HA10VSO Series
Variable Displacement Pump

Kinde Hydraulics

Product show and brief introduction

Open Circuit

Size 28…140
Series 31
Nominal Perssure 28 MPa
Peak pressure 35 MPa

Features

— Variable displacement axial piston pump of swashplate design for hydraulic
   open circuit systems
— Flow is proportional to drive speed and displacement.It can be infinitely varied
   by adjustment of the swashplate
— ISO mounting flange
— Flange connections to SAE metric
— 2 case drain ports
— Good suction characteristics
— Permissible continous pressure 28 MPa
— Low noise level
— Long service life
— Axial and radial loading of drive shaft possible
— High power-weight ratio
— Wide range of controls
— Short response times
— Through drive option for mulit-circuit system

Model Code

HA10VS	O	71	DR	/31	R	-P	P	A	12	N00
Axial piston unit	Type of operation	Size (mL/r)	Control device	Series	Direction of rotation	Seals	Shaft end	Mounting flange	Service line connections	Through drives
HA10VS: Variable swashp-late design,for industrial applica-tions Nominal pressure 28MPa, peak pressure 35MPa	O: Pump in open circuits	28 45 71 100 140	DR: Pressure control DRG: Pressure control, remotely controlled DFR: Pressure /flow control DFR1: Pressure /flow control, without orifice in X-line	31	(Viewed on shaft end) R: Clockwise L: Anti clockwise	P: NBR nitrl~ caoutchouc to DIN ISO 1629 (shalft seal in FKM) V: FKM fluor~ caoutchouc to DIN ISO 1629	See below	A: ISO 2-hole B: ISO 4-hole	12: Pressure port B, Suction port S (SAE ports at opposite sides Metric fixing thread)	See below

Shaft end

Size		28	45	71	100	140
Parallel with key DIN6885	P	√	√	√	√	√
Splined shaft SAE	S	7/8 "	1 "	1 1/4 "	1 1/2 "	1 3/4 "
Splined shaft SAE (higher through drive torque)	R	7/8 "	1 "	1 1/4 "	/	/

Through drives

Size		28	45	71	100	140
Withiout through drive	N00	√	√	√	√	√
ISO 100,2-hole splined shaft 7/8 " 22-4（SAE B) HA10VSO28(shaft S or R)	KB3	√	/	√	√	√
ISO 100,2-hole splined shaft 1 " 25-4（SAE B-B) HA10VSO45(shaft S or R)	KB4	/	√	√	√	√
ISO 125,2-hole splined shaft 1 1/4 " 32-4（SAE C) HA10VSO71(shaft S or R)	KB5	/	/	√	√	√
ISO 125,2-hole splined shaft 1 1/2 " 38-4（SAE C-C) HA10VSO100(shaft S)	KB6	/	/	/	√	√

√ = available   / = not available

1. If a second Brueninghaus pump is to be fitted at factory then the two model codes must be linked with a "+" sign.
   Model code 1st pump + Model code 2nd pump.
   Ordering example:HA10VSO 100DR/31R-PPA12KB5 + HA10VSO 71DFR/31R-PSA12N00
2. If a gear or radial piston pump is to be fitted at factory please consult us.

Fluid,Mechanical Displacement Limiter

Hydraulic fluid

The HA10VSO variable displacement pump is suitable for use with mineral oil.

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

ν_{opt}=operating viscosity 16...36 mm²/s

Referred to the reservoir temperature(open circuit).

Viscosity limits

The limiting values for viscosity are as follows:

ν_{min}=10 mm²/s
   short term at a max.permissible case temp. of 90℃.

ν_{max}=1000 mm²/s
   short term on cold start

Temperature range (see selection diagram)

t_{min}=-25℃
t_{max}=90℃

Selection diagram

t$_{min}$ = -25℃   fluid temperature range   t$_{max}$ = +90℃
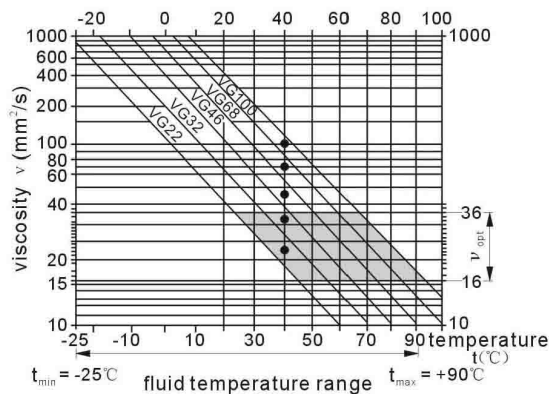
Notes on the selection of the hydraulic fluid

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℃ the operating temperature is 60℃.Within the operating viscosity range (ν_{opt};shaded area), this corresponds to viscosity ranges VG46 or VG68;VG68 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 on point in the circuit may the temperature exceed 90℃.

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 80.

Mechanical displacement limiter

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

$V_{g\,max}$: 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% $V_{g\,min}$ stepless

Technical Data

● Operating pressure range-inlet

Absolute pressure at port S

$P_{abs\,min}$ _____	0.08 MPa
$P_{abs\,max}$ _____	3 MPa

● Operating pressure range-outlet

Pressure at port B

Nominal pressurre P_N _____	28 MPa
Peak pressure P_{max} _____	35 MPa

(Pressure data to DIN 24312)
Applications with intermittent operating pressures up to 31.5 MPa 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 0.05 MPa higher than the inlet pressure at port S, but no higher than 0.2 MPa 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.

● Table of values (theoretical values, without taking into accout η_{mh} and η_v: values rounded off)

Size				28	45	71	100	140
Displacement	$V_{g\,max}$	mL/r		28	45	71	100	140
Max.speed[1]	at $V_{g\,max}$	$n_{o\,max}$	rpm	3000	2600	2200	2000	1800
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
Max.flow	at $n_{o\,max}$	$q_{vo\,max}$	L/min	84	117	156	200	252
	at n_E=1500 min⁻¹		L/min	42	68	107	150	210
Max.power ($\triangle P$= 28 MPa)	at $n_{o\,max}$	$P_{o\,max}$	kW	39	55	73	93	118
	at n_E=1500 min⁻¹		kW	20	32	50	70	98
Max.torque ($\triangle P$= 28 MPa)	at $V_{q\,max}$	T_{max}	Nm	125	200	316	445	623
Torque ($\triangle P$= 10 MPa)	at $V_{q\,max}$	T	Nm	45	72	113	159	223
Moment of inertia about drive axis		J	kgm²	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	12	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

1) These values are valid for an absolute pressure of 0.1 MPa at the suction port S. By reducing the displacement or increasing the input pressure the speed can be increased as shown in the diagram.
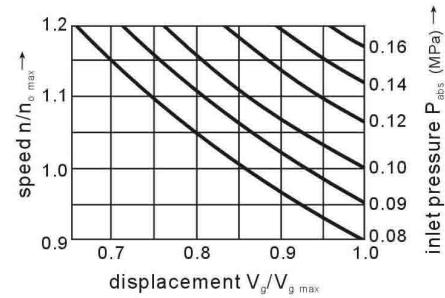2) Please consult us for higher radial forces.

application of forces

● Determination of displacement

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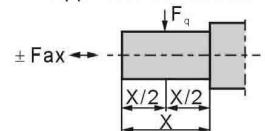$$q_v = \frac{V_g \cdot n \cdot \eta_v}{1000} \quad [\text{L/min}]$$

Torque
$$T = \frac{1.59 \cdot V_g \cdot \triangle P}{1000 \cdot \eta_{mh}} = \frac{V_g \cdot \triangle P}{20 \cdot \pi \cdot \eta_{mh}} \quad [\text{Nm}]$$

Power
$$P = \frac{T \cdot n}{9549} = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \triangle P}{600 \cdot \eta_t} \quad [\text{kW}]$$

V_g = displacement (mL/r) per revolution
$\triangle P$ = pressure differential (MPa)
n = speed (rpm)
η_v = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = overall efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

Installation Notes

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 flexble 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 minmum 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 minmum 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.
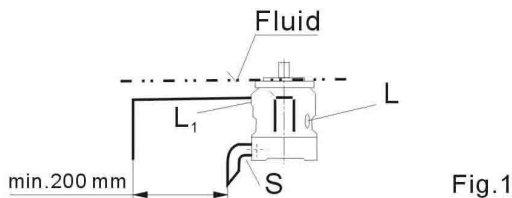
Fig.1

1.2. Arrangement outside the reservoir

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

Limiting condition:

1.2.1. Minimum pump inlet pressure $P_{abs\,min}$ = 0.08 MPa 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 (immerdion depth $h_{t\,min}$ = 200mm).
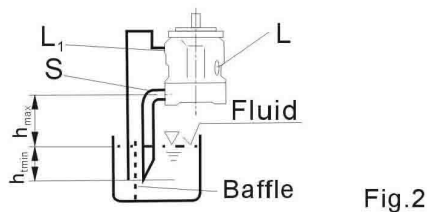

Fig.2

Overall pressure loss $\triangle P_{tot} = \triangle P_1 + \triangle P_2 + \triangle P_3 \leq (1-P_{abs\,min})=0.02$MPa

$\triangle P_1$: Pressure loss in pipe due to accelerating column of fluid

$$\triangle P_1 = \frac{\rho \cdot l \cdot dv}{dt} \cdot 10^{-6}(\text{MPa})$$

$\triangle P_2$: Pressure loss due to static head

$$\triangle P_2 = h \cdot \rho \cdot g \cdot 10^{-6}(\text{MPa})$$

$\triangle P3$: Line losses (elbows etc.)

ρ = density(kg/m^3)

l = pipe lenght（m）

dv/dt = rate of change in fluid velocity(m/s^2)

h = height（m）

ρ = density（kg/m^3）

g = gravity=9.81m/s^2

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".

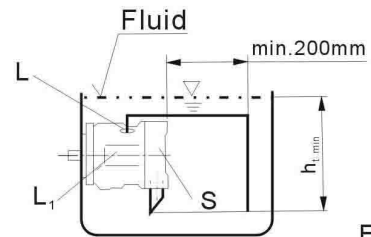The conditions acconrding to tiem 1.2.1.

Fig.3

2.2. Installation outside the reservoir

Fill the pump housing before commissionsing. Pipe ports "s" and the higher port "L" or "L_1".

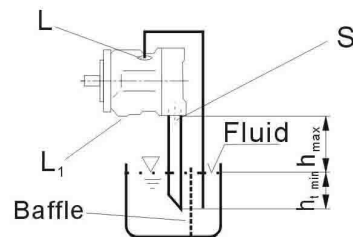a) When mounting above the reservoir, see fig.4. Conditions according to 1.2.1.

Fig.4

b) Mounting below the reservoir Pipe ports "L_1" and "S" according to Fig.5, close port "L".
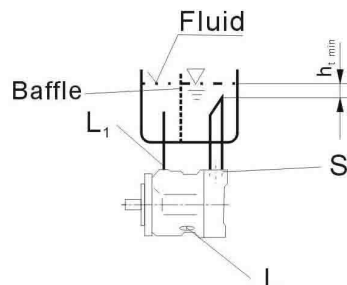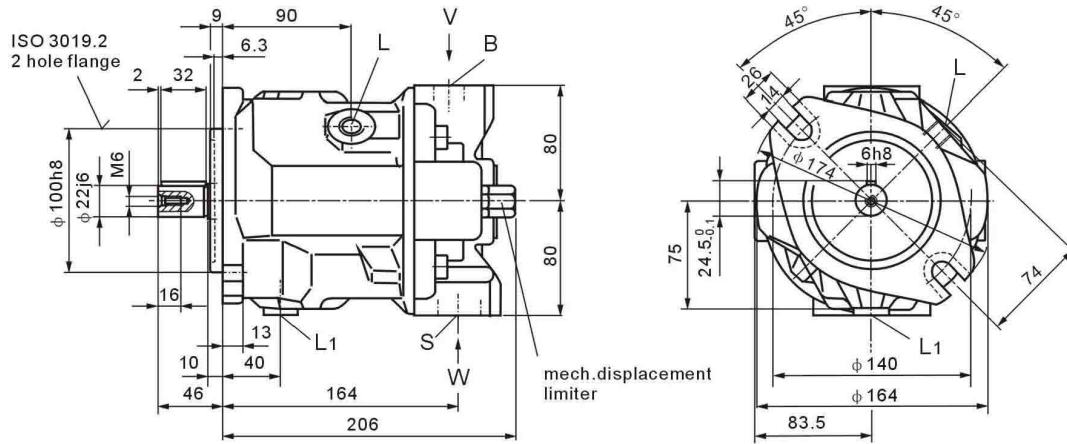

Fig.5

Installation Dimensions

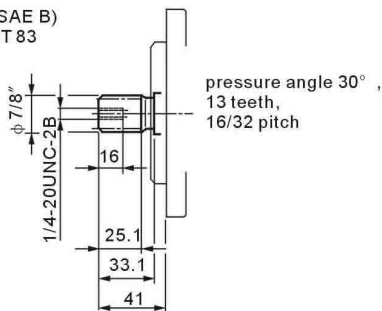HA10VSO28※/31※-※A12N00(without control valves)

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

1/4-20UNC-2B
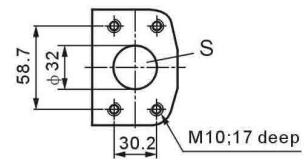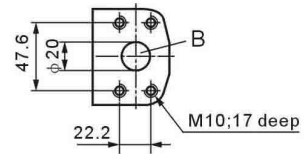
Shaft R

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

pressure angle 30° ,
13 teeth
16/32 pitch

1/4-20UNC-2B

useful spline length

View W

M10;17 deep

View V

M10;17 deep
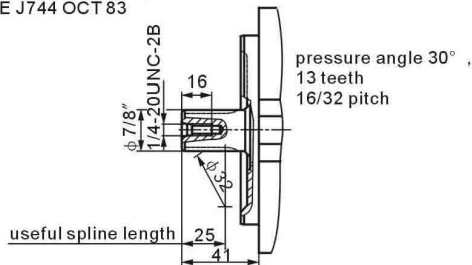
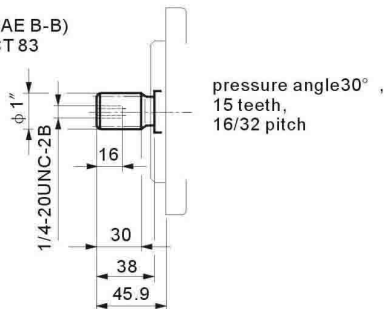| B | Pressure port | SAE 3/4″ | (Standard pressure range) |
| S | Suction port | SAE 11/4″ | (Standard pressure range) |
| L/L₁ | Case drain ports | M18 × 1.5 | (L₁ plugged at factory) |

Installation Dimensions
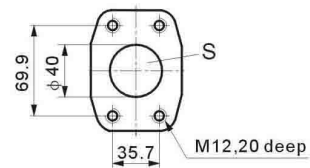
HA10VSO45※/31※-※A12N00 (without control valves)

Shaft P

ISO 3019.2
2 hole flange

ϕ 100h8
ϕ 25j6
M8

9
6.3
3
36
96

L
V
B

90
90

19
13
10
45
52
184
224

S
W

L_1

mech.displacement
limiter

45°
45°
26
14

8h9

80.5
28₋₀.₂

83

L_1
ϕ 140
ϕ 184
93.5
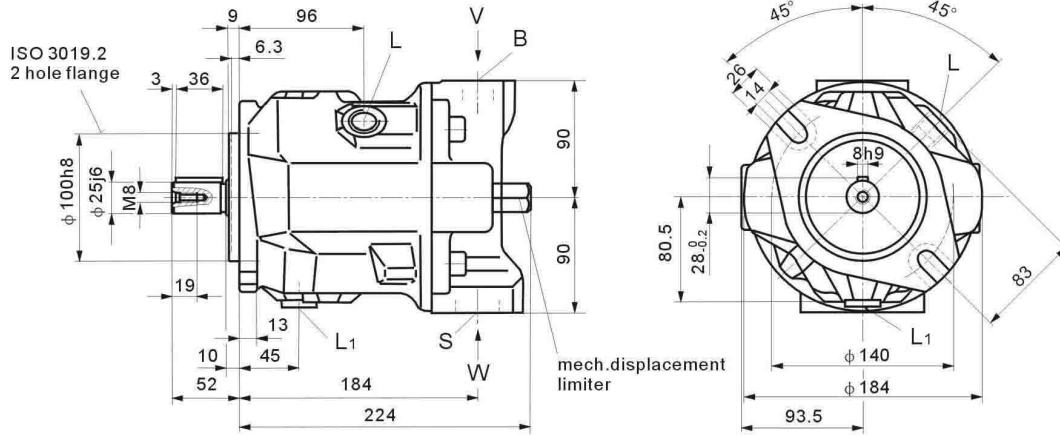
Shaft S

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

ϕ 1″
1/4-20UNC-2B

16
30
38
45.9

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

View W

69.9
ϕ 40
S
35.7
M12,20 deep

Shaft R

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

ϕ 1″
1/4-20UNC-2B

useful spline length
16
29.5
45.9

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

View V

52.4
ϕ 25
B
26.2
M10,17 deep
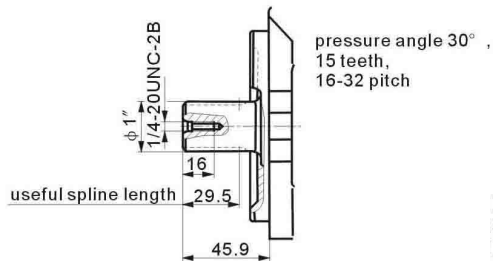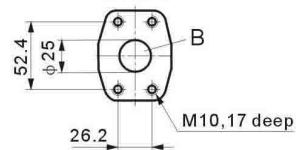
B	Pressure port	SAE 1″	(Standard pressure range)
S	Suction port	SAE 11/2″	(Standard pressure range)
L/L_1	Case drain ports	M22 × 1.5	(L_1 plugged factory)

Installation Dimensions

HA10VSO71※/31※-※A12N00(without control valves)

Shaft P

ISO 3019.2
2 hole flange

mech. displacement limiter
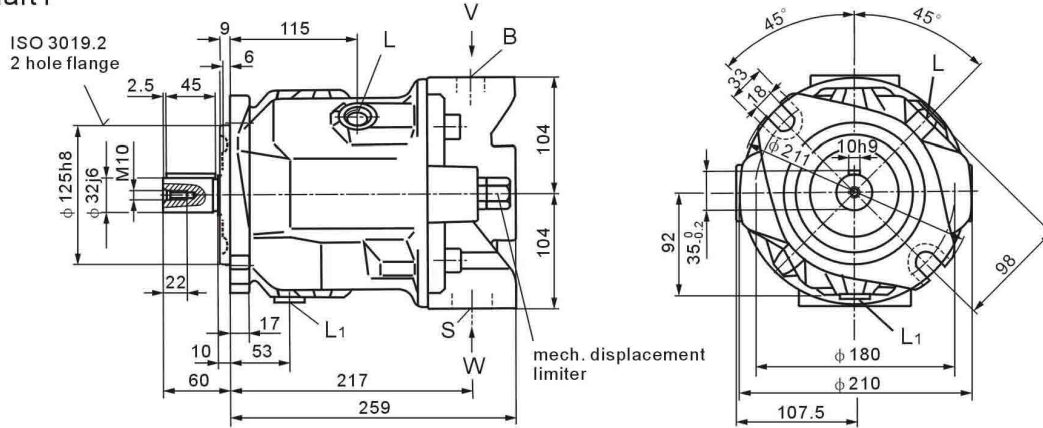
Shaft S

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

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

5/16-18UNC-2B

View W

M12;20 deep
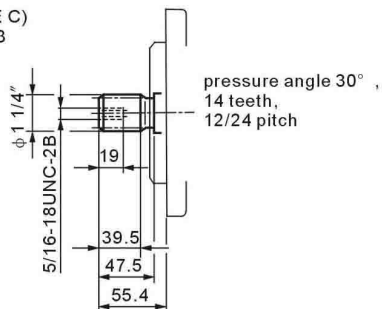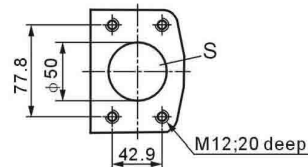
View V

Shaft R

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

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

useful spline length

5/16-18UNC-2B

M10;17 deep
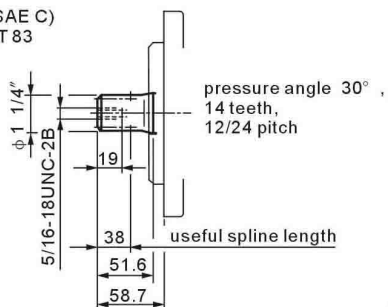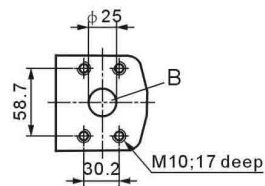
B	Pressure port	SAE 1″	(Standard pressure range)
S	Suction port	SAE 2″	(Standard pressure range)
L/L$_1$	Case drain ports	M22 × 1.5	(L$_1$ plugged at factory)

Installation Dimensions

HA10VSO100※/31※-※A12N00(without control valves)

Shaft P

ISO 3019.2
2 hole flange

φ 125h8
φ 40k6
M12

9
6
175
1.5
68
L
V
B
100
100
28
20
10
95
80
275
329
L₁
S
W
mech.displacement limiter

45°
106
L
12h9
152
43.9₀.₂
17.5
95
102
180
210
118
L₁
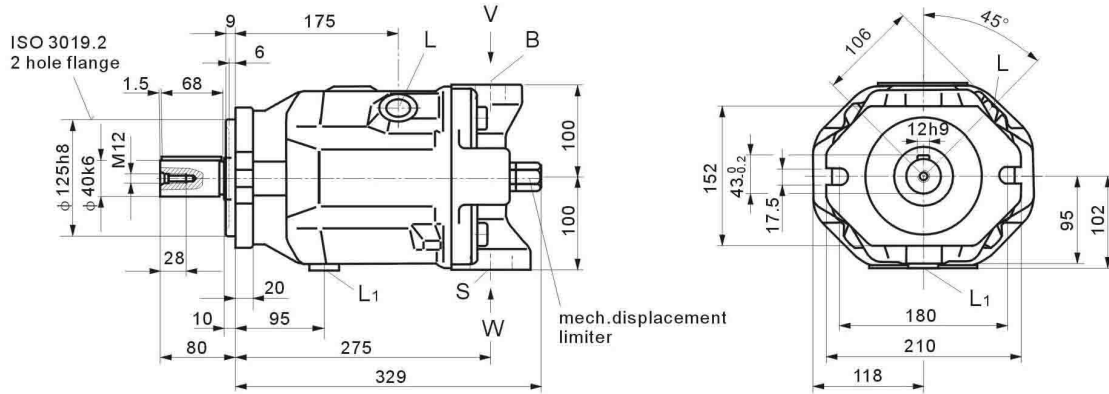
Shaft S

Shaft 38-4;(SAE C-C)
SAE J744 OCT 83
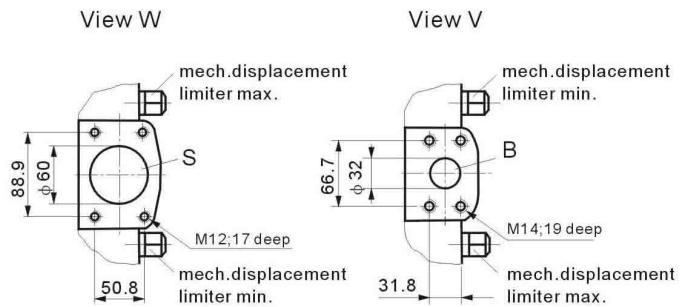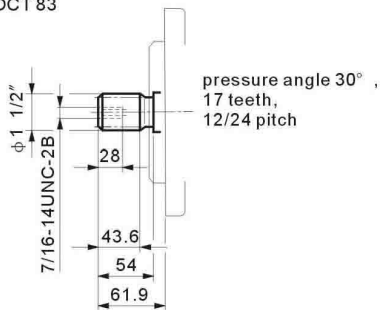
φ 1 1/2"
7/16-14UNC-2B
28
43.6
54
61.9

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

View W

mech.displacement limiter max.
88.9
φ 60
S
50.8
M12;17 deep
mech.displacement limiter min.

View V

mech.displacement limiter min.
66.7
φ 32
B
31.8
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/L₁	Case drain ports	M27 × 2	(L₁ plugged at factory)

Installation Dimensions

HA10VSO140※/31※-※A12N00(without control valves)

Shaft P

ISO 3019.2
4 hole flange

ϕ180h8
ϕ45k6
M16

mech.displacement limiter

Shaft S

Shaft 44-4; (SAE D)
SAE J744 OCT 83
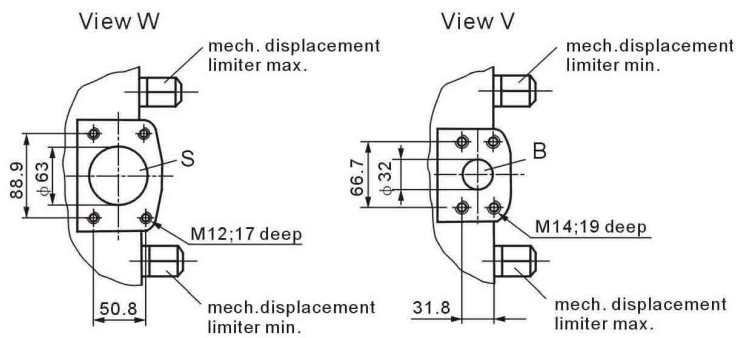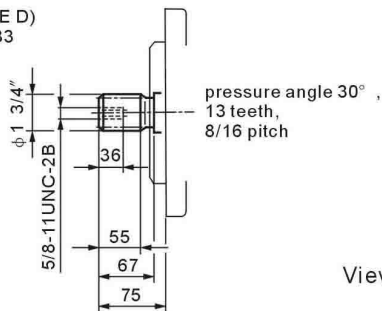
ϕ 1 3/4"
5/8-11UNC-2B

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

View W

mech. displacement limiter max.

ϕ63

S

M12;17 deep

mech.displacement limiter min.

View V

mech.displacement limiter min.

ϕ32
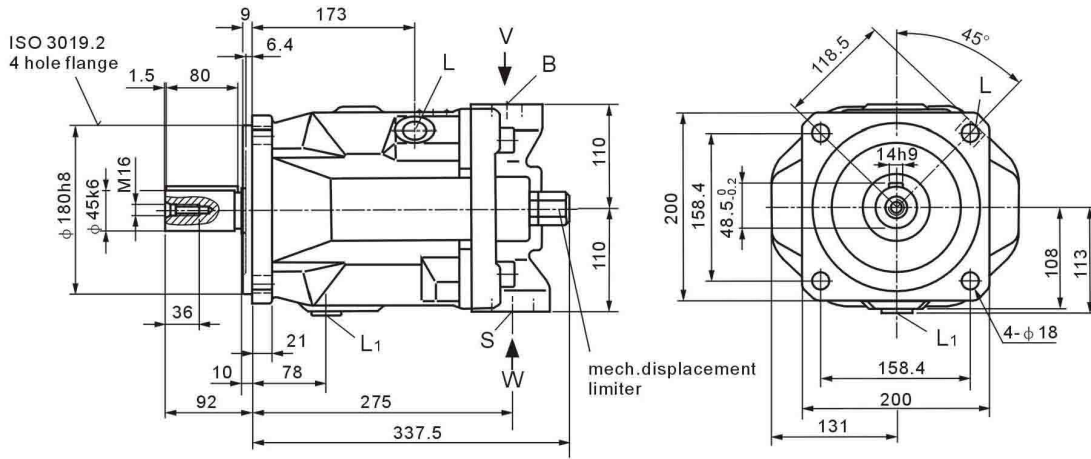
B

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/L₁	Case drain port	M27 × 2	(L₁ plugged at factory)

10

DR Pressure Contorl

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 contorl valves.

● Static operating curve
(at n_1=1500 rpm; t_{oil}=50℃)
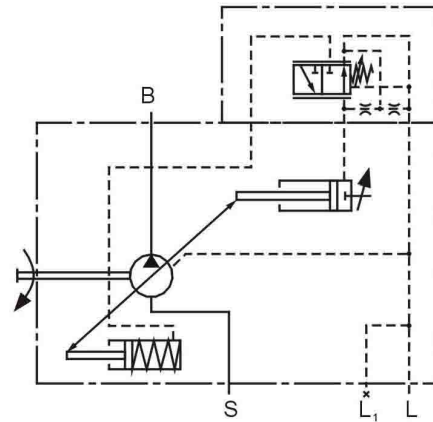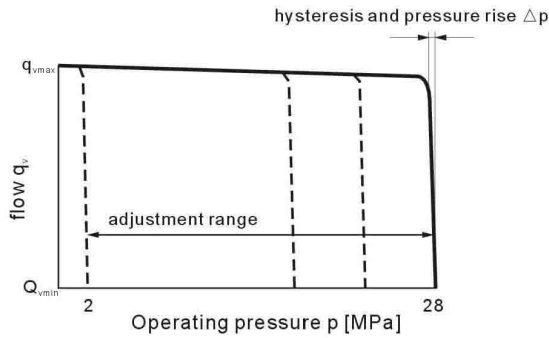
● Dynanmic operating curves

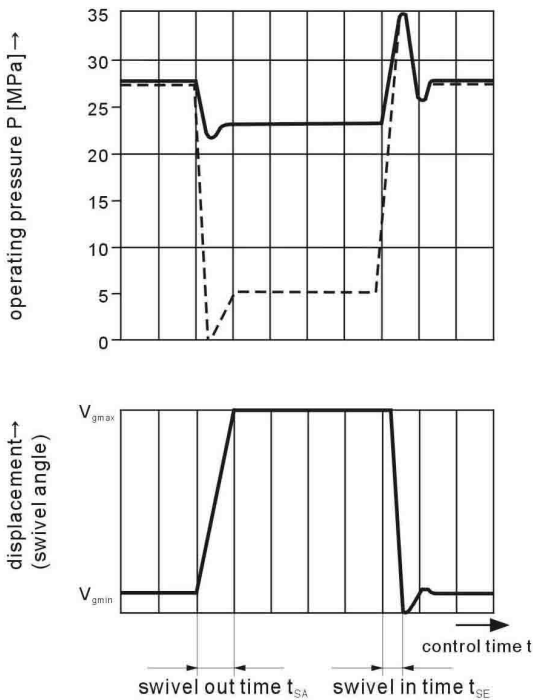The operating curves are mean values measured under test conditions with the unit mounted inside the tank.

Conditions: n = 1500 rpm
              t_{oil} = 50℃
              Main relief set at 35 MPa

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, L_1	Case drain ports (L_1 plugged)

● Contorller Data

Hysteresis and repetitive accuracy △P _____ max. 0.3 MPa

Max. pressure rise

Size		28	45	71	100	140
△P	MPa	0.4	0.6	0.8	1.0	1.2

Polit oil requirement _____ Max. approx 3 L/min

● Control Times

Size	t_{SA} (ms) again 5 MPa	t_{SA} (ms) again 22 MPa	t_{SA} (ms) again 28 MPa
28	60	30	20
45	80	40	20
71	100	50	25
100	125	90	30
140	130	110	30

Installation Dimensions

HA10VSO※DR/31R-※12N00

Sizes 28...100

Control valve installed here for anti-clockwise rotation

Control valve installed here for clockwise rotation

adjustment screw for pressure cut off

A_1

A_2

B

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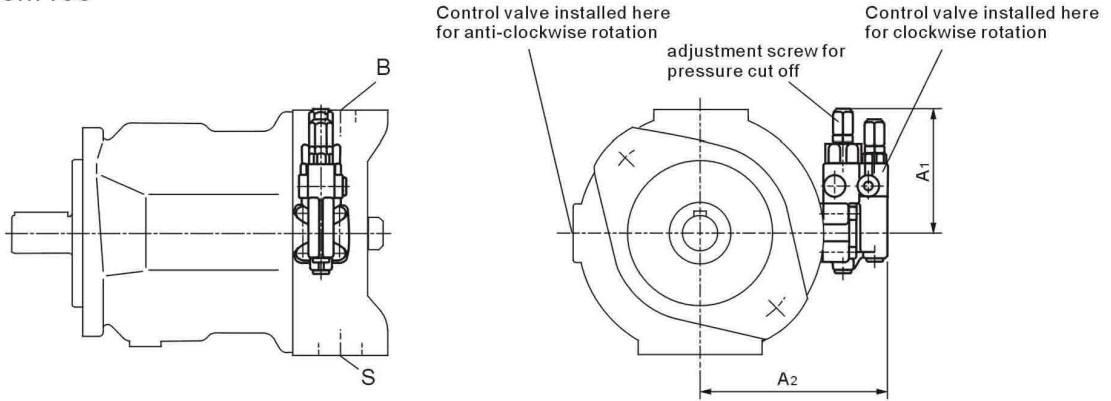
On sizes 28 to 100 the DFR valve used has the flow control spool blocked in the factory and is not tested.

Size 140

Control valve installed here for anti-clockwise rotation

Control valve installed here for clockwise rotation

adjustment screw for pressure cut off

B

S

A_1

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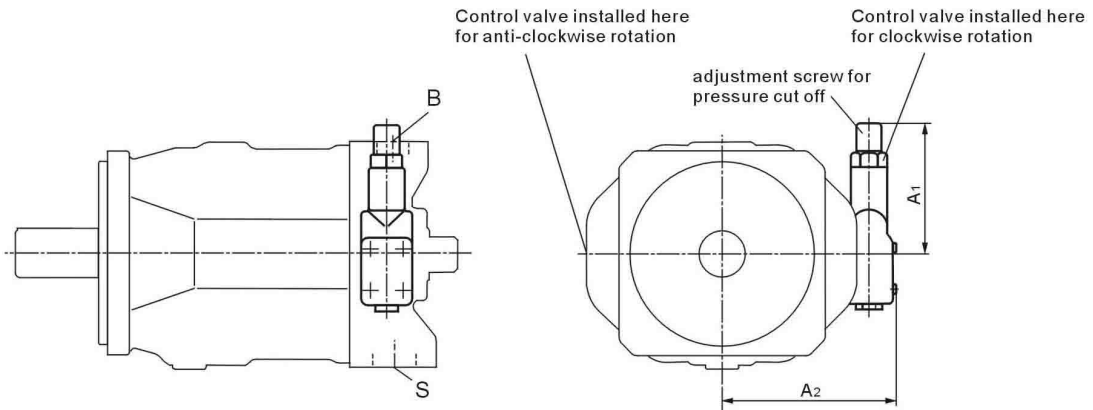
Size	A_1	A_2
28	109	136
45	106	146
71	106	160
100	106	165
140	127	169

DRG Pressure Controller, Remote Control

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 2 MPa. A pilot oil flow of approw. 1.5 L/min is then used. If an other setting (range 1-2.2 Mpa) is required please indicate in clear text.

● Static Operating Curve
(at n_1=1500 rpm; t_{oil}=50℃)

Sizes 28...100
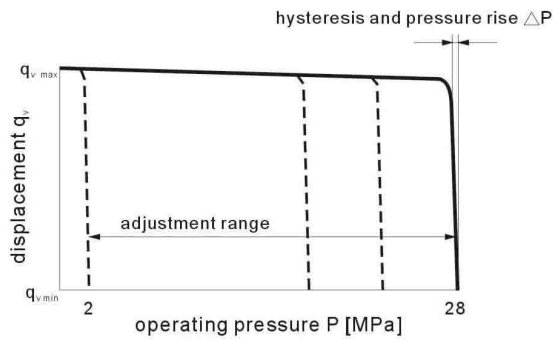
Size 140

● Contorller Data

Hysteresis $\triangle P$ _____ max. 0.3 MPa

Max. pressure rise

Size	28	45	71	100	140
$\triangle P$ MPa	0.4	0.6	0.8	1.0	1.2

Pilot oil requirement _____ approx. 4.5 L/min
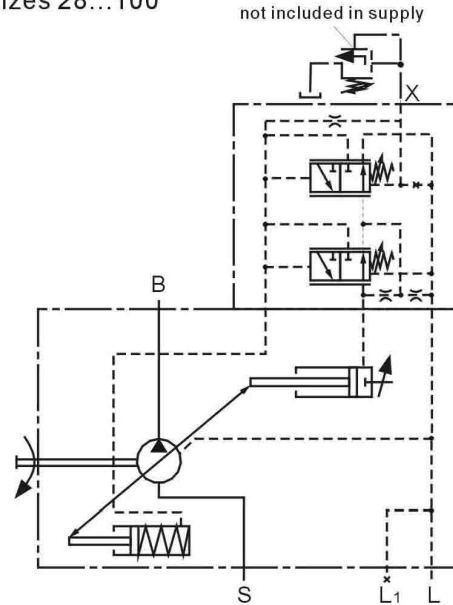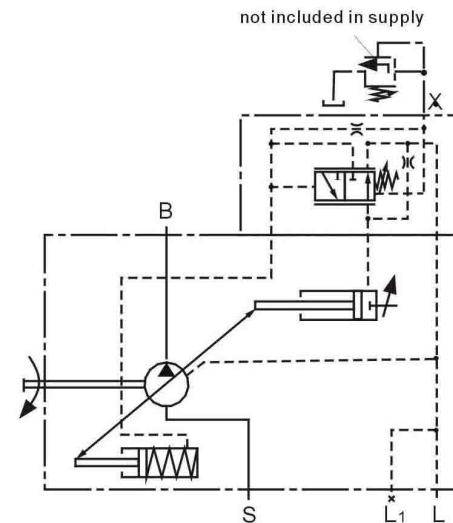
Ports

B	Pressure port
S	Suction port
L, L_1	Case drain ports(L_1 plugged)
X	Pilot pressure port

Installation Dimensions

HA10VSO※DRG/31R-※12N00

Sizes 28...100
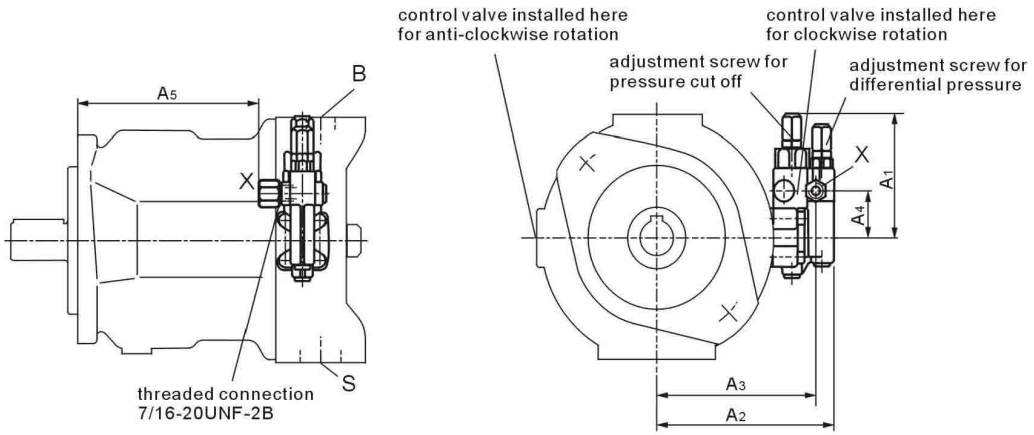
control valve installed here
for anti-clockwise rotation

control valve installed here
for clockwise rotation

adjustment screw for
pressure cut off

adjustment screw for
differential pressure

threaded connection
7/16-20UNF-2B

Size 140

control valve installed here
for anti-clockwise rotation

control valve installed here
for clockwise rotation

adjustment screw for
differential pressure
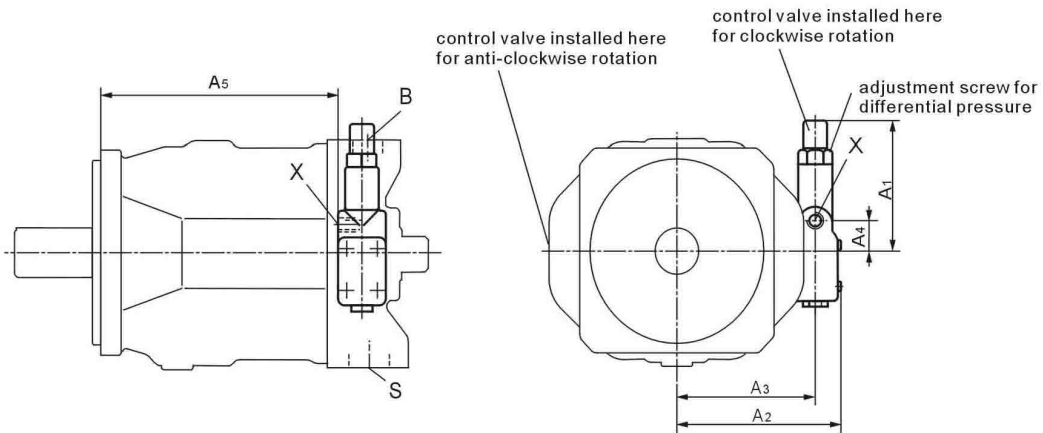
| Size	A_1	A_2	A_3	A_4	A_5	Port X	
28	109	136	119	40	119	M14 × 1.5;12 deep	with adaptor
45	106	146	129	40	134	M14 × 1.5;12 deep	
71	106	160	143	40	162	M14 × 1.5;12 deep	
100	106	165	148	40	229	M14 × 1.5;12 deep	
140	127	169	143	27	244	M14 × 1.5;12 deep	without adaptor

DFR/DFR1 Pressure / Flow Control

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.
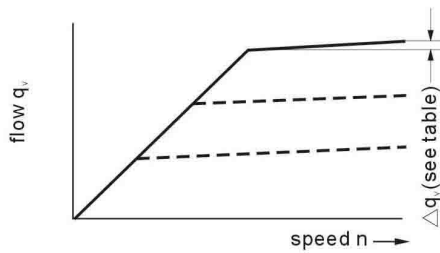
The DFR1-valve has no connection between X and the tank. For function of pressure control see pages 87/88.

● Static operating curve
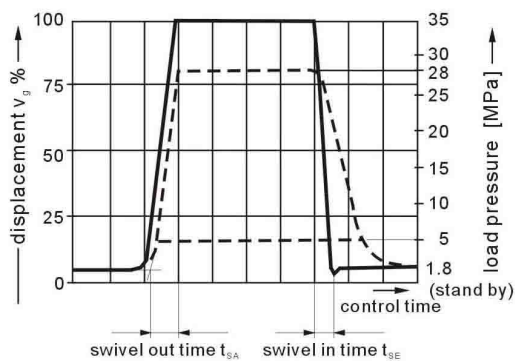(at n_1=1500 rpm; t_{oil}=50℃)
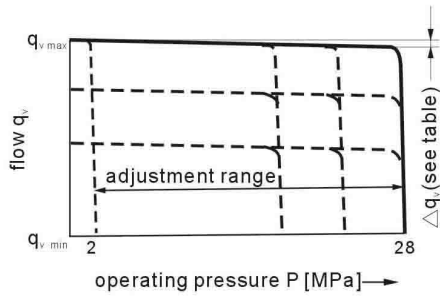
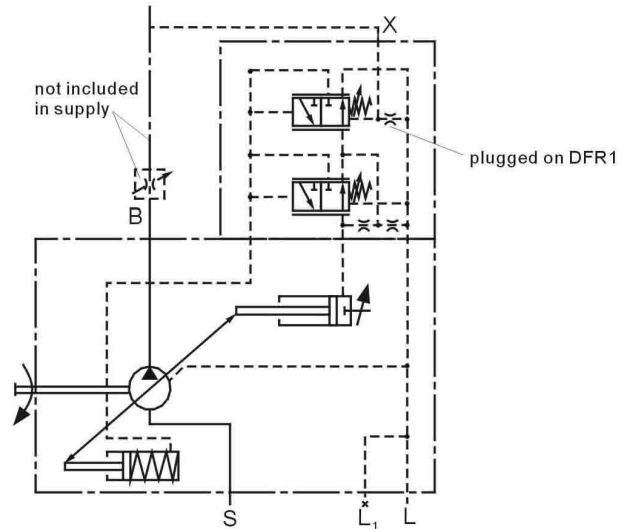## ● Static operating curve at variable speed

● Dynamic flow control operating curve

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

Size	t_{SA} (ms) stand by-28 MPa	t_{SE} (ms) 28 MPa-stand by	t_{SE} (ms) 5 MPa-stand by
28	40	20	40
45	50	25	50
71	60	30	60
100	120	60	120
140	130	60	130

not included in supply

plugged on DFR1

Ports

B	Pressure port
S	Suction port
L, L_1	Case drain ports(L_1 plugged)
X	Pilot pressure port

● Differential Pressure △P

Adjustable between 1 and 2.2 MPa (higher valves on request).
Standard setting: 1.4 MPa . If a different setting is required please indicate in clear text.
When port X is unloaded to tank a "zerostroke pressure" of P=1.8 ± 0.2 MPa (stand by) results (dependent on △P).

● Controller Data

Data pressure controller see page 87.
Max. Flow variation (hysteresis and increase) measured at drive speed n=1500 rpm

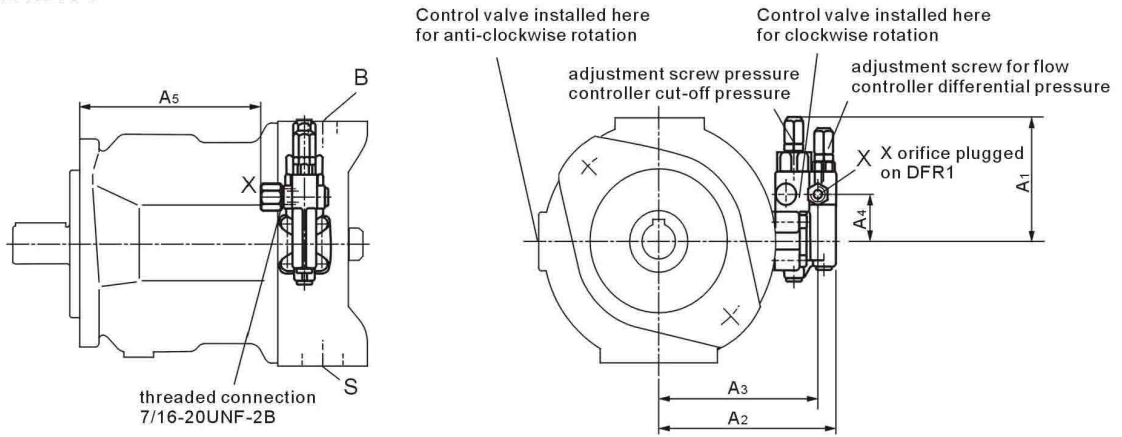| Size		28	45	71	100	140
$\triangle q_{vmax}$	L/min	1.0	1.8	2.8	4.0	6.0

DFR pilot oil consumption___max.approx. 3...4.5 L/min

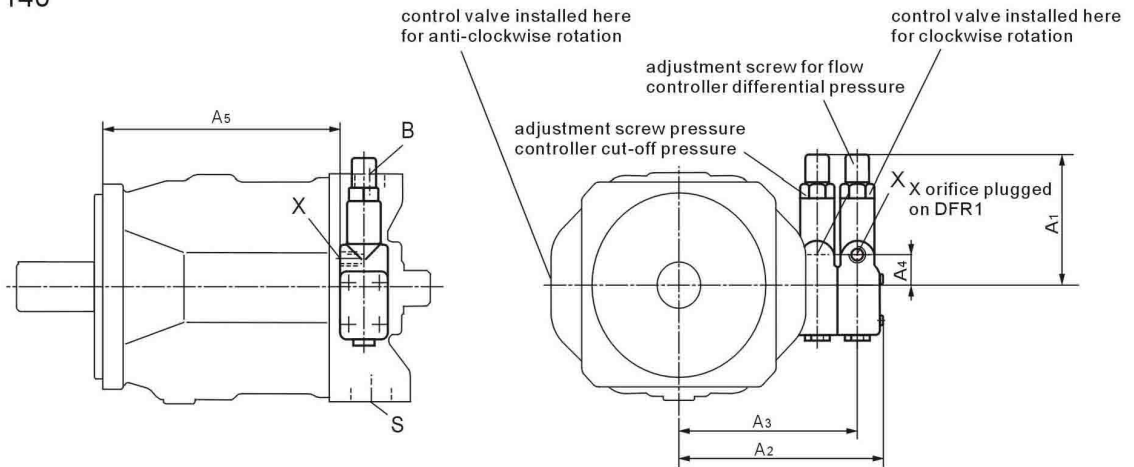DFR1 pilot oil consumption_____max.approx. 3 L/min

Installation Dimensions

HA10VSO※DFR/31R-※12N00
HA10VSO※DFR1/31R-※12N00

Sizes 28…100

Control valve installed here
for anti-clockwise rotation

Control valve installed here
for clockwise rotation

adjustment screw pressure
controller cut-off pressure

adjustment screw for flow
controller differential pressure

X orifice plugged
on DFR1

threaded connection
7/16-20UNF-2B

Size 140

control valve installed here
for anti-clockwise rotation

control valve installed here
for clockwise rotation

adjustment screw for flow
controller differential pressure

adjustment screw pressure
controller cut-off pressure

X orifice plugged
on DFR1

Size	A_1	A_2	A_3	A_4	A_5	Port X	
28	109	136	119	40	119	M14 × 1.5; 12 deep	with adaptor
45	106	146	129	40	134	M14 × 1.5; 12 deep	with adaptor
71	106	160	143	40	162	M14 × 1.5; 12 deep	with adaptor
100	106	165	148	40	229	M14 × 1.5; 12 deep	with adaptor
140	127	209	183	27	244	M14 × 1.5; 12 deep	without adaptor

Through Drive

The HA10VSO pump can be supplied with through drive in accordance with the type code on page 78.
The through drive version is designated by the code numbers (KB3-KB6).
If on other pumps are fitted by the manufacturer,the simple type designation is sufficient.
in this case, the delivery package comprises:
Hub fixing screws,seal and,if necessary, an adaptor flange.

◦ Combination Pump

By building on further pumps it is possible to obtain independent circuits:
1. If the combination pump consists of 2 HA10VSO and if these are to be supplied assembled then the two order codes should be linked by means of a "+"sign.
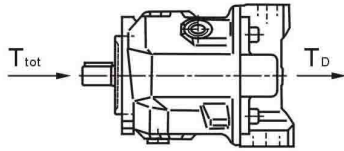Ordering example:
HA10VSO 71 DR/31 L -PPA12KB3+
HA10VSO 28 DR/31 L -PSA12N00
2. If a gear or radial piston pump is to be built on at the factory, please consult us.

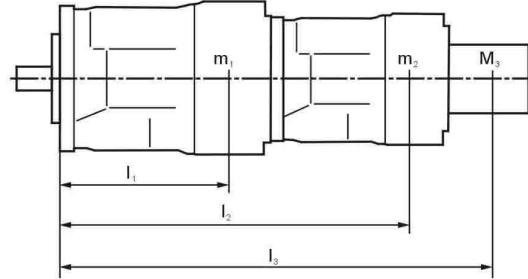## ◦ Maximum permissible input and through drive torque

The split in torque between pump 1 and 2 is optional.
The max. permissible input torque T_{tot} as well as the max. permissible through drive torque T_D may not be exceeded.

Permissible moment of inertia

m_1, m_2, m_3 [kg] Pump mass
l_1, l_2, l_3 [mm] distance to center of gravity
$T_m = (m_1 \cdot l_1 + m_2 \cdot l_2 + m_3 \cdot l_3) \cdot \dfrac{1}{102}$ [Nm]

Size			28	45	71	100	140
Permissible moment of inertia	T_m	Nm	880	1370	2160	3000	4500
Permissible moment of inertia at dynamic mass acceleration 10g ≙ 98.1 m/s²	T_m	Nm	88	137	216	300	450
Mass	m_1	kg	15	21	33	45	60
To center of gravity	l_1	mm	110	130	150	160	160

Size			28	45	71	100	140
Max. permissible input torque at pump 1 with shaft "P"							
	T_{tot}	Nm	137	200	439	857	1206
Max. permissible through-drive torque	T_D	Nm	137	200	439	778	1206
	$T_{D\ keyed\ shaft}$	Nm	112	179	283	398	557

Size			28	45	71	100	140
Max. permissible input torque at pump 1 with shaft "S"							
	T_{tot}	Nm	137	319	626	1104	1620
Max. permissible through-drive torque	T_D	Nm	160	319	492	778	1266
	$T_{D\ keyed\ shaft}$	Nm	112	179	283	398	557

Size			28	45	71	100	140
Max. Permissible input torque at pump 1 with shaft "R"							
	T_{tot}	Nm	225	400	644	-	-
Max. permissible through-drive torque	T_D	Nm	176	365	548	-	-
	$T_{D\ keyed\ shaft}$	Nm	112	179	283	-	-

T_{tot} = Max. permissible input torque at pump 1

T_D = Max. permissible through-drive torque at through-drive to splined shaft

$T_{D\ keyed\ shaft}$ = Max. permissible through-drive torque at through-drive to keyed shaft

Installation Dimensions

HA10VSO+HA10VSO
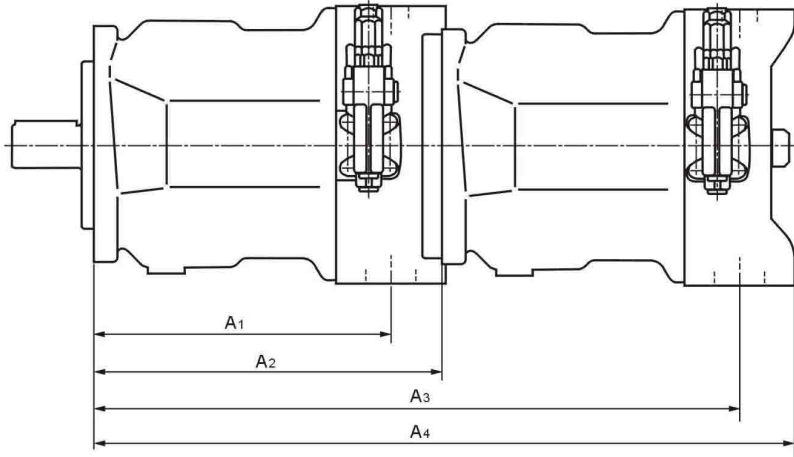
| main p. built-on p.	HA10VSO 28				HA10VSO 45				HA10VSO 71				HA10VSO 100				HA10VSO 140			
	A_1	A_2	A_3	A_4	A_1	A_2	A_3	A_4	A_1	A_2	A_3	A_4	A_1	A_2	A_3	A_4	A_1	A_2	A_3	A_4
HA10VSO28	164	204	368.5	410	-	-	-	-	217	267	431.5	473	275	338	502.5	544	275	350	514	556
HA10VSO45	-	-	-	-	184	229	413	453	217	267	451	491	275	338	522	562	275	350	534	574
HA10VSO71	-	-	-	-	-	-	-	-	217	267	484	524	275	338	555	595	275	350	567	609
HA10VSO100	-	-	-	-	-	-	-	-	-	-	-	-	275	337	613	664	275	350	625	679

Installation Dimensions Through Drives KB3 And KB4

Flange ISO 100, 2-hole for built-on HA10VSO 28 (splined shaft S or R)
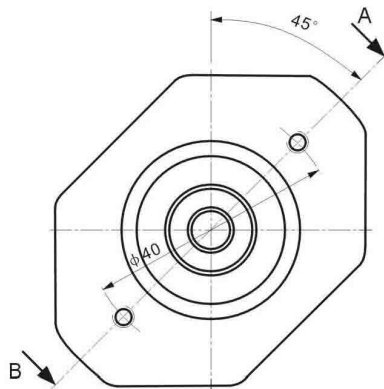## Order code KB3

section A-B

to pump mounting flange A₁
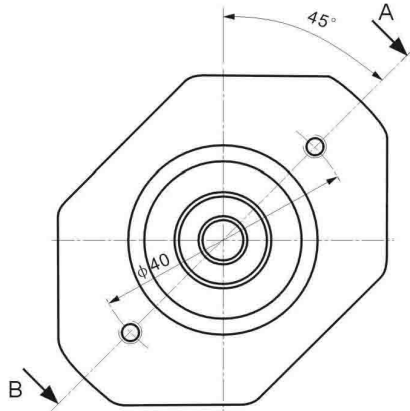
Size main pump	A₁	A₂	A₃
28	204	19.2	14
71	267	16.5	18
100	338	17.6	18
140	350	18.2	24
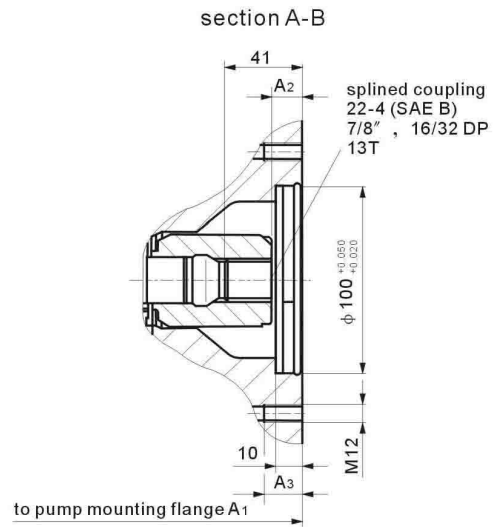
Flange ISO 100, 2-hole for built-on HA10VSO 45 (splined S or R)
Order code KB4

section A-B

to pump mounting flange A₁

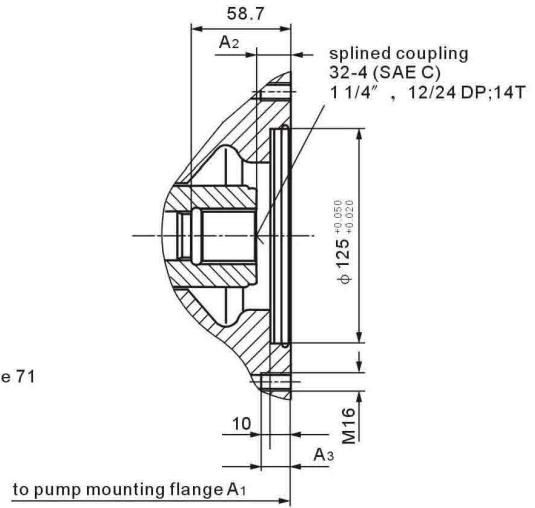| Size main pump	A₁	A₂	A₃
45	229	17.2	14
71	267	17.2	18
100	338	18.2	20
140	350	18.2	24
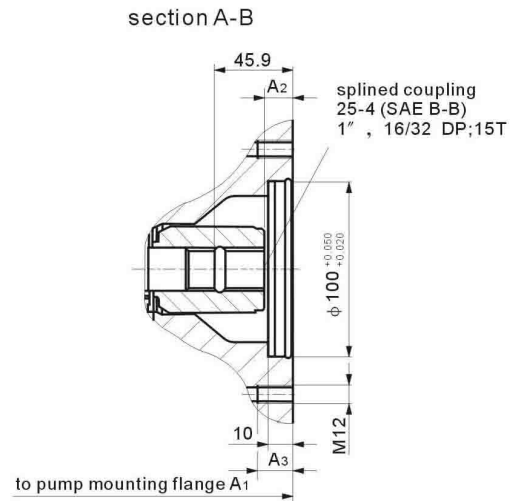
Installation Dimensions Through Drives KB5 And KB6

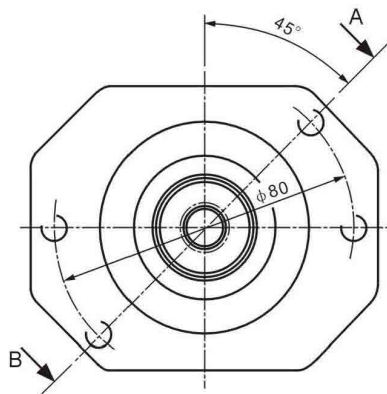## Flange ISO 125,2-hole for built-on HAVSO 71 (splined S or R)
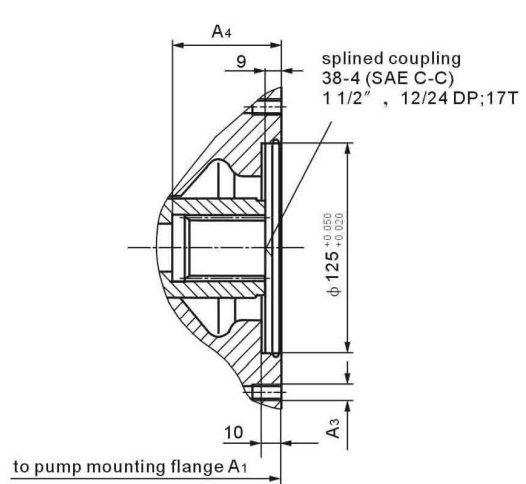## Order code KB5

section A-B

splined coupling
32-4 (SAE C)
1 1/4″ , 12/24 DP;14T

$\phi 125^{+0.050}_{+0.020}$

$\phi 80$

58.7

A_2

10

M16

A_3

to pump mounting flange A_1

omitted on size 71

omitted on size 71

45°
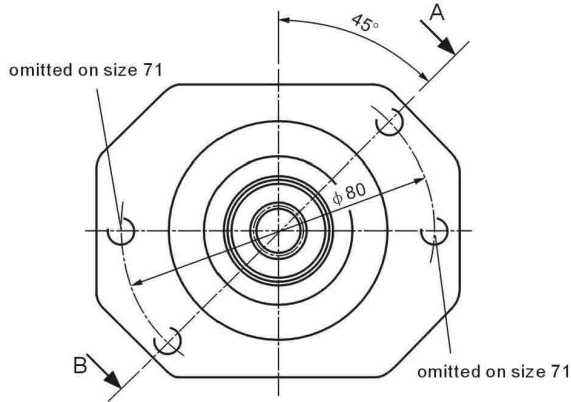
Size main pump	A_1	A_2	A_3
71	267	20	18.5
100	338	20	25
140	350	21	32

Flange ISO 125,2-hole for built-on HA10VSO 100 (splined shaft S)
Order code KB6

section A-B

splined coupling
38-4 (SAE C-C)
1 1/2″ , 12/24 DP;17T

$\phi 125^{+0.050}_{+0.020}$

$\phi 80$

A_4

9

10

A_3

to pump mounting flange A_1

45°

Size mian pump	A_1	A_3	A_4
100	338	M16; 25 deep	65
140	350	M16; 32 deep	77.3