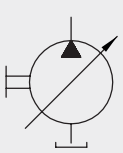
Variable displacement axial piston pump V40M

Applications including commercial vehicles, open circuit

Nominal pressure $p_{nom\ max}$:	380 bar
Peak pressure p_{max}:	400 bar
Geometric displacement V_{max}:	46 cm³/rev

Circuit symbol:



Product documentation
D 7961
10-2014-2.1

SOLUTIONS FOR A WORLD UNDER PRESSURE

HAWE HYDRAULIK

Contents

1 Overview: variable displacement axial piston pump typesV40M,

The axial piston pump type V40M is designed for open circuits in mobile hydraulics and works according to the swash plate principle. It is available with the option of a thru-shaft for operating additional hydraulic pumps in series. The pump is normally attached to the power take-off of diesel engines. The range of pump controllers allows the axial piston pump to be used in a variety of applications.

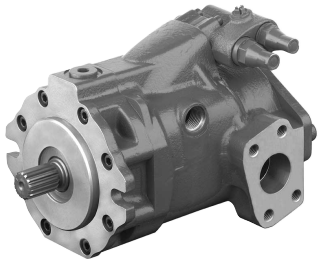


Figure 1: Variable displacement axial piston pump type V40M

Features and benefits:

- Optimized power-to-weight ratio
- High self-suction speed
- Different shaft and flange versions

Intended applications:

- Machines for forestry and agricultural purposes
- Cranes and lifting equipment
- Truck-mounted concrete pumps
- Municipal trucks

2 Available versions, main data

2.1 Basic version

Circuit symbol:

Order coding example:

V40M	-045	L	T	X	V	- 2	- 0	- 00	/LS-DA	C 11

Flange version Table 9 Flange versions (output side)

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Basic type

Table 1 Nominal size

Coding	Geometric displacement (cm^3/rev.)	Nominal pressure p_{nom} (bar)	Peak pressure p_{max} (bar)
028	28	250	320
028 H	28	380	400
045	46.5	250	320
045 H	46.5	380	400

Table 2 Rotation directions

Coding	Description
L	Anti-clockwise
R	Clockwise

When looking at the shaft journal (for information on change of rotation direction, see Chapter 3, "Parameters")

Table 3 Shaft versions

Coding	Description	Designation/Standard	Max. drive torque (Nm)
H	Spline shaft	SAE-B J 744 13T 16/32 DP 22-4 ISO 3019-1	280
T	Spline shaft	SAE-B-B J 744 15T 16/32 DP 25-4 ISO 3019-1	400

Table 4 Flange versions (input side)

Coding	Description	Designation
X	Flange	SAE-B 2-hole J 744 101-2 ISO 3019-1

Table 5 Seals

Coding	Description
V	FKM

Table 6 Housing versions

Coding	Description
1	Suction and pressure port axial
2	Suction and pressure port radial, with thru-shaft
3	Suction and pressure port radial

Table 7 Additional functions

Coding	Description
0	None

Table 8 Controllers

Coding	Description
LS-DA	Load-sensing controller with integrated pressure limitation.
P1R1-AMP 24	Electric proportional controller with pressure decrease as current increases and reliable residual function in the event of a power failure, 24 V DC, AMP Junior Timer 2-pole

Order coding example:

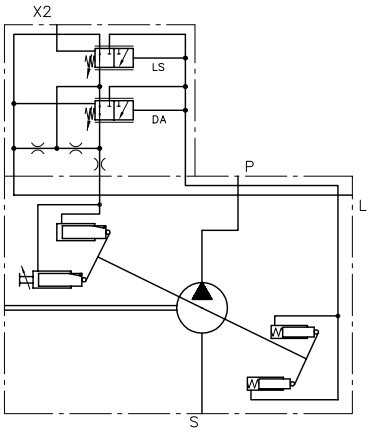
V40M-045 LTXV-2-0-00/LS-DA- **C 11**

Table 9 Flange versions (output side)

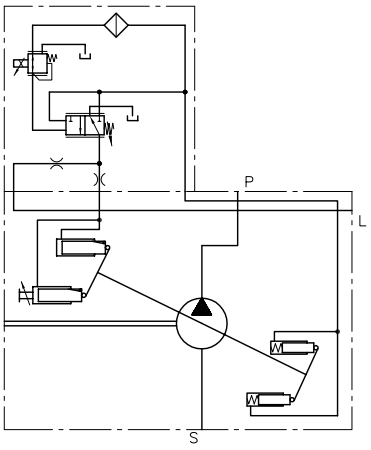
Coding	Flange	Shaft	V40M-028	V40M-045
C 11	SAE-A 2-hole J 744 82-2 ISO 3019-1	SAE-A J 744 (16-4 ISO 3019-1) 9T 16/32 DP	x	x
C 23	SAE-B 2-hole J 744 101-2 ISO 3019-1	SAE-B J 744 (22-4 ISO 3019-1) 13T 16/32 DP	x	x
C 24	SAE-B 2-hole J 744 101-2 ISO 3019-1	SAE-BB J 744 (25-4 ISO 3019-1) 15T 16/32 DP		x

2.2 Controller switching symbols

Coding LS-DA



Coding P1R1



3 Parameters

3.1 General

Description	Variable displacement axial piston pump
Design	Axial piston pump according to the swash plate principle
Mounting	Flange mounting
Surface	Primed
Drive/output torque	See Chapter 3, "Parameters", under "Additional parameters"
Installation position	Any (for installation information see Chapter 5, "Installation information")
Rotation direction	Clockwise or anti-clockwise
Ports	▪ Suction port ▪ Pressure port ▪ Drain port
Hydraulic fluid	Hydraulic oil: according to DIN 51 524 Part 1 to 3; ISO VG 10 to 68 according to DIN 51 519 Viscosity range: min. approx. 10; max. approx. 1000 mm ²/s Optimal operating range: 16 to 35 mm²/s Also suitable for biologically degradable pressure fluids type HEPG (polyalkalene glycol) and HEES (synthetic ester) at operating temperatures up to approx. +70°C.
Purity class	**ISO 4406** 19/17/14
Temperatures	Ambient: approx. -40 to +60°C, oil: -25 to +80°C, pay attention to the viscosity range! Start temperature: down to -40°C is permissible (observe start-viscosity!), as long as the steady-state temperature is at least 20K higher for subsequent operation. Biologically degradable pressure fluids: note manufacturer specifications. With consideration for the seal compatibility, 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"

Dimensions

Type V40M	With controller (kg)
028, 028 H	19
045, 045 H	20.9

Additional parameters

Description	Nominal size	
	028	045
Max. swash plate angle	18°	18°
Absolute inlet pressure required in open circuit	0.85 bar	0.85 bar
Max. permissible housing pressure (static/dynamic)	2 bar/3 bar	2 bar/3 bar
Max. permissible inlet pressure (static/dynamic)	20 bar/30 bar	20 bar/30 bar
Max. speed during suction operation and max. swash plate angle at 1 bar abs. Inlet pressure	3200 rpm	2900 rpm
Min. speed in continuous operation	500 rpm	500 rpm
Required drive torque at 100 bar	48 Nm	74 Nm
Drive power at 250 bar and 2000 rpm	25.25 kW	38.75 kW
Weight torque	14.13 Nm	23 Nm
Inertia torque	0.002 kg m²	0.0042 kg m²
Noise level at 250 bar, 1500 rpm and max. swash plate angle (measured in acoustic measurement chamber according to DIN ISO 4412, measurement distance 1 m)	75 dB(A)	75 dB(A)

Max. permissible drive/output torque

Description		Nominal size			
		028	028 H	045	045 H
Spline shaft H	Drive/output	280 Nm/280 Nm	280 Nm/280 Nm	280 Nm/280 Nm	280 Nm/280 Nm
Spline shaft T	Drive/output	--	--	400 Nm/400 Nm	400 Nm/400 Nm

3.2 Planning information for parameters

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. delivery volume (cm³/rev.)
Δp	= Differential pressure
n	= Speed (rpm)
η_v	= Volumetric efficiency
η_{mh}	= Mechanical-hydraulic efficiency
η_t	= Overall efficiency ($\eta_t = \eta v \cdot \eta_{mh}$)

3.3 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

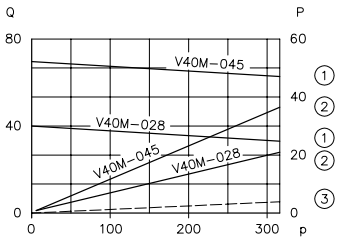


Figure 2: p pressure (bar); Q delivery flow (lpm); P power (kW)

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/speed at the max. swash plate angle and an oil viscosity of 75 mm²/s

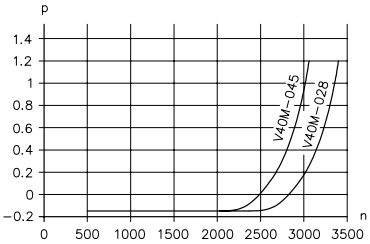


Figure 3: n speed (rpm); p inlet pressure (bar)

1 0 bar relative = 1 bar absolute

3.4 Controller characteristic curves

Controller characteristic curves

Coding LS-DA

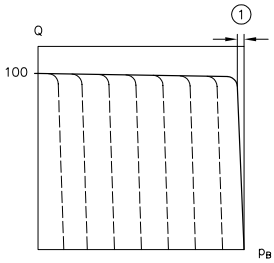


Figure 4: p_B operating pressure (bar); Q geometric displacement (%)

1 Approx. 4 bar

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

Coding P1R1

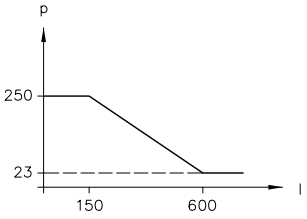


Figure 5: I solenoid current (mA); p pressure (bar)

4 Dimensions

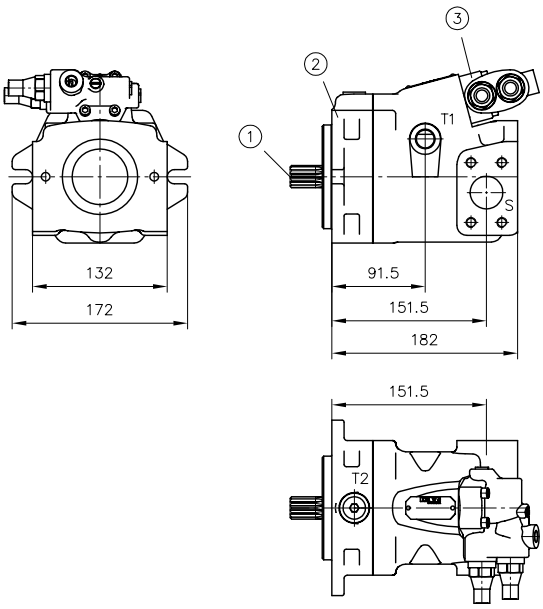
All dimensions in mm, subject to change!

4.1 Basic pump

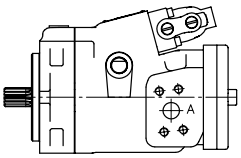
4.1.1 Types V40M-028, V40M-028 H

Housing version -2 (radial ports, with thru-shaft)

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

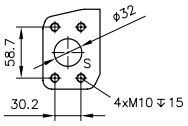


Rotation direction **anti-clockwise** (viewed from shaft journal)

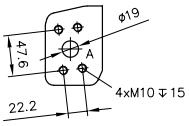


1 Shaft version
2 Flange version
3 Controller

Type V40M-028

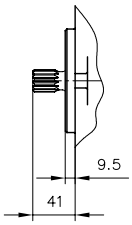


Type V40M-028 H



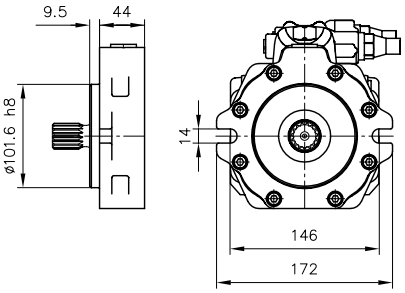
Shaft version

Spline shaft
Coding **H**
(SAE-B 13T 16/32 DP)

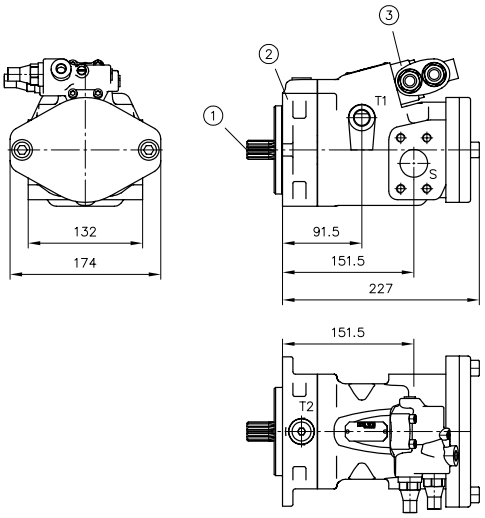


Flange version

Coding **X**
(SAE-B 2-hole)
(101-2 ISO 3019-1)



Housing version -3 (radial ports)

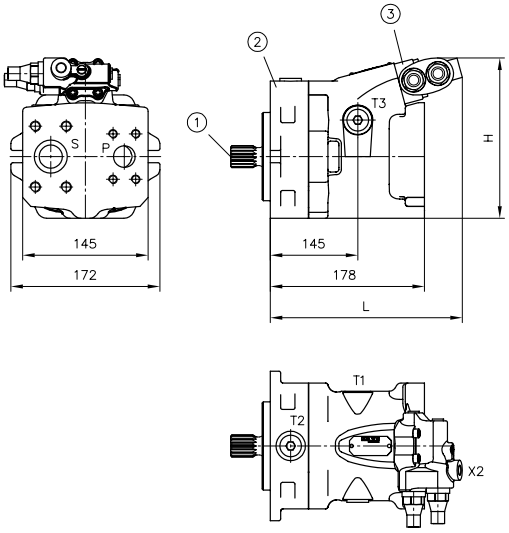


1 Shaft version
2 Flange version
3 Controller

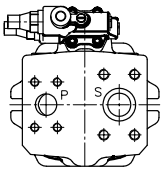
4.1.2 Type V40M-045, V40M-045 H

Housing version -1 (axial ports)

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



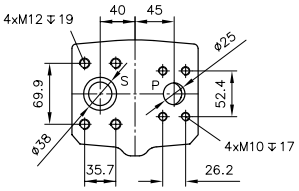
Rotation direction **anti-clockwise** (viewed from shaft journal)



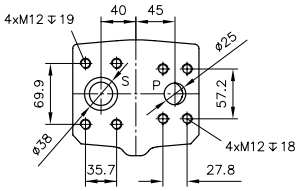
1 Shaft version
2 Flange version
3 Controller

Controller	H	L
LS-DA	186.0	221.7
P1R1	193.2	210.6

Type V40M-045

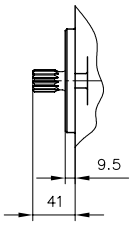


Type V40M-045 H

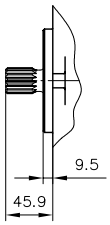


Shaft version

Spline shaft
Coding **H**
(SAE-B 13T 16/32 DP)

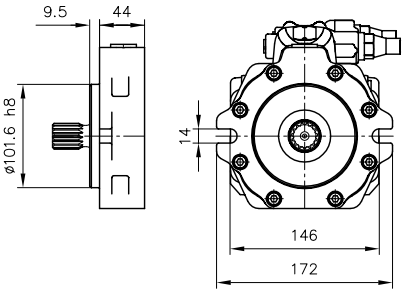


Spline shaft
Coding **T**
(SAE-BB 15T 16/32 DP)

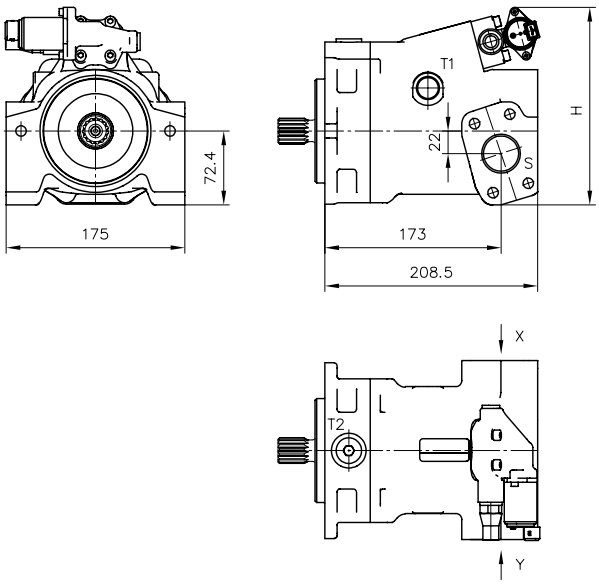


Flange version

Coding **X**
(SAE-B 2-hole)
(101-2 ISO 3019-1)



Housing version -2 (radial ports, with thru-shaft)



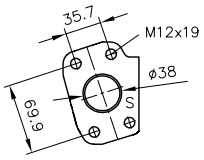
Ports P, S, T1 and T2 (SAE J 518):

P	Pressure port SAE 1"	(5000 psi)
S	Suction port SAE 1 1/2"	(500 psi)
T1, T2	Drain port 7/8-14 UNF-2B	

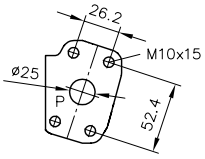
Note
For pressures above 210 bar, use M10 screws with a property class of 10.8.

Type V40M-045

View Y

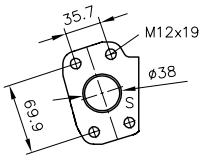


View X

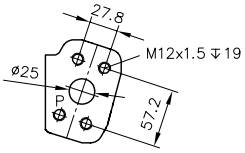


Type V40M-045 H

View Y



View X

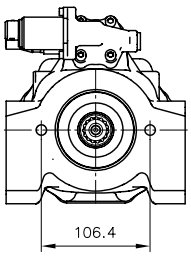


Rotation direction clockwise	Rotation direction anti-clockwise
X = pressure port	X = suction port
Y = suction port	Y = pressure port

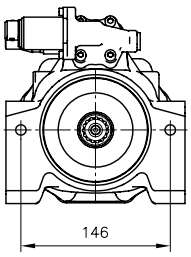
Controller	H
LS-DA	186.0
P1R1	193.2

Flange version (output side)

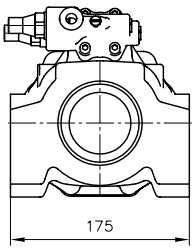
Coding **C 00, C 11, C 12**
(SAE-A 2-hole)

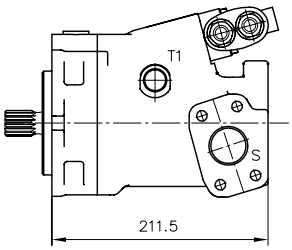


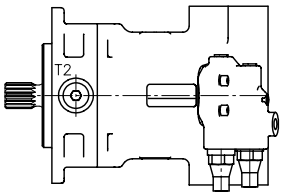
Coding **C 23, C 24**
(SAE-B 2-hole)



Housing version -3 (radial ports)





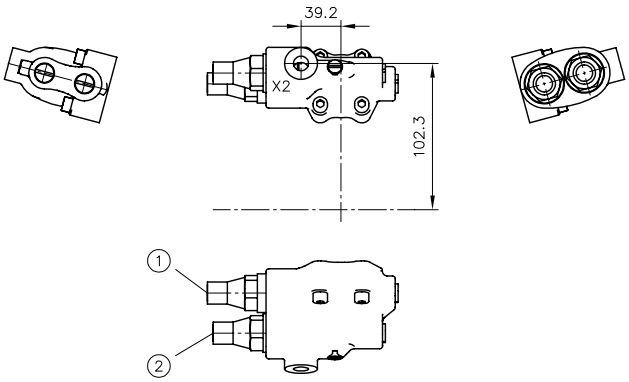


Rotation direction clockwise	Rotation direction anti-clockwise
X = pressure port	X = suction port
Y = suction port	Y = pressure port

4.2 Controller

Controller

Coding LS-DA

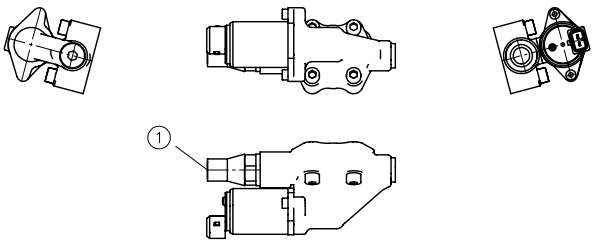


1 Pressure limitation
2 Differential pressure Δp (stand-by pressure)

LS signal port

	Port
X2	M12 x 1.5

Coding P1R1



1 Pressure limitation

Adjustment range for ① restricted by retaining ring

Pressure adjustment

	Pressure range (bar)	Δp (bar) / 1/2 revolution	Default pressure setting (bar)
Pressure limitation (type P1R1)	20 ... 250	100	250
Pressure limitation (type LS-DA)	20 ... 250	approx. 50	250
Differential pressure Δp (type LS-DA)	20 ... 55	approx. 12.5	20

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

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

5 Installation information

5.1 General information

The V40M variable displacement axial piston pump is designed for use in an open circuit. It can be mounted using a flange in accordance with specifications.

Further connection options are available with a propshaft and suitable coupling sleeves.

The following essential points must be noted when installing the pump:

Mounting and removal of the pump and attached components may be performed by trained persons only. Ensure absolute cleanliness during all work. Contamination may have an adverse effect on the function and service life of the pump.

- Remove all plastic plugs prior to initial operation.
- Avoid installing the motor above the tank (see Installation positions" inChapter 5.3, "Installation positions").
- Observe the reference values in Section ; see the information on suction intakes in the section.
- Prior to initial operation, fill the pump with oil and bleed. Automatic pump filling via the suction line by opening the drain ports is not possible.
- Prevent the pump and suction line from running dry.
- Always ensure a constant supply of oil. Even a brief shortage in the supply of hydraulic fluid to the pump may damage internal parts. This may not be immediately evident after initial operation.
- The hydraulic oil returning to the tank from the system must not be sucked back in immediately (baffles).
- Run the pump for approx. 10 minutes at max. 50 bar after initial operation.
- Thorough bleeding/flushing of the entire system is recommended before the full pressure range is used.
- Observe the max. permissible operating range temperatures (see Chapter 3, "Parameters") at all times.
- Always comply with the specified oil purity classes (see Chapter 3, "Parameters"); provide appropriate hydraulic fluid filtering.
- Use of a filter in the intake line must be approved by HAWE Hydraulik.
- Include a main pressure-limiting valve in the pressure line to limit the max. system pressure.

5.2 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 speed of the pump. In principle we recommend the use of hose lines due to the superior damping characteristics.

Pressure port

The pressure port connection on type V40M-045 is established via a flange port 1".

Observe the tightening torque specified by the part manufacturer.

Suction port

The suction port connection on type V40M-045 is established via a flange port 1 1/2".

The specifications of the max. delivery flow Q_{max} must be observed. These can be found in the following table.

Nominal width (N)	1 1/2"	2"
Q_{max} (l/min)	75	125

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, "Installation information". The absolute intake pressure must not fall below 0.85 bar. A hose line should generally be used in preference to a rigid pipe.

Drain port

The V40M pumps have 2 drain ports G 3/4" 7/8-14UNF-2B.

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

Integrate the overflow oil line in the system in such a way as to prevent direct connection with the suction line of the pump. Both drain ports can be used simultaneously.

A separate overflow oil line from the controller to the tank is not required. Observe the specifications inChapter 5.3, "Installation positions".

LS port for version LS-DA

The LS line is connected to the controller via an M12x1.5 threaded connection.

The nominal diameter of the line depends on the installation position of the pump and should be 10% of the pressure line capacity. 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.

5.3 Installation positions

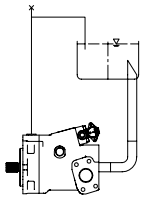
The variable displacement axial piston pump V40M can be installed in any installation position.

Observe the truck manufacturer's specifications if installing the pump directly on a truck power take-off.

A support is required for tandem pumps or two hydraulic pumps mounted in series. The following points must be observed:

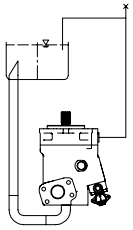
Horizontal installation: (pump below the min. fill level)

For horizontal installation, use the uppermost drain port.



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

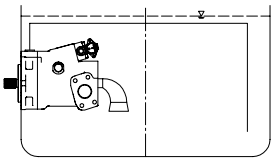
Mount the pump so that the pump mounting flange is facing upwards. For vertical installation, use the uppermost drain port. Take appropriate measures to ensure continuous bleeding of this line (line routing/bleeding).

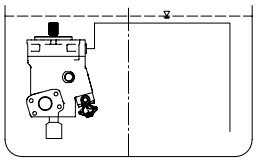


5.4 Tank installation

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.



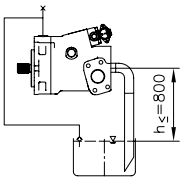


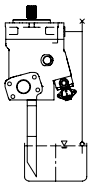
Additional notes regarding installation above the fill level

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.

- A check valve (opening pressure approx. 0.5 to 0.6 bar) in the overflow oil line can prevent the pump housing from being emptied.
- Facilitate bleeding of connecting lines via separate bleed openings.
- Adjust the bleeding sequence to the specific installation.
- A gear pump must be provided in order to fill 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.





6 Installation, operation and maintenance information

6.1 Designated use

This fluid-power product has been designed, manufactured and tested acc. to standards and regulations generally applicable in the European Union and left the plant in a safe and fault-free condition.

To maintain this condition and ensure safe operation, operators must observe the information and warnings in this documentation.

This fluid-power product must be installed and integrated in a hydraulic system by a qualified staff who is familiar with and observes the general engineering principles and relevant applicable regulations and standards.

In addition, application-specific features of the system or installation location must be taken into account if relevant.

This product may only be used as a pump within oil-hydraulic systems.

The product must be operated within the specified data. This documentation contains the technical parameters for various product versions.

Note
Non-compliance will void any warranty claims made against HAWE Hydraulik.

6.2 Assembly information

The hydraulic accumulator must be integrated in the system via state of the art connection components (screw fittings, hoses, pipes, etc.). The hydraulic system must be shut down as a precautionary measure prior to dismounting; this applies in particular to systems with hydraulic accumulators.

6.3 Operating instructions

Product, pressure and/or flow settings

All statements in this documentation must be observed for all product, pressure and/or flow settings on or in the hydraulic system.

Filtering and purity of the hydraulic fluid

Fine contamination (e.g. grit and dust) or contamination in the macro range (e.g. filings, rubber particles from hoses and seals) can significantly impair the function of a hydraulic system. It should also be noted that new hydraulic fluid straight from the container does not necessarily meet the highest purity standards.

Attention must therefore be paid to the purity of the hydraulic fluid to ensure smooth operation (see also “Purity class” in Chapter 3, "Parameters").

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

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 V40M: D 7961
- 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
- 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, PSVF and SLF 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

Headquarter
HAWE Hydraulik SE
Streitfeldstr. 25
D-81673 München
PO Box 800804 D-81608 München
Tel. +49 89 37 91 00 - 1000
Fax: +49 89 37 91 00 - 9 1000
e-mail: info@hawe.de
www.hawe.de