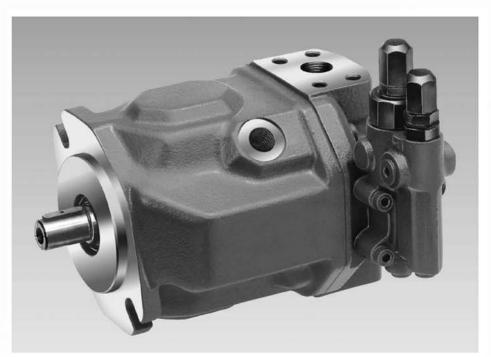# Variable Displacement Pump D10VSO
for open circuits
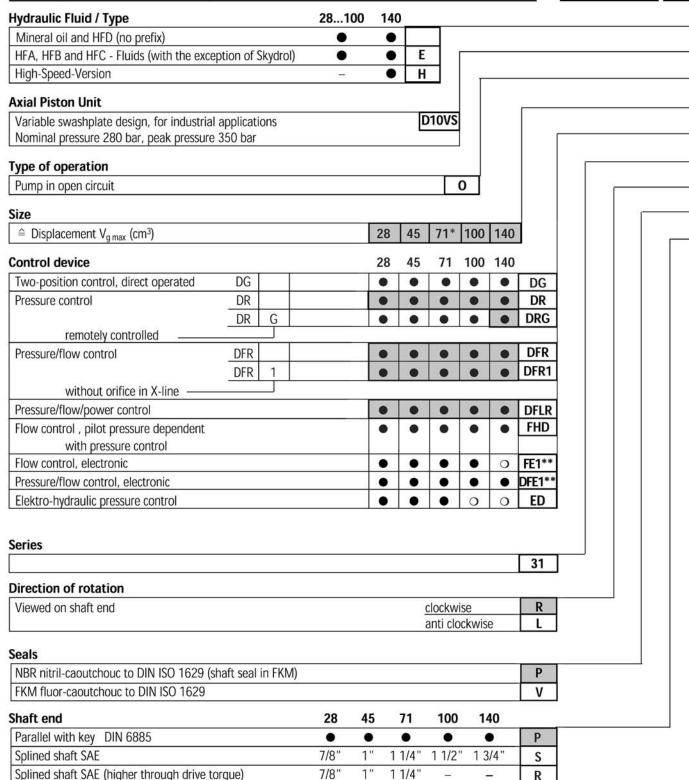
Sizes 28...140
Series 31
Nominal Pressure 280 bar
Peak pressure 350 bar
Axial Piston Swashplate Design

D10VSO...DR

Ordering Code / Standard Program

DYNA ⊞

Hydraulic Fluid / Type	28...100	140	
Mineral oil and HFD (no prefix)	●	●	
HFA, HFB and HFC - Fluids (with the exception of Skydrol)	●	●	E
High-Speed-Version	–	●	H

Axial Piston Unit

Variable swashplate design, for industrial applications Nominal pressure 280 bar, peak pressure 350 bar	D10VS

Type of operation

Pump in open circuit	O

Size

	28	45	71*	100	140
≙ Displacement $V_{g\,max}$ (cm^3)	28	45	71*	100	140

Control device

			28	45	71	100	140	
Two-position control, direct operated	DG		●	●	●	●	●	DG
Pressure control	DR		●	●	●	●	●	DR
	DR	G	●	●	●	●	●	DRG
remotely controlled								
Pressure/flow control	DFR		●	●	●	●	●	DFR
	DFR	1	●	●	●	●	●	DFR1
without orifice in X-line								
Pressure/flow/power control			●	●	●	●	●	DFLR
Flow control , pilot pressure dependent with pressure control			●	●	●	●	●	FHD
Flow control, electronic			●	●	●	●	○	FE1**
Pressure/flow control, electronic			●	●	●	●	●	DFE1**
Elektro-hydraulic pressure control			●	●	●	○	○	ED

Series

	31

Direction of rotation

Viewed on shaft end	clockwise	R
	anti clockwise	L

Seals

NBR nitril-caoutchouc to DIN ISO 1629 (shaft seal in FKM)	P
FKM fluor-caoutchouc to DIN ISO 1629	V

Shaft end

	28	45	71	100	140	
Parallel with key DIN 6885	●	●	●	●	●	P
Splined shaft SAE	7/8"	1"	1 1/4"	1 1/2"	1 3/4"	S
Splined shaft SAE (higher through drive torque)	7/8"	1"	1 1/4"	–	–	R

---

* Project note for size 71
Pressure port B consists of a high pressure combination port
SAE 11/4" standard pressure range, 3000 psi, **for pressures up to 250 bar**
SAE 1" standard pressure range, 5000 psi, **for pressures in excess of 250 bar** (see page 12).
For **new applications high pressure port SAE 1" must be used.**

● = available
○ = in preparation
– = not available

	D10VS	**O**			**/31**	**–**				**12**	

Hydraulic Fluid

Axial Piston Unit

Type of operation

Size

Control device

Series

Direction of rotation

Seals

Shaft end

Mounting flange

	28	45	71	100	140	
ISO 2-hole	●	●	●	●	–	**A**
ISO 4-hole	–	–	–	○	●	**B**

Service line connections

Pressure port B } SAE ports at opposite sides		**12**
Suction port S } Metric fixing thread		

Through drives

			28	45	71	100	140	
without through drive			●	●	●	●	●	**N00**
with through drive to accept an axial piston pump, a gear pump or a radial piston pump								
Mounting flange	shaft / coupling	for mounting of:						
ISO 80, 2-hole	splined shaft 3/4" 19-4 (SAE A-B)	D10VSO 10, 18 (shaft S or R)	●	●	●	○	○	**KB2**
ISO 80, 2-hole	keyed shaft ø18	D10VSO 18	●	●	●	●	●	**K51***
ISO 100, 2-hole	splined shaft 7/8" 22-4 (SAE B)	D10VSO 28 (shaft S or R)	●	○	●	●	●	**KB3**
ISO 100, 2-hole	keyed shaft ø22	D10VSO 28	●	●	●	●	●	**K25***
ISO 100, 2-hole	splined shaft 1" 25-4 (SAE B-B)	D10VSO 45 (shaft S or R)	–	●	●	●	●	**KB4**
ISO 100, 2-hole	keyed shaft ø25	D10VSO 45	–	●	●	●	●	**K26***
ISO 125, 2-hole	splined shaft 1 1/4" 32-4 (SAE C)	D10VSO 71 (shaft S or R)	–	–	●	●	●	**KB5**
ISO 125, 2-hole	keyed shaft ø32	D10VSO 71	–	–	●	●	●	**K27***
ISO 125, 2-hole	splined shaft 1 1/2" 38-4 (SAE C-C)	D10VSO 100 (shaft S)	–	–	–	●	●	**KB6**
ISO 125, 2-hole	keyed shaft ø40	D10VSO 100	–	–	–	●	●	**K37***
ISO 180, 4-hole	splined shaft 1 3/4" 44-4 (SAE D)	D10VSO 140 (shaft S)	–	–	–	–	●	**KB7**
ISO 180, 4-hole	keyed shaft ø45	D10VSO 140	–	–	–	–	●	**K59***
82-2(SAE A, 2-hole)	splined shaft 5/8" 16-4 (SAE A)		●	●	●	●	●	**K01**
82-2(SAE A, 2-hole)	splined shaft 3/4" 19-4 (SAE A-B)	D10VSO 10, 18 (shaft S)	●	●	●	●	●	**K52**
101-2(SAE B, 2-hole)	splined shaft 7/8" 22-4 (SAE B)		●	●	●	●	●	**K02**
101-2 (SAE B)	splined shaft 22-4 (SAE B)	D10VO 28 (shaft S)	●	●	○	●	●	**K68**
101-2(SAE B)	splined shaft 25-4 (SAE B-B)	D10VO 45 (shaft S)	●	●	●	●	●	**K04**
127-2 (SAE C)	splined shaft 32-4 (SAE C)	D10VO 71 (shaft S)	–	–	●	●	○	**K07**
127-2 (SAE C)	splined shaft 38-4 (SAE C-C)	D10VO 100 (shaft S)	–	–	–	●	●	**K24**
152-4 (SAE D)	splined shaft 44-4 (SAE D)	D10VO 140 (shaft S)	–	–	–	–	●	**K17**
Ø 63, metr. 4-hole	keyed shaft Ø 25		●	●	●	●	●	**K57**

* Not for new applications, only permissible with reduced through drive torque (see page 26)

Hydraulic fluid

When using HF- or environmentally acceptable hydraulic fluids possible limitations for the technical data have to be taken into consideration. If necessary please consult our technical department (please indicate type of the hydraulic fluid used for your application on the order sheet).

Operation on Skydrol hydraulic fluid is subject to consultation.

Operating viscosity range

In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected from within the range

$$\nu_{opt} = \text{operating viscosity } 16...36 \text{ mm}^2/\text{s}$$

referred to the reservoir temperature (open circuit).

Viscosity limits

The limiting values for viscosity are as follows:

$\nu_{min} = 10 \text{ mm}^2/\text{s}$
short term at a max. permissible case temp. of 90° C.
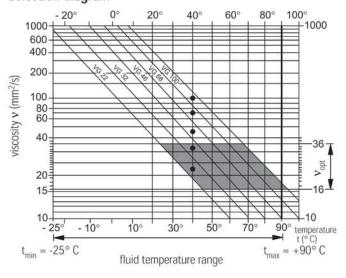
$\nu_{max} = 1000 \text{ mm}^2/\text{s}$
short term on cold start.

Temperature range (see selection diagram)

$t_{min} = -25° C$
$t_{max} = 90° C$

Selection diagram

Notes on the selection of the hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the tank (open loop) in relation to the ambient temperature.

The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range (ν_{opt}) (see shaded section of the selection diagram). We recommend that the higher viscosity range should be chosen in each case.

Example: At an ambient temperature of X° C the operating temperature is 60° C. Within the operating viscosity range (ν_{opt}; shaded area), this corresponds to viscosity ranges VG 46 or VG 68; VG 68 should be selected.

Important: The leakage oil (case drain oil) temperature is influenced by pressure and pump speed and is always higher than the tank temperature. However, at no point in the circuit may the temperature exceed 90° C.

If it is not possible to comply with the above conditions because of extreme operating parameters or high ambient temperatures please consult us.

Filtration

The finer the filtration the better the cleanliness of the pressure fluid and the longer the life of the axial piston unit.

To ensure the functioning of the axial piston unit a minimum cleanliness level of:

9 to NAS 1638

18/15 to ISO/DIS 4406 is necessary.

If above mentioned grades cannot be maintained please consult supplier.

High-speed-version

The size 140 is available in an optional high speed version. This version allows higher drive speeds at max. displacement (higher output flow) without affecting outside dimensions, see table on page 5.

Mechanical displacement limiter

Mechanical displacement limiter **is possible on the nonthrough-drive model, N00 series** but **not** for the model **with through-drive**.

Exception: with FE1-, FE1D- and DFE1 control a max. displacement screw is not possible at all.

$V_{g\,max}$: for sizes 28 to 140
Setting range $V_{g\,max}$ to 50% $V_{g\,max}$ stepless

$V_{g\,min}$: for sizes 100 and 140
Setting range $V_{g\,min}$ to 50% $V_{g\,max}$ stepless

Operating pressure range - inlet
Absolute pressure at port S

$p_{abs\ min}$ ————————————————— 0,8 bar
$p_{abs\ max}$ ———————————————— 30 bar

Operating pressure range - outlet
Pressure at port B

Nominal pressure p_N ————————————— 280 bar
Peak pressure p_{max} —————————————— 350 bar
(Pressure data to DIN 24312)

Applications with intermittent operating pressures up to 315 bar at 10% duty are permissible.

Limitation of pump output pressure spikes is possible with relief valve blocks mounted directly on flange connection,
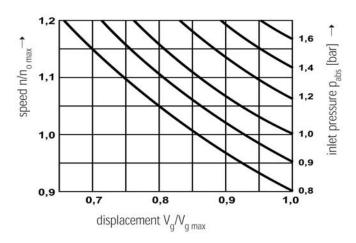
Case drain pressure
Maximum permissible pressure of leakage fluid (at port L, L_1):
Maximum 0,5 bar higher than the inlet pressure at port S, but no higher than 2 bar absolute.

Direction of through flow
S to B.

Determination of inlet pressure p_{abs} at suction port S or reduction of displacement for increasing speed.

displacement $V_g/V_{g\ max}$

Table of values (theoretical values, without taking into account η_{mh} and η_v: values rounded off)
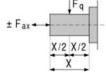
Size					28	45	71	100	140/High-S*
Displacement		$V_{g\ max}$	cm^3		28	45	71	100	140/140
Max. speed [1])	at $V_{g\ max}$	$n_{o\ max}$	rpm		3000	2600	2200	2000	1800/2050
Max. permitted speed (limit speed) with increased input pressure p_{abs} bzw. $V_g < V_{g\ max}$		$n_{o\ max}$	rpm		3600	3100	2600	2400	2100/2200
Max. flow	at $n_{o\ max}$	$q_{vo\ max}$	L/min		84	117	156	200	252/287
	at $n_E = 1500$ min^{-1}		L/min		42	68	107	150	210
Max. power	at $n_{o\ max}$	$P_{o\ max}$	kW		39	55	73	93	118/134
($\Delta p = 280$ bar)	at $n_E = 1500$ min^{-1}		kW		20	32	50	70	98
Max. torque ($\Delta p = 280$ bar)	at $V_{g\ max}$	T_{max}	Nm		125	200	316	445	623
Torque ($\Delta p = 100$ bar)	at $V_{g\ max}$	T	Nm		45	72	113	159	223
Moment of inertia about drive axis		J	kgm^2		0,0017	0,0033	0,0083	0,0167	0,0242
Case volume			L		0,7	1,0	1,6	2,2	3,0
Weight (without fluid)		m	kg		15	21	33	45	60
Permissible loading of drive shaft:	max. axial force	$F_{ax\ max}$	N		1000	1500	2400	4000	4800
Max. permissible radial force [2])		$F_{q\ max}$	N		1200	1500	1900	2300	2800

*= High-Speed-Version

[1]) These values are valid for an absolute pressure of 1 bar at the suction port S. By reducing the displacement or increasing the input pressure the speed can be increased as shown in the diagram.

[2]) Please consult us for higher radial forces.

application of forces

Determination of displacement

Flow $q_v = \dfrac{V_g \cdot n \cdot \eta_v}{1000}$ [L/min]

Torque $T = \dfrac{1,59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}} = \dfrac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}}$ [Nm]

Power $P = \dfrac{T \cdot n}{9549} = \dfrac{2\,\pi \cdot T \cdot n}{60\,000} = \dfrac{q_v \cdot \Delta p}{600 \cdot \eta_t}$ [kW]

V_g = displacement [cm^3] per revolution
Δp = pressure differential [bar]
n = speed [rpm]
η_v = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = overall efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Optional installation position. The pump housing must be filled with fluid during commissioning and remain full when operating.

In order to attain the lowest noise level, all connections (suction, pressure, case drain ports) must be linked by flexible couplings to tank.

Avoid placing a check valve in the case drain line.

This may, however, be permissible in individual cases, after consultation with us.
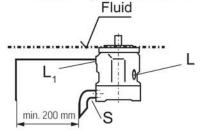
1. Vertical installation (shaft end upwards)

The following installation conditions must be taken into account:

1.1. Arrangement in the reservoir

Before installation fill pump housing, keeping it in a horizontal position.

a) If the minimum fluid level is equal to or above the pump mounting face close port "L" plugged, leave ports "L$_1$" and "S" open; L$_1$ piped and recommendation S piped (see Fig.1).

b) If the minimum fluid level is below the pump mounting face pipe port "L$_1$" and "S" according to Fig. 2.
Close port "L" with respect taking into consideration conditions in 1.2.1.

Fig. 1

1.2. Arrangement outside the reservoir
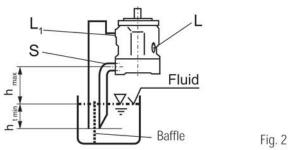
Before installation fill the pump housing, keeping it in a horizontal position. For mounting above reservoir see Fig. 2.

Limiting condition:

1.2.1. Minimum pump inlet pressure $p_{abs\ min}$ = 0.8 bar under both static and dynamic conditions.

Note: Avoid mounting above reservoir wherever possible in order to achieve a low noise level.

The permissible suction height h comes from the overall pressure loss, but may not be bigger than h_{max} = 800 mm (immersion depth $h_{t\ min}$ = 200 mm).

Fig. 2

Overall pressure loss $\Delta p_{tot} = \Delta p_1 + \Delta p_2 + \Delta p_3 \leq (1 - p_{abs\ min}) = 0.2$ bar

Δp_1: Pressure loss in pipe due to accelerating column of fluid

$$\Delta p_1 = \frac{\rho \cdot l \cdot dv}{dt} \cdot 10^{-5} \ (bar)$$

ρ = density (kg/m^3)
l = pipe lenght (m)
dv/dt = rate of change in fluid velocity (m/s^2)

Δp_2: Pressure loss due to static head

$\Delta p_2 = h \cdot \rho \cdot g \cdot 10^{-5}$ (bar)

h = height (m)
ρ = density (kg/m^3)
g = gravity = 9.81 m/s^2

Δp_3: Line losses (elbows etc.)

2. Horizontal installation

The pump must be installed, so that "L" or "L$_1$" is at the top.

2.1. Arrangement in the reservoir

a) If the minimum fluid level is above the top of the pump, port "L$_1$" closed, "L" and "S" should remain open, L piped and recommendation S piped (see Fig. 3)

b) If the minimum fluid level is equal to or below the top of the pump, pipe ports "L" and possibly "S" as Fig. 4.; close port "L$_1$". The conditions according to item 1.2.1.
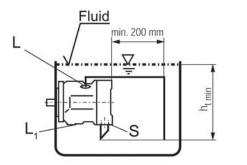
Fig. 3

2.2. Installation outside the reservoir

Fill the pump housing before commissioning.

Pipe ports "S" and the higher port "L" or "L$_1$".

a) When mounting above the reservoir, see Fig. 4.
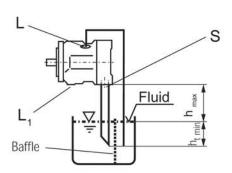
Conditions according to 1.2.1.

Fig. 4

b) Mounting below the reservoir

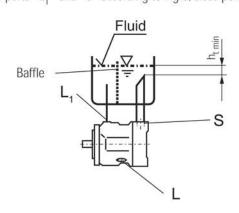Pipe ports "L$_1$" and "S" according to Fig.5, close port "L".
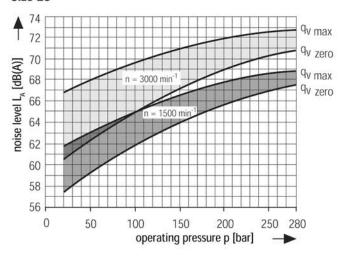

Fig. 5

Noise level

Measured in an anechoic chamber
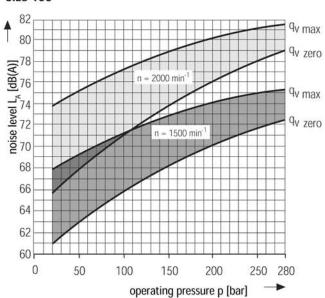
Distance from microphone to pump = 1 m

Measuring error: ± 2 dB (A)

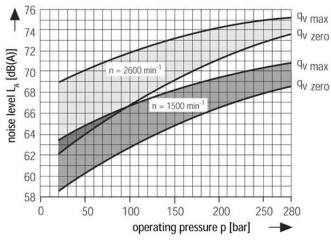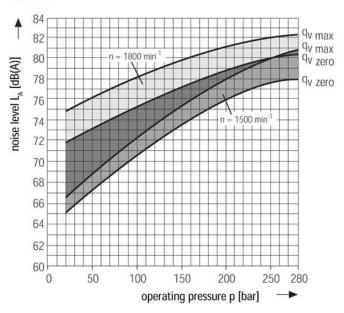(Fluid: Hydraulic oil to ISO VG 46 DIN 51519, t = 50° C)
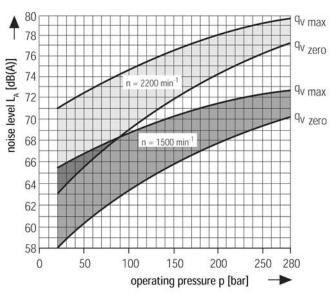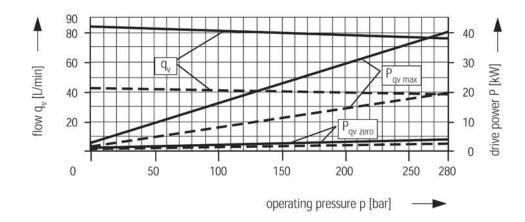
Size 28

Size 100

Size 45

Size 140

Size 71

(Fluid: Hydraulic oil ISO VG 46 DIN 51519, t = 50° C)
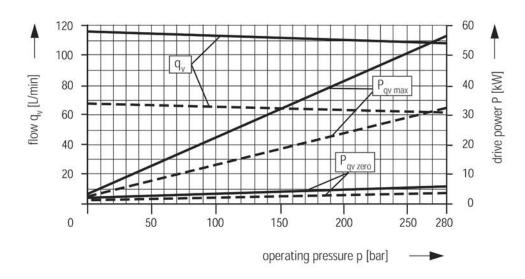
Size 28
- – – – n = 1500 min^{-1}
- ——— n = 3000 min^{-1}

Size 45
- – – – n = 1500 min^{-1}
- ——— n = 2600 min^{-1}
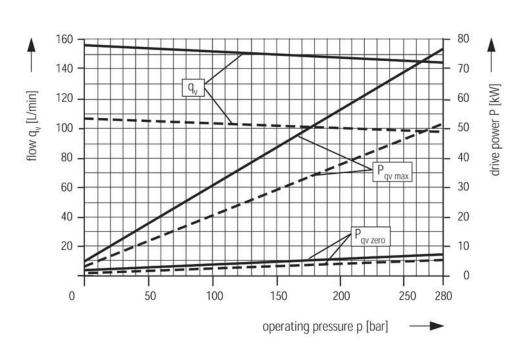
Size 71
- – – – n = 1500 min^{-1}
- ——— n = 2200 min^{-1}

Drive Power and Output Flow

(Fluid: Hydraulic oil ISO VG 46 DIN 51519, t = 50° C)

Size 100
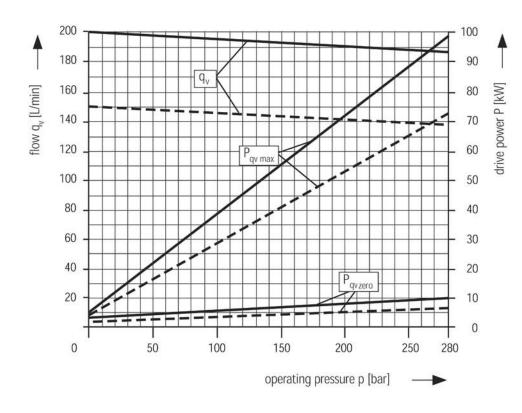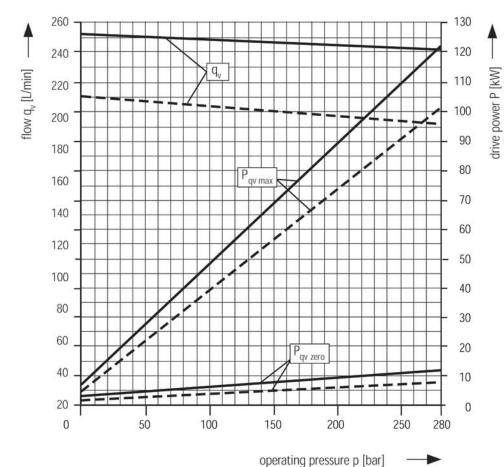
- – – – n = 1500 min^{-1}
- ——— n = 2000 min^{-1}

Size 140

- – – – n = 1500 min^{-1}
- ——— n = 1800 min^{-1}

Overall efficiency

$$\eta_t = \frac{q_v \cdot p}{P_{qv\,max} \cdot 600}$$
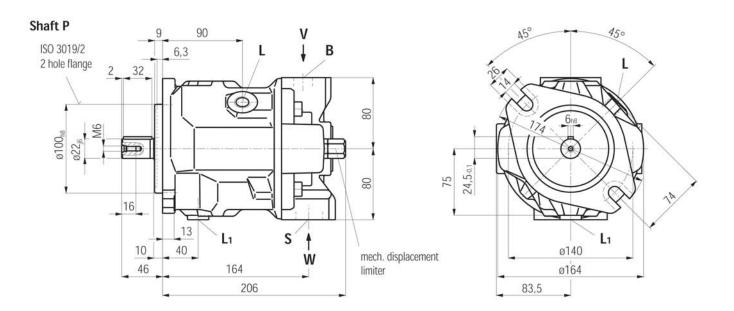
Volumetric efficiency

$$\eta_v = \frac{q_v}{q_{v\,theor.}}$$

N**00** model (without through drive)
without control valves

Shaft P

ISO 3019/2
2 hole flange

mech. displacement
limiter

Shaft S

Shaft 22-4; (SAE B)
SAE J744 OCT 83

pressure angle 30°,
13 teeth,
16/32 pitch

View **W**

M10; 17 deep

View **V**

M10; 17 deep

Shaft R

Shaft 22-4; (SAE B)
SAE J744 OCT 83

pressure angle 30°,
13 teeth,
16/32 pitch

useful spline length

B	Pressure port	SAE 3/4"	(Standard pressure range)
S	Suction port	SAE 1 1/4"	(Standard pressure range)
L/L$_1$	Case drain ports	M18x1,5	(L$_1$ plugged at factory)

DYNA ⊡

N**00** model (without through drive)
without control valves

Shaft P

ISO 3019/2
2 hole flange

9
96
6,3
3
36
L
V
B
45°
45°
26
14
L
ø100 h8
ø25 j6
M8
8 h9
90
90
80,5
28 -0,2
83
19
13
L₁
S
W
L₁
ø140
10
45
52
184
W
224
mech. displacement
limiter
ø184
93,5

Shaft S

Shaft 25-4; (SAE B-B)
SAE J744 OCT 83

ø1"
1/4-20UNC-2B
16
30
38
45,9

pressure angle 30°,
15 teeth,
16/32 pitch

View **W**

69,9
ø40
S
35,7
M12; 20
deep

Shaft R

Shaft 25-4; (SAE B-B)
SAE J744 OCT 83

pressure angle 30°,
15 teeth,
16/32 pitch

ø1"
1/4-20UNC-2B
16
29.5
useful spline length
45.9

View **V**

52,4
ø25
B
26,2
M10; 17
deep

B	Pressure port	SAE 1"	(Standard pressure range)
S	Suction port	SAE 1 1/2"	(Standard pressure range)
L/L₁	Case drain ports	M22x1,5	(L₁ plugged at factory)

N**00** model (without through drive)
without control valves

Shaft P

ISO 3019/2
2 hole flange

mech. displacement limiter

Shaft S

Shaft 32-4; (SAE C)
SAE J744 OCT 83

pressure angle 30°,
14 teeth,
12/24 pitch

View **W**

M12; 20 deep

View **V**

fixing hole thread M10; 17 deep
for SAE 1"

B

fixing hole thread M10; 17 deep
for SAE 1 1/4"

Shaft R

Shaft 32-4; (SAE C)
SAE J744 OCT 83

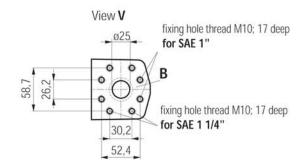pressure angle 30°,
14 teeth,
12/24 pitch

useful spline length

Note:
At **pressure port B** there are two SAE mountings available, each offset by 90°.
SAE 1 1/4" Standard pressure range, 3000 psi, for pressures **up to 250 bar** or
SAE 1" Standard pressure range, 5000 psi, for pressures **in excess of 250 bar**.
For operating pressures in excess of 250 bar or for new projects an SAE 1" pressure
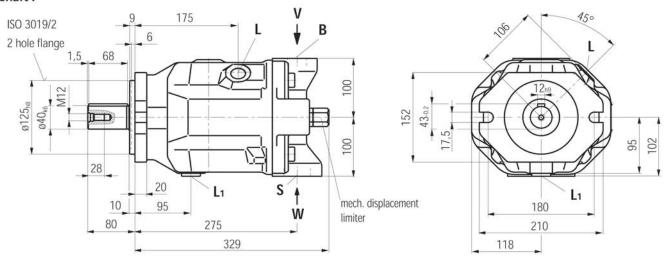flange should be used.

B	Pressure port	**SAE 1"**	(Standard pressure range) bolt hole threads to either SAE 1" or SAE 1 1/4" (optional)
S	Suction port	SAE 2"	(Standard pressure range)
L/L₁	Case drain ports	M22x1,5	(L₁ plugged at factory)
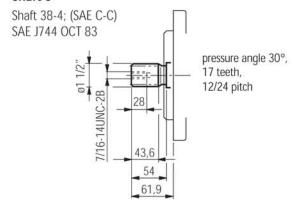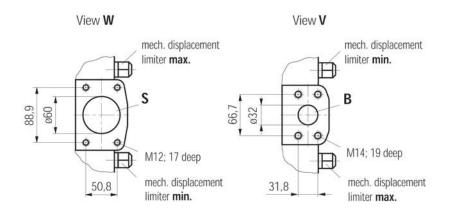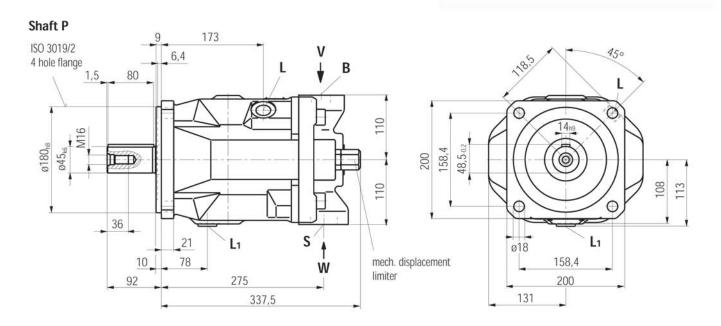
Unit Dimensions Size 100

DYNA ▣

N**00** model (without through drive)
without control valves

Shaft P

ISO 3019/2
2 hole flange

mech. displacement
limiter

Shaft S

Shaft 38-4; (SAE C-C)
SAE J744 OCT 83

pressure angle 30°,
17 teeth,
12/24 pitch

View **W**

mech. displacement
limiter **max.**

M12; 17 deep

mech. displacement
limiter **min.**

View **V**

mech. displacement
limiter **min.**

M14; 19 deep

mech. displacement
limiter **max.**

B	Pressure port	SAE 1 1/4"	(High pressure range)
S	Suction port	SAE 2 1/2"	(Standard pressure range)
L/L$_1$	Case drain ports	M27x2	(L$_1$ plugged at factory)

N**00** model (without through drive)

without control valves

Shaft P

ISO 3019/2
4 hole flange

mech. displacement limiter

Shaft S

Shaft 44-4; (SAE D)
SAE J744 OCT 83

pressure angle 30°,
13 teeth,
8/16 pitch

View **W**

mech. displacement limiter **max.**

S

M12; 17 deep

mech. displacement limiter **min.**

View **V**

mech. displacement limiter **min.**

B

M14; 19 deep

mech. displacement limiter **max.**

B	Pressure port	SAE 1 1/4"	(High pressure range)
S	Suction port	SAE 2 1/2"	(Standard pressure range)
L/L$_1$	Case drain ports	M27x2	(L$_1$ plugged at factory)

DG 2-position adjustment, direct control

The pump can be set to a minimum swivel anle by connecting an external switching pressure to port X.

This pressure acts directly onto the control piston, a min. control pressure of at least 30 bar is required.

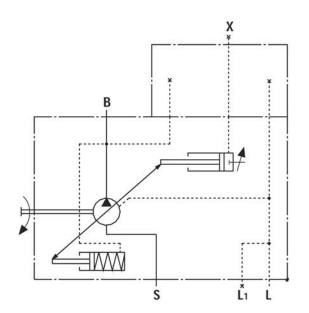The pump can only be switched between V_{gmax} and V_{gmin}.

The switching pressure p_{St} depends on pump output pressure at a ratio of 1:4

$$p_{St} = \frac{p}{4}$$

switching pressure p_{St} in X $=$ 0 bar $\;\;\; \hat{=} \; V_{gmax}$

switching pressure p_{St} in X $\geq$ 30 bar   or $\dfrac{p}{4}$ $\;\; \hat{=} \; V_{gmin}$
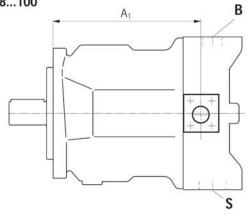
Controller data
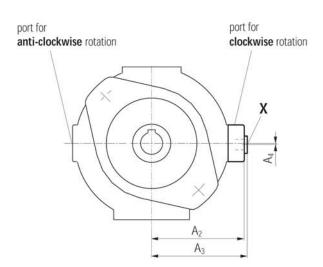
min. switching pressure	30 bar
max. switching pressure	280 bar

Unit dimensions
Sizes 28...100

port for **anti-clockwise** rotation

port for **clockwise** rotation

Size 140

port for **anti-clockwise** rotation

port for **clockwise** rotation
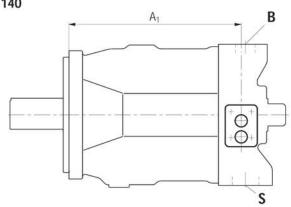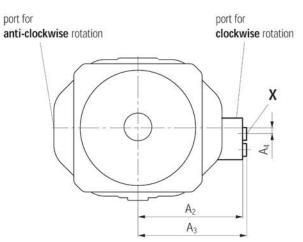
Unit dimensions

Size	A$_1$	A$_2$	A$_3$	A$_4$	X (plugged)
28	158	100	103,5	3	R 1/4"
45	173	110	113,5	3	R 1/4"
71	201	123,5	127,5	3	R 1/4"
100	268	128,5	132,5	3	R 1/4"
140	268	153	158	4,6	M14x1,5

Ports

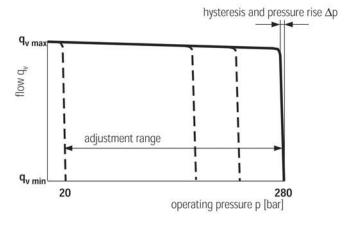|	
B	Pressure port
S	Suction port
L, L1	Case drain ports (L1 plugged)
X	**Pilot pressure port (plugged)**

The pressure controller serves to maintain a constant pressure in a hydraulic system within the control range of the pump. The pump therefore supplies only the amount of hydraulic fluid required by the system. Pressure may be steplessly set at the control valve.

Static operating curve

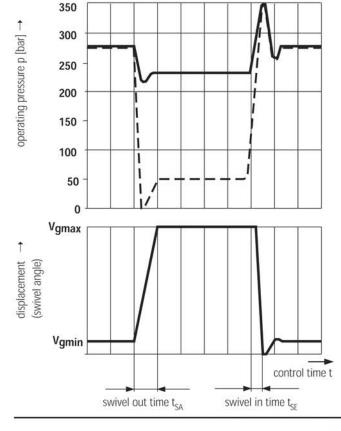(at n_1 = 1500 rpm; t_{oil} = 50° C)

Dynamic operating curves

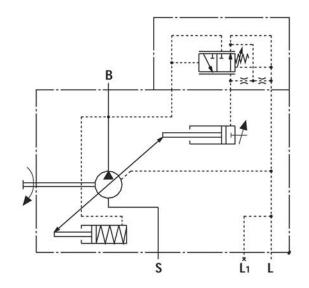The operating curves are mean values measured under test conditions with the unit mounted inside the tank.

Conditions: n = 1500 rpm

t_{oil} = 50° C

Main relief set at 350 bar

Load steps were obtained by suddenly opening and closing the pressure line with a pressure relief valve as load valve 1 m from the output flange of the pump.

Ports

B   Pressure port

S   Suction port

L, L1   Case drain ports (L1 plugged)

Controller data

Hysteresis and repetitive accuracy Δp _____ max. 3 bar

Max. Pressure rise

Size		28	45	71	100	140
Δp	bar	4	6	8	10	12

Pilot oil requirement _____ max. approx 3 L/min
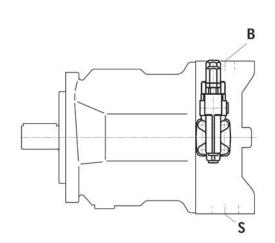
Flow loss at q_{vmax} see pages 8 and 9.
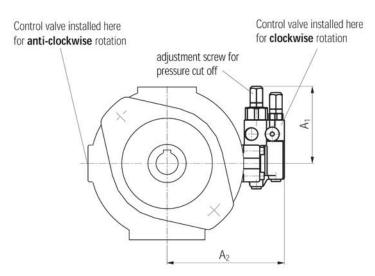
Control times

Size	t_{SA} (ms) against 50 bar	t_{SA} (ms) against 220 bar	t_{SE} (ms) stalled at 280 bar
28	60	30	20
45	80	40	20
71	100	50	25
100	125	90	30
140	130	110	30

DYNA ⊞

Sizes 28...100

Control valve installed here
for **anti-clockwise** rotation

Control valve installed here
for **clockwise** rotation

adjustment screw for
pressure cut off

B

A_1

S

A_2
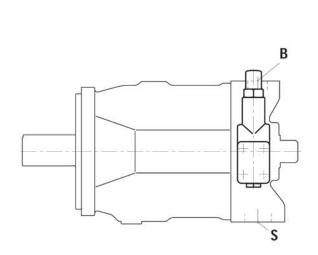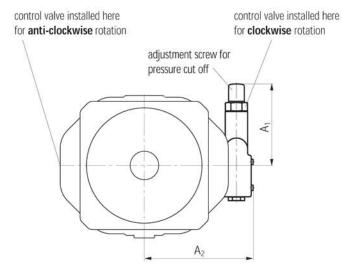
On sizes 28 to 100 the DFR valve used has the flow control spool
blocked in the factory and is not tested.

Size 140

control valve installed here
for **anti-clockwise** rotation

control valve installed here
for **clockwise** rotation

adjustment screw for
pressure cut off

B

A_1

S

A_2

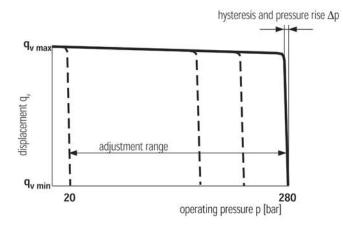| Size	A_1	A_2
28	109	136
45	106	146
71	106	160
100	106	165
140	127	169

Function and equipment as for DR.

A pressure relief valve can be connected to port X for remote control applications; this is not included in the items supplied with the DRG control.

The standard pressure differential setting at the control valve is 20 bar. A pilot oil flow of approx. 1,5 L/min is then used. If an other setting (range 10-22 bar) is required please indicate in clear text.

The max. pipe length should not exceed 2m.

Static Operating Curve

(at n_1 = 1500 rpm; t_{oil} = 50° C)

Controller data
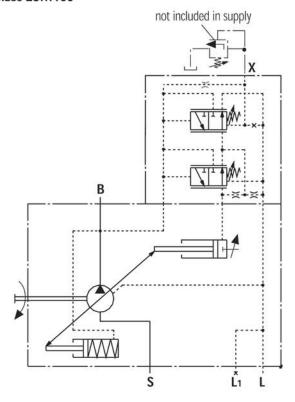
| Hysteresis Δp | | | | max. 3 bar | |

Max. pressure rise

Size		28	45	71	100	140
Δp	bar	4	6	8	10	12
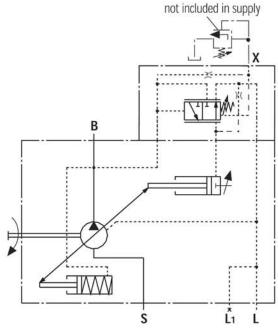
Pilot oil requirement _____ approx. 4,5 L/min

Flow loss at qv_{max} see pages 8 and 9.
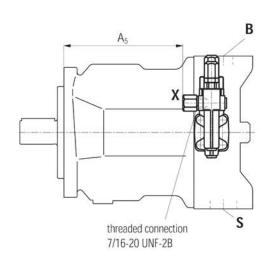
Sizes 28…100

Size 140

Ports
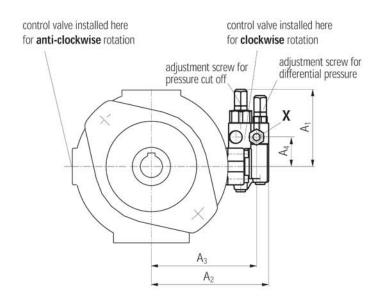
B	Pressure port
S	Suction port
L, L1	Case drain ports (L1 plugged)
X	**Pilot pressure port**

Size 28…100

control valve installed here for **anti-clockwise** rotation

control valve installed here for **clockwise** rotation

adjustment screw for pressure cut off

adjustment screw for differential pressure

threaded connection 7/16-20 UNF-2B

Size 140

control valve installed here for **anti-clockwise** rotation

control valve installed here for **clockwise** rotation

adjustment screw for differential pressure
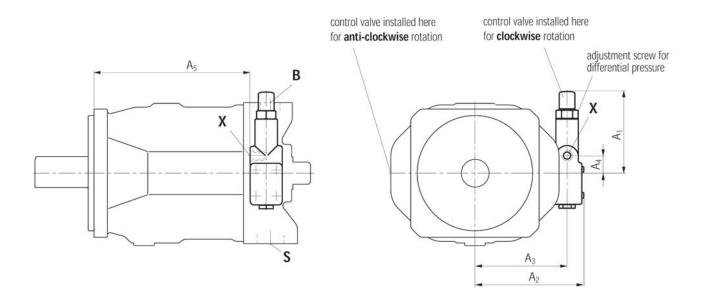
Size	A_1	A_2	A_3	A_4	A_5	Port X	
28	109	136	119	40	119	M14x1,5; 12 deep	
45	106	146	129	40	134	M14x1,5; 12 deep	with adaptor
71	106	160	143	40	162	M14x1,5; 12 deep	
100	106	165	148	40	229	M14x1,5; 12 deep	
140	127	169	143	27	244	M14x1,5; 12 deep	without adaptor

DYNA [⊡]

In addition to the pressure control function, the pump flow may be varied by means of a differential pressure over an orifice or valvespool, installed in the service line. The pump flow is equal to the actual required flow by the actuator.
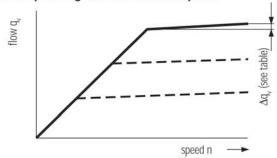
The DFR1-valve has no connection between X and the tank.

not included in supply

plugged on DFR1

Static operating curve

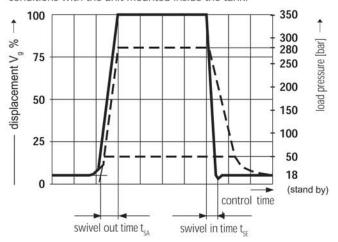(at n_1 = 1500 rpm; t_{oil} = 50° C)

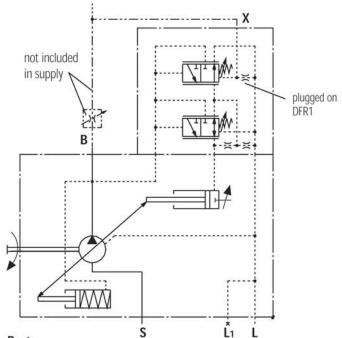## Static operating curve at variable speed

Dynamic flow control operating curve

The operating curves are average values measured under test conditions with the unit mounted inside the tank.

Ports

B	Pressure port
S	Suction port
L, L1	Case drain ports (L1 plugged)
X	**Pilot pressure port**

Differential pressure Δp:

Adjustable between 10 and 22 bar (higher values on request).

Standard setting: 14 bar. If a different setting is required please indicate in clear text.

When port X is unloaded to tank a "zerostroke pressure" of $p = 18 \pm 2$ bar ("stand by") results (dependent on Δp).

Controller data
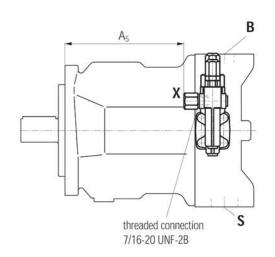
Max. flow variation (hysteresis and increase) measured at drive speed n = 1500 rpm
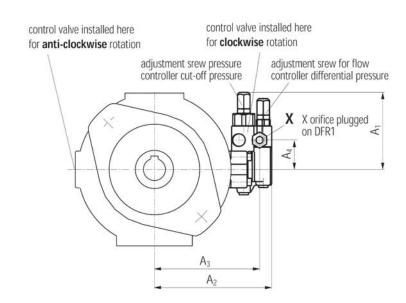
Size		28	45	71	100	140
Δqv_{max}	L/min	1,0	1,8	2,8	4,0	6,0

DFR pilot oil consumption _____ max. approx. 3 ... 4,5 L/min

DFR1 pilot oil consumption _____ max. approx. 3 L/min

NG	t_{SA} [ms] stand by–280 bar	t_{SE} [ms] 280 bar–stand by	t_{SE} 50 bar–stand by
28	40	20	40
45	50	25	50
71	60	30	60
100	120	60	120
140	130	60	130

Sizes 28…100

control valve installed here
for **anti-clockwise** rotation

control valve installed here
for **clockwise** rotation

adjustment srew pressure
controller cut-off pressure

adjustment srew for flow
controller differential pressure

X orifice plugged
on DFR1

threaded connection
7/16-20 UNF-2B

Size 140

control valve installed here
for **anti-clockwise** rotation

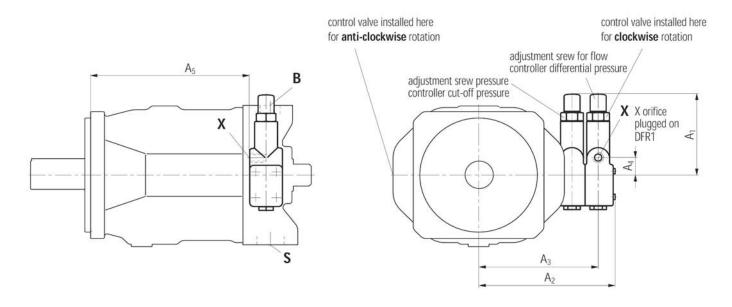control valve installed here
for **clockwise** rotation

adjustment srew for flow
controller differential pressure

adjustment srew pressure
controller cut-off pressure

X orifice
plugged on
DFR1

NG	A_1	A_2	A_3	A_4	A_5	port X	
28	109	136	119	40	119	M14x1,5; 12 deep	
45	106	146	129	40	134	M14x1,5; 12 deep	} with adaptor
71	106	160	143	40	162	M14x1,5; 12 deep	
100	106	165	148	40	229	M14x1,5; 12 deep	
140	127	209	183	27	244	M14x1,5; 12 deep	without adaptor

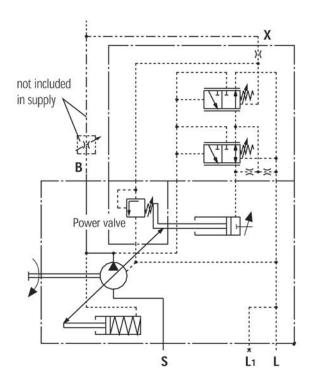In order to achieve a constant drive torque with a varying operating pressure, the swivel angle and with it the output flow of the axial piston pump is varied so that the product of flow and pressure remains constant.

Constant flow control is possible below the power curve.

Static operating curve

Ports

B	Pressure port
S	Suction port
L, L1	Case drain ports (L1 plugged)
X	Pilot pressure port

The power curve is set at the factory, please state your requirements in clear text e.g. 20 kW at 1500 rpm.

Controller data

Technical data constant pressure control see page 16.
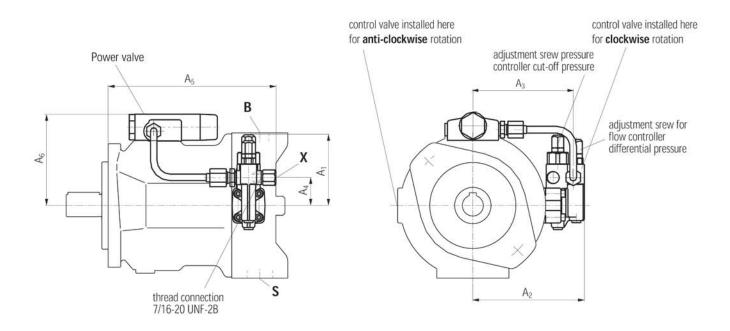
Technical data flow control see page 20.

Start of control _____ ab 80 bar

Pilot oil requirement _____ max. approx. 5,5 L/min

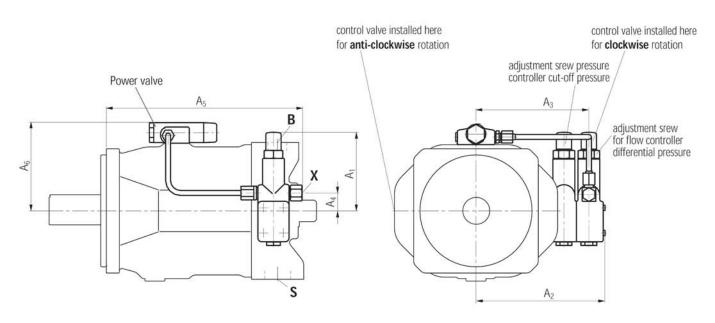Flow loss at q_{vmax} see pages 8 and 9.

Sizes 28…100

Power valve

control valve installed here
for **anti-clockwise** rotation

control valve installed here
for **clockwise** rotation

adjustment srew pressure
controller cut-off pressure

adjustment srew for
flow controller
differential pressure

A_5

B

X

A_6

A_1

A_4

A_3

A_2

thread connection
7/16-20 UNF-2B

S

Size 140

Power valve

control valve installed here
for **anti-clockwise** rotation

control valve installed here
for **clockwise** rotation

adjustment srew pressure
controller cut-off pressure

adjustment srew
for flow controller
differential pressure

A_5

B

X

A_6

A_1

A_4

A_3

A_2

S

NG	A_1	A_2	A_3	A_4	A_5	A_6	Port X
28	109	136	119	40	197	107	M14x1,5; 12 deep
45	106	146	129	40	212	112	M14x1,5; 12 deep
71	106	160	143	40	240	124	M14x1,5; 12 deep
100	106	165	148	40	307	129	M14x1,5; 12 deep
140	127	209	183	27	314	140	M14x1,5; 12 deep