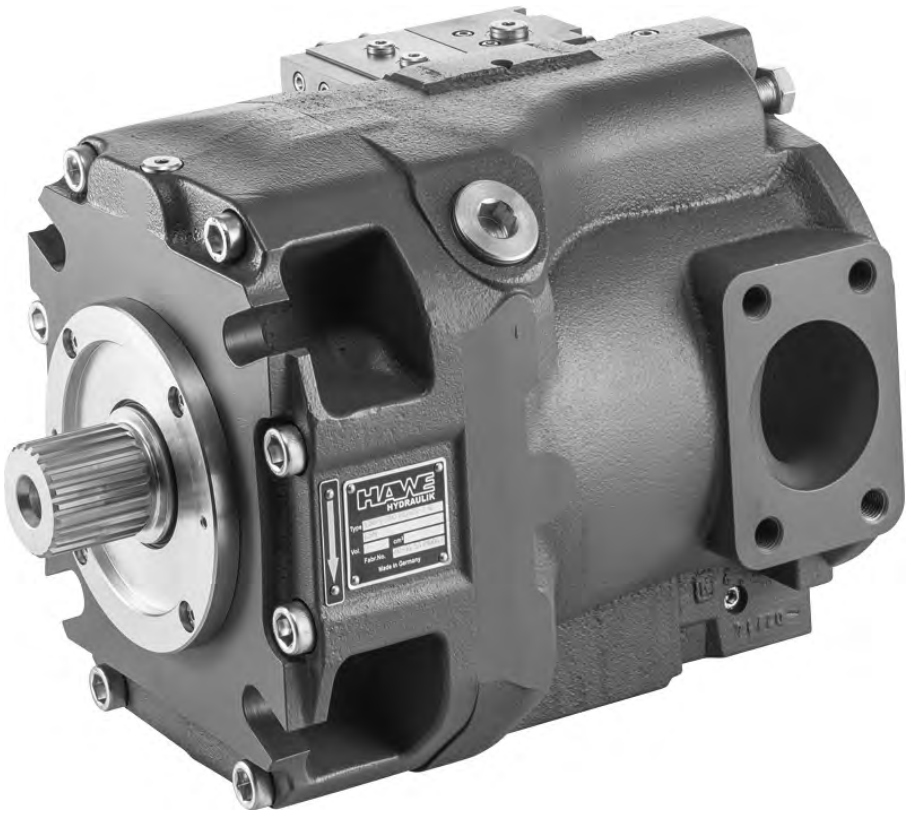
Variable displacement axial piston pump type V80M

Product documentation

Open circuit

Nominal pressure $p_{nom\ max}$:	400 bar
Peak pressure p_{max}:	450 bar
Geometric displacement V_{max}:	202 cm^3/rev



D 7962 M
03-2015-1.3

HAWE HYDRAULIK

Printing date / document generated on: 15.09.2017

1 Overview variable displacement axial piston pump types V80M

Variable displacement axial piston pumps operate according to the bent axis principle. They adjust the geometric output volume from maximum to zero. As a result they vary the flow rate that is provided to the loads.
The axial piston pump type V80M is designed for open circuits in mobile hydraulics and operate according to the swash plate principle. They are available with the option of a thru-shaft for operating additional hydraulic pumps in series.
The sturdy pump is particularly suitable for continuous operation in challenging applications. The range of pump controllers allows the axial piston pump to be used in a variety of applications.

Variable displacement axial piston pump type V80M

Features and benefits:

- High speed
- High nominal pressure
- Less installation space
- Full torque available at the second pump in tandem pump applications

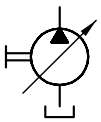
Intended applications:

- Machines for forestry and agricultural purposes
- Cranes and lifting equipment
- Construction machines

2 Available versions, main data

2.1 Basic version

Circuit symbol:



Order coding example:

V80M	-200	R	S	F	N	- 1	- 0	- XX	/LSN	- 2/190	- 400	C 311	- Z 05

- **2. pump**
- **Flange version** Table 9 Flange versions (output side)
- **Pressure specification (bar)**
- **Stroke limitation** Table 7a Stroke limitation
- **Controller** Table 8 Controllers
- **Release** Release
- **Additional function** Table 7 Additional functions, swash plate angle indicator
- **Housing version** Table 6 Housing versions
- **Seal** Table 5 Seals
- **Flange version** Table 4 Flange versions (input side)
- **Shaft version** Table 3 Shaft versions
- **Rotating direction** Table 2 Rotating directions
- **Nominal size** Table 1 Nominal size
- **Basic type**

Table 1 Nominal size

Coding	Geometric displacement (cm^3/rev)	Nominal pressure p_{nom} (bar)	Peak pressure p_{max} (bar)
200	202	400	450

Table 2 Rotation directions

Coding	Description
L	Anti-clockwise
R	Clockwise

Table 3 Shaft versions

Coding	Description	Designation/standard	Max. drive torque (Nm)
D	Spline shaft	W50x2x24x9g DIN 5480	2550
S	Spline shaft	SAE-F J 744 15T 8/16 DP 50-4 DIN ISO 3019-1	2350
U	Spline shaft	SAE-D J 744 13T 8/16 DP 44-4 DIN ISO 3019-1	1200

Table 4 Flange versions (input side)

Coding	Description	Designation
G	Flange	180 B4 HW DIN ISO 3019-2
F	Flange	SAE-E 4-hole J 744 155-4 DIN ISO 3019-1
W	Flange	SAE-D 4-hole J 744 152-4 DIN ISO 3019-1

Table 5 Seals

Coding	Description
N	NBR (nitrile rubber)

Table 6 Housing versions

Coding	Description
1	No thru-shaft
2	Thru-shaft

Table 7 Additional functions, swash plate angle indicator

Coding	Description
0	Without display
1	With display

Table 7a Stroke limitation

Coding	Description
2	Stroke limitation adjustable (Factory setting: 202 cm^3/rev)
2/...	Stroke limitation fixed with specification of the set geometric displacement Vg (cm^3/rev)

Table 8 Controllers

Coding	Description
/N	Pressure controller, with pressure adjustable directly at the pump. The pressure controller automatically maintains a constant system pressure independently of the required delivery flow. Therefore, it is suited to constant pressure systems where differing delivery flows are required or for efficient pressure limitation of a hydraulic system. Adjustment: Approx. 150 bar/rev
/LSN	Load-sensing controller with pressure limitation. Stand-by pressure adjustable from 20 to 50 bar. Default differential pressure setting: 27 bar Adjustment: Approx. 13 bar/rev
/LSNT	Like LSN + in addition to the LSN controller, the LSNT controller contains internal LS signal relief. Internal leakage flow rate ≤ 1.5 lpm
/LSNL	Load-sensing controller with power controller The power controller with exact hyperbolic curve is used in the case of greatly varying pressures where the drive motor must also be protected against overloading. The drive torque is limited along the line "Pressure x Geometric displacement = Constant" by the special structure. If, for example, the pressure doubles at constant rotation speed, the delivery flow is automatically halved. External mechanical adjustment can be made to the drive torque at any time.

Order coding example:

V80M-200 RSFN-1-0-00/LSN-2-400- **C313**

Coding V80M	Flange	Shaft	e.g. mounting of HAWE pump with coding
200			
C 311	SAE-A 2-hole J 744 82-2 DIN ISO 3019-1	SAE-A J 744 (16-4 DIN ISO 3019-1) 9T 16/32 DP	
C 312	SAE-A 2-hole J 744 82-2 DIN ISO 3019-1	SAE-A J 744 (16-4 ISO 3019-1) 9T 16/32 DP [1)]	
C 313	SAE-A 2-hole J 744 82-2 DIN ISO 3019-1	19-4 DIN ISO 3019-1 11T 16/32 DP	
C 314	SAE-B 2-hole J 744 101-2 DIN ISO 3019-1	SAE-B J 744 (22-4 DIN ISO 3019-1) 13T 16/32 DP	V60N-060 .. HX
C 315	SAE-B 4-hole J 744 101-4 DIN ISO 3019-1	SAE-B J 744 (22-4 DIN ISO 3019-1) 13T 16/32 DP	V60N-060 .. HZ
C 316	SAE-B 2/4-hole 101-2/4 DIN ISO 3019-1	SAE-BB J 744 (25-4 DIN ISO 3019-1) 15T 12/24 DP	V40M
C 317	SAE-C 2-hole J 744 127-2 DIN ISO 3019-1	SAE-C J 744 (32-4 DIN ISO 3019-1) 14T 12/24 DP	
C 318	SAE-C 4-hole J 744 127-4 DIN ISO 3019-1	SAE-C J 744 (32-4 DIN ISO 3019-1) 14T 12/24 DP	V60N- .. SF
C 319	SAE-C 4-hole J 744 127-4 DIN ISO 3019-1	23T 16/32 DP	
C 320	SAE-D 4-hole J 744 152-4 DIN ISO 3019-1	SAE-D&E J 744 (44-4 DIN ISO 3019-1) 13T 8/16 DP	V30E-095 ..SF.. /V30E-160 ..SF.. /V80M-200 ..UW..
C 321	SAE-E 4-hole J 744 165-4 DIN ISO 3019-1	15T 8/16 DP	V80M-200 ..SF..
C 322	Prepared for thru-shaft (cover)		

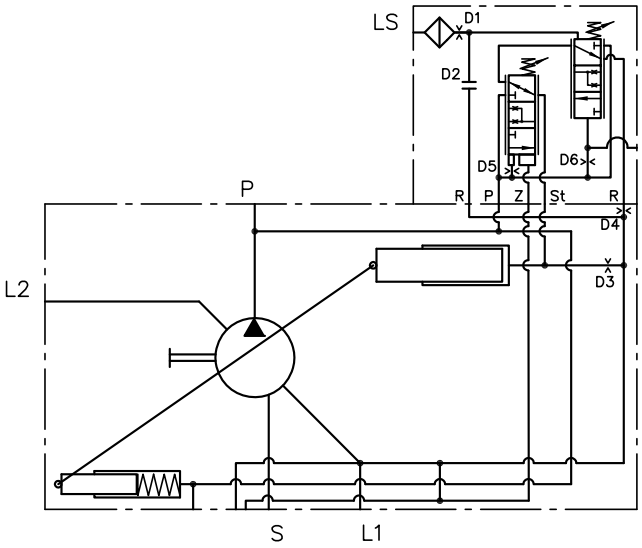
Note
Pay attention to the maximum permissible drive torque, as the flange or shaft may be damaged otherwise.

Note
- An additional support is to be provided for pump combinations.
- Additional versions on request.

[1)] ANSI B 92.1, FLAT ROOT SIDE FIT, spline width deviating from the standard, s = 2.357-0.03

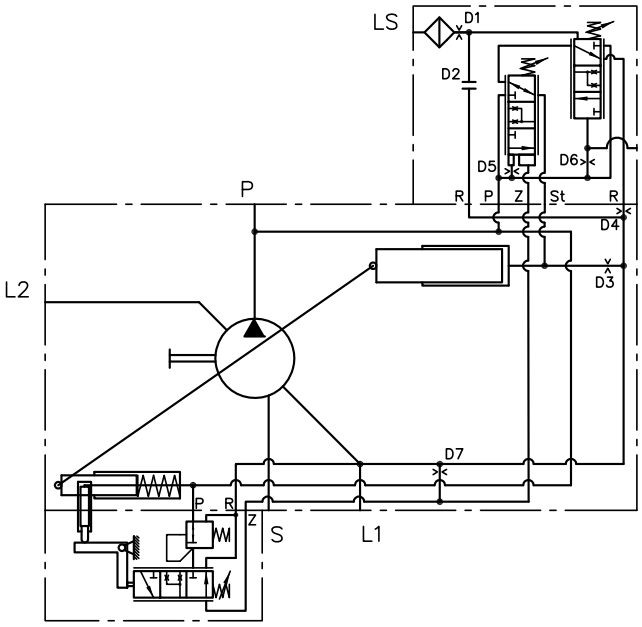
2.2 Controller switching symbols

Coding **LSN**



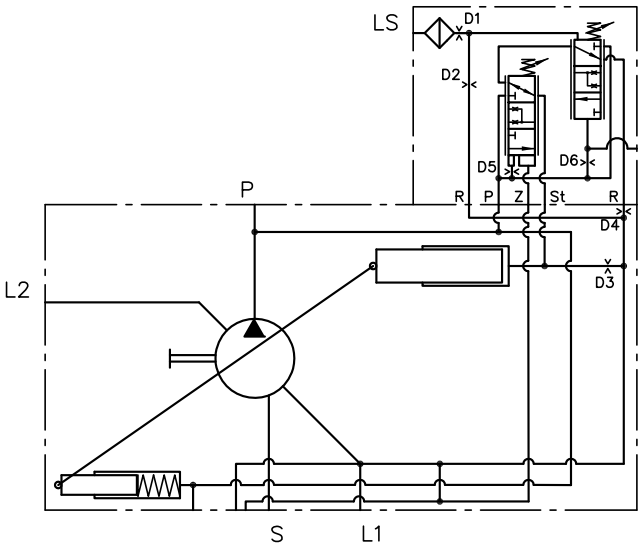
Position	Description
D1	LS orifice
D2	Closed
D3	bypass
D4	Open, for on-stroke velocity
D5	∅0.7
D6	2x ∅0.7 in series

Coding **LSNL**



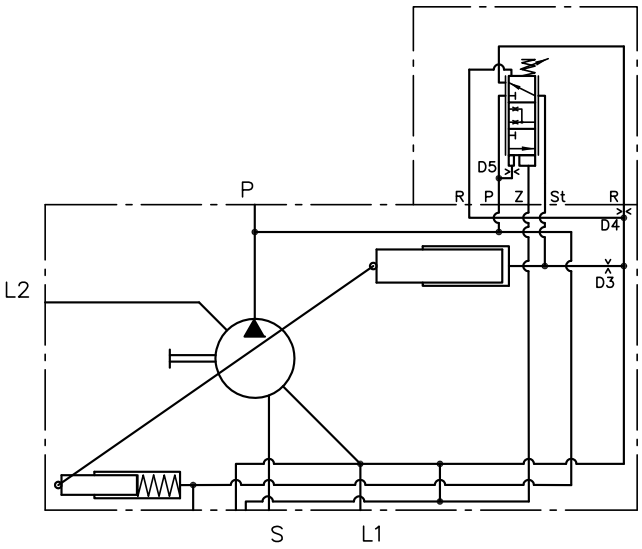
Position	Description
D1	LS orifice
D2	Closed
D3	bypass
D4	Open, for on-stroke velocity
D5	∅0.7
D6	2x ∅0.7 in series
D7	∅0.8

Coding **LSNT**



Position	Description
D1	LS orifice
D2	Open, for oscillation damping
D3	bypass
D4	Open, for on-stroke velocity
D5	∅0.7
D6	2x ∅0.7 in series

Coding **N**



Position	Description
D3	bypass
D4	Open, for on-stroke velocity
D5	∅0.7

3 Parameters

3.1 General

Description	Variable displacement axial piston pump
Design	Axial piston pump according to the swash plate principle
Mounting	Flange mounting or foot bracket
Surface	Temporarily protected
Drive/output torque	See Chapter 3, "Parameters", under "Additional parameters"
Installation position	Any (for installation information see Chapter 5, "Assembly, operation and maintenance recommendations")
Rotating direction	Clockwise or anti-clockwise
Ports	▪ Suction port ▪ Pressure port ▪ Drain port ▪ Ventilation connection
Hydraulic fluid	▪ Hydraulic oil according to Part 1 to 3; ISO VG 10 to 68 according to DIN 51519 ▪ Viscosity range: min 10; max 1000 mm^2/s ▪ Optimal operating range between 16 and 35 mm^2/s ▪ Also suitable for biologically degradable hydraulic fluids type HEPG (polyalkylene glycol) and HEES (synthetic ester) at operating temperatures up to approx. +70°C. ▪ HFC pressure fluids (water glycol); note installation information in Chapter 5, "Assembly, operation and maintenance recommendations".
Purity class	**ISO 4406** 19/17/14
Temperatures	▪ Surrounding area: -40°C to +60°C (observe viscosity range) ▪ Oil: - 25°C to +80°C (observe viscosity range) ▪ Start temperature: To -40°C is permissible (observe start viscosity), as long as the steady-state temperature is at least 20K higher during operation ▪ Biologically degradable hydraulic fluids: Not above +70°C

Pressure and delivery flow

Operating pressure	See Chapter 2, "Available versions, main data"
Geometric displacement	See Chapter 2, "Available versions, main data"

Weight

Type V80M	Without controller (kg)	With controller (kg)
		LSN, LSNb, N, Nb
200	93	+2.5

Additional parameters

Description	Nominal size
	200
Max. swash plate angle	16°
Absolute inlet pressure required in open circuit	0.85 bar
Minimum operating pressure	15 bar
Max. permissible housing pressure (static/dynamic)	2 bar / 3 bar
Max. permissible inlet pressure (static/dynamic)	20 bar / 30 bar
Max. rotation speed during suction operation and max. swash plate angle at 1 bar abs. Inlet pressure	2,150 rpm
Max. rotation speed in supply mode	2500 rpm
Min. rotation speed in continuous operation	500 rpm
Required drive torque at 100 bar	350 Nm
Drive power at 250 bar and 1450 rpm	133 kW
Inertia torque	0.057 kg m^2
Lifetime L_h of the shaft bearing at 250 bar, 1450 rpm and max. swash plate angle	20,000 h
Noise level at 250 bar, 1450 rpm and max. swash plate angle (measured in acoustic measurement chamber according to DIN ISO 4412-1with measuring distance 1 m)	75 dB(A)

Note
The minimum operating pressure in the pump line depends on the rotation speed and the pivoting angle; the pressure must not fall below 15 bar under any circumstances.

Note
The housing pressure is only allowed to be 1 bar higher than the suction pressure.

Max. permissible drive/output torque

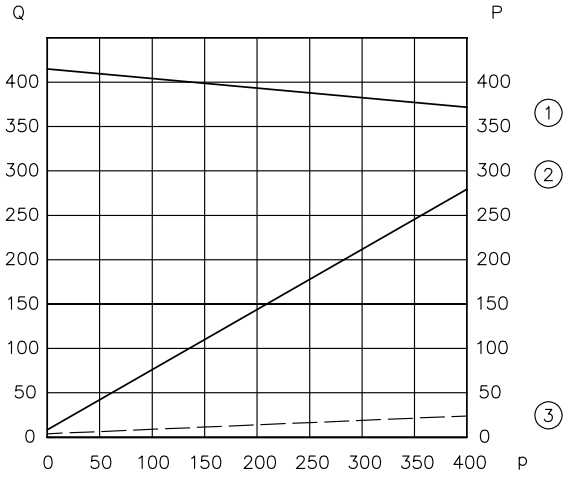
Description		Nominal size
		200
Spline shaft D	Drive/output	2550 Nm/1800 Nm
Spline shaft S	Drive/output	2350 Nm/1800 Nm
Spline shaft U	Drive/output	1200 Nm/1200 Nm

3.2 Characteristic curves

Delivery flow and power (basic pump)

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

V80M-200

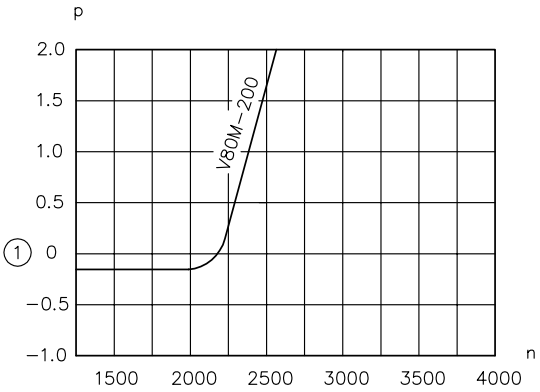


p pressure (bar); Q delivery flow (lpm); P power (kW)

1 Delivery flow/pressure
2 Drive power/pressure
3 Drive power/pressure (zero stroke)

Inlet pressure and self-suction speed

The diagrams show the inlet pressure/rotation speed at the max. swash plate angle and an oil viscosity of 75 mm2/s.

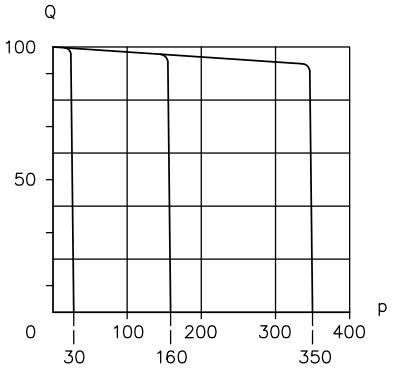


n rotation speed (rpm); p inlet pressure (bar)

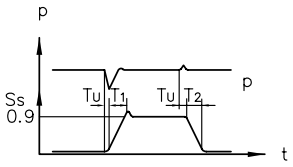
1 0 bar relative = 1 bar absolute

3.3 Controller - characteristic curves

Coding **N, LSN, LSNT**



p pressure (bar); Q delivery flow (%)



t in ms; p pressure (bar)

S_S = positioning travel of actuator

T_u = delay < 3 ms

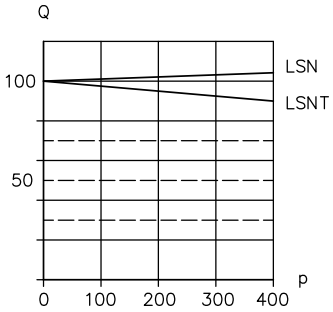
T_1 = on-stroke time

T_2 = destroke time

p = pressure

Coding **LSN, LSNT**

Drive speed constant



p pressure (bar); Q delivery flow (%)

LS line approx. 10% of the volume of the P line

Parameters

Control accuracy in relation to max. delivery flow

a) Rotation speed n constant,
Pressure variable between 30 and 350 bar (< 3%)

b) Pressure p constant,
Rotation speed variable (< 1%)

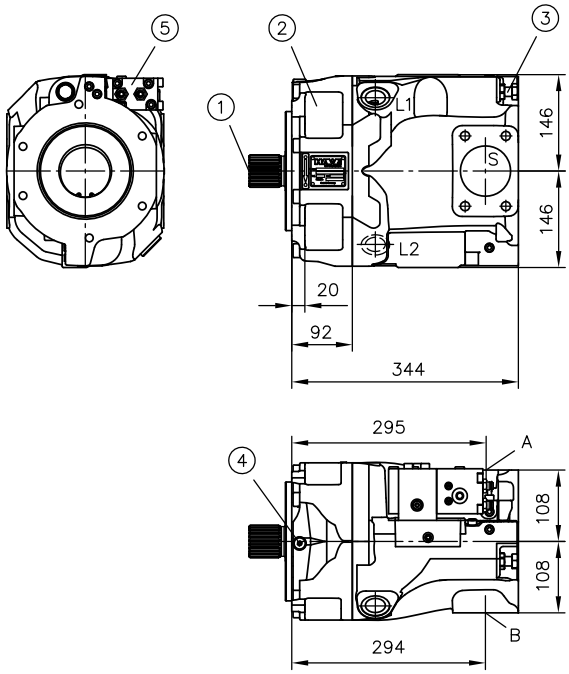
4 Dimensions

All dimensions in mm, subject to change.

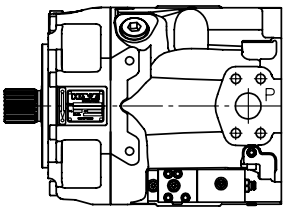
4.1 Basic pump

4.1.1 Type V80M-200

Rotation direction **clockwise** (viewed from shaft journal)



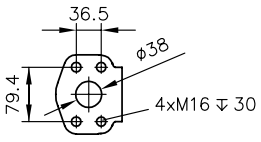
Rotation direction **anti-clockwise** (viewed from shaft journal)



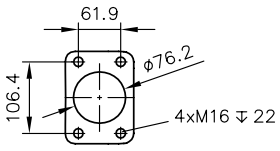
1 Shaft version
2 Flange version
3 Stroke limitation (V_g approx. 10 cm³/rev.)
4 Bleeding port
5 Controller

Rotation direction clockwise	Rotation direction anti-clockwise
A = pressure connection	A = suction port
B = suction port	B = pressure connection

Pressure connection

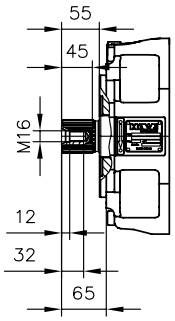


Suction port

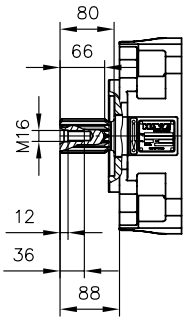


Shaft versions

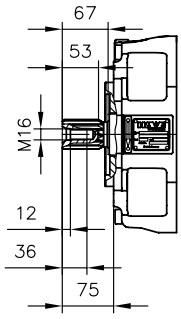
Spline shaft
Coding **D**
(DIN 5480 W50x2x24x9g)



Spline shaft
Coding **S**
(SAE-F J 744 15T 8/16 DP)

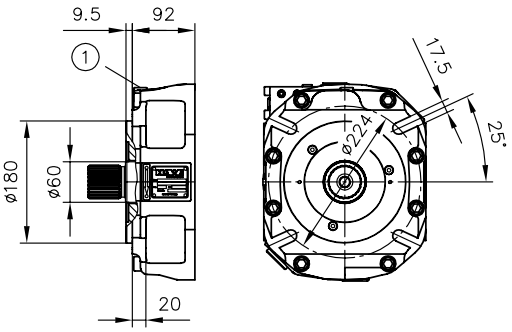


Spline shaft
Coding U
(SAE-D J 744 13T 8/16 DP)



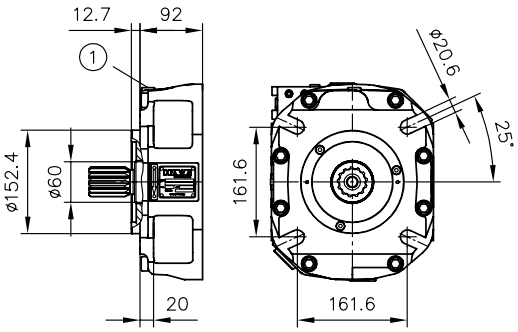
Flange versions

Coding **G**
(180 B4 HW DIN ISO 3019-2)



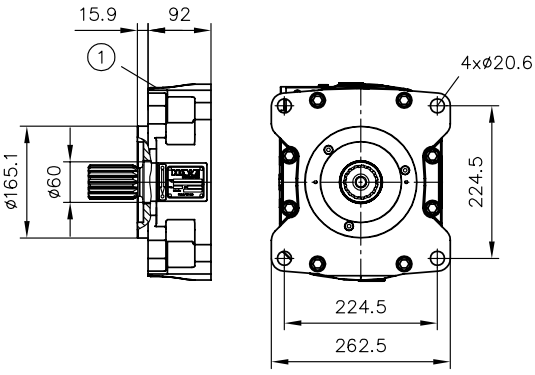
1 Bleeding and flushing port G1/4

Coding **W**
(SAE-D 4-hole J 744)
(152-4 DIN ISO 3019-1)



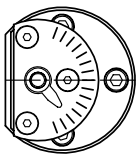
1 Bleeding and flushing port G1/4

Coding **F**
(SAE-E 4-hole J 744)
(165-4 DIN ISO 3019-1)



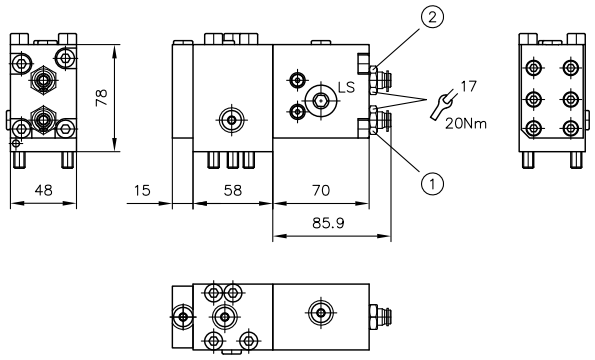
1 Bleeding and flushing port G1/4

Swash plate angle indicator



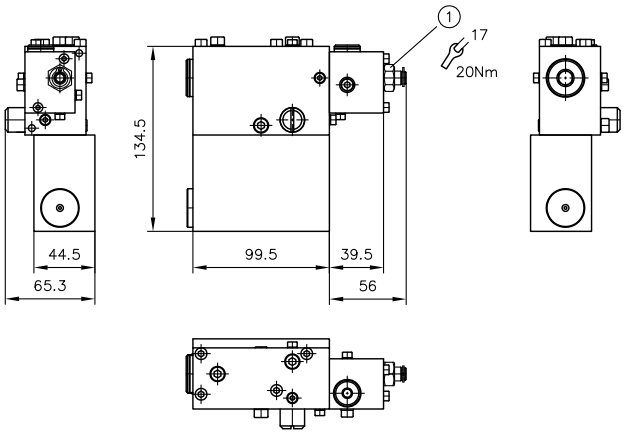
4.2 Controllers

Coding **LSN, LSNT**



1 Pressure limitation
2 Differential pressure p (stand-by pressure)

Coding **L**



1 Torque setting

Connection LS: G 1/4 (BSPP)

order coding for adapter for UNF thread 79 93245 00

Adjustment range for ① and ② restricted by retaining ring

Pressure adjustment

	Pressure range (bar)	Δp (bar) / revolution	Factory-set pressure setting (bar)
Pressure limitation	20 to 400	approx. 150	300
Differential pressure Δp	20 to 55	approx. 15	27

Torque setting

	ΔM (Nm) / revolution
Power controller L	approx. 150

Caution
Risk of injury on overloading components due to incorrect pressure settings!
Risk of minor injury.

- Always monitor the pressure gauge when setting and changing the pressure.

5 Assembly, operation and maintenance recommendations

5.1 Intended use

This productis exclusively intended for hydraulic applications (fluid engineering).

The product demands high technical safety standards and regulations for fluid engineering and electrical engineering.

The user must observe the safety measures and warnings in this documentation.

Essential requirements for the product to function correctly and safely:

- All information in this documentation must be observed. This applies in particular to all safety measures and warnings.
- The product must only be assembled and put into operation by qualified personnel.
- The product must only be operated within the specified technical parameters. The technical parameters are described in detail in this documentation.
- The operating and maintenance manual of the specific complete system must also always be observed.

If the product can no longer be operated safely:

⇨ Remove the product from operation and mark it accordingly. It is then not permitted to continue using or operating the product.

5.2 Assembly information

The must only be installed in the complete system with standard and compliant connection components (screw fittings, hoses, pipes, etc.).

The hydraulic power pack must be shut down correctly prior to dismounting; this applies in particular to power packs with hydraulic accumulators.

Danger
Risk to life caused by sudden movement of the hydraulic drives when dismantled incorrectly!
Risk of serious injury or death.

- Depressurise the hydraulic system.
- Perform safety measures in preparation for maintenance.

5.2.1 General information

The V80M variable displacement axial piston pump is suitable for use in an open circuit.

The pump can be mounted using a flange in accordance with specifications.

The various controllers can be fitted as separate devices as required.

During assembly, note the following principles:

Only trained persons are allowed to mount or remove the pump. Always ensure absolute cleanliness so that no contamination can influence the pump.

- Remove all plastic plugs before operation.
- Avoid installation above the tank (see Chapter 5.2.3, "Installation positions").
- For electric reference values "Suction intakes" must be adhered to.
- Before initial use, fill the pump with hydraulic fluid and bleed. The pump automatically fills via the suction line when the drain ports are opened.
- Never drain the pump.
- Always supply the pump with hydraulic fluid from the start. Even just a short period with insufficient hydraulic fluid can damage the pump. Such damage is not immediately visible once the pump is put into operation.
- Hydraulic fluid which flows back into the tank must not be sucked back in immediately (install baffles!).
- Before first use, run the pump for approx. 10 minutes at max. 50 bar after initial start-up.
- Only use the entire pressure range of the pump once thorough bleeding and flushing have taken place.
- From the start, always keep the temperature in the specified range (see Chapter 3, "Parameters"). Never exceed maximum temperatures.
- Always comply with the cleanliness level of the hydraulic fluid. In addition, always filter the hydraulic fluid appropriately (see Chapter 3, "Parameters").
- Self-installed filters in the suction line must be approved beforehand by HAWE Hydraulik SE.
- A system pressure-limiting valve must be installed in the pressure line so that the maximum system pressure is not exceeded.

5.2.2 Ports

The nominal diameter of the connecting lines depends on the specified operating conditions, the viscosity of the hydraulic fluid, the start-up and operating temperatures and the rotation speed of the pump. In principle we recommend the use of hose lines due to the superior damping characteristics.

Bleeding and flushing port

The pump type V80M is fitted with a G 1/4" (BSPP) bleeding and flushing port. This is used to bleed and flush the front shaft bearing in the case of vertical installation.

Pressure port

The pressure port connection is established in the case of type V80M via SAE ports, see Chapter 4, "Dimensions". Metric attachment threads are used in deviation from the standard.

Observe the tightening torque specified by the fitting manufacturer.

Suction port

The suction port can be established via SAE ports; see Chapter 4, "Dimensions". Metric attachment threads are used in deviation from the standard.

If possible, route the suction line to the tank in such a way that it is steadily rising. This allows trapped air to escape. Observe the specifications in "Installation positions "Chapter 5.2.3, "Installation positions". The absolute suction pressure must not fall below 0.85 bar. A hose line should generally be used in preference to a rigid pipe.

Drain port

The Pump type V80M has 2 drain ports G 1" (BSPP).

The nominal diameter of the leakage line must not be less than 16 mm. The cross-section is determined by the max. permissible housing pressure.

Integrate the leakage line in the system in such a way as to prevent direct connection with the suction line of the pump.

All drain ports can be used simultaneously.

A separate leakage line from the controller to the tank is not required. Observe the specifications in Chapter 5.2.3, "Installation positions".

The top drain port can be used to fill the housing.

LS port for versions LSN

The LS line is connected to the controller via a G 1/4" (BSPP) threaded connection.

The nominal diameter of the line depends on the installation position of the pump and should be 10% of the pressure line nominal volume. A hose line should generally be used in preference to a rigid pipe.

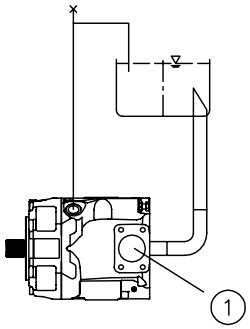
- When the proportional directional spool valve is in a neutral position, the LS line must be fully relieved (only controller type LSNR, LSN). In the case of controller type LSNRT, relief takes place internally in the controller.

5.2.3 Installation positions

The variable displacement axial piston pump V80M can be installed in any installation position.

Horizontal installation: (pump below the min. fill level)

⇨ For horizontal installation, use the uppermost drain port

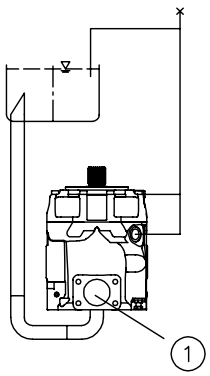


1 suction port open

Vertical installation: (pump below the min. fill level)

⇨ Mount the pump so that the pump mounting flange is facing upwards
⇨ For vertical installation, use the uppermost drain port
⇨ Also connect the G 1/8" bleeding port on the pump flange.
⇨ Take appropriate measures to ensure continuous bleeding of this line (line routing/bleeding)

For installation with the pump flange facing downwards, please contact HAWE Hydraulik.

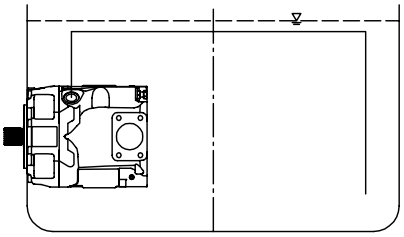


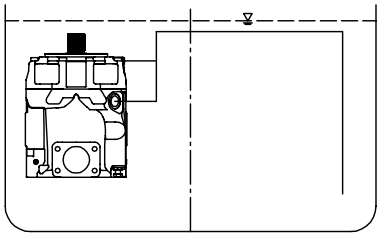
1 suction port open

5.2.4 Tank installation

Tank installation (pump below the min. fill level)

The pump can be operated either with or without a suction tube. Using a short suction intake is recommended.



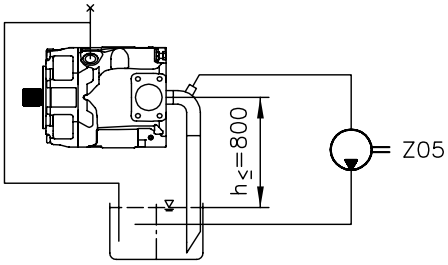


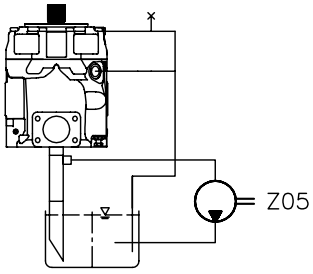
Additional notes regarding installation above the fill level

Special measures are required if the pump is installed above the fill level. The pump must not run dry via the pressure, intake, drain, bleed or control lines. This applies in particular to long periods of downtime.

- The leakage line must be installed in the tank in such a way that it ends below the oil level.
- Facilitate bleeding of connecting lines via separate bleed openings.
- Adjust the bleeding sequence to the specific installation.
- If necessary, a gear pump should be provided in order to draw air from the suction line.

For specialist advice on designing axial piston pumps, the following contact form is available:
Checklist for designing variable displacement axial piston pumps: B 7960 checklist.





For further information on installation, operation and maintenance, see the relevant assembly instructions:
B 7960, B 5488.

5.3 Operating instructions

Product configuration and setting the pressure and flow rate

The statements and technical parameters in this documentation must be strictly observed.
The instructions for the complete technical system must also always be followed.

Note

- Read the documentation carefully before usage.
- The documentation must be accessible to the operating and maintenance staff at all times.
- Keep documentation up to date after every addition or update.

Caution

Risk of injury on overloading components due to incorrect pressure settings!

Risk of minor injury.

- Always monitor the pressure gauge when setting and changing the pressure.

Purity and filtering of the hydraulic fluid

Fine contamination can significantly impair the function of the hydraulic component. Contamination can cause irreparable damage.

Examples of fine contamination include:

- Metal chips
- Rubber particles from hoses and seals
- Dirt due to assembly and maintenance
- Mechanical debris
- Chemical ageing of the hydraulic fluid

Note

Fresh hydraulic fluid from the drum does not always have the highest degree of purity. Under some circumstances the fresh hydraulic fluid must be filtered before use.

Adhere to the cleanliness level of the hydraulic fluid in order to maintain faultless operation.
(Also see cleanliness level in Chapter 3, "Parameters").

5.4 Maintenance information

This product is largely maintenance-free.

Conduct a visual inspection at regular intervals, but at least once per year, to check if the hydraulic connections are damaged. If external leakages are found, shut down and repair the system.

Clean the device surface of dust deposits and dirt at regular intervals, but at least once per year.

6 Other information

6.1 Planning information

Determination of nominal sizes

Delivery flow	$Q = \frac{V_g \cdot n \cdot \eta_V}{1000} (l/\min)$
Drive torque	$M = \frac{V_g \cdot \Delta p}{20 \cdot \pi \cdot \eta_{mh}} (Nm)$
Drive power	$P = \frac{2\pi \cdot M \cdot n}{60000} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t} (kW)$

V_g	= Geom. output volume (cm^3/rev.)
Δp	= Differential pressure
n	= Rotation speed (rpm)
η_V	= Volumetric efficiency
η_{mh}	= Mechanical-hydraulic efficiency
η_t	= Overall efficiency ($\eta_t = \eta v \cdot \eta_{mh}$)

Further information

Additional versions

- General operating manual for the assembly, initial operation and maintenance of hydraulic components and systems: B 5488
- Variable displacement axial piston pump type V60N: D 7960 N
- Variable displacement axial piston pump type V30D: D 7960
- Fixed displacement axial piston pump type K60N: D 7960 K
- Axial piston motors type M60N: D 7960 M
- Variable displacement axial piston pump type V30E: D 7960 E
- Proportional directional spool valve type EDL: D 8086
- Proportional directional spool valve, type PSL and PSV size 2: D 7700-2
- Proportional directional spool valve, type PSL, PSM and PSV size 3: D 7700-3
- Proportional directional spool valve, type PSL, PSM and PSV size 5: D 7700-5
- Proportional directional spool valve type PSLF, PSVF and SLF size 3: D 7700-3F
- Proportional directional spool valve type PSLF, PSVF and SLF size 5: D 7700-5F
- Proportional directional spool valve banks type PSLF and PSVF size 7: D 7700-7F
- Load-holding valve type LHT: D 7918
- Load-holding valve type LHDV: D 7770
- Proportional amplifier type EV1M3: D 7831/2
- Proportional amplifier type EV1D: D 7831 D

D 7962 M - V80M - 03-2015-1.3

HAWE Hydraulik SE
Streitfeldstraße 25 | 81673 München | Postfach 80 08 04 | 81608 München | Germany
Tel +49 89 379100-1000 | Fax +49 89 379100-91000 | info@hawe.de | www.hawe.com