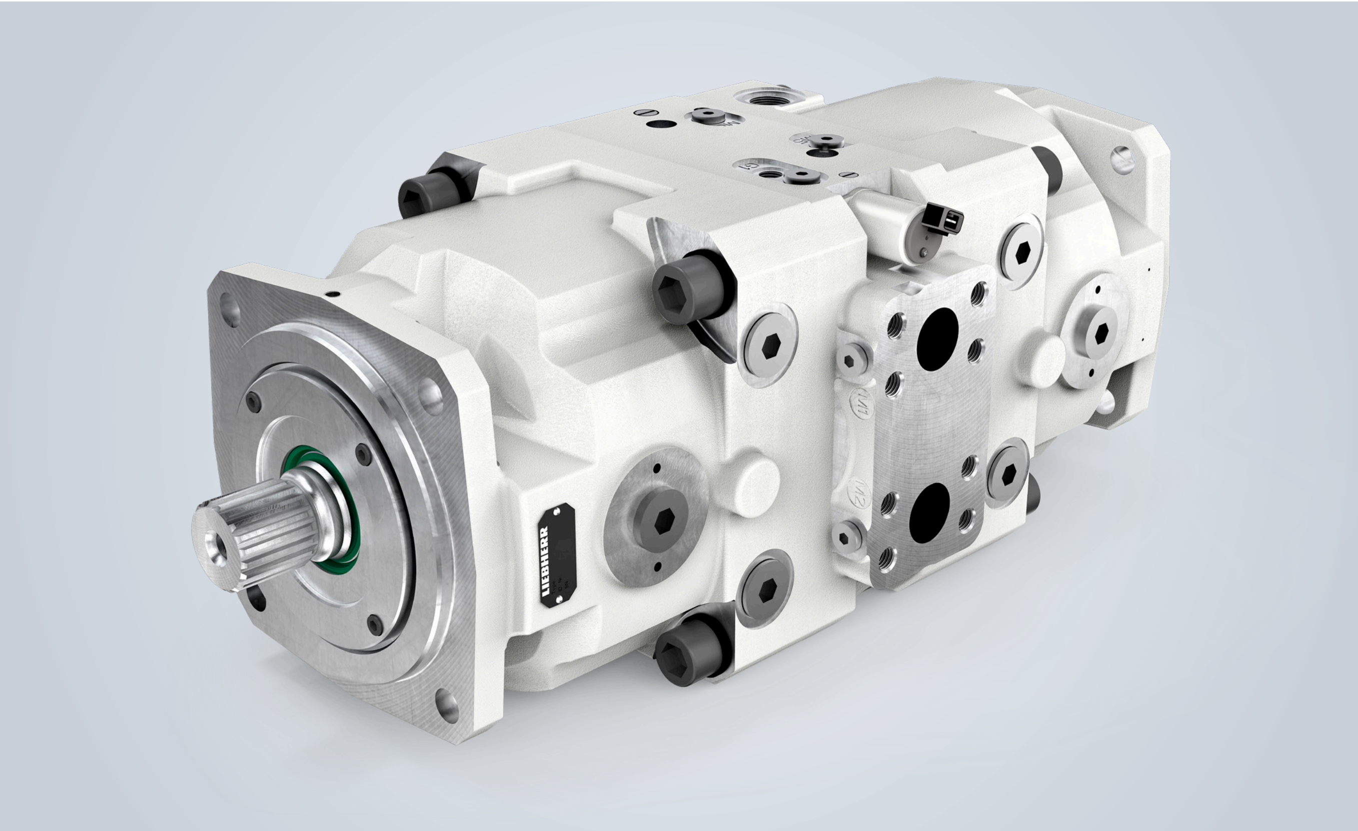
Data sheet

Axial piston motor DMVA



The Liebherr axial piston double motors in the DMVA series are designed as swashplates for open and closed circuits and were specially developed for use in mobile machinery in harsh environments.

The inverse drive with a swivel angle of 22° is very efficient and has a very high power density, making it ideal for applications that require a variable displacement to hydraulic motor.

These flanged variable displacement double motors are available in nominal sizes from 165–108 to 215–165. The nominal pressure of the units is 6,527 psi (450 bar) and the maximum pressure is 7,252 psi (500 bar) absolute.

The driving gears are adjustable individually or in parallel. A shared connecting plate simplifies hydraulic line installation. The DMVA series is available with the most common controls. Speed sensor or preparation for speed sensor available on request.

The through-drive capability can be used for mounting a brake or tandem units (axial piston multi-circuit motor).

Valid for:
DMVA 165 – 108
DMVA 165 – 165
DMVA 165 – 215
DMVA 215 – 165

Features:
Axial piston double motor
D series
Open and closed circuit

Control types:
Various control types can be selected

Pressure range:
Nominal pressure p_N = 6,527 psi (450 bar)
Maximum pressure p_{max} = 7,252 psi (500 bar)

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1 Type code

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

1. Motor type

D series / motor / variable / flanged	DMVA

2. Type of circuit

Open	■	O
Closed	■	G

3. Nominal size (NS)

	165-108	165-165	165-215	215-165	

4. Residual displacement $V_{g\ min}$

Enter values in cm^3/rev for both axial piston units separated by "/", e.g.: 000 / 055	■	

5. Activation / control type

Electro-proportional (negative characteristic)	□	■	□	□	EL
Electro-proportional (positive characteristic)	■	■	□	□	EL1
Electro-proportional (negative characteristic) / pressure cut-off	□	■	■	■	EL - DA
Electro-proportional (negative characteristic) / pressure cut-off with override	■	■	□	□	EL - DA1
Hydraulic-proportional (negative characteristic) / pressure cut-off	□	■	□	□	SD - DA
Hydraulic regulation, dependent on high pressure	□	■	□	□	HD

6. Design

	1

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

alternating	W

8. Mounting flange

Mounting flange ISO 3019-2	Ø180B4 (four-hole mounting flange). Enter "Ø180" in the order text	■	■	■	□	31
	Ø200B4 (four-hole mounting flange). Enter "Ø200" in the order text	□	□	□	■	31

9. Shaft end

Splined shaft	DIN 5480	1

10. Connections

ISO 6162-2 / SAE J518-2, high-pressure connection 6000 psi	A

11. Accessories

Without add-on parts	0

■ = Available / □= On request / -= Not available

1 Type code

	165-108	165-165	165-215	215-165	
12. Through drive					
No through drive	■	■	■	■	0
Special through-drive	□	■	■	■	K
13. Valves					
Without valve	■	■	■	■	0
Flushing, closed circuit	■	■	■	■	SO
14. Sensors					
Without sensor	■	■	■	■	0
With speed sensor	■	■	■	■	D*
With angle sensor	■	■	■	■	W*

* Can be combined, separated by hyphen, e.g.: D-W

■ = Available
□ = On request
\- = Not available

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

2 Technical data

2.1 Table of values

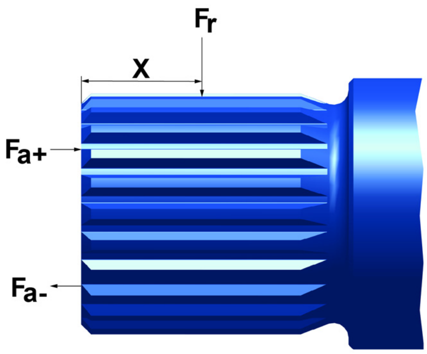
Nominal size			165-108	165-165	165-215	215-165
Displacement	$V_{g\ max}$	cm^3	167.8-107.7	167.8-167.8	167.8-216.6	216.6-167.8
	$V_{g\ min}$	cm^3	0 - 80% of $V_{g\ max}$, value specified in [cm^3/rev] Other values upon request			
Displacement flow at n_{max}	qv_{max}	l/min	827	1007	1038	1038
Max. speed at $V_{g\ max}$ and Δp* = 430 bar	n_{max}	rpm	3000	3000	2700	2700
Max. speed at $V_{g\ max}$ = 0.65 and Δp = 200 bar	n_{max}	rpm	4500	4500	4100	4100
Output torque at $V_{g\ max}$ and Δp = 430 bar	M_{max}	Nm	1885	2297	2631	2631
Torq constant at $V_{g\ max}$	M_K	Nm/bar	4.38	5.34	6.12	6.12
Output power at qv_{max} and Δp = 430 bar	p_{max}	kW	593	722	744	744
Torsional rigidity	Nm/rad * 10^3		353	353	353	511
Driving gear moment of inertia	J_{TW}	kgm^2	0.0464	0.0626	0.0773	0.0773
Weight (approx.)	m	kg	140	152	179	179

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

2 Technical data

2.1.1 Maximum radial and axial load of the driving shaft

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



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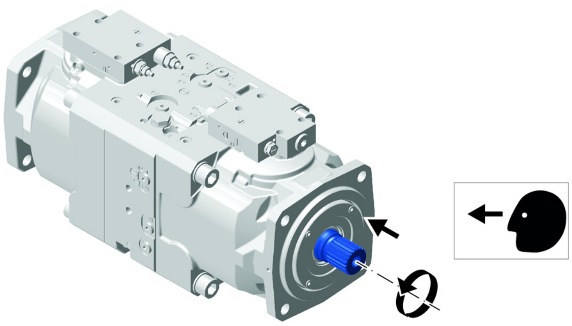
Nominal size			165-108	165-165	165-215	215-165
Max. radial force	$F_{r\ max}$	N	Values upon request			
Max. axial force	$F_{a\pm\ max}$	N				

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

2.2 Direction of rotation

DMVA			/			1	W		1	A	0			
1.	2.	3.	/	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.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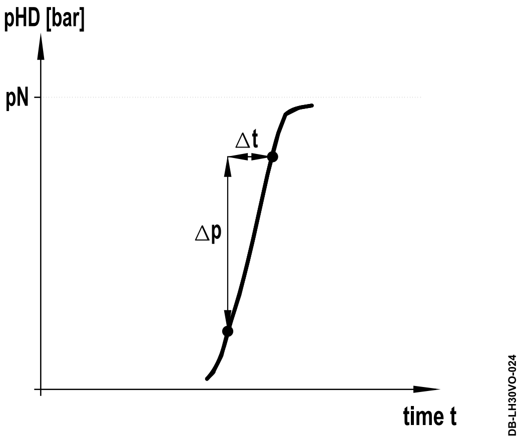
The direction of rotation is stated with view of the driving shaft, as shown in the figure.

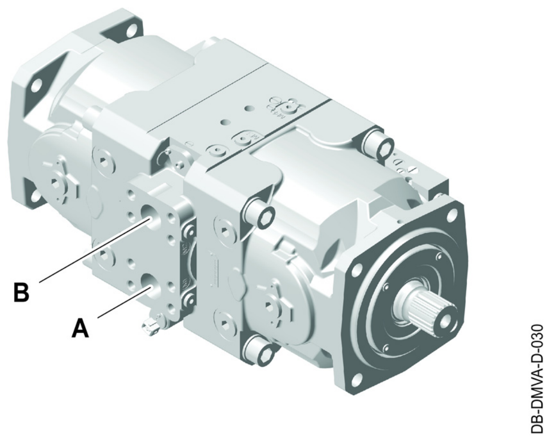
R	right	=	clockwise
L	left	=	anti-clockwise
W	alternating	=	depending on the activation at A / B

2 Technical data

2.3 Permitted pressure range

2.3.1 Operating pressure





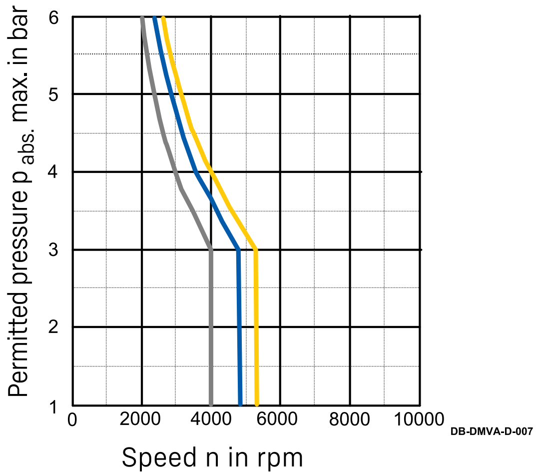
Operating pressure at connection A / B			**108 to 215**	
			open circuit	**closed circuit**
Minimum pressure**	pHD_{min}	bar	8	
Nominal pressure (fatigue resistant)	pHD_N	bar	400	450
Maximum pressure (single operating period)	pHD_{max}	bar	450	500
Single operating period at maximum pressure pHD_{max}	t	s	< 1	
Total operating period at maximum pressure pHD_{max}	t	OH*	300	
Rate of pressure change	RA	bar/s	17000	

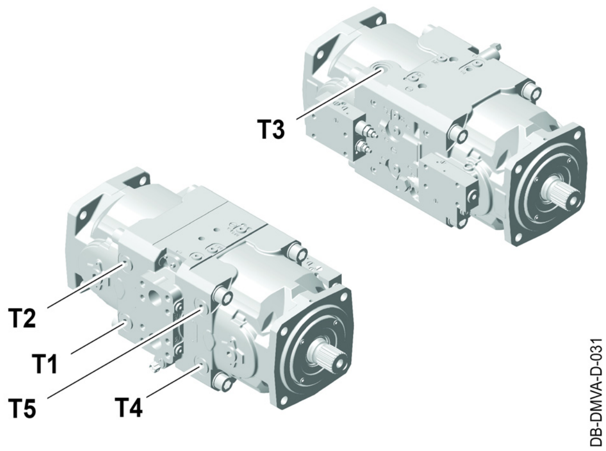
*) OH = operating hours
**) There must be minimum pressure in the working circuit at connection A/B to ensure adequate lubrication of the driving gear during operation.

DANGER
Failure of the fastening screws at working connection A / B!
Danger to life.
Use fastening screws of strength category 10.9.

2 Technical data

2.3.2 Housing, leakage oil pressure





Characteristic curve	Nominal size	Shaft diameter (mm)
yellow	108	45
blue	165	50
grey	215	60

Leakage oil pressure at connection T1 to T5			
Nominal size			**108 to 215**
Permanent leakage oil pressure, absolute, open and closed circuit	p_L	bar	3
Maximum pressure, absolute, open and closed circuit at reduced speed	pL_{max}	bar	6*

*) Short pressure peaks of max. 10 bar abs. are permitted (t < 0.1 s).

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

2 Technical data

2.4 Hydraulic liquids

2.4.1 General information

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

ATTENTION
You must not mix different mineral oil hydraulic fluids!

Minimum required quality

Specification
LH-00-HYC3A
LH-00-HYE3A

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

2.4.2 Fill quantity

Nominal size	Fill quantity
108 to 215	Values upon request

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

2.4.3 Filtering

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

2 Technical data

2.5 Temperature

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

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

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

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

2.5.1 Operating limits

Maximum values:

Maximum leakage oil temperature: 115 °C.

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

Low temperatures: (for additional information see: 2.5.2 Low temperatures, Page 10)

Note
The operating limits of Liebherr hydraulic fluids are provided in the viscosity chart included below to allow users to make an informed choice.
(for additional information see: 2.5.6 Viscosity chart, Page 15)

2.5.2 Low temperatures

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

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

2 Technical data

Overview

Temperature [°C]	Phase	Viscosity [mm²/s]	Note
< -50 °C	Idle state	-*	No storage or operation permitted
< -40 °C	Idle state	-**	No operation permitted, preheat to at least -40 °C, select appropriate hydraulic fluid

***) Idle state < -50 °C**

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

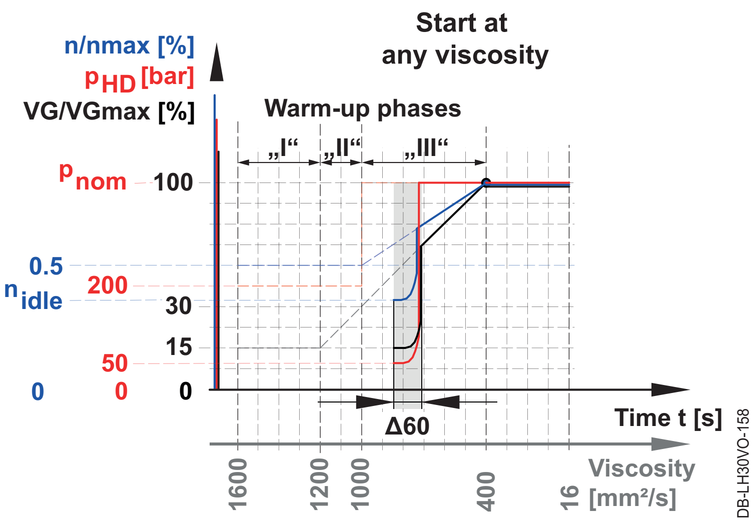
****) Idle state < -40 °C**

ATTENTION
Temperatures < -40 °C on the system = no operation of the axial piston unit permitted.
Functioning of the sealing elements in the axial piston unit is not guaranteed at temperatures < -40 °C. Preheat the axial piston unit and tank to at least -40 °C and use Liebherr Hydraulic Plus Arctic/Liebherr Hydraulic FFE 30 hydraulic fluid with a viscosity < 1600 mm²/s.
(for additional information see: 2.5.6 Viscosity chart, Page 15)

Regardless of the viscosity < 1600 mm²/s, the axial piston unit must be operated for at least 60 s under the following conditions before entering the cold start including the warm-up phases or on warm start:

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

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



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

2 Technical data

Overview

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

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

2.5.3 Cold start with subsequent warm-up phases

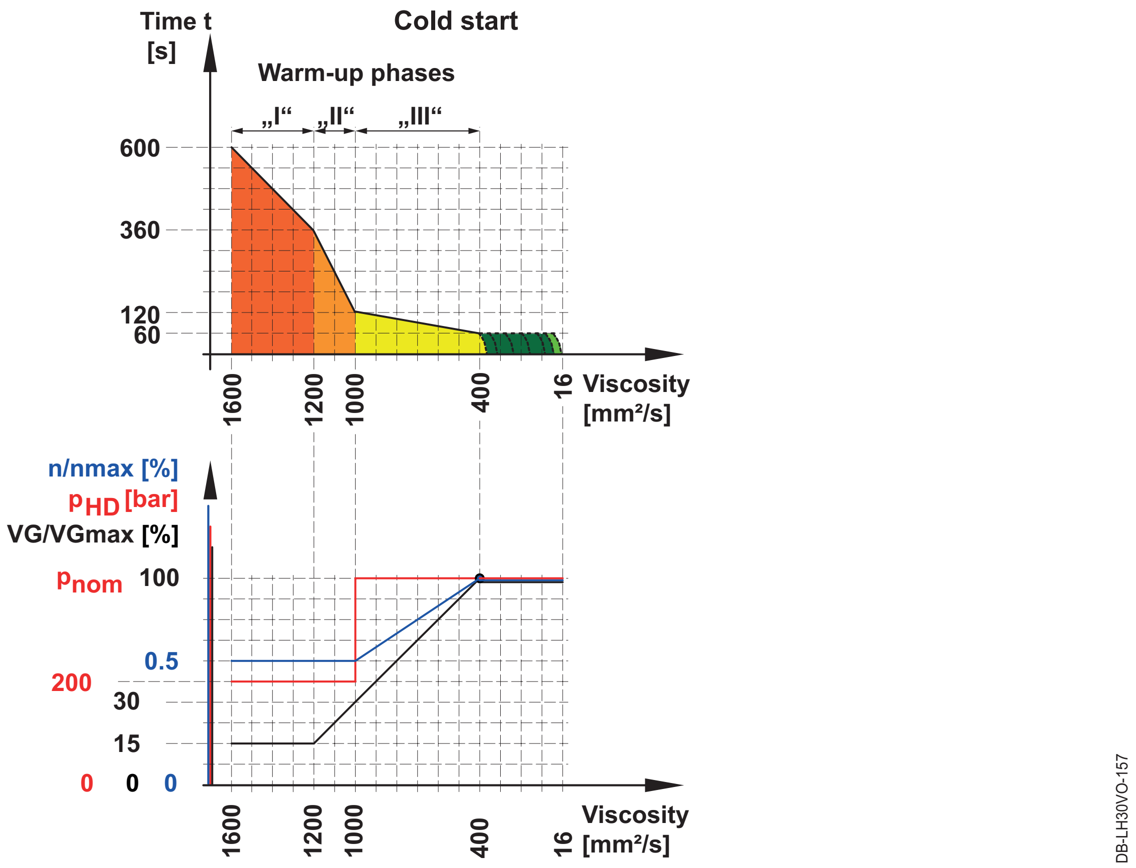
ATTENTION
Before cold start, the viscosity* must be determined on the basis of the oil temperature (e.g. tank temperature) in order to avoid damage to the axial piston units from excessive viscosity* of the hydraulic fluid. At a viscosity* > 1600 mm^2/s, the hydraulic system must be preheated.
Using the determined viscosity*, the type and duration of the warm-up must be followed, using the cold start chart**.

*) (for additional information see: 2.5.6 Viscosity chart, Page 15)

The following conditions apply:

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

****) Cold start chart**



2.5.4 Warm-up phases

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

Warm-up phase " I "

Condition:

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

Measures:

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

Warm-up phase "Ⅱ"

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

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

Warm-up phase "Ⅲ"

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

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

Warm start

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

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

2.5.5 Normal operation

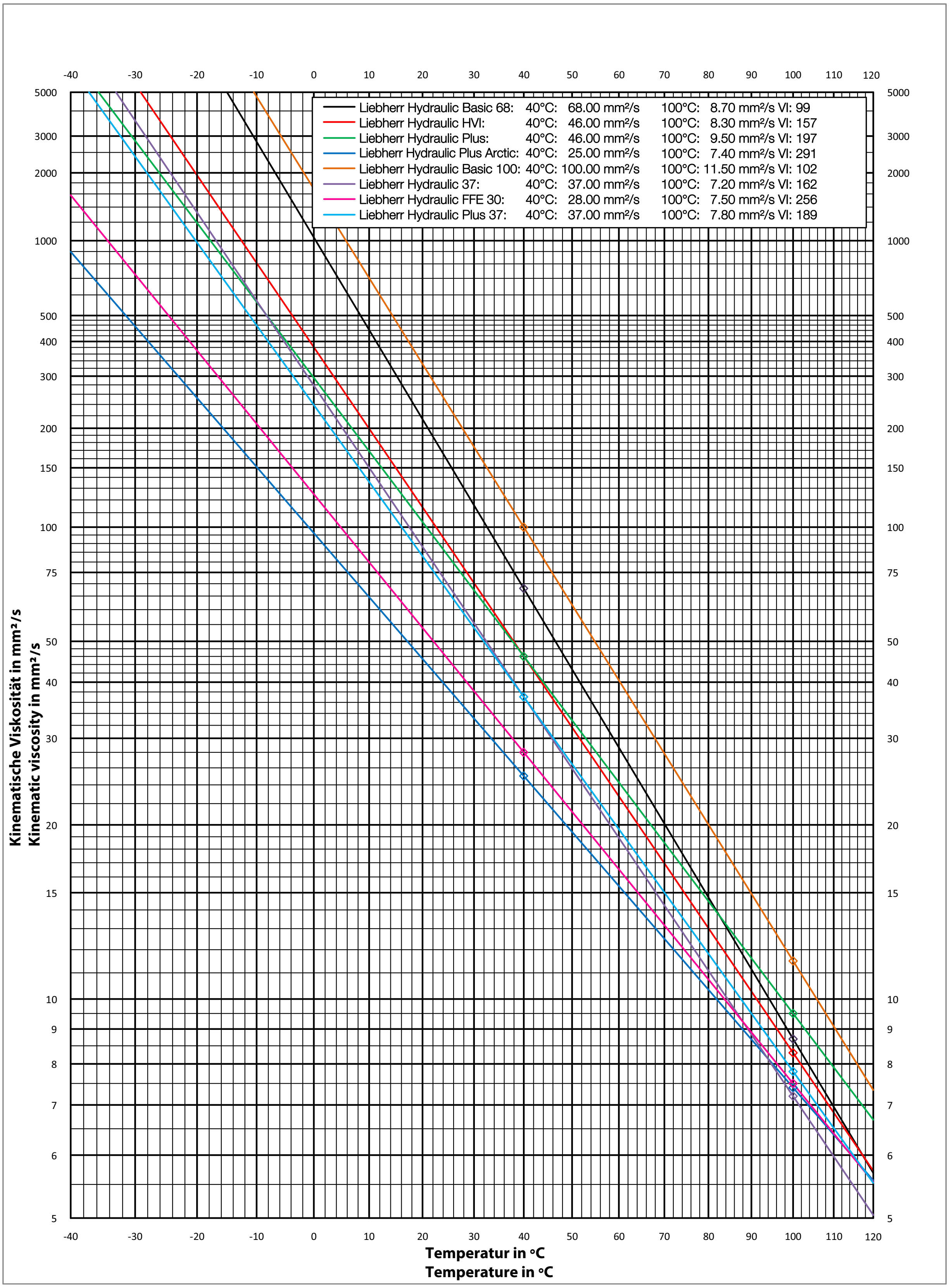
Note
Optimum operating range: 16-36 mm^2/s
The viscosity must not fall below 8 mm^2/s (for a short period, thud < 3 minutes, 7 mm^2/s) at maximum leakage oil temperature.

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

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

2 Technical data

2.5.6 Viscosity chart



2 Technical data

2.6 Shaft lip seal

2.6.1 General information

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

Sealing edge temperature varies due to the following factors in the housing:
- Circumferential speed
- Hydraulic fluid temperature
- Lubricating medium
- Pressure build-up

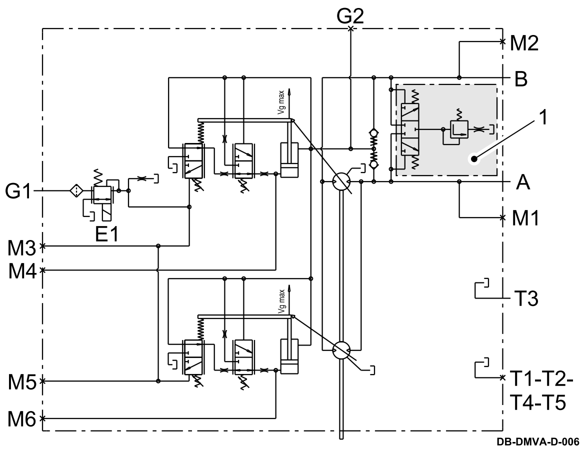
The sealing edge temperature could be 20 °C to 40 °C above the leakage oil temperature of a hydraulic axial piston unit.

2.7 Housing flushing

Under different operating conditions, e.g. a very low displacement flow over a longer period of time, the temperature in the housing may rise to its limit.

Depending on the hydraulic setup, a flushing circuit 1 for cooling and filtration may be required, where the "hot" hydraulic oil is led to an external cooler, cools down and is fed back into the hydraulic system.

The flushing volume Q_V in l/min is to be individually set for each nominal size in connection with the application and is the responsibility of the device or system manufacturer.



3 Activation and control type

3.1 Control types

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

Note
For each control type or function, only one nominal size is illustrated, typically nominal size 165. Special applications and designs are not included in this chapter. Always use the information from the installation drawing provided or contact Liebherr.

The following applies to all control types:

DANGER
The spring-guided reset in the regulating valve is not a safety device!
Contaminants in the hydraulic system such as chips or residual dirt from parts of the device or system can cause blockages at undefined points of various control components.
Under some circumstances, the machine operator's specifications can no longer be implemented.
It is the device or system manufacturer's responsibility to install a safety device e.g. an emergency stop.

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

3.1.1 Mechanical-hydraulic control

- HD- control, see chapter 3.2.1
- SD-DA- control, see chapter 3.2.1

3.1.2 Electric-hydraulic control

- EL- control, see chapter 3.2.2
- EL1- control, see chapter 3.2.2
- EL-DA- control, see chapter 3.2.2
- EL-DA1- control, see chapter 3.2.2

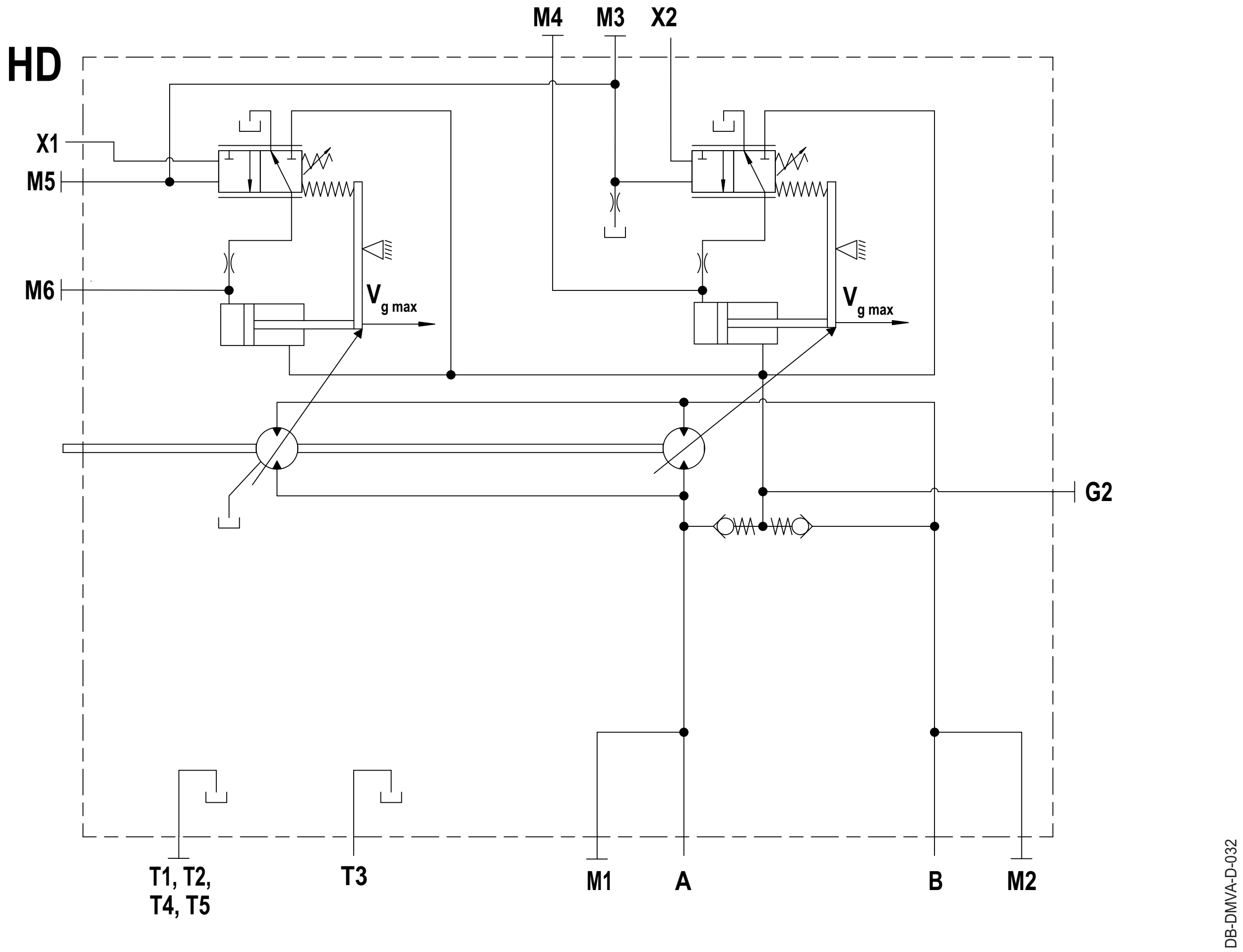
Further control types on request.

3 Activation and control type

3.2 Standard hydraulic diagrams

3.2.1 Mechanical-hydraulic control

HD control

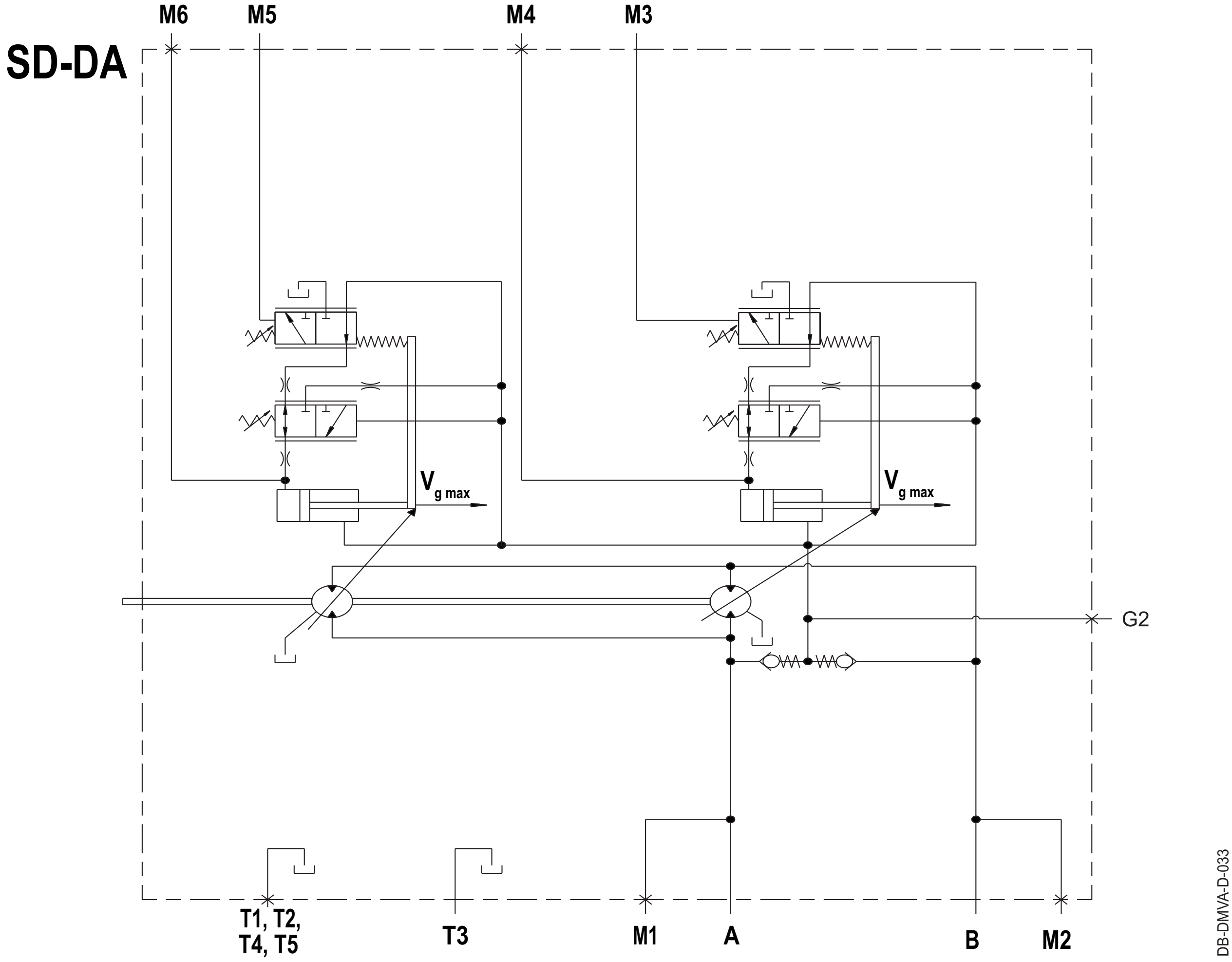


A, B	Working connections SAE J 518	M3, M5	Steering pressure connection ISO 9974-1
G2	Auxiliary pressure ISO 9974-1	M4, M6	Adjusting pressure measuring connection ISO 9974-1
M1, M2	High pressure measuring connections ISO 9974-1	T1, T2, T3 T4, T5	Leakage oil connection ISO 9974-1

Note
Oil inlet at connection A: direction of rotation = clockwise
Oil inlet at connection B: direction of rotation = anti-clockwise

3 Activation and control type

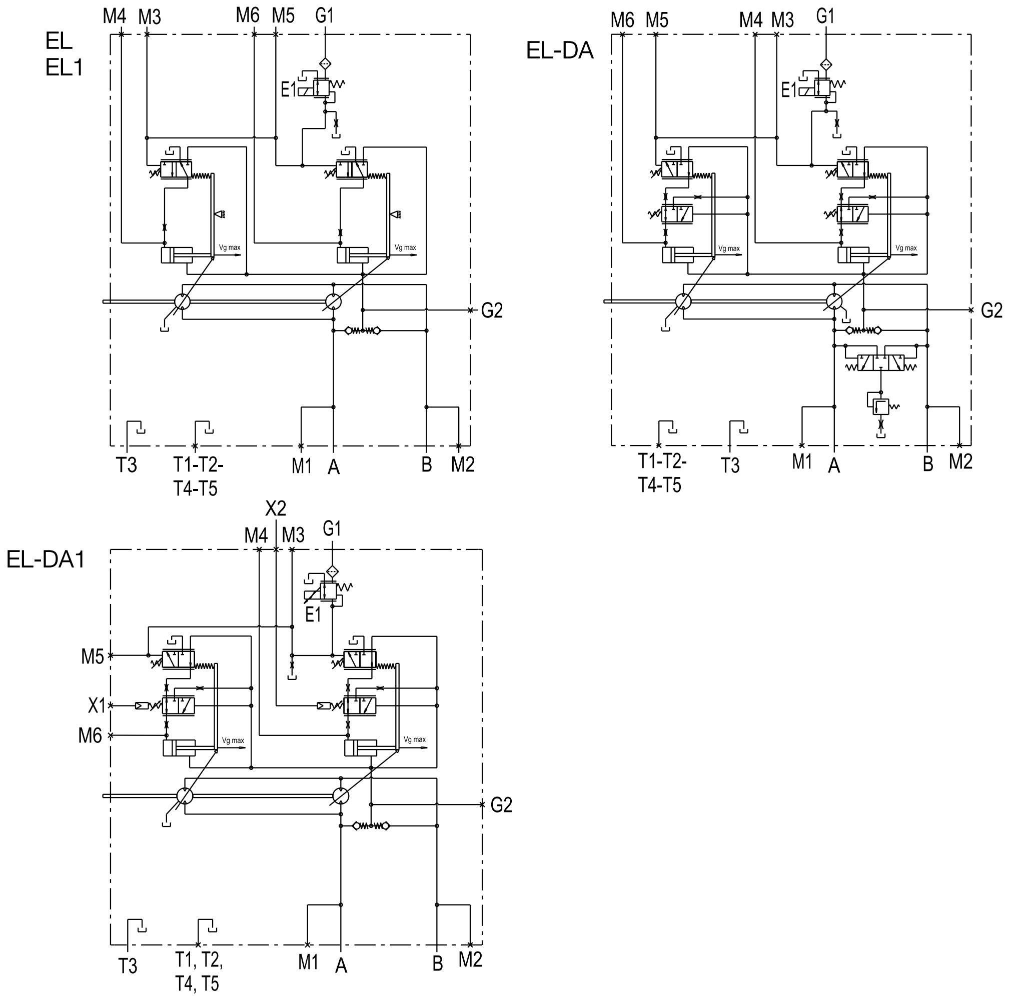
SD-DA control



A, B	Working connections SAE J 518	M3, M5	Steering pressure connection ISO 9974-1
G2	Auxiliary pressure ISO 9974-1	M4, M6	Adjusting pressure measuring connection ISO 9974-1
M1, M2	High pressure measuring connections ISO 9974-1	T1, T2, T3 T4, T5	Leakage oil connection ISO 9974-1

Note
Oil inlet at connection A: direction of rotation = clockwise
Oil inlet at connection B: direction of rotation = anti-clockwise

3.2.2 Electric-hydraulic control



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A, B	Working connections SAE J 518	M3, M5	Steering pressure measuring connection ISO 9974-1
E1	DRE plug-in terminal AMP junior Timer, 2P	M4, M6	Adjusting pressure measuring connection ISO 9974-1
G1	Adjusting pressure supply ISO 9974-1	T1, T2, T3 T4, T5	Leakage oil connection ISO 9974-1
G2	Auxiliary pressure connection ISO 9974-1	X1, X2	DA1 override signal ISO 9974-1
M1, M2	High pressure measuring connections ISO 9974-1	-	-

Note
Oil inlet at connection A: direction of rotation = clockwise
Oil inlet at connection B: direction of rotation = anti-clockwise

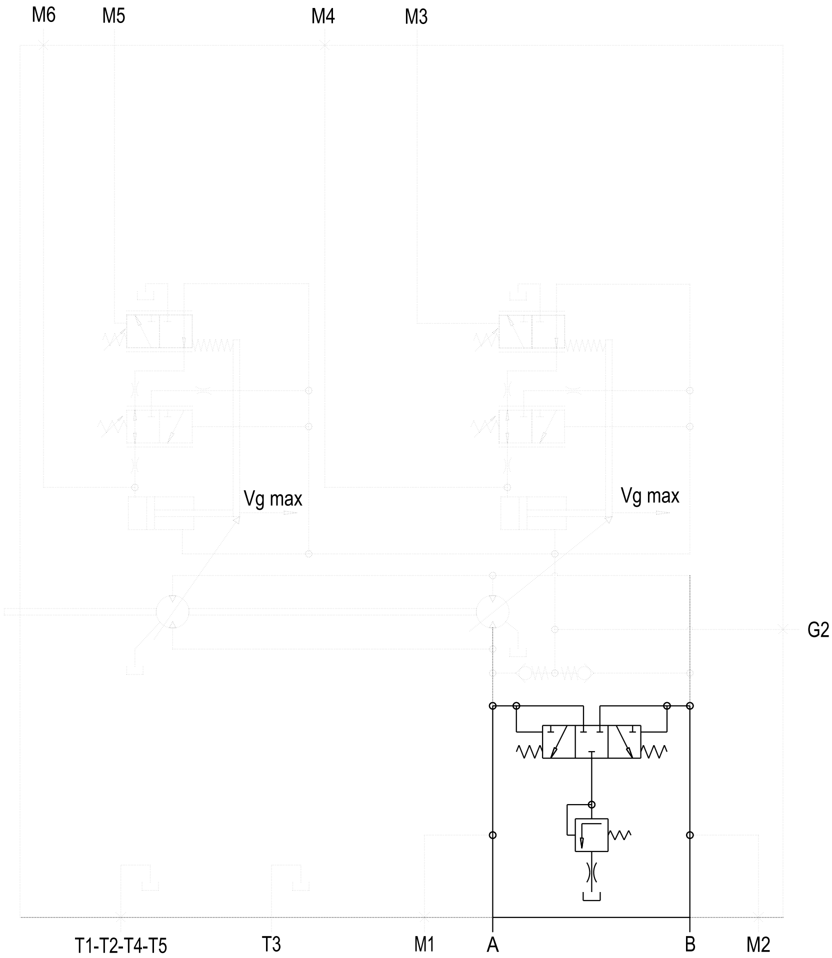
3 Activation and control type

3.2.3 Controls with flushing

Note
For flushing:

closed circuit = flushing compulsory

Closed circuit



A, B	Working connections SAE J 518	M3, M5	Steering pressure connection ISO 9974-1
G2	Auxiliary pressure ISO 9974-1	M4, M6	Adjusting pressure measuring connection ISO 9974-1
M1, M2	High pressure measuring connections ISO 9974-1	T1, T2, T3 T4, T5	Leakage oil connection ISO 9974-1

Note
Oil inlet at connection A: direction of rotation = clockwise
Oil inlet at connection B: direction of rotation = anti-clockwise

3 Activation and control type

3.3 Control functions

- HD- function / high pressure-dependent hydraulic regulation, see chapter 3.3.1
- HD- override, see chapter 3.3.2
- SD- function / steering-pressure proportional hydraulic regulation, see chapter 3.3.3
- DA- function / pressure control, see chapter 3.3.4
- DA1- function / pressure control with override, see chapter 3.3.5
- EL- function / electro-proportional regulation, see chapter 3.3.6
- EL1- function / electro-proportional regulation, see chapter 3.3.7

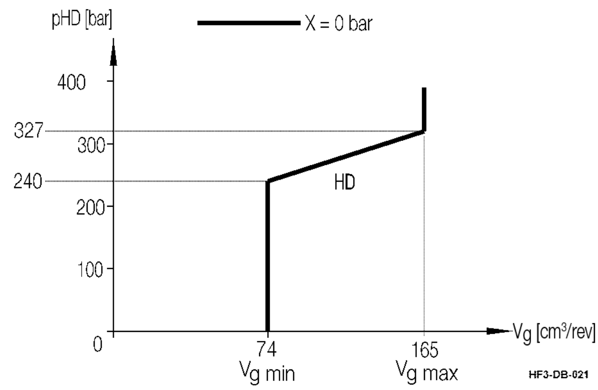
Note
The following applies to all control functions:

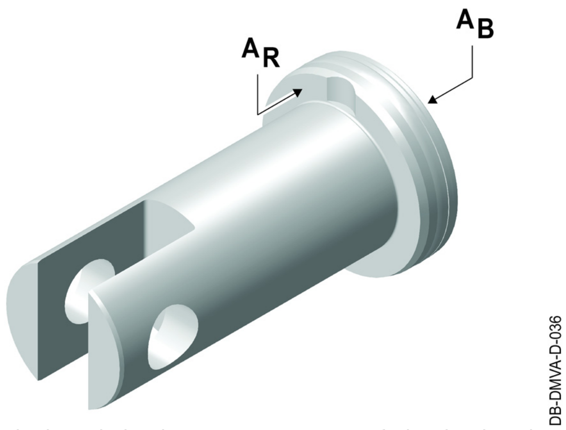
$V_{g\ min}$ = small torque “M” = high speed “n”
$V_{g\ max}$ = large torque “M” = low speed “n”

3.3.1 HD- function

In HD- control, the displacement V_g within the regulation range is proportionally dependent on the operating pressure pHD applied at the high-pressure connection A / B (provided by the hydraulic pump).

Characteristic





The high pressure connection A / B at the hydraulic motor is loaded with high pressure pHD of the hydraulic pump.

Up to a fixed value set at the $V_{g\ min}$ regulating screw, when regulation starts, e.g. 74 cm^3, the adjusting piston bottom area A_B is loaded with pReg = 0 bar and the adjusting piston ring area A_R is loaded with high pressure pHD. The axial piston unit is swivelled to $V_{g\ min}$.

If pHD at the high pressure connection A / B exceeds the value when regulation starts, e.g. 240 bar, the regulating valve loads the adjusting piston bottom area A_B with pReg (approx. 1/2 pHD). If pReg x A_B is greater than pHD x A_R, the adjusting piston moves and swivels the axial piston unit towards $V_{g\ max}$, settling depending on the load.

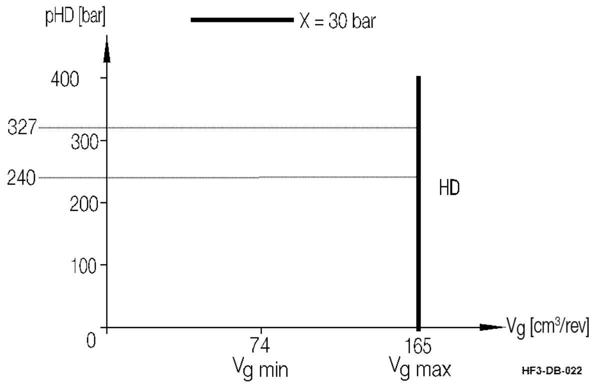
With a load of 0 bar at connection X, the characteristic of the HD function is driven.

Optionally, the HD function can be oversteered.

3 Activation and control type

3.3.2 HD- override

Characteristic

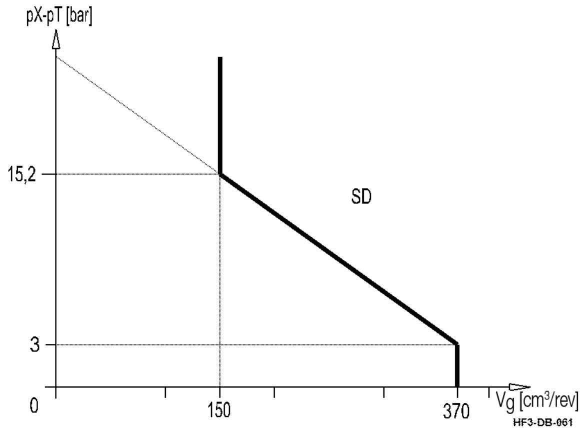


With the override function, connection X is loaded with 30 bar. The axial piston unit swivels to $V_{g\ max}$, regardless of the high pressure pHD at connection A / B. The hydraulic motor therefore responds more sensitively with maximum torque.

3.3.3 SD- function (negative characteristic)

SD- control is suitable for applications which require a proportionally regulated displacement flow.

Characteristic

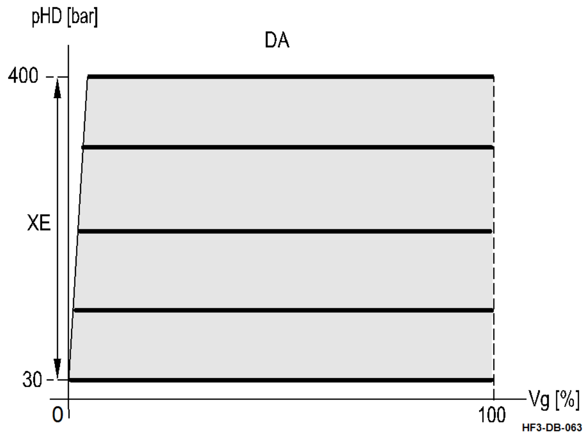


If the drive is adjusted from $V_{g\ max}$ towards $V_{g\ min}$, the axial piston unit swivels to a lower displacement V_g as the SD steering pressure at M3/M5 increases.

If the activating signal at M3/M5 is weakening, missing or defective, the axial piston unit swivels towards $V_{g\ max}$.

3.3.4 DA- function

Characteristic



The DA function regulates the displacement flow of the axial piston unit. The operating pressure is kept constant after reaching the setpoint, regardless of the torque at the driving shaft of the flange-mounted motor:

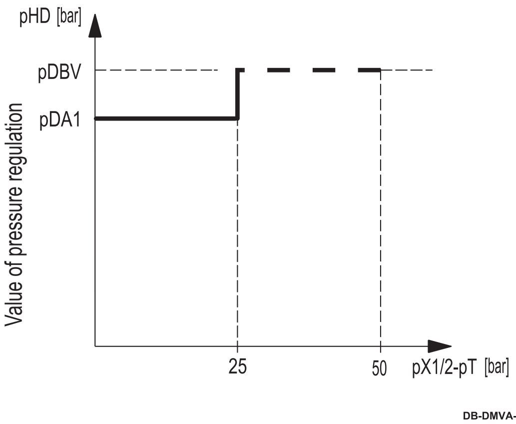
- As the output torque increases, the axial piston unit swivels towards $V_{g\ max}$ to keep the operating pressure constant.
- As the output torque decreases, the axial piston unit swivels towards $V_{g\ min}$ to keep the operating pressure constant.

Options

- Additional internal design measures for vibration damping on request.
- DA override (DA1)

3.3.5 DA1- function

Characteristic



The DA1 function ensures for, e.g. with drilling head drive, for a deactivation of the DA function by controlling with an oversteer pressure (p_{min}= 25 bar, p_{max}= 50 bar) at X1/X2. The pressure increase is not limited until activation of the pressure limiting valve (pDBV).

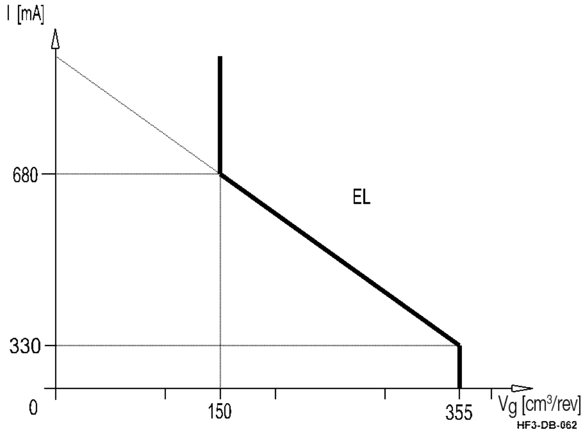
The DA function remains active up to an oversteer pressure (p < 25 bar) at X1/X2.

3 Activation and control type

3.3.6 EL- function (negative characteristic)

EL- control is suitable for applications which require a proportionally regulated displacement flow.

Characteristic



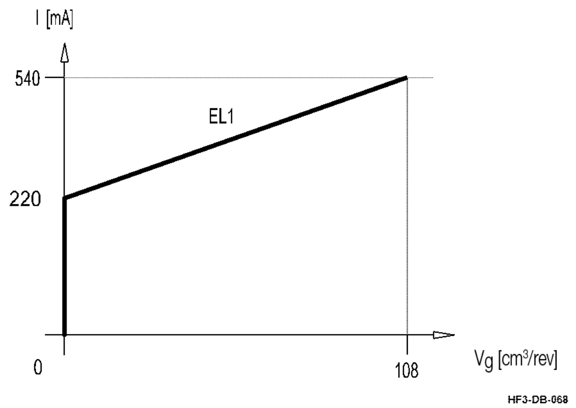
If the drive is adjusted from $V_{g\ max}$ towards $V_{g\ min}$, the axial piston unit swivels to a lower displacement V_g as the activating signal at E1 increases.

If the activating signal at E1 is weakening, missing or defective, the axial piston unit swivels towards $V_{g\ max}$.

3.3.7 EL1- function (positive characteristic)

EL- control is suitable for applications which require a proportionally regulated displacement flow.

Characteristic



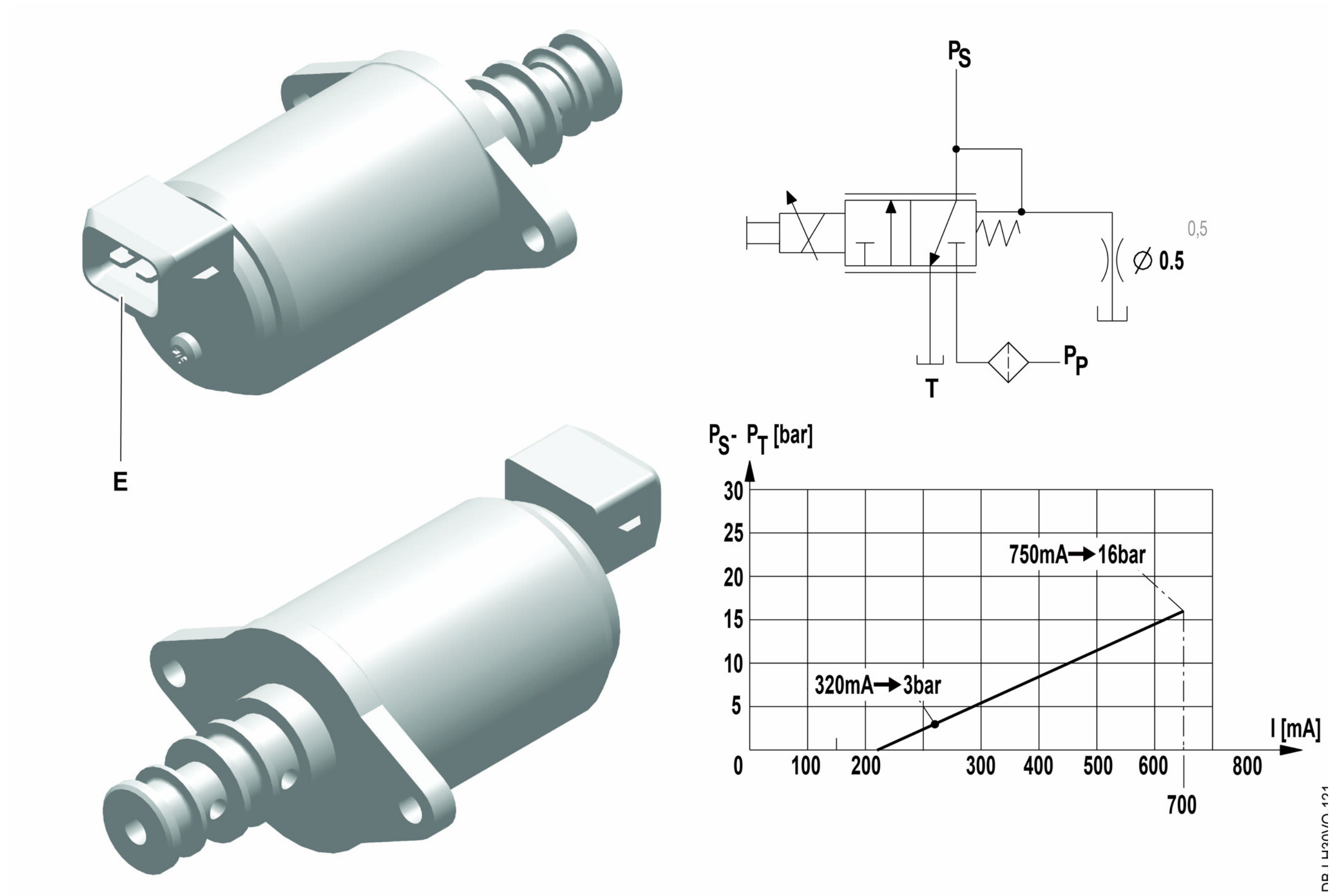
If the drive is adjusted from $V_{g\ min}$ towards $V_{g\ max}$, the axial piston unit swivels to a larger displacement V_g as the activating signal at E1 increases.

If the activating signal at E1 is weakening, missing or defective, the axial piston unit swivels towards $V_{g\ min}$.

3 Activation and control type

3.4 Electrical components

3.4.1 Pressure control valve (DRE) variant 1



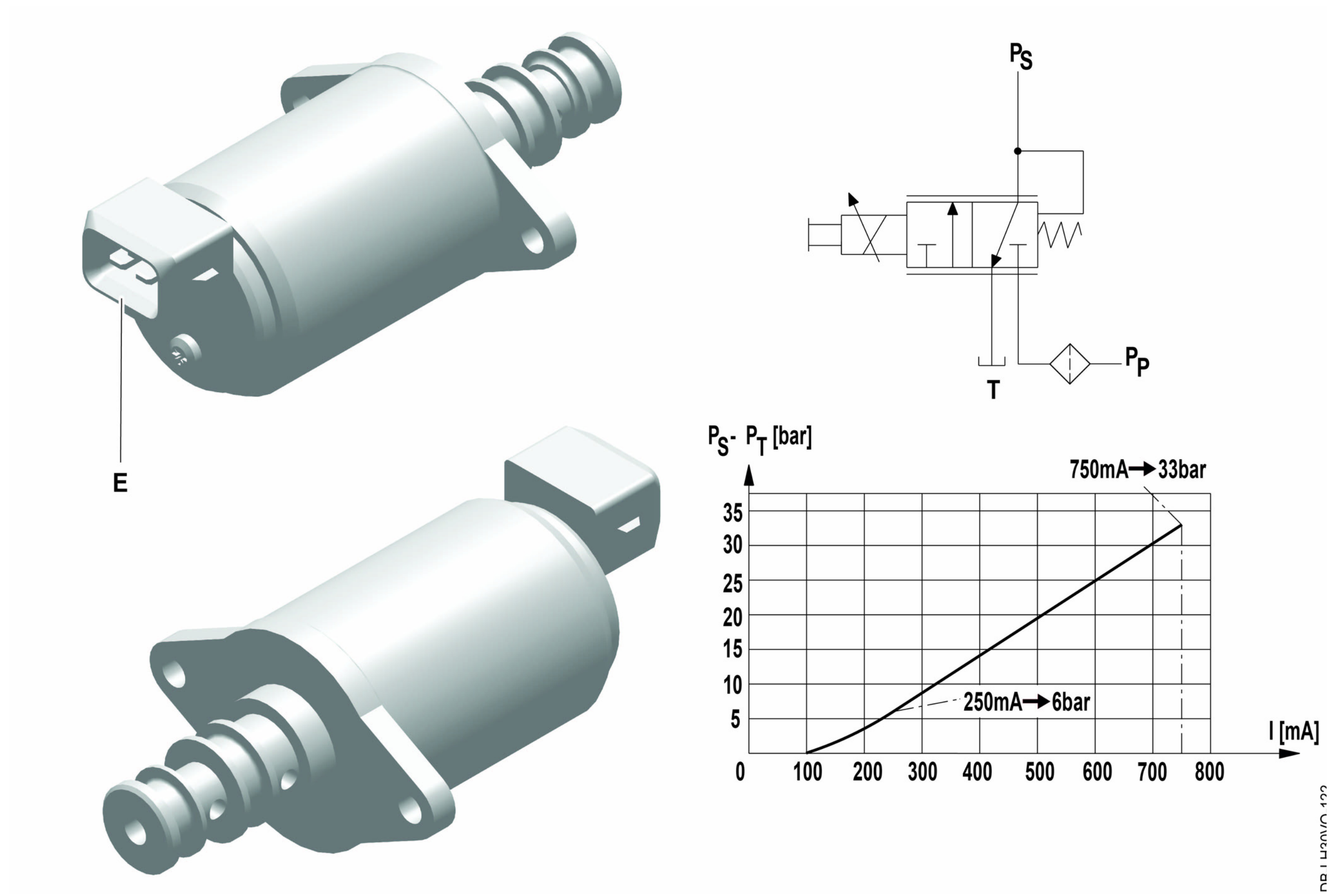
T	Tank	PS	Output DRE
PP	Input DRE	E	Connection AMP Junior Timer

General information

Technical data of pressure control valve	
Rated voltage U	24 V
Current $I_{max.}$	750 mA
Supply pressure $p_{max.}$	50 bar
Magnet characteristic curve: flat around the regulating position	-
AMP JUNIOR TIMER plug-in terminal, 2-pin	-

3 Activation and control type

3.4.2 Pressure control valve (DRE) variant 2



T	Tank	PS	Output DRE
PP	Input DRE	E	Connection AMP Junior Timer

General information

Technical data of pressure control valve	
Rated voltage U	24 V
Current $I_{max.}$	750 mA
Supply pressure $p_{max.}$	350 bar
Magnet characteristic curve: flat around the regulating position	-
AMP Junior Timer plug-in terminal	-

3 Activation and control type

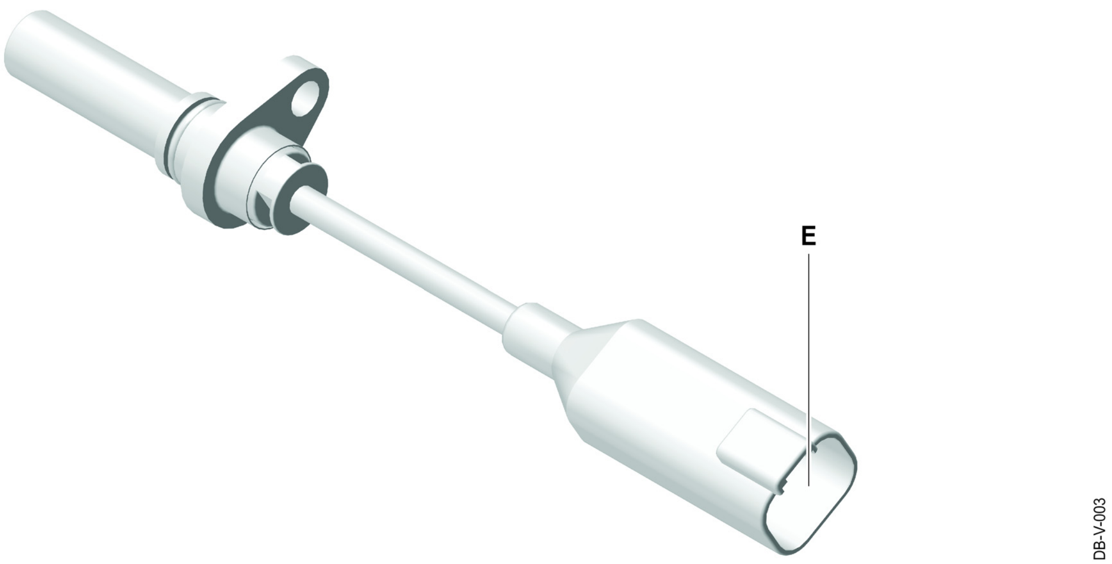
3.4.3 Sensors

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

0	without sensor
D*	with speed sensor
W*	with rotation angle sensor

* can be combined, separated by hyphen, e.g.: D-W

Speed sensor

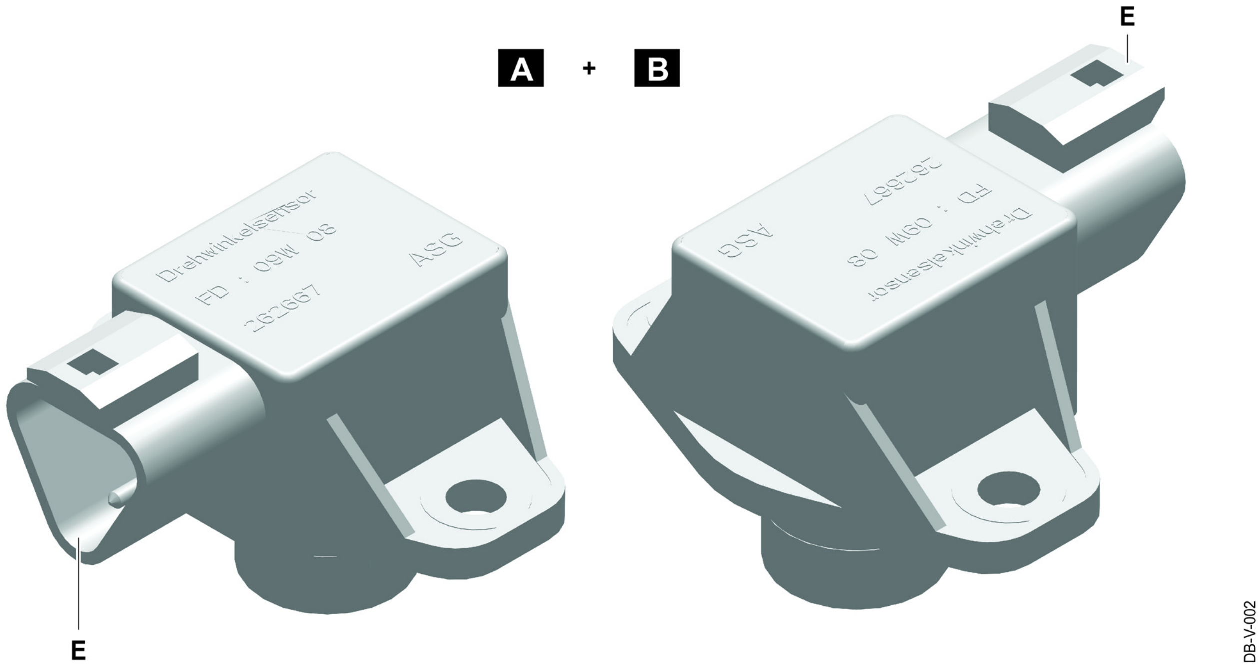


Technical data			
Rated voltage U	8-32 V	Short-circuit resistance	Yes
Power consumption	<20 mA at 24 V	Reverse polarity protection	Yes up to max. 32 V
Wiring harness length	887 mm	Protection class Sensor side Plug side (connected)	ISO 20635 IP6K9K IP67
Frequency range	- 0 to 20 kHz	Maximum pressure onto active surface	10 bar
Plug-in terminal E	Deutsch DT04-4P	Air gap, minimum/maximum	0.3/2.0 mm
$Current_{max.}$	40 mA	-	-

Note
The speed sensor cannot be retrofitted and must be included in the reconfiguration of the DMVA.

3 Activation and control type

Rotation angle sensor



Technical data			
Option A		**Option B**	
Rated voltage U	5 V	Rated voltage U	8-30 V
Measuring range	-27° to +27°	Measuring range	-27° to +27°
Output signal -27° 0° + 27°	0.5 VDC 2.5 VDC 4.5 VDC	Output signal -27° 0° + 27°	4 mA 12 mA 20 mA
Working temperature	-40 °C to +125 °C	Working temperature	-40 °C to +85 °C
Deutsch DT04-3P electrical plug-in terminal			

Note
The angle sensor cannot be retrofitted and must be included when planning the DMVA project.
Dimensions for variant A and B are identical; specify desired variant when ordering.

4 Installation conditions

4.1 General information about project planning

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

ATTENTION
Damage of the hydraulic product.
Lack of lubrication on the hydraulic product!
Make sure that the following requirements are observed:
- Comply with the approved installation positions for the hydraulic product.
- For other installation positions, contact Liebherr customer service.
- Housing is completely filled with hydraulic fluid during commissioning and operation.
- Housing is vented after commissioning and during operation.

Liebherr distinguishes between two installation variants for axial piston units:

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

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-the-tank installation A
Installation location: 1/3/5/7/9/11 Driving shaft horizontal with "control at top"

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

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

4.1.1 Leakage oil lines

To prevent draining of the axial piston unit during long downtimes, the leakage oil line must be routed in a bend so that it runs at the minimum dimension Ü1 = 30 mm above the highest possible level of the axial piston unit. This applies in particular to installation variant B: over-the-tank installation.

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

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

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

4 Installation conditions

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

4.1.2 Hydraulic fluid tank

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

Make sure that the lines are connected according to recommendations and that they open into the hydraulic fluid tank. (for additional information see: 4.1.1 Leakage oil lines, Page 30)

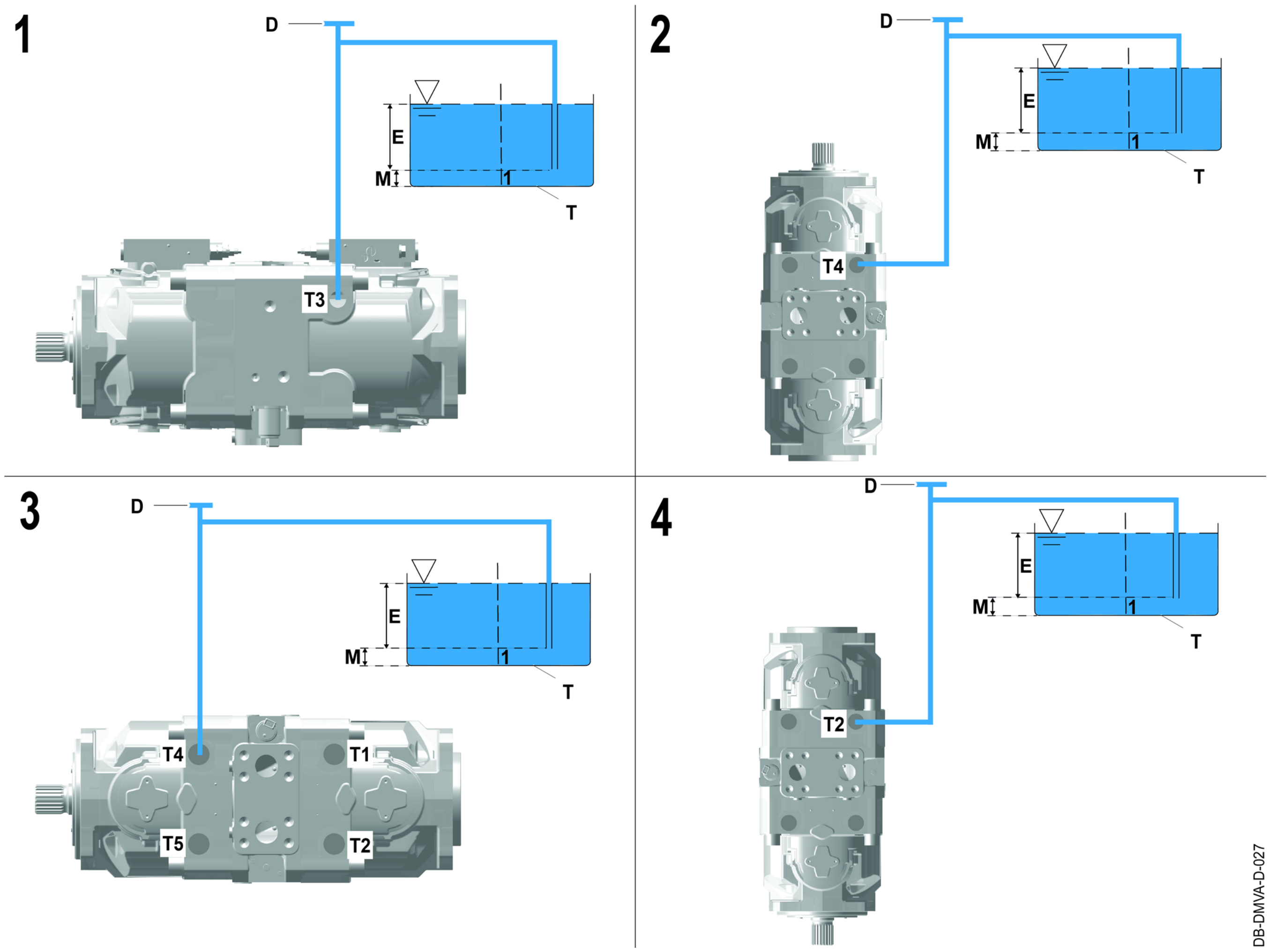
4 Installation conditions

4.2 Installation variants

Note
When using the DMVA in a "closed circuit", the installation variant is irrelevant due to the missing tank.

4.2.1 Under-the-tank installation variant

Note
Liebherr recommends: Under-the-tank installation A, so that:
- The housing cannot empty to the tank.



1	Baffle (to calm the hydraulic fluid in the tank)	M	Minimum line end distance from tank bottom = 115 mm
D	Fill and vent connection (external, not included in scope of delivery)	T_	Leakage oil connections T1 / T2 / T3 / T4 (T4 = optional)
E	Minimum immersion depth = 250 mm	T	Tank

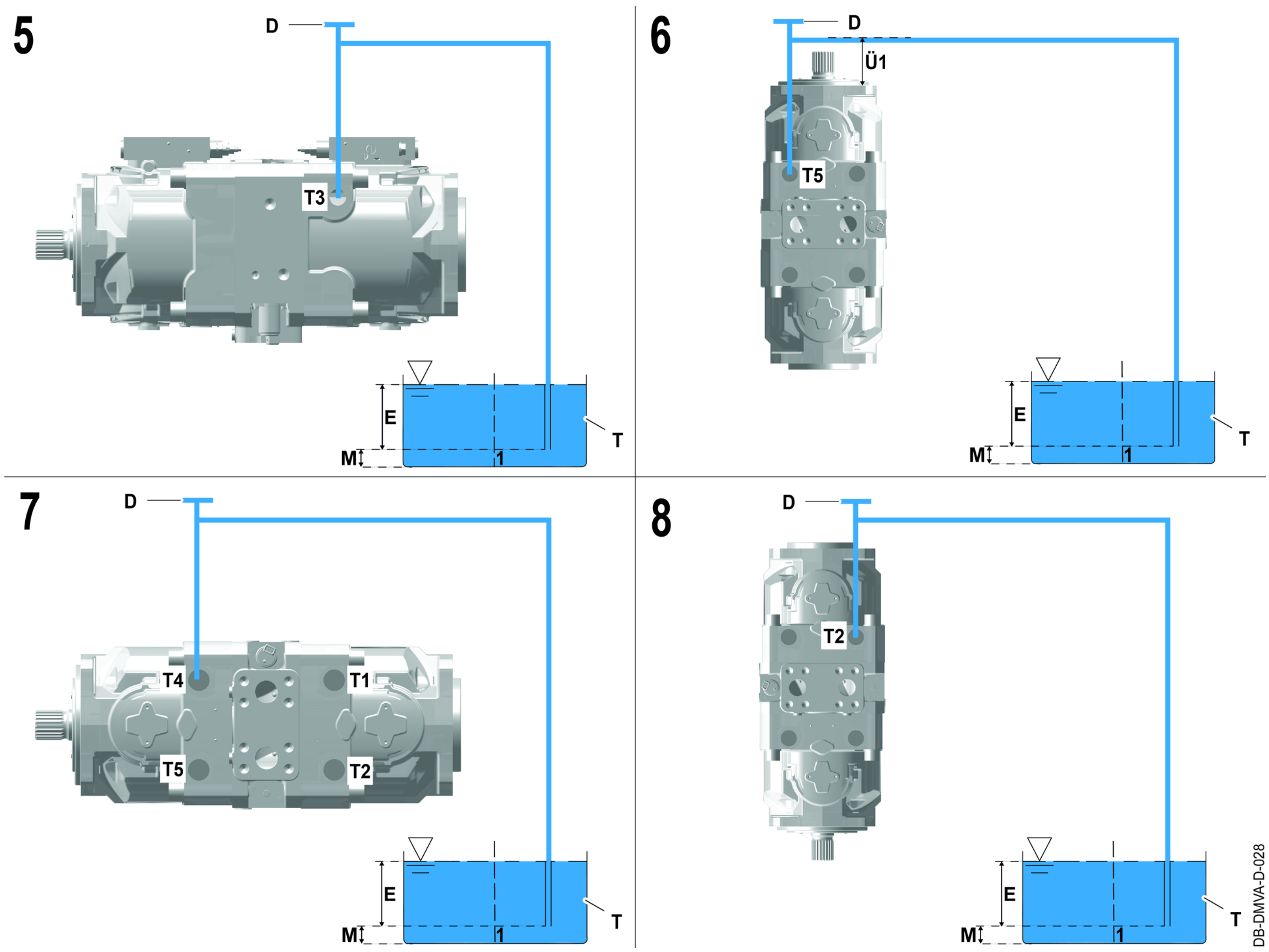
4 Installation conditions

4.2.2 Over-the-tank installation variant

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

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

Note
To prevent draining of the axial piston unit during long shutdowns, the leakage oil line must be routed in a bend so that it runs at the minimum dimension Ü1 = 30 mm above the highest possible level of the axial piston unit.



1	Baffle (to calm the hydraulic fluid in the tank)	M	Minimum line end distance from tank bottom = 115 mm
E	Minimum immersion depth = 250 mm	T_	Leakage oil connections T1 / T2 / T3 / T4 (T4 = optional)

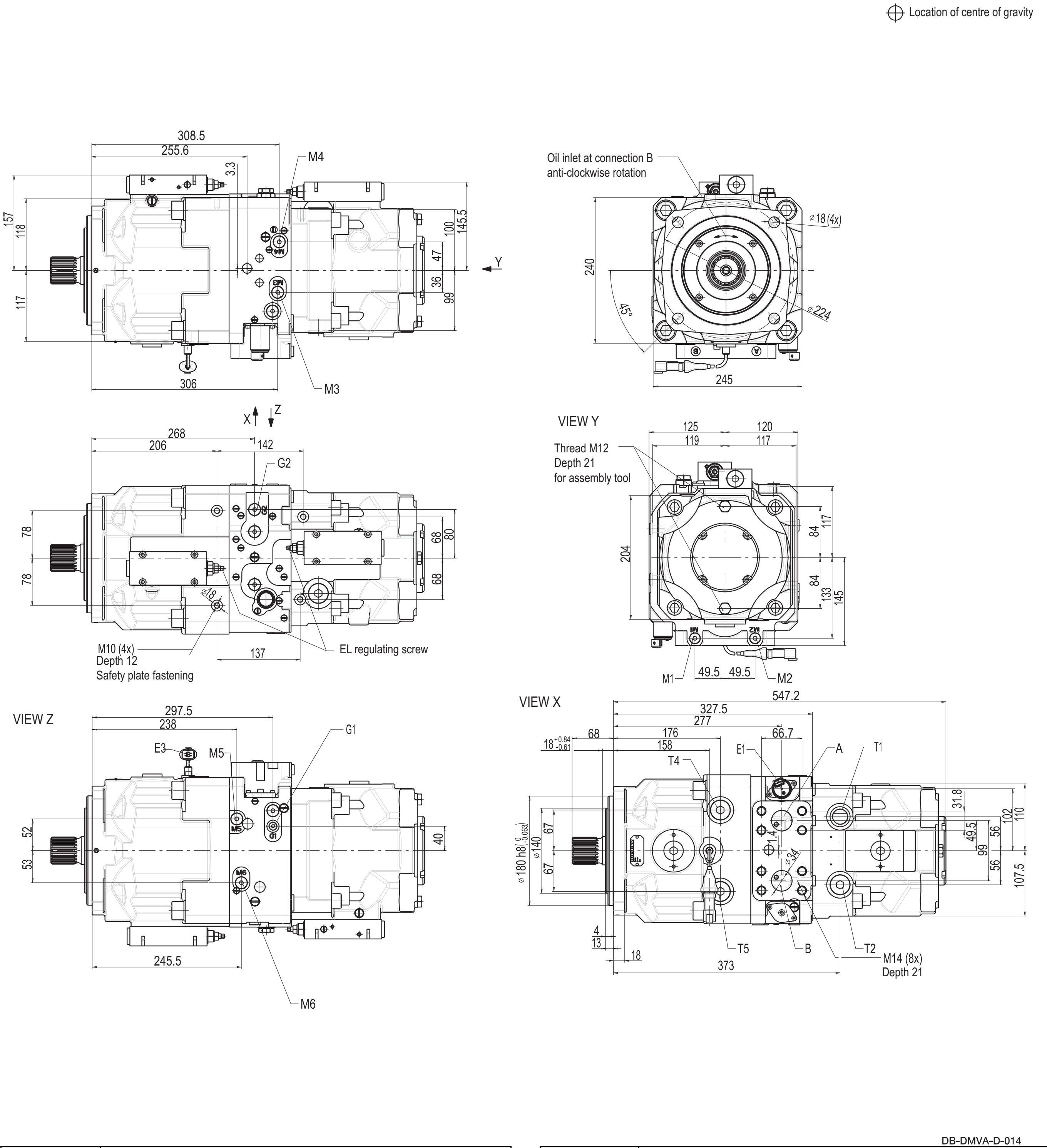
4 Installation conditions

D	Fill and vent connection (external, not included in scope of delivery)	T	Tank
Ü1	Minimum leakage oil line height = 30 mm	-	-

5 Dimensions

5.1 Nominal size 165-108

5.1.1 Nominal size 165-108, control type EL1



DB-DMVA-D-014

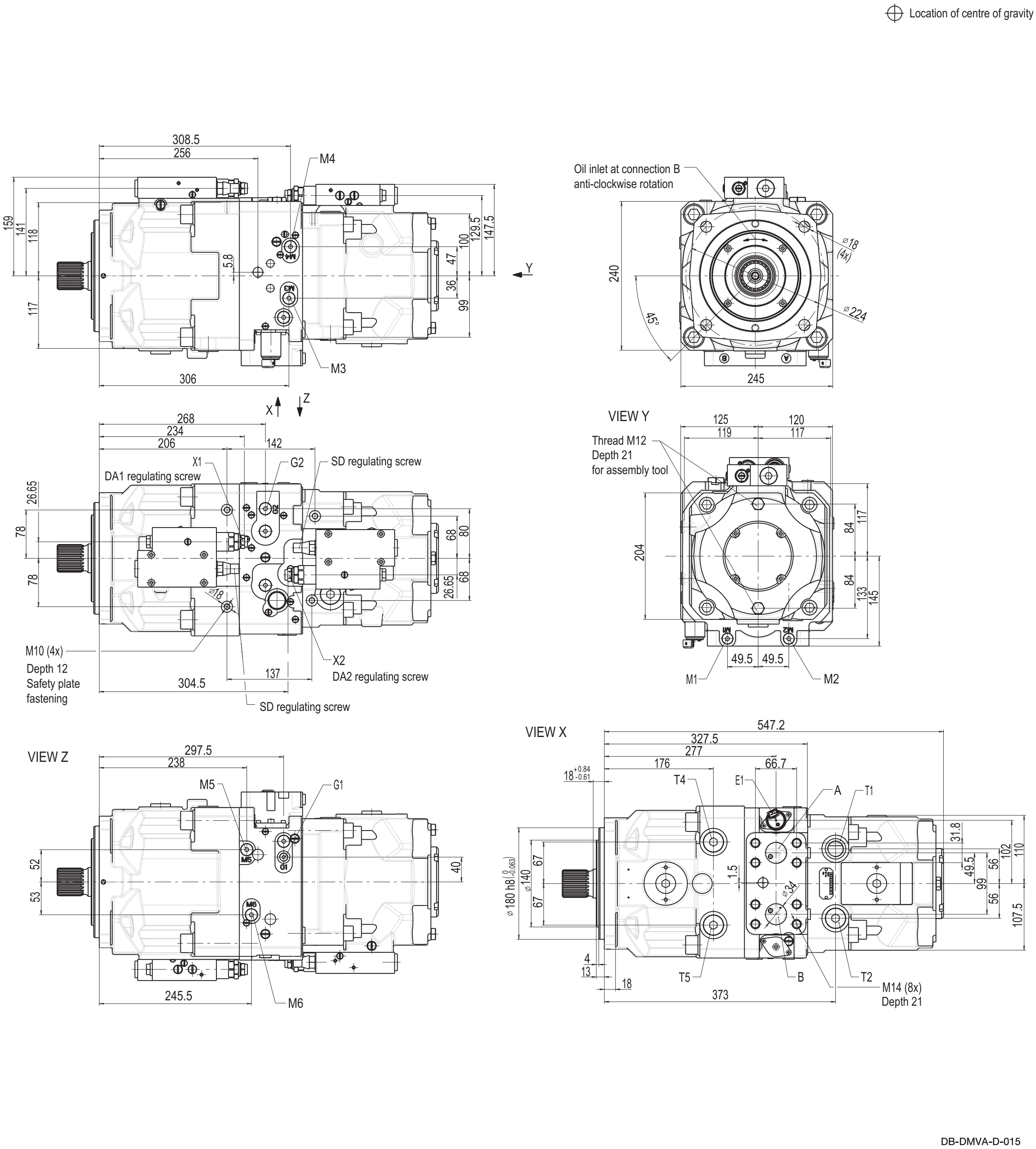
E1	DRE / AMP Junior Timer 2-pin, PWM= 100 Hz, Un= 24 V, $I_{max.}$= 750 mA	T1 / T2 T4 / T5	Leakage oil connection ISO 9974-1, M26x1.5
A / B	Working connection SAE J 518-1 1/4“, 6000 psi	M4 / M6	Adjusting pressure meas. connection ISO 9974-1, M14x1.5

5 Dimensions

M1 / M2	High pressure meas. connection ISO 9974-1, M12x1.5
M3 / M5	Steering pressure meas. connection ISO 9974-1, M14x1.5

G1	Adjusting pressure supply ISO 9974-1, M14x1.5
G2	Auxiliary pressure ISO 9974-1, M14x1.5

5.1.2 Nominal size 165-108, control type EL-DA1



A / B	Working connection SAE J 518-1 1/4“, 6000 psi
M1 / M2	High pressure meas. connection ISO 9974-1, M12x1.5

G1	Adjusting pressure supply ISO 9974-1, M14x1.5
G2	Auxiliary pressure ISO 9974-1, M14x1.5

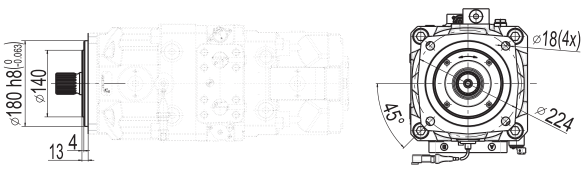
5 Dimensions

M3 / M5	Steering pressure meas. connection ISO 9974-1, M14x1.5	X1 / X2	DA1 override ISO 9974-1, M12x1.5
M4 / M6	Adjusting pressure meas. connection ISO 9974-1, M14x1.5	-	-
E1	DRE / AMP Junior Timer 2-pin, PWM= 100 Hz, Un= 24 V, $I_{max.}$= 750 mA	T1 / T2 T4 / T5	Leakage oil connection ISO 9974-1, M26x1.5

5.2 Nominal size 165-108, mounting flange

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

ISO 3019-2



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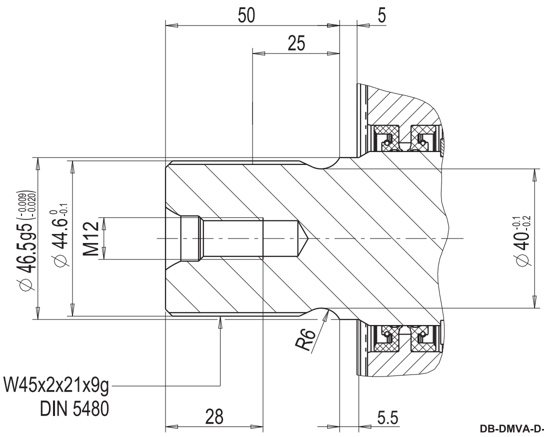
DB-DMVA-D-022

5.3 Nominal size 165-108, shaft end

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

DIN 5480 splined shaft W45x2x21x9g



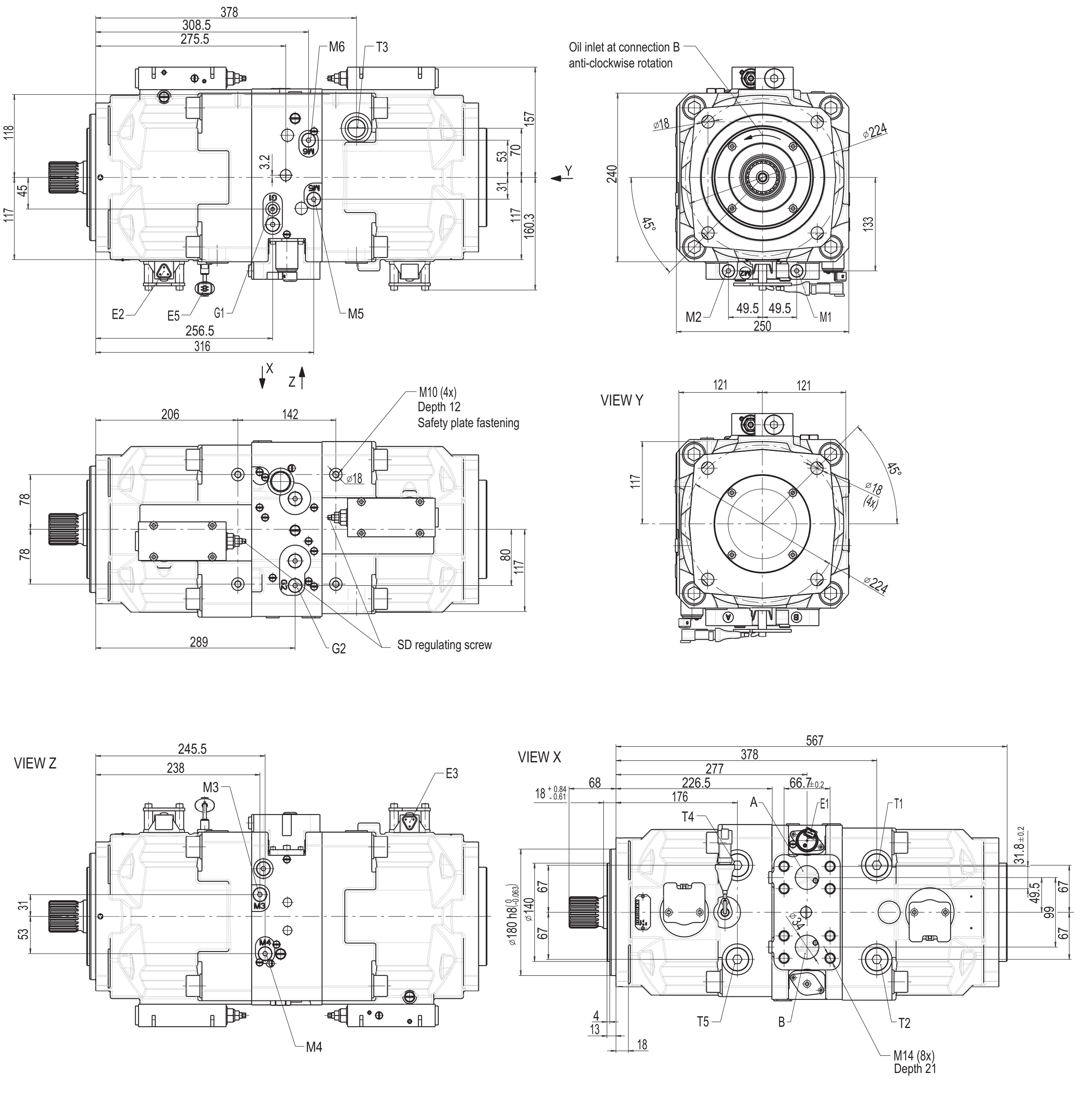
1

5 Dimensions

5.4 Nominal size 165-165

5.4.1 Nominal size 165-165, control type EL and EL1

Location of centre of gravity



DB-DMVA-D-016

E1	DRE / AMP Junior Timer 2-pin, PWM= 100 Hz, Un= 24 V, $I_{max.}$= 750 mA
A / B	Working connection SAE J 518-1 1/4“, 6000 psi

T1/T2/T3 T4 / T5	Leakage oil connection ISO 9974-1, M26x1.5
M4 / M6	Adjusting pressure meas. connection ISO 9974-1, M14x1.5

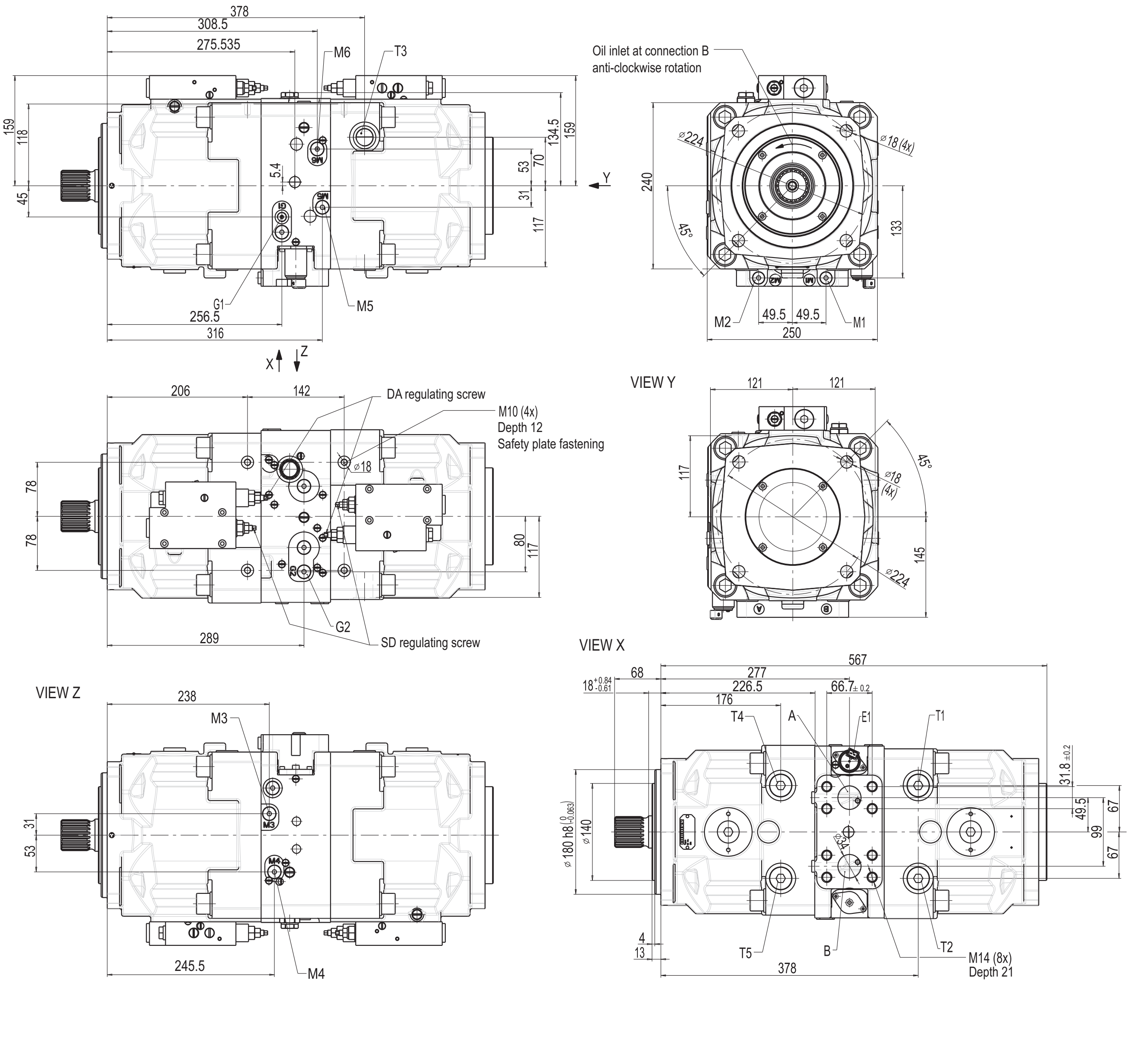
5 Dimensions

M1 / M2	High pressure meas. connection ISO 9974-1, M12x1.5
M3 / M5	Steering pressure meas. connection ISO 9974-1, M14x1.5

G1	Adjusting pressure supply ISO 9974-1, M14x1.5
G2	Auxiliary pressure ISO 9974-1, M14x1.5

5.4.2 Nominal size 165-165, control type EL-DA

Location of centre of gravity



DB-DMVA-D-017

A / B	Working connection SAE J 518-1 1/4“, 6000 psi

M4 / M6	Adjusting pressure meas. connection ISO 9974-1, M14x1.5

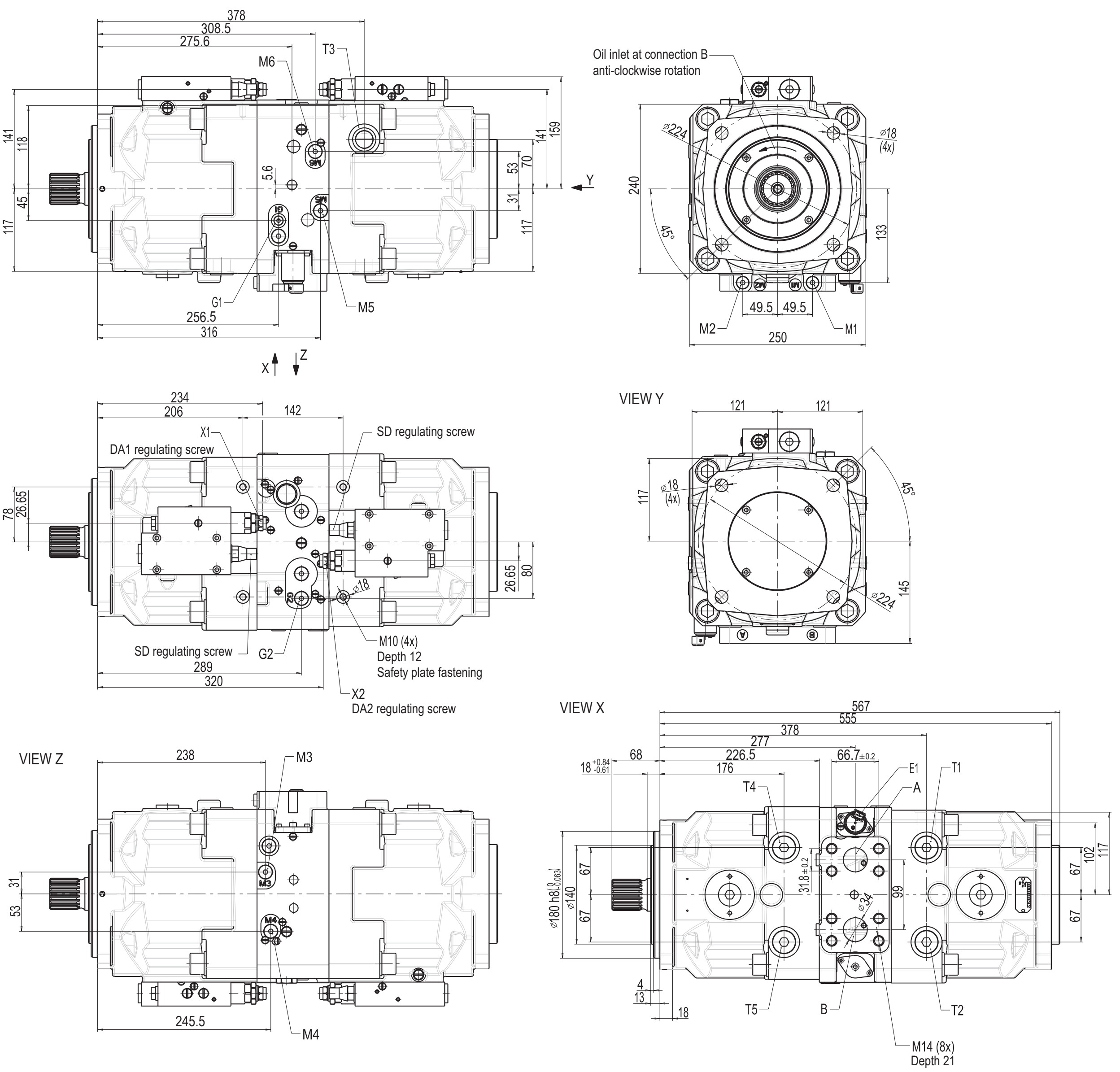
5 Dimensions

E1	DRE / AMP Junior Timer 2-pin, PWM= 100 Hz, Un= 24 V, $I_{max.}$= 750 mA
M1 / M2	High pressure meas. connection ISO 9974-1, M12x1.5
M3 / M5	Steering pressure meas. connection ISO 9974-1, M14x1.5

T1/T2/T3 T4 / T5	Leakage oil connection ISO 9974-1, M26x1.5
G1	Adjusting pressure supply ISO 9974-1, M14x1.5
G2	Auxiliary pressure ISO 9974-1, M14x1.5

5.4.3 Nominal size 165-165, control type EL-DA1

Location of centre of gravity



DB-DMVA-D-018

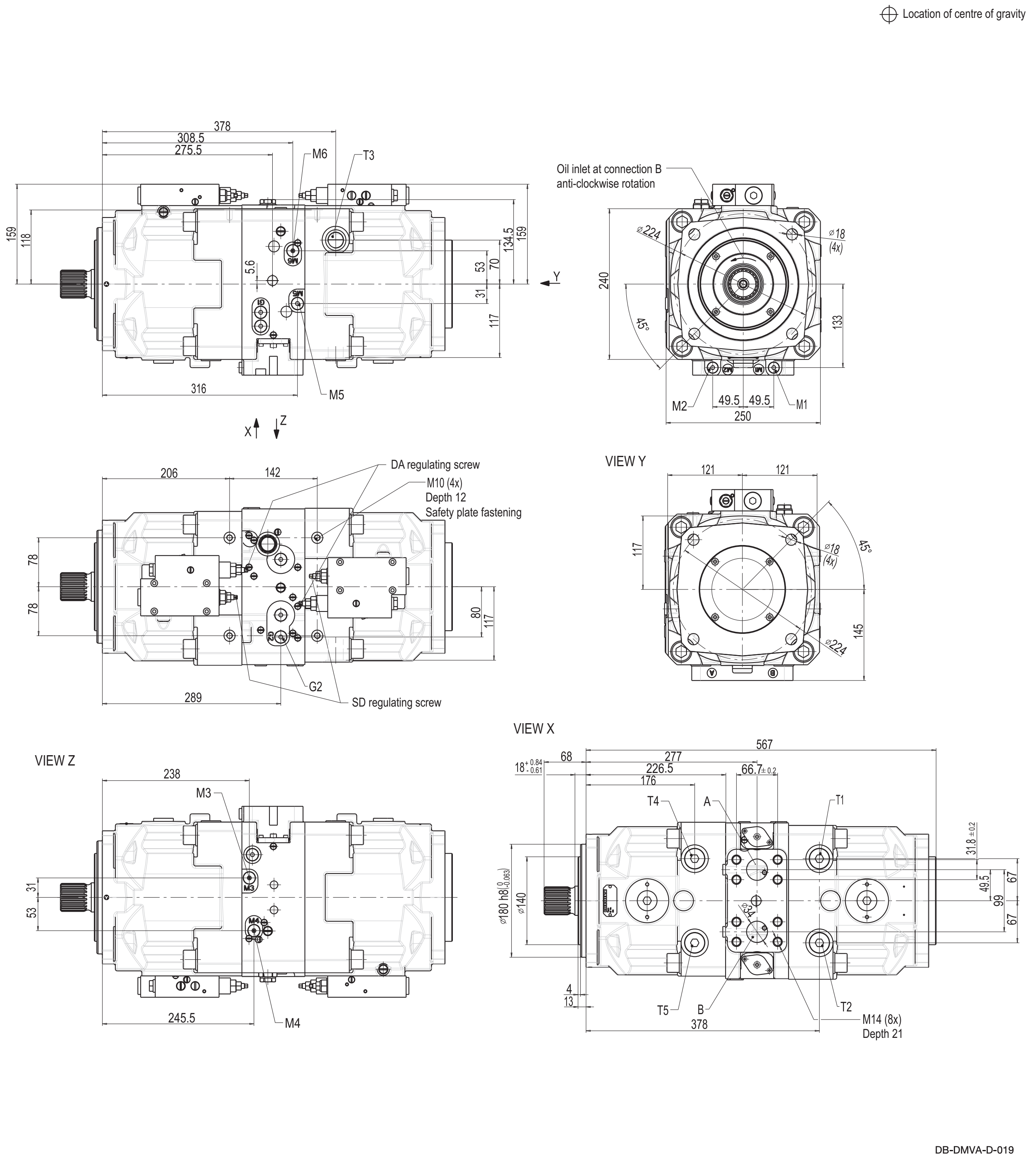
A / B	Working connection SAE J 518-1 1/4“, 6000 psi

G1	Adjusting pressure supply ISO 9974-1, M14x1.5

5 Dimensions

M1 / M2	High pressure meas. connection ISO 9974-1, M12x1.5	G2	Auxiliary pressure ISO 9974-1, M14x1.5
M3 / M5	Steering pressure meas. connection ISO 9974-1, M14x1.5	X1 / X2	DA1 override ISO 9974-1, M12x1.5
E1	DRE / AMP Junior Timer 2-pin, PWM= 100 Hz, Un= 24 V, $I_{max.}$= 750 mA	T1/T2/T3 T4 / T5	Leakage oil connection ISO 9974-1, M26x1.5
M4 / M6	Adjusting pressure meas. connection ISO 9974-1, M14x1.5	-	-

5.4.4 Nominal size 165-165, control type SD-DA

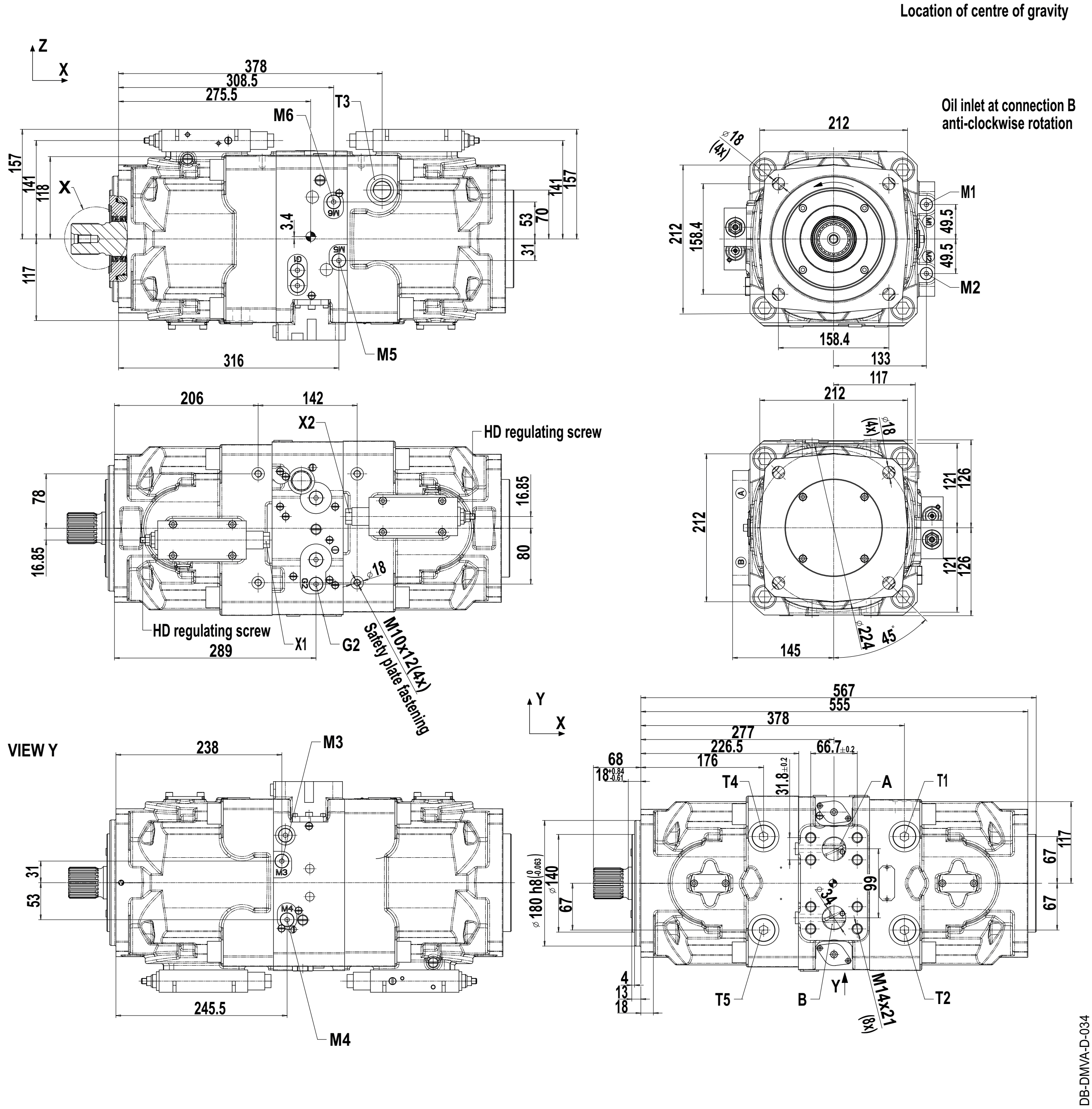


5 Dimensions

A / B	Working connection SAE J 518-1 1/4“, 6000 psi		T1/T2/T3 T4 / T5	Leakage oil connection ISO 9974-1, M26x1.5
M1 / M2	High pressure meas. connection ISO 9974-1, M12x1.5		M4 / M6	Adjusting pressure meas. connection ISO 9974-1, M14x1.5
M3 / M5	Steering pressure meas. connection ISO 9974-1, M14x1.5		G2	Auxiliary pressure ISO 9974-1, M14x1.5

5 Dimensions

5.4.5 Nominal size 165-165, control type HD



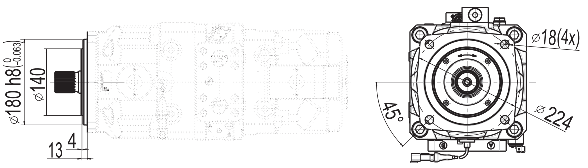
A / B	Working connection SAE J 518-1 1/4“, 6000 psi	T1/T2/T3 T4 / T5	Leakage oil connection ISO 9974-1, M26x1.5
M1 / M2	High pressure meas. connection ISO 9974-1, M12x1.5	M4 / M6	Adjusting pressure meas. connection ISO 9974-1, M14x1.5
M3 / M5	Steering pressure meas. connection ISO 9974-1, M14x1.5	G2	Auxiliary pressure ISO 9974-1, M14x1.5

5 Dimensions

5.5 Nominal size 165-165, mounting flange

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

ISO 3019-2



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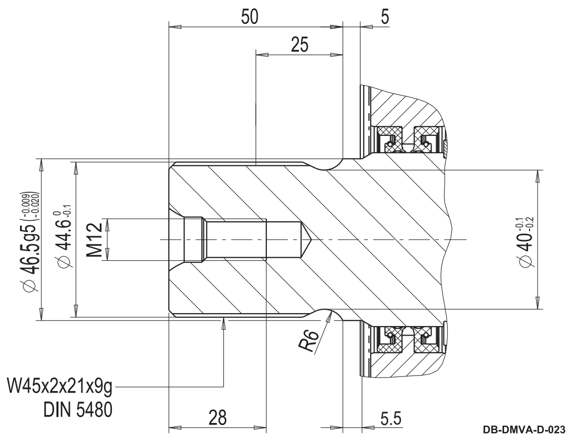
5.6 Nominal size 165-165, shaft end

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

DIN 5480 splined shaft W45x2x21x9g



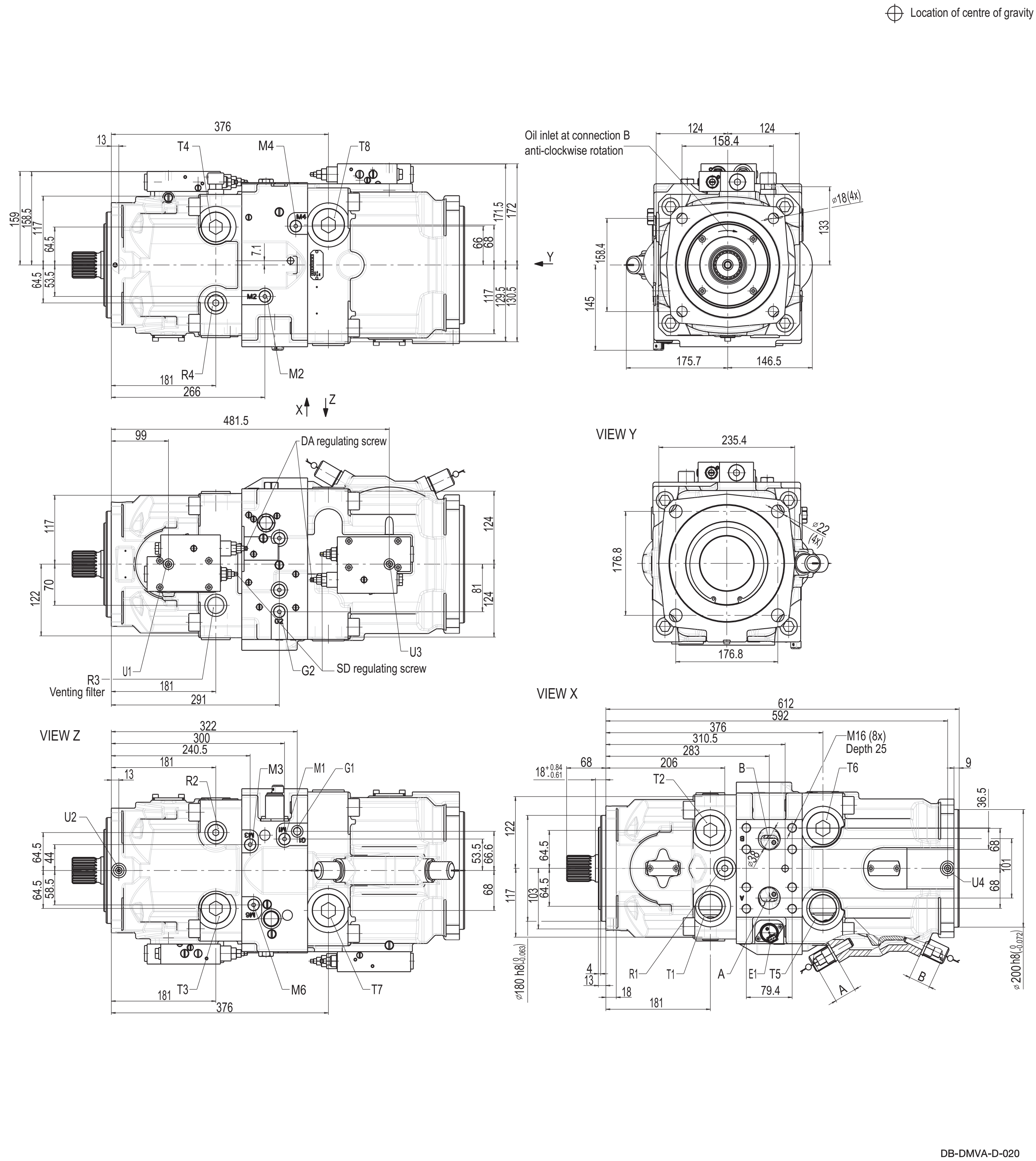
DB-DMVA-D-023

1

5 Dimensions

5.7 Nominal size 165-215

5.7.1 Nominal size 165-215, control type EL-DA



A / B	Working connection SAE J 518-1 1/2", 6000 psi
M3	Steering pressure meas. connection ISO 9974-1, M14x1.5
R1 / R2 R3 / R4	Vent connection ISO 9974-1, M22x1.5

M1 / M2	High pressure meas. connection ISO 9974-1, M14x1.5
G2	Auxiliary pressure ISO 9974-1, M14x1.5
T5 / T6 T7 / T8	Leakage oil connection ISO 9974-1, M48x2

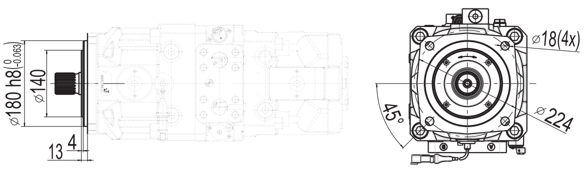
5 Dimensions

E1	DRE / AMP Junior Timer 2-pin, PWM= 100 Hz, Un= 24 V, $I_{max.}$= 750 mA	T1 / T2 T3 / T4	Leakage oil connection ISO 9974-1, M42x2
M4 / M6	Adjusting pressure meas. connection ISO 9974-1, M14x1.5	U1 / U2 U3 / U4	Flushing connection ISO 9974-1, M12x1.5
G1	Adjusting pressure supply ISO 9974-1, M14x1.5	-	-

5.8 Nominal size 165-215, mounting flange

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

ISO 3019-2



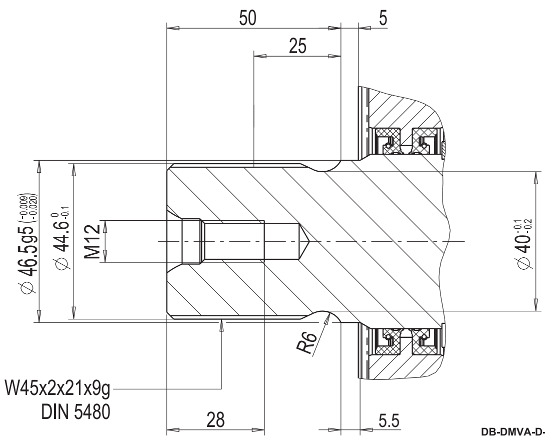
31

DB-DMVA-D-022

5.9 Nominal size 165-215, shaft end

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

DIN 5480 splined shaft W45x2x21x9g



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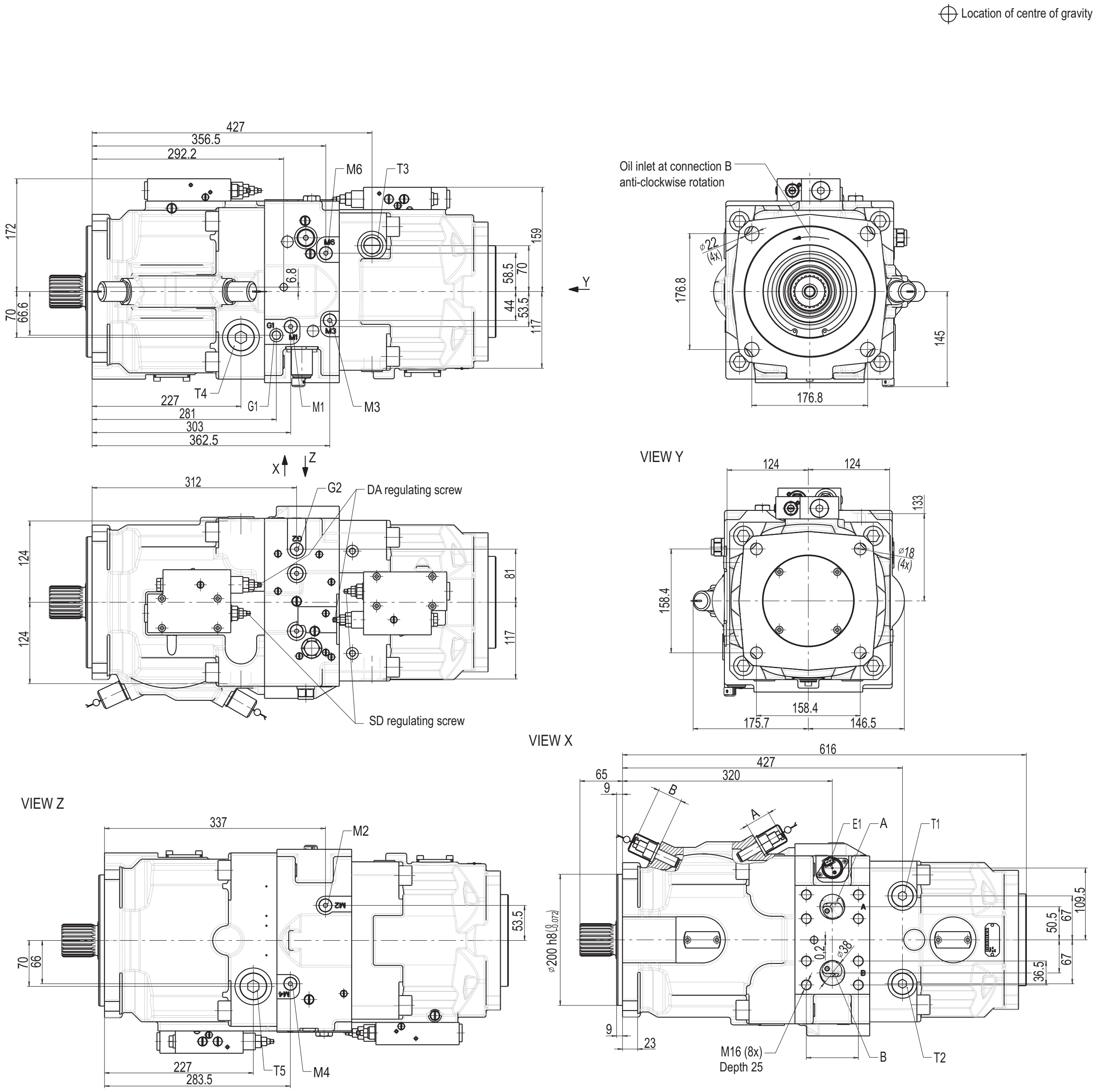
DB-DMVA-D-023

5 Dimensions

5.10 Nominal size 215-165

5.10.1 Nominal size 215-165, control type EL-DA



DB-DMVA-D-021

A / B	Working connection SAE J 518-1 1/2“, 6000 psi	T4 / T5	Leakage oil connection ISO 9974-1, M33x2
M1 / M2	High pressure meas. connection ISO 9974-1, M14x1.5	G1	Adjusting pressure supply ISO 9974-1, M14x1.5
M3	Steering pressure meas. connection ISO 9974-1, M14x1.5	G2	Auxiliary pressure ISO 9974-1, M14x1.5

5 Dimensions

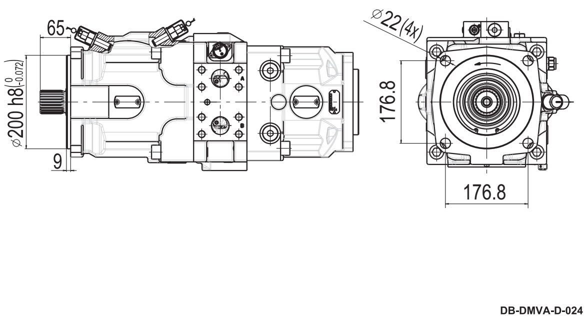
E1	DRE / AMP Junior Timer 2-pin, PWM= 100 Hz, Un= 24 V, $I_{max.}$= 750 mA
M4 / M6	Adjusting pressure meas. connection ISO 9974-1, M14x1.5

T1 / T2 T3	Leakage oil connection ISO 9974-1, M26x1.5
-	-

5.11 Nominal size 215-165, mounting flange

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

ISO 3019-2



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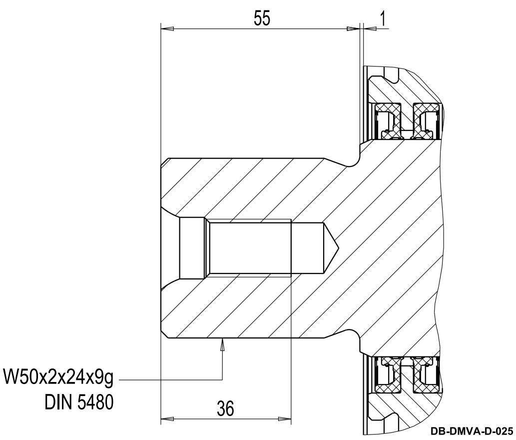
5.12 Nominal size 215-165, shaft end

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

DIN 5480 splined shaft W50x2x24x9g



1

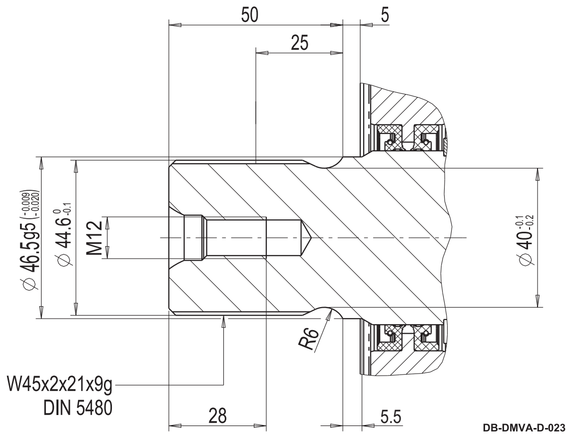
5 Dimensions

5.13 Through-drive DIN 5480

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

5.13.1 Nominal size 165 special through-drive

W45x2x21x9g



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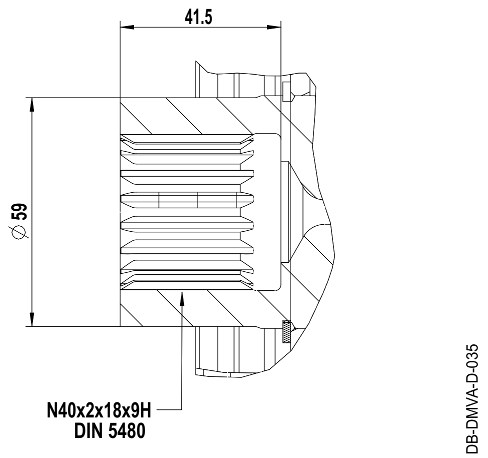
5.13.2 Nominal size 215 special through-drive

N40x2x18x9H



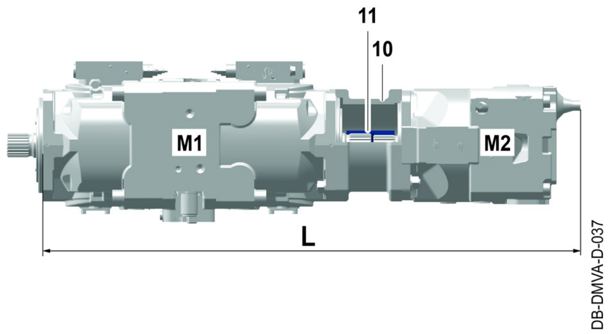
K

5 Dimensions

5.14 Multi-circuit motor in tandem design

General information
Multi inline axial piston units of two or more single units can be supplied on request. In this case, the base Axial piston double motor M1 must be connected with another axial piston pump M2 through an adapter plate 10 and a coupling ferrule 11.

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



M1	Base motor
M2	Flange-mounted motor
L	Multi-circuit motor overall length in mm

10	Adapter
11	Coupling ferrule
-	-

5.14.1 Dimensions of the multi-circuit motor in tandem design

Nominal size M1	Nominal size M2
	108
165-165	(L = 1018)

L = total length in mm

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Subject to changes without prior notice in the course of technical development.

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The data sheet mostly shows an example configuration, unless otherwise stated. The product delivered to you may therefore differ from the illustrations. Data and values may also deviate. Such data and values are provided only for the purpose of selecting the product configuration and are not binding. Therefore, use the values from the installation drawing provided to you.

Warranty and liability conditions under the general terms and conditions of the relevant Liebherr business partner are not extended by the above information.

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Do you have any questions? Get in touch with your contact for further information.

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