

Data sheet

Axial piston pump LH30VO



The Liebherr LH30VO axial piston pumps were developed for open circuits in mobile and stationary applications.

The medium pressure pumps are designed as swashplates and can be operated with through-drive up to 130%.

The through-drive design of the LH30VO is highly flexible, even after installation in the final application. Its modular control model kit provides more than 35 possible control combinations, including power control (LR), electrical volume flow control (VE) with rising characteristic, and additional jump function at signal loss (VK). They are designed for the most common applications, such as driving equipment, ventilation, or steering of a machine.

Its increased performance and the optimised production and assembly processes make the LH30VO an attractive and high-performing product for mobile and stationary applications where a pressure range up to 4,061 psi (280 bar) is required.

Valid for:

LH30VO028 / LH30VO045 / LH30VO085 / LH30VO100

Features:

Open circuit
Modular design of through-drive and control

Control types:

Pressure control
Volume flow regulation
Performance regulation
Various combined forms of regulation

Pressure range:

Nominal pressure $p_N = 4,061$ psi (280 bar)
Maximum pressure $p_{max} = 4,641$ psi (320 bar)

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LIEBHERR

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1 Type code

L	H	3	0	V	0		/		20	V					0	00		000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14	15	16	17	18	19	20	21

1. Manufacturer

Liebherr Machines Bulle SA	L
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2. Division

Hydraulics	H
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3. Nominal pressure range

Nominal pressure $p_N = 4,061$ psi (280 bar) / Maximum pressure $p_{max} = 4,641$ psi (320 bar)	3
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4. Version

Single unit (pump) (multiple unit inline, see chapter 5.14)	0
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5. Design type

Variable displacement	V
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6. Circuit

Open circuit	0
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7. Nominal size (NS)

	028	045	085	100	
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8. Control (3- / 6- or 9-digit)

1. Control axis	XX-
2. Control axis (combination control)	XX-XX-
3. Control axis (combination control)	XX-XX-XX-

Mechanical-hydraulic controls

Pressure cut-off	■	■	■	■	DA-
Hydraulic pressure control (remotely controllable) / pressure cut-off (combination control)	■	■	■	■	DF-DA-
Load sensing control (without vent nozzle in control) / pressure cut-off (combination control)	▼	▼	▼	▼	LS0DA-
Load sensing control (with vent nozzle in control) / pressure cut-off (combination control)	□	□	□	□	LS2DA-
Power control	■	■	■	■	LR-

A dash must be added as suffix for two-character mechanical-hydraulic controls. This applies to each control axis.

Electro-hydraulic pressure control

Electrical pressure control	▼	▼	▼	▼	DE_
Load sensing control (without vent nozzle in control) / electrical pressure control (combination control)	■	■	■	■	LS0DE_
Load sensing control (with vent nozzle in control) / electrical pressure control (combination control)	□	□	□	□	LS2DE_

1 Type code

028	045	085	100
-----	-----	-----	-----

The underscore placeholder for electro-hydraulic pressure controls is for the desired voltage / characteristic / plug.
Please enter 1-8 instead of the underscore.

Voltage / characteristic / plug: 24V, rising characteristic, Deutsch plug	■	■	■	■	1
Voltage / characteristic / plug: 24V, falling characteristic, Deutsch plug	■	■	■	■	2
Voltage / characteristic / plug: 12V, rising characteristic, Deutsch plug	□	□	□	□	3
Voltage / characteristic / plug: 12V, falling characteristic, Deutsch plug	□	□	□	□	4
Voltage / characteristic / plug: 24V, rising characteristic, AMP plug	▼	▼	▼	▼	5
Voltage / characteristic / plug: 24V, falling characteristic, AMP plug	▼	▼	▼	▼	6
Voltage / characteristic / plug: 12V, rising characteristic, AMP plug	□	□	□	□	7
Voltage / characteristic / plug: 12V, falling characteristic, AMP plug	□	□	□	■	8

Electrical volume flow control

Electrical volume control	■	■	■	■	VE_
Electrical volume control with jump function at signal loss	■	■	■	■	VK_
Volume electrically overridden (retarder)	■	■	■	■	VO_

The underscore placeholder for electrical volume flow controls is for the desired voltage / characteristic / plug.
Please enter 1-7 instead of the underscore.

Voltage / characteristic / plug: 24V, rising characteristic, Deutsch plug	■	■	■	■	1
Voltage / characteristic / plug: 12V, rising characteristic, Deutsch plug	□	□	□	□	3
Voltage / characteristic / plug: 24V, rising characteristic, AMP plug	■	■	■	■	5
Voltage / characteristic / plug: 12V, rising characteristic, AMP plug	□	□	□	□	7

Possible combinations for controls (1-3 control axes)

		Control axis 1-2										
		DA-	DE_	LS0DA-	LS2DA-	LS0DE_	LS2DE_	DF-DA-	DE_DA-	VE_	VK_	LR-
Additional option	None	■	■	■	□	■	□	■	■	■	■	■
	DA-	-	■	-	-	■	□	-	-	■	■	■
	VE_	■	■	■	□	■	□	■	■	-	-	-
	VK_	■	■	■	□	■	□	■	■	-	-	-
	LR-	■	■	■	□	■	□	■	■	-	-	-
	VO_	■	■	■	□	■	□	■	■	-	-	-

9. Series

Design	20
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10. Sealing material

Viton	V
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11. Direction of rotation (looking at the face of the drive shaft)

right	■	■	■	■	R
left	■	■	■	■	L

1 Type code

028	045	085	100
-----	-----	-----	-----

12. Mounting flange

SAE B = 4.0 inch (101.6 mm) (SAE J744) 2-hole fastening	▼	▼	-	-	B2
SAE C = 5.0 inch (127.0 mm) (similar to SAE J744) 2+4-hole fastening	-	-	▼	▼	C6

13. Driving shaft end

ANSI, 7/8", 13 teeth, with undercut	■	■	-	-	A1
ANSI, 7/8", 13 teeth, without undercut	▼	■	-	-	A2
ANSI, 1", 15 teeth, with undercut	□	■	-	-	A3
ANSI, 1", 15 teeth, without undercut	□	▼	-	-	A4
ANSI, 1 1/4", 14 teeth, with undercut	-	-	■	■	A5
ANSI, 1 1/4", 14 teeth, without undercut	-	-	■	■	A6
ANSI, 1 1/2", 17 teeth, with undercut	-	-	■	■	A9
ANSI, 1 1/2", 17 teeth, without undercut	-	-	▼	▼	A0

14. Working connection

Lateral metric fastening thread ISO 6162-2 / SAE J518-2	-	-	▼	▼	A1
Metric fastening thread at the rear ISO 6162-2 / SAE J518-2	-	-	■	■	A3
Lateral metric fastening thread ISO 6162-1 / SAE J518-1	▼	▼	-	-	B1
Metric fastening thread at the rear ISO 6162-1 / SAE J518-1	■	■	-	-	B3

15. Add-on parts

Without add-on parts	0
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16. Gear pump

Without gear pump	00
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17. Through-drive

Without through-drive with side working connections A1 / B1 (Rear working connections A3 / B3 = without through-drive available for all NS models, see type code 14)			□	□	□	□	0000
Centering diameter	Shaft gearing	Fastening					
Ø3.25 (Ø82.55) (SAE J744-A)	ANSI B92.1 5/8 in 9T 16/32DP	2-hole/open hole	■	■	■	■	A11D
Ø3.25 (Ø82.55) (SAE J744-A)	ANSI B92.1 3/4 in 11T 16/32DP	2-hole/open hole	■	■	■	■	A21D
Ø4.0 (Ø101.6) (SAE J744-B)	ANSI B92.1 7/8 in 13T 16/32DP	2-hole/open hole	▼	■	■	■	B11D
Ø4.0 (Ø101.6) (SAE J744-B)	ANSI B92.1 1 in 15T 16/32DP	2-hole/open hole	-	▼	■	■	B21D
Ø5.0 (Ø127) (SAE J744-C)	ANSI B92.1 1 1/4 in 14T 12/24DP	2-hole/open hole	-	-	■	■	C11D
Ø5.0 (Ø127) (SAE J744-C)	ANSI B92.1 1 1/2 in 17T 12/24DP	2-hole/open hole	-	-	■	■	C21D
Special centering diameter	No shaft coupling	4-hole/closed hole	▼	▼	▼	▼	K02G

1 Type code

028	045	085	100
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18. Valve

Without valve	000			
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19. Sensors

Without sensors	▼	▼	▼	▼	0
Preparation for pressure measuring connection (Minimesh)	-	□	□	□	V

20. Swivel angle limit stops

Standard (without Q_{min} + Q_{max} limit stop)	▼	▼	▼	▼	0
With Q_{min} fixed limit stop (please specify in purchase order)	□	□	□	□	4
With Q_{max} fixed limit stop (please specify in purchase order)	□	□	□	□	5

21. Special design and options

Primer	▼	▼	▼	▼	G
Primer + paint (color as specified by customer)	□	□	□	□	F
Conservation without primer (tank pump)	□	□	□	□	K
Additional leakage oil connection	■	■	■	■	Z

▼ = Preferred series

■ = Available

□ = Available on request

- = Not available



Note

Contact addresses for requests are listed on the reverse of this document.

2 Technical data

2.1 Table of values

Nominal size		028	045	085	100
Displacement volume	$V_{g \max}$	1.75 (28.7)	2.84 (46.5)	5.25 (86.1)	6.32 (103.5)
	$V_{g \min}$	0	0	0	0
Volume flow at $V_{g \max}$ and n_{\max}	$q_{v \max}$	25.02 (94.7)	36.85 (139.5)	54.58 (206.6)	65.62 (248.4)
Min. speed at $V_{g \max}$ and $p_{\text{abs}} = 14.5 \text{ psi (1 bar)}$ at the suction port	n_{\min}	100*	100*	100*	100*
Max. speed at $V_{g \max}$ and $p_{\text{abs}} = 14.5 \text{ psi (1 bar)}$ at the suction port	n_{\max}	3,300	3,000	2,500	2,400
Torque at $V_{g \max}$ and $\Delta p = 4,061 \text{ psi (280 bar)}$	M_{\max}	94.3 (127.9)	152.8 (207.2)	283.0 (383.7)	340.1 (461.1)
Drive power at $q_{v \max}$ and $\Delta p = 4,061 \text{ psi (280 bar)}$	P_{\max}	59.3 (44.2)	87.3 (65.1)	134.6 (100.4)	155.4 (115.9)
Driving gear moment of inertia	J_{TW}	0.0475 (0.002)	0.0949 (0.004)	0.2302 (0.0097)	0.3037 (0.0128)
Maximum angular acceleration	α	7,300	5,400	3,900	3,500
Weight without through-drive (approx.)	m	35.27 (16)	46.30 (21)	85.98 (39)	89.29 (40.5)
Weight with through-drive (approx.)	m	39.68 (18)	52.91 (24)	94.80 (43)	98.55 (44.7)
Torsional stiffness	Driving shaft code "A1"	14,604 (19,800)	17,406 (23,600)	-	-
	Driving shaft code "A2"	15,931 (21,600)	20,357 (27,600)	-	-
	Driving shaft code "A3"	□	23,602 (32,000)	-	-
	Driving shaft code "A4"	□	24,044 (32,600)	-	-
	Driving shaft code "A5"	-	-	51,482 (69,800)	57,087 (77,400)
	Driving shaft code "A6"	-	-	59,521 (80,700)	67,339 (91,300)
	Driving shaft code "A9"	-	-	75,157 (101,900)	86,516 (117,300)
	Driving shaft code "A0"	-	-	76,190 (103,300)	92,269 (125,100)

□ = Available on request

- = Not possible

*) Depending on the application, a special release can be issued for a lower minimum speed at low operating pressure: please contact Liebherr, giving details of the expected load cycle.



Note

Theoretical, rounded values which do not take into account the efficiency, tolerances, contamination of the hydraulic fluid, and deflection of the driving shaft.

2 Technical data

2.1.1 Maximum radial and axial force load on the driving shaft



Note

The radial and axial forces are calculated separately and for stated load cycles (pressure and direction of force). If you are planning a belt drive, or expect continuous axial and/or radial forces, please contact Liebherr stating the anticipated load cycle.

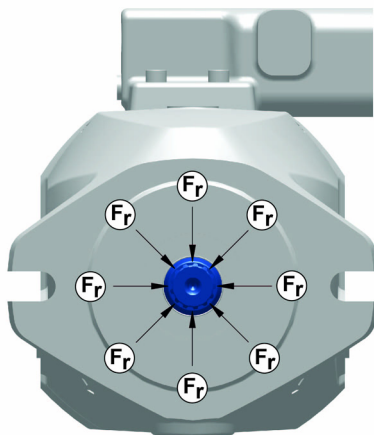


Note

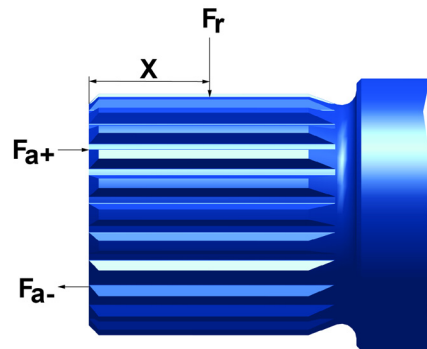
Theoretical, rounded values which do not take into account the efficiency, tolerances, contamination of the hydraulic fluid, and deflection of the driving shaft.

Generally applicable information for calculation

- $V_{g \max}$
- Operating pressure pHD: 2,901 psi (200 bar)



DB-LH30VC-113



DB-V-001

Nominal size			028	045	085	100
X		inch (mm)	0.49 (12.5)	0.59 (15)	0.71 (18)	0.71 (18)
Position of radial force application		-	All			
Max. radial force F_r	Reduction of LLD* by 20%	lbf (N)	112 (500)	146 (650)	348 (1,550)	348 (1,550)
	Reduction of LLD* by 50%		315 (1,400)	292 (1,300)	629 (2,800)	629 (2,800)
Max. axial force F_{a+}	Reduction of LLD* by 20%	lbf (N)	22 (100)	22 (100)	112 (500)	112 (500)
	Reduction of LLD* by 50%		67 (300)	112 (500)	270 (1,200)	270 (1,200)
Max. axial force F_{a-}	Reduction of LLD* by 20%	lbf (N)	427 (1,900)	348 (1,550)	607 (2,700)	607 (2,700)
	Reduction of LLD* by 50%		517 (2,300)	495 (2,200)	899 (4,000)	899 (4,000)

LLD*) Bearing service life

2 Technical data

2.1.2 Maximum input and through-drive torques

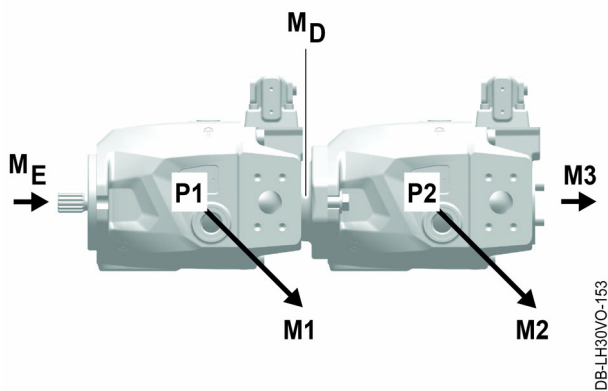


Note

Theoretical, rounded values which do not take into account the efficiency, tolerances, contamination of the hydraulic fluid, and deflection of the driving shaft.

Generally applicable information for calculation

- $V_{g \max}$
- Operating pressure pHD: 4,061 psi (280 bar)



M1	Torque, axial piston pump 1
M2	Torque, axial piston pump 2
M3	Torque, 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) $M_E = M1 + M2 + M3$
 $M_E < M_{E \max}$
- 2) $M_D = M2 + M3$
 $M_D < M_{D \max}$

Nominal size				028	045	085	100	
Torque at $V_{g \max}$ and $\Delta p = 4,061$ psi (280 bar)			M_{\max}	lbf ft (Nm)	94.3 (127.9)	152.8 (207.2)	283.0 (383.7)	340.1 (461.1)
Max. torque from driving shaft input (installed without shear force)	A1	7/8", 13 teeth, with undercut	$M_{E \max}$	lbf ft (Nm)	173 (235)	173 (235)	-	-
	A2	7/8", 13 teeth, without undercut	$M_{E \max}$	lbf ft (Nm)	207 (280)	207 (280)	-	-
	A3	1", 15 teeth, with undercut	$M_{E \max}$	lbf ft (Nm)	273 (370)	273 (370)	-	-
	A4	1", 15 teeth, without undercut	$M_{E \max}$	lbf ft (Nm)	330 (447)	330 (447)	-	-
	A5	1 1/4", 14 teeth, with undercut	$M_{E \max}$	lbf ft (Nm)	-	-	498 (675)	498 (675)
	A6	1 1/4", 14 teeth, without undercut	$M_{E \max}$	lbf ft (Nm)	-	-	579 (785)	579 (785)
	A9	1 1/2", 17 teeth, with undercut	$M_{E \max}$	lbf ft (Nm)	-	-	944 (1,280)	944 (1,280)
	A0	1 1/2", 17 teeth, without undercut	$M_{E \max}$	lbf ft (Nm)	-	-	1,090 (1,478)	1,090 (1,478)
Max. through-drive torque			$M_{D \max}$	lbf ft (Nm)	117 (158)	221 (300)	392 (532)	392 (532)

□ = Available on request / - = Not possible

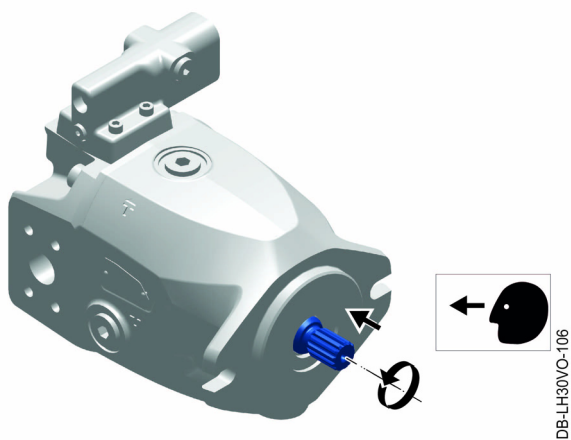
2 Technical data



Note
Higher through-drive torques available on request.

2.2 Direction of rotation

L	H	3	0	V	0		/		20	V				0	00		000				
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14	15	16	17	18	19	20	21

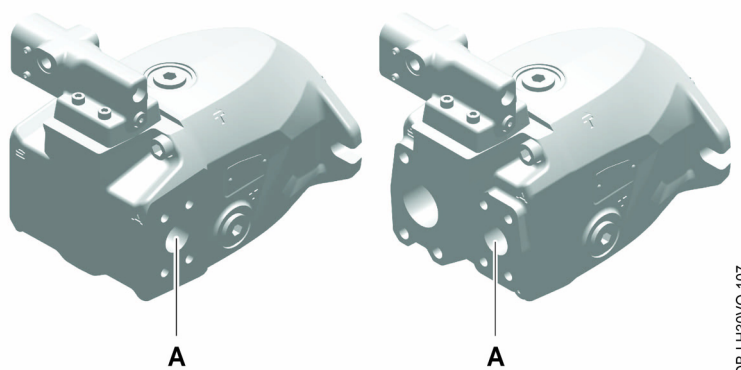
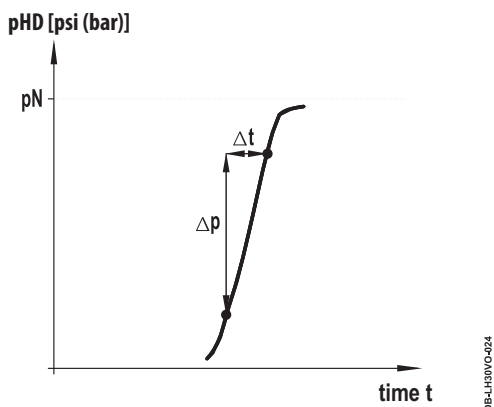


The direction of rotation is stated looking at the driving shaft as shown in the figure.

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

2.3 Permissible pressure range

2.3.1 Operating pressure



Operating pressure at connection A			028	045	085	100
Minimum pressure ¹	pHD _{min}	psi (bar)	232 (16)			
Nominal pressure (fatigue-resistant)	pHD _N	psi (bar)	4,061 (280)			
Maximum pressure (individual active duration)	pHD _{max}	psi (bar)	4,641 (320)			

2 Technical data

Individual active duration at maximum pressure $p_{HD \max}$	t	s	< 1
Total active duration at maximum pressure $p_{HD \max}$	t	Op.h*	300
Pressure change speed	RA	psi/s (bar/s)	246,564 (17,000)

*) Op.h = Operating hours

1) In the working circuit, there must be a minimum pressure at connection A to ensure sufficient lubrication in the driving gear during operation at all swivel angles.

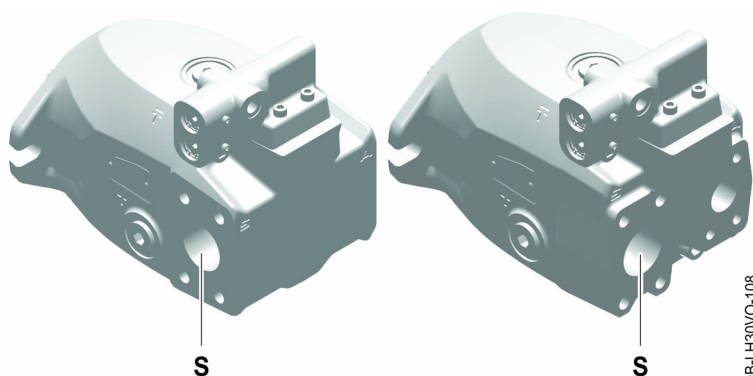


DANGER

Failure of the fastening bolts at working connection A!

Risk of fatal injury.

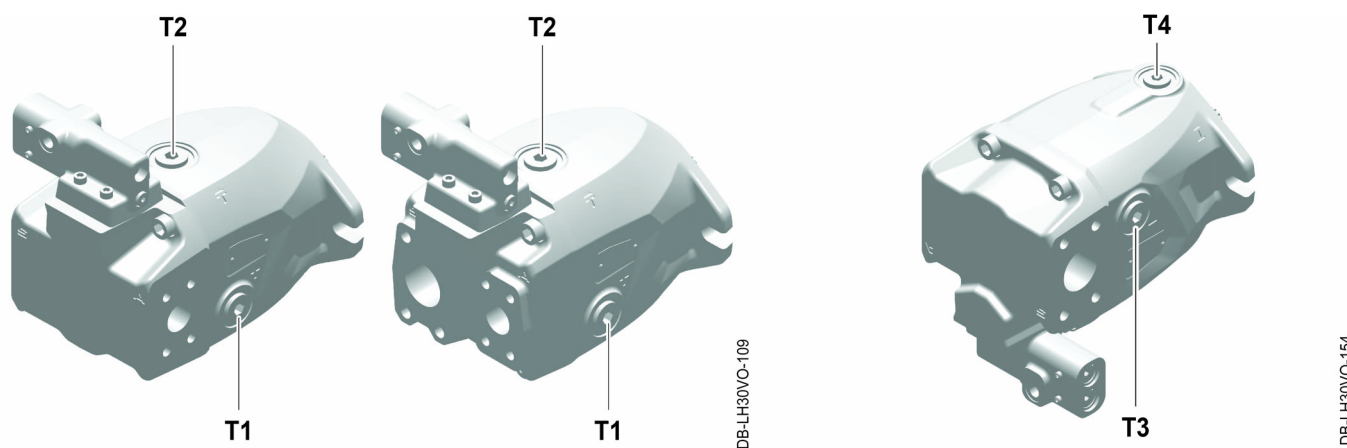
Use fastening bolts of strength class 10.9.



Suction pressure at connection S			
Nominal size	028 to 100		
Minimum pressure, absolute	$p_{S \min}$	psi (bar)	11.6* (0.8*)
Maximum pressure, absolute	$p_{S \max}$	psi (bar)	29.0* (2*)

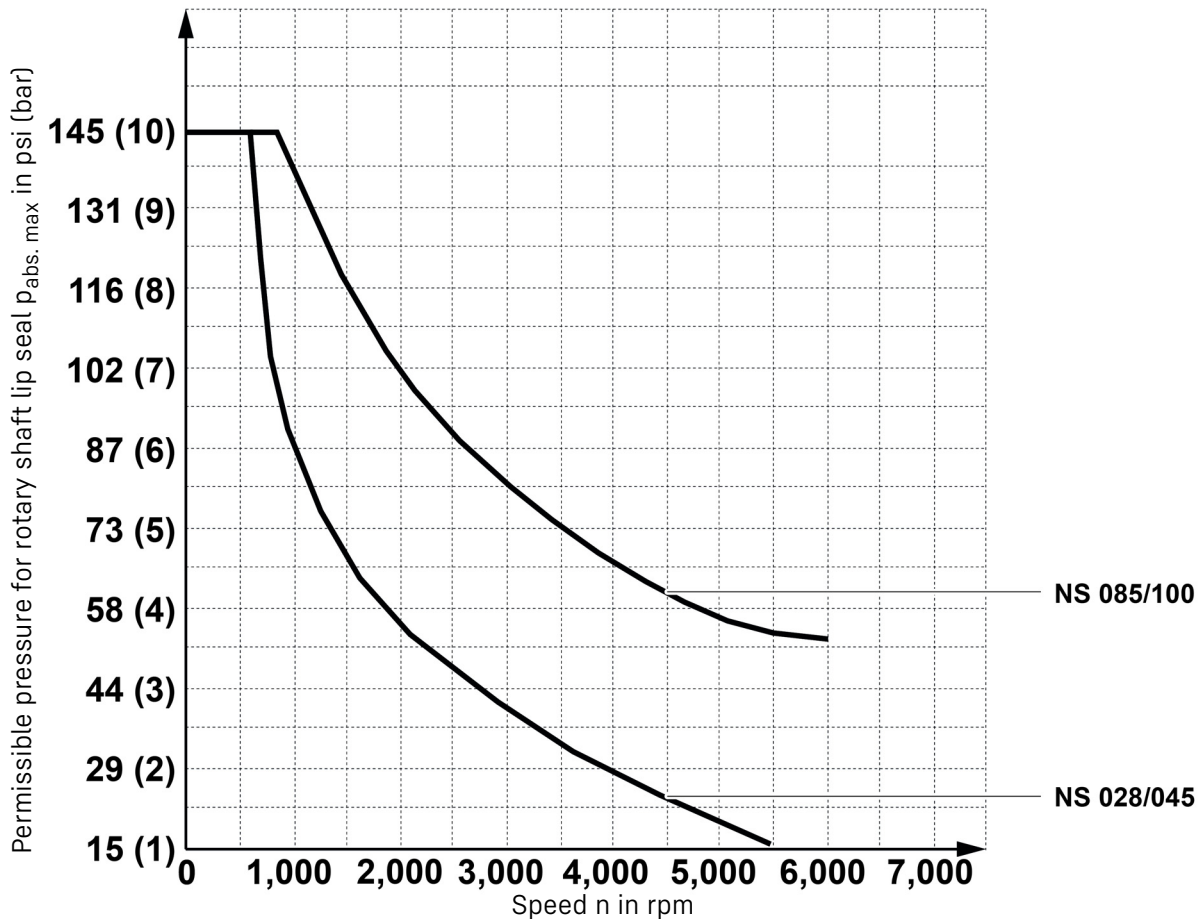
*) Deviating values on request

2.3.2 Housing pressure, leakage oil pressure



*) Leakage oil connection T4 can be ordered as a special design
(for additional information see: 1 Type code, Page 3)

2 Technical data



DB-LH50VO-116

Leakage oil pressure at connection T1/T2/T3/T4				
Nominal size			028 / 045	085 / 100
Maximum pressure, absolute	pL _{max}	psi	29.0*	43.5*
		(bar)	(2*)	(3*)

*) The housing or leakage oil pressure p_L must not exceed the suction pressure at connection S + 7.25 psi (0.5 bar), in any operating state.

$$p_L \leq p_{S_{max}} + 7.25 \text{ psi (0.5 bar)}$$



Note

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

2 Technical data

2.4 Hydraulic fluids

2.4.1 General information

The selection of the suitable hydraulic fluid is determined by the expected operating temperature as a function of the ambient temperature, which is equivalent to the tank temperature.

CAUTION

Mixing different mineral oil hydraulic fluids is prohibited!

Minimum required quality

Specification
LH-00-HYC3A
LH-00-HYE3A

**Note**

For additional information, see www.liebherr.com (brochure: Lubricants and operating fluids).
Alternatively: Contact lubricants@liebherr.com.

2.4.2 Fill quantity

Nominal size		028	045	085	100
Fill quantity	US.liq.gal (liters)	0.15 (0.55)	0.16 (0.6)	0.42 (1.6)	0.41 (1.55)

**Note**

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

2.4.3 Filtering

- The hydraulic fluid must be filtered to maintain the required cleanliness class "21/17/14 according to ISO 4406" in all circumstances.
- Filtering of the hydraulic fluid is achieved by the device-specific use of oil filters in the hydraulic system.
- The cleaning and maintenance intervals of the oil filters, and of the entire oil circuit, depend on use of the device; please see the device-specific operating instructions.

2 Technical data

2.5 Temperature



Note

The optimum operating range of the hydraulic fluid of 0.02-0.06 inch²/s (16-36 mm²/s) for Liebherr Hydraulik HVI (ISO VG 46) is between 89.6 °F and 143.6 °F (32 °C and 62 °C).

If the axial piston unit is operated within the optimum operating range of the hydraulic fluid and within the permitted operating conditions and limits for use, it will suffer little wear and be protected from temperature-dependent aging. At viscosities of < 0.017 inch²/s (11 mm²/s) (for Liebherr Hydraulik HVI (ISO VG 46) = 176 °F (80 °C)), it must be assumed that the service life of the hydraulic fluid will halve for every 10 °K of temperature increase.

If it is not possible to achieve the optimum operating range, a hydraulic fluid with a more suitable viscosity range should be selected or the hydraulic system must be preheated or cooled.

To avoid temperature shocks, a temperature difference of < 77 °F (25 °C) must be maintained between the hydraulic fluid and axial piston unit. This may be achieved by various methods, including maintaining a constant flow of fluid through all axial piston units in the hydraulic system.

2.5.1 Limits of use

Maximum values:

Maximum leakage oil temperature: 239 °F (115 °C).

CAUTION

You may assume that the highest temperature will occur in the drive shaft bearing area (rotary shaft lip seal and bearing), which experience shows is 10-15 °K higher than the leakage oil temperature.

Low temperatures: [\(for additional information see: 2.5.2 Low temperatures, Page 14\)](#)



Note

The usage limits of Liebherr hydraulic fluids are shown in the viscosity chart attached below, which enables you to make a sensible choice. [\(for additional information see: 2.5.6 Viscosity chart, Page 20\)](#)

2.5.2 Low temperatures

CAUTION

If temperatures fall below freezing, the sealing lip on the rotary shaft lip seal may freeze in damp conditions or frost. This may result in the sealing lip tearing when the axial piston unit is started. The danger of this must be prevented by preheating/thawing the rotary shaft lip seal/the shaft.



Note

In temperatures in which there is a risk of hardening caused by freezing, the friction heat may be sufficient to keep the seal elastic or to bring it to a functional condition quickly enough after the start of movement.

2 Technical data

Overview

Temperature [°F (°C)]	Phase	Viscosity [inch ² /s (mm ² /s)]	Note
< -58 °F (-50 °C)	Idle state	-*	No storage or operation permitted
< -40 °F (-40 °C)	Idle state	-**	No operation permitted, preheat to at least -40 °F (-40 °C), select appropriate hydraulic fluid

*) Idle state < -58 °F (-50 °C)

CAUTION

Temperatures < -58 °F (-50 °C) in the system = the axial piston unit must not be operated. Risk of damaging the sealing elements of the axial piston unit. Avoid temperatures < -58 °F (-50 °C).

***) Idle state < -40 °F (-40 °C)

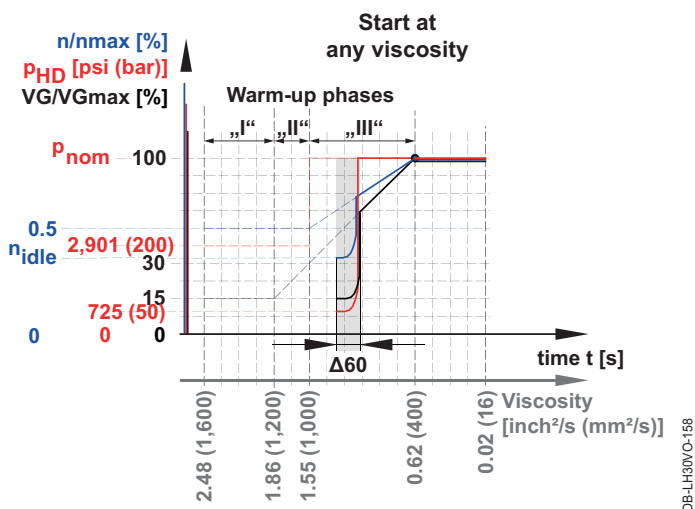
CAUTION

Temperatures < -40 °F (-40 °C) in the system = the axial piston unit must not be operated. The function of the sealing elements in the axial piston unit cannot be guaranteed at temperatures < -40 °F (-40 °C). Preheat the axial piston unit and tank to at least -40 °F (-40 °C) and use Liebherr Hydraulic Plus Arctic/Liebherr Hydraulic FFE 30 hydraulic fluid with a viscosity < 2.48 inch²/s (1,600 mm²/s). (for additional information see: 2.5.6 Viscosity chart, Page 20)

Regardless of the viscosity of < 2.48 inch²/s (1,600 mm²/s), the axial piston unit must be operated in the following conditions for at least 60 seconds before initiating a cold start, including the warm-up phases, or for a warm start:

- Operating pressure range: $p_{HD\ min} \leq p_{HD} \leq 725\ \text{psi}\ (50\ \text{bar})$
- Speed: $n_{\min} \leq n \leq 1,000\ \text{rpm}$, or idle speed of the drive motor*
- Displacement volume: $V_{g\ \min} \leq V_g \leq 15\ \% \text{ of } V_{g\ \max}$
- Do not initiate any movements of the equipment.

*) If you use a drive with higher speeds than required in the conditions (for example an electric motor), please contact Liebherr, stating the possible speed(s).



After the 60 seconds have elapsed, the viscosity must be calculated using the temperature values and the viscosity chart, a suitable warm-up phase must be selected and the axial piston unit must be operated within the defined time period and appropriate conditions: see Warm-up phases.

2 Technical data

Overview

Temperature [°F (°C)]	Phase	Viscosity [inch ² /s (mm ² /s)]	Note
> -40 °F (-40 °C)	Cold start	2.48-0.62 (1,600-400)	The current viscosity of the hydraulic fluid before start-up determines the type of start. It is a cold start if it is within a range of 2.48-0.62 inch ² /s (1,600-400 mm ² /s). The start of the warm-up phase must be selected according to the viscosity, and the other 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 20	Warm-up phase "I"	2.48-1.86 (1,600-1,200)	Observe the conditions and measures, see section Warm-up phase "I"
	Warm-up phase "II"	1.86-1.55 (1,200-1,000)	Observe the conditions and measures, see section Warm-up phase "II"
	Warm-up phase "III"	1.55-0.62 (1,000-400)	Observe the conditions and measures, see section Warm-up phase "III"
	Normal operation	0.62-0.02 (400-16)*	The axial piston unit can be operated at full load, see section Normal operation
	Optimum operating range	0.06-0.02 (36-16)	The axial piston unit can be operated at full load, see section Normal operation

*) At maximum leakage oil temperature, the viscosity must not drop below 0.012 inch²/s (8 mm²/s) (for a short period, i.e. < 3 minutes, it can be 0.011 inch²/s (7 mm²/s)).

2.5.3 Cold start with subsequent warm-up phases

CAUTION

Before a cold start, the current viscosity* must be determined based on the oil temperature (for example the tank temperature) to avoid damaging the axial piston unit through the hydraulic fluid having an excessive viscosity*. At a viscosity* > 2.48 inch²/s (1,600 mm²/s), the hydraulic system must be preheated.

The type and duration of the warm-up based on the cold start chart** for the calculated viscosity* must be complied with.

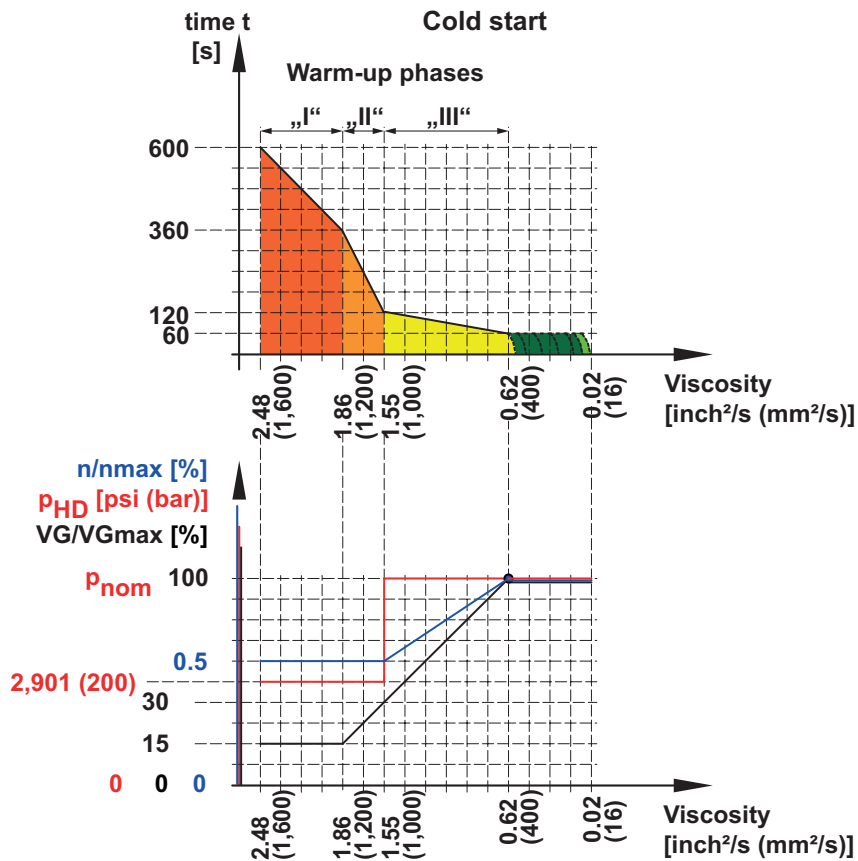
*) for additional information see: 2.5.6 Viscosity chart, Page 20

The following conditions apply:

- Viscosity: 2.48-1.86 inch²/s (1,600-1,200 mm²/s) = operate the axial piston unit for 600-360 s with the measures specified in warm-up phase "I".
- Viscosity: 1.86-1.55 inch²/s (1,200-1,000 mm²/s) = operate the axial piston unit for 360-120 s with the measures specified in warm-up phase "II".
- Viscosity: 1.55-0.62 inch²/s (1,000-400 mm²/s) = operate the axial piston unit for 120-60 s with the measures specified in warm-up phase "III".
- Viscosity: 0.62-0.02 inch²/s (400-16 mm²/s) = operate the axial piston unit for 60 s with the measures specified in "Warm start". That means that even at ≤ 0.62 inch²/s (400 mm²/s), the measures must be maintained for at least 60 seconds.

2 Technical data

***) Cold start chart



DB-LH30VO-157

2.5.4 Warm-up phases



Note

Depending on the current viscosity, the appropriate warm-up phase should be started after the cold start. In the subsequent warm-up phases, the operating parameters may be increased to enable the hydraulic system to be warmed up quickly.

Warm-up phase “ I ”

Condition:

- Viscosity: 2.48-1.86 inch²/s [1,600-1,200 mm²/s] = operate the axial piston unit using the measures listed below until a viscosity of 1.86 inch²/s [1,200 mm²/s] has been achieved.

Measures:

- Operating pressure range: p_{HD min} ≤ p_{HD Warm-up “I”} ≤ 2,901 psi (200 bar)
- Speed: n_{min} ≤ n_{Warm-up “I”} ≤ 50 % of n_{max}
- Displacement volume: V_{g min} ≤ V_{g Warm-up “I”} ≤ 15 % of V_{g max}

2 Technical data

Warm-up phase “II”

Condition:

- Viscosity: 1.86-1.55 inch²/s (1,200-1,000 mm²/s) = operate the axial piston unit using the measures listed below until a viscosity of 1.55 inch²/s (1,000 mm²/s) has been achieved.

Measures:

- Operating pressure range: $p_{HD \min} \leq p_{HD \text{ Warm-up "II"}} \leq 2,901 \text{ psi (200 bar)}$
- Speed: $n_{\min} \leq n_{\text{Warm-up "II"}} \leq 50 \% \text{ of } n_{\max}$
- Displacement volume: $V_{g \min} \leq V_{g \text{ Warm-up "II"}} \leq 15-30 \% \text{ of } V_{g \max}$

Warm-up phase “III”

Condition:

- Viscosity: 1.55-0.62 inch²/s (1,000-400 mm²/s) = operate the axial piston unit using the measures listed below until a viscosity of 0.62 inch²/s (400 mm²/s) has been achieved.

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: $V_{g \min} \leq V_{g \text{ Warm-up "III"}} \leq 30-100 \% \text{ of } V_{g \max}$

Warm start

Condition:

- Viscosity: 0.62-0.02 inch²/s (400-16 mm²/s) = operate the axial piston unit using the measures listed below for at least 60 seconds even at a viscosity < 0.62 inch²/s (400 mm²/s).

Measures:

- Operating pressure range: $p_{HD \min} \leq p_{HD} \leq 725 \text{ psi (50 bar)}$
- Speed: $n_{\min} \leq n \leq 1,000 \text{ rpm}$, 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: 0.02-0.06 inch²/s (16-36 mm²/s)

At the maximum leakage oil temperature, the viscosity must not drop below 0.012 inch²/s (8 mm²/s) (for a short period, i.e. < 3 minutes, it can be 0.011 inch²/s (7 mm²/s)).

Note

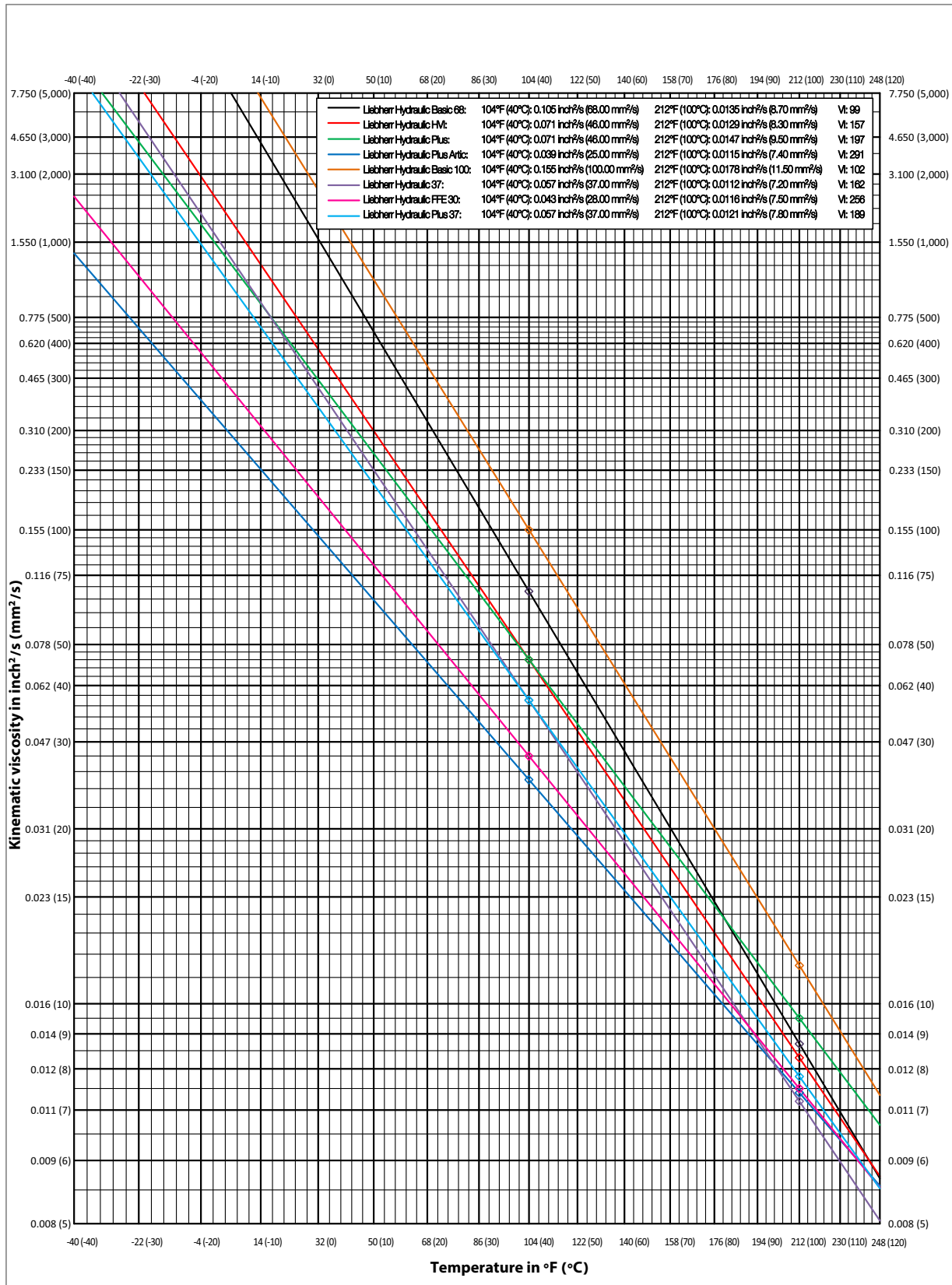
The axial piston unit can be operated at full load in the viscosity range of 0.62-0.012 inch²/s (400-8 mm²/s).



- 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

Rotary shaft lip seals are special sealing elements that allow a specific housing pressure. To ensure that the tribological system works optimally, the operating conditions must be met.

The sealing edge temperature varies due to the following factors in the housing:

- Circumferential speed
- Hydraulic fluid temperature
- Lubricant
- Pressure build-up

The sealing edge temperature could be 68 °F to 104 °F (20 °C to 40 °C) above the leakage oil temperature of a hydraulic axial piston unit.

3 Actuation and control type

3.1 Control types

L	H	3	0	V	0		/		20	V					0	00		000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14.	15	16	17	18	19	20	21

The following applies to all control types:

DANGER

The spring-loaded reset in the control valve is not a safety device!



Contamination in the hydraulic system, such as abrasion or residual dirt from equipment or system components, can cause blockages in undefined points of various control components. Under certain circumstances, it may no longer be possible to implement the machine operator's settings. The implementation of a safety device, e.g., for an emergency stop, is the responsibility of the device or system manufacturer.

DANGER

The control valve is not an overload safety device!



The implementation of an overload safety device, e.g., a pressure limiting valve, is the responsibility of the device or system manufacturer. Pressure limiting valves are included in our portfolio and can be ordered separately; please add your requirements in free text.

Note



For each control type or function, only one nominal size is illustrated, typically based on the nominal size 045. Special applications and custom designs are not described in this section. Always use the information from the supplied installation drawing or contact Liebherr. The following modular control types can be ordered for the LH30VO model series:

3.1.1 Mechanical-hydraulic controls

- DA- control, [see chapter 3.2.1](#)
- DF-DA- control, [see chapter 3.2.2](#)
- LSODA- control, [see chapter 3.2.3](#)
- LS2DA- control, [see chapter 3.2.4](#)
- LR- control, [see chapter 3.2.5](#)

3.1.2 Electro-hydraulic controls

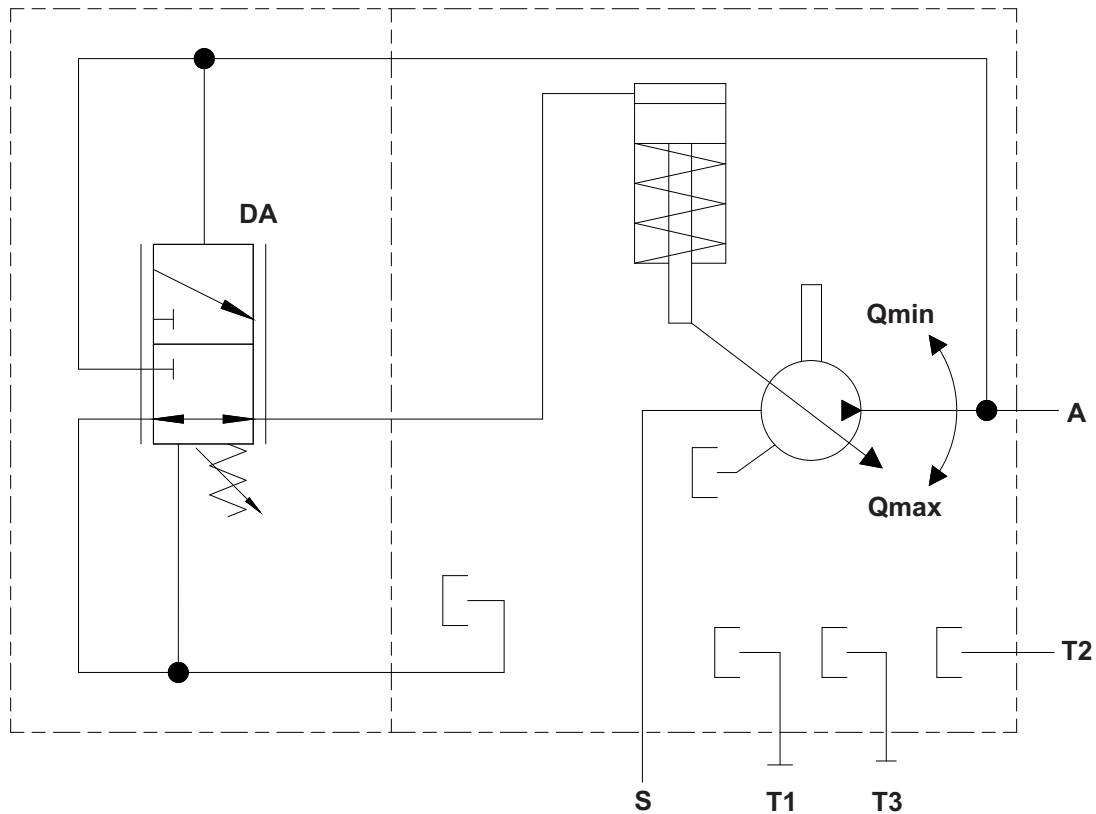
- DE1/3/5/7 control, rising characteristic, [see chapter 3.2.6](#)
- DE2/4/6/8 control, falling characteristic, [see chapter 3.2.7](#)
- LSODE1/3/5/7 control, rising characteristic, [see chapter 3.2.8](#)
- LS2DE1/3/5/7 control, rising characteristic, [see chapter 3.2.9](#)
- LSODE2/4/6/8 control, falling characteristic, [see chapter 3.2.10](#)
- LS2DE2/4/6/8 control, falling characteristic, [see chapter 3.2.11](#)
- VE1/3/5/7 control, rising characteristic, [see chapter 3.2.12](#)
- VK1/3/5/7 control, rising characteristic, [see chapter 3.2.13](#)
- VO1/3/5/7 control, rising characteristic, [see chapter 3.2.14](#)

Additional control types on request.

3 Actuation and control type

3.2 Standard hydraulic diagrams

3.2.1 DA- - Pressure cut-off

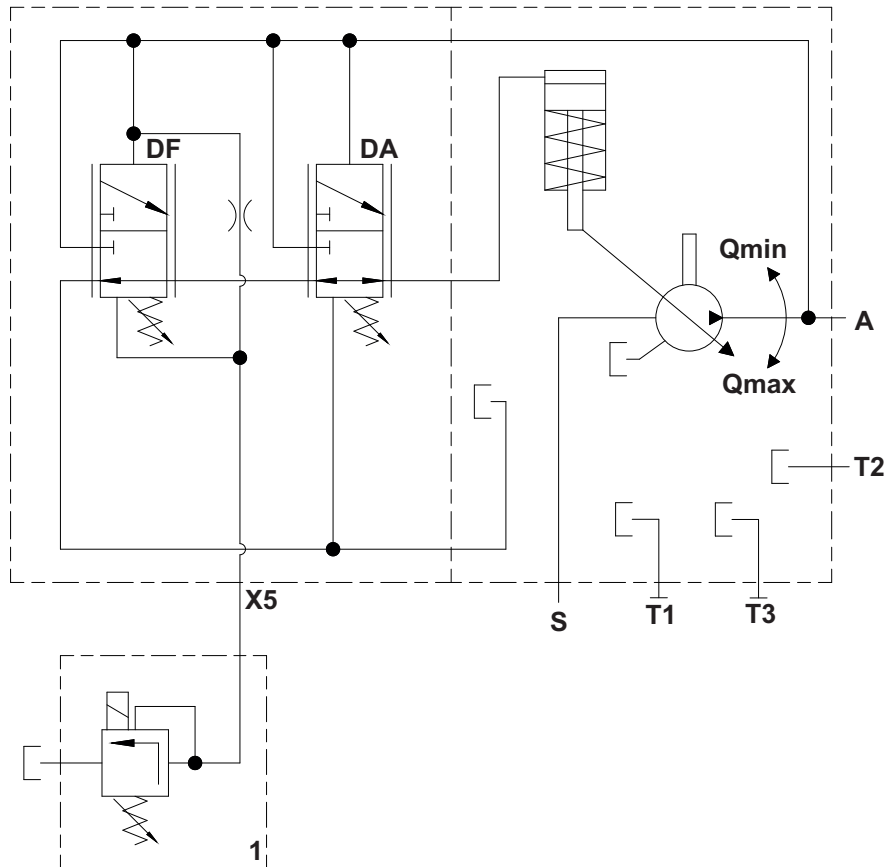


DA-
DB-LH30V0-056

A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	-	-

3 Actuation and control type

3.2.2 DF-DA- - Hydraulic pressure control, remotely controllable with pressure cut-off



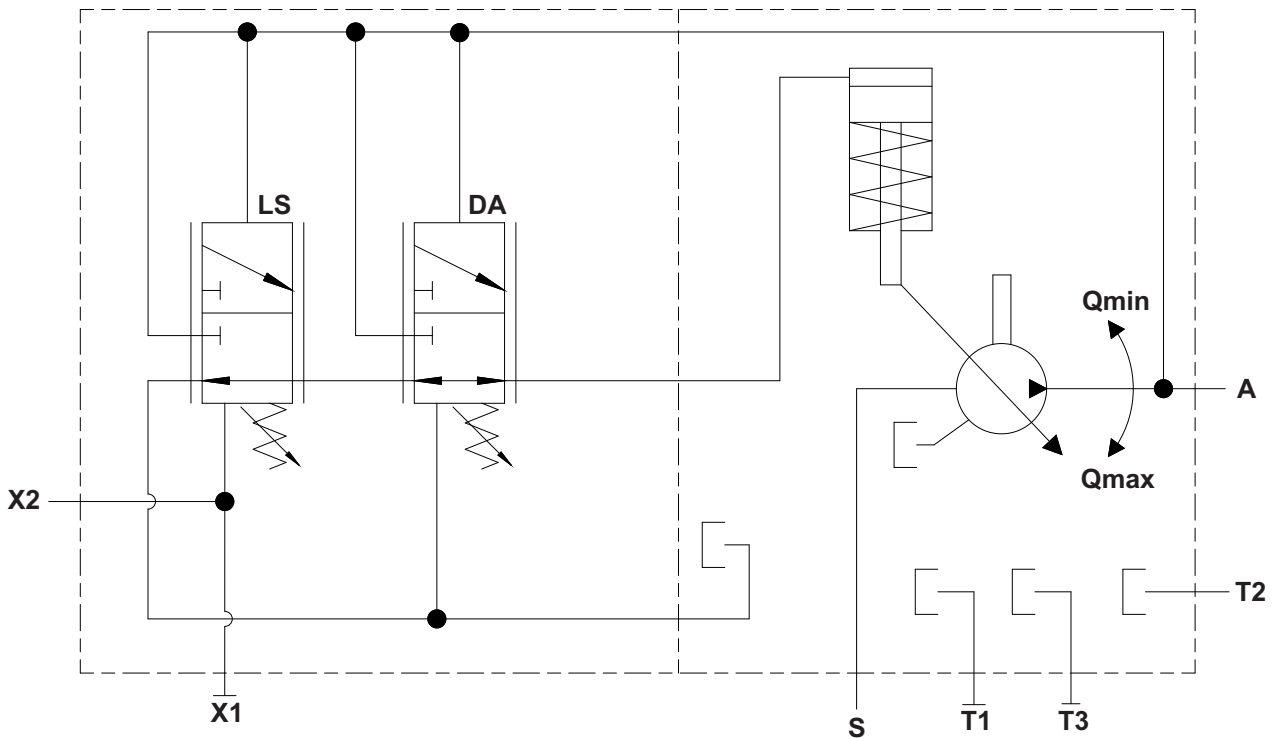
DF-DA-

DB-LH30VO-036

A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	X5	DF pressure ISO 9974-1-M12x1.5
1	Pressure limiting valve not included in the scope of delivery	-	-

3 Actuation and control type

3.2.3 LS0DA- - Load sensing + pressure cut-off



LS0DA-

DB-LH30VO-003

A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	X1, X2	LS pressure ISO 9974-1

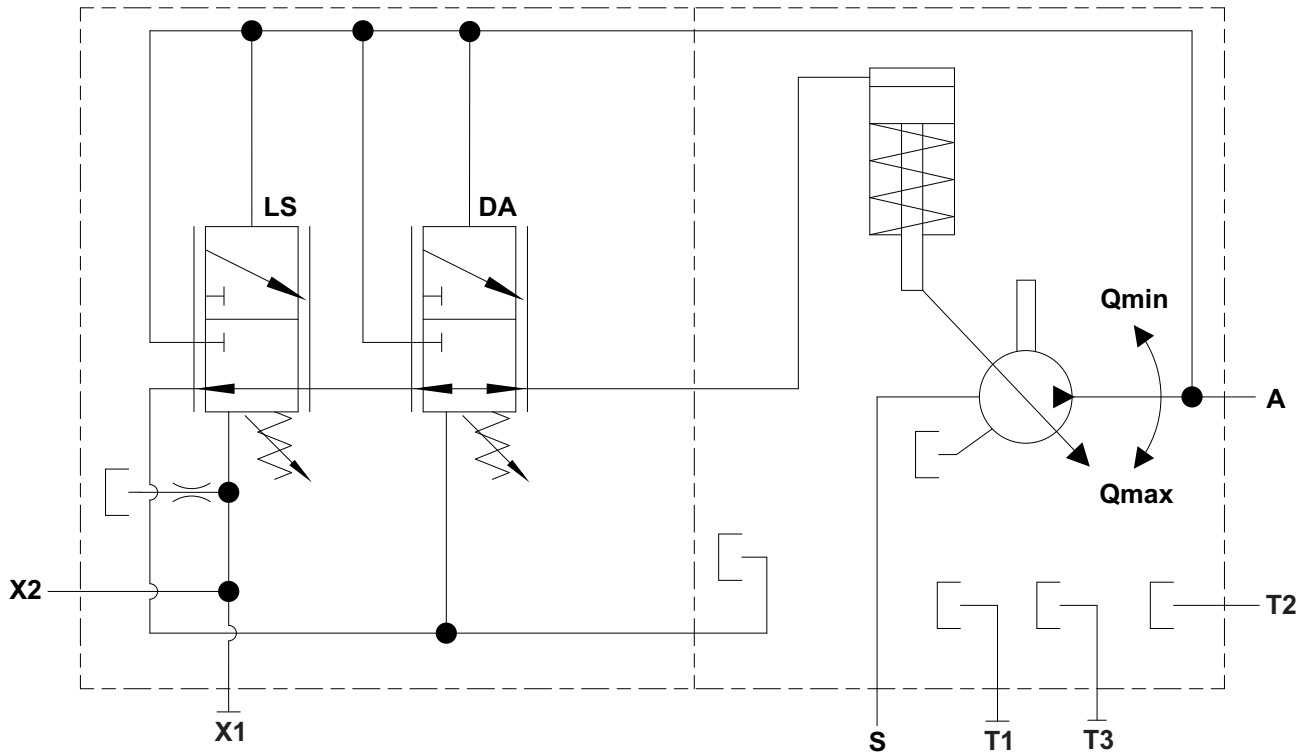


Note

The orifice required for the LS function to generate the pressure drop is not included in the axial piston unit's scope of delivery.

3 Actuation and control type

3.2.4 LS2DA- - Load sensing (with vent nozzle in control) + pressure cut-off



LS2DA- DB-LH30VO-167

A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	X1, X2	LS pressure ISO 9974-1

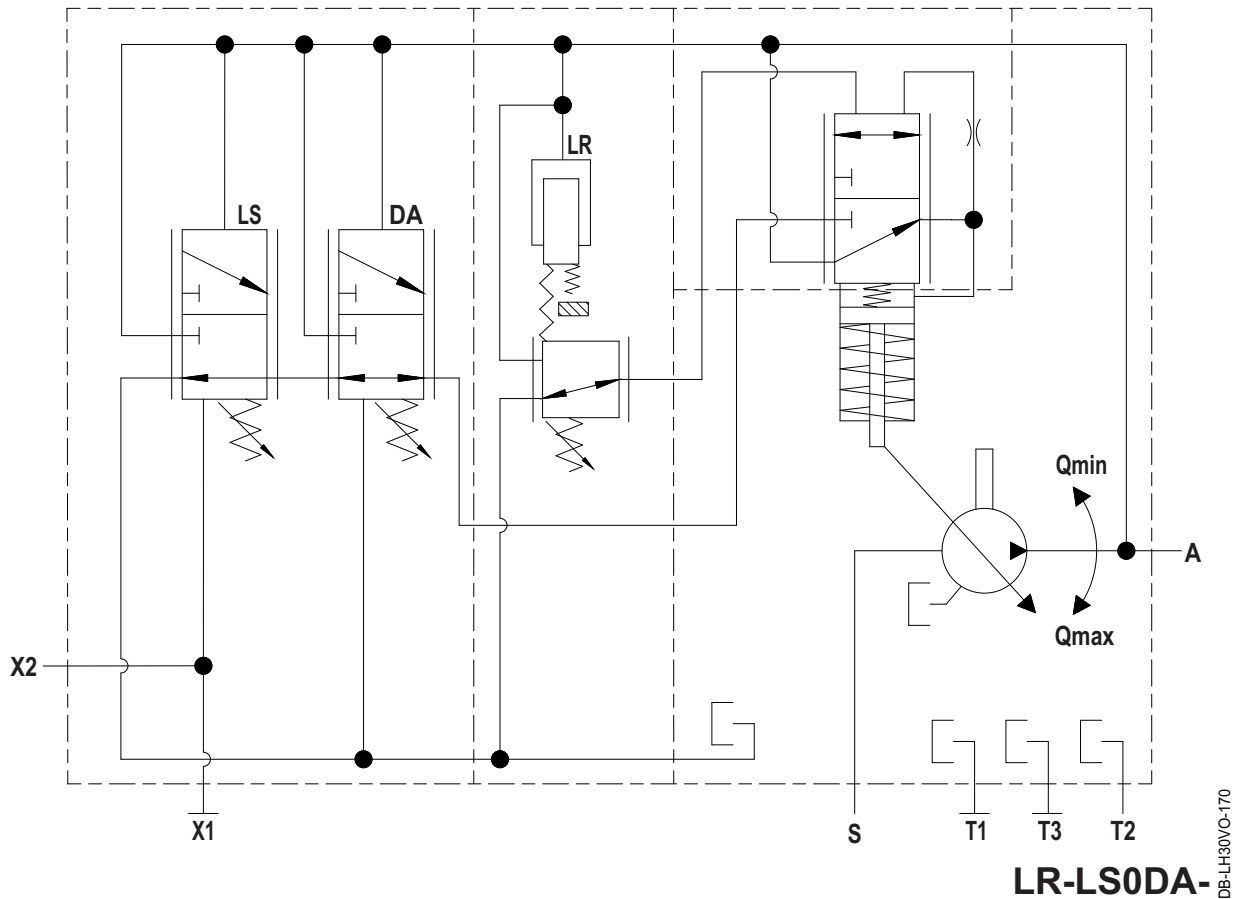


Note

The orifice required for the LS function to generate the pressure drop is not included in the axial piston unit's scope of delivery.

3 Actuation and control type

3.2.5 LR- - Power control



A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	X1, X2	LS pressure ISO 9974-1

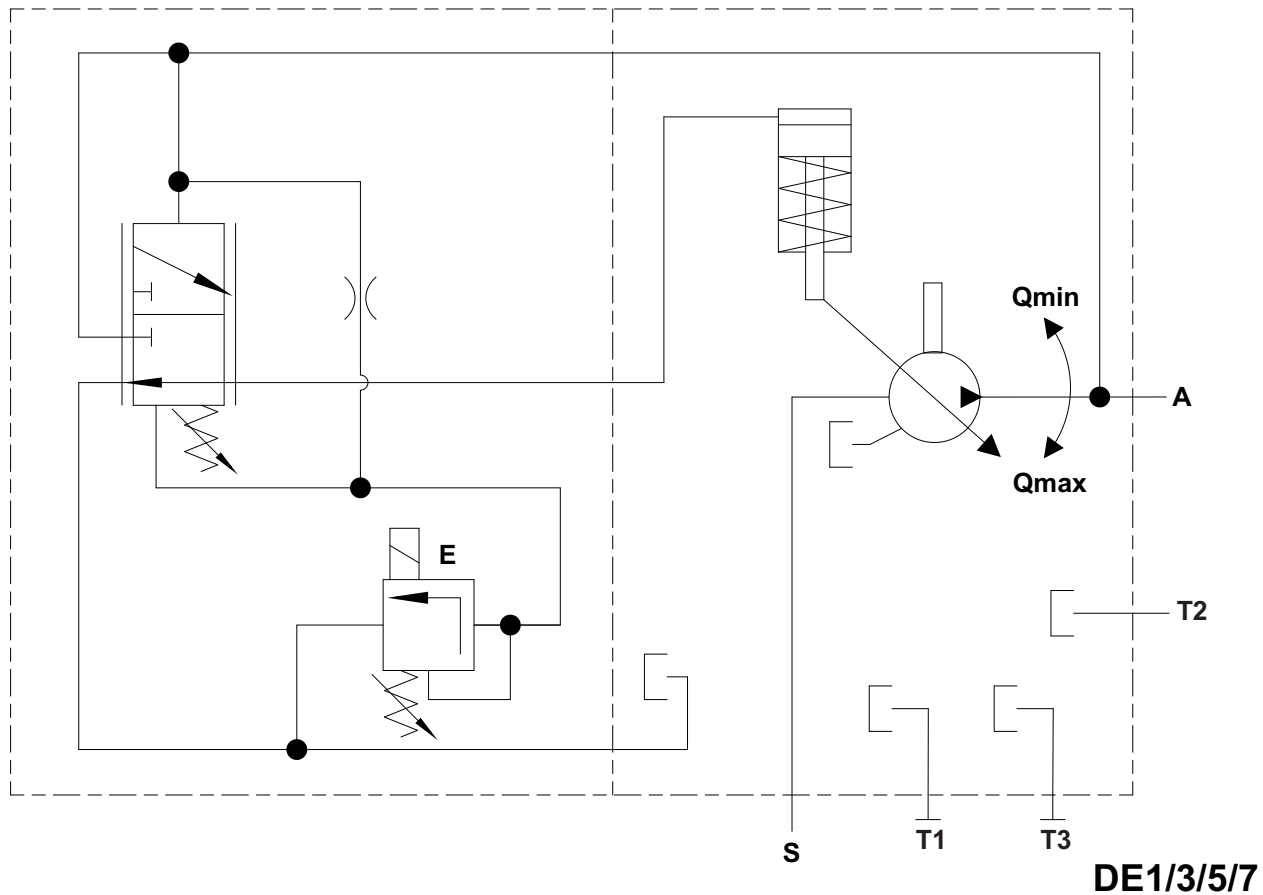


Note

The orifice required for the LS function to generate the pressure drop is not included in the axial piston unit's scope of delivery.

3 Actuation and control type

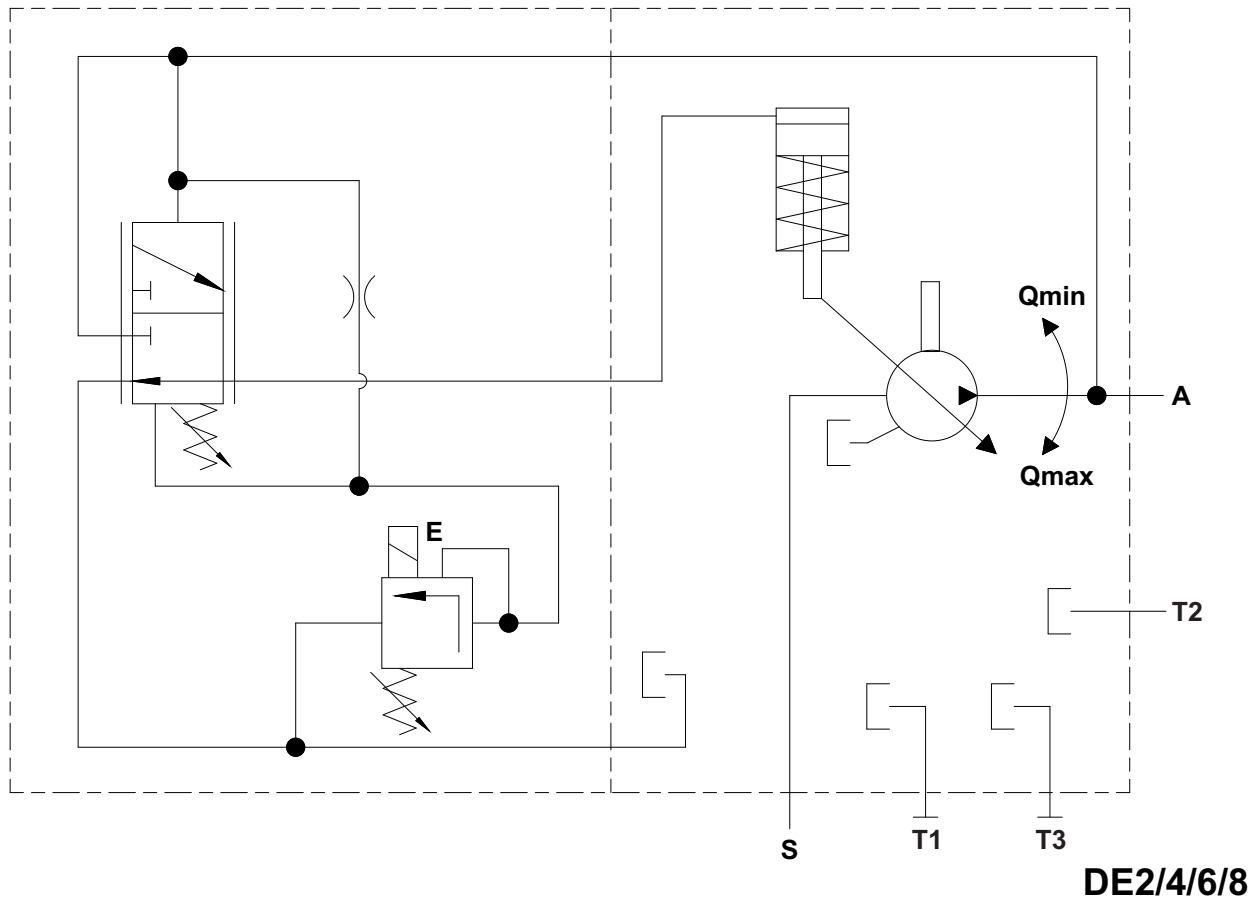
3.2.6 DE_ - Electrical pressure control, rising characteristic (1/3/5/7)



A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	E	_1 / _3: Deutsch plug DT04-2P 2-pin _5 / _7: AMP plug Junior Timer 2-pin

3 Actuation and control type

3.2.7 DE_ - Electrical pressure control, falling characteristic (2/4/6/8)

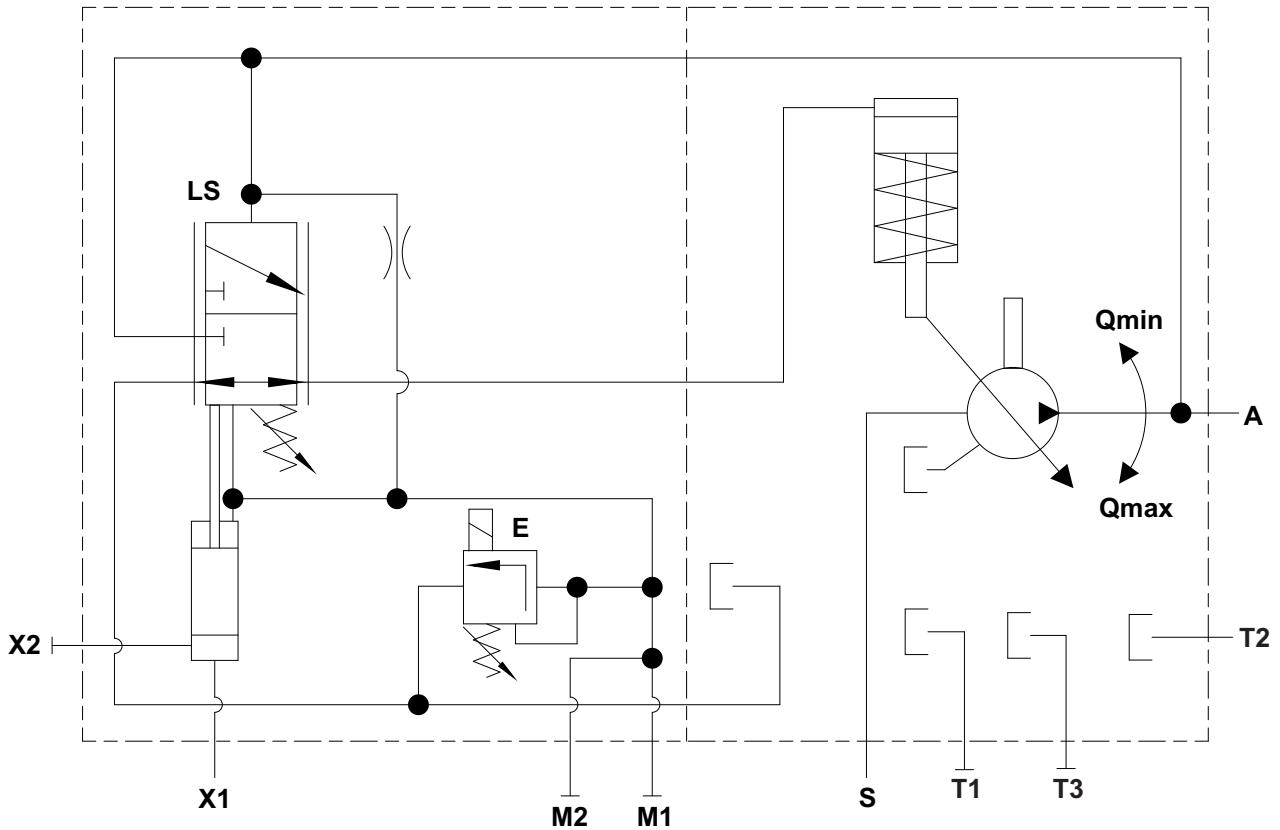


DB-LH30VO-001

A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	E	_2 / _4: Deutsch plug DT04-2P 2-pin _6 / _8: AMP plug Junior Timer 2-pin

3 Actuation and control type

3.2.8 LSODE_ - Load sensing + electrical pressure control, rising characteristic (1/3/5/7)



LSODE1/3/5/7

DB-LH30VO-061

A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	X1, X2	LS pressure ISO 9974-1
E	1 / _3: Deutsch plug DT04-2P 2-pin _5 / _7: AMP plug Junior Timer 2-pin	-	-

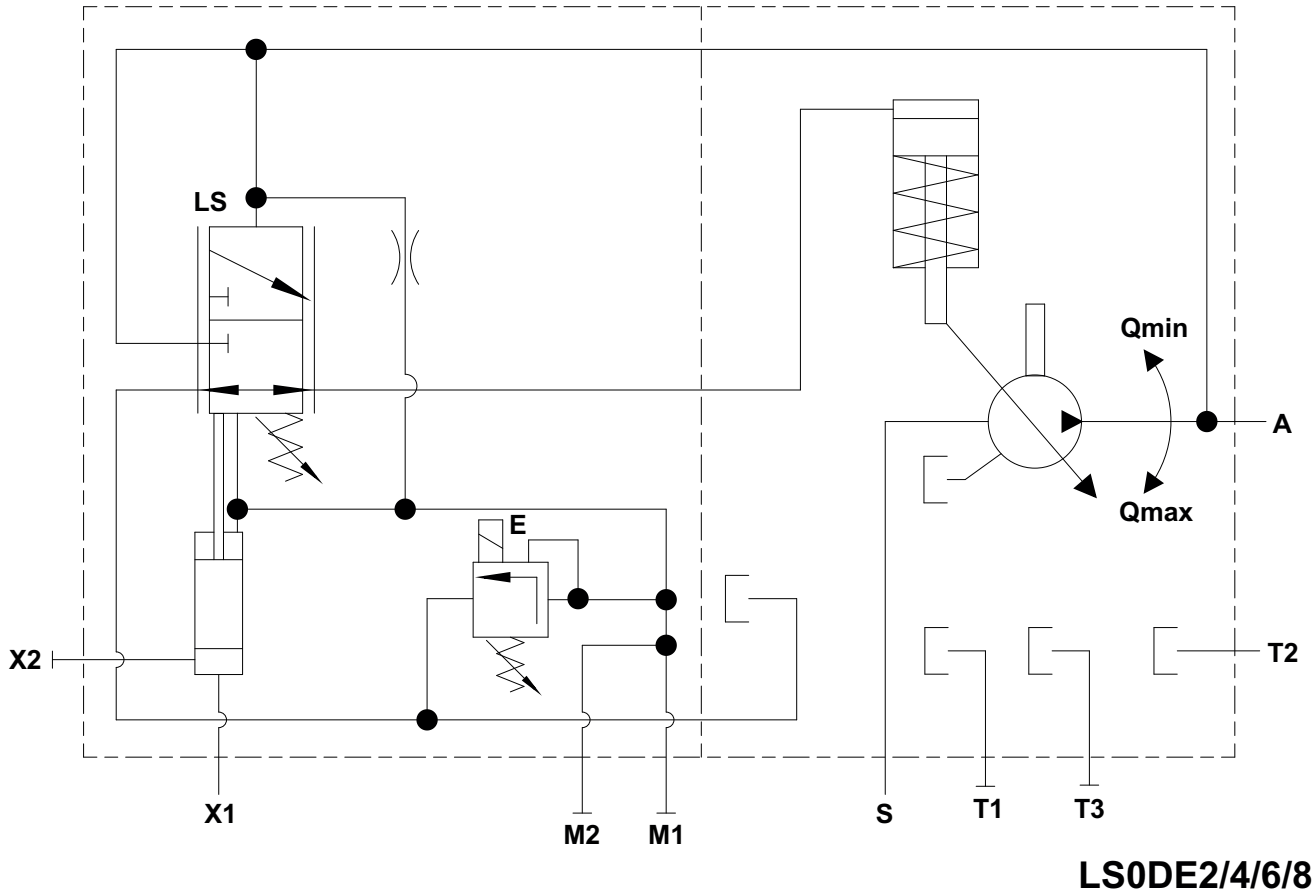


Note

The orifice required for the LS function to generate the pressure drop is not included in the axial piston unit's scope of delivery.

3 Actuation and control type

3.2.10 LS0DE_ - Load sensing + electrical pressure control, falling characteristic (2/4/6/8)



DB-LH30VO-060

A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	X1, X2	LS pressure ISO 9974-1
E	_2 / _4: Deutsch plug DT04-2P 2-pin _6 / _8: AMP plug Junior Timer 2-pin	-	-

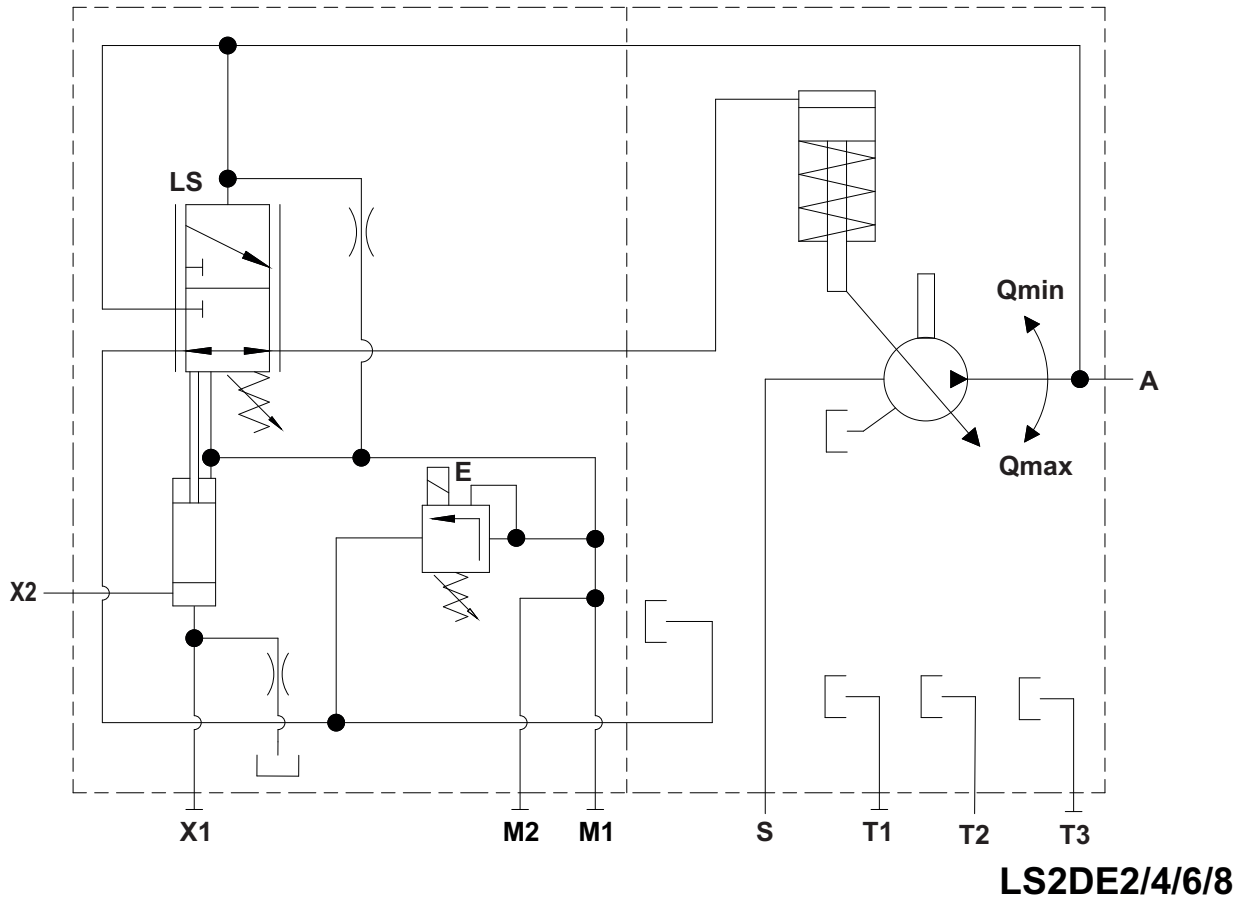


Note

The orifice required for the LS function to generate the pressure drop is not included in the axial piston unit's scope of delivery.

3 Actuation and control type

3.2.11 LS2DE_ - Load sensing (with vent nozzle in control) + electrical pressure control, falling characteristic (2/4/6/8)



A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	X1, X2	LS pressure ISO 9974-1
E	_2 / _4: Deutsch plug DT04-2P 2-pin _6 / _8: AMP plug Junior Timer 2-pin	-	-

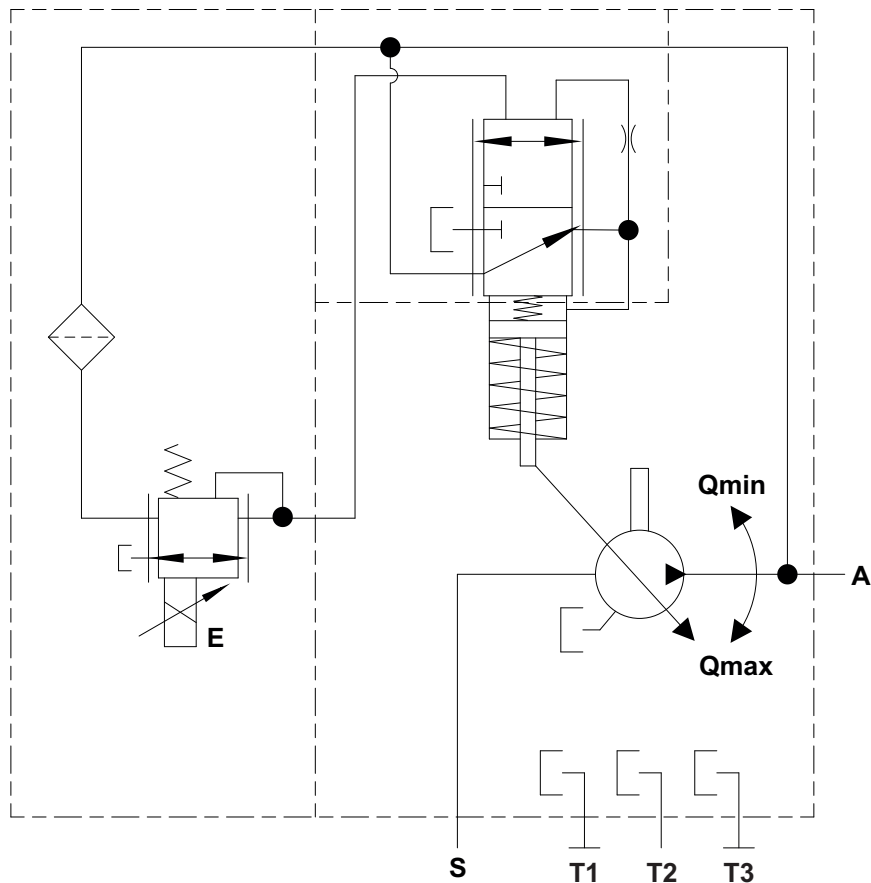


Note

The orifice required for the LS function to generate the pressure drop is not included in the axial piston unit's scope of delivery.

3 Actuation and control type

3.2.12 VE_ - Electrical volume control, rising characteristic (VE1/3/5/7)



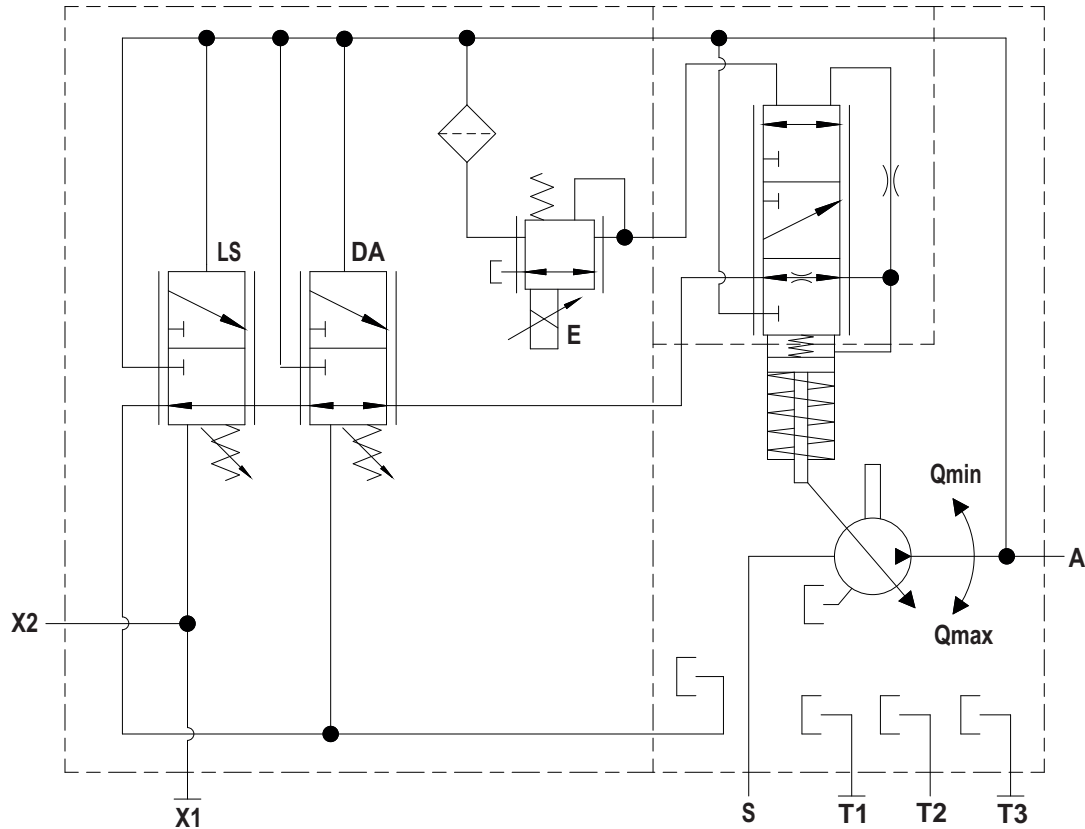
VE1/3/5/7

DB-LH30VO-058

A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	E	_1 / _3: Deutsch plug DT04-2P 2-pin _5 / _7: AMP plug Junior Timer 2-pin

3 Actuation and control type

3.2.13 VK_ - Electrical volume control with jump function at signal loss, rising characteristic (1/3/5/7)



VK1/3/5/7LS0DA-

DB-LH30VO-171

A	Working connection ISO 6162-1/-2 (SAE J518)	E	_1 / _3: Deutsch plug DT04-2P 2-pin _5 / _7: AMP plug Junior Timer 2-pin
S	Suction port ISO 6162-1/-2 (SAE J518)	X1, X2	LS pressure ISO 9974-1
T1, T2, T3	Leakage oil connections ISO 11926	-	-

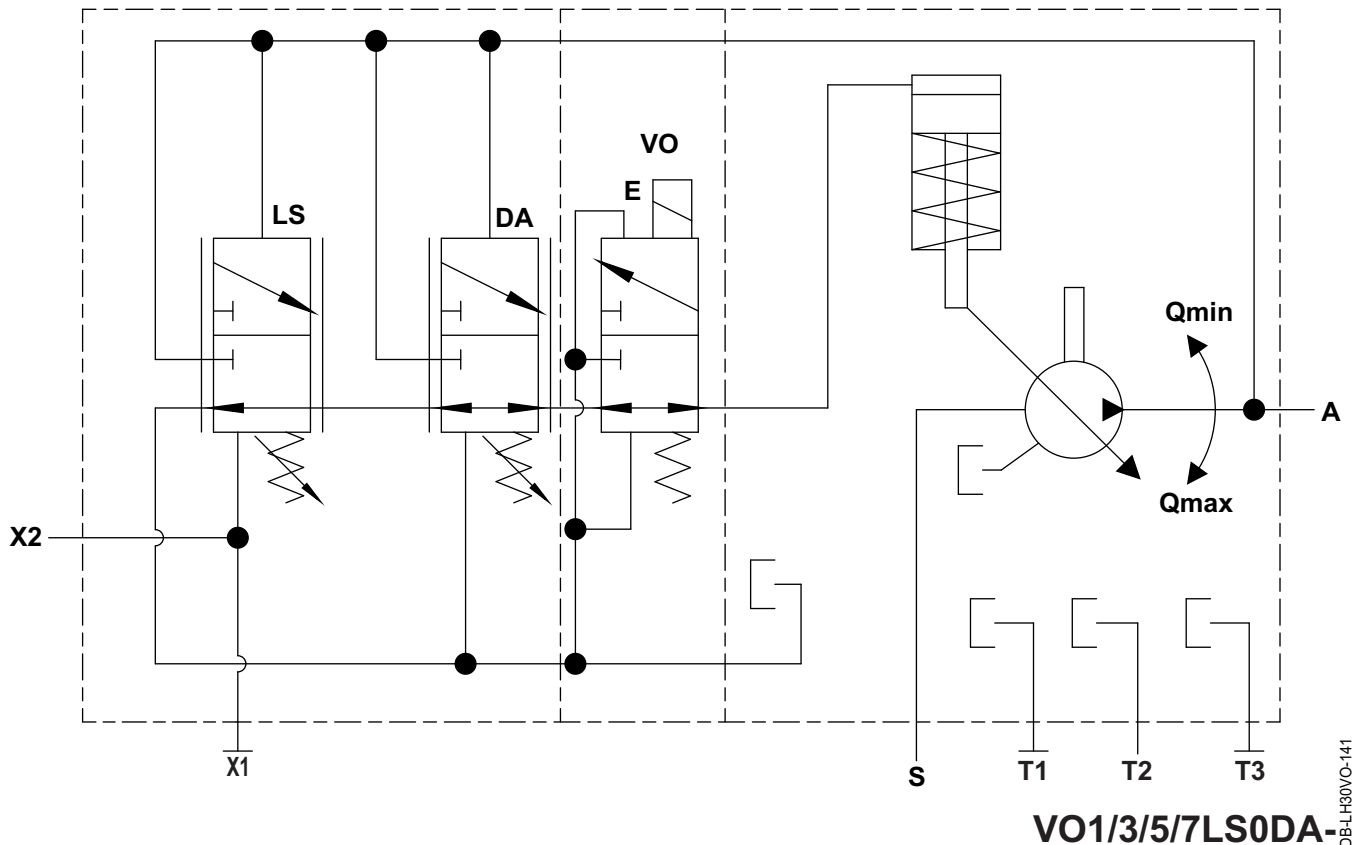


Note

The orifice required for the LS function to generate the pressure drop is not included in the axial piston unit's scope of delivery.

3 Actuation and control type

3.2.14 VO_ - Retarder (1/3/5/7)



A	Working connection ISO 6162-1/-2 (SAE J518)	T1, T2, T3	Leakage oil connections ISO 11926
S	Suction port ISO 6162-1/-2 (SAE J518)	X1, X2	LS pressure ISO 9974-1
E	_1 / _3: Deutsch plug DT04-2P 2-pin _5 / _7: AMP plug Junior Timer 2-pin	-	-

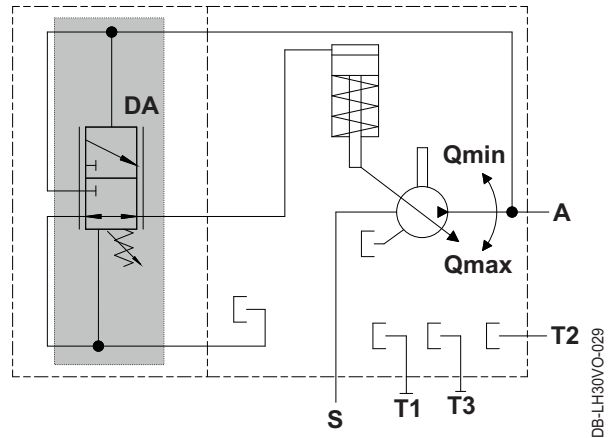
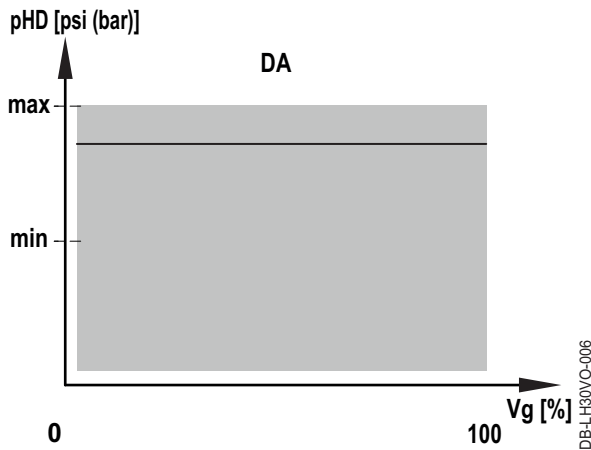
3 Actuation and control type

3.3 Control functions

- DA- function / pressure cut-off, [see chapter 3.3.1](#)
- DF- function / hydraulic pressure control, remotely controllable, [see chapter 3.3.2](#)
- LS0- function / load sensing without vent nozzle in the control, [see chapter 3.3.3](#)
- LS2- function / load sensing with vent nozzle in the control, [see chapter 3.3.4](#)
- LR- function, power control, [see chapter 3.3.5](#)
- DE1/3/5/7- function / pressure control, rising characteristic, [see chapter 3.3.6](#)
- DE2/4/6/8- function / pressure control, falling characteristic, [see chapter 3.3.7](#)
- VE1/3/5/7- function, volume flow control, electrically proportional, rising characteristic, [see chapter 3.3.8](#)
- VK1/3/5/7- function, volume flow control, electrically proportional, rising characteristic, [see chapter 3.3.9](#)
- VO1/3/5/7- function, electrical volume control, retarder, [see chapter 3.3.10](#)

3.3.1 DA- function

Characteristic curve



Additional technical data

DA adjustment range	2,176-4,061 psi (150-280 bar)*
---------------------	-----------------------------------

*) depending on requirement

The DA pressure cut-off limits the maximum high pressure of the axial piston unit in the control range.

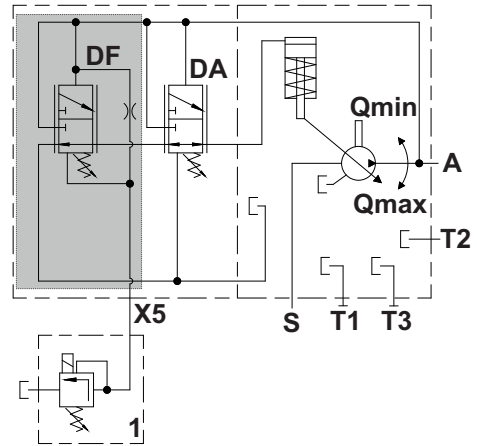
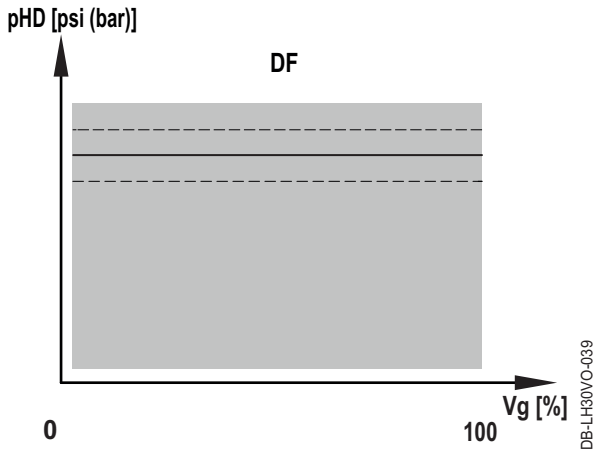
When a fixed, preset high pressure value pHD is reached, the axial piston unit swings in the direction of $V_{g \min}$ and protects the hydraulic system against damage and overload. It swings in the direction of $V_{g \min}$ until the volume flow that is generated matches the fixed, preset high pressure value pHD.

Once the system pressure drops below the fixed, preset high pressure value pHD, the axial piston unit swings up towards $V_{g \max}$.

3 Actuation and control type

3.3.2 DF- function

Characteristic curve



Additional technical data

Adjustment range Δp (pHDA -pX5)	203-363 psi (14-25 bar)*
---	-----------------------------

*) depending on requirement

The DF function can only be ordered in combination with the DA function for safety reasons.

The remote control can limit the system pressure via an external pressure limiting valve¹ (No. 1). The DF- pressure control provides the required pressure specification.

Any system pressure below the fixed DA- cut-off pressure can be set as the sum of the set pressure value of the external pressure limiting valve¹ at X5 and the Δp of the DF pressure control.

(for additional information see: [3.3.1 DA- function, Page 36](#))

The Δp of the DF pressure control must not exceed 1,450 psi (100 bar).

If the X5 connection is relieved towards the tank, the pump operates in standby mode. This mode is useful for ramping up the axial piston unit from its idle state.

¹) not included in the scope of delivery



Note

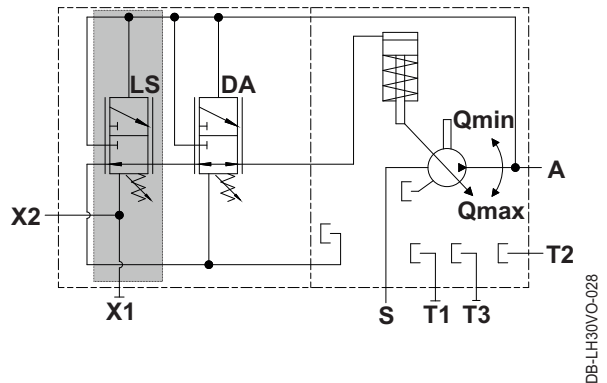
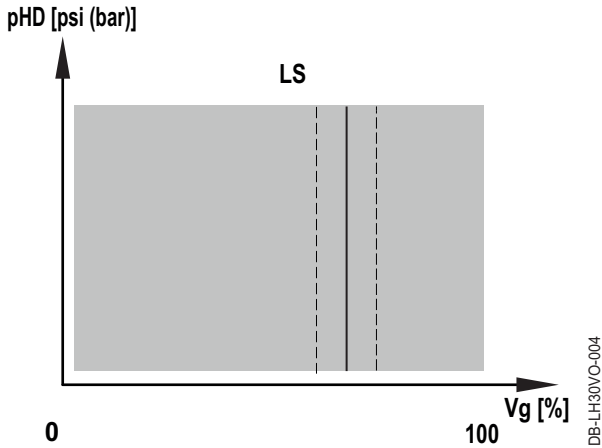
The DF function can only be ordered in combination with the pressure cut-off (DA-).
The DF-DA- control can be combined with other control functions.

(for additional information see: [1 Type code, Page 3](#))

3 Actuation and control type

3.3.3 LS0- function

Characteristic curve



Additional technical data

LS pressure adjustment range	Δp	203-363 psi* (14-25 bar*)
------------------------------	------------	---------------------------

*) depending on requirement

Load sensing systems, such as in an LS0DA control, can be used to further improve the dynamic properties of the control system for variable displacement axial piston pumps. By adjusting the volume flow to the current requirements of one or more consumers, the LS0 function is designed as a load pressure sensing system.

At an external adjustable orifice plate, the pressure difference Δp between the highest LS pressure occurring in the system (controlled by shuttle valves in case of several consumers) and the high pressure pHD is compared and kept in equilibrium by the pressure compensator (LS axis) by adapting to the demand from the consumers.

The Δp LS depends on spring force and is therefore adjustable and must not exceed 1,450 psi (100 bar).

If there is no demand from the consumers, the axial piston unit adjusts towards $V_{g \min}$ until the value reaches the set Δp LS.

As consumer demand increases (opening the orifice), the axial piston unit adjusts towards $V_{g \max}$ until the working pressure pHD reaches the sum of the consumer demand-dependent LS pressure + Δp .



Note

The LS function can only be ordered in combination with the pressure cut-off (DA-) or the electrical pressure control DE_. The LS_DA- / LS_DE_ control can be combined with other control functions. [\(for additional information see: 1 Type code, Page 3\)](#)

CAUTION

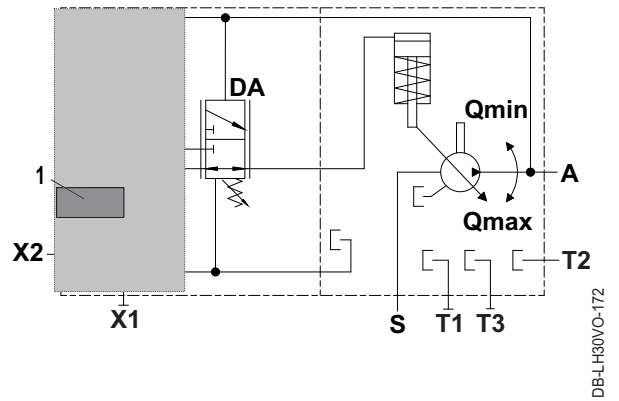
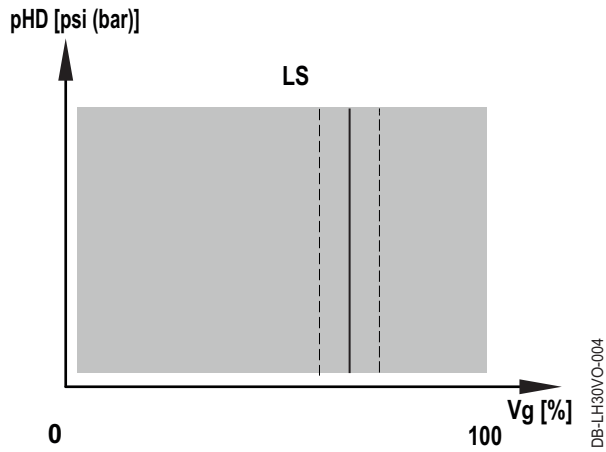
The LS_-DE control is designed so that the LS pressure can override the DE pressure. This means that the DE_ function does not limit the pressure of the pump if the LS demand is higher than the DE demand.

When using the LS_ function in the LS_-DE control, ensure that the LS pressure is limited on the system (LS pressure $_{\max}$ (pX2) at the control inlet = 3,771 psi (260 bar)) and that the pump is limited at high pressure.

3 Actuation and control type

3.3.4 LS2- function

Characteristic curve



The vent nozzle 1 in the LS2- function is designed to relieve the control pressure at X1 as the working pressure falls.

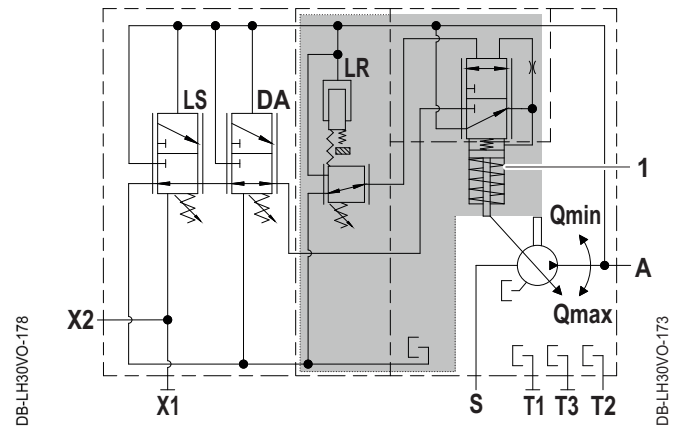
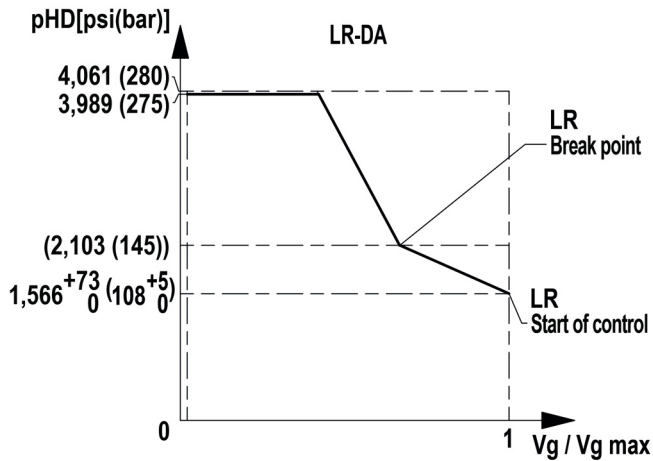
The vent nozzle is required if there is no venting facility in the main control block of the device/system.

3 Actuation and control type

3.3.5 LR- function

The swivel angle is controlled as a function of the load-dependent operating pressure pHD so that the maximum torque permitted by the drive motor is not exceeded.

Characteristic curve



As the operating pressure pHD increases, the axial piston unit swings back towards $V_{g \min}$ and vice versa, in keeping with the dual-spring characteristic curve in the volume flow.

A minimum pressure > 145 psi (10 bar) is required for this to function.

Below the dual-spring characteristic curve, the axial piston unit swings towards $V_{g \max}$.



Note

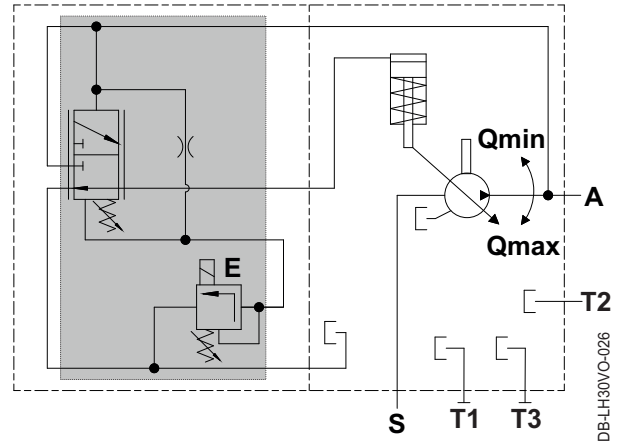
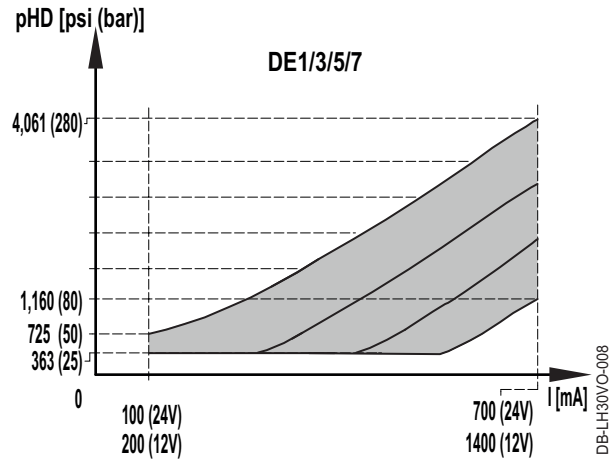
Liebherr recommends that the LR- function is combined with a pressure cut-off.
(for additional information see: [1 Type code, Page 3](#))

When placing your order, state the high pressure at maximum swivel angle (start of control) in pHD [psi (bar)].

3 Actuation and control type

3.3.6 DE- function, rising characteristic (DE1/3/5/7)

Characteristic curve



Additional technical data

Resulting start of control	max	725 psi (50 bar)
	min	363 psi (25 bar)
Adjustment range, end of control	max	4,061 psi (280 bar)
	min	1,160 psi (80 bar)



Note

Technical data of proportional magnet,
 (for additional information see: [3.4.1 Proportional magnet \(DE_ / LS_DE_ / VO_\)](#), Page 46)

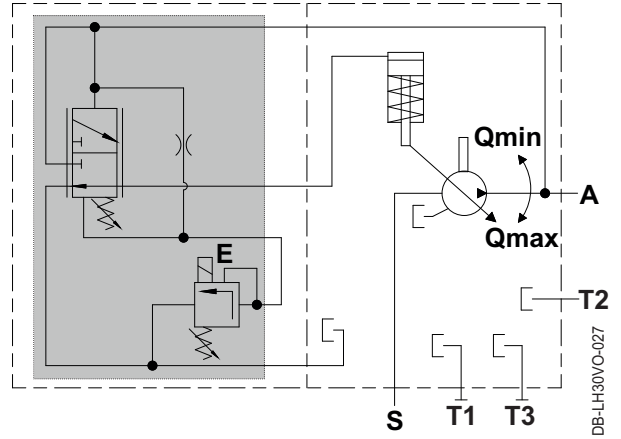
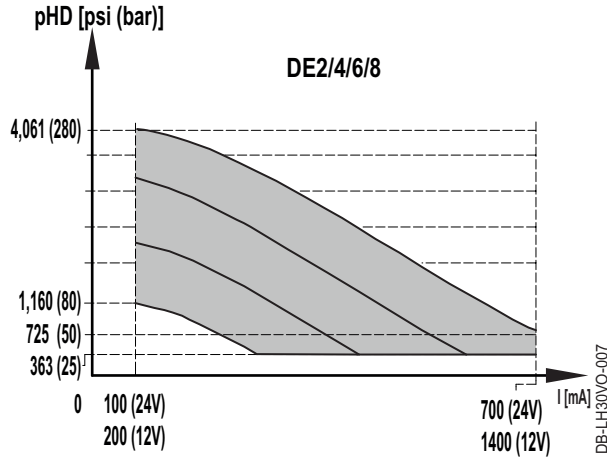
The DE- function is a pressure control where the pressure level can be continuously adjusted by a defined, variable magnetic field on the proportional magnet.

The axial piston pump supplies as much hydraulic fluid as necessary to maintain the required pressure. If the magnet has no current, the axial piston pump maintains the minimum pressure (see characteristic curve).

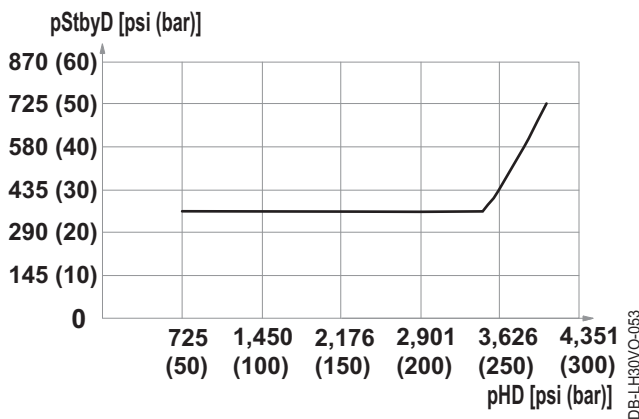
3 Actuation and control type

3.3.7 DE- function, falling characteristic (DE2/4/6/8)

Characteristic curve



Dependence of standby pressure on high pressure (at I_{max})



Additional technical data

Adjustment range, start of control	max	4,061 psi (280 bar)
	min	1,160 psi (80 bar)
Resulting end of control	max	725 psi (50 bar)
	min	363 psi (25 bar)

*) see chart



Note

Technical data of proportional magnet, [\(for additional information see: 3.4.1 Proportional magnet \(DE_ / LS_DE_ / VO_\), Page 46\)](#)

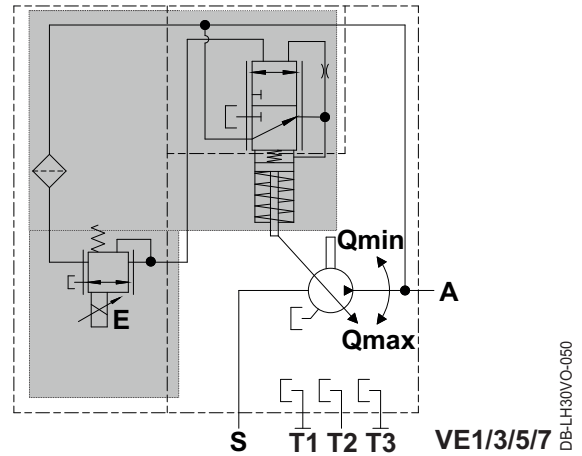
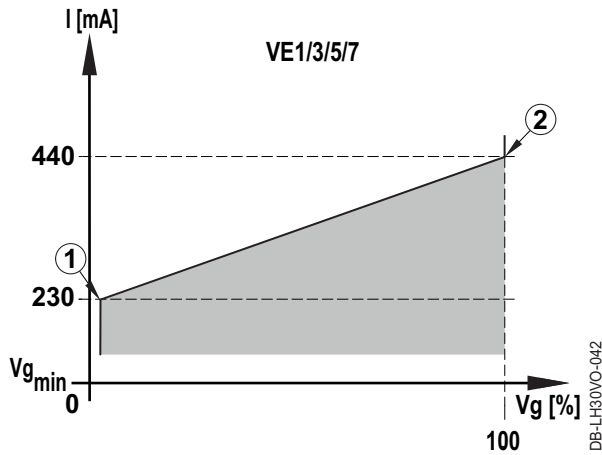
The DE- function is a pressure control where the pressure level can be continuously adjusted by a defined, variable magnetic field on the proportional magnet.

The axial piston pump supplies as much hydraulic fluid as necessary to maintain the required pressure. If the magnet has no current, the axial piston pump maintains the maximum pressure (see characteristic curve). (As a failsafe for fan use, for example)

3 Actuation and control type

3.3.8 VE- function, rising characteristic

Characteristic curve



Additional technical data



Note

Technical data of pressure control valve,
(for additional information see: [3.4.2 Pressure control valve \(VE_ / VK_\)](#), Page 47)

For the VE function, the displacement volume V_g is continuously adjusted by a proportional magnet regardless of the axial piston unit's high pressure.

The VE function is designed with a positive characteristic curve. (VE1/3/5/7)

At a minimum pressure of > 145 psi (> 10 bar) with a minimum swivel angle $V_{g \min}$ and a control current $I < 230$ mA (start of control 1), the axial piston unit swings to $V_{g \min}$ and can then be swung to any angle as the control current I (> 230 mA, start of control 1) increases.

$V_{g \max}$ is reached at control current $I = 440$ mA (end of control 2).



Note

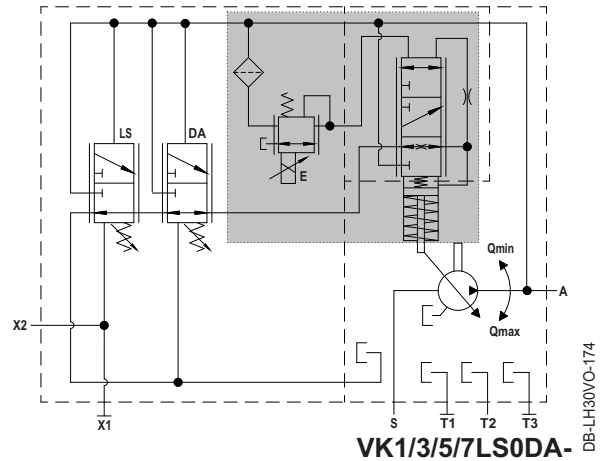
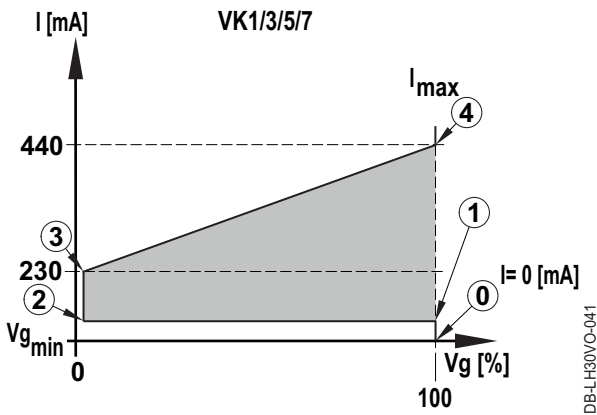
It is not possible to adjust the start of control. The current values may vary due to the tolerances.

The VE function can be used with a superordinate DA function; in other words, the control current-dependent VE function is only executed below the value set for pressure cut-off up to end of control 2.

3 Actuation and control type

3.3.9 VK- function, rising characteristic

Characteristic curve



Additional technical data



Note

Technical data of pressure control valve, (for additional information see: 3.4.2 Pressure control valve (VE_ / VK_), Page 47)

Based on the VE function (Nos. 2-4) with a positive characteristic curve (VE1/3/5/7), the VK function additionally features a jump function that allows the axial piston unit to swing to $V_{g\ max}$ in the event of a missing or faulty actuation signal, for example, in the event of a cable break.

The proportional magnet must always be provided with a control current $I > 230\ \text{mA}$ (No. 2) to maintain the control function.

If the control current I drops below 230 mA due to an external influence (no or faulty actuation signal), the axial piston unit swings to $V_{g\ max}$.

When the machine is restarted or after the jump function is activated (at a drop below control current $I < 230\ \text{mA}$), the proportional magnet must be supplied with a control current of $I_{\max} > 440\ \text{mA}$ (No. 4) momentarily before it can again swing the axial piston unit to a given angle.



Note

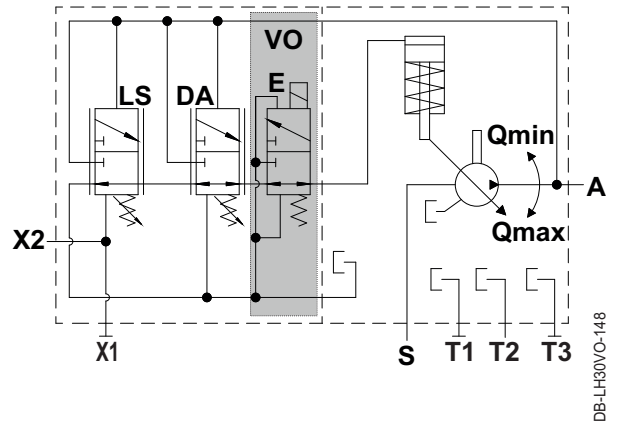
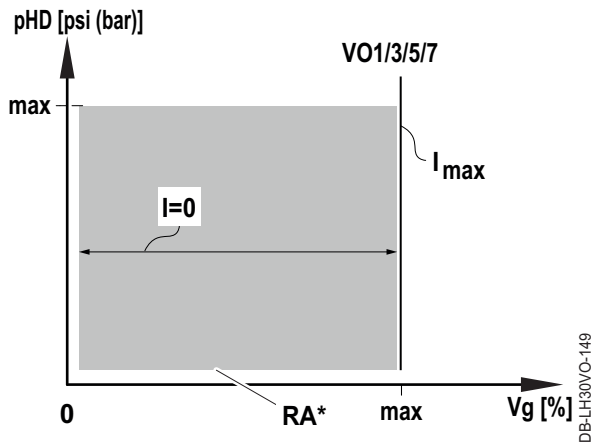
It is not possible to adjust the start of control. The current values may vary due to the tolerances.

3 Actuation and control type

3.3.10 VO- function

The functions of further control axes, for example, LS0DA- are overridden by the VO_ function.

Characteristic curve



RA*) further control axes

The electrically actuated retarder function adjusts the axial piston unit to $V_{g \max}$ which is done by energizing the switching magnets at connection E. Other control axes, for example LS0DA- are thereby disabled.

If the switching magnet at connection E is not energized or only energized at a low level ($I_{\min} \sim 100 \text{ mA}$), the other control axes are active.



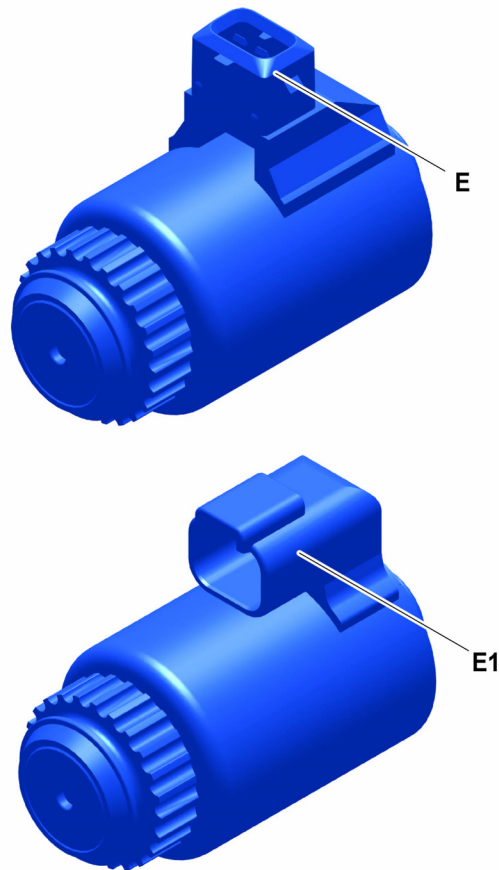
Note

The VO_ function is only available as a combination control with other control axes; shown here using the LS0DA- as an example. [\(for additional information see: 1 Type code, Page 3\)](#)

3 Actuation and control type

3.4 Electrical components

3.4.1 Proportional magnet (DE_ / LS_DE_ / VO_)

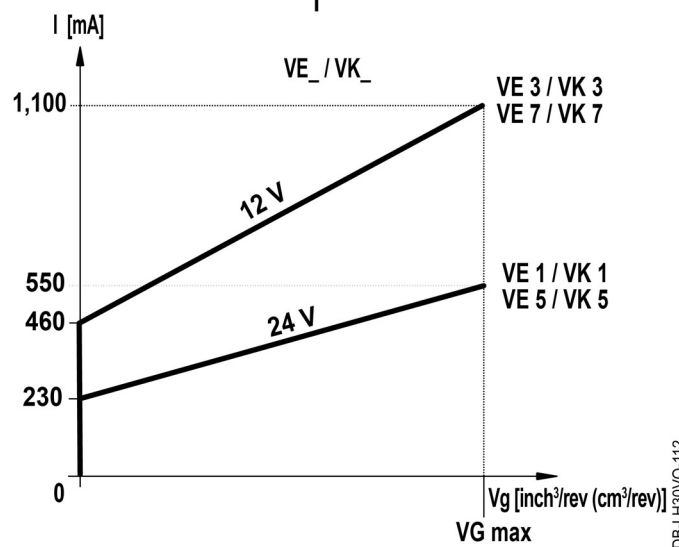
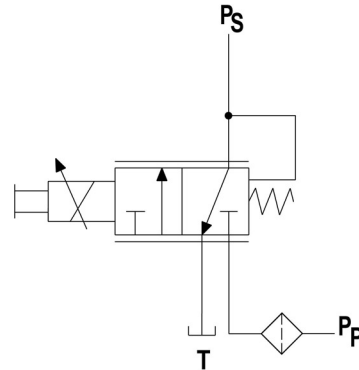
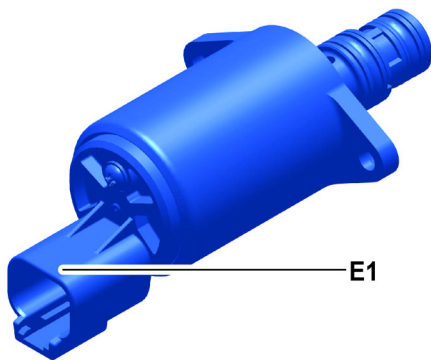
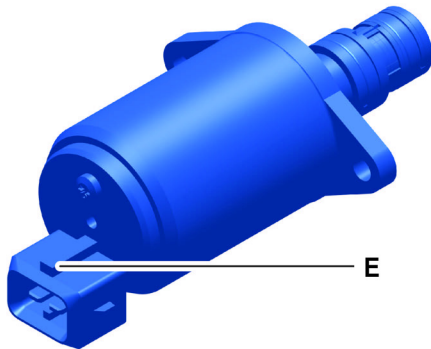


DE-LH30VO-140

Technical data of proportional magnet	1/2/5/6	3/4/7/8
Connection E	AMP Junior Timer	
Connection E1	Deutsch DT04-2P	
Nominal voltage U	24 V	12 V
Current I _{max.}	700 mA	1,400 mA
Nominal resistance R	24.4 - 26.2 Ω	6.0 - 6.4 Ω
Power P	0.03 hp (18.7 W)	0.02 hp (18.3 W)
Dither frequency	100 - 200 Hz	
Minimal dither oscillation width within the control range	240 mA	120 mA
Duty cycle	100 %	
Degree of protection according to DIN VDE0470 when assembled and plugged in	max. IP 65	
Permissible ambient temperature	-4 °F to +176 °F (-20 °C to +80 °C)	

3 Actuation and control type

3.4.2 Pressure control valve (VE_ / VK_)



DB-LH30VO-112

Technical data of pressure control valve VE_ / VK_	1/5	3/7
Connection E	AMP Junior Timer	
Connection E1	Deutsch DT04-2P	
Nominal voltage U	24 V	12 V
Current I _{max.}	750 mA	1,500 mA
Supply pressure p _{max.}	5,076 psi (350 bar)	
Nominal resistance R	22.0 Ω ± 6%	5.3 Ω ± 6%
Dither frequency	100 - 200 Hz	
Degree of protection according to DIN VDE0470/EN when assembled and plugged in	max. IP 67	
Permissible ambient temperature	-22 °F to +194 °F (-30 °C to +90 °C)	

4 Installation conditions

4.1 General information on project planning

The installation variant provided in the device or system in combination with the installation position must be agreed on with Liebherr when designing the axial piston unit and must be approved by Liebherr.

CAUTION



Poor lubrication of the hydraulic product!

Damage to the hydraulic product.

Ensure that the following conditions are met:

- Comply with the approved installation positions for the hydraulic product.
 - Contact Liebherr customer service if you wish to use other installation positions.
 - The housing is completely filled with hydraulic fluid during commissioning and operation.
 - The housing is vented after commissioning and during operation.
-

Liebherr distinguishes between three installation variants for axial piston units:

A: Under-tank installation (the axial piston unit is installed **below** the tank's minimum fluid level)

B: Over-tank installation (the axial piston unit is installed **above** the tank's minimum fluid level)

C: Tank installation (the 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

Note



Liebherr recommends:

Installation variant: Under-tank installation A

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

*] Complete filling and venting is critical for installation positions 2/4/6/8 driving shaft vertical and 1/3/5/7 driving shaft horizontal with "control at the bottom". The axial piston unit must be connected, filled and vented before it is finally positioned in installation position 1/3/5/7/9 with the "control at the top".

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

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

4.1.1 Suction line

The maximum suction head is 29.53 inch (750 mm), based on the laws of physics and simple assumptions for hydraulic fluid, temperature and ambient pressures. This particularly applies to installation variant B: over-tank installation.

At low temperatures with high viscosities, it is vital to ensure that the minimum suction pressure is maintained for axial piston units. [\(for additional information see: 2.3 Permissible pressure range, Page 10\)](#)

4 Installation conditions

The suction line must open into the tank at a minimum distance of 4.53 inch (115 mm) from the floor of the tank 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 it from drawing in hot leakage oil.

4.1.2 Leakage oil lines

To prevent the axial piston unit from emptying if it is not used for lengthy periods, the leakage oil line must be routed in a bend so that it runs at a minimum distance $\bar{U}1 = 1.18$ inch (30 mm) above the highest possible level of the axial piston unit. This particularly applies to installation variant B: over-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 4.53 inch (115 mm) from the floor of the tank to prevent stirring up dirt particles inside the tank.

The leakage oil line must open into the tank at a minimum distance of 9.84 inch (250 mm) below the minimum fluid level in the tank to prevent foam formation inside 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 drawn in by the suction line.

At low temperatures with high viscosities, it is essential to comply with the maximum housing pressure for axial piston units with multiple driving gears and with a shared leakage oil line. [\(for additional information see: 2.3.2 Housing pressure, leakage oil pressure, Page 11\)](#) If the maximum housing pressure is out of tolerance, a separate leakage oil line must be connected for each driving gear.

4.1.3 Hydraulic fluid tank

The hydraulic fluid tank must be designed so that the hydraulic fluid cools sufficiently during circulation and that contamination from operation settles at the bottom of the tank.

Ensure that the lines are connected as described in the recommendations and that they open into the hydraulic fluid tank. [\(for additional information see: 4.1.1 Suction line, Page 48 and for additional information see: 4.1.2 Leakage oil lines, Page 49\)](#)

4 Installation conditions

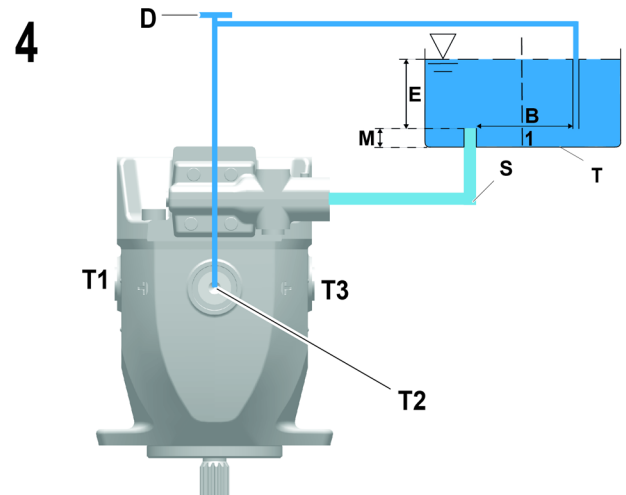
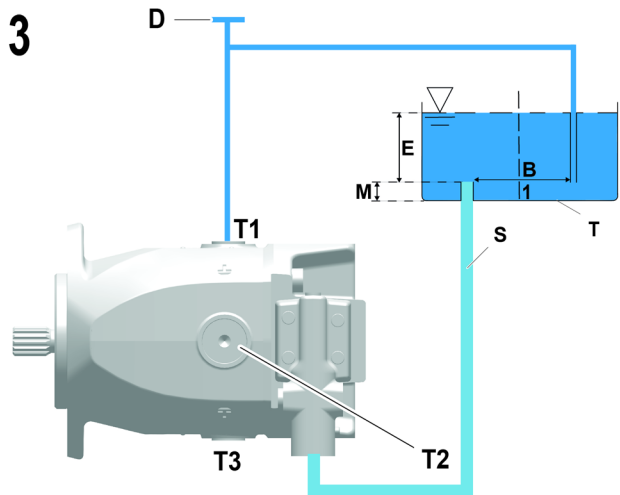
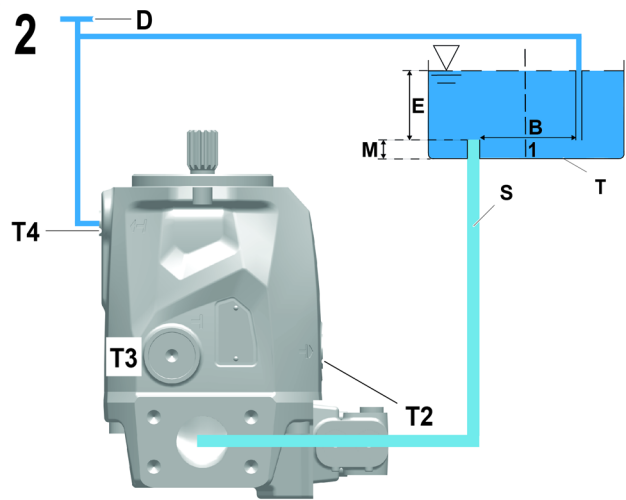
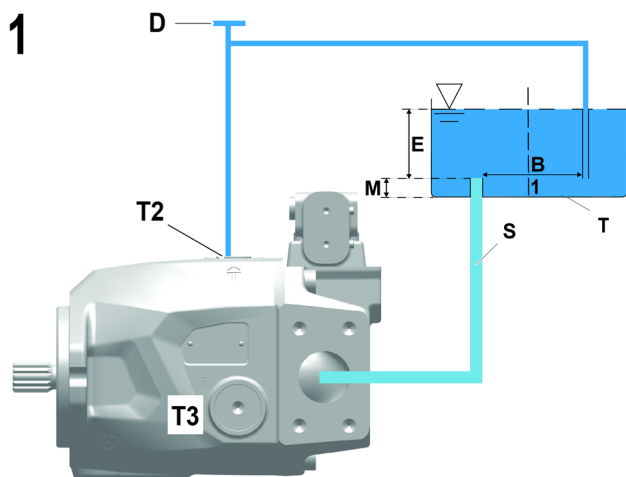
4.2 Installation variants

4.2.1 Under-tank installation variant



Note

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



DB-LH30VO-175

1	Splash plate (to calm the hydraulic fluid in the tank)	M	Minimum distance between line end and the tank floor = 4.53 inch (115 mm)
B	Clearance 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 the scope of delivery)	T	Tank
E	Minimum immersion depth = 9.84 inch (250 mm)	T ₋	Leakage oil connections T1 / T2 / T3 / T4 (T4 = optional)

4 Installation conditions

4.2.2 Over-tank installation variant

CAUTION

Damage to the hydraulic product.

"Overheating" due to air pockets in the bearing area or rotary shaft lip seal in case of over-tank installation (installation variant B)! Ensure that the following conditions are met:

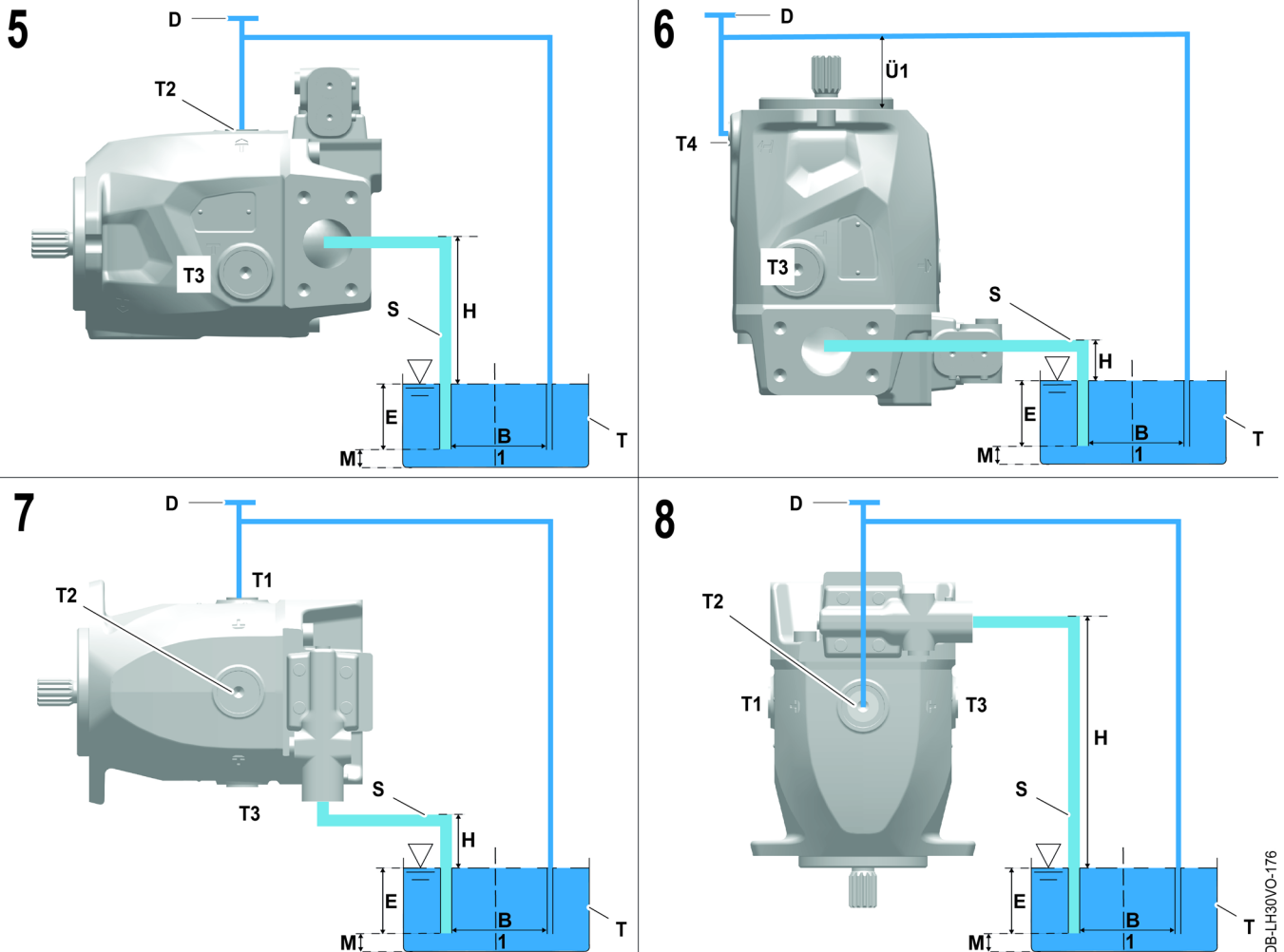


- The housing is completely filled with hydraulic fluid during commissioning and operation.
- The housing is completely vented* after commissioning and during operation.

Note



To prevent the axial piston unit from emptying during long shutdowns, the leakage oil line must be routed in a bend so that it runs at a minimum distance $\dot{U}1 = 1.18$ inch (30 mm) above the highest possible level of the axial piston unit.



DB-LH30VO-176

1	Splash plate (to calm the hydraulic fluid in the tank)	M	Minimum distance between line end and the tank floor = 4.53 inch (115 mm)
B	Clearance 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 the scope of delivery)	T	Tank
E	Minimum immersion depth = 9.84 inch (250 mm)	T ₋	Leakage oil connections T1 / T2 / T3 / T4 (T4 = optional)
H	Maximum suction head = 29.53 inch (750 mm)	Ü1	Minimum height of leakage oil line = 1.18 inch (30 mm)

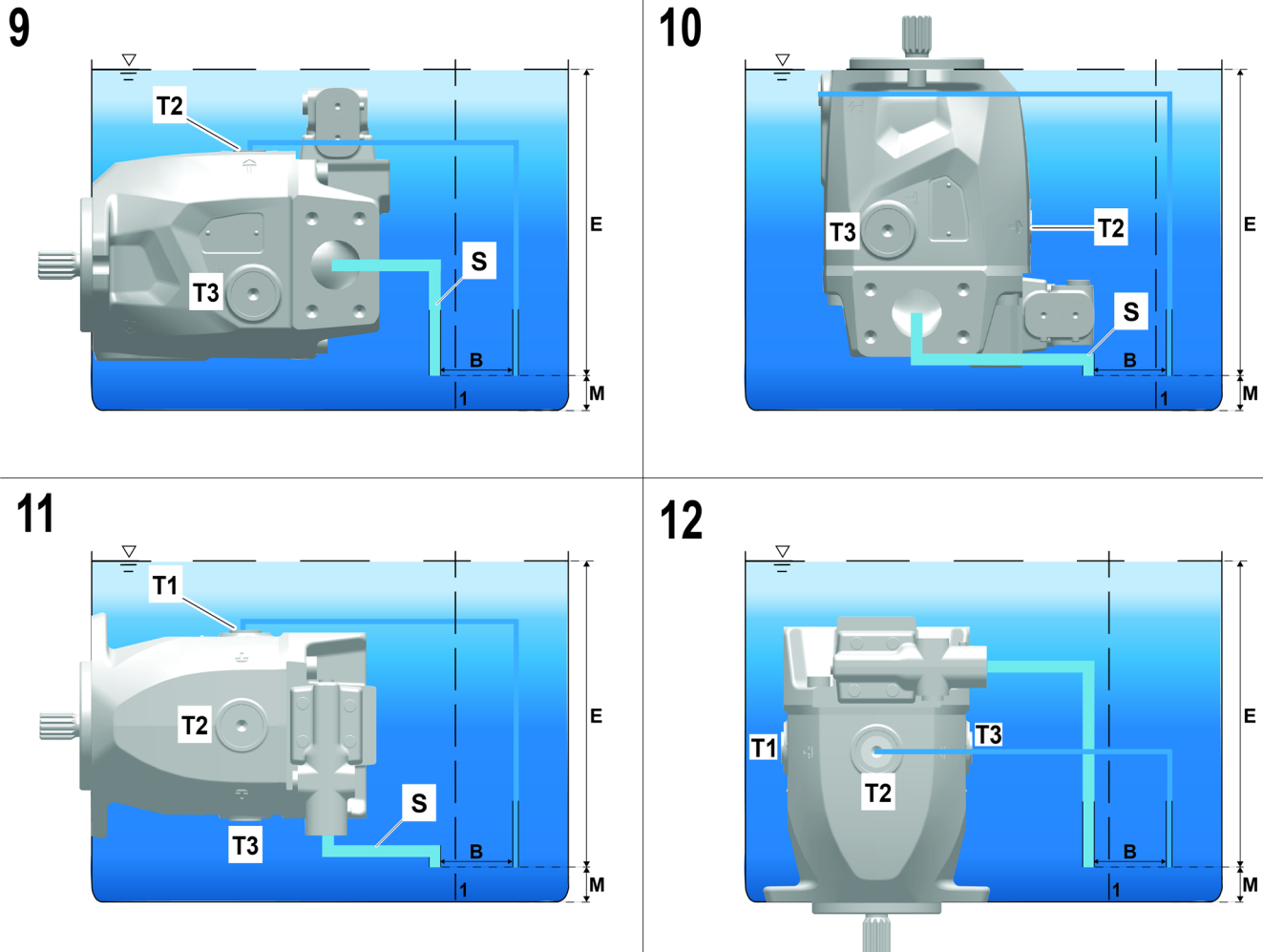
4.2.3 Tank installation variant



Note

For the 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 electric components (for example: electric proportional magnet)



1	Splash plate	To calm the hydraulic fluid in the tank
B	Clearance	Between suction port and leakage oil connection in the tank (the larger the better)

4 Installation conditions

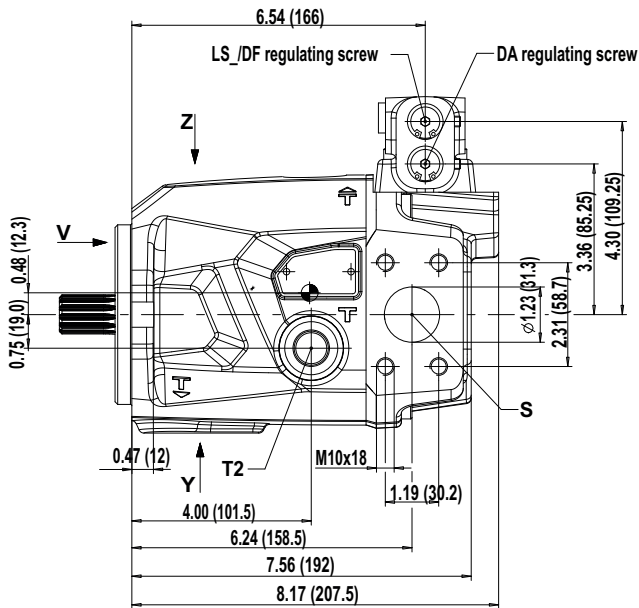
L	Leakage oil connections	-
M	Minimum distance between line end and tank floor	4.53 inch (115 mm)
S	Suction line connection	-
T	Tank	-

5 Dimensions

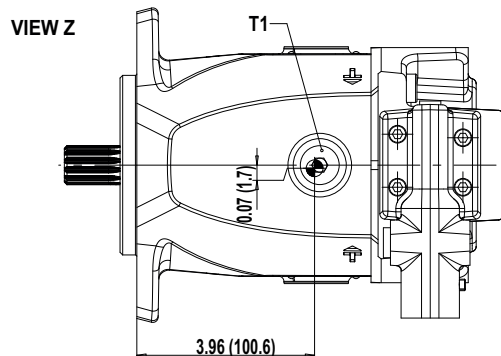
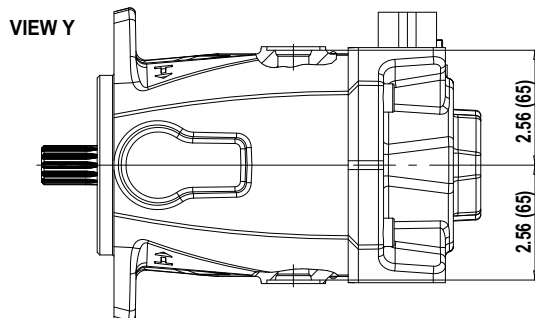
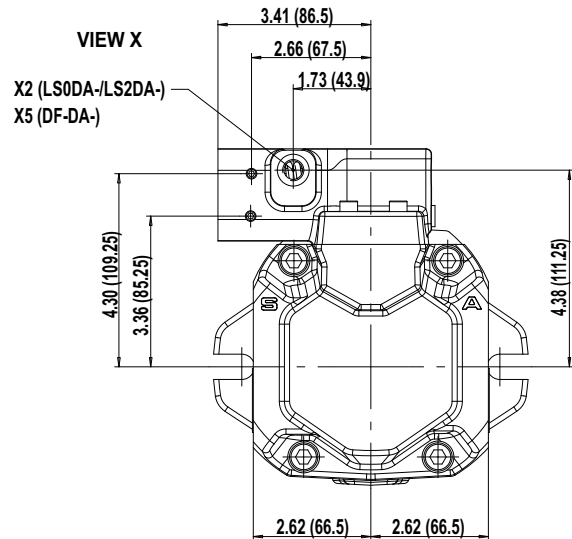
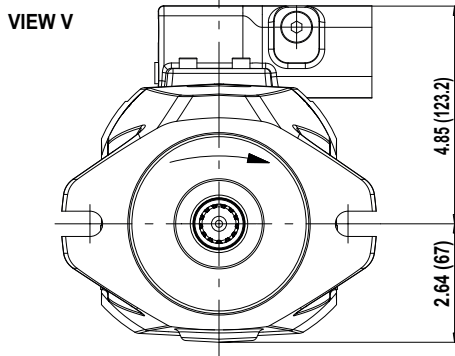
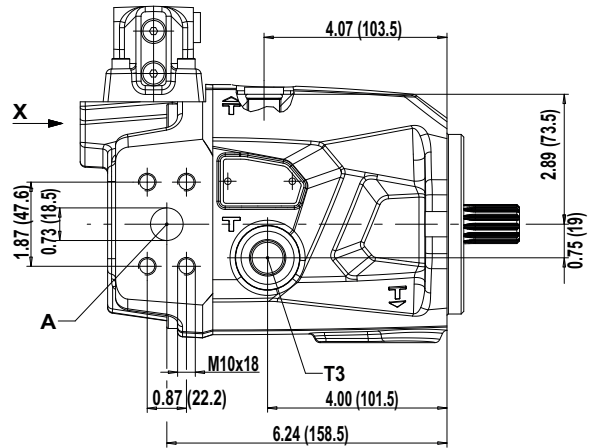
5.1 Nominal size 028, main dimensions

5.1.1 Working connection, side, control type LS0DA- / LS2DA- / DF-DA-

L	H	3	0	V	O	028	/	LS0DA-	20	V	R	B2		B1	0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14	15	16	17	18	19	20	21



Center of gravity location



DB-LH30VO-118

5 Dimensions

A	Working connection ISO 6162-1 (SAE J518-1) - 3/4"	X2	LS0DA: LS pressure connection ISO 9974-1-M12x1.5 LS2DA: LS pressure connection ISO 9974-1-M12x1.5
S	Suction port ISO 6162-1 (SAE J518-1) - 1 1/4"	X5	DF-DA-: DF control pressure connection for external pressure limiting valve, ISO 9974-1-M12x1.5
T1, T2, T3	Leakage oil connections ISO 11926 - 3/4-16 UNF-2B	-	-



Note

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.

5.1.2 Nominal size 028, working connection, rear

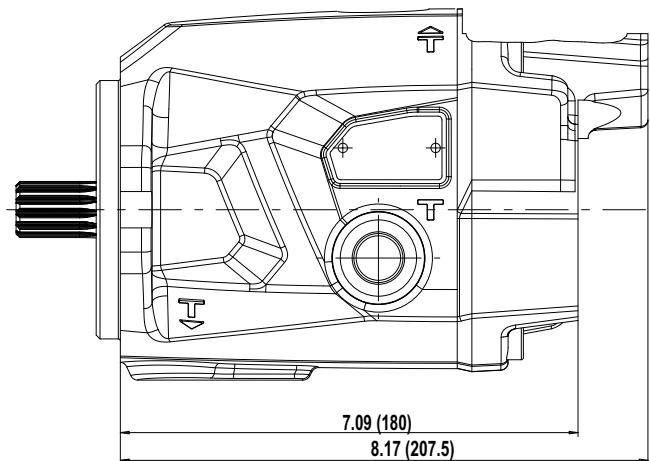
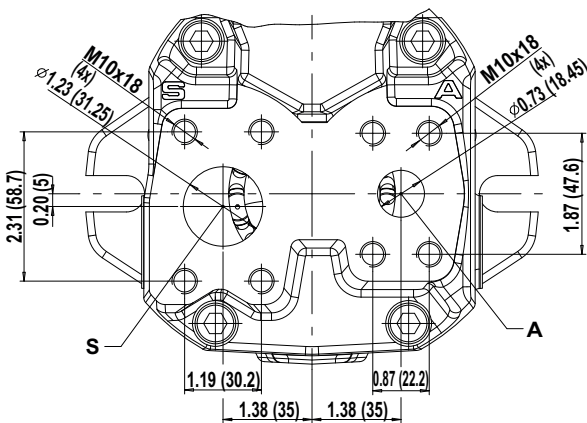
L	H	3	0	V	0	028	/		20	V	R	B2		B3	0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	



Note

Dimensions not shown: (for additional information see: [5.1.1 Working connection, side, control type LS0DA- / LS2DA- / DF-DA-](#), Page 54)

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.



DB-LH30VO-120

5 Dimensions

5.1.3 Nominal size 028, other control types

L	H	3	0	V	O	028	/		20	V	R				0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.



Note

Dimensions of control types LS0DA- / LS2DA- / DF-DA-: (for additional information see: 5.1.1 Working connection, side, control type LS0DA- / LS2DA- / DF-DA-, Page 54)

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.

DA-

DB-LH30VO-127

-	-
-	-

LR-

DB-LH30VO-142

-	-
-	-

DE_

DB-LH30VO-124

E	1/2/3/4: Deutsch plug DT04-2P 2-pin 5/6/7/8: AMP plug Junior Timer 2-pin
-	-

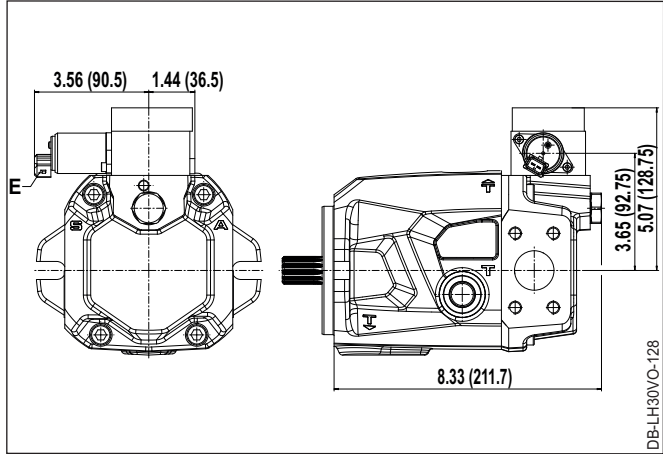
LS0DE_ / LS2DE_

DB-LH30VO-126

E	1/2/3/4: Deutsch plug DT04-2P 2-pin 5/6/7/8: AMP plug Junior Timer 2-pin
X2	LS0DE_: LS pressure connection ISO 9974-1-M12x1.5 LS2DE_: LS pressure connection ISO 9974-1-M12x1.5

5 Dimensions

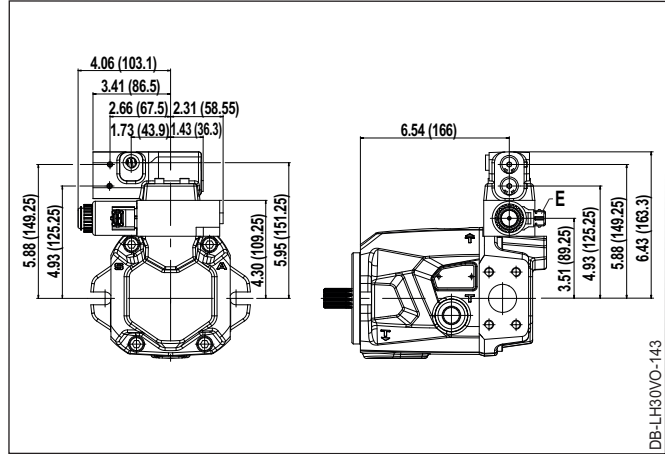
VE_ / VK_



DB-LH30VO-128

E	1/3: Deutsch plug DT04-2P 2-pin 5/7: AMP plug Junior Timer 2-pin
-	-

LSODA-VO_



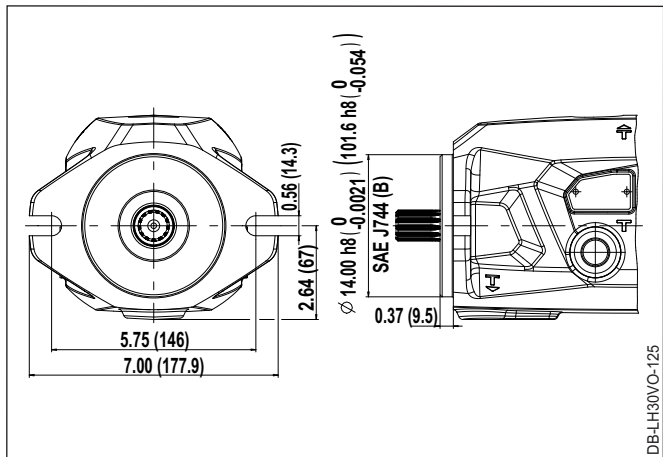
DB-LH30VO-143

E	1/3: Deutsch plug DT04-2P 2-pin 5/7: AMP plug Junior Timer 2-pin
-	-

5.2 Nominal size 028, mounting flange

L	H	3	0	V	0	028	/	-	20	V		B2			0	00		000			
1.	2.	3.	4.	5.	6.	7.		8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.

SAE B, (SAE J744)



DB-LH30VO-128

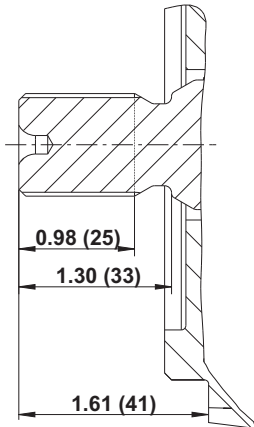
B2

5 Dimensions

5.3 Nominal size 028, shaft end

L	H	3	0	V	0	028	/	-	20	V					0	00		000			
1.	2.	3.	4.	5.	6.	7.		8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.

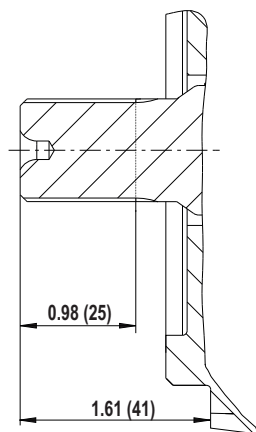
Splined shaft ANSI B92.1a-1976 7/8" 13T, with undercut



DB-LH30VO-072

A1

Splined shaft ANSI B92.1a-1976 7/8" 13T, without undercut



DB-LH30VO-071

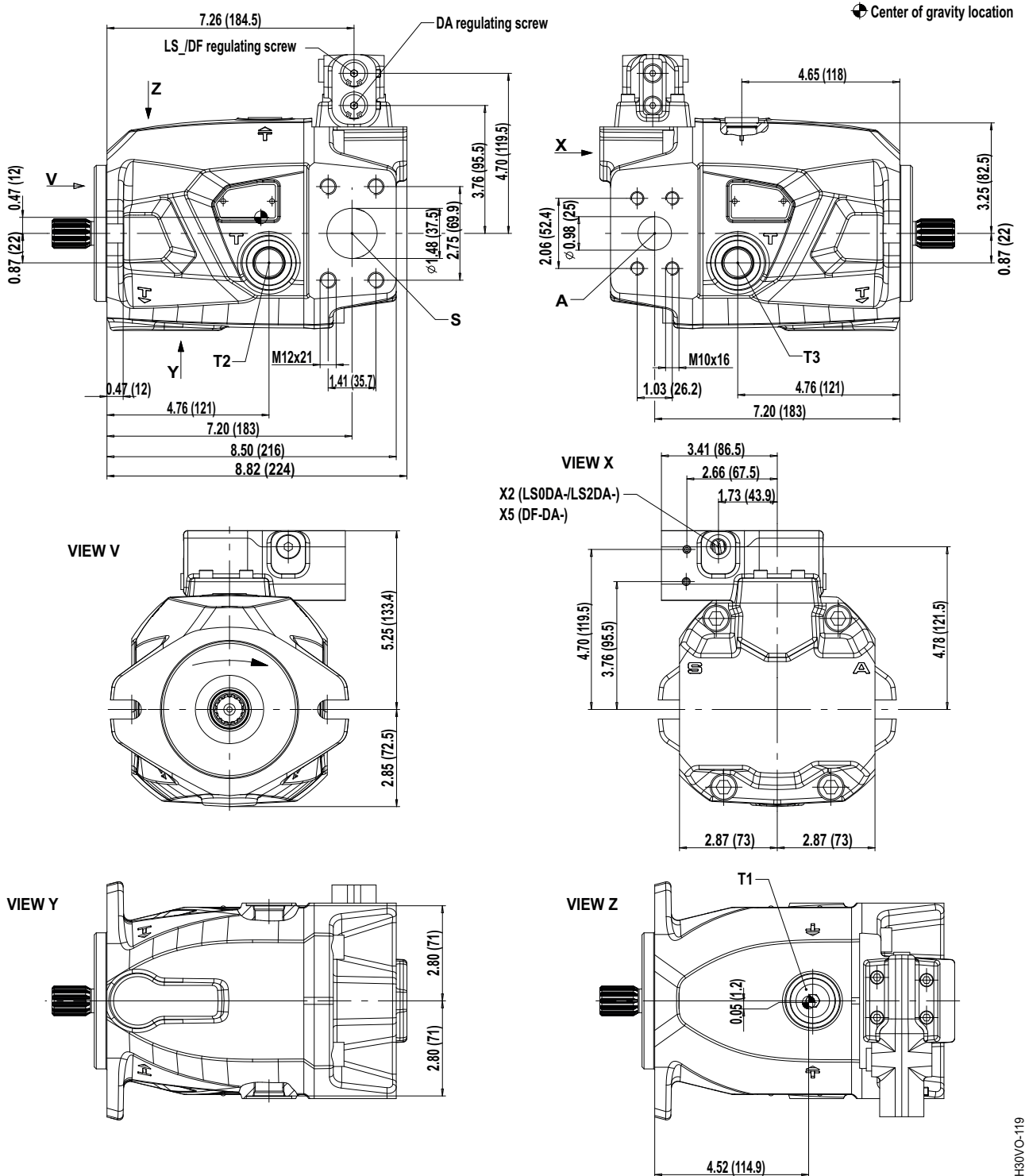
A2

5 Dimensions

5.4 Nominal size 045, main dimensions

5.4.1 Working connection, side, control type LS0DA- / LS2DA- / DF-DA-

L	H	3	0	V	0	045	/	LS0DA-	20	V	R	B2		B1	0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14	15	16	17	18	19	20	21



5 Dimensions

A	Working connection ISO 6162-1/-2 (SAE J518-1/-2) - 1"
S	Suction port ISO 6162-1/-2 (SAE J518-1/-2) - 1 1/2"
T1, T2, T3	Leakage oil connections ISO 11926 - 7/8-14 UNF-2B

X2	LS0DA: LS pressure connection ISO 9974-1-M12x1.5 LS2DA: LS pressure connection ISO 9974-1-M12x1.5
X5	DF-DA-: DF control pressure connection for external pressure limiting valve, ISO 9974-1-M12x1.5
-	-



Note

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.

5.4.2 Nominal size 045, working connection, rear

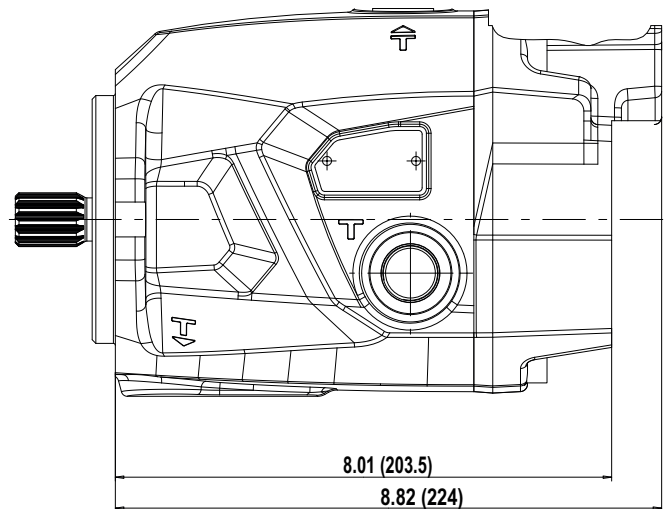
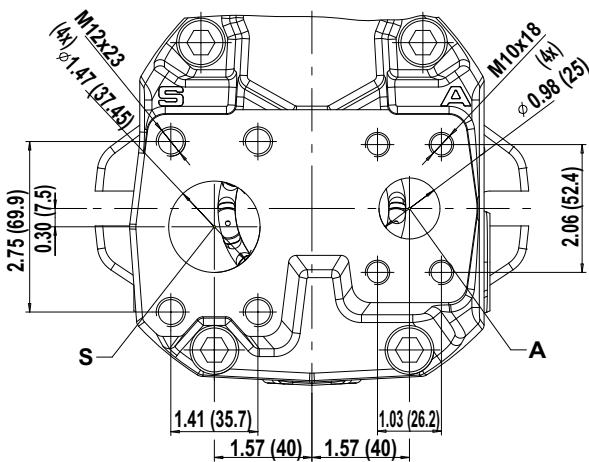
L	H	3	0	V	0	045	/		20	V	R			B3	0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.



Note

Dimensions not shown: (for additional information see: [5.4.1 Working connection, side, control type LS0DA- / LS2DA- / DF-DA-](#), Page 59)

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.



5 Dimensions

5.4.3 Nominal size 045, other control types

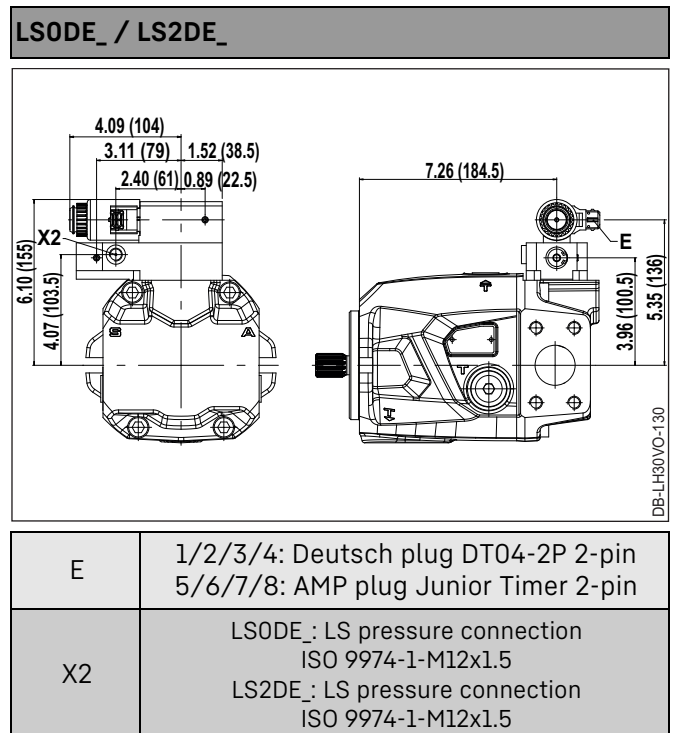
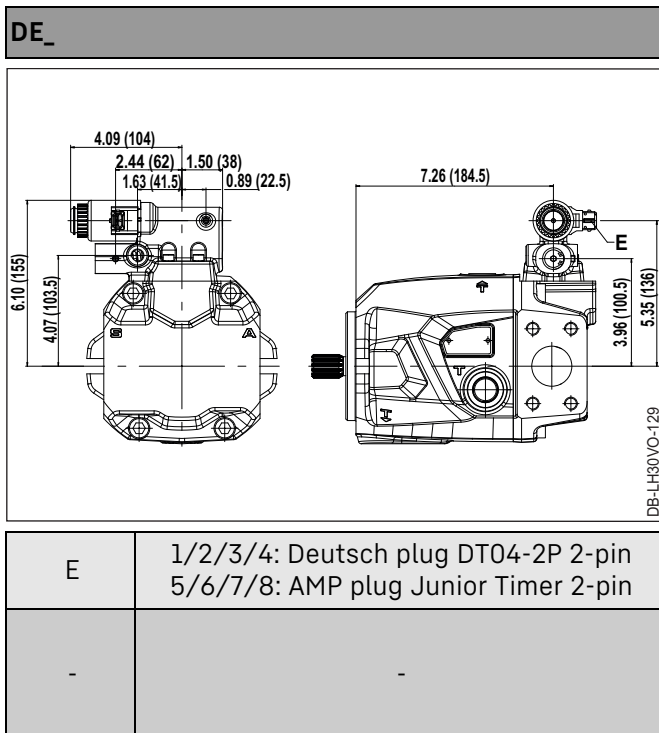
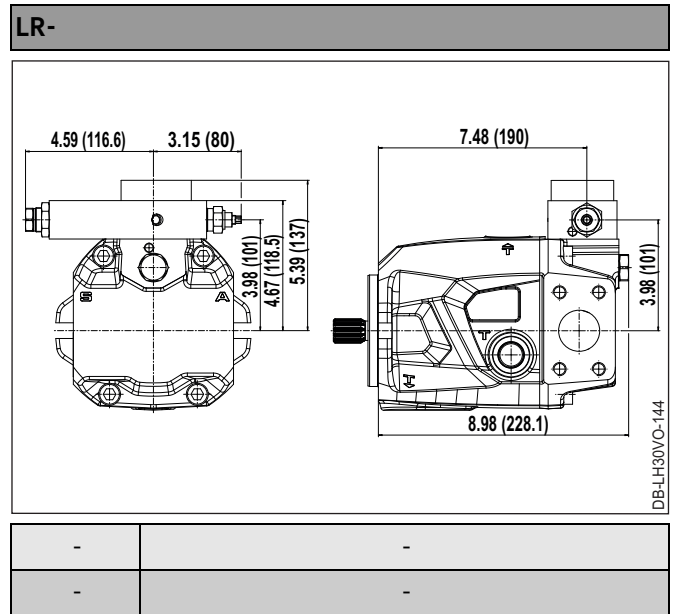
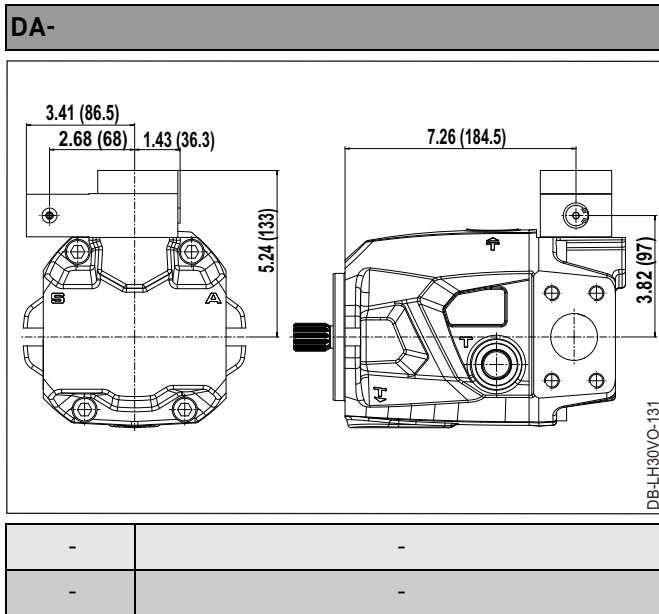
L	H	3	0	V	O	045	/		20	V	R				0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.



Note

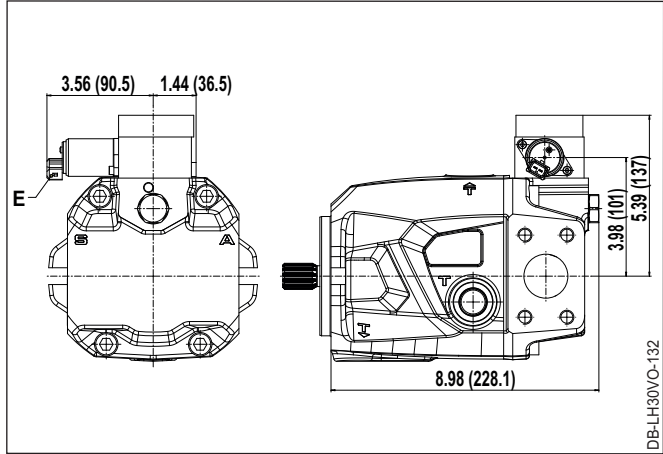
Dimensions of control types LS0DA- / LS2DA- / DF-DA-: (for additional information see: 5.1.1 Working connection, side, control type LS0DA- / LS2DA- / DF-DA-, Page 54)

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.



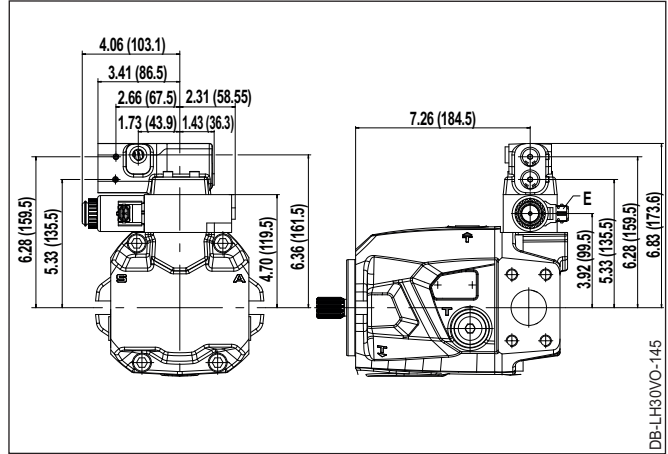
5 Dimensions

VE_ / VK_



E	1/3: Deutsch plug DT04-2P 2-pin 5/7: AMP plug Junior Timer 2-pin
-	-

LSODA-VO_

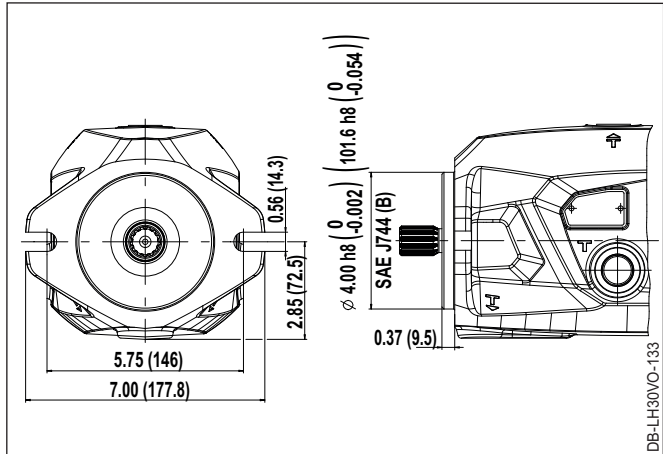


E	1/3: Deutsch plug DT04-2P 2-pin 5/7: AMP plug Junior Timer 2-pin
-	-

5.5 Nominal size 045, mounting flange

L	H	3	0	V	0	045	/	-	20	V		B2			0	00		000			
1.	2.	3.	4.	5.	6.	7.		8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.

SAE B, (SAE J744)



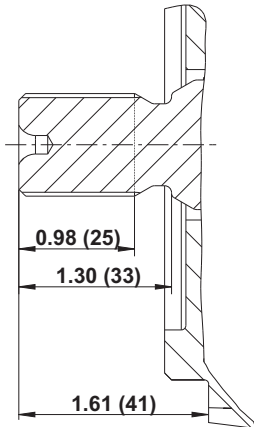
B2

5 Dimensions

5.6 Nominal size 045, shaft end

L	H	3	0	V	O	045	/	-	20	V						0	00		000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14	15	16	17	18	19	20	21	

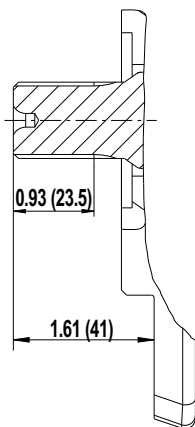
Splined shaft ANSI B92.1a-1976 7/8" 13T, with undercut



DB-LH30VO-072

A1

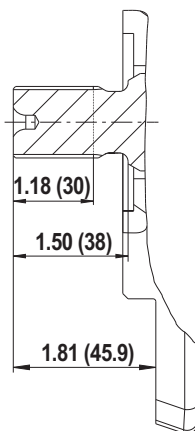
Splined shaft ANSI B92.1a-1976 7/8" 13T, without undercut



DB-LH30VO-074

A2

Splined shaft ANSI B92.1-1976 1" 15T, with undercut

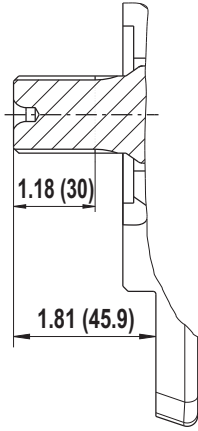


DB-LH30VO-075

A3

5 Dimensions

Splined shaft ANSI B92.1-1976 1" 15T, without undercut



A4

DB-LH80VO-076

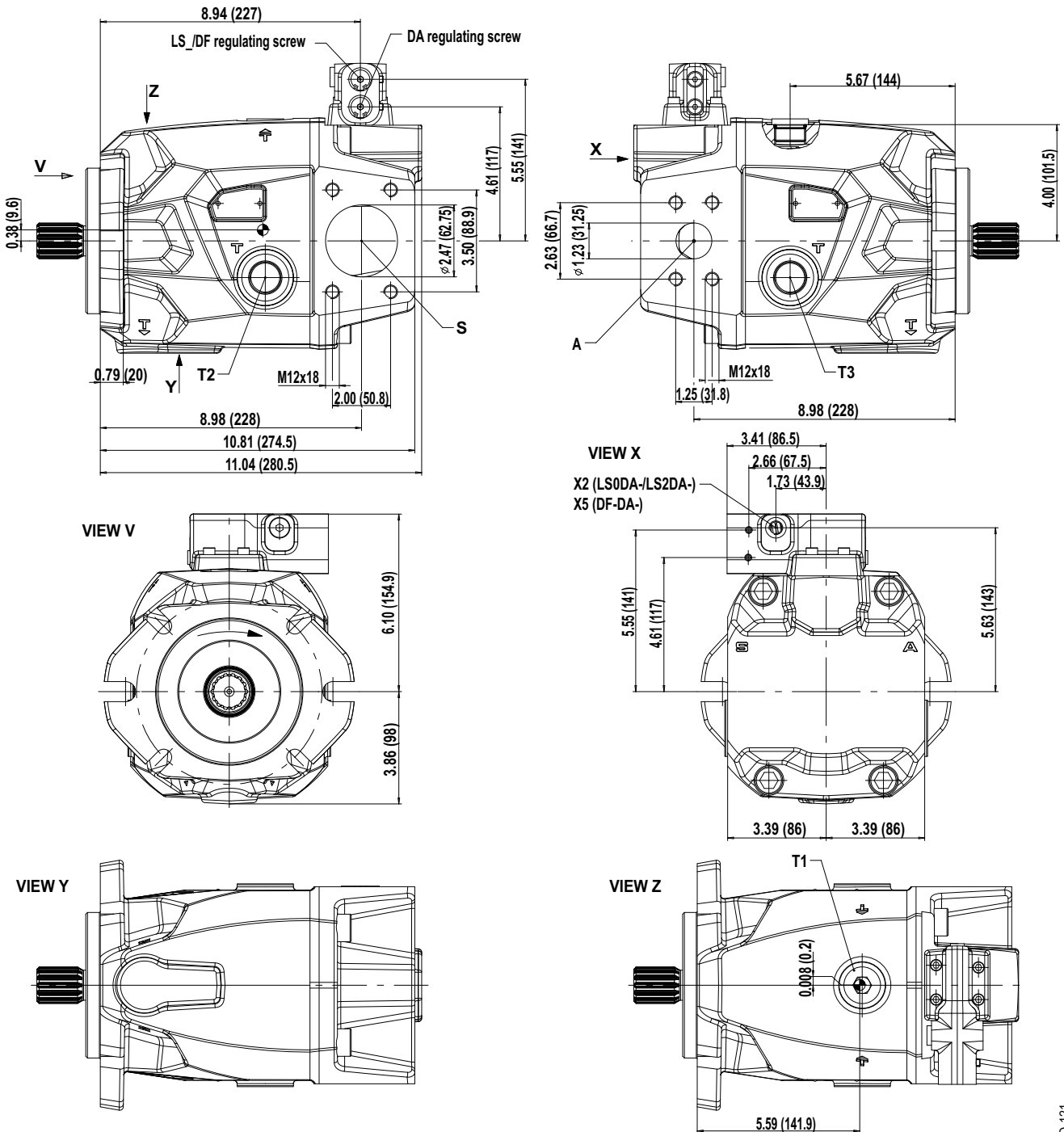
5 Dimensions

5.7 Nominal size 085 main dimensions

5.7.1 Working connection, side, control type LS0DA- / LS2DA- / DF-DA-

L	H	3	0	V	O	085	/	LS0DA-	20	V	R	C6		A1	0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14	15	16	17	18	19	20	21

☉ Center of gravity location



DB-LH30VO-121

5 Dimensions

A	Working connection ISO 6162-2 (SAE J518-2) - 1 1/4"
S	Suction port ISO 6162-2 (SAE J518-2) - 2 1/2"
T1, T2, T3	Leakage oil connections ISO 11926 - 1 1/16-12 UNF-2B

X2	LSODA: LS pressure connection ISO 9974-1-M12x1.5 LS2DA: LS pressure connection ISO 9974-1-M12x1.5
X5	DF-DA-: DF control pressure connection for external pressure limiting valve, ISO 9974-1-M12x1.5
-	-



Note

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.

5.7.2 Nominal size 085, working connection, rear

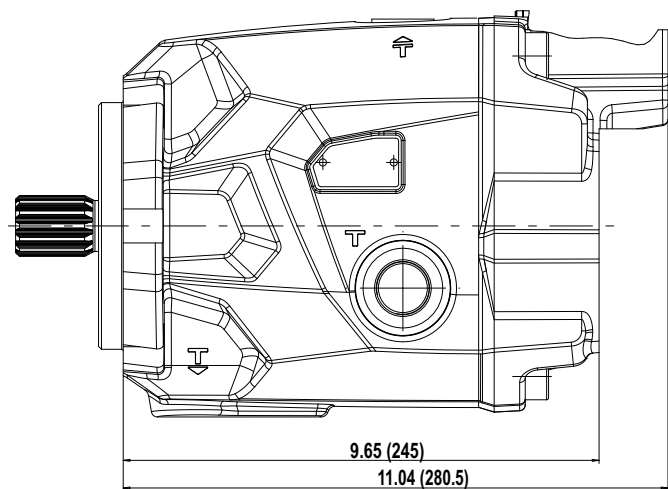
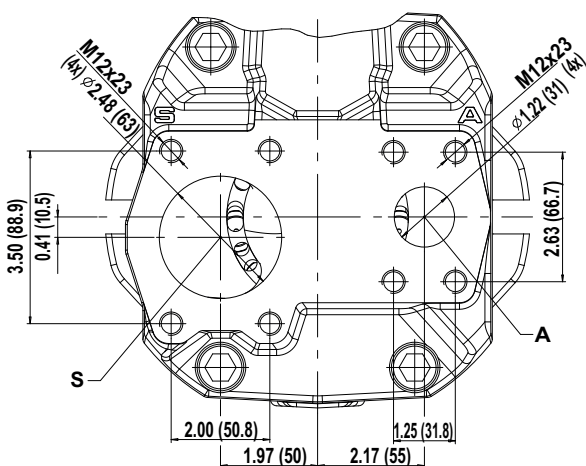
L	H	3	0	V	0	085	/		20	V	R	C6		A3	0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.



Note

Dimensions not shown: (for additional information see: [5.7.1 Working connection, side, control type LSODA- / LS2DA- / DF-DA-](#), Page 65)

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.



5 Dimensions

5.7.3 Nominal size 085, other control types

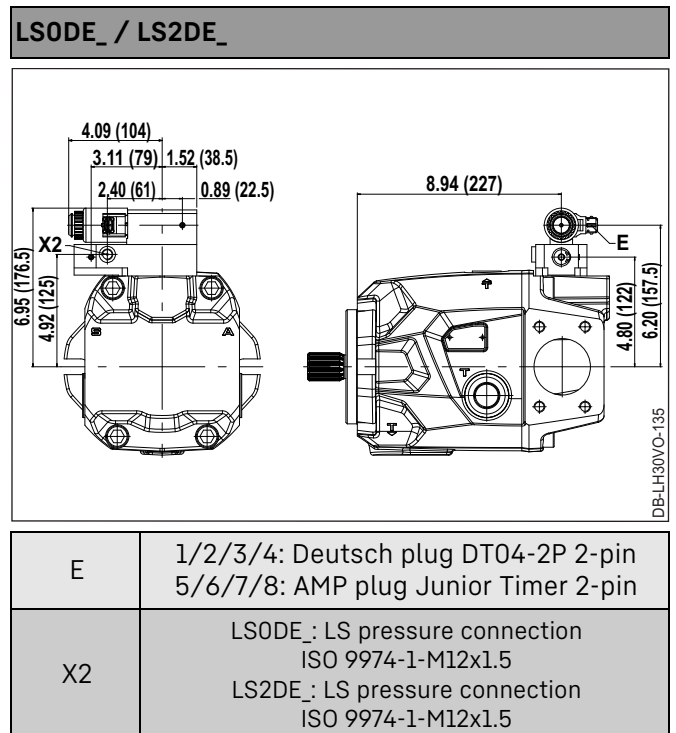
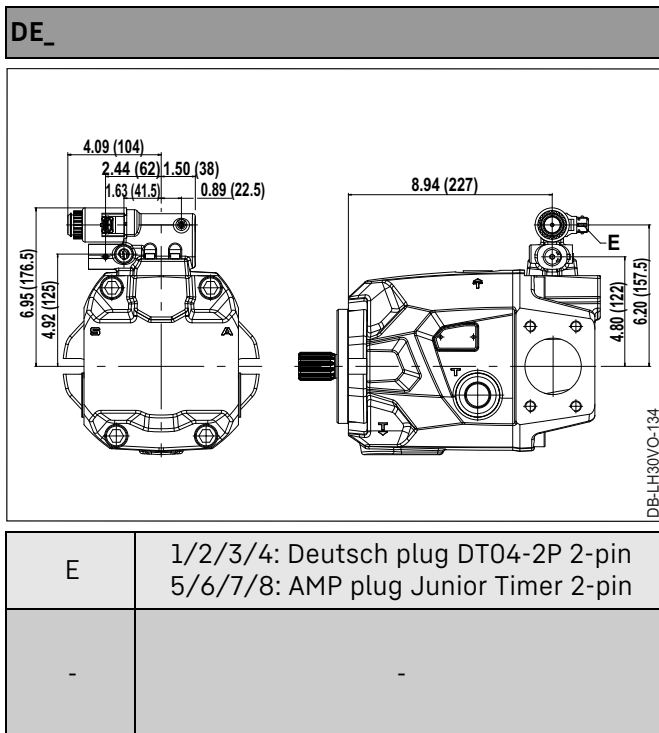
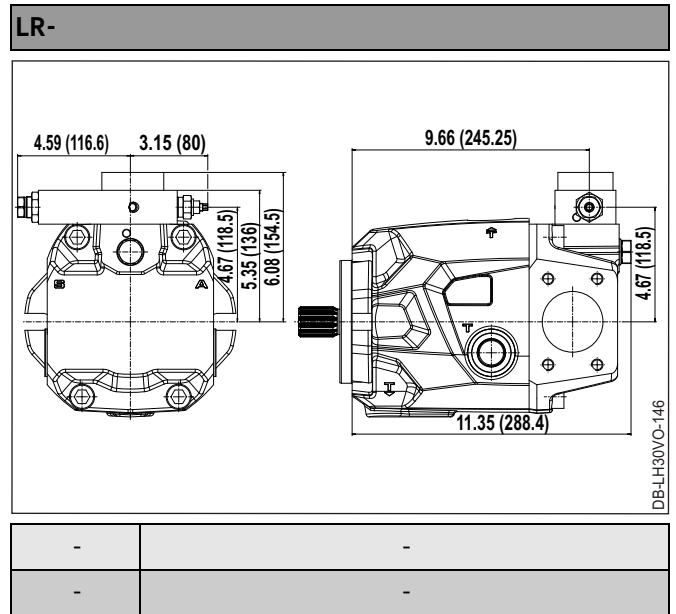
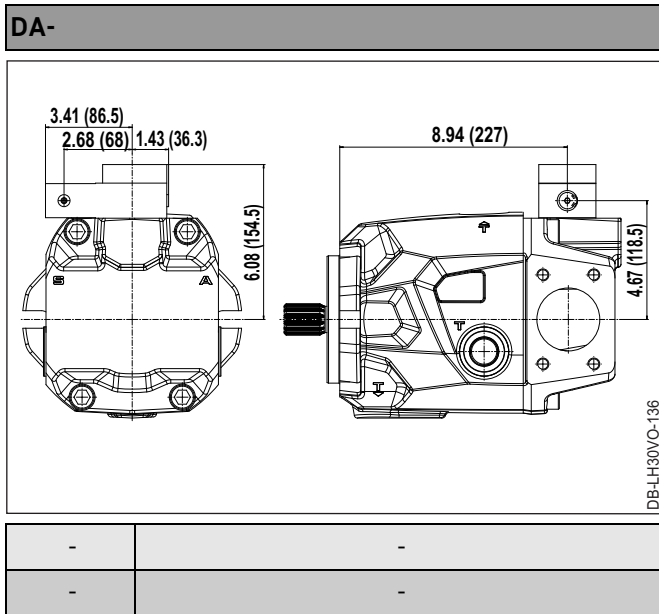
L	H	3	0	V	O	085	/		20	V	R				0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.



Note

Dimensions of control types LS0DA- / LS2DA- / DF-DA-: (for additional information see: 5.7.1 Working connection, side, control type LS0DA- / LS2DA- / DF-DA-, Page 65)

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.



5 Dimensions

VE_ / VK_

DB-LH30VO-137

E	1/3: Deutsch plug DT04-2P 2-pin 5/7: AMP plug Junior Timer 2-pin
-	-

LSODA-VO_

DB-LH30VO-147

E	1/3: Deutsch plug DT04-2P 2-pin 5/7: AMP plug Junior Timer 2-pin
-	-

5.8 Nominal size 085, mounting flange

L	H	3	0	V	0	085	/	-	20	V		C6			0	00		000			
1.	2.	3.	4.	5.	6.	7.		8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.

Similar to SAE C, (SAE J744), 2+4-hole fastening

DB-LH30VO-138

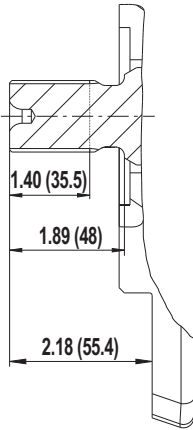
C6

5 Dimensions

5.9 Nominal size 085, shaft end

L	H	3	0	V	O	085	/	-	20	V						0	00		000			
1.	2.	3.	4.	5.	6.	7.		8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	

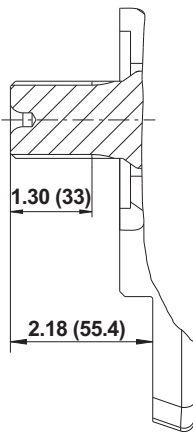
Splined shaft ANSI B92.1-1976 1 1/4" 14T, with undercut



DB-LH30VO-078

A5

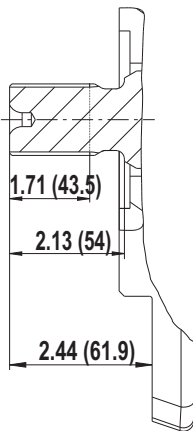
Splined shaft ANSI B92.1-1976 1 1/4" 14T, without undercut



DB-LH30VO-077

A6

Splined shaft ANSI B92.1-1976 1 1/2" 17T, with undercut

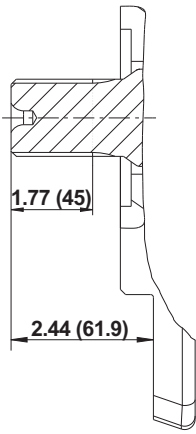


DB-LH30VO-179

A9

5 Dimensions

Splined shaft ANSI B92.1-1976 1 1/2" 17T, without undercut



A0

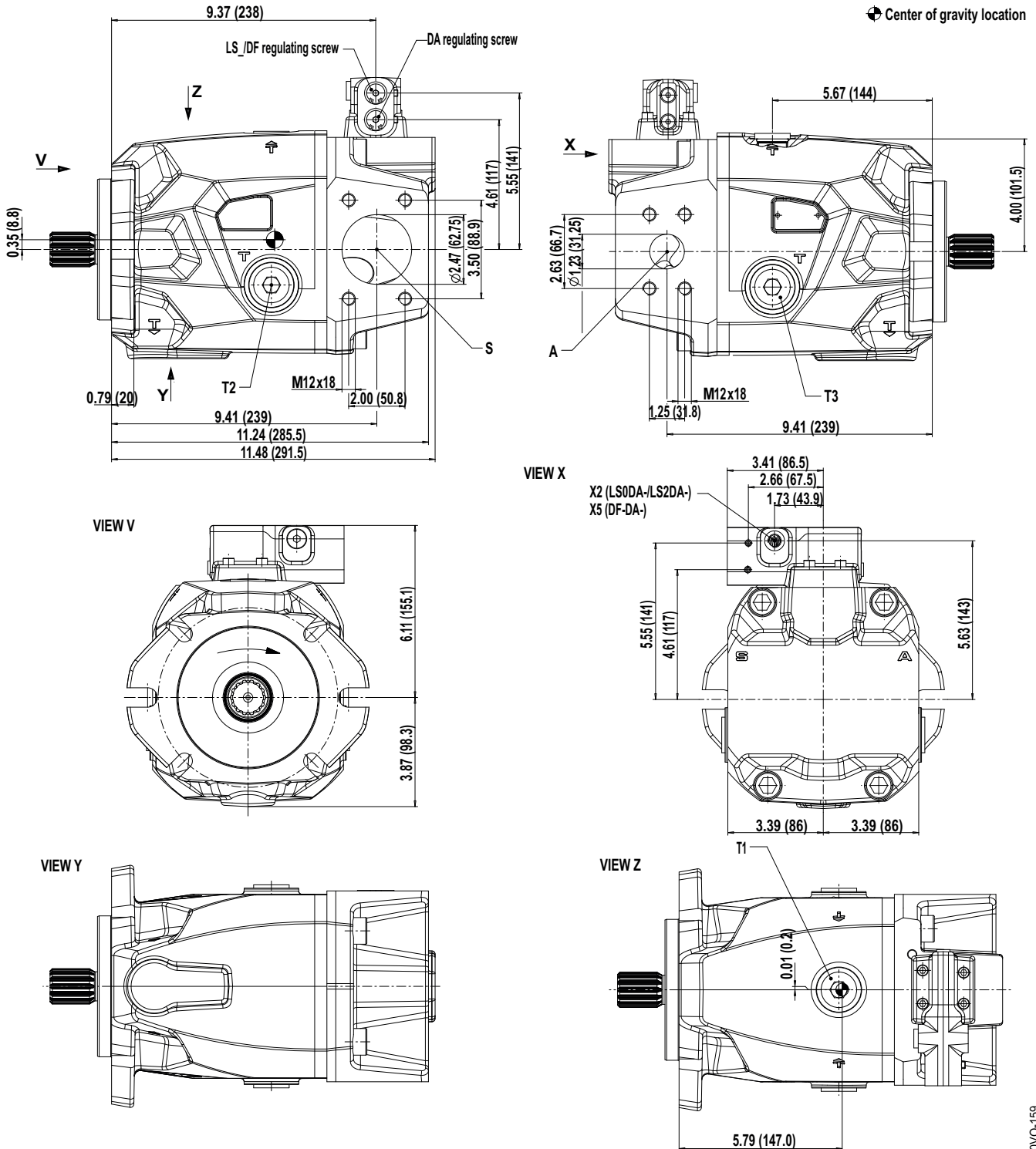
DB-LH80VO-079

5 Dimensions

5.10 Nominal size 100 main dimensions

5.10.1 Working connection, side, control type LS0DA- / LS2DA- / DF-DA-

L	H	3	0	V	0	100	/	LS0DA-	20	V	R	C6		A1	0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14	15	16	17	18	19	20	21



5 Dimensions

A	Working connection ISO 6162-2 (SAE J518-2) - 1 1/4"	X2	LSODA: LS pressure connection ISO 9974-1-M12x1.5 LS2DA: LS pressure connection ISO 9974-1-M12x1.5
S	Suction port ISO 6162-2 (SAE J518-2) - 2 1/2"	X5	DF-DA-: DF control pressure connection for external pressure limiting valve, ISO 9974-1-M12x1.5
T1, T2, T3	Leakage oil connections ISO 11926 - 1 1/16-12 UNF-2B	-	-



Note

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.

5.10.2 Nominal size 100, working connection, rear

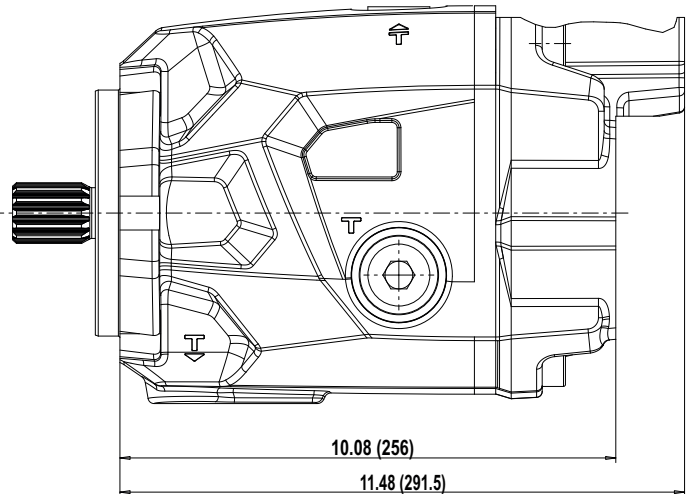
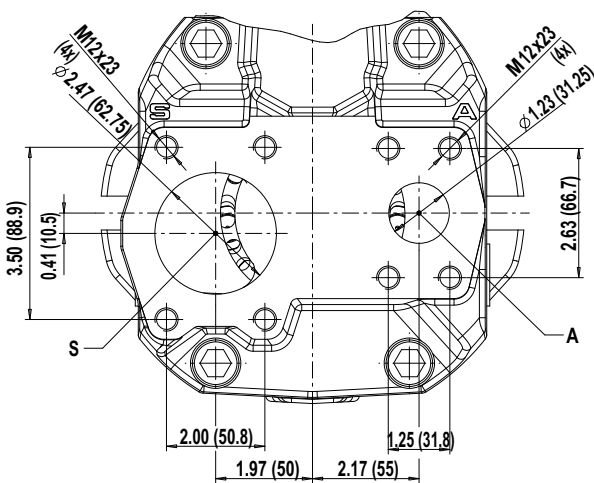
L	H	3	0	V	0	100	/		20	V	R	C6		A3	0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.



Note

Dimensions not shown: (for additional information see: [5.10.1 Working connection, side, control type LSODA- / LS2DA- / DF-DA-](#), Page 71)

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.



DB-LH30V0-160

5 Dimensions

5.10.3 Nominal size 100, other control types

L	H	3	0	V	O	100	/		20	V	R				0	00	0000	000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.



Note

Dimensions of control types LS0DA- / LS2DA- / DF-DA-: (for additional information see: [5.10.1 Working connection, side, control type LS0DA- / LS2DA- / DF-DA-](#), Page 71)

Counterclockwise direction of rotation: Connecting plate and control arranged in mirror image.

DA-

-	-
-	-

DB-LH30VO-161

LR-

-	-
-	-

DB-LH30VO-162

DE_

E	1/2/3/4: Deutsch plug DT04-2P 2-pin 5/6/7/8: AMP plug Junior Timer 2-pin
-	-

DB-LH30VO-163

LS0DE_ / LS2DE_

E	1/2/3/4: Deutsch plug DT04-2P 2-pin 5/6/7/8: AMP plug Junior Timer 2-pin
X2	LS0DE_: LS pressure connection ISO 9974-1-M12x1.5 LS2DE_: LS pressure connection ISO 9974-1-M12x1.5

DB-LH30VO-164

5 Dimensions

VE_ / VK_

DB-LH30VO-165

E	1/3: Deutsch plug DT04-2P 2-pin 5/7: AMP plug Junior Timer 2-pin
-	-

LSODA-VO_

DB-LH30VO-166

E	1/3: Deutsch plug DT04-2P 2-pin 5/7: AMP plug Junior Timer 2-pin
-	-

5.11 Nominal size 100, mounting flange

L	H	3	0	V	0	100	/	-	20	V		C6			0	00		000			
1.	2.	3.	4.	5.	6.	7.		8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.

Similar to SAE C, (SAE J744), 2+4-hole fastening

DB-LH30VO-138

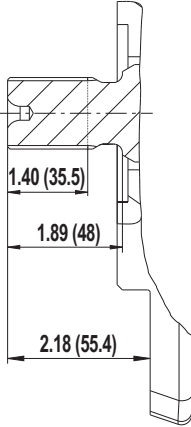
C6

5 Dimensions

5.12 Nominal size 100, shaft end

L	H	3	0	V	O	100	/	-	20	V						0	00		000			
1.	2.	3.	4.	5.	6.	7.		8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	

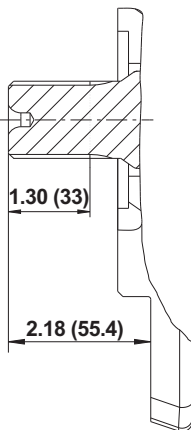
Splined shaft ANSI B92.1-1976 1 1/4" 14T, with undercut



DB-LH30VO-078

A5

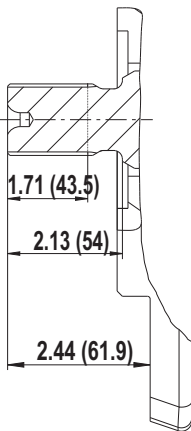
Splined shaft ANSI B92.1-1976 1 1/4" 14T, without undercut



DB-LH30VO-077

A6

Splined shaft ANSI B92.1-1976 1 1/2" 17T, with undercut

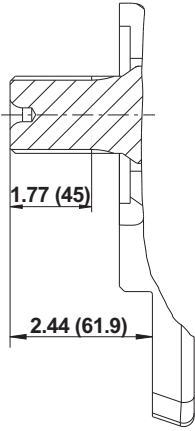


DB-LH30VO-179

A9

5 Dimensions

Splined shaft ANSI B92.1-1976 1 1/2" 17T, without undercut



DB-LH30VO-079

A0

5.13 Through-drive

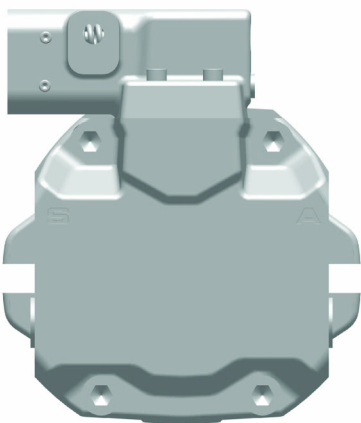
L	H	3	0	V	0		/	-	20	V					0	00		000			
1.	2.	3.	4.	5.	6.	7.		8	9.	10.	11.	12.	13.	14.	15	16	17	18	19	20	21

5.13.1 Axial piston unit without through-drive



Note

For dimensions for axial piston unit without through-drive, see main dimensions.



DB-LH30VO-139

0000

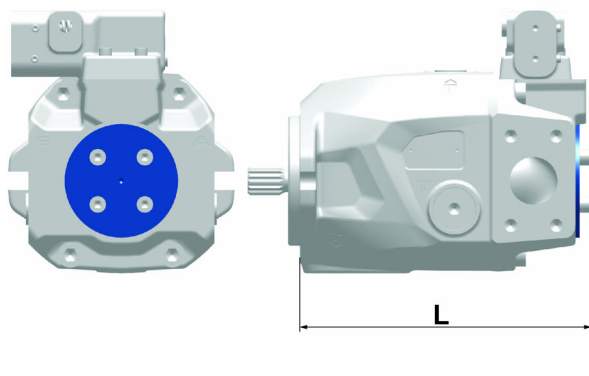
5 Dimensions

5.13.2 Axial piston unit with preparation for adapter mounting kit



Note

Preparation for adapter mounting kit, sealed with cover.
 To use the through-drive, the selected adapter mounting kit including coupling ferrule (see installation drawing) must be ordered separately; the cover must be removed and the adapter mounting kit fitted.



K02G 4-hole

NS	028	045	085	100
L	8.05 (204.5)	9.00 (228.5)	11.40 (289.5)	11.83 (300.5)
L*	8.35 (212)	9.00 (228.5)	11.40 (289.5)	11.83 (300.5)

L) Up to mounting flange

L*) Total length of axial piston unit with control type VE_/VK_ and LR-, [see information below](#).



Note

NS 028: Total length of axial piston unit with control type VE_/VK_ and LR-, [see chapter 5.1.3](#).
 NS 045: Total length of axial piston unit with control type VE_/VK_ and LR-, [see chapter 5.4.3](#).
 NS 085: Total length of axial piston unit with control type VE_/VK_ and LR-, [see chapter 5.7.3](#).
 NS 100: Total length of axial piston unit with control type VE_/VK_ and LR-, [see chapter 5.10.3](#).

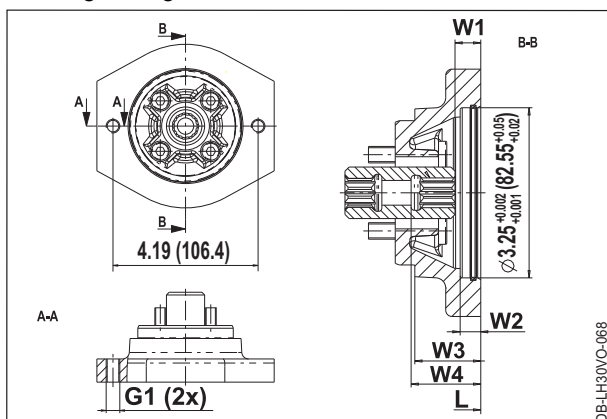
5.13.3 Axial piston unit with through-drive SAE A



Note

O-ring for sealing of axial piston unit 2 is included in the scope of delivery.
 NS 028: The following applies to control type VE_/VK_ and LR-; total length up to mounting flange L + 0.51 inch (13 mm).

Shaft gearing: 5/8 in 9T 16/32DP



A11D 2-hole

NS	W1	W2	W3	W4	L	G1 (2-hole)
028	0.39 (9.9)	0.31 (8)	1.26 (32)	1.33 (33.8)	8.66 (220)	M10x1.5; 17 deep
045	0.57 (14.5)	0.31 (8)	1.26 (32)	1.41 (35.8)	9.61 (244)	M10x1.5; 17 deep
085	0.53 (13.4)	0.31 (8)	0.77 (19.5)	1.34 (34)	11.42 (290)	M10x1.5; 19.5 deep
100	0.53 (13.4)	0.31 (8)	0.77 (19.5)	1.34 (34)	11.85 (301)	M10x1.5; 19.5 deep

L*) Up to mounting flange

5 Dimensions

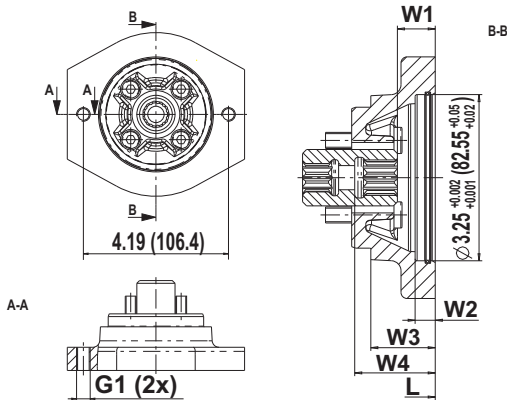
5.13.4 Axial piston unit with through-drive SAE A-B



Note

O-ring for sealing of axial piston unit 2 is included in the scope of delivery.
 NS 028: The following applies to control type VE_/ VK_ and LR-; total length up to mounting flange L + 0.51 inch (13 mm).

Shaft gearing: 3/4 in 11T 16/32DP



A21D 2-hole

NS	W1	W2	W3	W4	L	G1 (2-hole)
028	0.74 (18.8)	0.31 (8)	1.26 (32)	1.57 (40)	8.66 (220)	M10x1.5; 17 deep
045	0.82 (20.9)	0.31 (8)	1.26 (32)	1.66 (42.1)	9.61 (244)	M10x1.5; 17 deep
085	0.93 (23.6)	0.31 (8)	0.77 (19.5)	1.57 (40)	11.42 (290)	M10x1.5; 19.5 deep
100	0.93 (23.6)	0.31 (8)	0.77 (19.5)	1.57 (40)	11.85 (301)	M10x1.5; 19.5 deep

L*) Up to mounting flange

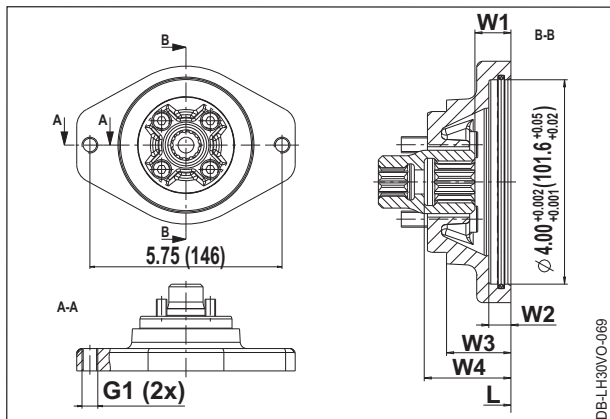
5.13.5 Axial piston unit with through-drive SAE B



Note

O-ring for sealing of axial piston unit 2 is included in the scope of delivery.
 NS 028: The following applies to control type VE_/ VK_ and LR-; total length up to mounting flange L + 0.51 inch (13 mm).

Shaft gearing: 7/8 in 13T 16/32DP



B11D 2-hole

NS	W1	W2	W3	W4	L	G1 (2-hole)
028	0.70 (17.8)	0.39 (10)	1.26 (32)	1.70 (43.1)	8.66 (220)	M12x1.5; 17 deep
045	0.85 (21.7)	0.39 (10)	1.26 (32)	1.78 (45.1)	9.61 (244)	M12x1.5; 17 deep
085	0.79 (20)	0.39 (10)	1.04 (26.5)	1.69 (43)	11.69 (297)	M12x1.5; 18 deep
100	0.79 (20)	0.39 (10)	1.04 (26.5)	1.69 (43)	12.13 (308)	M12x1.5; 18 deep

L*) Up to mounting flange

5 Dimensions

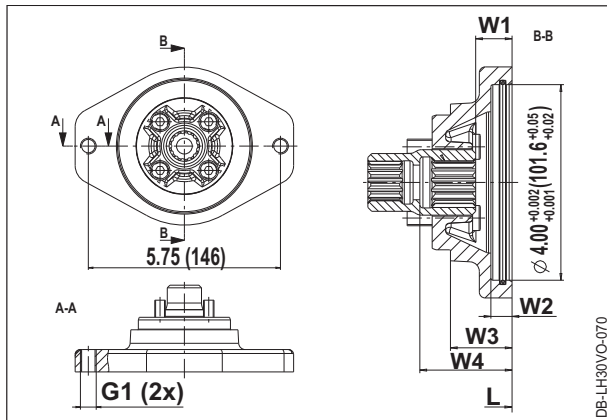
5.13.6 Axial piston unit with through-drive SAE B-B



Note

O-ring for sealing of axial piston unit 2 is included in the scope of delivery.
 NS 028: The following applies to control type VE_/ VK_ and LR-; total length up to mounting flange L + 0.51 inch (13 mm).

Shaft gearing: 1 in 15T 16/32DP



B21D 2-hole

NS	W1	W2	W3	W4	L	G1 (2-hole)
028	-	-	-	-	-	-
045	0.82 (20.9)	0.39 (10)	1.26 (32)	1.96 (49.9)	9.61 (244)	M12x1.75; 17 deep
085	0.87 (22.2)	0.39 (10)	1.04 (26.5)	1.89 (48)	11.69 (297)	M12x1.75; 18 deep
100	0.87 (22.2)	0.39 (10)	1.04 (26.5)	1.89 (48)	12.13 (308)	M12x1.75; 18 deep

L*) Up to mounting flange
 - not possible

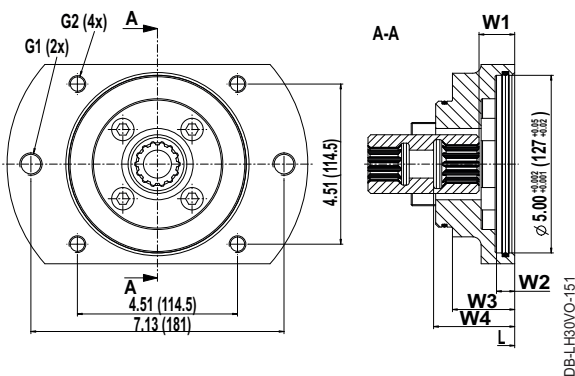
5.13.7 Axial piston unit with through-drive SAE C



Note

O-ring for sealing of axial piston unit 2 is included in the scope of delivery.

Shaft gearing: 1 1/4 in 14T 12/24DP



C11D 2-hole

C12D 4-hole

NS	W1	W2	W3	W4	L	G1 (2-hole) G2 (4-hole)
028	-	-	-	-	-	-
045	-	-	-	-	-	-
085	1.00 (25.5)	0.51 (13)	1.75 (44.5)	2.28 (58)	12.40 (315)	G1: M16x2; 24 deep G2: M12x1.75; 24 deep
100	1.00 (25.5)	0.51 (13)	1.75 (44.5)	2.28 (58)	12.83 (326)	G1: M16x2; 24 deep G2: M12x1.75; 24 deep

L*) Up to mounting flange
 - not possible

5 Dimensions

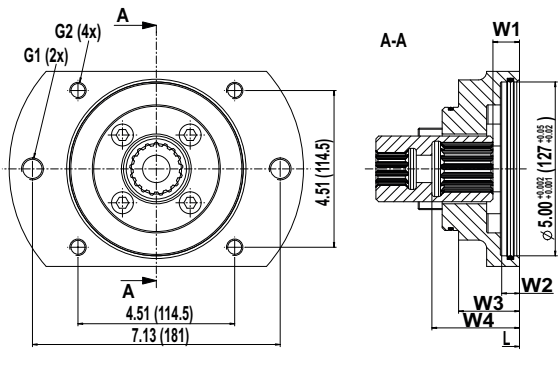
5.13.8 Axial piston unit with through-drive SAE C-C



Note

O-ring for sealing of axial piston unit 2 is included in the scope of delivery.

Shaft gearing: 1 1/2 in 17T 12/24DP



C21D 2-hole
C22D 4-hole

NS	W1	W2	W3	W4	L	G1 (2-hole) G2 (4-hole)
028	-	-	-	-	-	-
045	-	-	-	-	-	-
085	0.76 (19.4)	0.51 (13)	1.75 (44.5)	2.52 (64)	12.40 (315)	G1: M16x2; 24 deep G2: M12x1.75; 24 deep
100	0.76 (19.4)	0.51 (13)	1.75 (44.5)	2.52 (64)	12.83 (326)	G1: M16x2; 24 deep G2: M12x1.75; 24 deep

L*) Up to mounting flange
- not possible

5 Dimensions

5.14 Multiple axial piston unit

General information

On request, multiple axial piston units consisting of 2 or more individual units can be implemented.

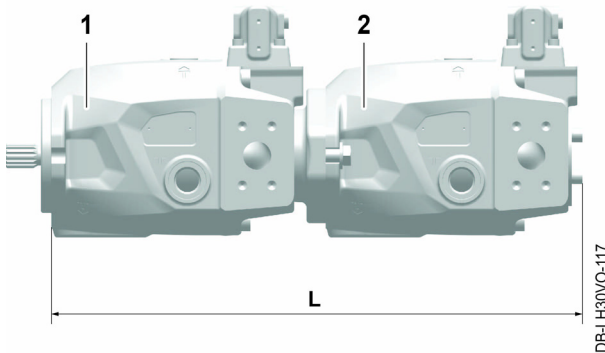
The type code must be completed separately for each individual unit. These type codes must be separated with a dash when ordering.

On the separate type plate for the multiple unit, the nominal sizes are separated by a "+". The last nominal size is followed only by the code for the direction of rotation. (Spaces before and after the letter are mandatory)

L	H	3	8	V	O	045+045...	
1.	2.	3.	4.	5.	6.	7.	11.

Type code 4 on the type plate changes from 0 to 8 for the design and the multiple unit is designated as LH38V0.

Details of the individual units can be found on the type plate of each individual unit.



1	Basic axial piston unit
2	Add-on axial piston unit
L	Total length of multi-circuit axial piston unit in inch (mm)
-	-

5.14.1 Dimensions of the multiple unit

Note



The overall length of the multiple unit is the total of the individual units.

For all nominal sizes, the overall length of the multiple units with control type VE_/VK_ and LR- must be calculated from the arrangement of the individual units.

Basic axial piston unit 1	Add-on axial piston unit 2 with type code for through-drive K02G			
	NS 028	NS 045	NS 085	NS 100
NS 028 SAE B	16.71 (424.5)	-	-	-
NS 045 SAE B	17.66 (448.5)	18.60 (472.5)	-	-
NS 085 SAE B / C	19.74 / - (501.5 / -)	20.69 / - (525.5 / -)	- / 23.80 (- / 604.5)	-
NS 100 SAE B / C	20.18 / - (512.5 / -)	21.12 / - (536.5 / -)	- / 24.23 (- / 615.5)	- / 24.67 (- / 626.5)

- = Not possible

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