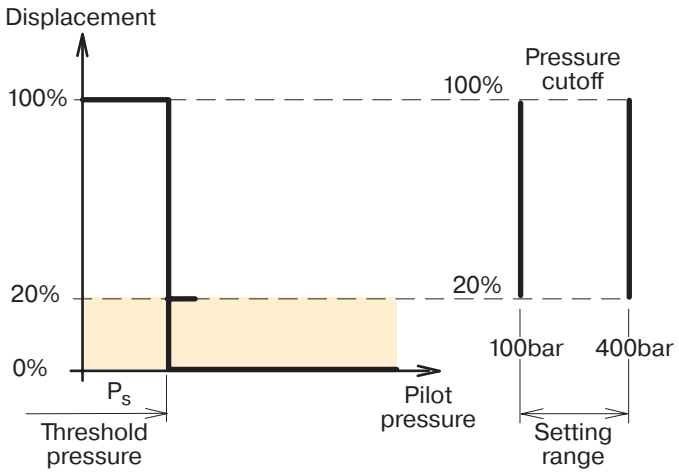
Pressure cut off setting range is 100 – 400 bar. One revolution corresponds to 48 bar (696 psi)

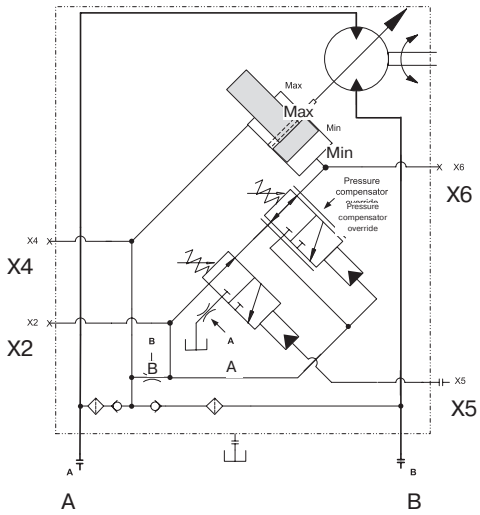
Threshold pressure is preset from factory to 10 bar; (ref. charts 1 and 2, on pages 79 and 80).





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

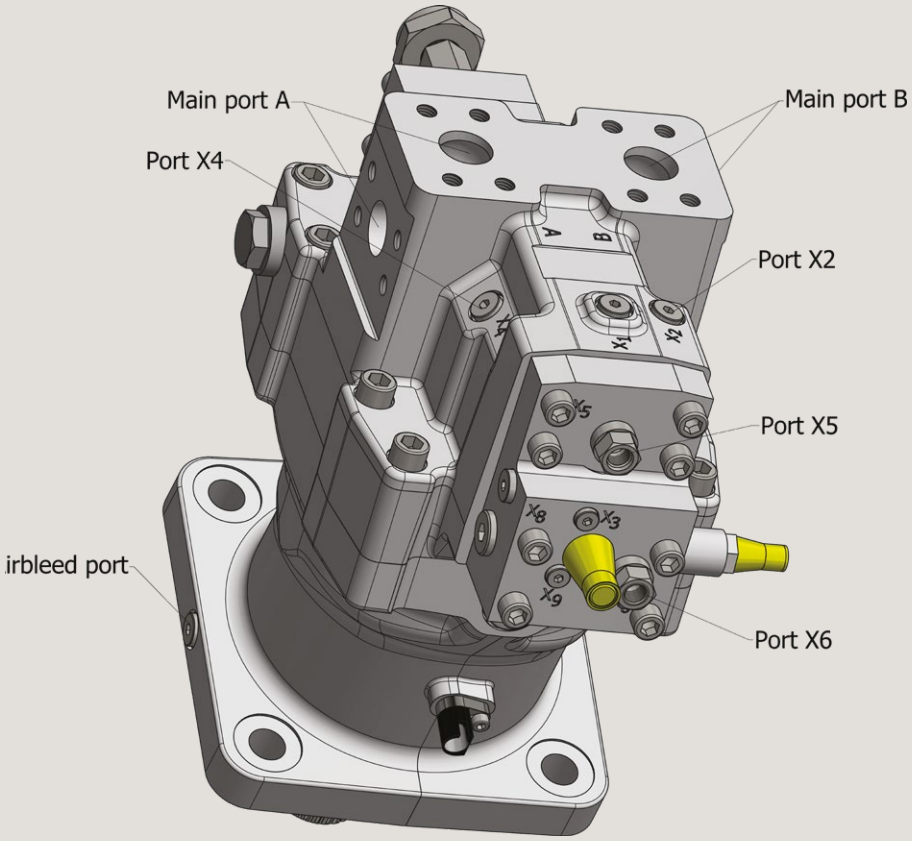




HOC control, type M, negative control (begins at max. displacement)

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

Gauge ports HPC/HOC control



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

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

Product code V16

Example:

V16 – **220** – **T** – **S** **AA** **S** – **AC** **E** **3** **B** – **P**

Motor type | Frame size | Function | Mount.-flange & ports | Main-ports | Shaft end | Control | Control signal | Control orifice set | Control modulation | Valve options

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

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

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

Frame size		220	270
Code	Main ports [5], see Fig. 2		
00	Axial and radial ports	x	x
AA	Axial ports	x	x
RR	Radial ports	x	x
AR	Axial port on A-side Radial port on B-side	x	x
RA	Radial port on A-side Axial port on B-side	x	x
A0	Axial port on A-side Radial and axial port on B-side	x	x
0A	Radial and axial port on A-side Axial port on B-side	x	x
R0	Radial port on A-side Radial and axial port on B-side	x	x
0R	Radial and axial port on A-side Radial port on B-side	x	x

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

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

Code	Control signal
A	Pressure cutoff, EO, EP 12 VDC
B	Pressure cutoff, EO, EP 24 VDC
C	Pressure cutoff, HO, HP
E	External pressure (AC, HO, HP)
I	Internal pressure (AC)
L	12 VDC (EO, EP)
H	24 VDC (EO, EP)
D	24 VDC ATEX-version (EO, EP) Class, see note [4]

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

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

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

Version number
Factory assigned (000 = standard)

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

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

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

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

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

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

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

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

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

1) All values in pressure/current control range apply to motors without displacement limitations (0 - 35°).

2) All V16 motors are prepared for speed sensor.

3) Threshold pressure/current depends on the «displacement limitation group» to which the motor belongs, see Chart 1 and Chart 2, on pages 79 and 80).

4) The solenoid valve is both IECEx and ATEX certified according to the classification in Fig.1.

5) All motors have both axial and radial ports. Options at 'Main ports' applies to which ports shall not have cover caps.

Product code V16

Equipment protection level						
Temperature classes						
Explosion group						
II	**2G**	**Ex**	**e mb**	**IIC**	**T4**	**Gb**
			Type of protection			
		Explosion protection				
	Product category					
Equipment group						

Fig. 1. ATEX classification

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

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

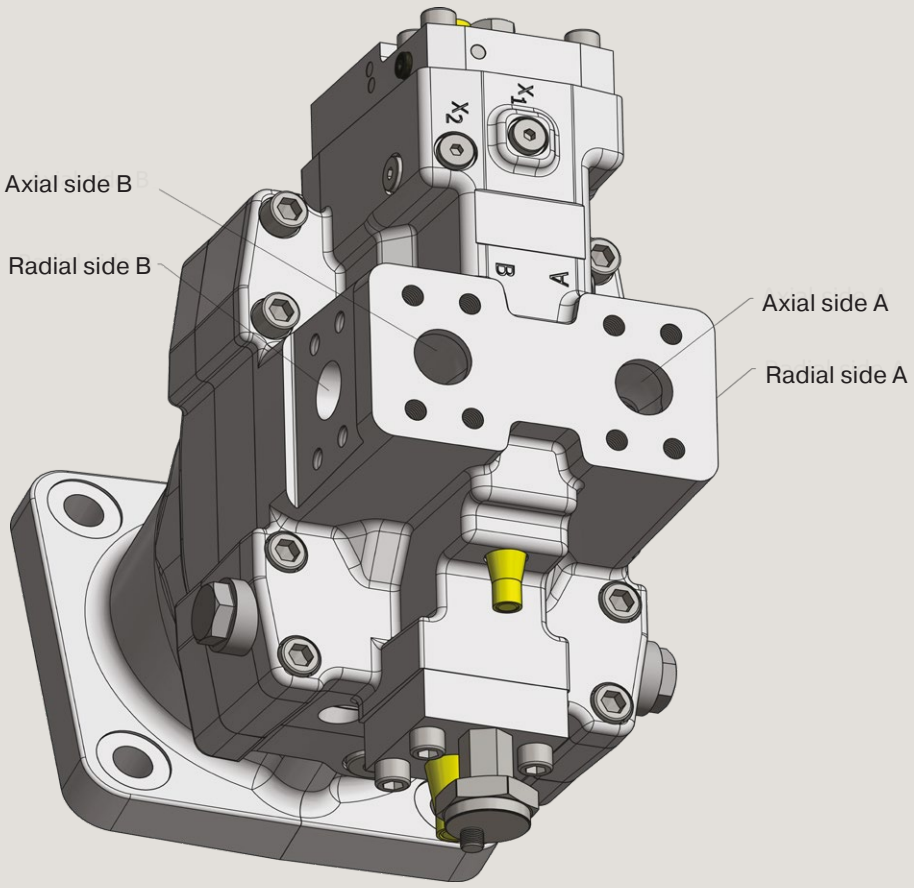


Fig. 2. Definitions: Axial/Radial main ports and A/B side of the motor.

Product code V16

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

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

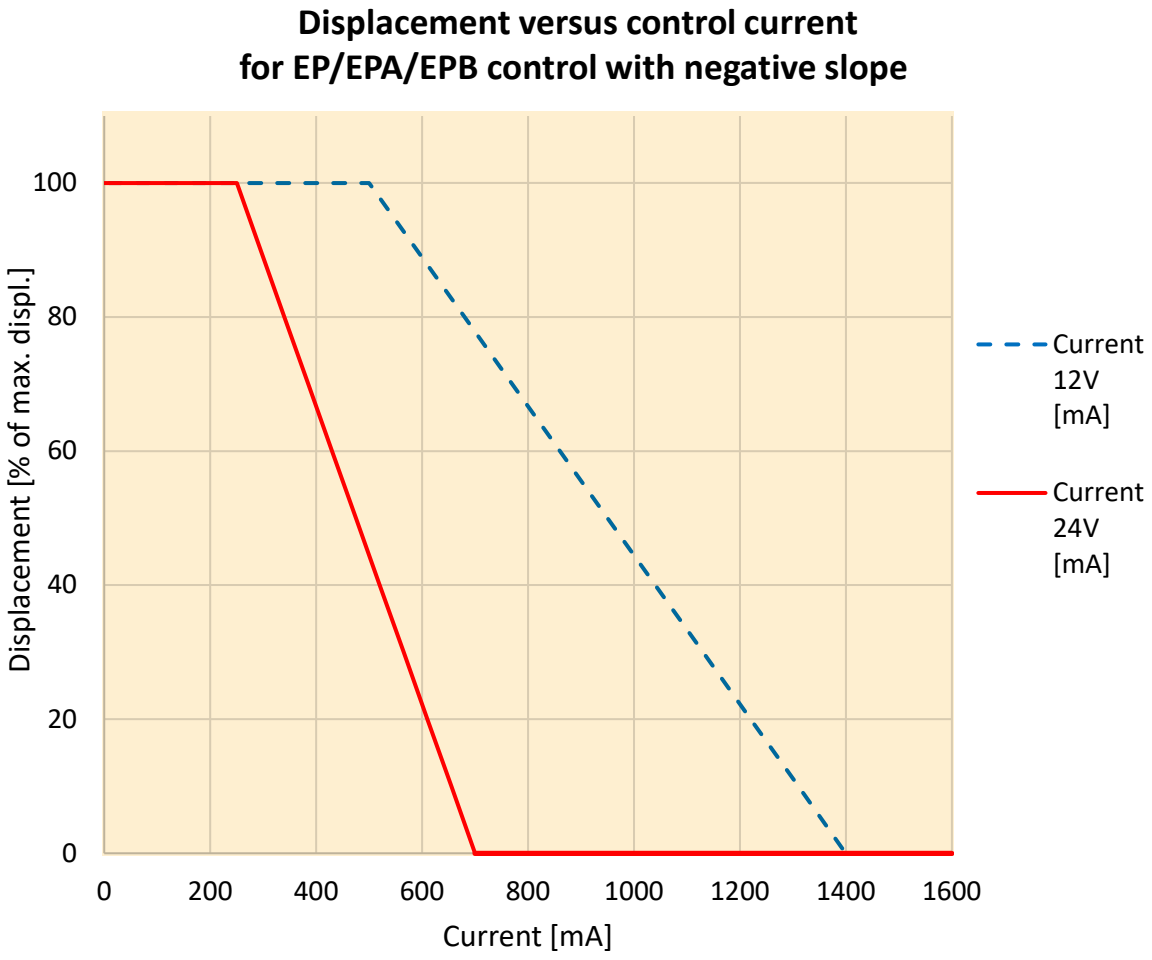


Fig. 3. Characteristics of EP control with negative slope control curve (control starts at max. displacement).

Product code V16

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

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

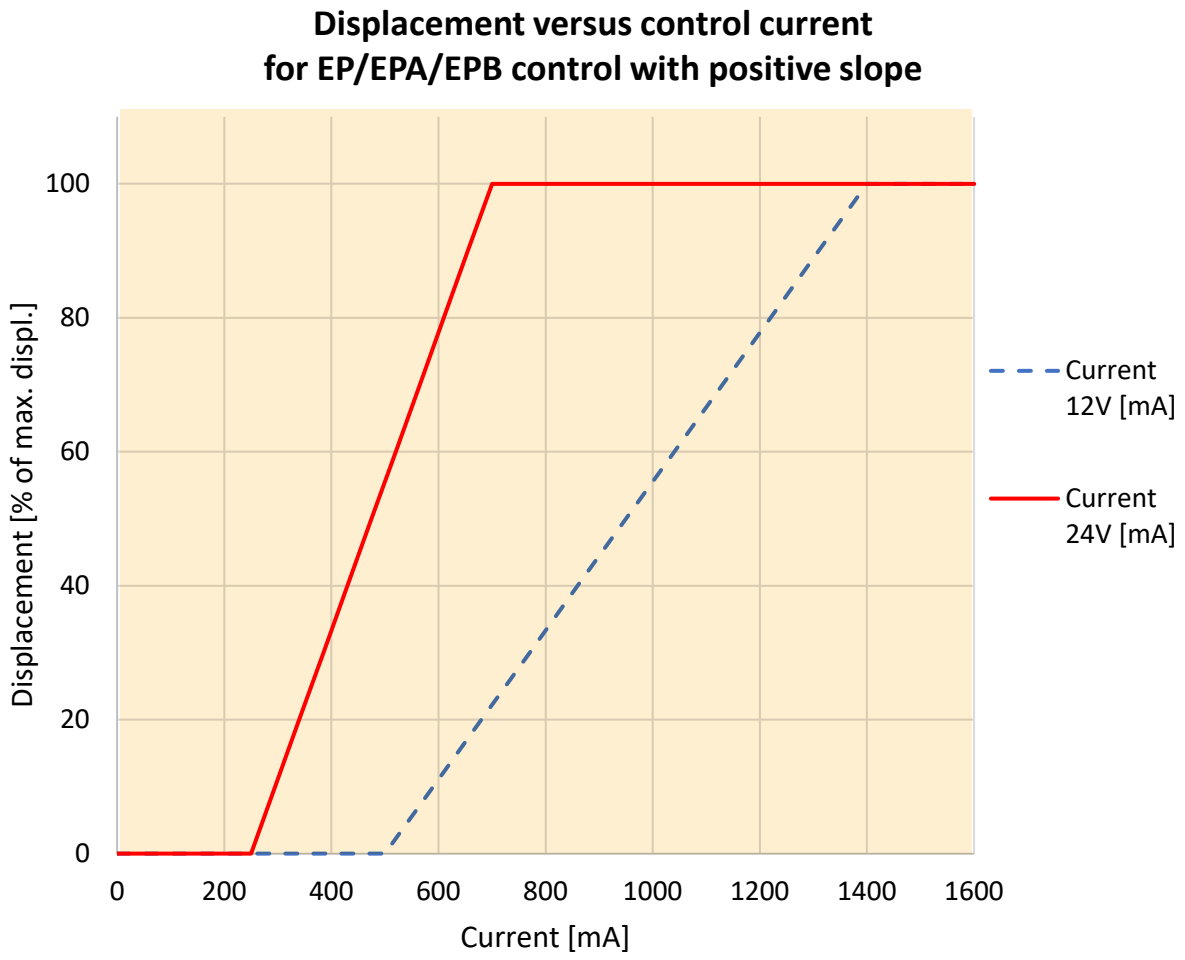


Fig. 4. Characteristics of EP control with positive slope control curve (control starts at min. displacement).

Product code V16

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

Chart 3. Available cartridge valves.

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

Chart 4. Available flushing orifices.

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

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

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

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

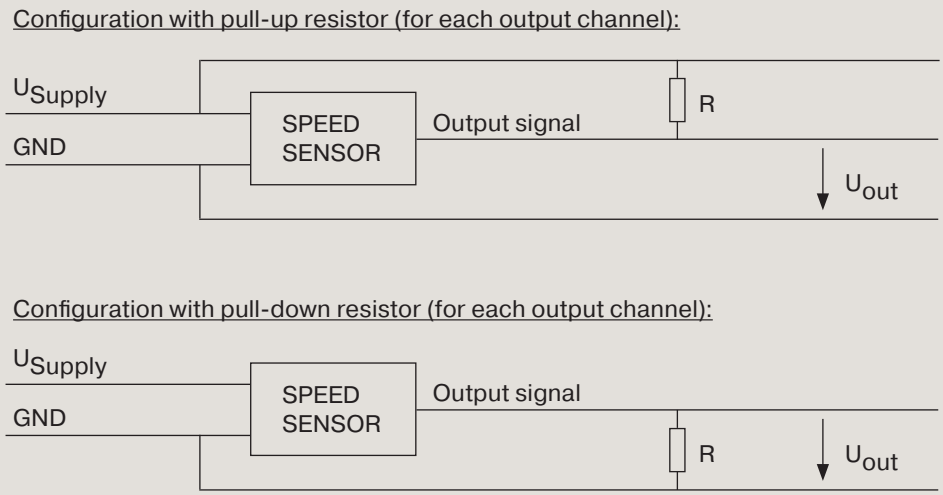
	Spline shaft (DIN 5480)	*Mounting flange (Brg. Hsg)*	*Dimension, flange to shaft shoulder*
	Code **G** (opt.)		[mm]
V16-270	W50x2x30x24	ISO 200	50

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

Chart 5. Compilation of selectable shaft variants.

Product code V16

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



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

Fig. 5. Available speed sensor types.

Shaft Code D

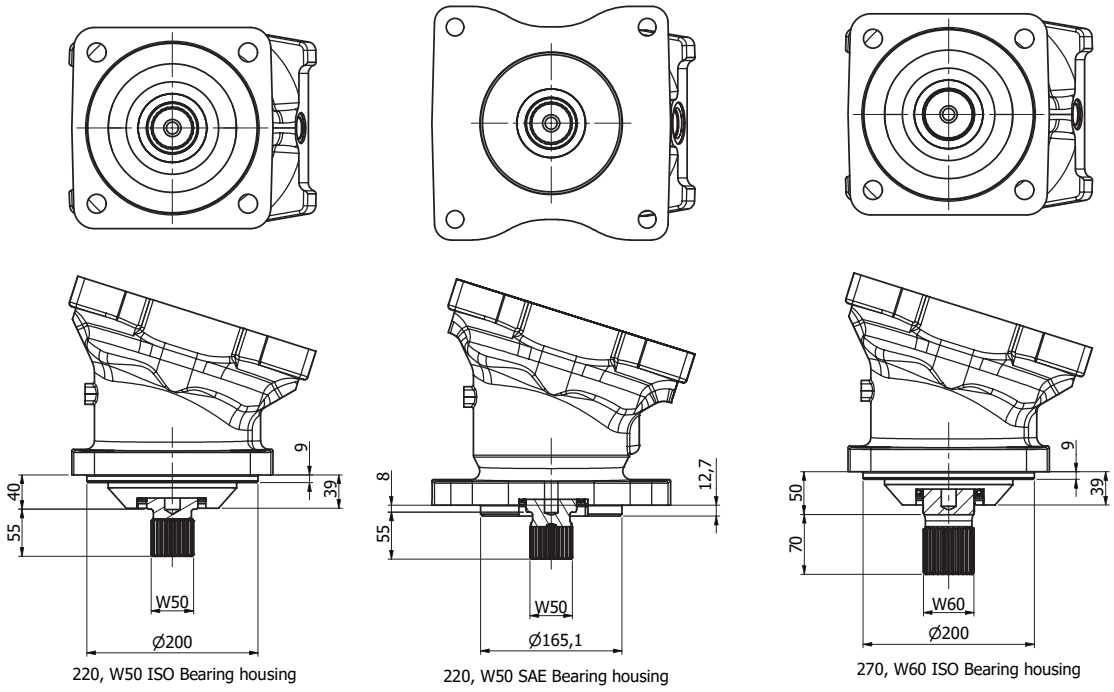
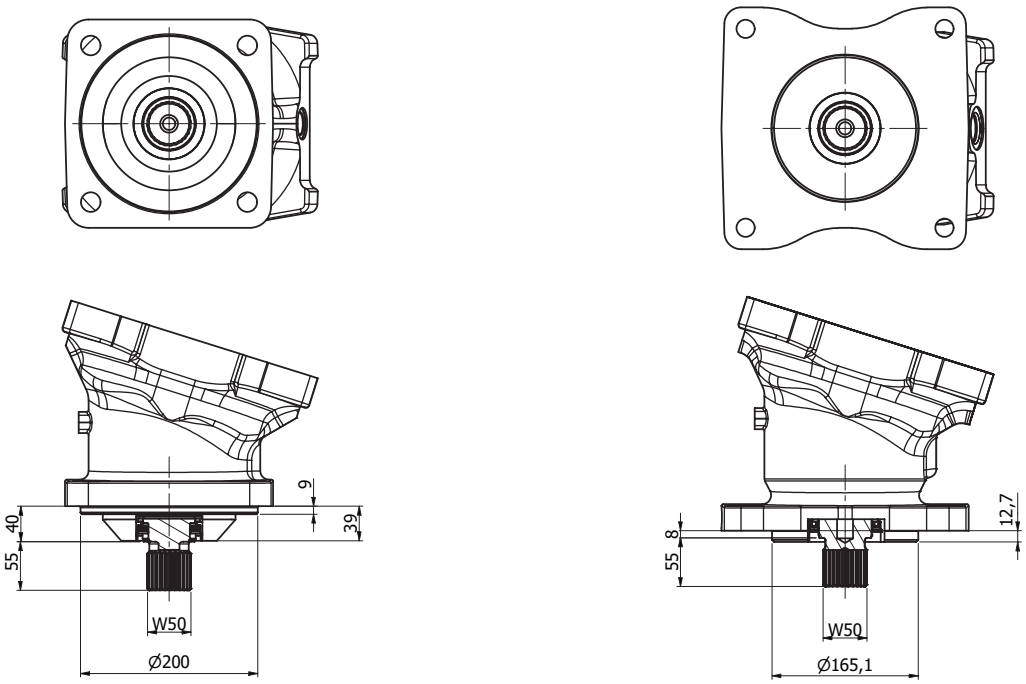


Fig. 6. Dimensional drawings, shaft end code D.

Shaft Code Z

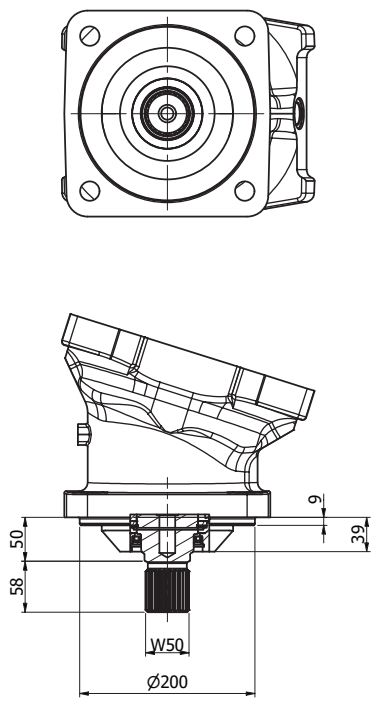


270, W50 ISO Bearing housing

270, W50 SAE Bearing housing

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

Shaft Code G



270, W50 ISO Bearing housing

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

Shaft Code S

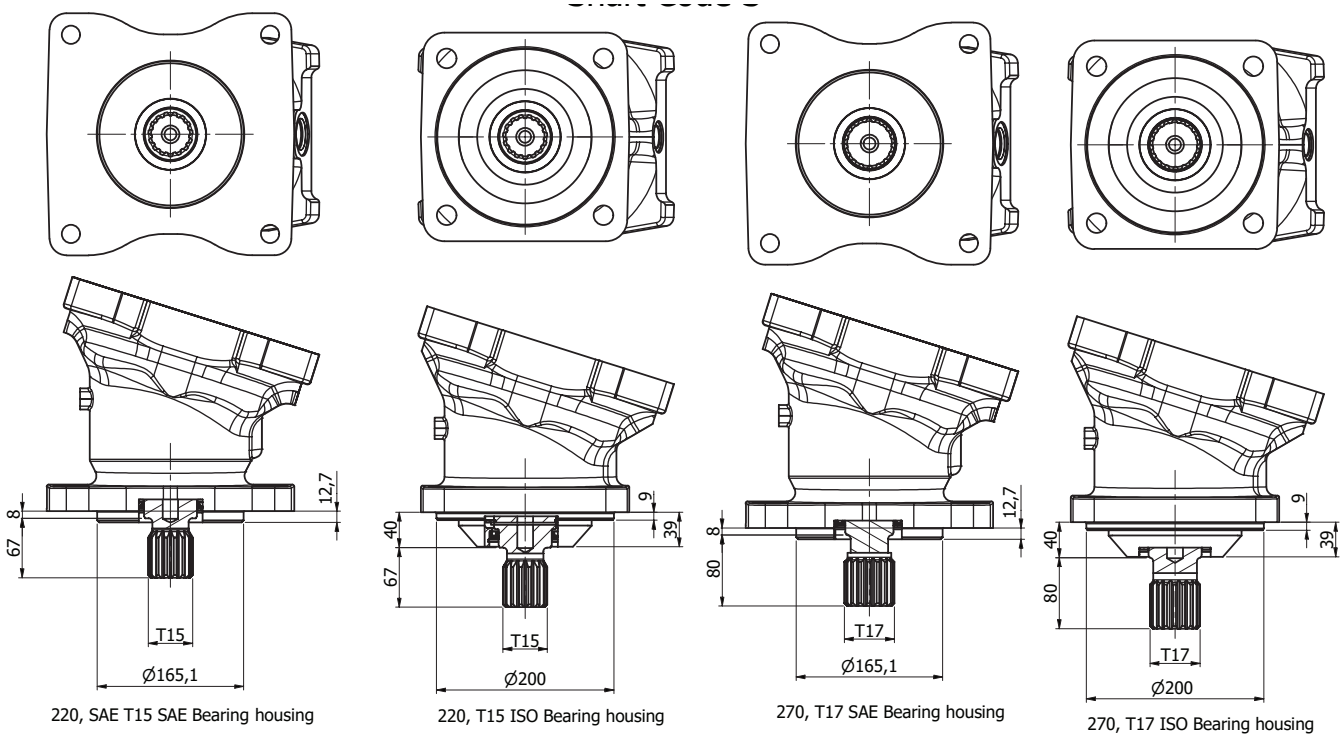


Fig. 9. Dimensional drawings, shaft end code S.

Shaft Code U

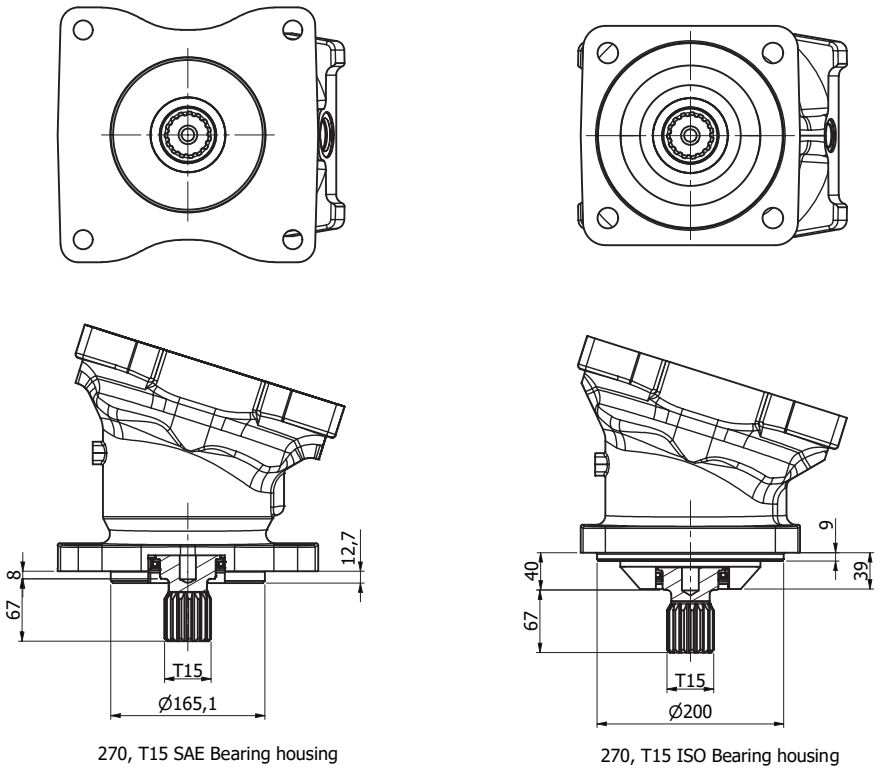
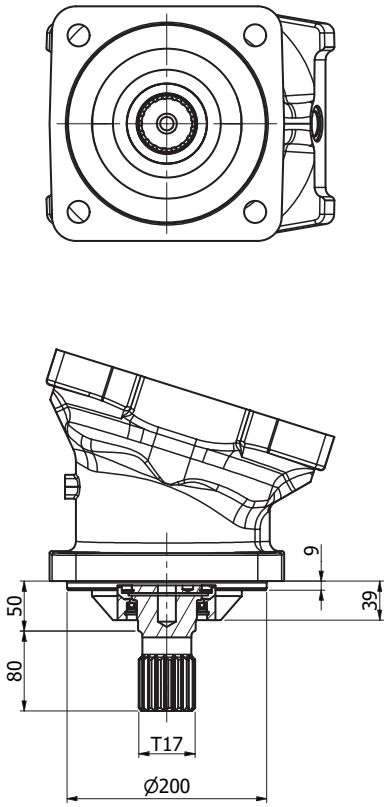


Fig. 10. Dimensional drawings, shaft end code U.

Shaft Code H

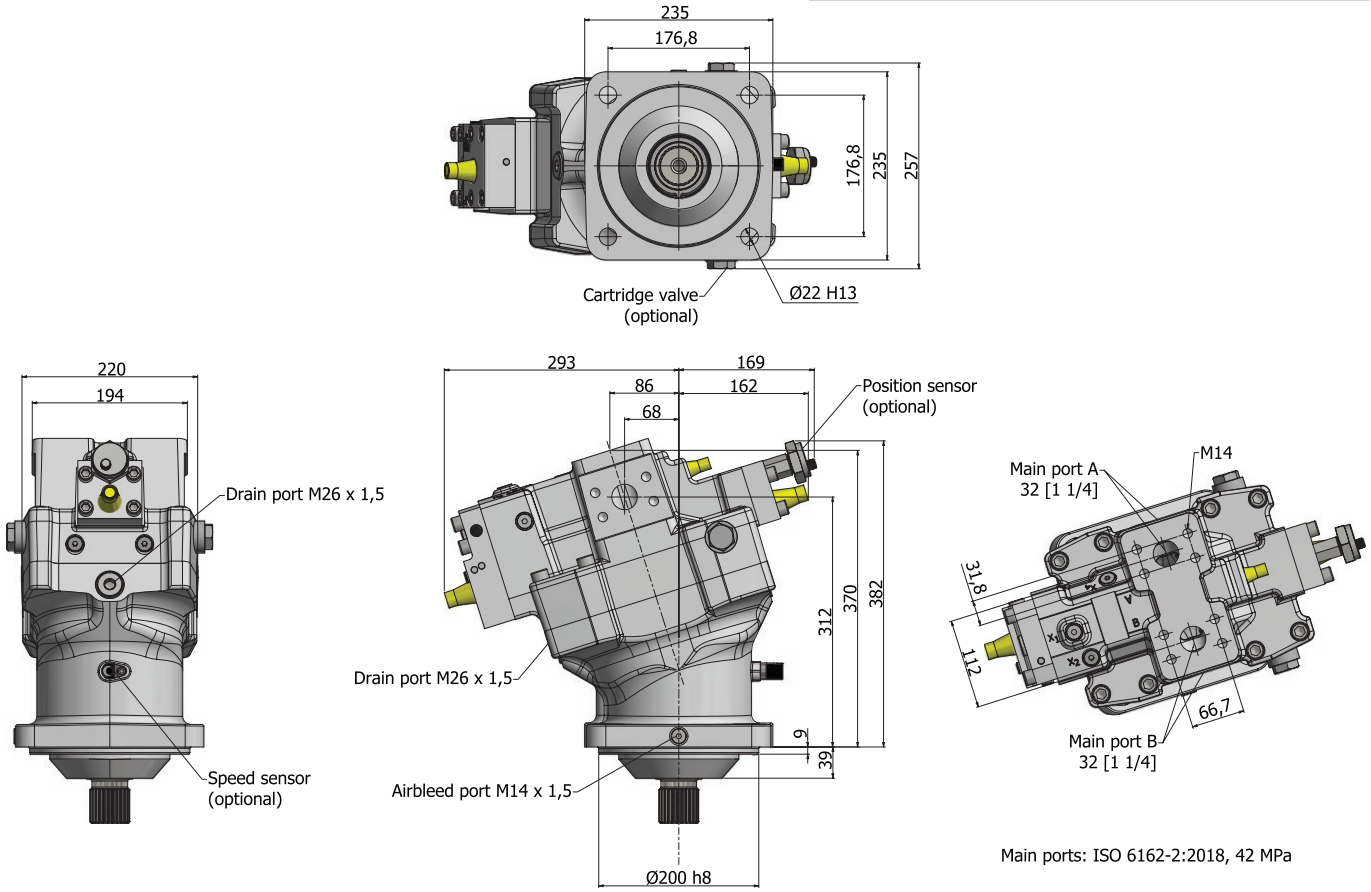


270, T17 ISO Bearing housing

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

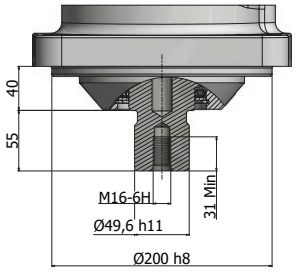
V16-220, ISO version, type T positive control

Shown: V16-220-ISO with AC compensator

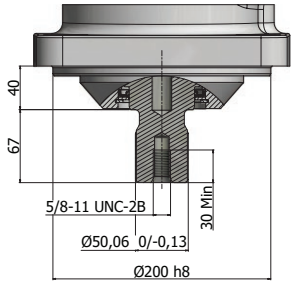


Main ports: ISO 6162-2:2018, 42 MPa

Shaft code D, -220

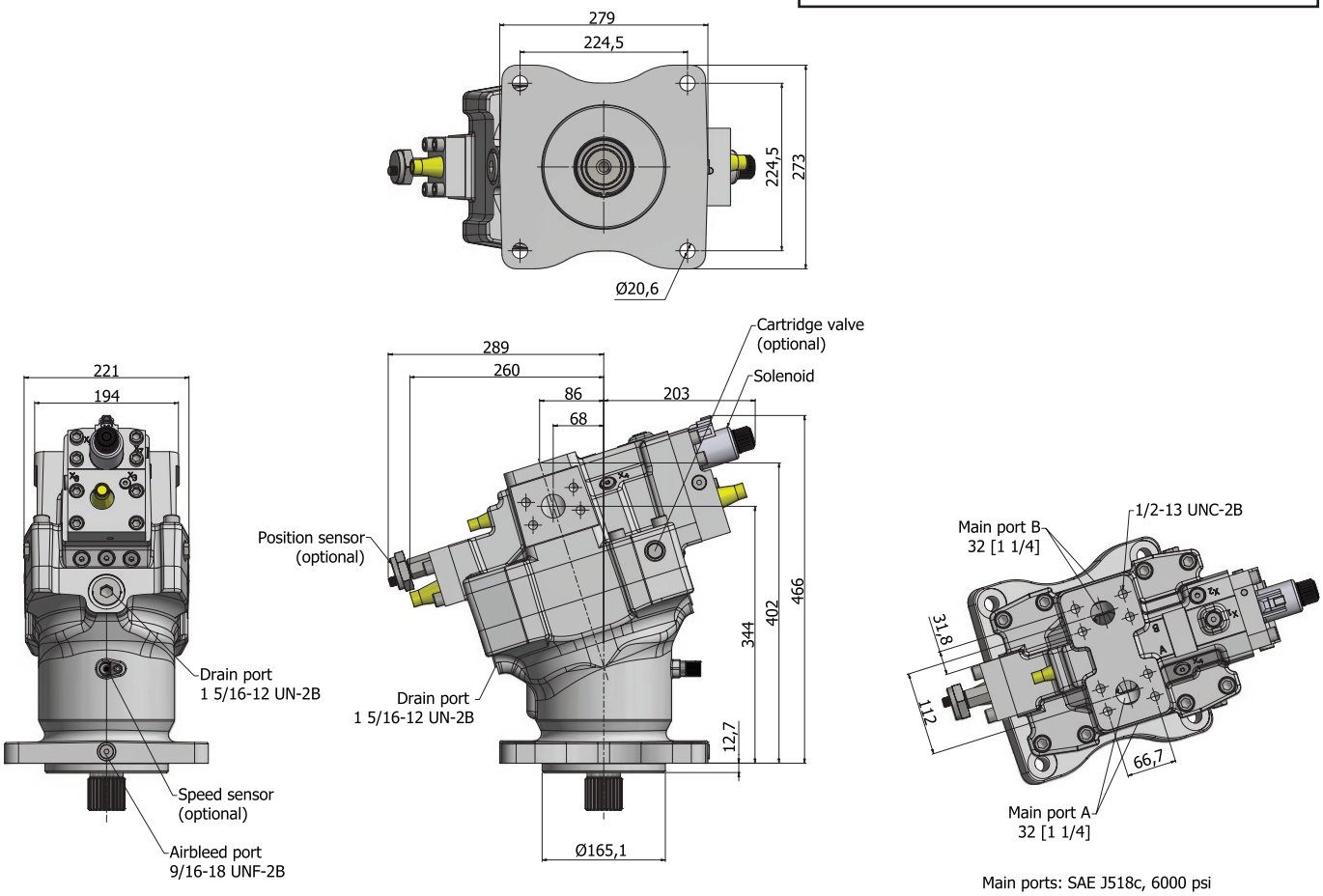


Shaft code S, -220



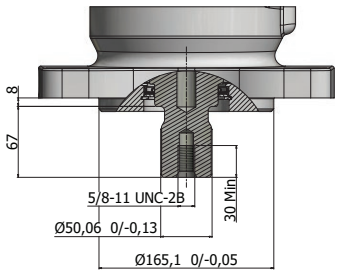
V16-220, SAE version, type M negative control

Shown: V16-220-SAE with EP control

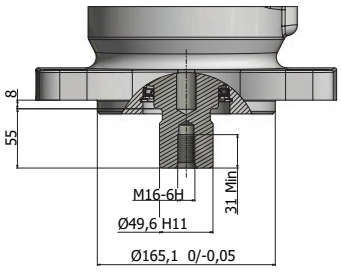


Main ports: SAE J518c, 6000 psi

Shaft code S, -220

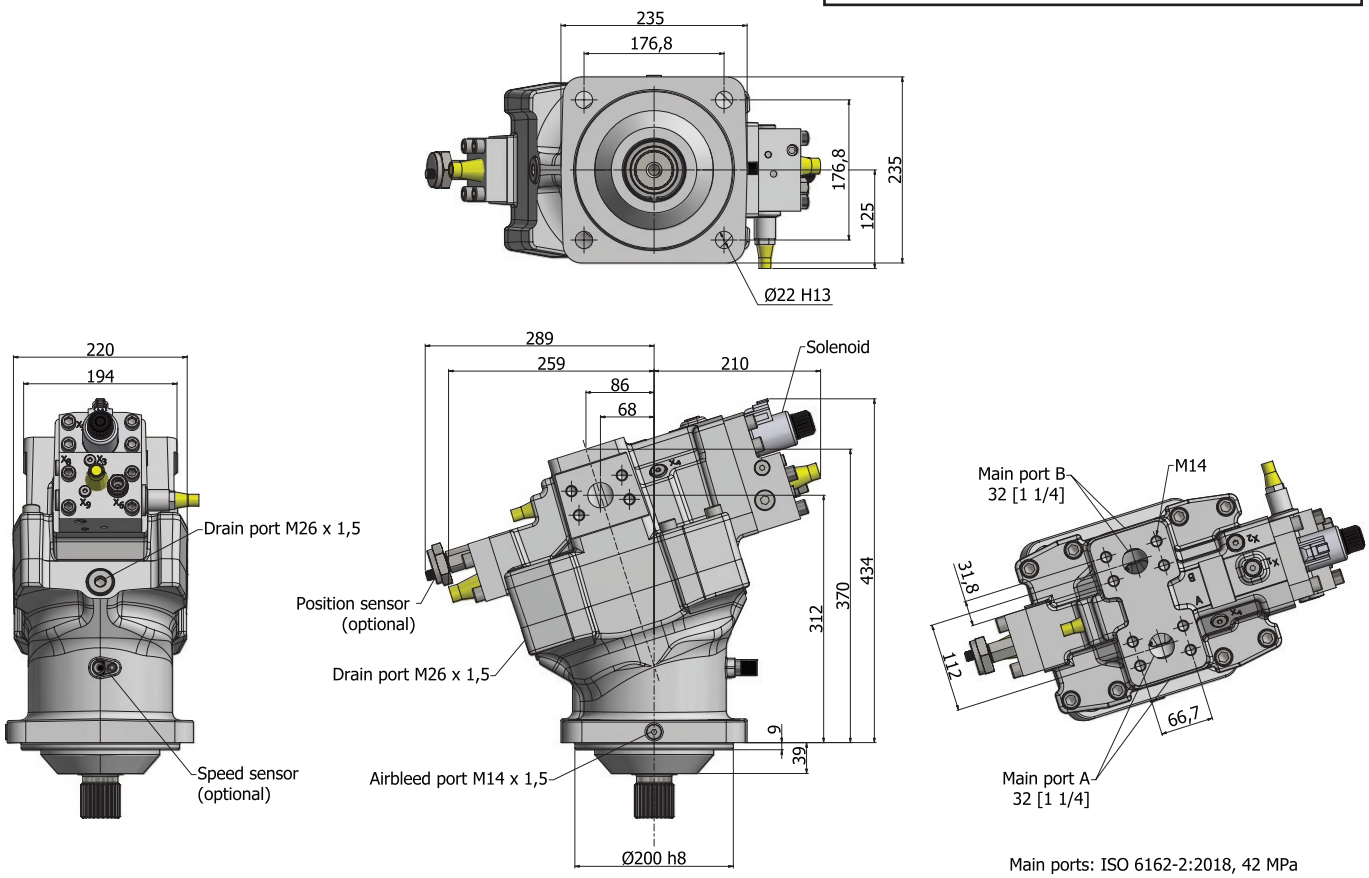


Shaft code D, -220



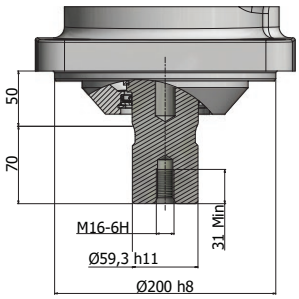
V16-270, ISO version, type M negative control

Shown: V16-270-ISO with EPA control

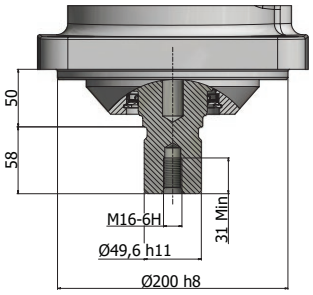


Main ports: ISO 6162-2:2018, 42 MPa

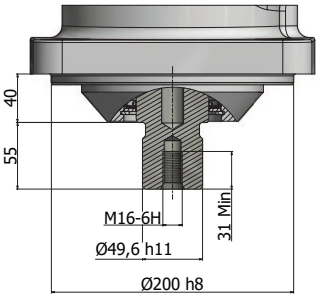
Shaft code D, -270



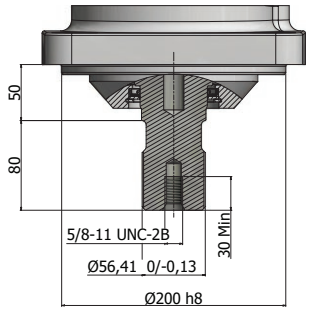
Shaft code G -270



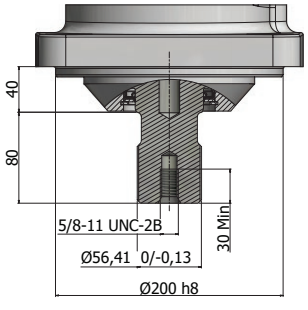
Shaft code Z, -270



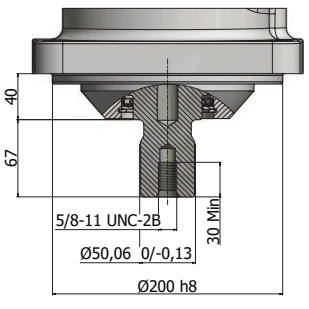
Shaft code H, -270



Shaft code S, -270

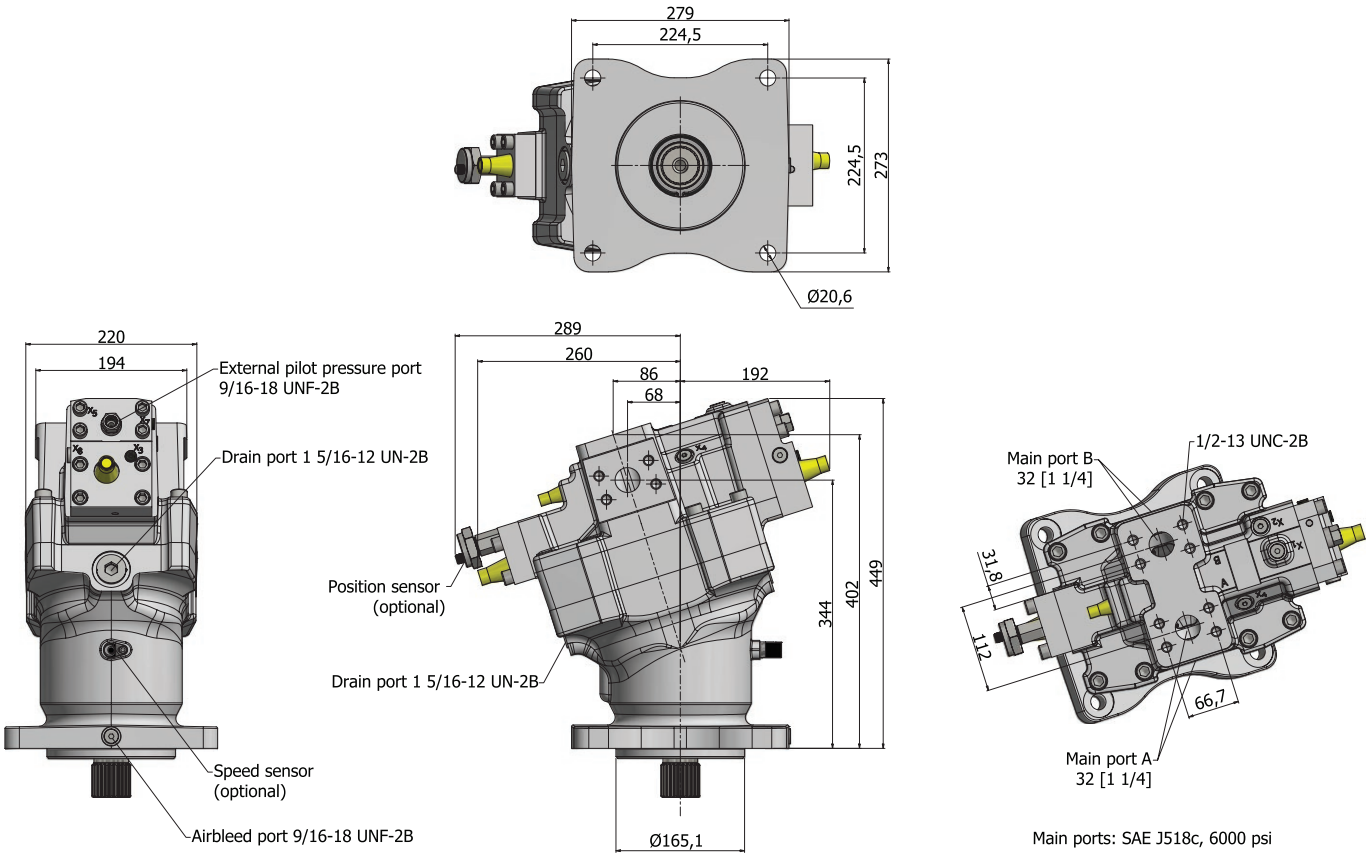


Shaft code U, -270

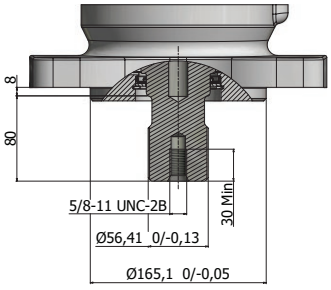


V16-270, SAE version, type M negative control

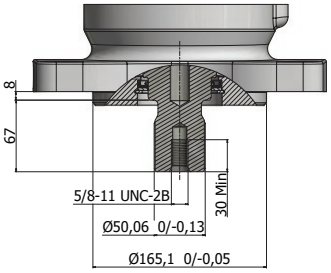
Shown: V16-270-SAE with HP control



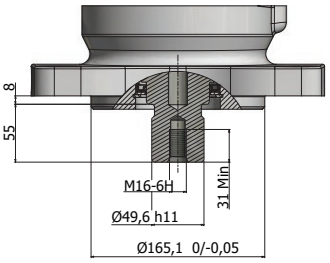
Shaft code S, -270



Shaft code U, -270



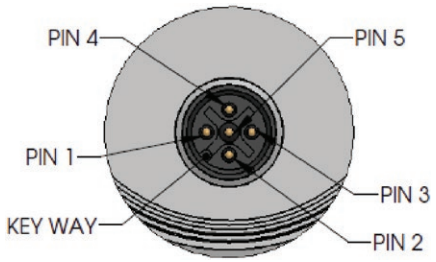
Shaft code Z, -270



Position sensor

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

M12 connector



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

Specifications on page 91.

Environmental

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

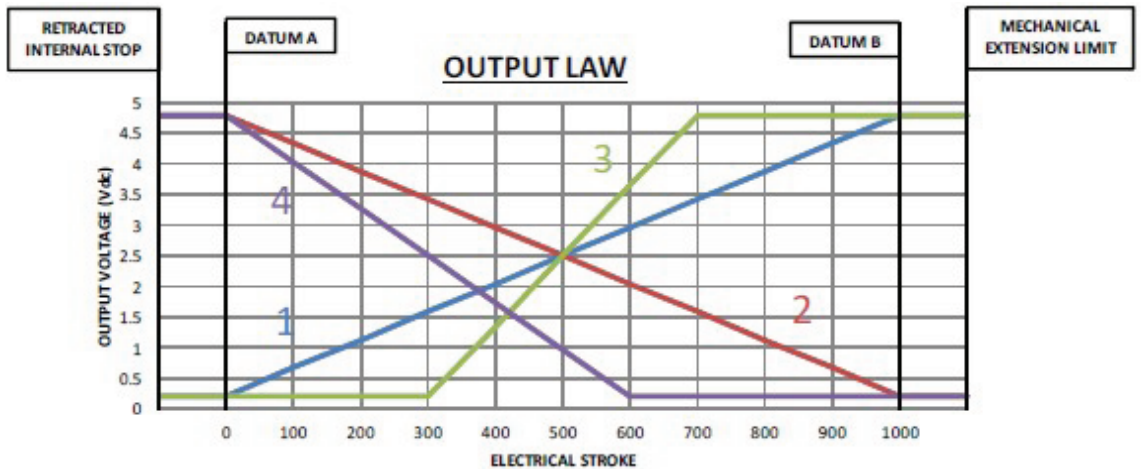
Specifications

Electrical

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

Voltage Output – ICT800

ACTUAL ELECTRICAL STROKE	= High Voltage Position – Low Voltage Position

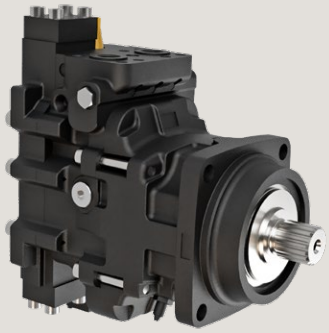


	Low Voltage Output Position	High Voltage Output Position	Actual Electrical Stroke
1	0000	0000	1000
2	1000	0000	1000
3	0300	0700	0400
4	0600	0000	0600

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

V12

V14



V16

Content

Page

Valve options (overview)

- Flushing valve (option **L**; below)
- Pressure relief valves (option **P**; page 94)

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

Sensor options (overview)

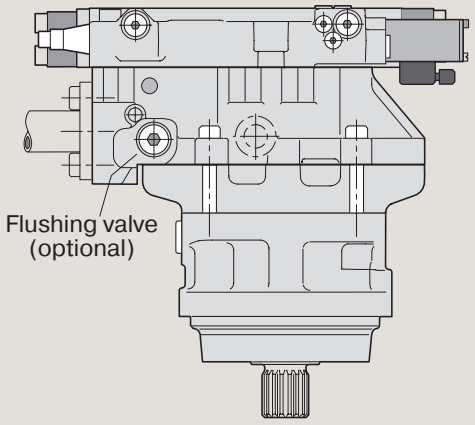
- Shaft speed sensor V14 (option **P**; page 95)
  Shaft speed sensor V16 (option **S0** or **H0**; page 95)

Flushing valve (option L)

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

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

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



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

Available nozzles V12

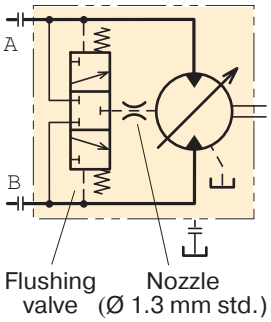
Ordering code	Orifice size [mm]	Status	Flow [l/min] at		
			15 bar	20 bar	25 bar
L01	**1.3**	**Standard**	**3.9**	**4.5**	**5.0**
L02	0.8	Optional	1.5	1.7	1.9
L03	1.0	Optional	2.3	2.7	3.0
L04	1.2	Optional	3.2	3.7	4.1
L05	1.5	Optional	5.2	6.0	6.7
L06	1.7	Optional	6.6	7.7	8.6
L07	2.0	Optional	9.2	10.6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

NOTE: 'L00' = plug

Available nozzles V14 and V16

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

NOTE: 'L000' = plug



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

Pressure relief valves (option P)

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

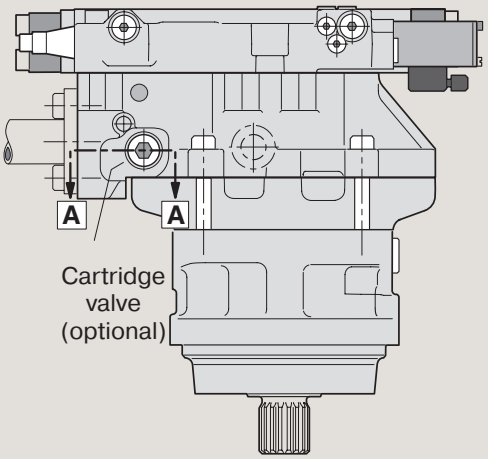
NOTE:
- The pressure relief cartridges should not be used as main pressure reliefs; in a motor application, they should only be relied on to limit short duration pressure peaks (or the temperature of the fluid which circulates through the motor will rapidly reach damaging high levels).
- The main pressure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

Available cartridges V14

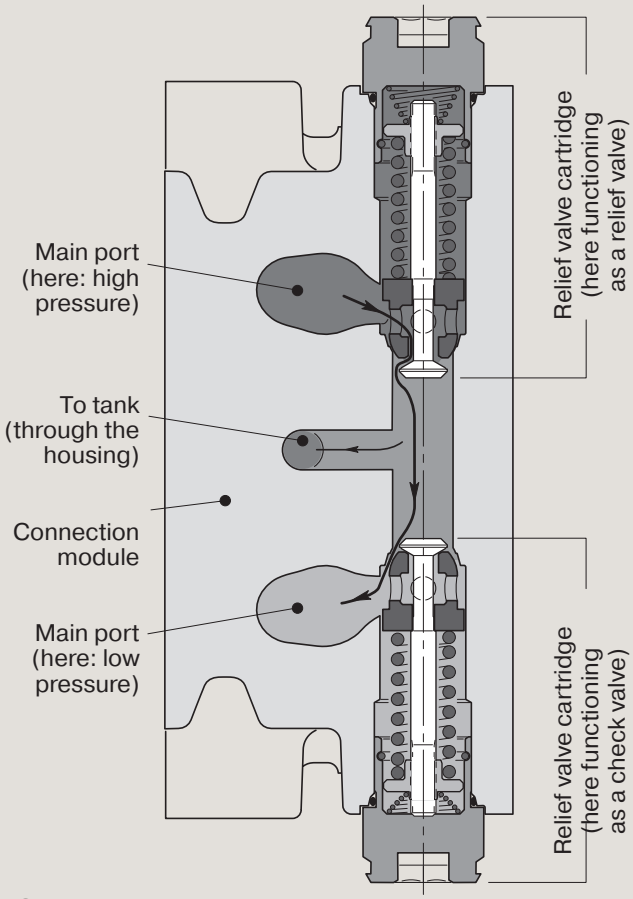
Ordering code	Pressure setting [bar]	Partnumber
P300	300	9120029264
P330	330	9120029265
P350	350	9120029266
P380	380	9120029267
P400	400	9120029268
P420	420	9120029269
P450	450	3766886

Available cartridges V16

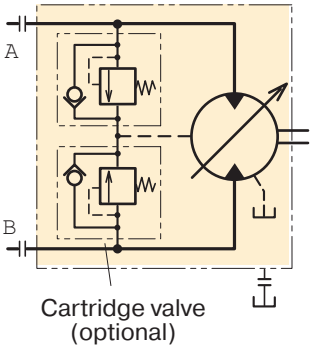
Ordering code	Pressure setting [bar]	Partnumber
P230	230	20006727
P250	250	20004981
P280	280	20007439
P300	300	20005798
P350	350	20000990
P380	380	20006115
P420	420	00153491



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



Section A-A (showing pressure relief cartridges).



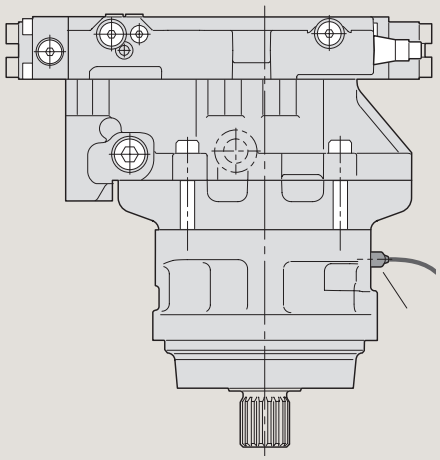
Hydraulic schematic

Speed sensor

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

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

NOTE:
- V12 series must be specified in the ordering code refer to pages 15 to 18.
- V14 series must be specified in the ordering code refer to pages 40 to 42.
- V16 series must be specified in the ordering code refer to pages 76 to 81.



V14-160 (AC control) with speed sensor.

Order number	Electronic	Signals	Installation	Connector	Cable lenght	Installation instruction
3785190	NPN	2	M12*1 adjustable	Free leads	1000 mm	MSG30-8301-INST
3722481	NPN	2	M12*1 adjustable	M12 4 pin	260 mm	MSG30-8303-INST
3722480	NPN	1	M12*1 adjustable	AMP 3 pin	338 mm	MSG30-8304-INST
3722268*	NPN	2	Plug-in	M12 4 pin	260 mm	MSG30-5525-INST
3722271*	PNP	2	Plug-in	M12 4 pin	260 mm	MSG30-5525-INST

** Only for V16.*

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

Running in procedure Parker Motors

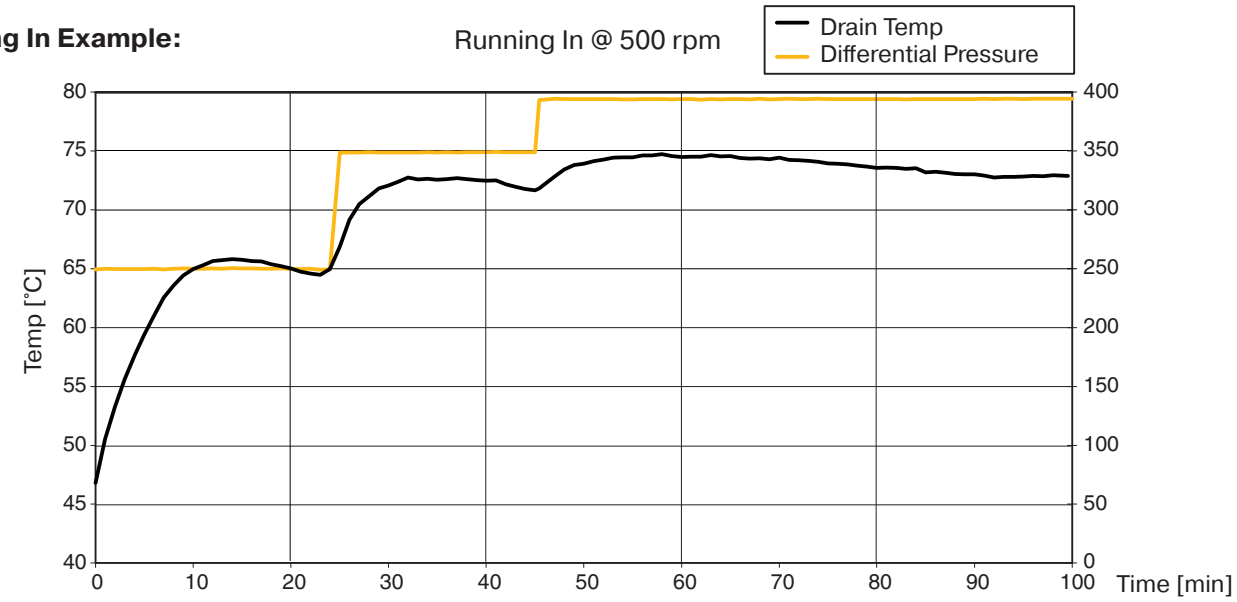
We suggest the following procedure to run in the Variable motors.

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

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

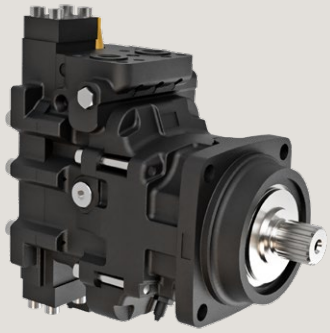
Please make sure the drain temperature probe is in the drain oil flow to measure the correct temp.

Running In Example:



V12

V14



V16

Content

Page

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