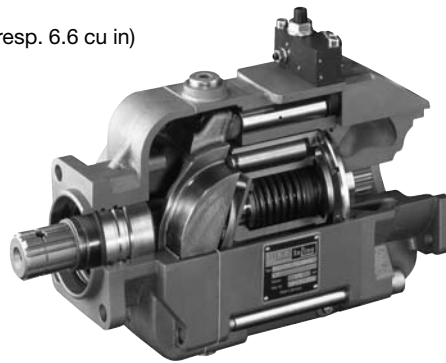
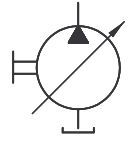


Axial piston variable displacement pump type V60N

For commercial vehicles
Open circuit



Nominal pressure = 350 bar (5075 psi)
 Maximum pressure p_{max} = 400 bar (5800 psi)
 Geometric displacement V_{max} = 90 resp. 110 cm³/rev (5.5 resp. 6.6 cu in)



1. General information

This variable displacement pump with its rugged construction is designed for direct mounting at the auxiliary drive (P.T.O.) of commercial vehicles as well as for standard mounting via a SAE-flange.

With a max. displacement of 110 cm³/rev and a peak pressure of 400 bar it is suited for many applications. This is complemented furthermore by the high self priming rate and the low noise level.

These features can be best employed when the variable displacement pump is combined with the directional spool valves type PSV according to D 7700 ++ and the corresponding over-center valves type LHT and LHDV according to D 7918 and D 7770.

Reversing the rotation direction is very simple and can be done out in the field, which helps to adapt the pump to existing applications.

2. Available versions, main data

Order example: **V60N - 090 R DUN - 1 - 0 - 01/LSN - 2 - 350 - A00/76**

Basic type

Table 1: Nominal size

Coding	090	110
Geometric displacement V_g	90 cm ³ /rev	110 cm ³ /rev
Nom. pressure $p_{nom.}$	350 bar	350 bar
Pressure p_{max}	400 bar	400 bar

Direction of rotation: **L** = Counter clock wise
R = Clock wise
 always facing the drive shaft
 (note for changing the rotation direction see position 3)

Drive shaft design:

- D** = Spline shaft (DIN ISO 14) with mounting flange ISO 7653-1985, P- and S-ports with BSPP-thread (only size V60N-090)
- S** = Spline shaft and mounting flange SAE-C, P- and S-ports with BSPP-thread (only size V60N-090)
- DU** = Spline shaft (DIN ISO 14) with mounting flange ISO 7653-1985, flange-suction port
- SU** = Spline shaft and mounting flange SAE-C, flange-suction port

Suction connections, see table 3 page 6
 no coding = Ports conforming
 DIN ISO 228/1 (BSPP)
UNF = Ports conforming
 SAE J 514 (only V60N-090)

Pressure specification (bar)

no coding = Without stroke limitation (standard)
2 = With stroke limitation (not available for versions with thru-shaft)

Table 2: Pump controllers

Coding	Description
LSN	Load-Sensing controller with integrated pressure limitation
LLSN	Torque controller (power controller) in combination with LSN - Product "Pressure x Displacement" = constant Adjustment range: 25...100% of max. drive torque

Production standard

Additional functions: **0** = Without

Drive shaft version: **1** = Standard
2 = Thru-shaft (only available for type V60N-110)

Seals: **N** = NBR (Nitril) - Standard
V = FKM (Viton)



HAWE HYDRAULIK GMBH & CO. KG
 STREITFELDSTR. 25 • 81673 MÜNCHEN

D 7960 N
 Axial piston variable displacement pump

3. Additional parameter

3.1 General

Calculation of the nom. sizes:

Flow rate

$$Q = \frac{V_g \cdot n \cdot \eta_v}{1000} \text{ (lpm)}$$

Flow rate

$$M = \frac{1,59 \cdot V_g \cdot \Delta p}{100 \cdot \eta_{mh}} \text{ (Nm)}$$

Power

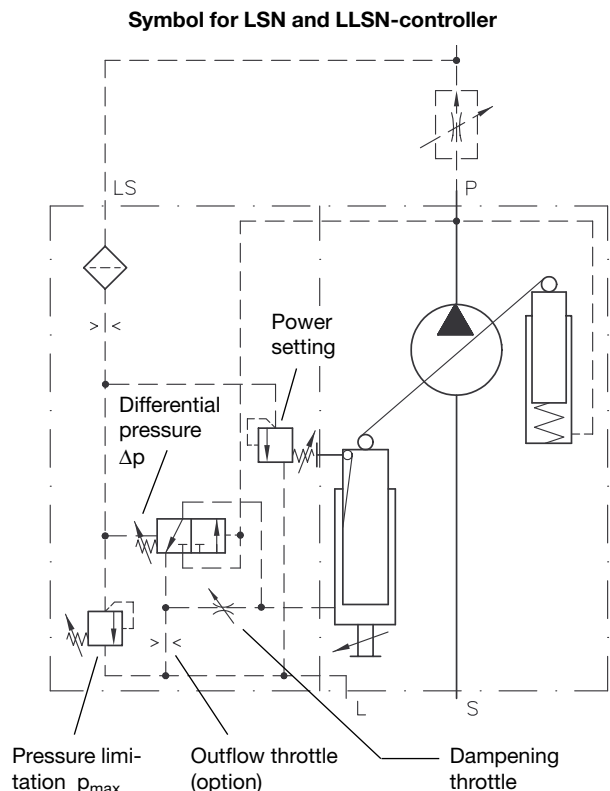
$$P = \frac{2\pi \cdot M \cdot n}{60000} = \frac{M \cdot n}{9549} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t} \text{ (kW)}$$

V_g = Displacement (cm³/rev)
 Δp = Differential pressure (bar)
 n = Speed (rpm)

η_v = Volumetric efficiency
 η_{mh} = Mechanical-hydraulic efficiency
 η_t = Total efficiency ($\eta_t = \eta_v \times \eta_{mh}$)

Nomenclature	Axial piston pump according to the swash plate principle		
Mounting	At the auxiliary drive of commercial vehicles (flange ISO 7653-1985 for trucks) or flange assembly (flange SAE-C)		
Surface	nitro-carb hardened		
Direction of rotation	Clock wise or counter clock wise		
Changing the rotation direction	turn the endplate (see dimensions, pos. 4) and change the port plate, see also B 7960 N		
		V60N-090	V60N-110
Order No.:	port plate	clock wise	79-29020.00
		counter clock wise	79-29035.00
			79-29763.00
			79-29765.00
Installed position	Preferably horizontal (Other positions on request!)		
Hydraulic fluid	Hydraulic oil acc. to DIN 51524 table 2 and 3; ISO VG 10 to 68 acc. to DIN 51519 Viscosity range: min. approx. 10; max. approx. 1000 mm ² /sec Optimal operation range: approx. 10...35 mm ² /sec Also suitable are biologically degradable pressure fluids type HEES (synth. Ester) at operation temperatures up to approx. +70°C.		
Temperature	Ambient: approx. -40...+60°C Fluid: -25...+80°C, pay attention to the viscosity range! Start temperature down to -40°C is allowable (Pay attention to the viscosity range during start!), as long as the operation temperature during subsequent running is at least 20K (Kelvin) higher.		
Filtration	Recommended contamination level ≤ 18/13 conforming DIN ISO 4406		
Initial operation	All pipes should be flushed with the same fluid intended for the later service prior to initial operation. The housing of the pump should be primed via the upper case drain port. The case drain line must be routed in such a way that running empty is prevented. The pressure limiting valve should be set to 50 bar or lower for initial operation and the first few minutes of regular service. Attention: Do not screw-out the set screw of the sequence / pressure limiting valve beyond the red index marking!		

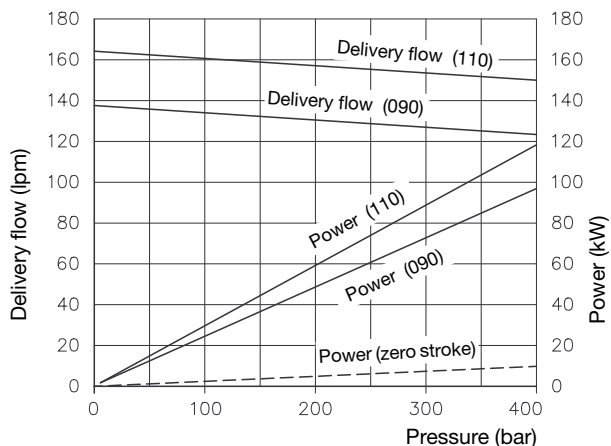
	V60N-090	V60N-110
Angle of the swash plate	21.5°	21.5°
Required inlet pressure abs. for open circuit	0.85 bar	0.85 bar
Max. permissible drive torque	530 Nm	600 Nm
Max. rev. rating when self priming and max. angle of the swash plate at 1 bar abs. inlet pressure	2300 rpm	2200 rpm
Min. rev. rating for permanent running	500 rpm	500 rpm
Required torque at 100 bar	151 Nm	184 Nm
Drive power for 250 bar and 2000 rpm	79.5 kW	97.2 kW
Mass (weight) complete with controller	approx. 25.8 kg	28 kg
Weight torque	35.3 Nm	40 Nm
Inertia moment	0.008 kg m ²	0.01 kg m ²
Sound level at 250 bar, 1500 rpm and max. swash plate angle (Measured in a sound measuring room DIN ISO 4412, distance 1m)	75 dB(A)	75 dB(A)
Pressure range	15 ... 30 bar (HAWE setting 25 bar)	
Differential pressure Δp	15 ... 30 bar (HAWE setting 25 bar)	
Pressure limitation	50 ... 400 bar	



3.2 Curves

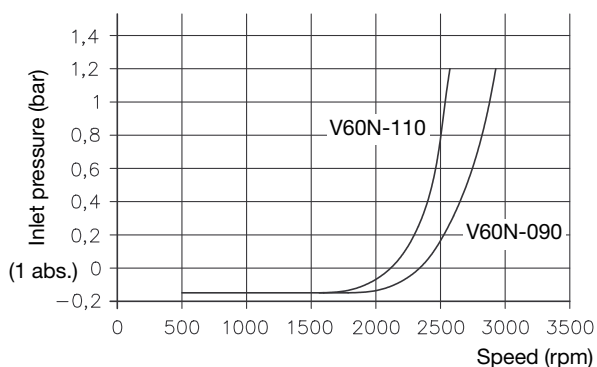
Delivery flow and performance

The curves illustrate delivery flow/pressure (without controller). Drive power at max. swash plate angle and drive power at zero stroke at 1500 rpm.



Inlet pressure

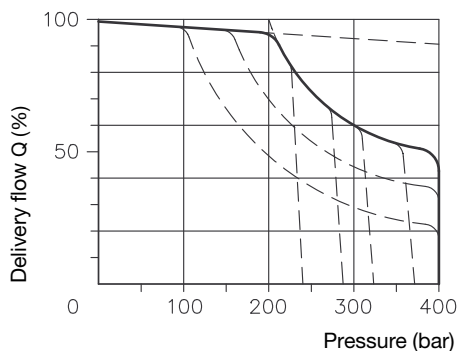
The curve was taken at viscosity 75 mm²/sec and max. swash plate angle



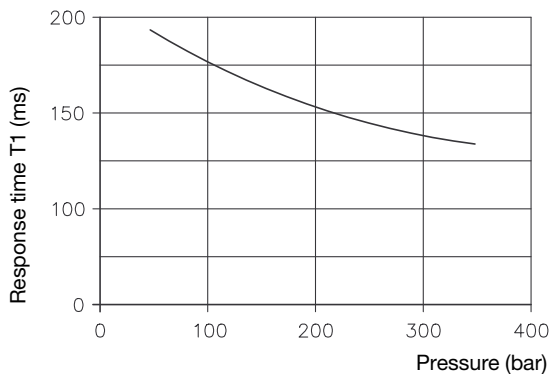
Controller curve

Coding L

Pressure / delivery flow

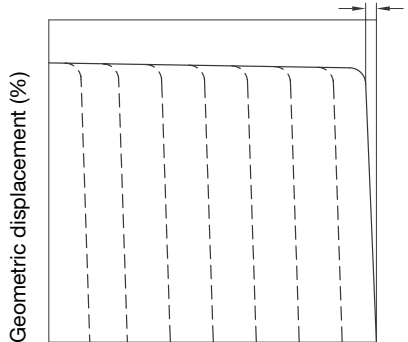


Response time T1 (LSN-controller)



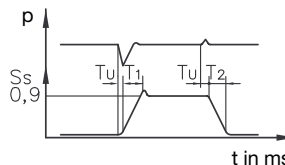
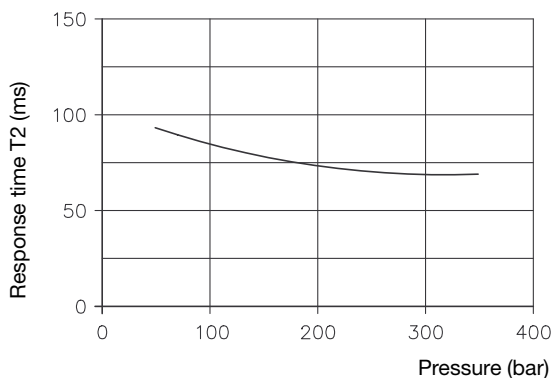
Coding LSN

approx. 4 bar



Operating pressure $p_{oper.}$ (bar)

Response time T2 (LSN-controller)



- S_s = Displacement
- T_u = Delay < 3 ms
- T_1 = Response time min to max
- T_2 = Response time max to min
- p = Pressure
- LS-line min. length 1.5 m,
- min. internal diameter 12 mm

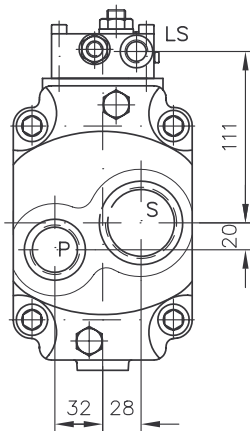
4. Unit dimensions

All dimensions in mm, subject to change without notice!

4.1 Basic pumps

Type V60N-090

Illustration version "D" and "S"
counter clock wise rotation direction
 (facing the shaft end)



Coding **S** and **SU**
 Spline shaft SAE-C
 14T-12/24 DP

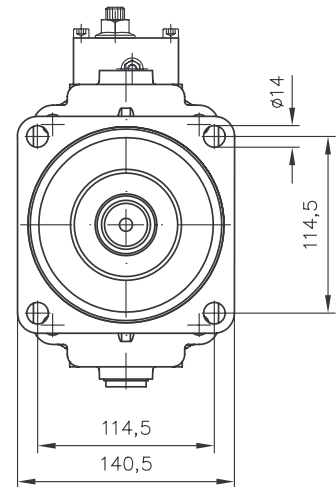
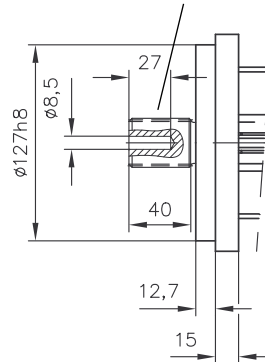
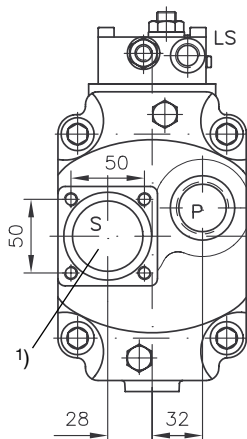
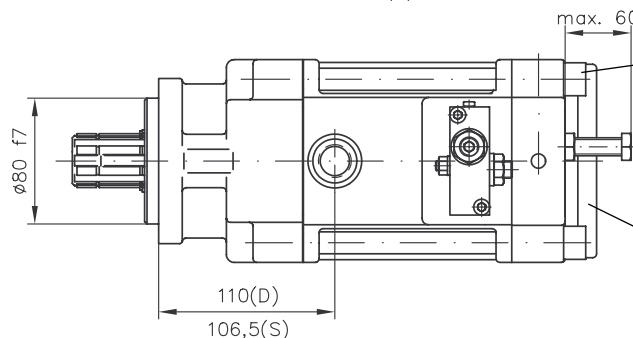
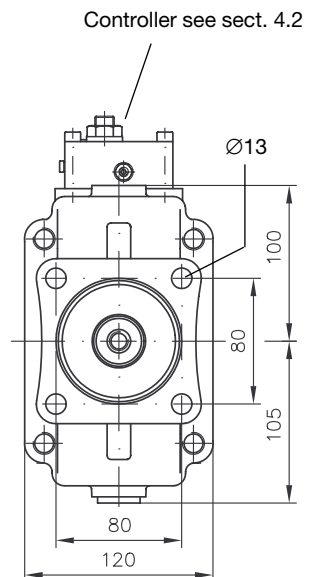
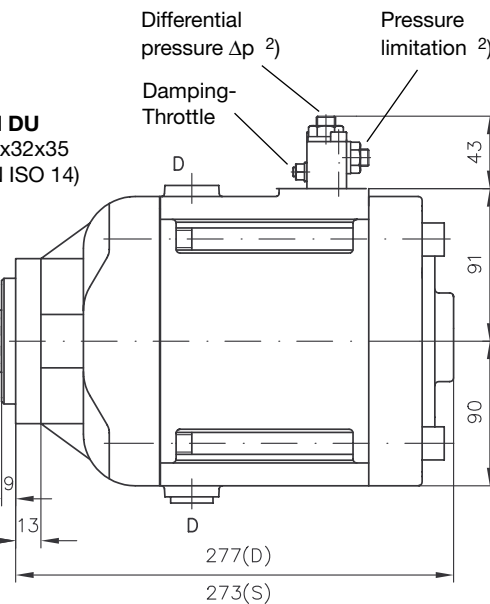


Illustration version "DU" and "SU"
clock wise rotation direction
 (facing the shaft end)



Coding **D** and **DU**
 Spline shaft 8x32x35
 (similar to DIN ISO 14)

M12,
 24 deep



max. torque 120 Nm
 (4 x tie rod M14 x190)

Stroke limiter
 ΔV_g approx. 5 cm³/rev

End plate
 (has to be turned by
 changing the rotation
 direction, see note sect. 3
 or B 7960 N)

- 1) Mounting kit is scope of delivery with the intake acc.to sect. 4.3 (part No. 7993355). It consists of:
- 4x skt.-head screw M8x16-8.8
 - O-ring 44.2x3 NBR 70 Sh
 - 2 brackets

- 2) **Attention:**
 Do not screw-out the set screw of the sequence / pressure limiting valve beyond the red index marking!

Ports (BSPP):
 P = Pressure outlet G 1
 S = Priming port G 1 1/2
 or flange suction port
 D = Case drain G 1/2

Coding **UNF**, ports
 conforming SAE J 514:
 P = 1 5/16-12 UN-2B
 S = 1 7/8-12 UN-2B
 D = 7/8-14 UNF-2B
 LS = G 1/4
 (DIN ISO 228/1 (BSPP))

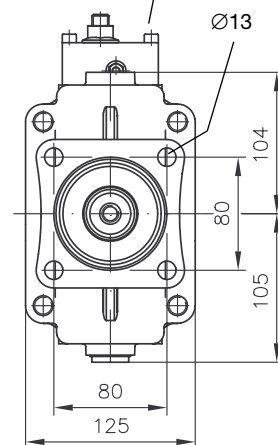
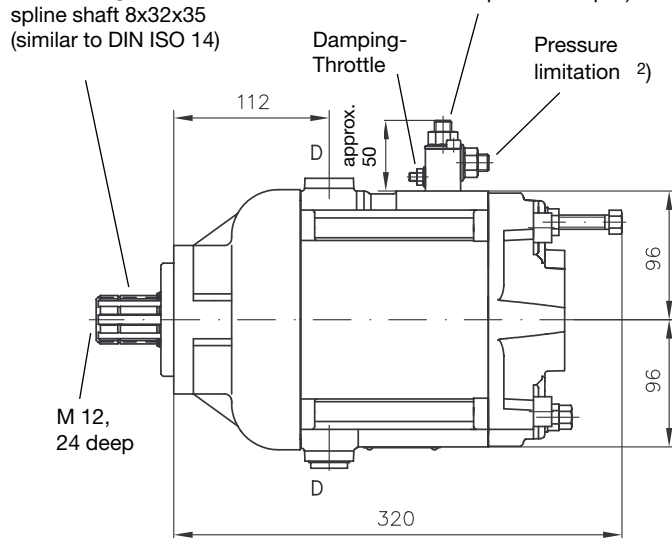
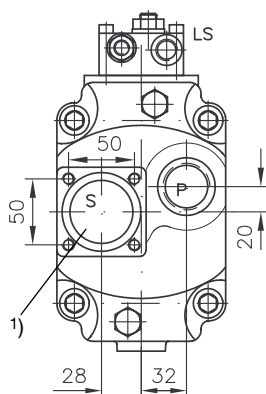
Type V60N-110

Illustration
clock wise rotation
direction
(facing the shaft end)

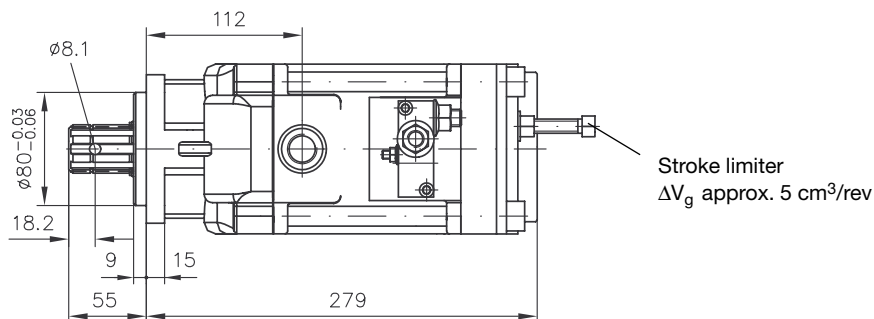
Here coding **DU**
spline shaft 8x32x35
(similar to DIN ISO 14)

Differential pressure Δp ²⁾

Controller see sect. 4.2

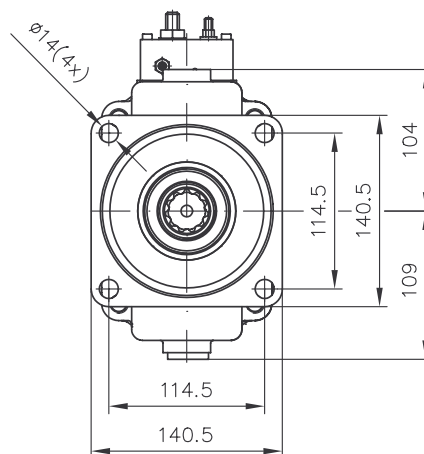
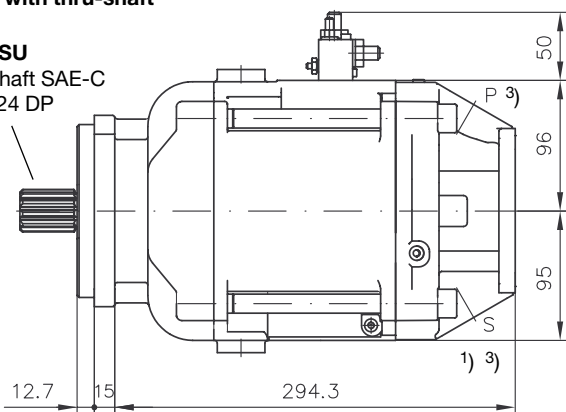


Ports
see type V60N-090



Version with thru-shaft

Coding **SU**
Spline shaft SAE-C
14T-12/24 DP



Order example: V60N-110 RSUN-2-0-01/LLSN-350- **SAE-B/4** -A00/76

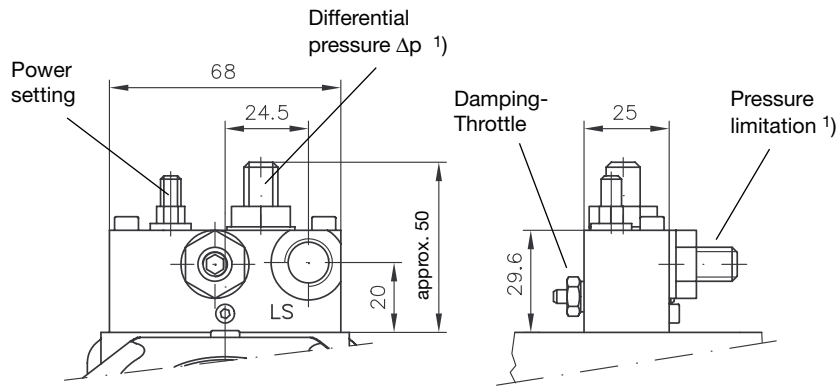
Available flange design incl. coupling

Coding	Description
- SAE-A	Flange SAE-A, spline shaft
- SAE-B/2	Flange SAE-B-2-hole, spline shaft
- SAE-B/4	Flange SAE-B-4-hole, spline shaft

- 1) Mounting kit with the intake see type V60N-090 (page 4)
- 2) **Attention:**
Do not screw-out the set screw of the sequence / pressure limiting valve beyond the red index marking!
- 3) With clockwise rotation

4.2 Controller

Type LSN and LLSN



Pressure adjustment

	Pressure range (bar)	Δp (bar) / rev.
Pressure limitation	50 ... 400	150
Differential pressure Δp	15 ... 30	12

1) Attention:

Do not screw-out the set screw of the sequence / pressure limiting valve beyond the red index marking!

4.3 Suction connections

Order example: **V60N - 090 R DU N - 1 - 0 - 01/LSN - 350 - A00/76**

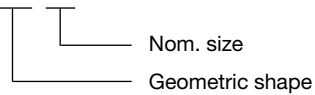


Table 3: Suction connections

Nom. size	Q_{max} (lpm)	straight	45°		90°		thread
		A00/..	A45/..		A90/..		A.
		h	h	k	h	k	h
38 (1 1/2" ²⁾)	75	65	-	-	-	-	-
42	90	-	85	40	-	-	-
50 (2")	125	65	96	40	53	84	-
64 (2 1/2")	190	90	96	40	109	129	-
76 (3")	250	106	106	40	-	-	-
6 (G 1 1/4)	125	-	-	-	-	-	21

2) Attention:

Should be used for reduced flow only!

Suction connections

Dimension b: 6.2 mm

