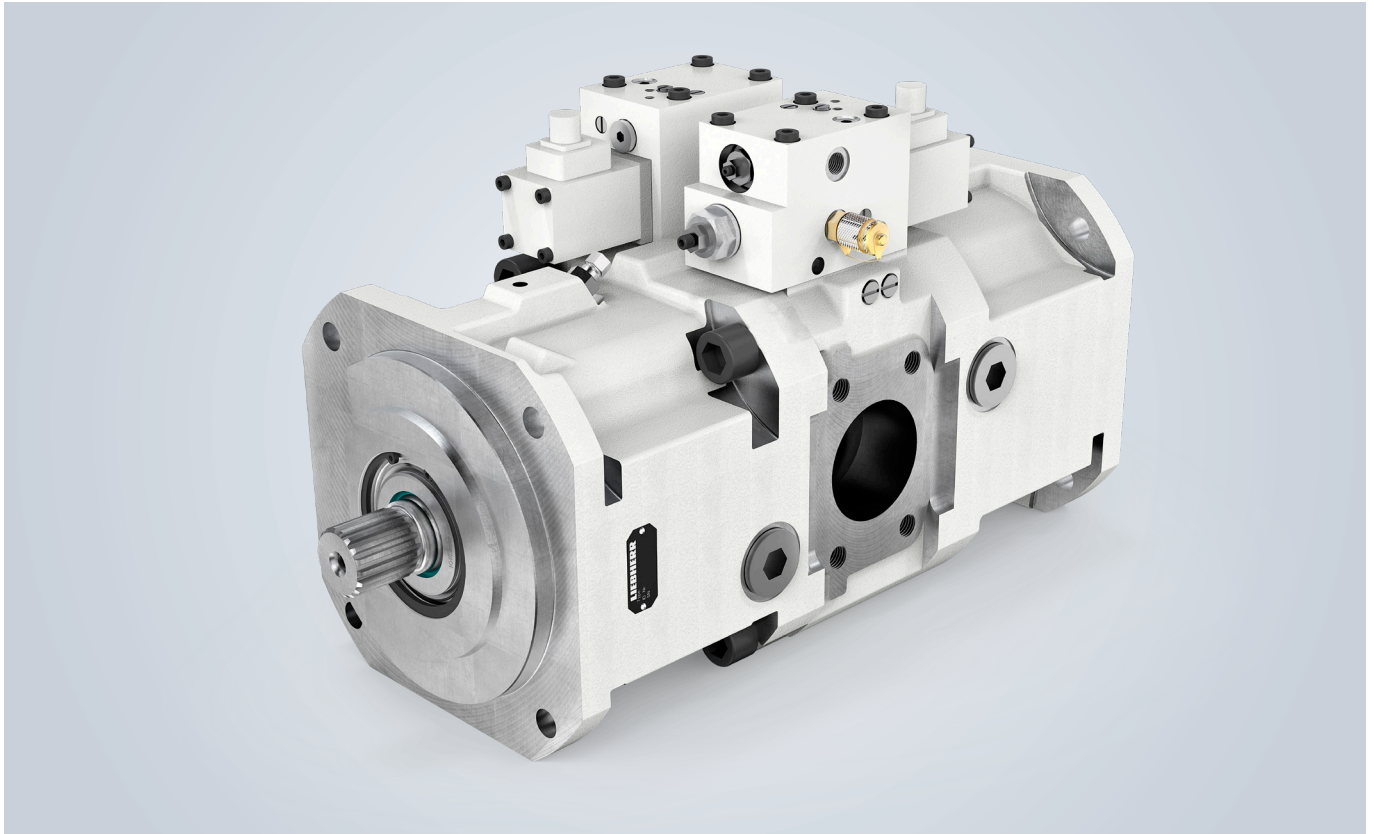


Data sheet

# Axial piston pump DPVD



The Liebherr axial piston double pumps in the DPVD series are designed as swashplates for open circuits.

These variable displacement double pumps are available in nominal sizes from 108-108 to 165-165. The nominal pressure of the units is 5,802 psi (400 bar) and the maximum pressure is 6,527 psi (450 bar) absolute.

The model is available as a double pump with a back to back arrangement. Connecting the hydraulic lines is greatly simplified by a shared suction port.

The inverse drive with a swivel angle of 22° is very efficient and has a very high power density.

**Valid for:**

DPVD 108-108  
DPVD 165-165

**Features:**

D series  
Open circuit

**Control types:**

Load Sensing with pressure cut-off  
Electrical volume control with pressure cut-off

**Pressure range:**

Nominal pressure  $p_N$  = 5,802 psi (400 bar)  
Maximum pressure  $p_{max}$  = 6,527 psi (450 bar)

**Document identification:**

ID number: 12455455  
Date of issue: 03/2023  
Authors: Liebherr - Abteilung VH13  
Version: 1.2

**LIEBHERR**

# Table of contents

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<b>1 Type code</b>	<b>3</b>
<b>2 Technical data</b>	<b>5</b>
2.1 Table of values	5
2.2 Direction of rotation	7
2.3 Permitted pressure range	7
2.4 Hydraulic fluids	9
2.5 Temperature	10
2.6 Shaft lip seal	16
<b>3 Activation and control type</b>	<b>17</b>
3.1 Control types	17
3.2 Standard hydraulic diagrams	18
3.3 Control functions	20
3.4 Electrical components	23
<b>4 Installation conditions</b>	<b>25</b>
4.1 General information about project planning	25
4.2 Installation variants	27
<b>5 Dimensions</b>	<b>31</b>
5.1 Nominal size 108	31
5.2 Nominal size 108, mounting flange	32
5.3 Nominal size 108, shaft end	32
5.4 Nominal size 165	33
5.5 Nominal size 165, mounting flange	34
5.6 Nominal size 165, shaft end	35
5.7 Through-drive	35
5.8 Multi axial piston unit	37

# 1 Type code

DPVD	0		/			1				A				0	
1.	2.	3.		4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.

## 1. Pump type

D series / pump / variable displacement / double	DPVD
--	------

## 2. Type of circuit

Open	0
------	---

## 3. Nominal size (NS)

	108	165	
--	-----	-----	--

## 4. Residual displacement $V_g$ min

0 - 15% of $V_{g\ max}$ / enter value in $cm^3/rev$	■	
---	---	--

## 5. Activation / control type

Electro-proportional regulation (positive characteristic) / pressure cut-off	■	□	EL1 - DA
Pressure cut-off	□	□	DA
Electro-proportional regulation (positive characteristic) / load sensing	□	■	EL1 - LS
Load sensing / pressure cut-off	□	□	LS - DA
Fan drive	□	□	LU
Power control / load sensing	□	□	LR - LS
Power control/steering-pressure proportional/pressure cut-off	□	□	LR - SD - DA
Total power control / steering-pressure proportional regulation	□	□	SL - SD
Steering-pressure proportional / load sensing	□	□	SD - LS

## 6. Design

	1
--	---

## 7. Direction of rotation (viewed towards the drive shaft)

right	■	■	R
left	□	□	L

## 8. Mounting flange

Diesel engine flange SAE J617a	SAE 1	■	■	11
	SAE 2	□	□	12
	SAE 3	□	□	13
	SAE 4	□	□	14
SAE E (SAE J744)	-	■	25	
DIN / ISO 3019-2	□	□	31...	
Special flange	□	□	51...	

# 1 Type code

108	165
-----	-----

## 9. Shaft end

Splined shaft	DIN 5480	■	■	1
	ANSI B92.1a	□	□	2

## 10. Connections

ISO 6162-2 / SAE J518-2, high-pressure connection 6000 psi	■	■	A
ISO 6162-1 / SAE J518-1, high-pressure connection 3000 psi	□	□	B

## 11. Add-on parts

Without add-on parts	■	■	0
Impeller	□	□	I

## 12. Gear pump

Without gear pump	□	□	00
With gear pump $V_g = 24 \text{ cm}^3$ , enter value in $\text{cm}^3/\text{rev}$	□	■	24

## 13. Through-drive

Without through-drive		■	■	0000	
SAE B	2-hole	Open hole	■	□	B11D
		Closed hole	■	□	B11G
SAE B-B		Closed hole	□	■	B21G

## 14. Valve

Without valve	0		
---------------	---	--	--

## 15. Sensors

Without sensor	■	■	0
With angle sensor	□	□	W
With pressure sensor	□	□	P
With speed sensor	□	□	D

■ = Available

□ = On request

- = Not available



### Note

Contact addresses for queries are provided on the back of this document.

# 2 Technical data

## 2.1 Table of values

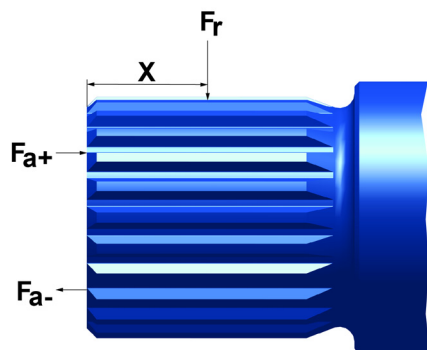
Nominal size			108	165
Displacement volume	$V_{g \max}$	cm <sup>3</sup>	107.7	167.8
	$V_{g \min}$	cm <sup>3</sup>	0 - 15% of $V_{g \max}$ > 15% of $V_{g \max}$ on request	
Volume flow at $V_{g \max}$ and $n_{\max}$	$qV_{\max}$	l/min	237	352
Min. speed at $V_{g \max}$ and 1 bar at the suction port	$n_{\max}$	rpm	50	
Max. speed at $V_{g \max}$ and 1 bar at the suction port	$n_{\max}$	rpm	2200	2100
Drive torque at $V_{g \max}$ and $\Delta p = 400$ bar	$M_{\max}$	Nm	686	1068
Drive power at $qV_{\max}$ and $\Delta p = 400$ bar	$P_{\max}$	kW	158	235
Driving gear moment of inertia	$J_{TW}$	kgm <sup>2</sup>	0.0313	0062
Weight (approx.)	m	kg	116	190
Torsional rigidity	Driving shaft code "1"	Nm/rad	Values upon request	



### Note

The stated values (maximum values) are theoretical values, rounded, and without efficiencies or tolerances.

### 2.1.1 Maximum radial and axial load of the driving shaft



DB-V-001

Nominal size			108	165
Max. radial force	$F_{r \max}$	N	Values upon request	
Max. axial force	$F_{a\pm \max}$	N		

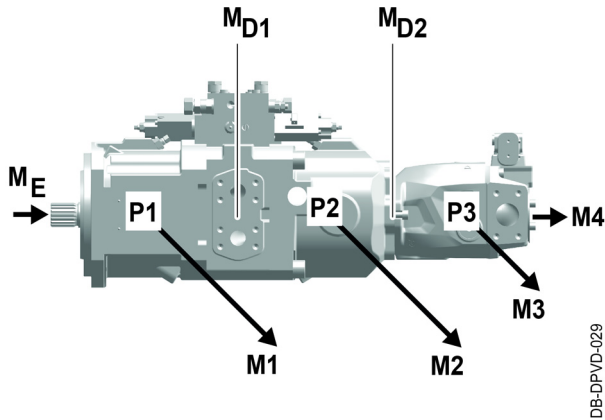
# 2 Technical data



**Note**

The radial and axial loads depend on the load cycle, e.g. pressure, rpm and direction of force. If planning a belt drive or continuous axial and/or radial forces are expected, please contact Liebherr.

## 2.1.2 Maximum input and through drive torques



**Note**

Theoretical rounded values, not taking into account efficiency, tolerances, contamination of the hydraulic fluid or deflection of the driving shaft.

Nominal size			108	165
Torque at $V_{g \max}$ and $\Delta p = 400$ bar	$M_{\max}$	Nm	686	1068
Max. torque of drive shaft input (Installed without lateral force)	$M_{E \max}$	Nm	Values upon request	
	Ø	in	W40	W45
Max. torque of through drive	$M_{D \max}$	Nm	Values upon request	

M1	Torque of axial piston pump 1
M2	Torque of axial piston pump 2
M3	Torque of axial piston pump 3
P1	Axial piston pump 1

P2	Axial piston pump 2
$M_E^1$	Input torque
$M_D^2$	Through drive torque
-	-

1)  $M_E = M1 + M2 + M3 + M4$

$M_E < M_{E \max}$

2)  $M_{D1} = M2 + M3 + M4$

$M_{D1} < M_{D \max}$

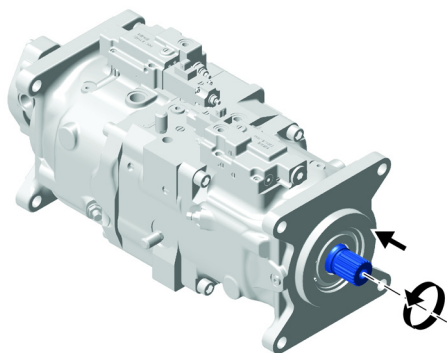
$M_{D2} = M3 + M4$

$M_{D2} < M_{D \max}$

# 2 Technical data

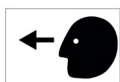
## 2.2 Direction of rotation

DPVD	0		/			1				A				0	
1.	2.	3.		4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.



The direction of rotation is stated with view of the driving shaft, as shown in the figure.

- R** right = clockwise
- L** left = anti-clockwise



DB-DPVD-030

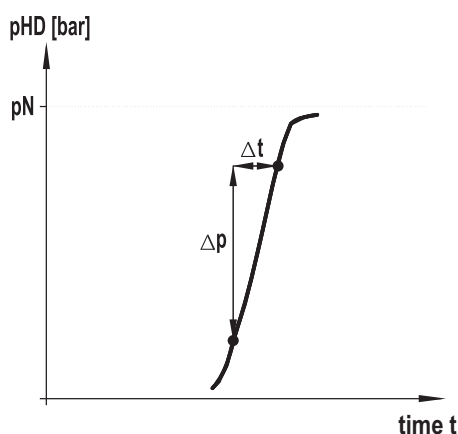
## 2.3 Permitted pressure range

### 2.3.1 Operating pressure

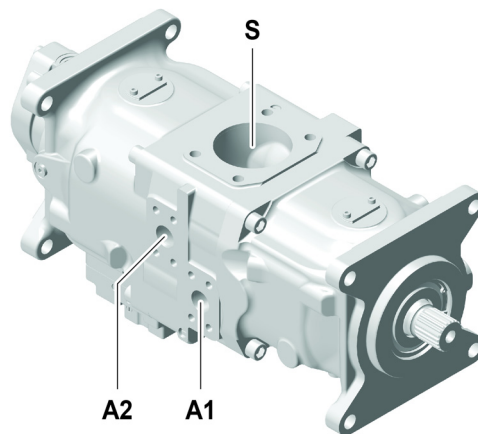


#### Note

Standard with one high-pressure connection per axial piston unit A1 / A2.



DE-LH30/VO-024



DB-DPVD-031

Operating pressure at connection A				108	165
Nominal size				108	165
Minimum pressure**	$V_g \text{ min}$	pHD <sub>min</sub>	bar	6	
	$V_g \text{ max}$			18	
Nominal pressure (fatigue resistant)		pHD <sub>N</sub>	bar	400	
Maximum pressure (single operating period)		pHD <sub>max</sub>	bar	450	
Single operating period at maximum pressure pHD <sub>max</sub>		t	s	< 1	





# 2 Technical data

---



## Note

The pressure in the axial piston unit must always be higher than the external pressure on the shaft lip seal.

---

## 2.4 Hydraulic fluids

### 2.4.1 General information

Selection of the appropriate hydraulic fluid is significantly influenced by the anticipated operating temperature relative to the ambient temperature, which is equivalent to the tank temperature.

---

### ATTENTION

You must not mix different mineral oil hydraulic fluids!

---

### Minimum required quality

Specification
LH-00-HYC3A
LH-00-HYE3A

---



## Note

For additional information, see: [www.liebherr.com](http://www.liebherr.com) (brochure: Lubricants and operating fluids) Alternatively: contact [lubricants@liebherr.com](mailto:lubricants@liebherr.com).

---

### 2.4.2 Fill quantity

Nominal size		108	165
Fill quantity	Litres	5.45	8.70

---



## Note

Before commissioning, the axial piston unit must be filled with oil and vented. This process must be checked and repeated if necessary during operation and after long downtimes!

---

### 2.4.3 Filtering

- Filtering of the hydraulic fluid is necessary to maintain the specified purity class "21/17/14 according to ISO 4406" under all circumstances.
- The hydraulic fluid is filtered by the device-specific use of oil filters in the hydraulic system.
- Cleaning and maintenance intervals for the oil filters and the entire oil circuit depend on use of the unit: see the device-specific operating instructions.

# 2 Technical data

---

## 2.5 Temperature

---



### Note

The optimum operating range of the hydraulic fluid of 16-36 mm<sup>2</sup>/s for Liebherr Hydraulic HVI (ISO VG 46) is from 32° to 62 °C.

---

If the axial piston unit is operated in the optimum operating range of the hydraulic fluid within the permitted operating conditions and operating limits, it is low-wear and is protected against temperature-dependent ageing. From a viscosity < 11 mm<sup>2</sup>/s (for Liebherr Hydraulic HVI (ISO VG 46) = 80 °C), a halving of the service life of the hydraulic fluid must be assumed for every 10 °K increase in temperature.

If the optimum range cannot be met, a hydraulic fluid with a more suitable viscosity range must be selected or the hydraulic system must be preheated or cooled.

To prevent temperature shocks, the temperature difference between the hydraulic fluid and the axial piston unit must be kept to less than 25 °C. This can be achieved by, among other things, a continuous flow through all axial piston units in the hydraulic system.

### 2.5.1 Operating limits

#### Maximum values:

Maximum leakage oil temperature: 115 °C.

---

#### ATTENTION

The temperature should be assumed to be highest in the drive shaft bearing area (rotary shaft lip seal and bearing). Experience has shown this temperature to be 10-15 °K higher than the leakage oil temperature.

---

Low temperatures: [\(for additional information see: 2.5.2 Low temperatures, Page 10\)](#)

---



### Note

The operating limits of Liebherr hydraulic fluids are provided in the viscosity chart included below to allow users to make an informed choice.

[\(for additional information see: 2.5.6 Viscosity chart, Page 15\)](#)

---

### 2.5.2 Low temperatures

#### ATTENTION

When temperatures drop below freezing point, the sealing lip of the rotary shaft lip seal may freeze if it becomes wet or frosted. This can cause the sealing lip to tear off when the axial piston unit is started. The risk must be prevented by preheating/thawing the rotary shaft lip seal/the shaft.

---



### Note

At temperatures at which there is already a risk of hardening from freezing, the frictional heat may be sufficient to keep the seal elastic or to bring it to a functional state quickly enough after the start of movement.

---

# 2 Technical data

## Overview

Temperature [°C]	Phase	Viscosity [mm <sup>2</sup> /s]	Note
< -50 °C	Idle state	-*	No storage or operation permitted
< -40 °C	Idle state	-**	No operation permitted, preheat to at least -40 °C, select appropriate hydraulic fluid

### \*) Idle state < -50 °C

#### ATTENTION

Temperatures < -50 °C on the system = no operation of the axial piston unit permitted.  
Risk of damaging the sealing elements of the axial piston unit.  
Avoid temperatures < -50 °C.

### \*\*\*) Idle state < -40 °C

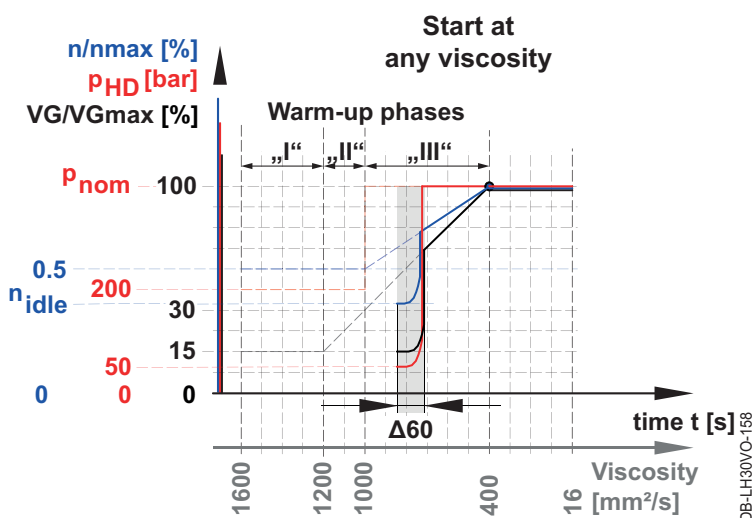
#### ATTENTION

Temperatures < -40 °C on the system = no operation of the axial piston unit permitted.  
Functioning of the sealing elements in the axial piston unit is not guaranteed at temperatures < -40 °C.  
Preheat the axial piston unit and tank to at least -40 °C and use Liebherr Hydraulic Plus Arctic/  
Liebherr Hydraulic FFE 30 hydraulic fluid with a viscosity < 1600 mm<sup>2</sup>/s.  
(for additional information see: 2.5.6 Viscosity chart, Page 15)

Regardless of the viscosity < 1600 mm<sup>2</sup>/s, the axial piston unit must be operated for at least 60 s under the following conditions before entering the cold start including the warm-up phases or on warm start:

- Operating pressure range:  $p_{HD\ min} \leq p_{HD} \leq 50\ bar$
- Speed:  $n_{min} \leq n \leq 1000\ rpm$ , or idle speed of the drive motor\*
- Displacement volume:  $V_{g\ min} \leq V_g \leq 15\% \text{ of } V_{g\ max}$
- Do not move any of the equipment.

\*) When using a drive with higher speeds than required in the conditions (e.g. an electric motor), please consult Liebherr, stating the potential speed(s).



After the 60 s have elapsed, determine the viscosity using the available temperature values and the viscosity chart, select the appropriate warm-up phase and operate the axial piston unit in the defined period and appropriate conditions (see Warm-up phases).

# 2 Technical data

## Overview

Temperature [°C]	Phase	Viscosity [mm <sup>2</sup> /s]	Note
> -40 °C	Cold start	1600-400	The current viscosity of the hydraulic fluid before start-up determines the type of start. In the range of 1600-400 [mm <sup>2</sup> /s], it is a cold start. Entry into the warm-up phase must be selected according to the viscosity and the further warm-up phases must be run through according to the time specifications and operating conditions.
for additional information see: 2.5.6 Viscosity chart, Page 15	Warm-up phase "I"	1600-1200	Observe conditions and measures (see Warm-up phase "I")
	Warm-up phase "II"	1200-1000	Observe conditions and measures (see Warm-up phase "II")
	Warm-up phase "III"	1000-400	Observe conditions and measures (see Warm-up phase "III")
	Normal operation	400-16*	Axial piston unit, fully loadable (see Normal operation)
	Optimum operating range	36-16	Axial piston unit, fully loadable (see Normal operation)

\*] At maximum leakage oil temperature, the viscosity must not fall below 8 mm<sup>2</sup>/s (for a short period, i.e. < 3 minutes, it can be 7 mm<sup>2</sup>/s).

### 2.5.3 Cold start with subsequent warm-up phases

#### ATTENTION

Before cold start, the viscosity\* must be determined on the basis of the oil temperature (e.g. tank temperature) in order to avoid damage to the axial piston units from excessive viscosity\* of the hydraulic fluid. At a viscosity\* > 1600 mm<sup>2</sup>/s, the hydraulic system must be preheated.

Using the determined viscosity\*, the type and duration of the warm-up must be followed, using the cold start chart\*\*.

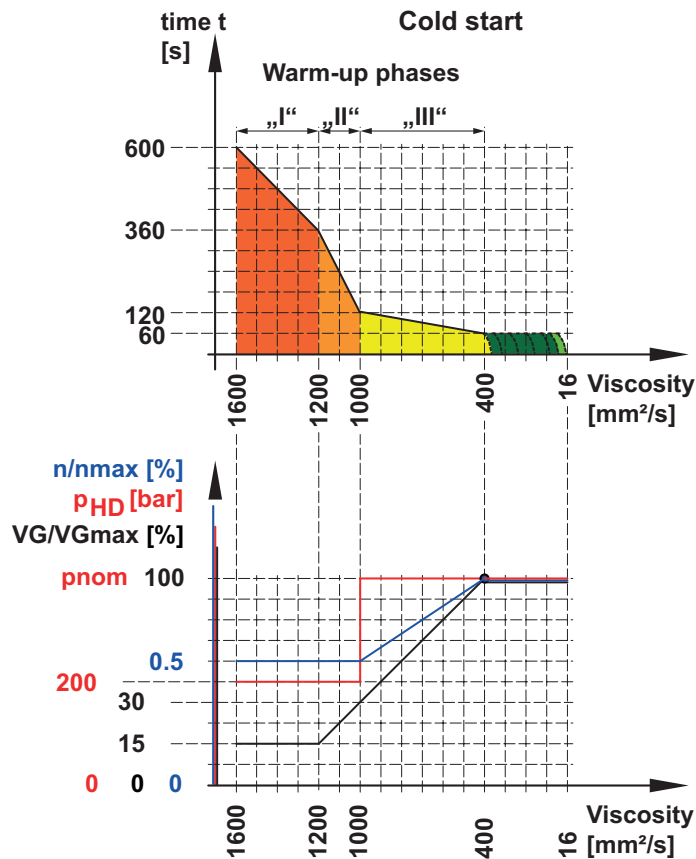
\*] for additional information see: 2.5.6 Viscosity chart, Page 15

#### The following conditions apply:

- Viscosity: 1600-1200 mm<sup>2</sup>/s = operate the axial piston unit for 600-360 s with measures listed for Warm-up phase "I".
- Viscosity: 1200-1000 mm<sup>2</sup>/s = operate the axial piston unit for 360-120 s with measures listed for Warm-up phase "II".
- Viscosity: 1000-400 mm<sup>2</sup>/s = operate the axial piston unit for 120-60 s with measures listed for Warm-up phase "III".
- Viscosity: 400-16 mm<sup>2</sup>/s = operate the axial piston unit for 60 s with measures listed for "Warm start". This means that even at ≤ 400 mm<sup>2</sup>/s, the measures must be applied for at least 60 s.

# 2 Technical data

## \*\*\*) Cold start chart



DB-LH30VO-157

### 2.5.4 Warm-up phases



#### Note

Depending on the current viscosity, continue with the corresponding warm-up phase after the cold start. In the subsequent warm-up phases, the operating parameters may be increased to allow the hydraulic system to warm up rapidly.

#### Warm-up phase " I "

##### Condition:

- Viscosity: 1600-1200 mm<sup>2</sup>/s = operate the axial piston unit with measures listed below until a viscosity of 1200 mm<sup>2</sup>/s is reached.

##### Measures:

- Operating pressure range:  $p_{HD \min} \leq p_{HD \text{ Warm-up "I" }} \leq 200$  bar
- Speed:  $n_{\min} \leq n_{\text{Warm-up "I" }} \leq 50\%$  of  $n_{\max}$
- Displacement volume:  $V_{g \min} \leq V_{g \text{ Warm-up "I" }} \leq 15\%$  of  $V_{g \max}$

# 2 Technical data

---

## Warm-up phase "II"

### Condition:

- Viscosity: 1200-1000 mm<sup>2</sup>/s = operate the axial piston unit with measures listed below until a viscosity of 1000 mm<sup>2</sup>/s is reached.

### Measures:

- Operating pressure range:  $p_{HD \min} \leq p_{HD \text{ Warm-up "II"}} \leq 200 \text{ bar}$
- Speed:  $n_{\min} \leq n_{\text{Warm-up "II"}} \leq 50\% \text{ of } n_{\max}$
- Displacement volume:  $V_{g \min} \leq V_{g \text{ Warm-up "II"}} \leq 15\text{-}30\% \text{ of } V_{g \max}$

## Warm-up phase "III"

### Condition:

- Viscosity: 1000-400 mm<sup>2</sup>/s = operate the axial piston unit with measures listed below until a viscosity of 400 mm<sup>2</sup>/s is reached.

### Measures:

- Operating pressure range:  $p_{HD \min} \leq p_{HD \text{ Warm-up "III"}} \leq p_{HD \max}$
- Speed:  $n_{\min} \leq n_{\text{Warm-up "III"}} \leq 50\% \text{ of } n_{\max}$
- Displacement volume:  $V_{g \min} \leq V_{g \text{ Warm-up "III"}} \leq 30\text{-}100\% \text{ of } V_{g \max}$

## Warm start

### Condition:

- Viscosity: 400-16 mm<sup>2</sup>/s = operate the axial piston unit for at least 60 s, even at viscosity < 400 mm<sup>2</sup>/s, with measures listed below.

### Measures:

- Operating pressure range:  $p_{HD \min} \leq p_{HD} \leq 50 \text{ bar}$
- Speed:  $n_{\min} \leq n \leq 1000 \text{ rpm}$ , or idle speed of the drive motor
- Displacement volume:  $V_{g \min} \leq V_g \leq 15\% \text{ of } V_{g \max}$

## 2.5.5 Normal operation

---

### Note



Optimum operating range: 16-36 mm<sup>2</sup>/s

The viscosity must not fall below 8 mm<sup>2</sup>/s (for a short period, thud < 3 minutes, 7 mm<sup>2</sup>/s) at maximum leakage oil temperature.

---

### Note

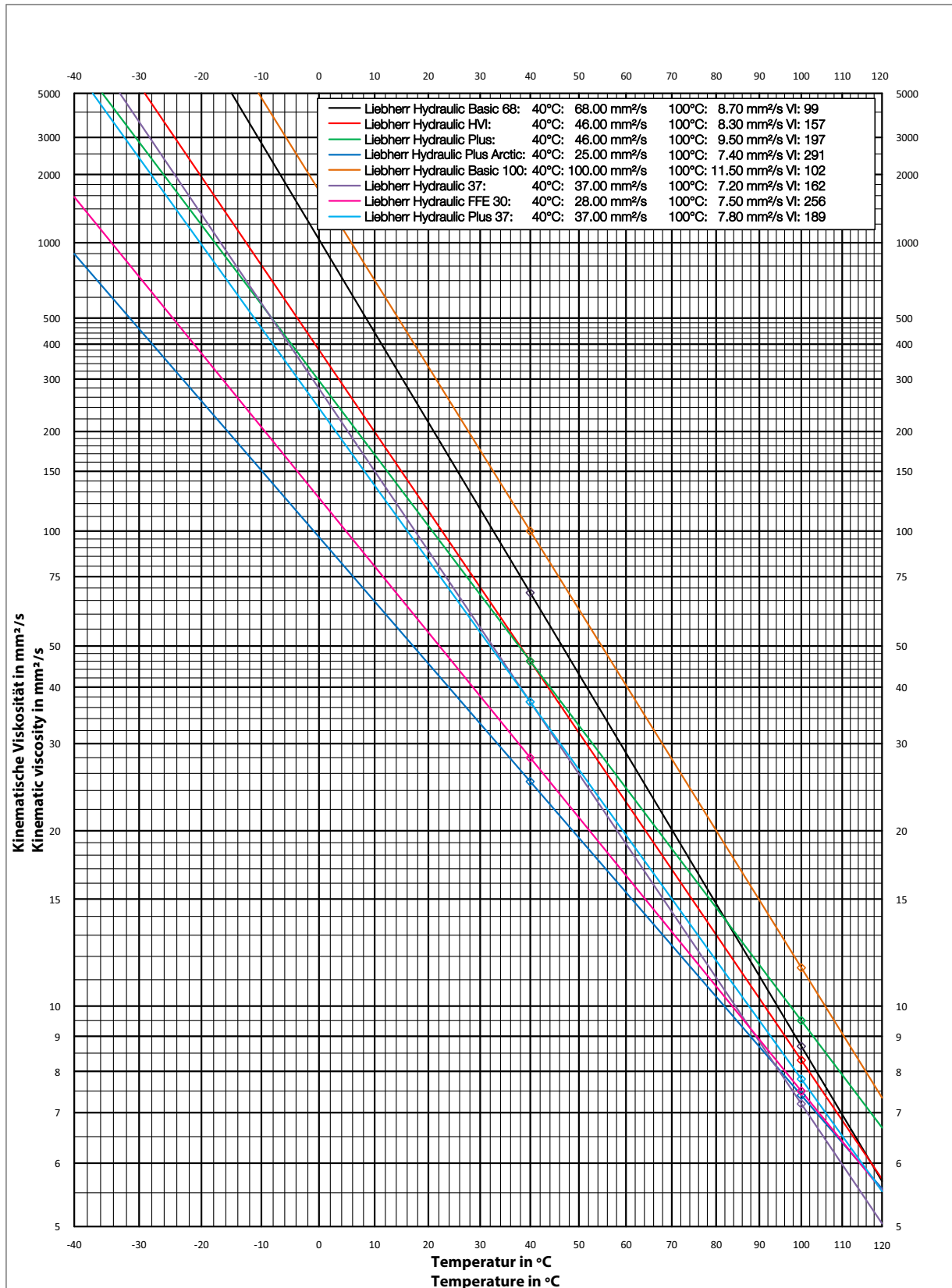


In the viscosity range of 400-8 mm<sup>2</sup>/s, the axial piston unit can be put under full load.

- Operating pressure range:  $p_{HD \min} \leq p_{HD} \leq p_{HD \max}$
  - Speed:  $n_{\min} \leq n \leq n_{\max}$
  - Displacement volume:  $V_G \min \leq V_G \leq V_G \max$
-

# 2 Technical data

## 2.5.6 Viscosity chart



# 2 Technical data

---

## 2.6 Shaft lip seal

### 2.6.1 General information

The rotary shaft lip seals (RWDR) are special sealing elements which permit a specific housing pressure. In order to ensure that the tribological system functions optimally, the operating conditions must be adhered to.

Sealing edge temperature varies due to the following factors in the housing:

- Circumferential speed
- Hydraulic fluid temperature
- Lubricating medium
- Pressure build-up

The sealing edge temperature could be 20 °C to 40 °C above the leakage oil temperature of a hydraulic axial piston unit.



# 3 Activation and control type

## 3.1 Control types

DPVD	0		/			1				A				0	
1.	2.	3.		4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.



### Note

For each control type or function, only one nominal size is illustrated, typically nominal size 108. Special applications and designs are not included in this chapter.  
Always use the information from the installation drawing provided or contact Liebherr.

The following applies to all control types:



### DANGER

#### The spring-guided reset in the regulating valve is not a safety device!

Contaminants in the hydraulic system such as chips or residual dirt from parts of the device or system can cause blockages at undefined points of various control components.

Under some circumstances, the machine operator's specifications can no longer be implemented. It is the device or system manufacturer's responsibility to install a safety device e.g. an emergency stop.

The following modular activation and control types can be ordered for the DPVD series:

### 3.1.1 Electric-hydraulic control

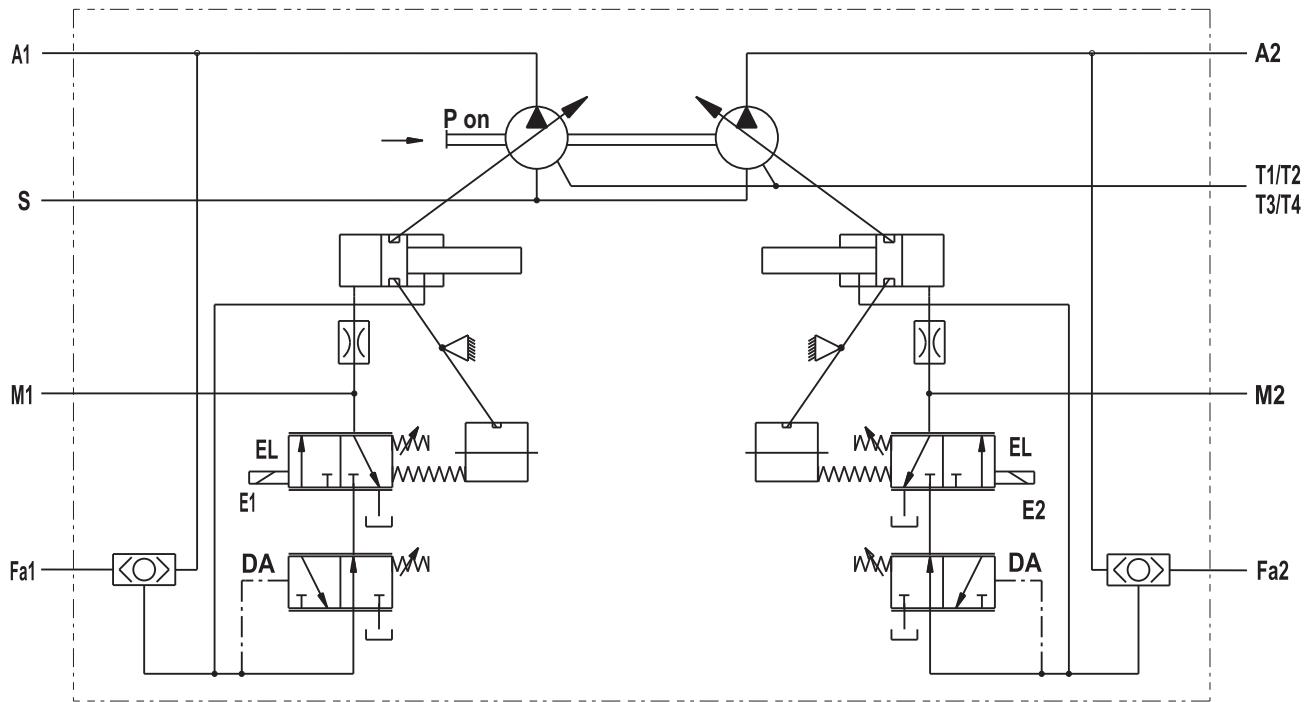
- ELI-DA - control, [see chapter 3.2.1](#)
- ELI-LS - control, [see chapter 3.2.2](#)

Further control types on request.

# 3 Activation and control type

## 3.2 Standard hydraulic diagrams

### 3.2.1 EL1-DA / electro-proportional regulation + pressure cut-off

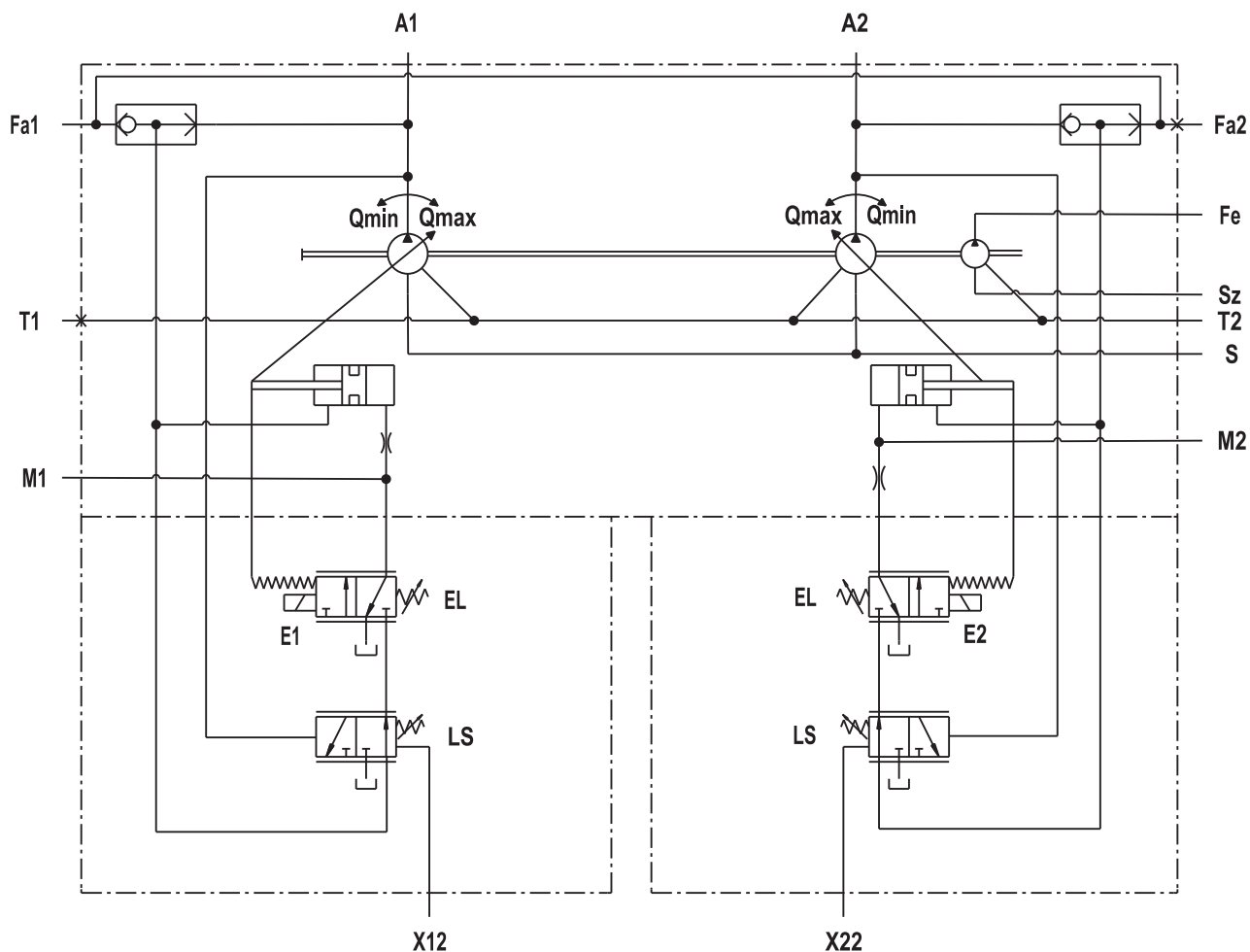


DB-DPVD-002

A1 / A2	Working connection SAE J 518	Fa1, Fa2	Filter outlet ISO 9974-1
S	Suction port SAE J 518	M1, M2	Regulated high pressure measuring connection P1 / P2
T1, T2, T3, T4	Leakage oil connections ISO 9974-1	E1, E2	Plug: CANNON-ITT CA02 COM-E10SL-4P-B01, PWM= 100-160 Hz, U= 24 V, I= 750 mA

# 3 Activation and control type

## 3.2.2 EL1-LS - Electro-proportional regulation + load sensing



A1 / A2	Working connection SAE J 518	E1, E2	Plug: AMP Junior - Timer, 2-pin PWM= 100-160 Hz, U= 24 V, I= 690 mA
S	Suction port SAE J 518	Sz	Auxiliary pump suction port SAE J 518 (option)
T1, T2	Leakage oil connections ISO 9974-1	Fe	Filter inlet ISO 9974-1
Fa1, Fa2	Filter outlet ISO 9974-1	X12, X22	LS pressure ISO 9974-1
M1, M2	Regulated high pressure measuring connection P1 / P2	-	-

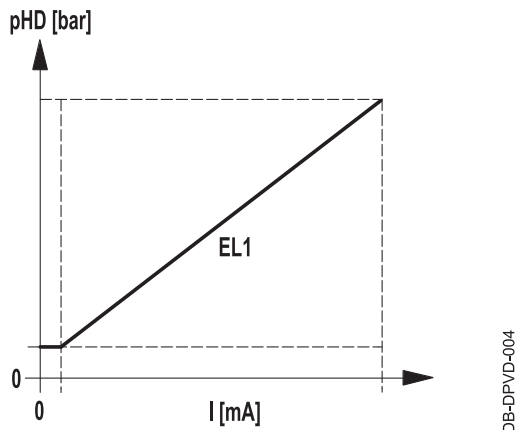
# 3 Activation and control type

## 3.3 Control functions

- EL1- function / electro-proportional regulation, [see chapter 3.3.1](#)
- DA- function / pressure cut-off, [see chapter 3.3.2](#)
- LS- function, load sensing, [see chapter 3.3.3](#)

### 3.3.1 EL1- function, rising characteristic

#### Characteristic



The EL function is designed with a positive characteristic as standard.

For the EL1 function, the displacement volume  $V_g$  of the axial piston unit is adjusted proportionally and continuously via an electromagnet. The EL1 function is subordinate to the DA function, i.e. the control-current-dependent EL1 function is only executed below the set value for the pressure cut-off.

As the control current (I) increases, the axial piston unit swivels from  $V_{g \min}$  in the direction of  $V_{g \max}$  to a large displacement volume  $V_g$  by adjusting the drive.

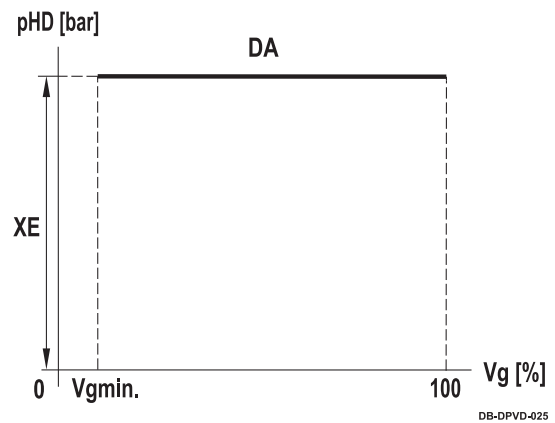
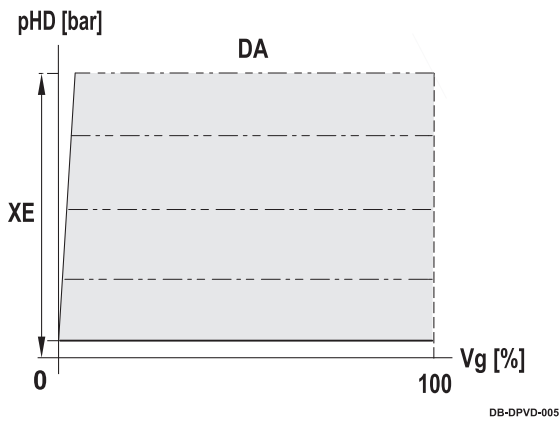
The hydraulic fluid required for this purpose is taken from high pressure pHD. At high pressure  $pHD < 30$  bar, the Fa port must be supplied with auxiliary pressure of approx. 30 bar to ensure that regulation is possible.

Safety function: If the activating signal is missing or defective, the axial piston unit swivels to  $V_{g \min}$ .

# 3 Activation and control type

## 3.3.2 DA- function

### Characteristic



The DA pressure cut-off ensures that the maximum high pressure of the axial piston unit is limited within the regulation range. When a set high pressure value pHD is reached, the axial piston unit swivels in direction  $V_{g \min}$  and the hydraulic system is protected against damage and overloading.

XE setting range: 30 - 400 bar

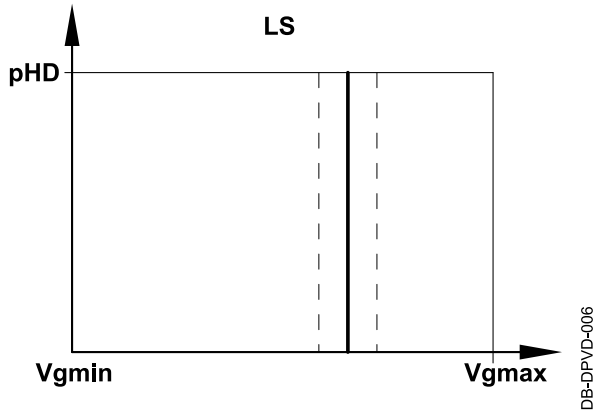
It continues to swivel in direction  $V_{g \min}$ , until the generated flow equals the set high pressure value pHD.

If the system pressure falls below the fixed high-pressure value pHD, the axial piston unit swivels until  $V_{g \max}$ .

# 3 Activation and control type

## 3.3.3 LS- function

### Characteristic



The dynamic characteristics of the control system of variable axial piston pumps can be further improved by load sensing (LS) systems. The LS function is designed as a so-called load pressure reporting system that adapts the volume flow to the current requirements of one or more consumers. It reduces power losses compared to control functions that deliver at maximum volume for a lower volume flow demand.

The pressure differential  $\Delta p$  between the highest LS pressure in the system (controlled via shuttle valves for multiple consumers) and the high pressure pHD is compared at an external adjustable measuring orifice and kept in balance by the pressure compensator (LS axis), which adjust to the demand from the consumers. The LS pressure depends on the spring force and can therefore be adjusted.

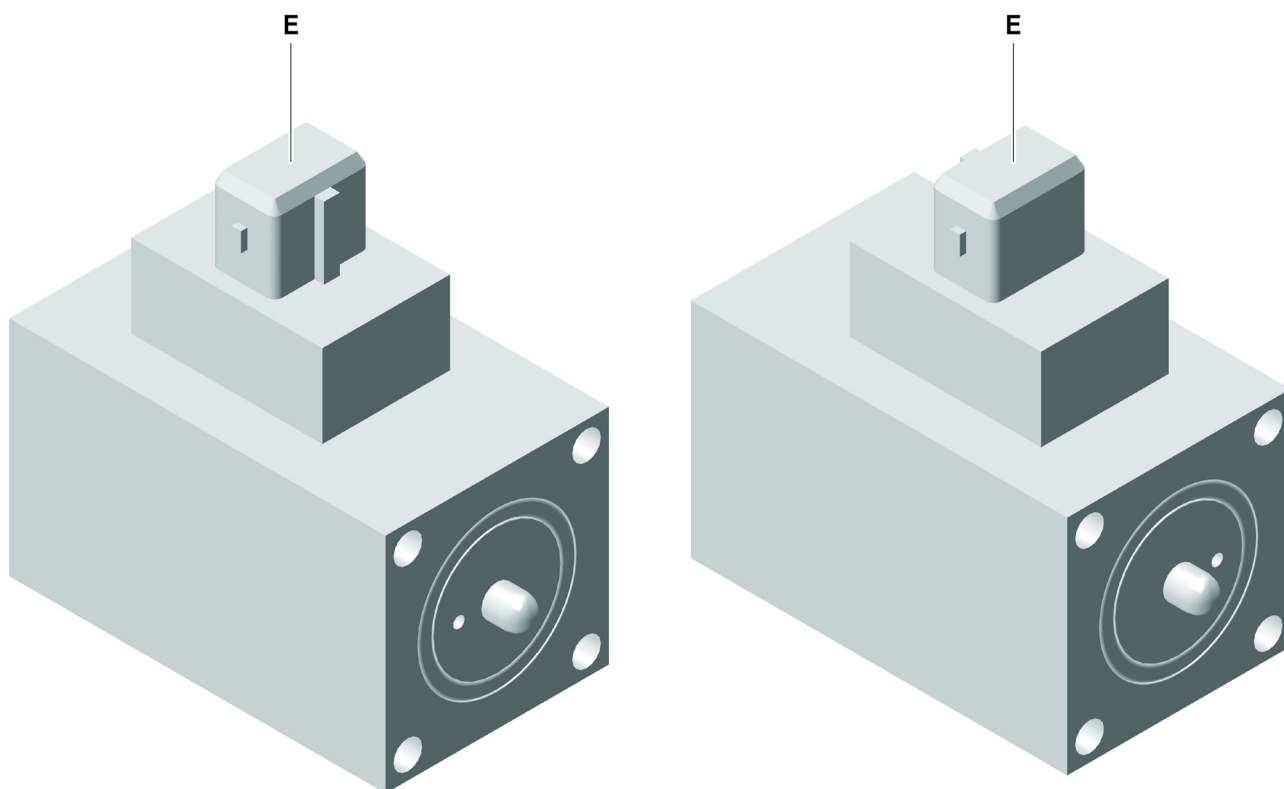
If there is no demand from consumers, the axial piston unit adjusts in direction  $V_{g \min}$ , until the value is equal to the set LS pressure.  $\Delta p = \text{approx. } 14\text{-}25 \text{ bar}$ , depending on requirement.

If the demand from consumers increases (rising  $\Delta p$  at the orifice), the axial piston unit adjusts in direction  $V_{g \max}$ , until the working pressure pHD is equal to the sum of the demand-dependent LS pressure +  $\Delta p$ .

# 3 Activation and control type

## 3.4 Electrical components

### 3.4.1 Proportional magnet (variant A)

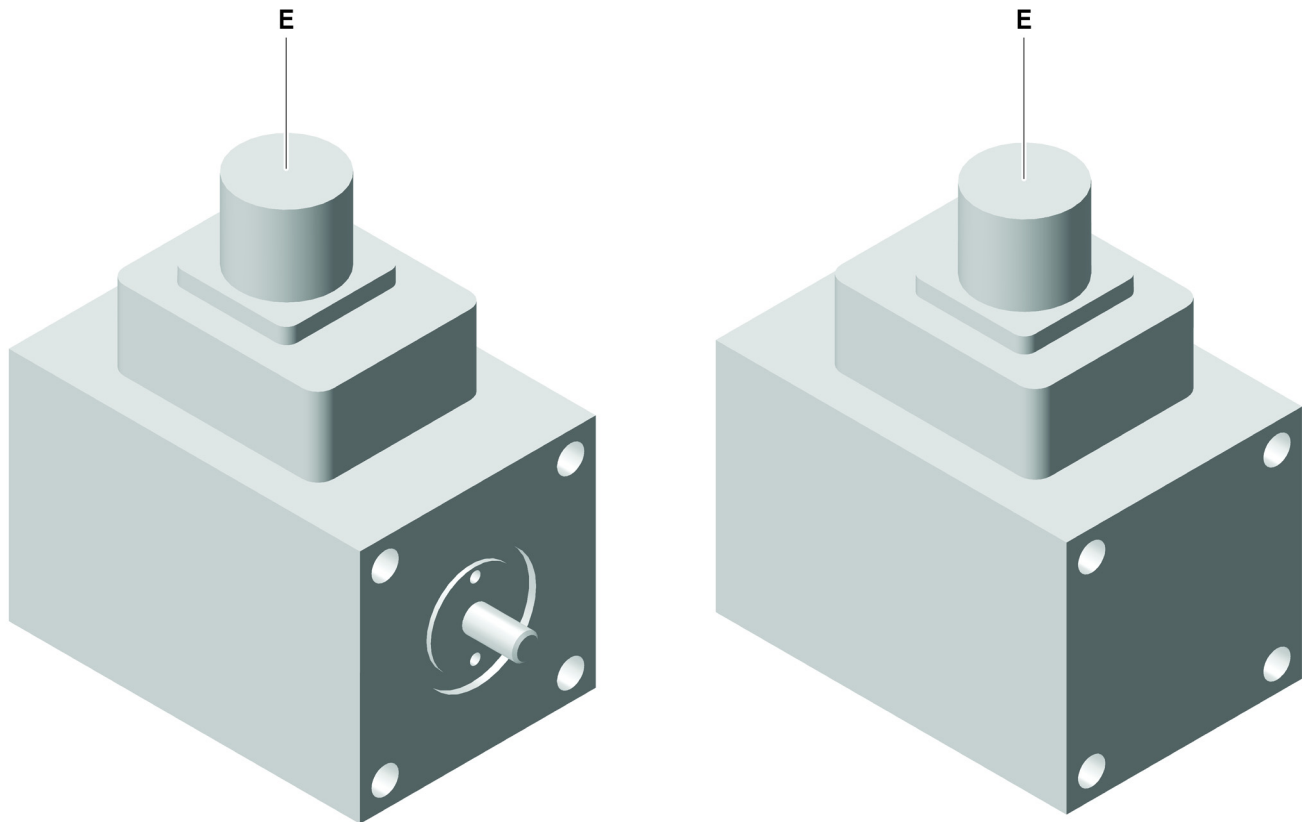


DB-DPVO-155

Technical data of proportional magnet	
Rated voltage U	24 V
Current $I_{\max}$	700 mA
PWM frequency	100-160 Hz
Protection class according to DIN VDE0470 when assembled and connected	max. IP 67
AMP JUNIOR TIMER plug-in terminal, 2-pin	-

# 3 Activation and control type

## 3.4.2 Proportional magnet (variant B)



DB-DPVD-033

Technical data of proportional magnet	
Rated voltage U	24 V
Current $I_{\max}$	750 mA
PWM frequency	100-160 Hz
Protection class according to DIN VDE0470 when assembled and connected	max. IP 54
CANNON-ITT plug-in terminal	-



# 4 Installation conditions

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## 4.1 General information about project planning

The installation variant for the device or system must be coordinated with Liebherr, as well as the installation position, at the conceptual design stage of the axial piston unit and must be approved by Liebherr.

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### ATTENTION

#### Damage of the hydraulic product.



Lack of lubrication on the hydraulic product!

Make sure that the following requirements are observed:

- Comply with the approved installation positions for the hydraulic product.
  - For other installation positions, contact Liebherr customer service.
  - Housing is completely filled with hydraulic fluid during commissioning and operation.
  - Housing is vented after commissioning and during operation.
- 

Liebherr distinguishes between three installation variants for axial piston units:

A: Under-the-tank installation (axial piston unit is installed **under** the minimum liquid level of the tank)

B: Over-the-tank installation (axial piston unit is installed **above** the minimum liquid level of the tank)

C: Tank installation (axial piston unit is installed **in** the tank)

Liebherr distinguishes between two installation positions for axial piston units:

1/3/5/7/9/11: Driving shaft horizontal

2/4/6/8/10/12: Driving shaft vertical

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### Note



Liebherr recommends:

Installation variant: Under-the-tank installation A

Installation location: 1/3/5/7/9/11 Driving shaft horizontal with "control at top"

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\*For installation positions 2/4/6/8 with driving shaft vertical and 1/3/5/7 with driving shaft horizontal with "control at bottom", complete filling and venting is critical. The axial piston unit must then be connected, filled and vented before final positioning in installation position 1/3/5/7/9 "control at top".

It can then be rotated to the final installation position 2/4/6/8 driving shaft vertical or 1/3/5/7 driving shaft horizontal with "control at bottom".

On some axial piston units, an additional T4 leakage oil connection is provided for the installation positions 2/4/6/8 driving shaft vertical and 1/3/5/7 driving shaft horizontal with control at bottom: Order leakage oil connection T4 as special design. [\(for additional information see: 1 Type code, Page 3\)](#)

### 4.1.1 Suction line

Given the laws of physics and under simple assumptions about the hydraulic fluid, temperature and ambient pressures, the maximum suction head is 750 mm. This applies in particular to installation variant B: over-the-tank installation.

At low temperatures with high viscosities, it is essential to observe the minimum suction pressure for axial piston units. [\(for additional information see: 2.3 Permitted pressure range, Page 7\)](#)

The suction line must open into the tank at a minimum distance of 115 mm from the tank bottom to prevent particles of dirt in the tank from being sucked in.

The suction line must open into the tank at a maximum distance from the leakage oil line to prevent hot leakage oil from being sucked in directly.

# 4 Installation conditions

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## 4.1.2 Leakage oil lines

To prevent draining of the axial piston unit during long downtimes, the leakage oil line must be routed in a bend so that it runs at the minimum dimension  $\ddot{U}1 = 30$  mm above the highest possible level of the axial piston unit. This applies in particular to installation variant B: over-the-tank installation.

Connect the leakage oil line to the top leakage oil connection T1, T2, T3...Tx depending on the installation position.

The leakage oil line must open into the tank at a minimum distance of 115 mm from the tank bottom to prevent stirring up dirt particles in the tank.

The leakage oil line must open into the tank at a minimum distance of 250 mm below the minimum liquid level to prevent foaming in the tank.

The leakage oil line must open into the tank at a maximum distance from the suction line to prevent hot leakage oil from being sucked in directly.

At low temperatures with high viscosities, it is essential to observe the maximum housing pressure for axial piston units with multiple driving gears and with a shared leakage oil line. [\(for additional information see: 2.3.2 Housing, leakage oil pressure, Page 8\)](#) If the maximum housing pressure is outside the tolerance limit, a separate leakage oil line must be connected for each driving gear.

## 4.1.3 Hydraulic fluid tank

Design the hydraulic fluid tank so that the hydraulic oil cools off sufficiently during circulation and impurities that develop during operation settle to the bottom of the tank.

Make sure that the lines are connected according to recommendations and that they open into the hydraulic fluid tank. [\(for additional information see: 4.1.1 Suction line, Page 25 and for additional information see: 4.1.2 Leakage oil lines, Page 26\)](#)

# 4 Installation conditions

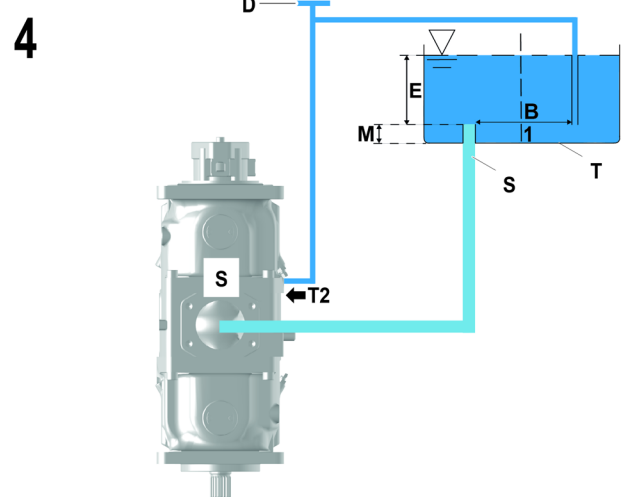
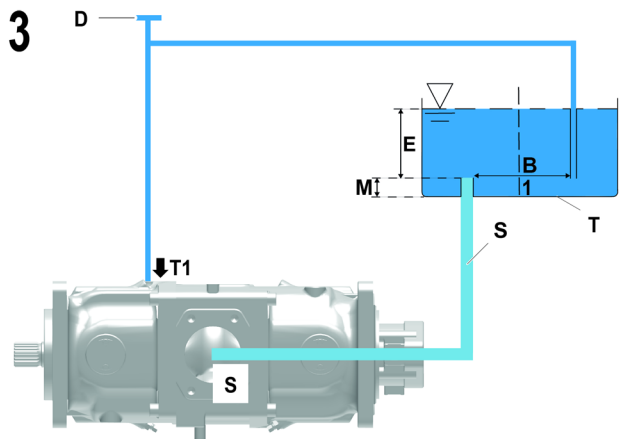
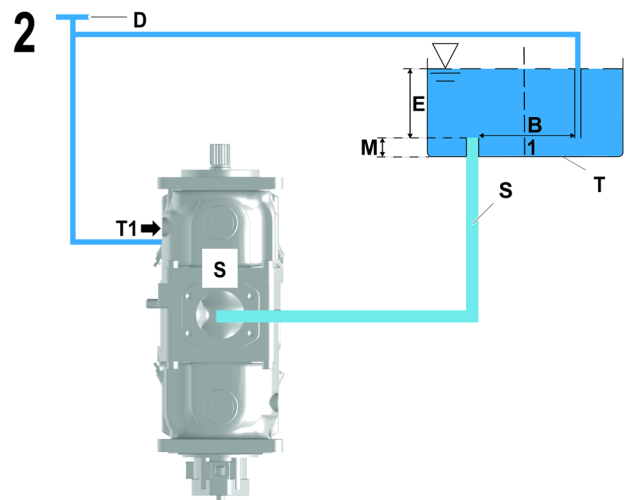
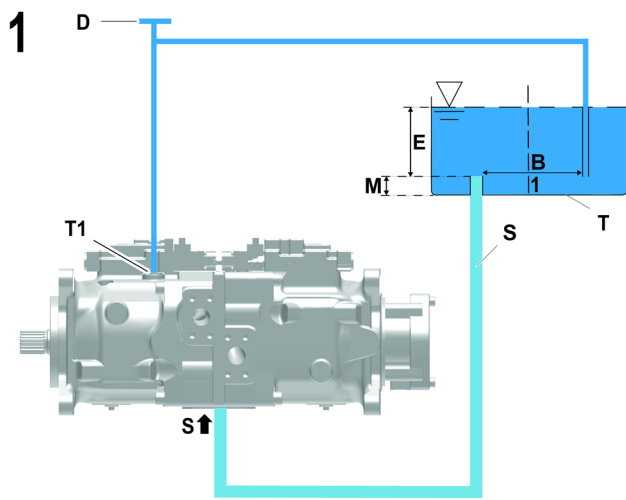
## 4.2 Installation variants

### 4.2.1 Under-the-tank installation variant



**Note**

- Liebherr recommends: Under-the-tank installation A, so that:
- There is hydraulic fluid at suction port S when not operated.
  - The housing cannot empty to the tank.



DB-DPVD-026

1	Baffle (to calm the hydraulic fluid in the tank)	M	Minimum line end distance from tank bottom = 115 mm
B	Distance between suction port and leakage oil connection in the tank (the larger the better)	S	Suction line connection
D	Fill and vent connection (external, not included in scope of delivery)	T	Tank
E	Minimum immersion depth = 250 mm	T <sub>-</sub>	Leakage oil connections T1 / T2 / T3 / T4 (T4 = optional)

# 4 Installation conditions

## 4.2.2 Over-the-tank installation variant

### ATTENTION

#### Damage of the hydraulic product.



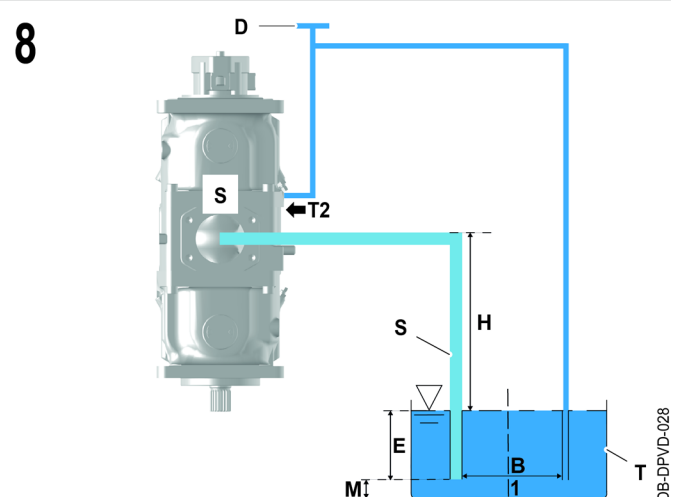
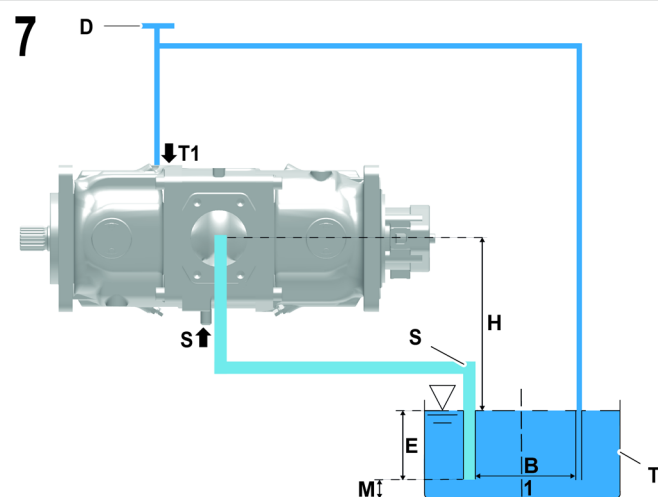
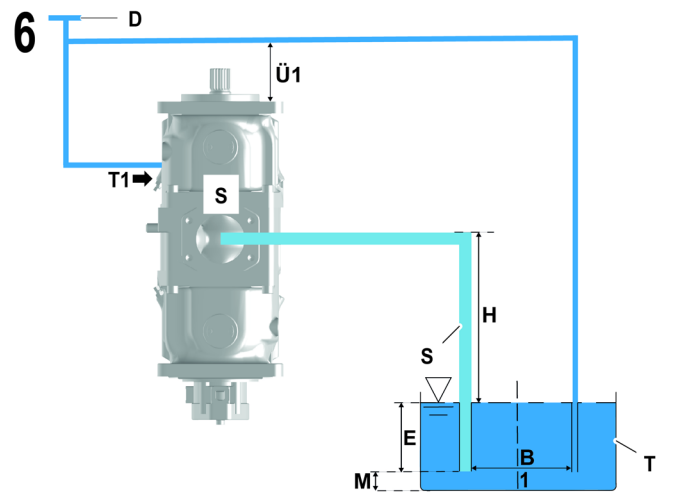
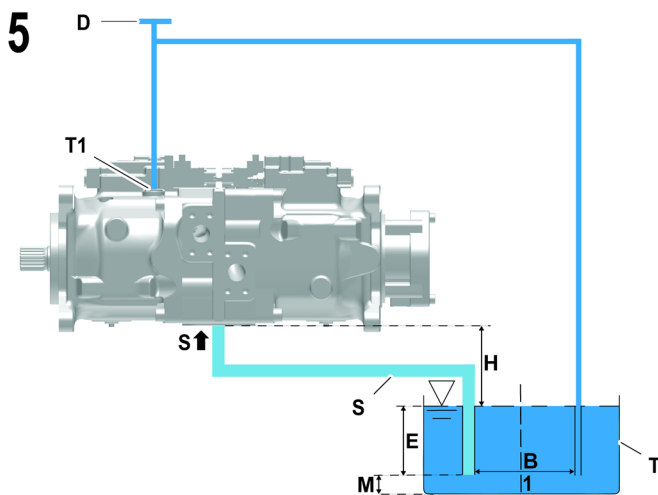
The air cushion in the bearing area or on the rotary shaft lip seal “runs hot” in over-the-tank installation position (installation variant B)! Make sure that the following requirements are observed:

- Housing is completely filled with hydraulic fluid during commissioning and operation.
- Housing is vented after commissioning and during operation.

### Note



To prevent draining of the axial piston unit during long shutdowns, the leakage oil line must be routed in a bend so that it runs at the minimum dimension  $\dot{U}1 = 30 \text{ mm}$  above the highest possible level of the axial piston unit.



DB-DPVD-028

1	Baffle (to calm the hydraulic fluid in the tank)	M	Minimum line end distance from tank bottom = 115 mm
B	Distance between suction port and leakage oil connection in the tank (the larger the better)	S	Suction line connection

# 4 Installation conditions

D	Fill and vent connection (external, not included in scope of delivery)	T	Tank
E	Minimum immersion depth = 250 mm	T <sub>-</sub>	Leakage oil connections T1 / T2 / T3 / T4 (T4 = optional)
H	Maximum suction head = 750 mm	Ü1	Minimum leakage oil line height = 30 mm

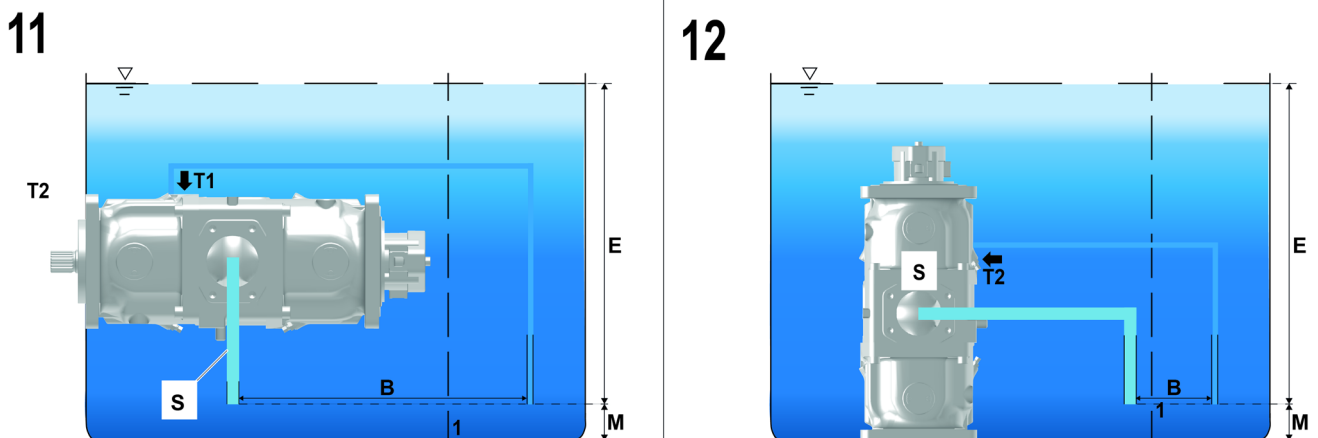
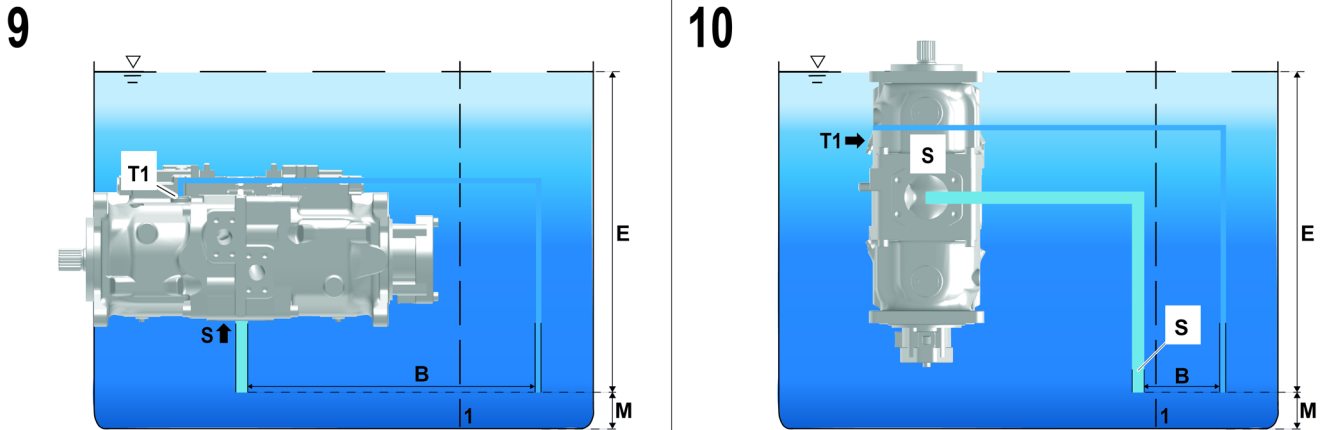
## 4.2.3 Tank installation variant

### Note



For tank installation variant C, the hydraulic product must be ordered and used as a special design without primer. (for additional information see: 1 Type code, Page 3)

This tank installation variant is not permitted for axial piston units with electrical components (for example: electro-proportional magnet)



DB-DPVD-027

l	Baffle	To calm the hydraulic fluid in the tank
B	Distance	Between suction port and leakage oil connection in the tank (the larger the better)

# 4 Installation conditions

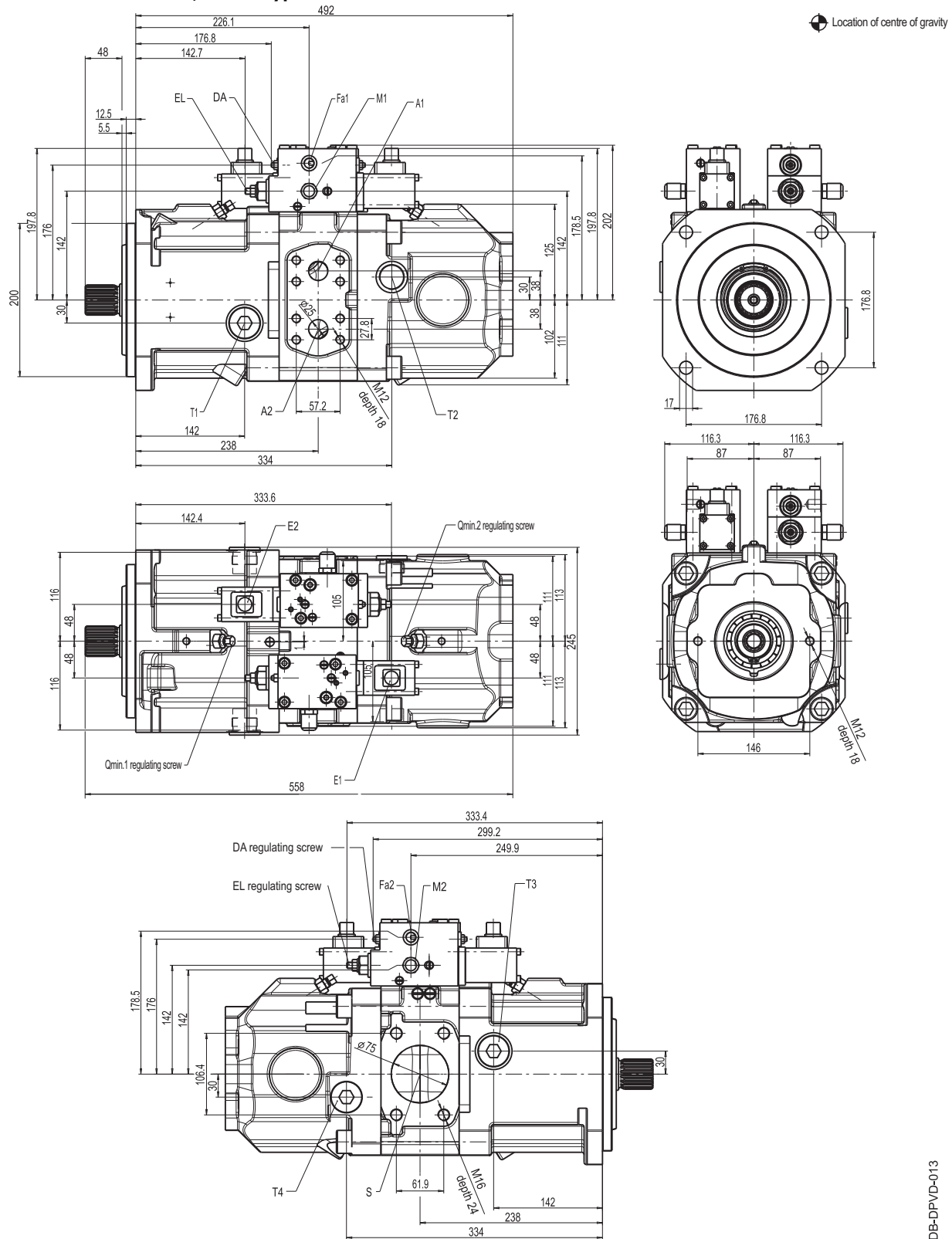
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L	Leakage oil connections	-
M	Minimum distance of the ends of the lines to the bottom of the tank	115 mm
S	Suction line connection	-
T	Tank	-

# 5 Dimensions

## 5.1 Nominal size 108

### 5.1.1 Nominal size 108, control type EL1-DA



# 5 Dimensions

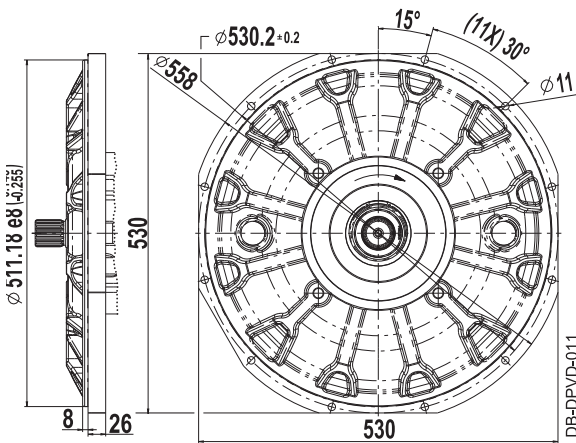
A1 / A2	Working connection SAE J 518 - 1 1/4", 6000 psi
S	Suction port SAE J 518 - 3", 500 psi
M1 / M2	Regulated high pressure M16

T1, T2, T3, T4	Leakage oil connection ISO 9974-1 - M33x2
Fa1 / Fa2	Filter outlet ISO 9974-1 - M14x1.5
E1 / E2	Plug: CANNON-ITT CAO2 COM-E10SL- 4P-B01, PWM= 100-160 Hz, U= 24 V, I= 750 mA

## 5.2 Nominal size 108, mounting flange

DPVD	0		/			1				A				0	
1.	2.	3.		4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.

Diesel engine flange SAE J617 / SAE 1

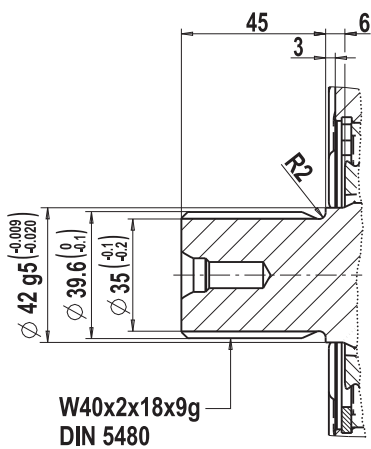


11

## 5.3 Nominal size 108, shaft end

DPVD	0		/			1				A				0	
1.	2.	3.		4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.

Splined shaft DIN 5480



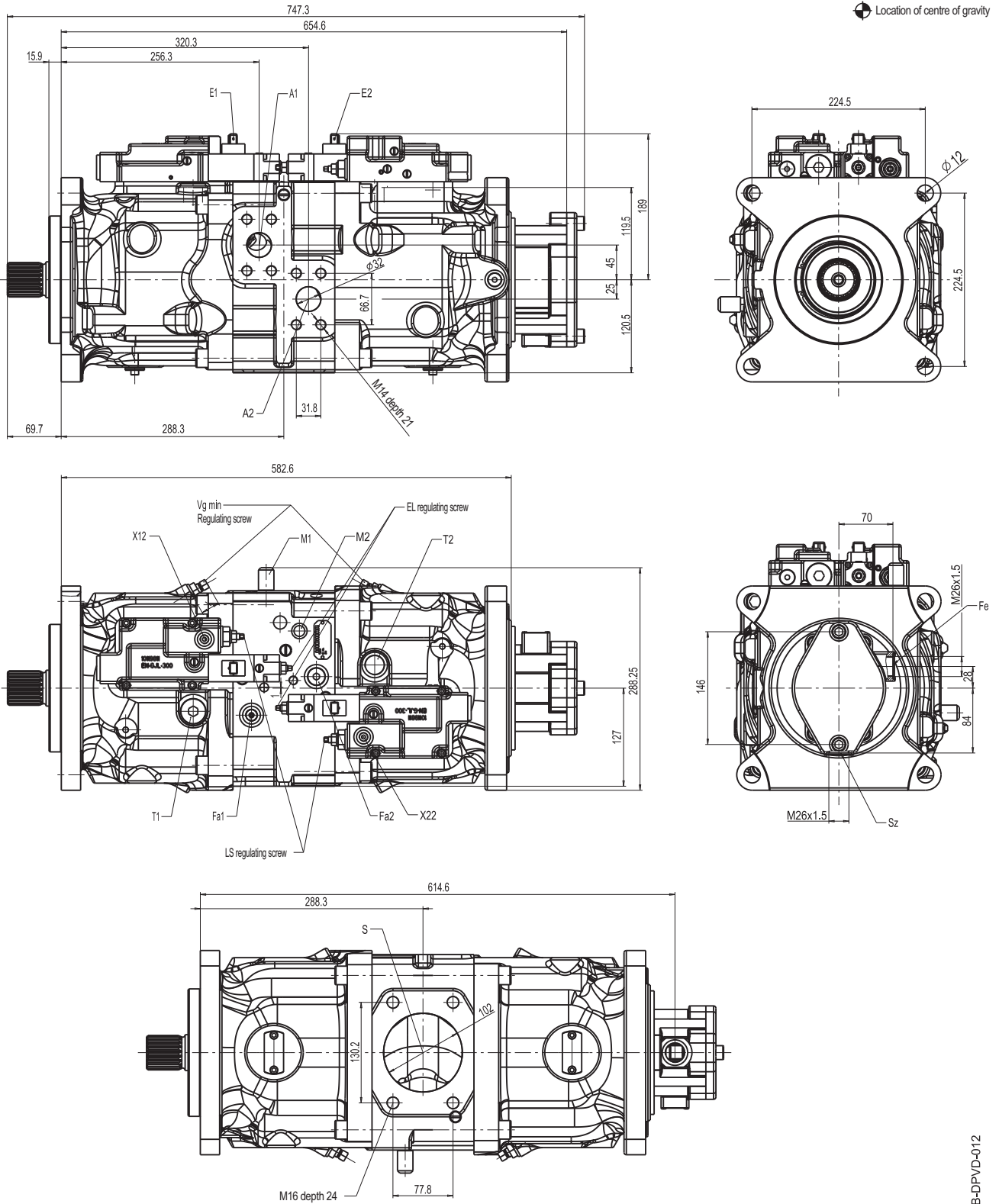
1



# 5 Dimensions

## 5.4 Nominal size 165

### 5.4.1 Nominal size 165, control type EL1-LS



DB-DPVD-012

# 5 Dimensions

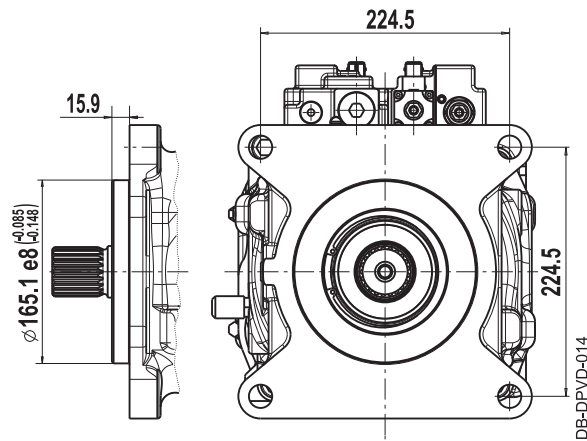
A1 / A2	Working connection SAE J 518 - 1 1/4", 6000 psi
S	Suction port SAE J 518 - 4", 500 psi
M1 / M2	Regulated high pressure M16
Fe	Filter inlet ISO 9974-1 - M26x1.5
Sz	Gear pump suction port ISO 9974-1 - M26x1.5

T1, T2	Leakage oil connection ISO 9974-1 - M26x1.5
Fa1 / Fa2	Filter outlet ISO 9974-1 - M16x1.5
E1 / E2	Plug: AMP Junior - Timer, 2-pin PWM= 100-160 Hz, U= 24 V, I= 690 mA
X12 / X22	LS pressure ISO 9974-1 - M12x1.5
-	-

## 5.5 Nominal size 165, mounting flange

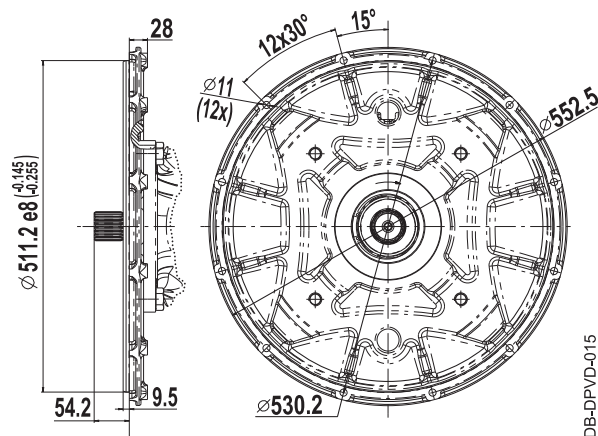
DPVD	0		/			1				A				0	
1.	2.	3.		4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.

SAE E (SAE J744)



25

Diesel engine flange SAE J617 / SAE 1



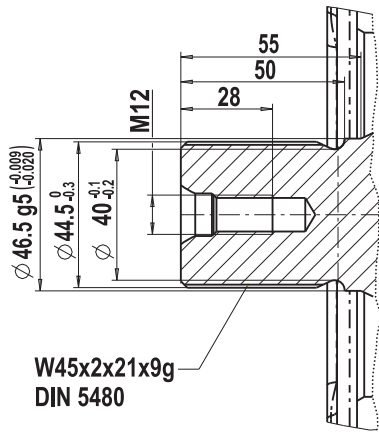
11

# 5 Dimensions

## 5.6 Nominal size 165, shaft end

DPVD	0		/			1				A				0	
1.	2.	3.		4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.

Splined shaft DIN 5480



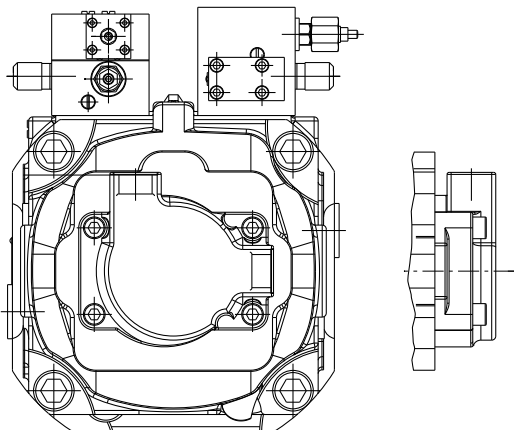
DB-DPVD-016

1

## 5.7 Through-drive

DPVD	0		/			1				A				0	
1.	2.	3.		4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.

### 5.7.1 Axial piston unit without through drive



DB-DPVD-017

0000

# 5 Dimensions

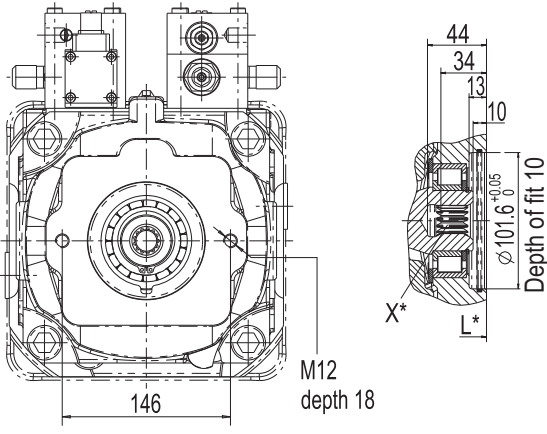
## 5.7.2 Axial piston unit with through drive



**Note**

O-ring to seal axial piston unit 2 is included in the scope of delivery.

### SAE B



**B11D**

- X\* ANSI B 92.1a-1976
- 7/8" spline shaft size
- 30° engagement angle
- 13 teeth
- 16/32 pitch
- cl. 5

L\* NS 108 = 492 mm (without mounting flange)

## 5.7.3 Axial piston unit ready for through-drive



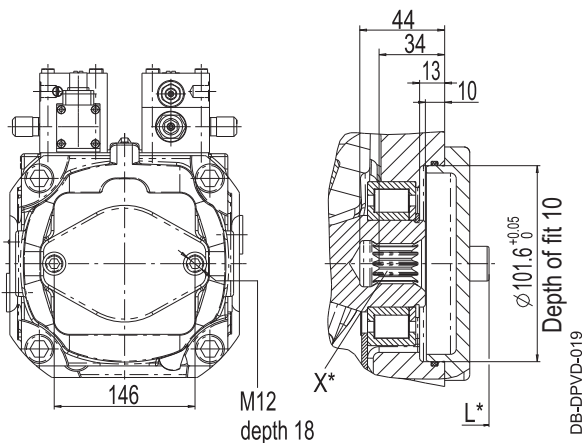
**Note**

Ready for through-drive SAE B/SAE B-B, closed with cover.

To use the through-drive, the cover must be removed.

O-ring to seal axial piston unit 2 is included in the scope of delivery.

### SAE B



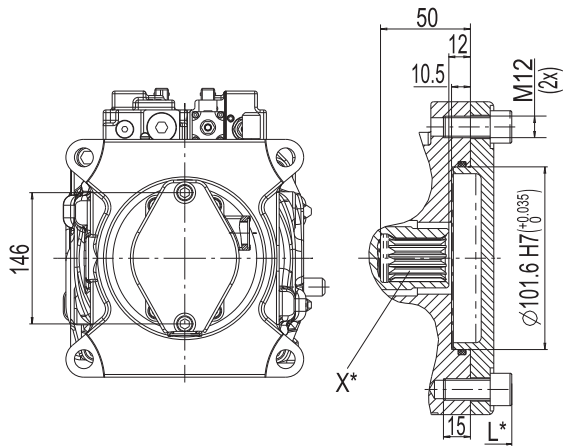
**B11G**

- X\* ANSI B 92.1a-1976
- 7/8" spline shaft size
- 30° engagement angle
- 13 teeth
- 16/32 pitch
- cl. 5

L\* NS 108 = 515.01 mm (without mounting flange)

# 5 Dimensions

## SAE B-B



**B21G**

X\* ANSI B 92.1a-1976  
1" spline shaft size  
30° engagement angle  
15 teeth  
16/32 pitch  
cl. 7

L\* NS 165 = 677.6 mm (without mounting flange)

DB-DPVD-020

## 5.8 Multi-axial piston unit

### General information

Multi-axial piston units inline of 2 or more single units can be supplied on request.

The type code must be filled out separately for each single unit. An abbreviated type designation on an additional type plate is used to identify the multi unit.

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