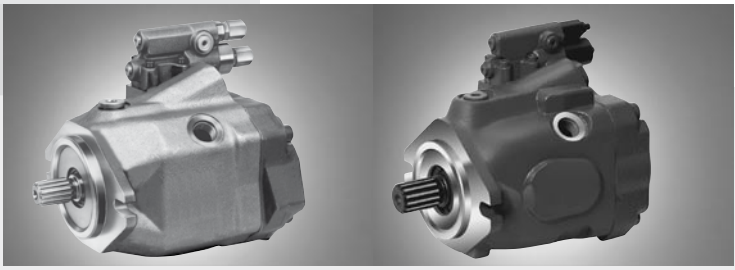
Axial Piston Variable Pump A10VNO

RA 92735/11.07 1/16
Replaces: 11.05

Technical Data Sheet



Series 52 Series 53

Series 52/53
Size 28...85
Nominal pressure 210 bar
Peak pressure 250 bar
Open circuit

Contents

Features

- Axial piston variable pump in swashplate design for hydrostatic drives in open circuits
- Flow is proportional to drive speed and displacement. It can be infinitely varied by adjustment of the swashplate.
- High power to weight ratio-small dimensions
- Low noise level
- Permissible continuous pressure 210 bar
- Axial and radial loading of drive shaft possible
- Pressure and flow control
- Short response times
- Well proven A10-technology
- Extreme small mounting dimensions
- Cost effective alternative to fixed displacement pumps
- Costs optimized design

Ordering code - Standard program

A10VN	O		DRS	/	5x		–	V	R	C		N00
01	02	03	04		05	06		07	08	09	10	11

Axial piston unit

01	Swash plate design, variable, nominal pressure 210 bar, peak pressure 250 bar	**A10VN**

Type of operation

02	Pump, open circuit	**O**

Size

			28	**45**	**63**	**85**
	~ Displacement $V_{g\ max}$ in	in^3	1.71	2.75	3.84	5.19
03		cm^3	28	45	63	85

Control device

04	Pressure control with flow control, hydraulic, X-T closed	**DRS**

Series

05	Series 5	Index 2	–	●	●	–	**52**
		Index 3	●	–	–	●	**53**

Direction of rotation

06	Viewed on shaft end	right hand	**R**
		left hand	**L**

Seals

07	FKM (Fluor-rubber)	**V**

Shaft end

08	Splined to SAE J744	**R**

Mounting flange

09	SAE 2-hole	**C**

Ports for service lines

10	ISO 6149-1 threaded ports at rear, metric	–	●	–	–	**40**
	SAE flange ports at rear, metric bolt holes	●	–	●	●	**11**

Through drives

11	No through drives	**N00**

Available versions

When ordering state ordering code and Ident. No.

Type	Ident-Nr.	Type	Ident-Nr.
A10VNO28DRS/53R-VRC11N00	2467798	A10VNO63DRS/52R-VRC11N00	2436458
A10VNO28DRS/53L-VRC11N00	2467800	A10VNO63DRS/52L-VRC11N00	2436459
A10VNO45DRS/52R-VRC40N00	2468248	A10VNO85DRS/53R-VRC11N00	2468201
A10VNO45DRS/52L-VRC40N00	2452518	A10VNO85DRS/53L-VRC11N00	2468202

● available O in preparation – not available

Hydraulic fluids

Prior to project design, please see our technical data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable fluids) and RE 90223 (HF-fluids) for detailed information on fluids and operating conditions.

When using HF- or environmentally acceptable fluids attention must be paid to possible limitations of the technical data, if necessary contact us. (when ordering please state in clear text the fluid to be used). Operation on Skydrol is only possible after consultation with us.

Operating viscosity range

For optimum efficiency and service life we recommend that the operating viscosity be chosen in the range of:

ν_{opt} = opt. operating viscosity 80...170 SUS (16 ... 36 mm²/s)

referred to tank temperature (open circuit).

Limit of viscosity range

For critical operating conditions the following values apply:

ν_{min} = 60 SUS (10 mm²/s)
for short periods (t ≤ 1 min)
at max. permissible leakage fluid temperature of 239 °F (115 °C).

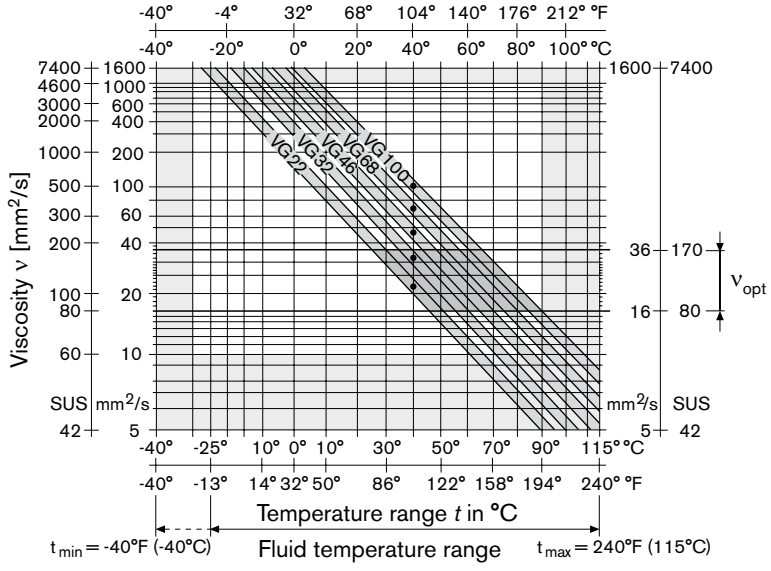
Please note, that the max fluid temperature of 239 °F (115 °C) is also not exceeded in certain areas (for instance bearing area) The fluid temperature in the bearing area is approx. 7 °F (5 K) higher than the average leakage fluid temperature.

ν_{max} = 7500 SUS (1600 mm²/s)
for short periods (t ≤ 1 min)
on cold start
(t_{min} = p ≤ 435 psi (30 bar), n ≤ 1000 rpm, -13 °F (-25 °C))

At temperatures between -13 °F (-25 °C) and -40 °F (-40 °C) special measures may be required, depending on installation conditions. Please consult us for further information.

For detailed information on operation with low temperatures see data sheet RE 90300-03-B.

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 circuit) in relation to the ambient temperature.

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

Example: at an ambient temperatue of X °F (X °C) the operating temperature in the tank is 140 °F (60 °C). In the optimum viscosity range (ν_{opt}; shaded area) this corresponds to viscosity grades VG 46 resp. VG 68; VG 68 should be selected

Important: The leakage fluid (case drain fluid) temperature is influenced by pressure and input speed, and is always higher than the tank temperature. However, at no point in the circuit may the temperature exceed 239 °F (115 °C).

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

Filtration of fluid

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

To ensure a reliable functioning of the axial piston unit, a minimum cleanliness of

20/18/15 to ISO 4406 is necessary.

At very high operating temperatures (195 °F (90 °C) to max. 239 °F (115 °C)) a cleanliness of

19/17/14 to ISO 4406 is necessary.

If above mentioned grades cannot be maintained please consult us.

Technical data

Operating pressure range, inlet

Absolute pressure at port S

$p_{abs\ min}$ 12 psi (0,8 bar)

$p_{abs\ max}$ 73 psi (5 bar)

Operating pressure range, outlet

Pressure at port B

Nominal pressure p_N 3000 psi (210 bar)

Peak pressure p_{max} 3600 psi (250 bar)

(Pressures to DIN 24312)

Direction of flow

S to **B**

Case drain pressure

Maximum permissible case drain pressure (port L_X):

maximum 7 psi (0,5 bar) higher than the inlet pressure at port S, however not higher than 29 psi (2 bar) absolute.

$p_{L\ abs\ max}$ 29 psi (2 bar)

Table of values (theoretical values, without considering efficiencies and tolerances; values rounded)

Size				28	45	63	85
Displacement		$V_{g\ max}$	in³ (cm³)	1.71 (28)	2.75 (45)	3.84 (63)	5.19 (85)
Speed[2]							
max. at $V_{g\ max}$		$n_{0\ max\ 1}$[1]	min⁻¹	3200	2900	2700	2700
Flow							
at $n_{0\ max}$		$q_{V0\ max\ 1}$[1]	gpm	23.8	34.6	45	60.8
			(L/min)	(90)	(131)	(170)	(230)
Power	Δp = 3000 psi (210 bar)						
at $n_{0\ max}$		$P_{0\ max\ 1}$[1]	HP (kW)	42 (31)	62 (46)	79 (59)	107 (80)
Torque							
at $V_{g\ max}$	Δp = 3000 psi (210 bar)	T_{max}	lb-ft (Nm)	69 (94)	110 (150)	155 (210)	209 (284)
Torsional stiffness	shaft end R	c	lb-ft/rad	10882	19480	29770	51029
			(Nm/rad)	(14800)	(26500)	(40500)	(69400)
Moment of inertia rotary group		J_{TW}	lb-ft/rad	0.0403	0.0474	0.0949	0.423
			(kgm²)	(0,001)	(0,002)	(0,004)	(0,006)
Angular acceleration, max.[2]		α	rad/s²	6800	4900	3500	2500
Case volume		V	gal (L)	0.08 (0,25)	0.08 (0,3)	0.13 (0,5)	0.21 (0,8)
Weight (with press. control)		m	lbs (kg)	25.3 (11,5)	31 (14)	39.7 (18)	48.5 (22)

[1] self priming with absolute pressure of 15 psi (1 bar) at inlet port S

[2] –These values are valid for conditions between the min. required and the max. permissible drive speeds.
For external sources of excitation (eg. diesel engine 2-8 fold rotary frequency, cardan shaft 2-fold rotary frequency).
– The limit is valid for a single pump.
– The load carrying capacity of the connecting parts must be taken into consideration.

Caution: Exceeding these limits can lead to a loss of operability, reduction of service life or complete destruction of the axial piston unit.
The permissible values can be calculated

Technical data

Determination of pump size

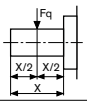
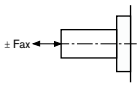
Flow $q_V = \frac{V_g \cdot n \cdot \eta_V}{231\ (1000)}$ [gpm (L/min)]

Torque $T = \frac{V_g \cdot \Delta p}{24\ (20) \cdot \pi \cdot \eta_{mh}}$ [lb-ft (Nm)]

Power $P = \frac{2\pi \cdot T \cdot n}{33{,}000\ (60000)} = \frac{q_V \cdot p}{1{,}714\ (600) \cdot \eta_t}$ [HP (kW)]

V_g = geometr. displacement per revolution in in^3 (cm^3)
p = pressure differential in psi (bar)
n = drive speed in rpm
η_V = volumetric efficiency
η_{mh} = mechanical-hydraulic efficiency
η_t = overall efficiency ($\eta_t = \eta_V \cdot \eta_{mh}$)

Permissible radial and axial loading on drive shaft

Size					28	45	63	85
Radial force, max.		bei X/2	$F_{q\ max}$	lbf (N)	79 (350)	146 (650)	225 (1000)	303 (1350)
Axial force, max.			F_{ax}	lbf (N)	157,4 (700)	146 (650)	225 (1000)	303 (1350)

DRS - Pressure and flow control

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

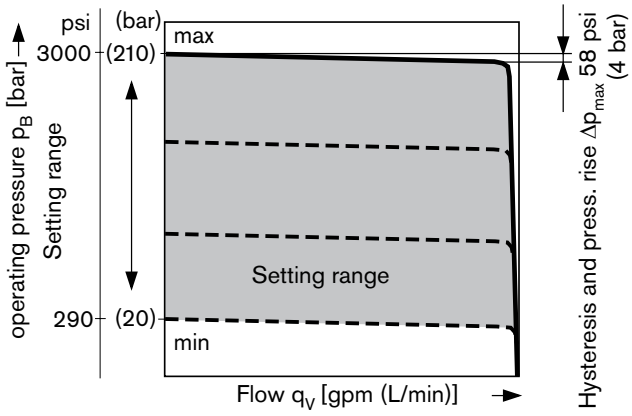
In addition to the pressure control function, the pump flow to the actuator may be varied by means of a differential pressure (eg. over an orifice or a directional valve). The pump supplies only the amount of fluid as required by the actuator.

The pressure control overrides the flow control function.

Characteristics and data of pressure control

Static characteristics

at n_1 = 1500 rpm; t_{fluid} = 122 °F (50 °C)

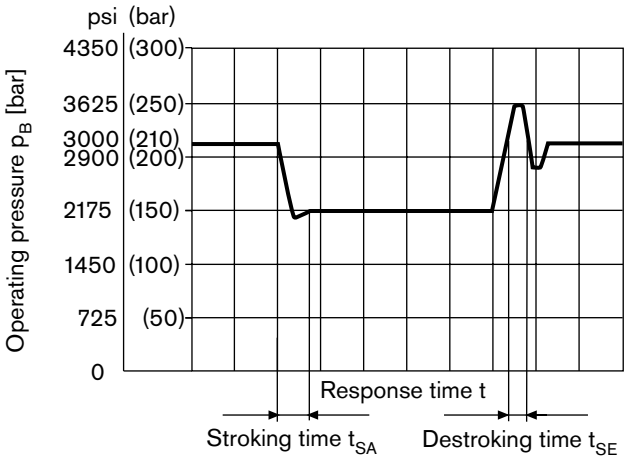


Dynamic characteristics

The curves show average measured values under test conditions to SAE J745 and the unit submerged.

Conditions: n = 1500 rpm
t_{fluid} = 122 °F (50 °C)
Line main relief set at 3600 psi (250 bar)

Stepped loading by suddenly opening or closing the pressure line using a pressure relief valve 3.3 ft (1 m) downstream from the pump outlet.



Control data

Hysteresis and repeatability Δp max. 45 psi (3 bar)
Pilot oil consumption max. ca. 0.8 gpm (3 L/min)

Response times

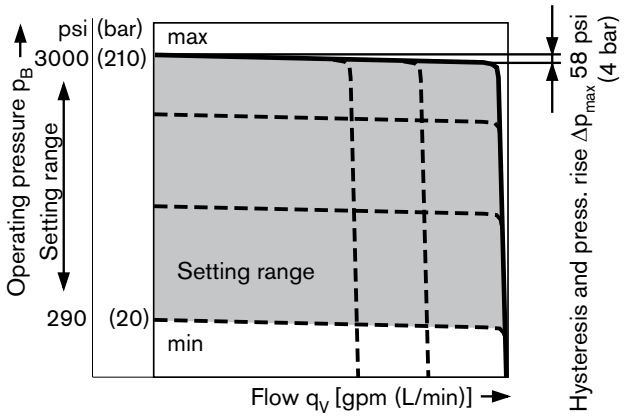
Size	t_{SA} [ms] against 2175 psi (150 bar)	t_{SE} [ms] Standby - 3000 psi (210 bar)
28	75	30
45	90	45
63	100	55
85	110	70

DRS - Pressure and flow control

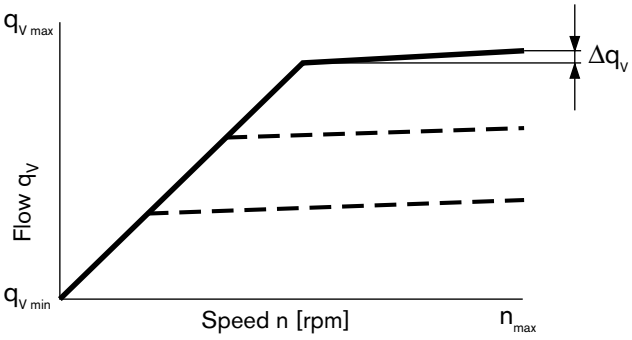
Characteristics and data of flow control

Static characteristics

Flow control at n_1 = 1500 rpm; t_{fluid} = 122 °F (50 °C)



Static curve at variable speed



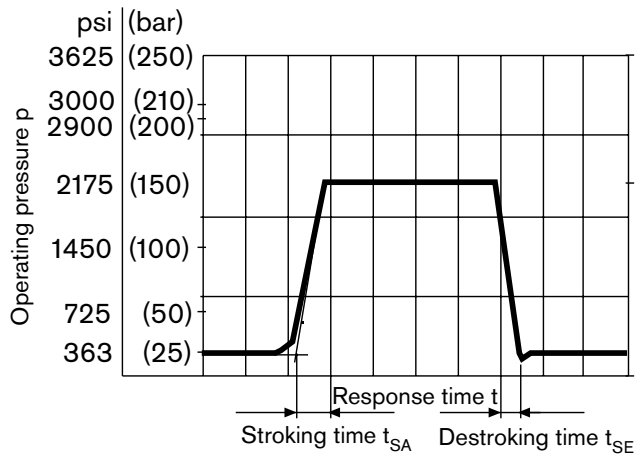
Max. flow deviation

Hysteresis and rise at n_1 = 1500 rpm

Size	28	45	63	85
Δq_V [gpm	0.24	0.26	0.47	0.66
(L/min)]	(0,9)	(1,0)	(1,8)	(2,5)

Dynamic curve

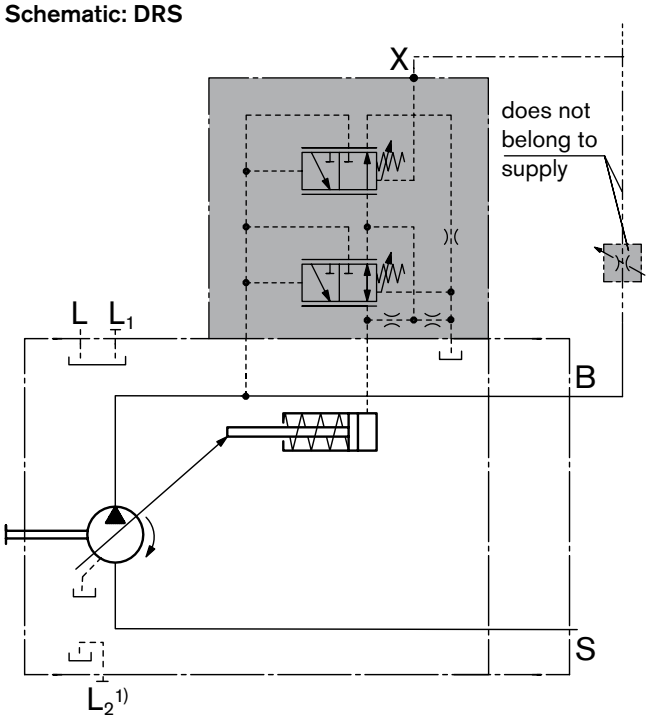
The curves show average measured values under test conditions to SAE J745 and unit submerged.



Response times

Size	t_{SA} [ms] stand by – 2175 psi (150 bar)	t_{SE} [ms] 2175 psi (150 bar) – stand by
28	85	35
45	90	45
63	95	50
85	100	55

Schematic: DRS



Ports

B	Outlet port
S	Inlet port
L, $L_{1,2}$	Case drain ports ($L_{1,2}$ plugged)
X	pilot pressure port

1) only on series 53

Control data

Pilot oil consumption: max. 0.8 gpm (3 L/min)

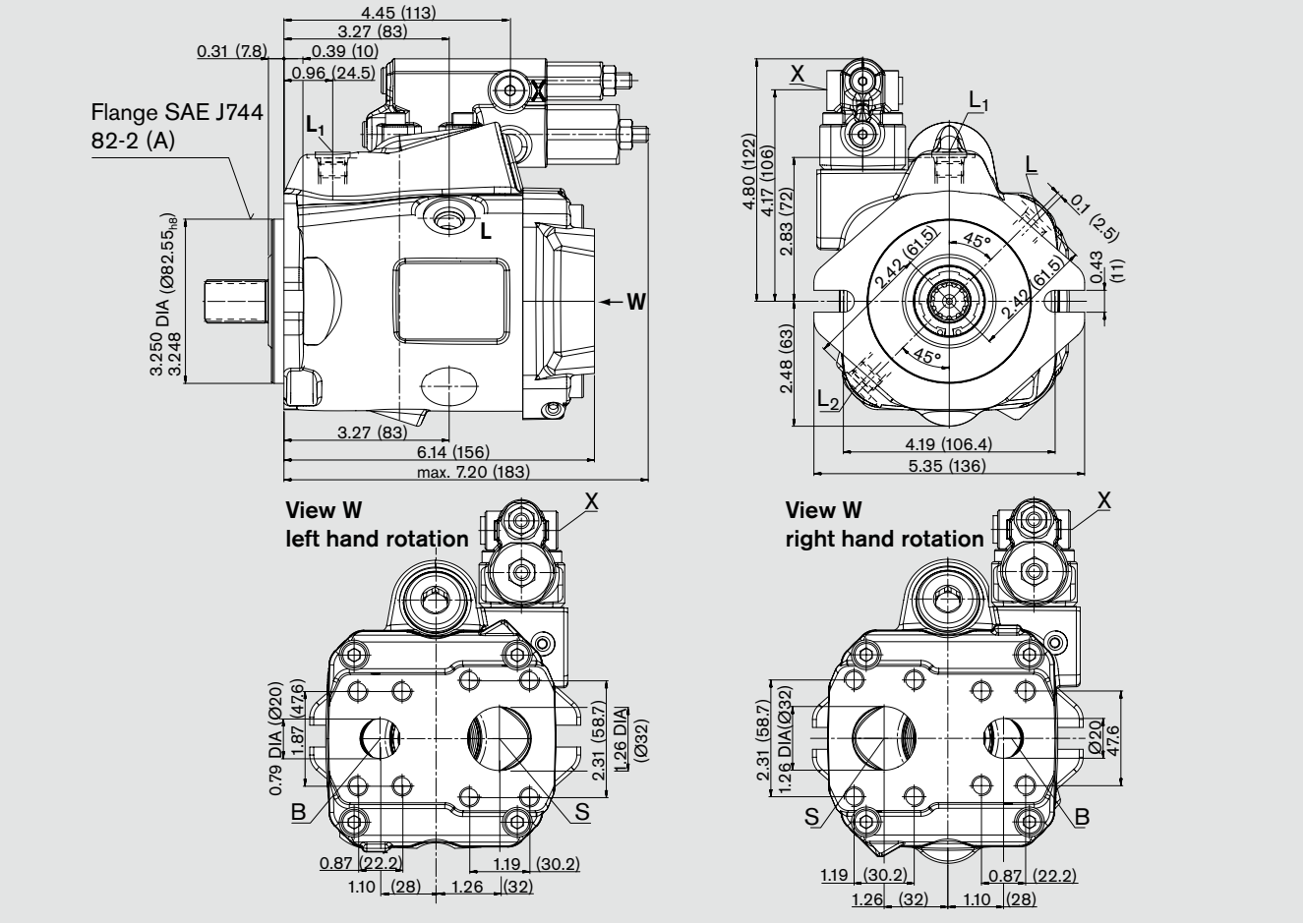
Differential pressure Δp:

Adjustable between 290 (20) and 580 psi (40 bar)
Standard setting 391 psi (27 bar)

Unit dimensions, size 28

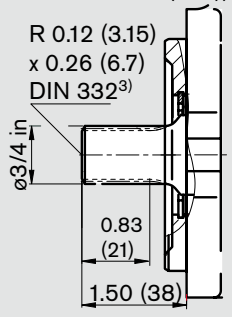
Before finalizing your design please request a certified installation drawing. Dimensions in inches and (mm)

A10VNO28DRS/53R(L)-VRC11N00



Shaft end

Splined
3/4 in 11T 16/32DP[1)]
(SAE J744 - 19-4 (A-B))



Ports

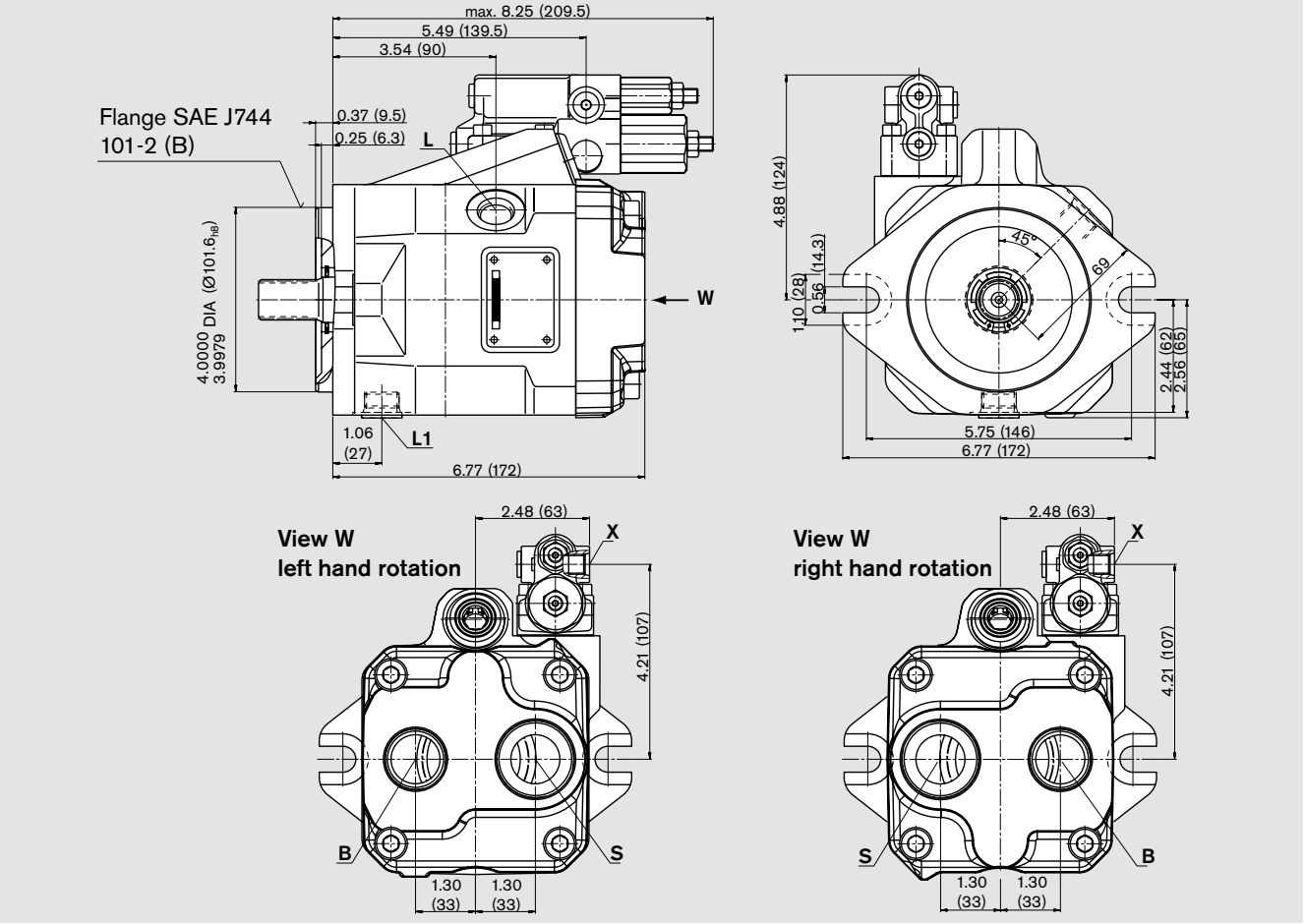
				Tightening torque, max.[2)]
B	Outlet port, SAE flange (code 61)	SAE J518C	3/4in	
	Fixing thread	DIN 13	M10; 0.67 (17) deep	44 lb-ft (60 Nm)
S	Inlet port, SAE flange (code 61)	SAE J518C	1 1/4in	
	Fixing thread	DIN 13	M10; 0.67 (17) deep	44 lb-ft (60 Nm)
$L/L_{1,2}$	Case drain ports ($L_{1,2}$ plugged)	ISO 11926	3/4-16UNF-2B	116 lb-ft (160 Nm)
X	Pilot pressure port	ISO 11926	7/16-20UNF-2B; 11,5 deep	29 lb-ft (40 Nm)

[1)] ANSI B92.1a-1996, 30° pressure angle, flat base, flank centering, fit class 5
[2)] see general notes
[3)] axial retention of coupling half eg. via clamp coupling or radial clamping screw

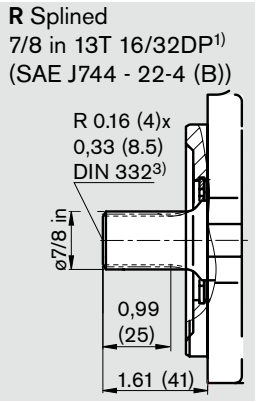
Unit dimensions, size 45

Before finalizing your design please request a certified installation drawing. Dimensions in inches and (mm)

A10VNO45DRS/52R(L)-VRC40N00



Shaft end



Ports

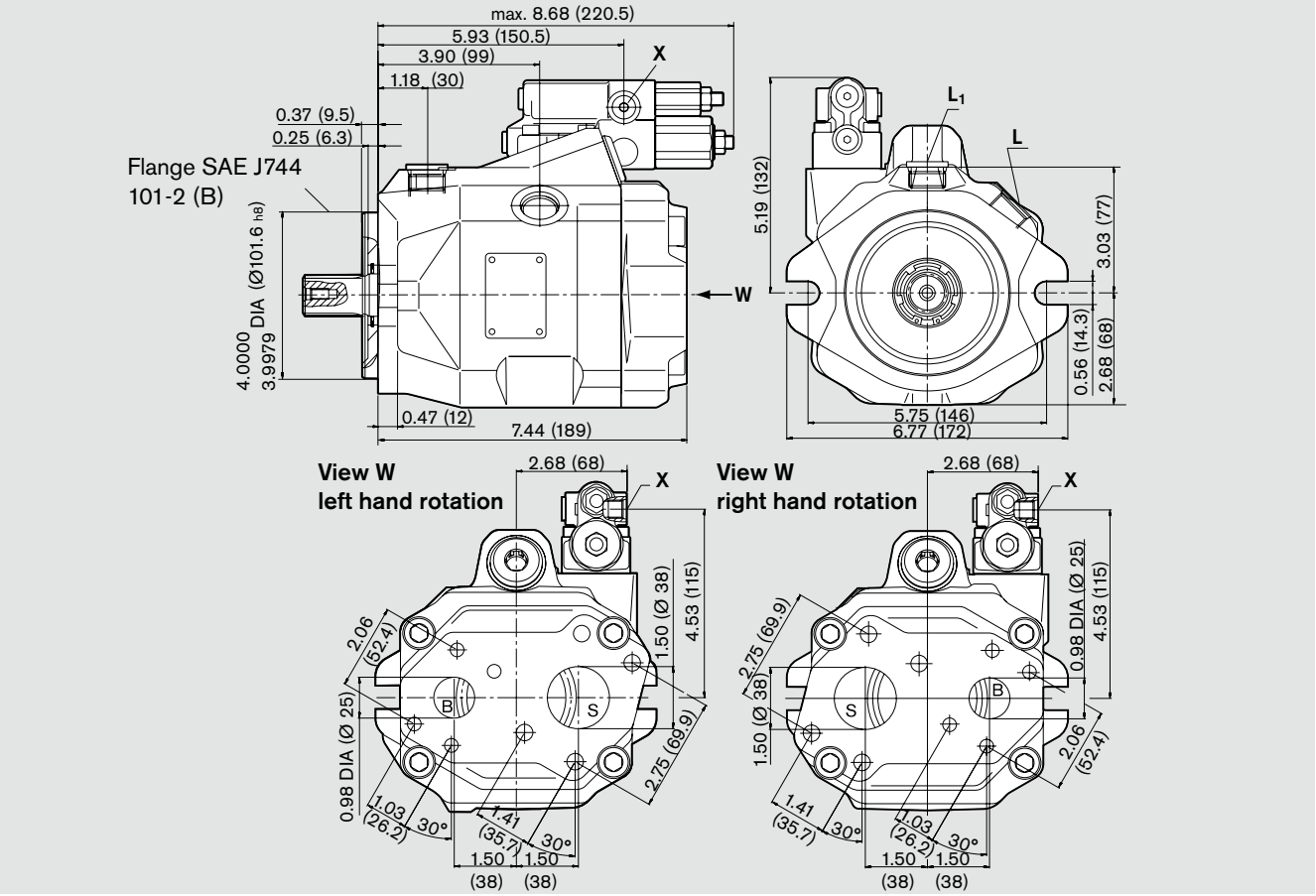
				Tightening torque, max.2)
B	Outlet port, SAE flange (code 61)	ISO 6149	M33x2; 0.79 (20) deep	229 lb-ft (310 Nm)
S	Inlet port, SAE flange (code 61)	ISO 6149	M42x2; 0.79 (20) deep	244 lb-ft (330 Nm)
L	Case drain ports (L_1 plugged)	ISO 11926	3/4-16UNF-2B	116 lb-ft (160 Nm)
X	Pilot pressure port	ISO 11926	7/16-20UNF-2B; 0.45 (11.5) deep	29 lb-ft (40 Nm)

1) ANSI B92.1a-1996, 30° pressure angle, flat base, flank centering, fit class 5
2) see general notes
3) axial retention of coupling eg. via clamp coupling or radial clamping screw

Unit dimensions, size 63

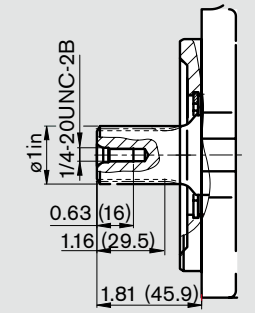
Before finalizing your design please request a certified installation drawing. Dimensions in inches and (mm)

A10VNO63DRS/52R(L)-VRC11N00



Shaft end

R Splined
1 in 15T 16/32DP[1)]
(SAE J744 - 25-4 (B-B))



Ports

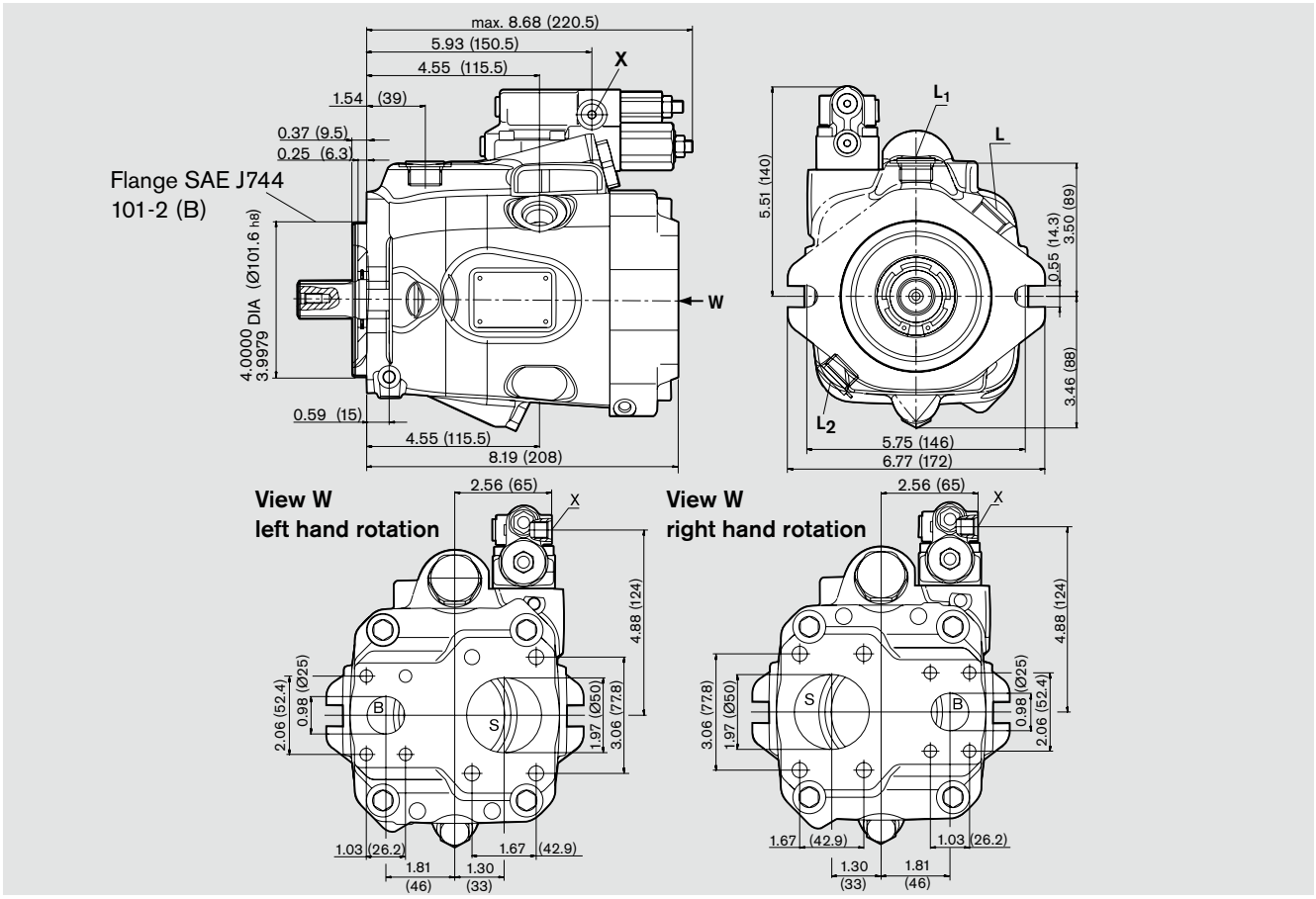
				Tightening torque, max.[2)]
B	Outlet port, SAE flange (code 61)	SAE J518c	1 in	
	Fixing thread	DIN 13	M10; 0.67 (17) deep	44 lb-ft (60 Nm)
S	Inlet port, SAE flange (code 61)	SAE J518c	1 1/2 in	
	Fixing thread	DIN 13	M12; 0.79 (20) deep	96 lb-ft (130 Nm)
L/L_1	Case drain ports (L_1 plugged)	ISO 11926	7/8-14UNF-2B	174 lb-ft (240 Nm)
X	Pilot pressure port	ISO 11926	7/16-20UNF-2B ; 0.45 (11.5) deep	29 lb-ft (40 Nm)

[1)] ANSI B92.1a-1996, 30° pressure angle, flat base, flank centering, fit class 5
[2)] see general notes

Unit dimensions, size 85

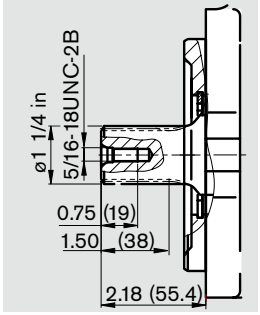
Before finalizing your design please request a certified installation drawing.
Dimensions in inches and (mm)

A10VNO85DRS/53R(L)-VRC11N00



Shaft end

R Splined
1 1/4 in 14T 12/24DP[1)]
(SAE J744 - 32-4 (C))



Ports

				Tightening torque, max.[2)]
B	Outlet port, SAE flange (code 61)	SAE J518c	1 in	
	Fixing thread	DIN 13	M10; 0.67 (17) deep	44 lb-ft (60 Nm)
S	Inlet port, SAE flange (code 61)	SAE J518c	2 in	
	Fixing thread	DIN 13	M12; 0.79 (20) deep	96 lb-ft (130 Nm)
$L/L_{1/2}$	Case drain ports ($L_{1/2}$ plugged)	ISO 11926	7/8-14UNF-2B	174 lb-ft (240 Nm)
X	Pilot pressure port	ISO 11926	7/16-20UNF-2B; 0.45 (11.5) deep	29 lb-ft (40 Nm)

[1)] ANSI B92.1a-1996, 30° pressure angle, flat base, flank centering, fit class 5
[2)] see general notes

Installation notes

Optional installation position. The pump housing must be filled with fluid during commissioning and operation.
In order to obtain a low noise level, all connections (inlet, outlet, pilot pressure and case drain lines) must be linked by flexible members to tank.
Avoid placing a check valve in the case drain line.

The highest of the case drain ports (L; L_1 or L_2) must be connected to tank with piping material for standard pressure rating suitable for the port sizes.

Vertical installation (Shaft end upwards)

Arrangement inside the reservoir

Before installation fill pump housing, keeping it in a horizontal position.
a) If the min. fluid level is equal to or above the pump mounting face: plug port "L" , "L_1" and "S" open; it is recommended to pipe "L_1" and connect a suction pipe to "S" (see fig. 1).

b) If the min. fluid level is below the pump mounting face: pipe ports "L_1" and „S" acc. to fig. 2 "L" plugged. (see also limit of conditions)

Note: to avoid pump damage, remove all protective parts (dust covers, plastic plugs etc.) before installation.

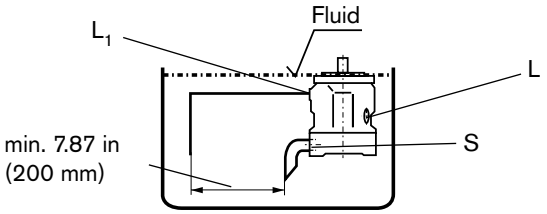


Fig. 1

Arrangement outside the reservoir

Above the reservoir as in fig. 2. Before installation fill pump housing, keeping it in a horizontal position.

Limit of conditions

Min. pump inlet pressure $p_{abs\ min}$ = 12 psi (0,8 bar) under static and dynamic conditions.
Note: try to avoid mounting above tank in order to obtain a low noise level.
The permissible suction height is a result of the overall pressure loss but may not exceed h_{max} = 32 in (800 mm) (immersion depth $h_{t\ min}$ = 7.87 in (200 mm)).

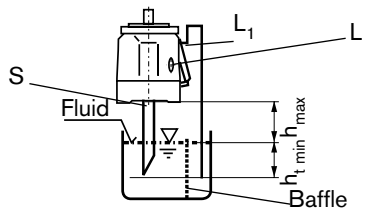


Fig. 2

Overall pressure loss

$\Delta p_{tot} = \Delta p_1 + \Delta p_2 + \Delta p_3 \leq (1 - p_{abs\ min}) = 3$ psi (0,2 bar)

Δp_1: press. loss in pipe due to acceleration of fluid column

ρ = density [kg/m³]

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

l = pipe lenght [m]

dv/dt = change of fluid velocity inlet [m/s²]

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/m³]

g = gravity acceleration = 9,81 m/s²

Δp_3 = Line losses (elbows etc.)

Horizontal installation

The pump must be installed in such a manner, that either "L", "L_1"or "L_2" is at the top.

Arrangement inside the reservoir

a) If the min. fluid level is above the top of the pump: plug port "L_1" , "L" and "S" open; it is recommended to pipe "L" and connect a suction pipe to "S" (see fig. 3).

b) If the min. fluid level is below the top of the pump: pipe "L" and "S" acc. to fig. 4, "L_1" plugged (see also limit of conditions).

Note: to avoid pump damage, remove all protective parts (dust covers, plastic plugs, etc) before installation.

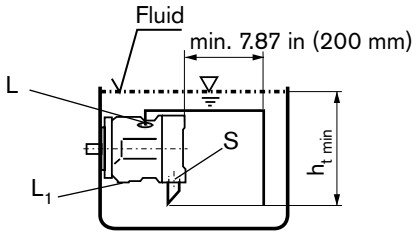


Fig. 3

Arrangement outside the reservoir

Fill pump housing before commissioning.

Pipe port "S" and the highest of the case drain ports "L", "L_1" or "L_2" .

a) Mounting above the tank: see fig. 4. (see also "Limit of conditions")

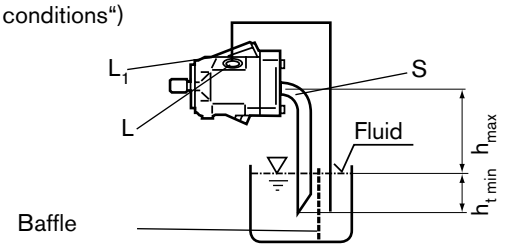


Fig. 4

b) Mounting below the reservoir: pipe ports "L_1" and "S" acc. to fig. 5, plug port "L" .

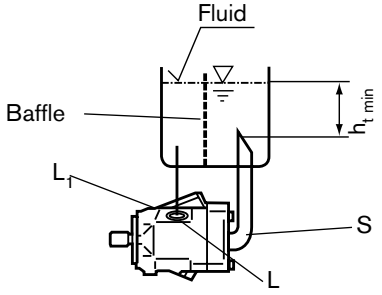


Fig. 5

Notes

Notes

Notes

General notes

– The A10VNO pump is designed to be used in open circuits.

– Project planning, assembly and commissioning of the pump require the involvement of qualified personnel.

– The service line ports and function ports are only designed to accommodate hydraulic lines.

– During and shortly after operation, there is a risk of burns on the pump and especially on the solenoids. Take suitable safety precautions, e.g. wear protective clothing

– There may be shifts in the characteristic depending on the operating state of the pump (operating pressure, fluid temperature).

– Tightening torques:
  - The tightening torques specified in this data sheet are maximum values and must not be exceeded (maximum values for screw thread).
    Manufacturer´s instruction for the max. permissible tightening torques of the used fittings must be observed!
  - For DIN 13 fixing screws, we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.

– The data and information contained herein must be adhered to.

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