HA10VSO Series
Variable Displacement Pump

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.

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 mm^2/s

Referred to the reservoir temperature(open circuit).

Viscosity limits

The limiting values for viscosity are as follows:

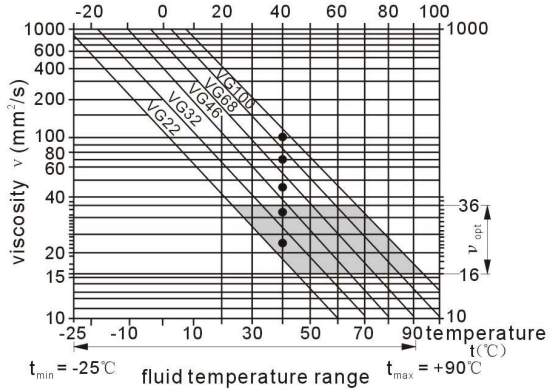
ν_{min}=10 mm^2/s
short term at a max.permissible case temp. of 90℃.

ν_{max}=1000 mm^2/s
short term on cold start

Temperature range (see selection diagram)

t_{min}=-25℃
t_{max}=90℃

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℃ 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

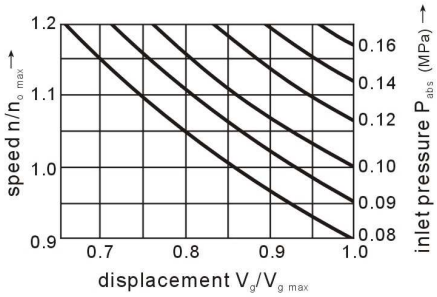
$P_{abs\,min}$ _____ 0.08 MPa
$P_{abs\,max}$ _____ 3 MPa

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.

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



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

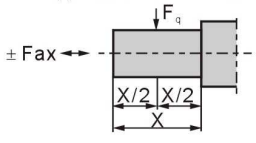
S to B

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 $V_{g\,max}$	T_{max}	Nm	125	200	316	445	623
Torque ($\triangle$P= 10 MPa)	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	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 $q_v = \frac{V_g \cdot n \cdot \eta_v}{1000}$ [L/min]

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

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

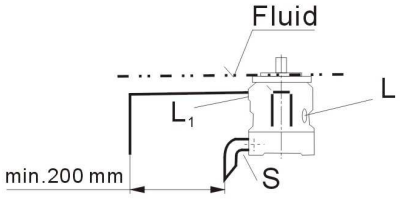


Fig.1

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).

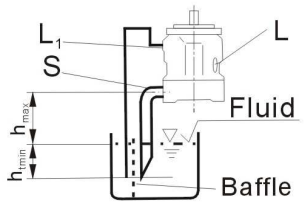


Fig.2

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

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

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

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

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

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

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

$\triangle P3$: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 acconrding to tiem 1.2.1.

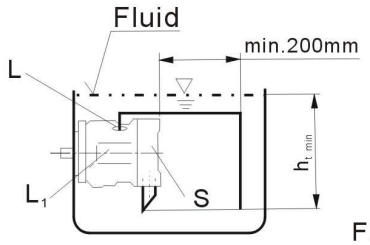


Fig.3

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.

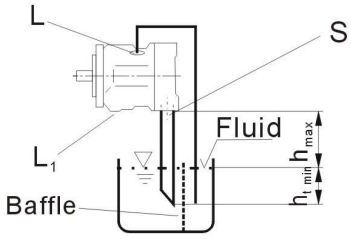


Fig.4

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

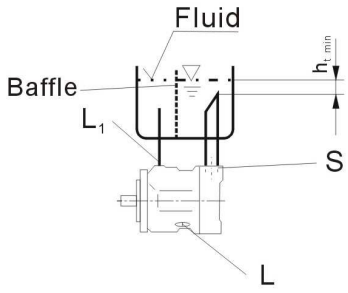


Fig.5