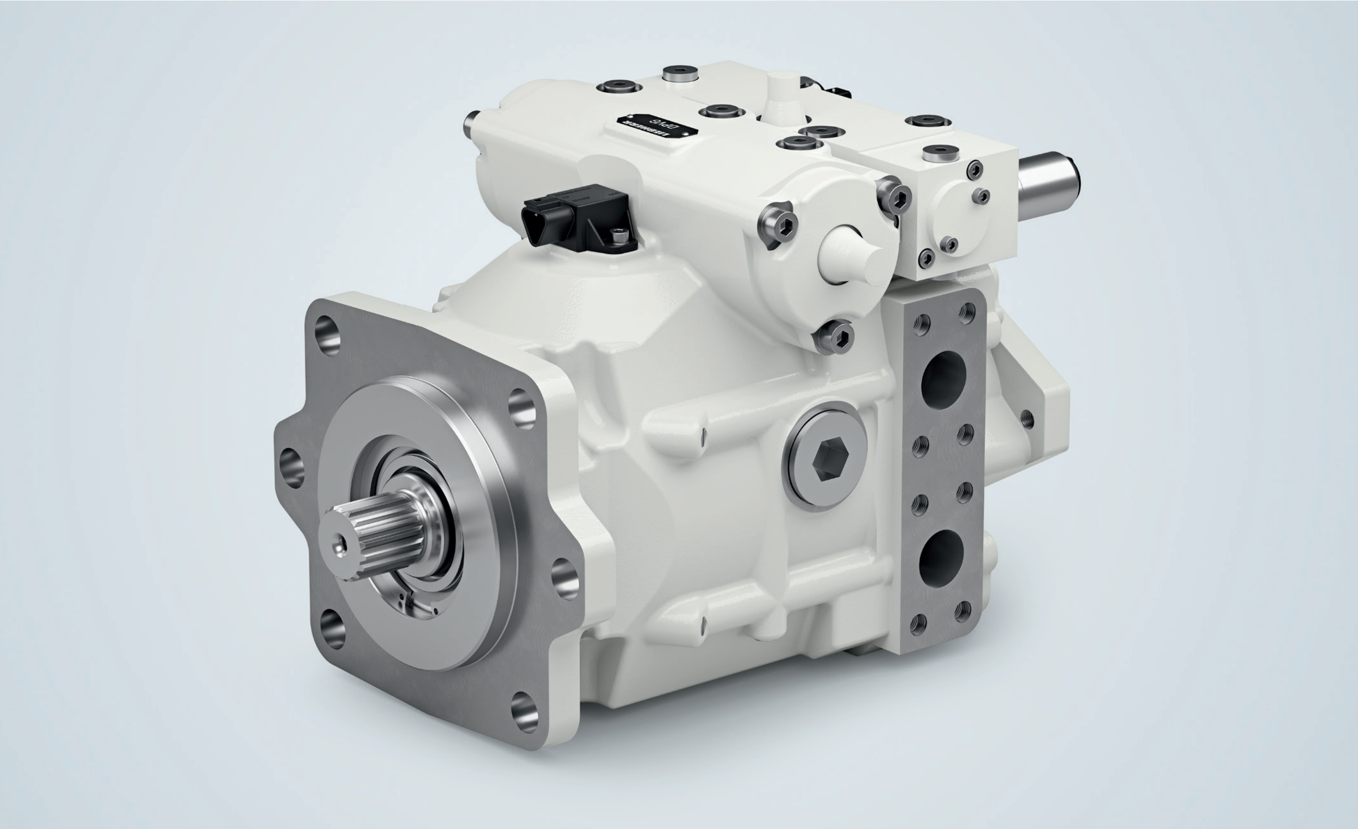
Data sheet

# Axial piston pump DPVG



The Liebherr axial piston pumps in the DPVG series are designed as swashplates for closed circuits. The variable displacement pumps are available in nominal sizes ranging from 085 to 280. The nominal pressure of the units is 450 bar and the maximum pressure is 500 bar absolute.

Thanks to a hydrostatic swashplate design, this variable displacement pump stands out with its high reliability and long service life, even under the toughest of conditions.

The hydrostatic swashplate mount is available for the nominal sizes 085, 140, and 280.

The inverse drive with a swivel angle of 22° is very efficient and has a very high power density. The DPVG is available with the common controls.

A through-drive is possible, as is the configuration of two DPVG pumps to form a multi-circuit pump in a tandem layout.

**Valid for:**
DPVG 085
DPVG 108
DPVG 140
DPVG 165
DPVG 280

**Features:**
D series
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)

**Document identification:**
ID number: 11357580
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Authors: Liebherr - Abteilung VH13
Version: 1.3

LIEBHERR

# Table of contents

# 1 Type code

| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

**1. Pump type**

| | | |
|---|---|---|
| D series / pump / variable displacement | DPV | |

**2. Type of circuit**

| | | |
|---|---|---|
| Closed | G | |

**3. Nominal size (NS)**

| | | | | | | |
|---|---|---|---|---|---|---|
| | 085 | 108 | 140 | 165 | 280 | |

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

| | | |
|---|---|---|
| $V_{g\ min}$ = 0 $cm^3$ / Enter value in $cm^3$/rev | ■ | |

**5. Activation / control type**

| | | | | | | |
|---|---|---|---|---|---|---|
| Electro-proportional regulation / pressure cut-off | ■ | ■ | ■ | ■ | ■ | EL - DA |
| Electro-proportional regulation | ■ | ■ | □ | ■ | ■ | EL |
| Hydraulic proportional regulation, dependent on steering pressure | □ | ■ | ■ | ■ | ■ | SD |
| Hydraulic proportional regulation, dependent on steering pressure / pressure cut-off | □ | □ | ■ | ■ | ■ | SD - DA |
| Hydraulically activated torque control with pressure cut-off (Hydraulic torque control) | - | □ | □ | ■ | ■ | TCH |
| Electrically activated torque control with pressure cut-off (Electric torque control with safety valve) | - | □ | □ | ■ | ■ | TCE |
| Electrical proportional regulation, with safety valve / pressure cut-off | ■ | ■ | ■ | ■ | ■ | ELS - DA |
| Electrical direct control | □ | □ | □ | □ | □ | DS |
| Electrical direct control, pressure cut-off | ■ | □ | ■ | □ | □ | DS-DA |
| Electrical proportional regulation, with safety valve | □ | ■ | ■ | ■ | ■ | ELS |
| Hydraulic speed control / mechanical stroke limitation / pressure cut-off | □ | □ | □ | ■ | ■ | DZH-M-DA |

**6. Design**

| | | |
|---|---|---|
| | 1 | |

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

| | | | | | | |
|---|---|---|---|---|---|---|
| Right | □ | ■ | ■ | ■ | ■ | R |
| Left | ■ | ■ | ■ | ■ | ■ | L |



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

# 1 Type code

| | | 085 | 108 | 140 | 165 | 280 | |
|---|---|---|---|---|---|---|---|

## 8. Mounting flange

| | | 085 | 108 | 140 | 165 | 280 | |
|---|---|---|---|---|---|---|---|
| Diesel engine flange SAE J617a | SAE 1 | □ | □ | □ | □ | □ | 11 |
| | SAE 2 | □ | ■ | □ | □ | □ | 12 |
| | SAE 3 | □ | □ | □ | □ | □ | 13 |
| | SAE 4 | □ | □ | □ | □ | □ | 14 |
| Mounting flange SAE J744 | SAE C | □ | - | - | - | - | 23 |
| | SAE D | - | ■ | ■ | □ | □ | 24 |
| | SAE E | - | - | - | □ | ■ | 25 |
| Mounting flange ISO 3019-2 | ∅ 160 | ■ | - | - | - | - | 31* |
| | ∅ 180 | - | ■ | - | - | - | 31* |
| | ∅ 200 | - | - | - | ■ | - | 31* |
| | ∅ 224 | - | - | - | - | ■ | 31* |

*) Enter mounting flange diameter in the free text field, see chapter 5.

## 9. Shaft end

| | | 085 | 108 | 140 | 165 | 280 | |
|---|---|---|---|---|---|---|---|
| Splined shaft | DIN 5480 | ■ | ■* | ■* | ■ | ■ | 1 |
| Splined shaft | ANSI B92.1a | ■ | ■ | ■ | - | ■ | 2 |

*) Enter splined shaft dimensions in the free text field, see chapter 5.

## 10. Connections

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

## 11. Add-on parts

| | | |
|---|---|---|
| Without add-on parts | 0 | |

## 12. Gear pump

| | 085 | 108 | 140 | 165 | 280 | |
|---|---|---|---|---|---|---|
| Without gear pump | □ | ■ | ■ | ■ | ■ | 00 |
| With gear pump $V_g$ = 24 $cm^3$, enter the value in $cm^3$/rev, without filter and cold start valve | ■ | □ | □ | - | - | 24 |
| With gear pump $V_g$ = 30 $cm^3$, enter the value in $cm^3$/rev, without filter and cold start valve | □ | ■ | ■ | - | - | 30 |
| With gear pump $V_g$ = 40 $cm^3$, enter the value in $cm^3$/rev, without filter and cold start valve | - | ■ | ■ | □ | - | 40 |
| With gear pump $V_g$ = 50 $cm^3$, enter the value in $cm^3$/rev, without filter and cold start valve | - | - | - | ■ | ■ | 50 |



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

# 1 Type code

## 13. Through drive

| Standard Centring diameter | | Fastening thread position according to SAE | Gearing | 085 | 108 | 140 | 165 | 280 | |
|---|---|---|---|---|---|---|---|---|---|
| No through drive | | | | | ■ | ■ | ■ | ■ | 0000 |
| Ø82.55 | SAE A | Type K Basic (2-hole) | ANSI B92.1a 5/8 in 9T 16/32DP | □ | □ | □ | □ | ■ | A11D |
| | | Type S Basic (4-hole) | | - | - | - | - | - | A12D |
| Ø101.6 | SAE B | Type K Basic (2-hole) | ANSI B92.1a 7/8 in 13T 16/32DP | ■ | ■ | ■ | ■ | ■ | B11D |
| | | Type S Basic (4-hole) | | □ | □ | □ | □ | □ | B12D |
| | SAE BB | Type K Basic (2-hole) | ANSI B92.1a 1 in 15T 16/32DP | □ | ■ | ■ | ■ | ■ | B21D |
| | | Type S Basic (4-hole) | | □ | □ | □ | □ | □ | B22D |
| Ø127 | SAE C** | Type K Basic (2-hole) | ANSI B92.1a 1 1/4 in 14T 12/24DP | □ | ■ | ■ | ■ | ■ | C11D |
| | | Type S Basic (4-hole) | | □ | ■ | ■ | ■ | ■ | C12D |
| | SAE CC** | Type K Basic (2-hole) | ANSI B92.1a 1 1/2 in 17T 12/24DP | □ | ■ | □ | ■ | ■ | C21D |
| | | Type S Basic (4-hole) | | □ | ■ | □ | ■ | ■ | C22D |
| | SAE C** | Type K Basic (2-hole) | DIN 5480 N30x2x14x10E | □ | □ | □ | □ | □ | C31D |
| | | Type S Basic (4-hole) | | □ | □ | □ | □ | ■ | C32D |
| Ø152.4 | SAE D** | Type K Basic (2-hole) | ANSI B92.1a 1 3/4 in 13T 8/16DP | - | □ | □ | □ | □ | D11D |
| | | Type S Basic (4-hole) | | - | ■ | □ | ■ | ■ | D12D |
| | | Type K Basic (2-hole) | DIN 5480 N40x2x18x10E | - | □ | □ | □ | ■ | D31D* |
| | | Type S Basic (4-hole) | | - | ■ | □ | ■ | ■ | D32D* |
| | | Type K Basic (2-hole) | DIN 5480 N45x2x21x10E | - | □ | □ | □ | ■ | D31D* |
| | | Type S Basic (4-hole) | | - | ■ | □ | ■ | ■ | D32D* |
| | | Type K Basic (2-hole) | DIN 5480 N50x2x24x10E | - | □ | □ | □ | ■ | D31D* |
| | | Type S Basic (4-hole) | | - | □ | □ | □ | ■ | D32D* |
| Ø165.1 | SAE E** | Type K Basic (2-hole) | ANSI B92.1a 1 3/4 in 13T 8/16DP | - | - | - | - | - | E11D |
| | | Type S Basic (4-hole) | | - | - | - | - | ■ | E12D |
| | | Type K Basic (2-hole) | DIN 5480 N50x2x24x10E | - | - | - | - | - | E31D* |
| | | Type S Basic (4-hole) | | - | - | - | - | ■ | E32D* |
| | | Type K Basic (2-hole) | DIN 5480 N55x2x26x10E | - | - | - | - | - | E31D* |
| | | Type S Basic (4-hole) | | - | - | - | - | ■ | E32D* |
| Ø200 | ISO 3019-2 | (2-hole) | DIN 5480 N45x2x21x10E | - | - | - | - | - | V31D* |
| | | (4-hole) | | - | - | - | - | ■ | V32D* |
| | | | | 085 | 108 | 140 | 165 | 280 | |
| Ø224 | ISO 3019-2 | (2-hole) | DIN 5480 N55x2x26x10E | - | - | - | - | - | W31D* |
| | | (4-hole) | | - | - | - | - | ■ | W32D* |

*) Enter splined shaft dimensions in the free text field, see chapter 5.

**) Through-drives SAE-C, SAE-CC, SAE-D and SAE-E not possible in conjunction with integrated feed pump.



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

# 1 Type code

| | 085 | 108 | 140 | 165 | 280 | |
|---|---|---|---|---|---|---|
| **14. Valve** | | | | | | |
| High-pressure relief valve with feed function | ■ | ■ | ■ | ■ | ■ | NS-DB |
| High-pressure relief valve with feed function and feed pressure valve | ■ | ■ | ■ | ■ | ■ | NS-DB-DS |
| **15. Sensors** | | | | | | |
| Without sensor | ■ | ■ | ■ | ■ | ■ | 0 |
| With angle sensor | □ | ■ | ■ | ■ | ■ | W |

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

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

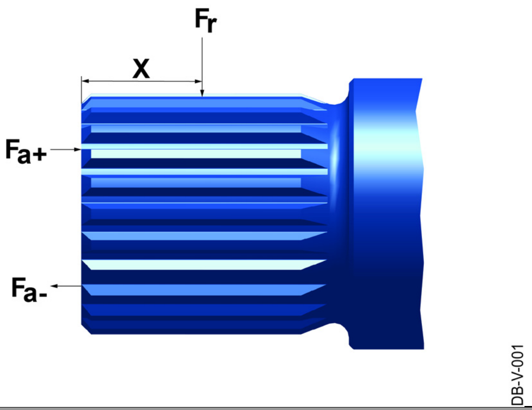
# 2 Technical data

## 2.1 Table of values

| Nominal size | | | 085 | 108 | | 140 | | 165 | 280 | |
|---|---|---|---|---|---|---|---|---|---|---|
| Displacement volume | $V_{g\ max}$ | $cm^3$ | 88.4 | 107.7 | | 140.2 | | 167.8 | 283.4 | |
| Max. speed at $V_{g\ max}$ | $n_{max}$ | rpm | 3300 | 3000 | | 2850 | | 2700 | 2500 | |
| Volume flow at $n_{max}$ and $V_{g\ max}$ | $qv_{max}$ | l/min | 291 | 323 | | 400 | | 453 | 709 | |
| Drive power at $qv_{max}$ and Δp = 430 bar | $p_{max}$ | kW | 209 | 232 | | 287 | | 325 | 508 | |
| Drive torque at $V_{g\ max}$ and Δp = 430 bar | $M_{max}$ | Nm | 604 | 737 | | 959 | | 1149 | 1940 | |
| Torsional rigidity | Shaft DIN 5480 | | W35 | W40 | W45 | W40 | W50 | W45 | W55 (Yoke) | W55 (Cradle) |
| | Nm/rad | | 103003 | 177000 | 205550 | 195300 | 254330 | 255250 | 471010 | 409310 |
| Driving gear moment of inertia | $J_{TW}$ | $kgm^2$ | 0.0101 | 0017 | | 0.024 | | 0.03 | 0.0693 | |
| Weight (approx.) | m | kg | 63 | 69 | | 79 | | 96 | 134 | |

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

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



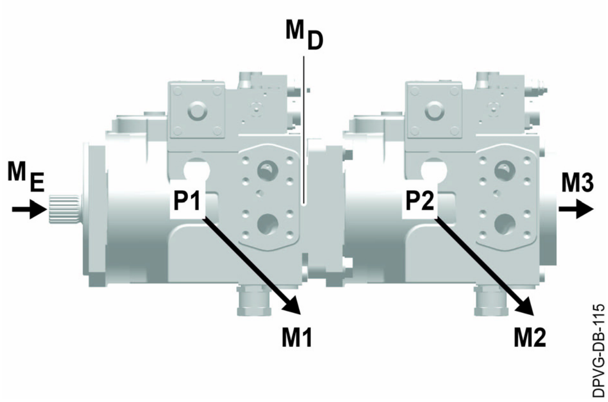

| Nominal size | | | 085 | 108 | 140 | 165 | 280 |
|---|---|---|---|---|---|---|---|
| Max. radial force | $F_{r\ max}$ | N | Values upon request | | | | |
| Max. axial force | $F_{a\pm\ max}$ | N | | | | | |

# 2 Technical data

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

### 2.1.2 Maximum input and through drive torques

| Nominal size | | | 085 | 108 | 140 | 165 | 280 |
|---|---|---|---|---|---|---|---|
| Max. torque of driving shaft input (installed without lateral force) at shaft end DIN 5480 | $M_{E\ max}$ | Nm | Values upon request | | | | |
| Max. torque of through drive | $M_{D\ max}$ | Nm | | | | | |




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

| | |
|---|---|
| P2 | Axial piston pump 2 |
| $M_E$ [1] | Input torque |
| $M_D$ [2] | Through drive torque |
| - | - |

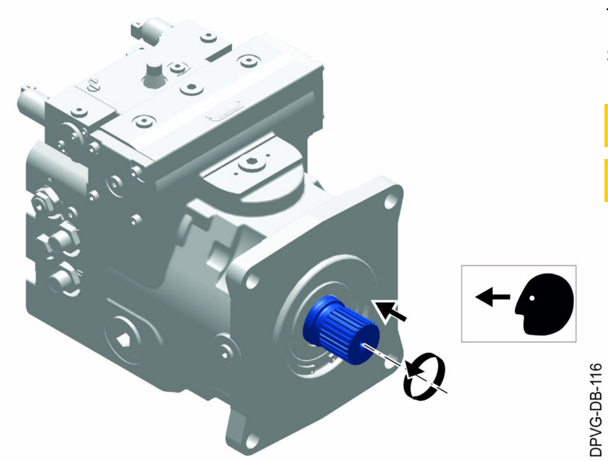
1) $M_E = M1+M2+M3$
$M_E < M_{E\ max}$

2) $M_D = M2+M3$
$M_D < M_{D\ max}$

# 2 Technical data

## 2.2 Direction of rotation

| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

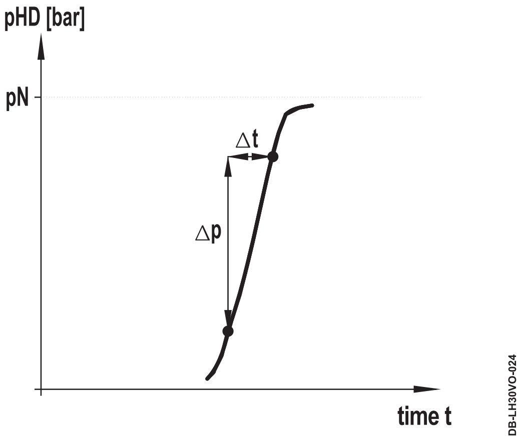


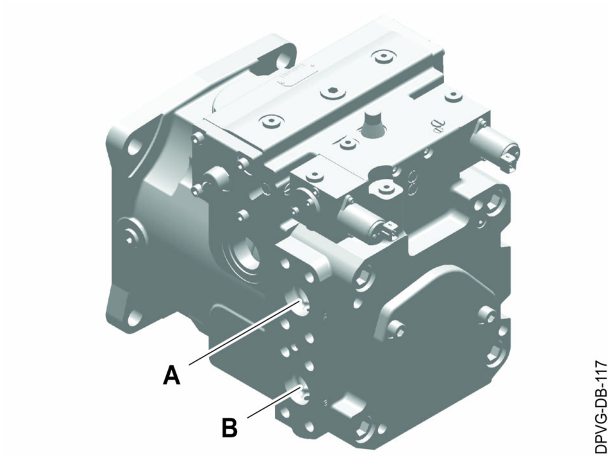

The direction of rotation is stated with view of the driving shaft, as shown in the figure.

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

## 2.3 Permitted pressure range

### 2.3.1 Operating pressure




| Operating pressure at connection A / B | | | |
|---|---|---|---|
| **Nominal size** | | | **085 to 280** |
| Minimum pressure** | $pHD_{min}$ | bar | 20 |
| Nominal pressure (fatigue resistant) | $pHD_N$ | bar | 450 |
| Maximum pressure (single operating period) | $pHD_{max}$ | bar | 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 |

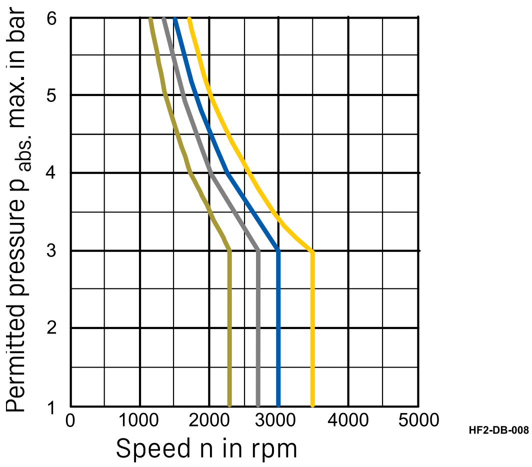
*) OH = operating hours

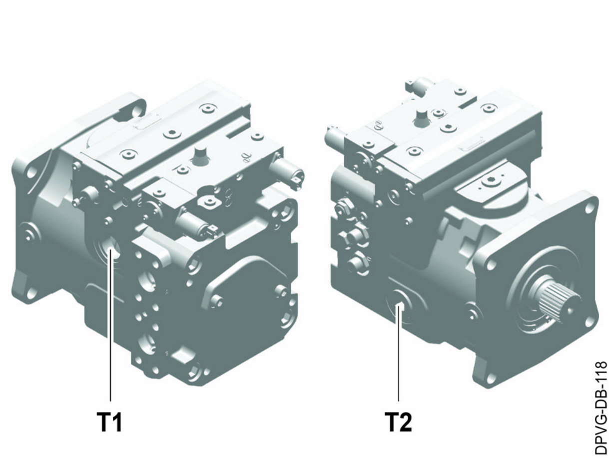
# 2 Technical data

**) There must be minimum pressure in the working circuit at port A to ensure adequate lubrication of the driving gear in all swivel angles during operation.

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

### 2.3.2 Housing, leakage oil pressure




| Characteristic curve | Nominal size | Shaft diameter (mm) |
|---|---|---|
| yellow | 085 | 40 |
| blue | 108 | 45 |
| grey | 165, 140 | 50, 56 |
| olive | 280 | 60 |

| Leakage oil pressure at connection T1/T2 | | | |
|---|---|---|---|
| **Nominal size** | | | **085 to 280** |
| Permanent absolute leakage oil pressure | $p_L$ | bar | 3 |
| Maximum absolute pressure | $pL_{max}$ | 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 fluids

### 2.4.1 General information

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

**ATTENTION**
You must not mix different mineral oil hydraulic fluids!

**Minimum required quality**

| Specification |
|---|
| LH-00-HYC3A |
| LH-00-HYE3A |

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

### 2.4.2 Fill quantity

| Nominal size | Fill quantity |
|---|---|
| 085 to 280 | Values upon request |

**Note**
Before commissioning, the hydraulic unit must be filled with hydraulic fluid and vented.
This must be checked during operation and after long downtimes and repeated if necessary.

### 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 12)

**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 17)

### 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 [$mm^2/s$] | Note |
|---|---|---|---|
| < -50 °C | Idle state | -* | No storage or operation permitted |
| < -40 °C | Idle state | -** | No operation permitted, preheat to at least -40 °C, select appropriate hydraulic fluid |

***) Idle state < -50 °C**

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

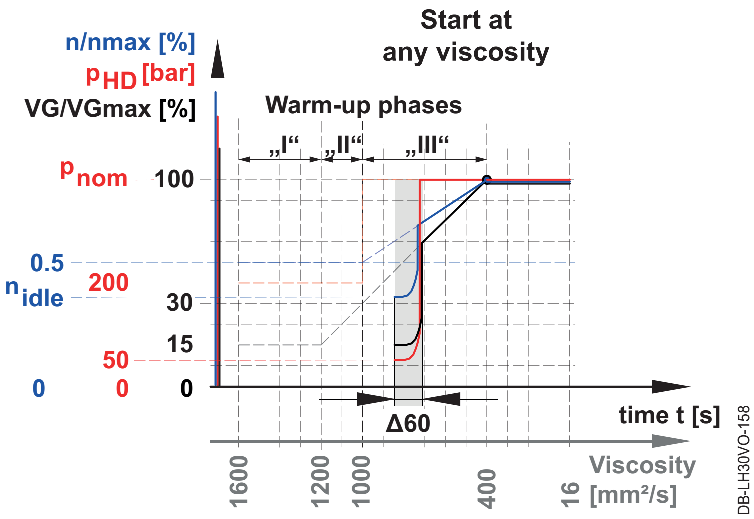
****) Idle state < -40 °C**

**ATTENTION**
Temperatures < -40 °C on the system = no operation of the axial piston unit permitted.
Functioning of the sealing elements in the axial piston unit is not guaranteed at temperatures < -40 °C.
Preheat the axial piston unit and tank to at least -40 °C and use Liebherr Hydraulic Plus Arctic/Liebherr Hydraulic FFE 30 hydraulic fluid with a viscosity < 1600 $mm^2/s$. (for additional information see: 2.5.6 Viscosity chart, Page 17)

**Regardless of the viscosity < 1600 $mm^2/s$, 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: $p_{HD\ min} \le p_{HD} \le 50$ bar
- Speed: $n_{min} \le n \le 1000$ rpm, or idle speed of the drive motor*
- Displacement volume: $V_{g\ min} \le V_g \le 15\%$ 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 Viscosity chart | 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**.

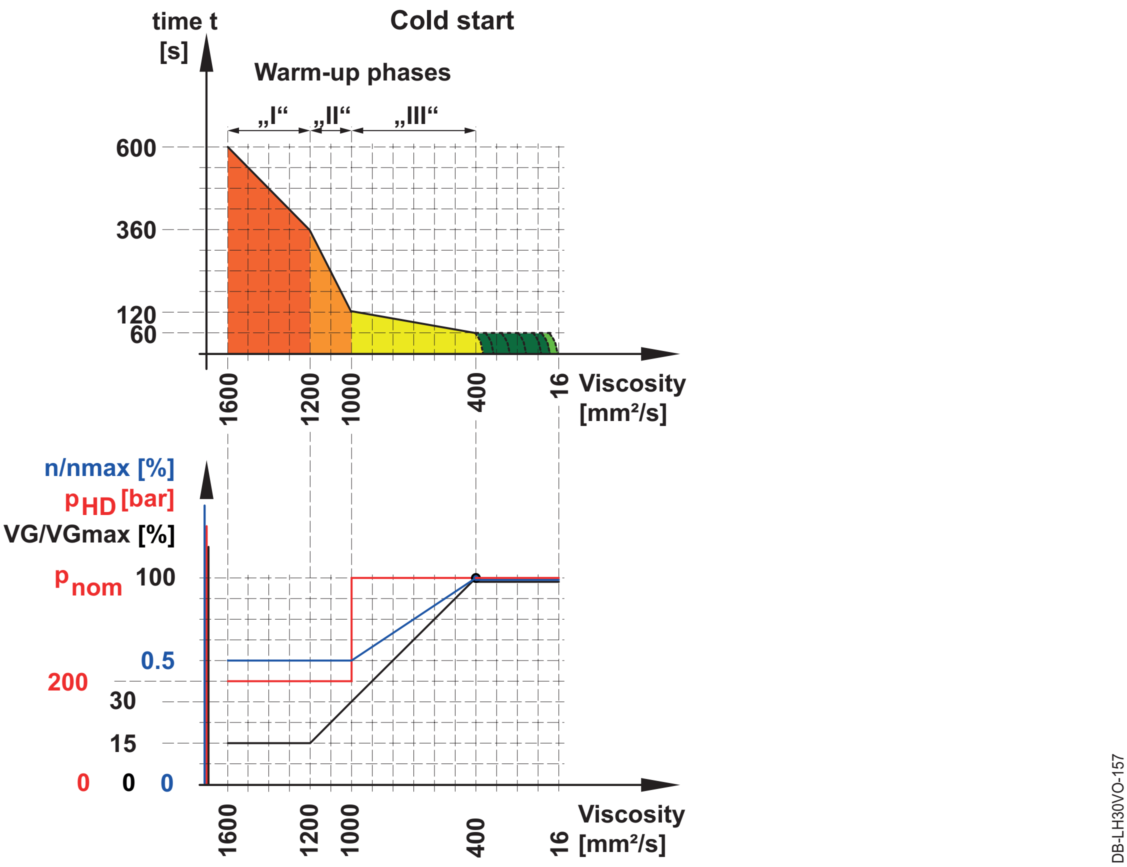
*) (for additional information see: 2.5.6 Viscosity chart, Page 17)

**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.

# 2 Technical data

****) 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 $V_{g\ max}$

# 2 Technical data

**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: $V_{g\ min} \leq V_{g\ Warm\text{-}up\ "II"} \leq$ 15-30% 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: $V_{g\ min} \leq V_{g\ Warm\text{-}up\ "III"} \leq$ 30-100% 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.

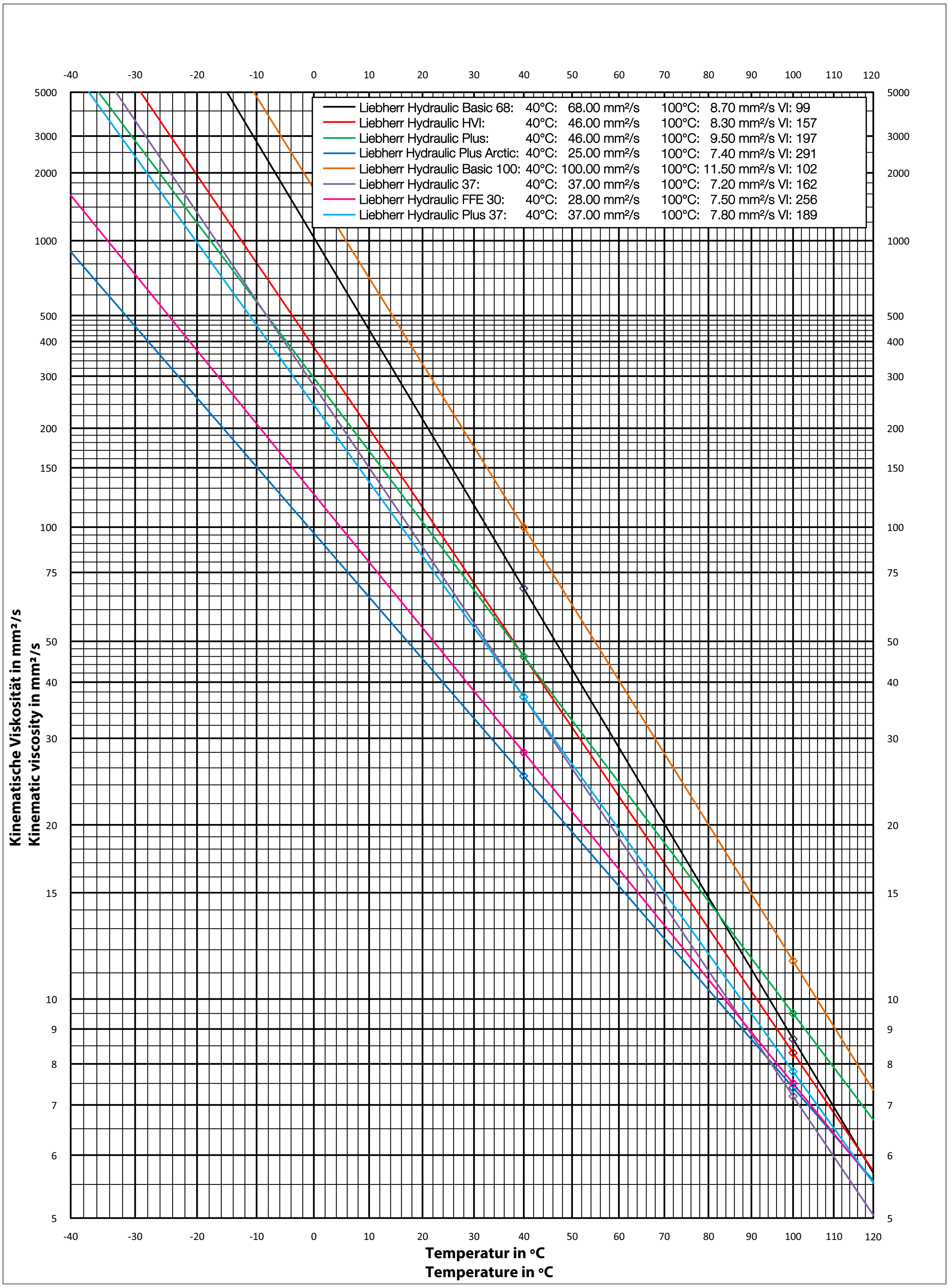
**Note**

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

- Operating pressure range: $p_{HD\ min} \leq p_{HD} \leq p_{HDmax}$
- 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

Various operating conditions, e.g. a very low flow rate over a longer period of time, could cause a critical temperature rise in the housing: see chapter 2.8.1.

If this is the case, the housing must be flushed, so the “hot” hydraulic oil is directed to an external cooler where it cools down and from where it is fed back into the hydraulic system.

The flushing volume qV 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.

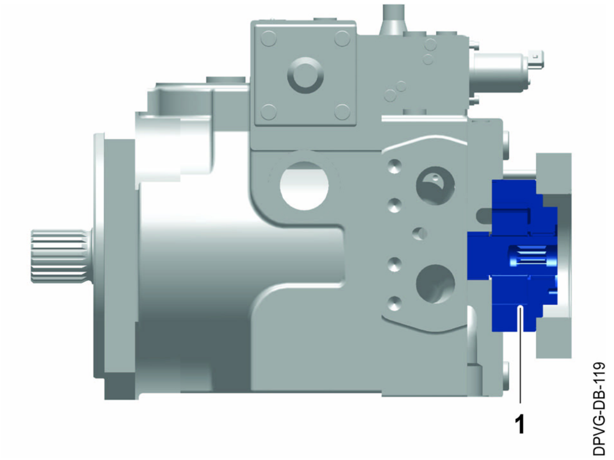
## 2.8 Feed pump

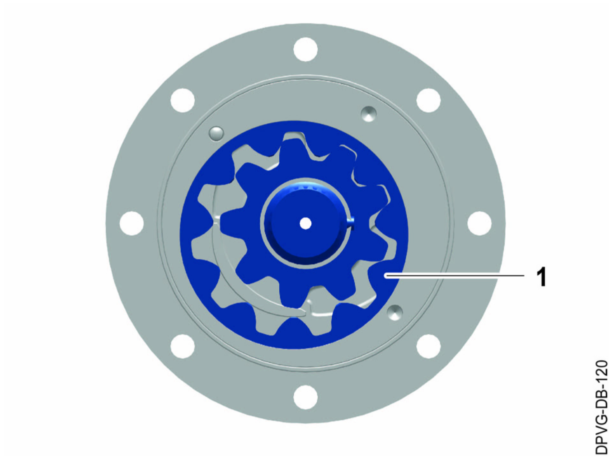
| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

**Note**
A feed pump can be implemented only in combination with through-drive = B11D, B11G or 0000.
A joint feed pump on hydraulic pump 2 is recommended for multi-circuit pumps in tandem design, see chapter 5.14.

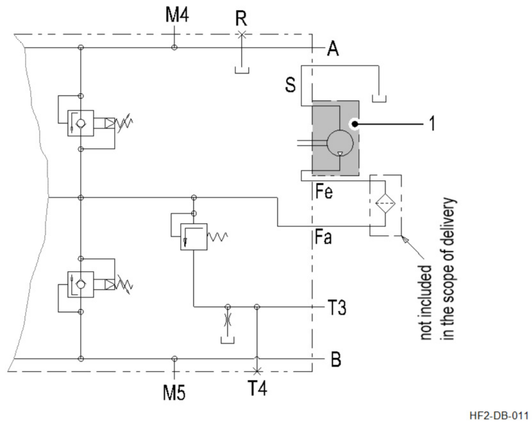
| | |
|---|---|
| 00 | Without feed pump |
| 24 | With feed pump ($V_g$ = 24 $cm^3$), without filter and cold-start valve |
| 30 | With feed pump ($V_g$ = 30 $cm^3$), without filter and cold-start valve |
| 40 | With feed pump ($V_g$ = 40 $cm^3$), without filter and cold-start valve |
| 50 | With feed pump ($V_g$ = 50 $cm^3$), without filter and cold-start valve |

# 2 Technical data




### 2.8.1 Hydraulic diagram with feed pump




| | | | |
|---|---|---|---|
| 1 | Feed pump | - | - |

# 3 Activation and control type

## 3.1 Control types

| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

**Note**
For each control type or function, only one nominal size is illustrated, typically nominal size 280. 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 responsibility of the manufacturer of the device or system to install a safety device e.g. an emergency stop.

The following modular control types can be ordered for the DPVG series:

### 3.1.1 Mechanical-hydraulic control

- SD- control, see chapter 3.2.1
- SD-DA- control, see chapter 3.2.2
- SD-DA1- control, see chapter 3.2.3
- TCH- control, see chapter 3.2.4 / see chapter 3.2.5
- DZH-M-DA- control, see chapter 3.2.16

### 3.1.2 Electric-hydraulic control

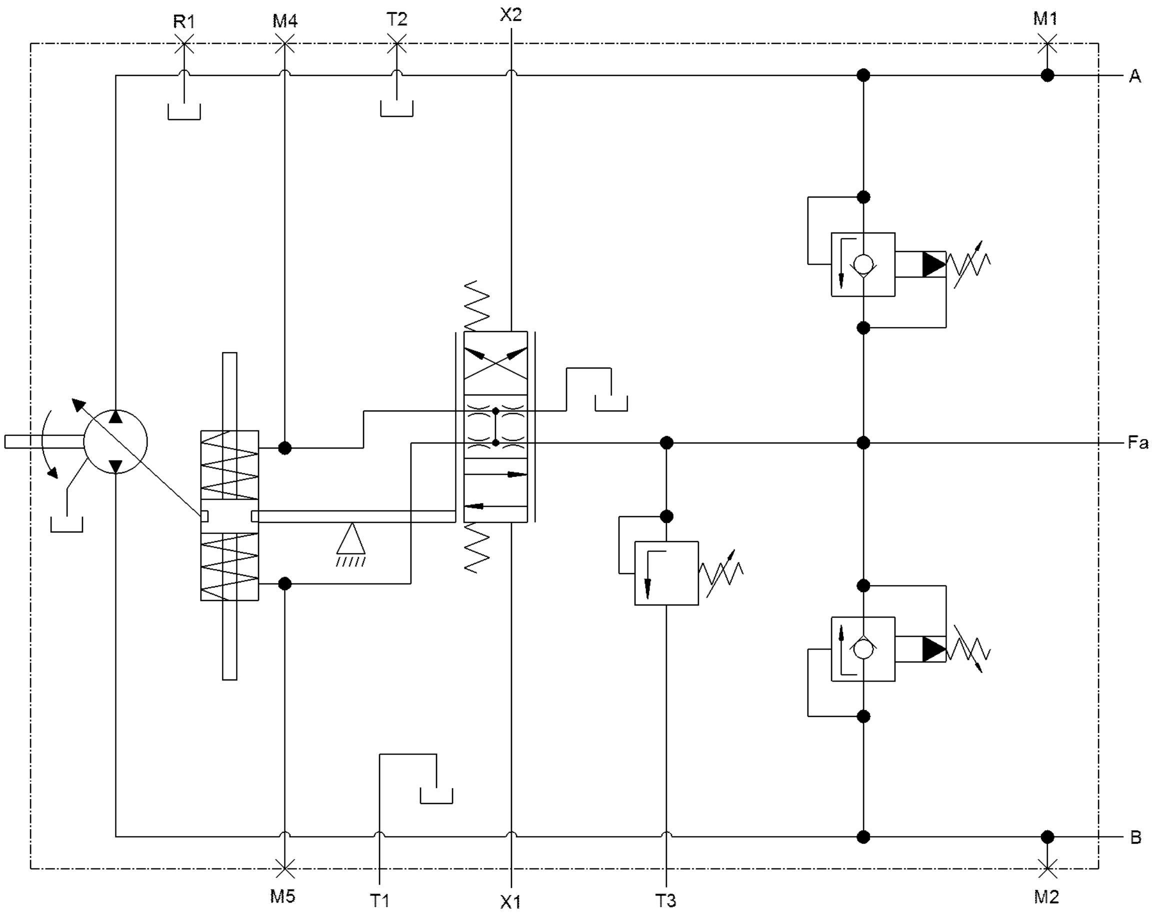
- EL- control, see chapter 3.2.7
- EL-DA- control, see chapter 3.2.8
- EL-DA1- control, see chapter 3.2.9
- ELS- control, see chapter 3.2.10
- ELS-DA- control, see chapter 3.2.11
- ELS-DA1- control, see chapter 3.2.12
- TCE- control, see chapter 3.2.13 / see chapter 3.2.14
- DS-DA- control, see chapter 3.2.15
- DS-DA1- control, see chapter 3.2.16

**Further control types are available upon request.**

# 3 Activation and control type

## 3.2 Standard hydraulic diagrams

### 3.2.1 SD- control



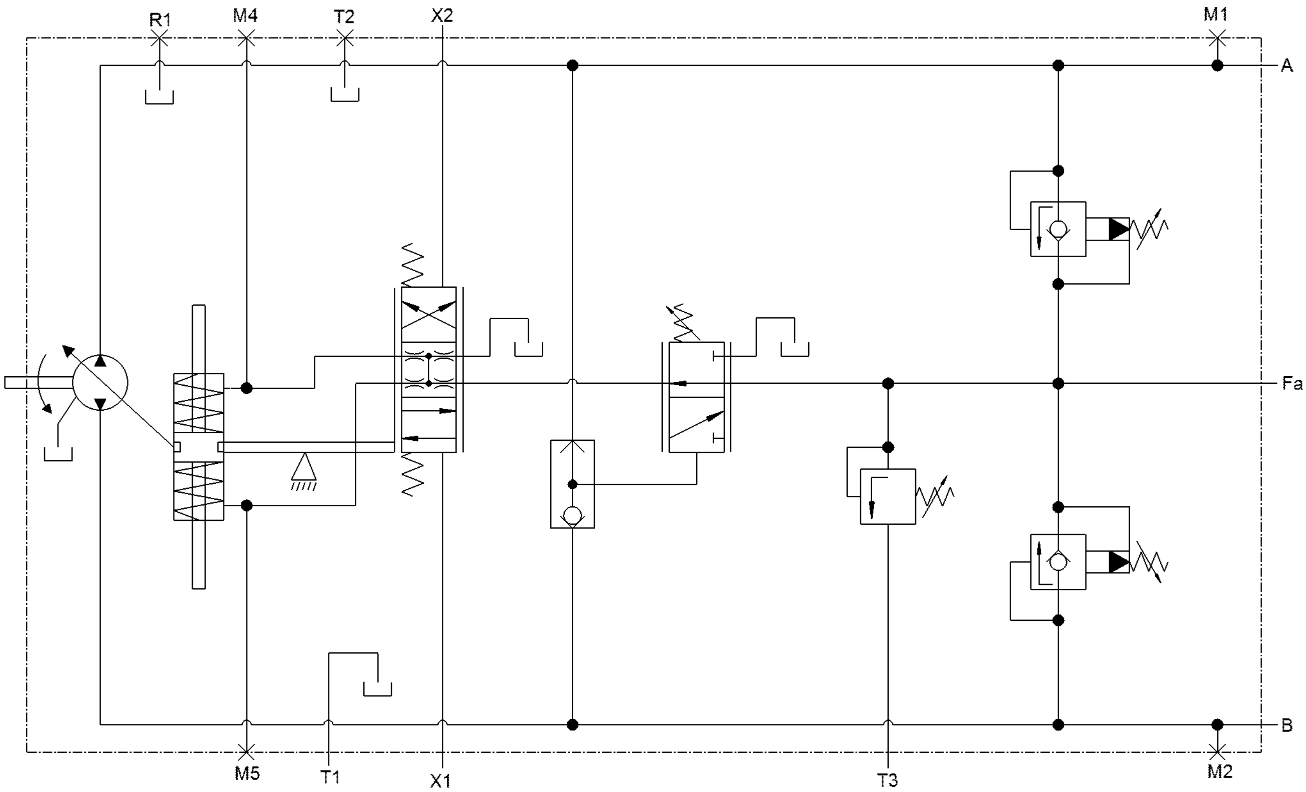

| | | | |
|---|---|---|---|
| X1, X2 | Steering pressure connection ISO 9974-1 | T2 | Oil drain ISO 9974-1 |
| A, B | Working connections SAE J 518 | T3 | Return for feed pressure ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| T1 | Leakage oil connection ISO 9974-1 | - | - |

**Note**

X1 switched, direction of rotation: R = Oil outlet at connection A,
direction of rotation: L = Oil outlet at connection B
X2 switched, direction of rotation: R = Oil outlet at connection B,
direction of rotation: L = Oil outlet at connection A

# 3 Activation and control type

### 3.2.2 SD-DA- control

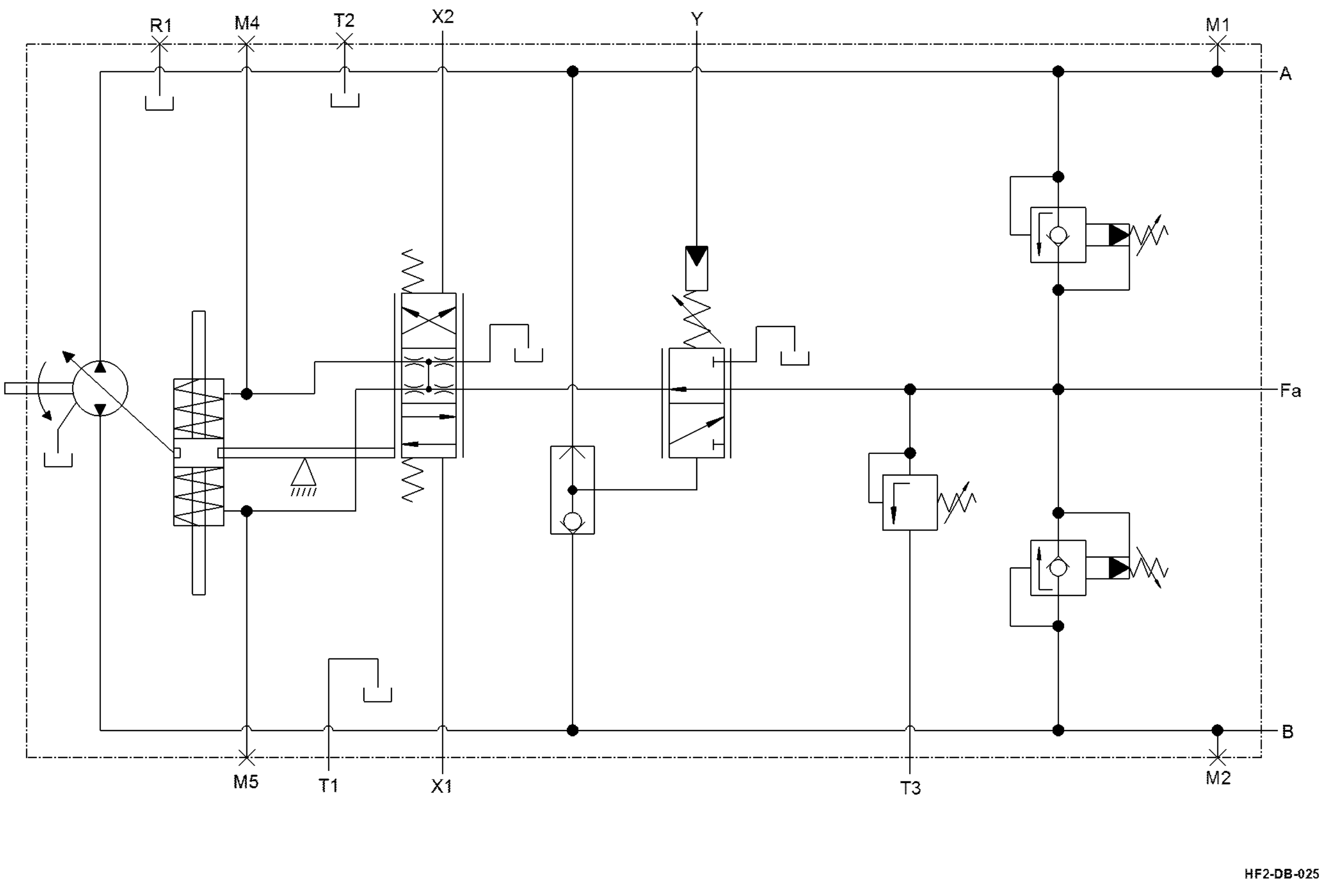



HF2-DB-024

| | | | |
|---|---|---|---|
| X1, X2 | Steering pressure connection ISO 9974-1 | T2 | Oil drain ISO 9974-1 |
| A, B | Working connections SAE J 518 | T3 | Return for feed pressure ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| T1 | Leakage oil connection ISO 9974-1 | - | - |

**Note**
X1 switched, direction of rotation: R = Oil outlet at connection A,
direction of rotation: L = Oil outlet at connection B
X2 switched, direction of rotation: R = Oil outlet at connection B,
direction of rotation: L = Oil outlet at connection A

### 3.2.3 SD-DA1- control

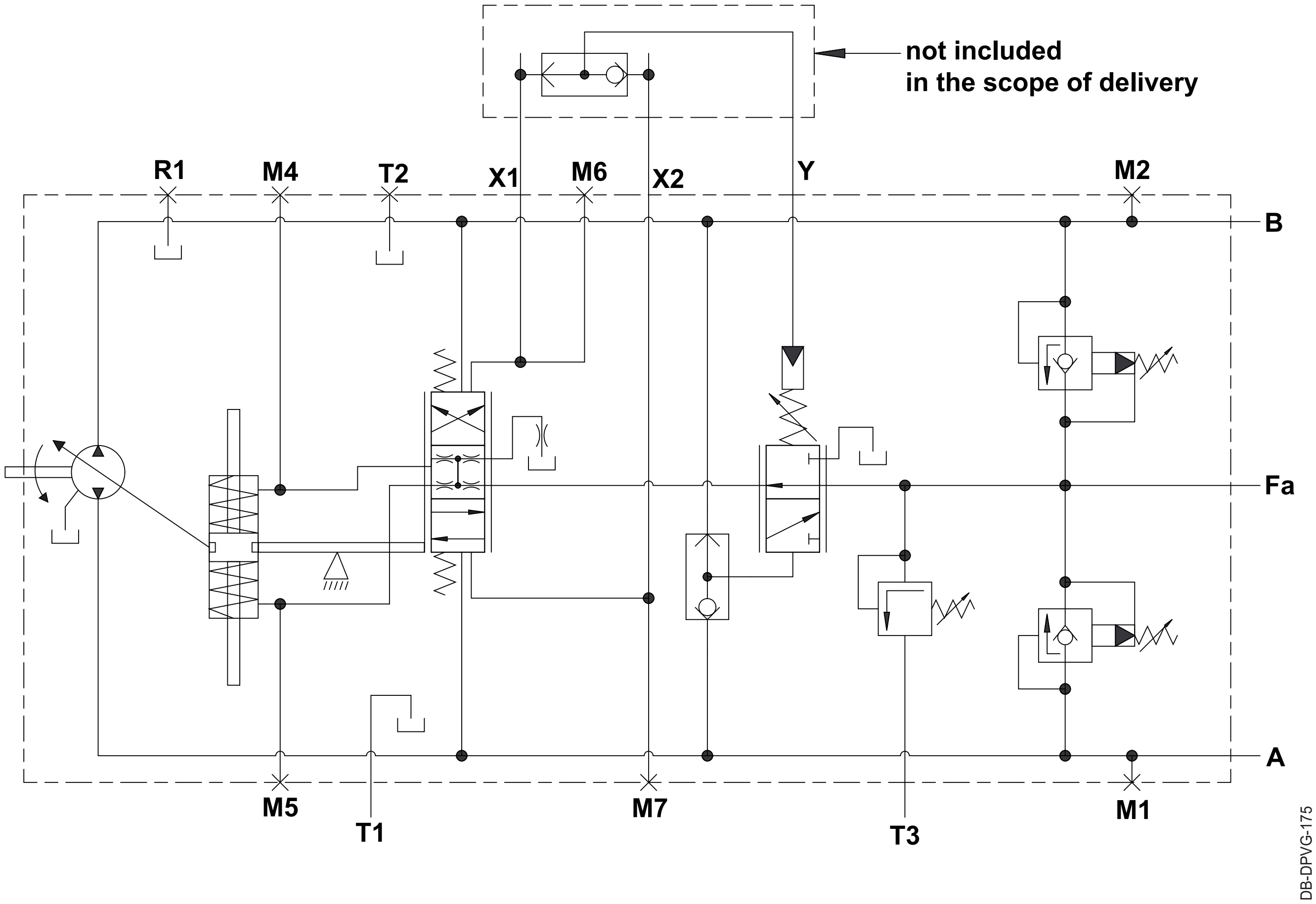



| X1, X2 | Steering pressure connection ISO 9974-1 | T1 | Leakage oil connection ISO 9974-1 |
|---|---|---|---|
| Y | DA1 override signal | T2 | Oil drain ISO 9974-1 |
| A, B | Working connections SAE J 518 | T3 | Return for feed pressure ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |

**Note**
X1 switched, direction of rotation: R = Oil outlet at connection A, L = Oil outlet at connection B
X2 switched, direction of rotation: R = Oil outlet at connection B, L = Oil outlet at connection A

# 3 Activation and control type

### 3.2.4 TCH- control, anti-clockwise rotation

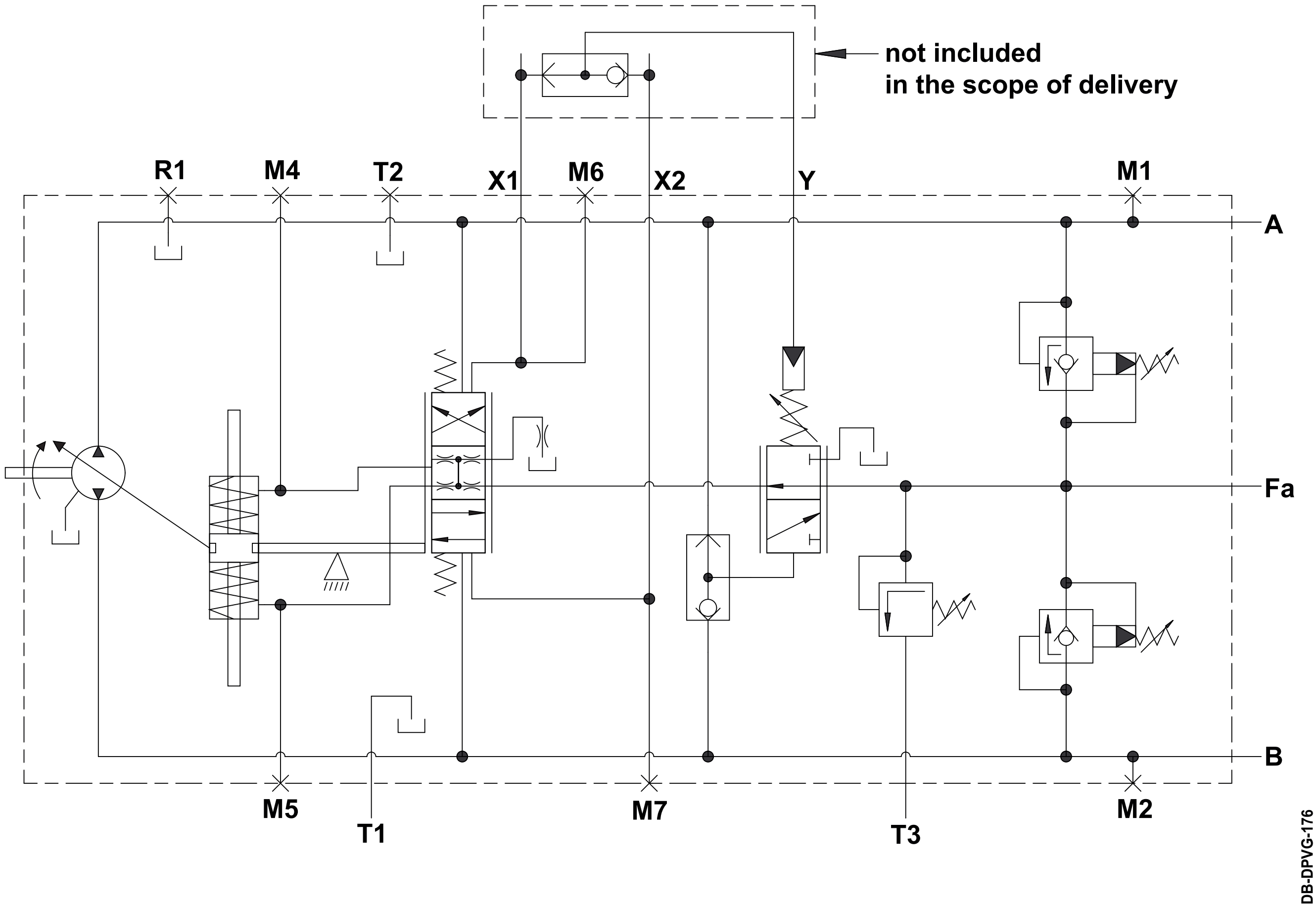



| | | | |
|---|---|---|---|
| X1, X2 | Steering pressure connections ISO 9974-1 | T1, T2 | Leakage oil connections ISO 9974-1 |
| A, B | Working connections SAE J 518 | T3 | Return for feed pressure ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| Y | DA1 override signal (weighed) ISO 9974-1 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| S | Suction port feed pump ISO 9974-1 | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | - | - |

**Note**
X1 switched, direction of rotation: R = Oil outlet at connection A, L = Oil outlet at connection B
X2 switched, direction of rotation: R = Oil outlet at connection B, L = Oil outlet at connection A

# 3 Activation and control type

### 3.2.5 TCH- control, clockwise rotation

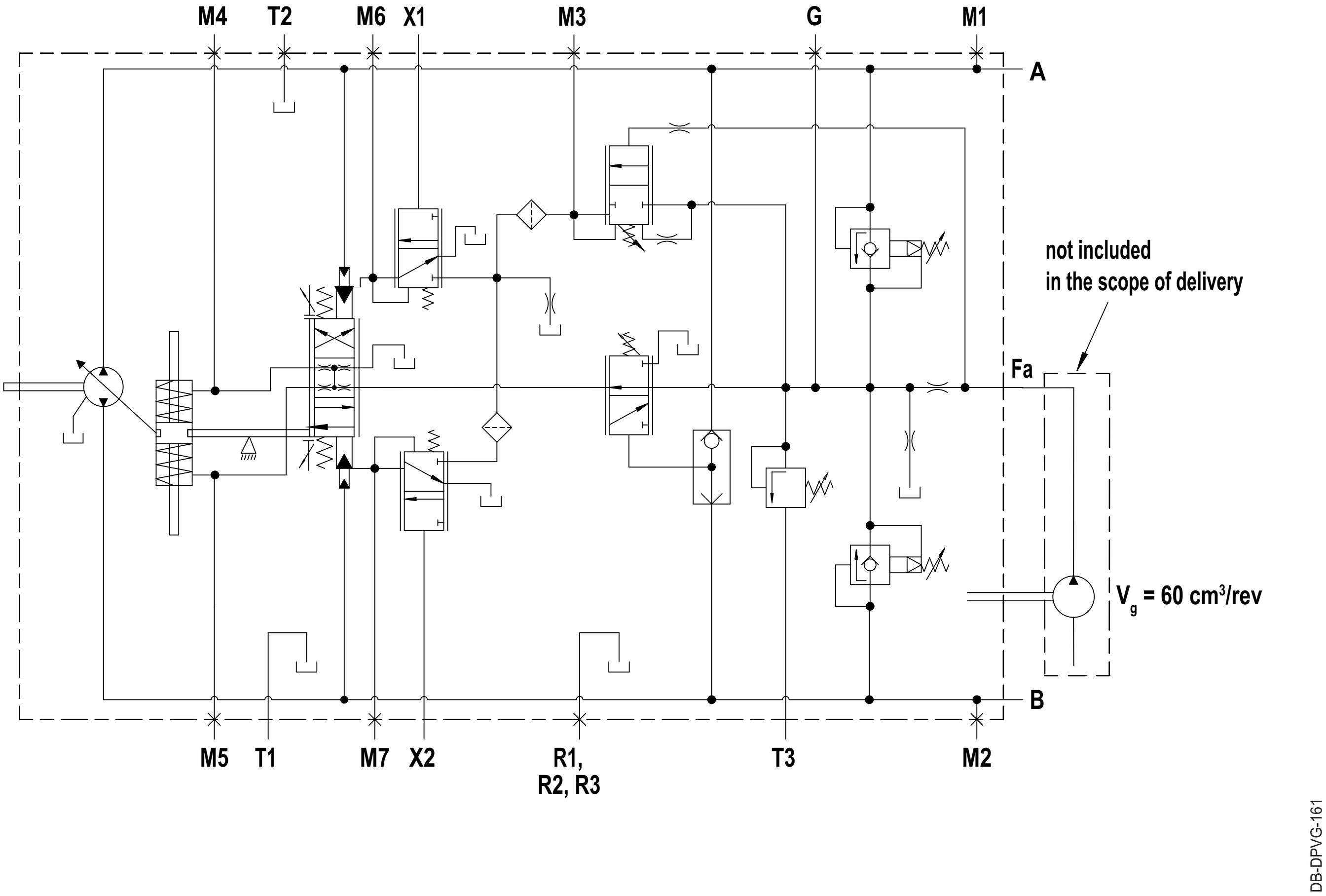



| | | | |
|---|---|---|---|
| X1, X2 | Steering pressure connections ISO 9974-1 | T3 | Return for feed pressure ISO 9974-1 |
| A, B | Working connections SAE J 518 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| Y | DA1 override signal (weighed) ISO 9974-1 | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| T1, T2 | Leakage oil connections ISO 9974-1 | Fa | Feed pressure connection ISO 9974-1 |

**Note**
X1 switched, direction of rotation: R = Oil outlet at connection A, L = Oil outlet at connection B
X2 switched, direction of rotation: R = Oil outlet at connection B, L = Oil outlet at connection A

# 3 Activation and control type

### 3.2.6 DZH-M-DA- control




| | | | |
|---|---|---|---|
| X1, X2 | Steering pressure connections ISO 9974-1 | T3 | Return for feed pressure ISO 9974-1 |
| A, B | Working connections SAE J 518 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| R1, R2, R3 | Vent connection ISO 9974-1 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| G | Pressure connection for auxiliary circuits ISO 9974-1 | M3, M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| T1, T2 | Leakage oil connections ISO 9974-1 | Fa | Filter output ISO 9974-1 |

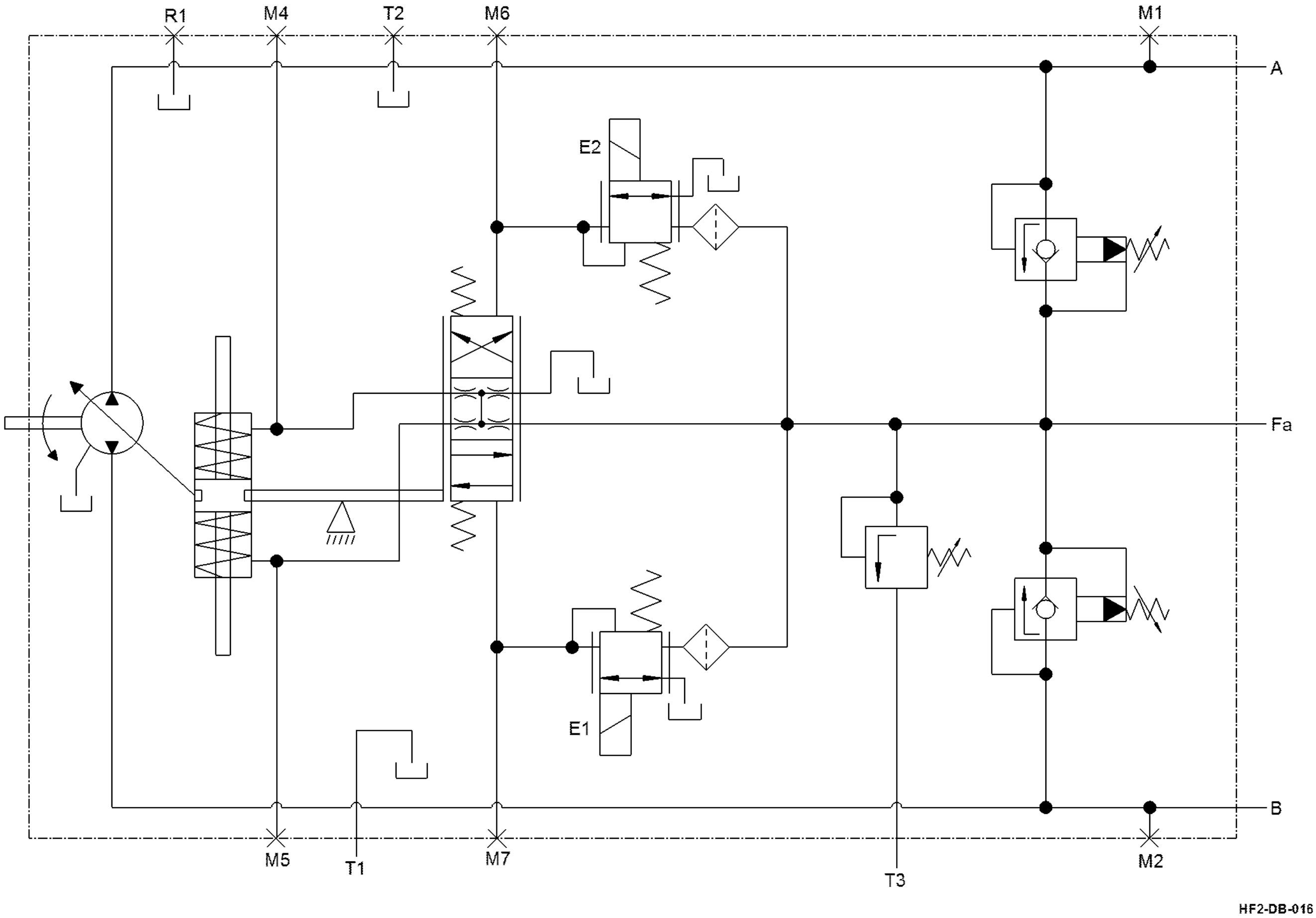
**Note**

X1 switched, direction of rotation: R = Oil outlet at connection B, L = Oil outlet at connection A

X2 switched, direction of rotation: R = Oil outlet at connection A, L = Oil outlet at connection B

# 3 Activation and control type

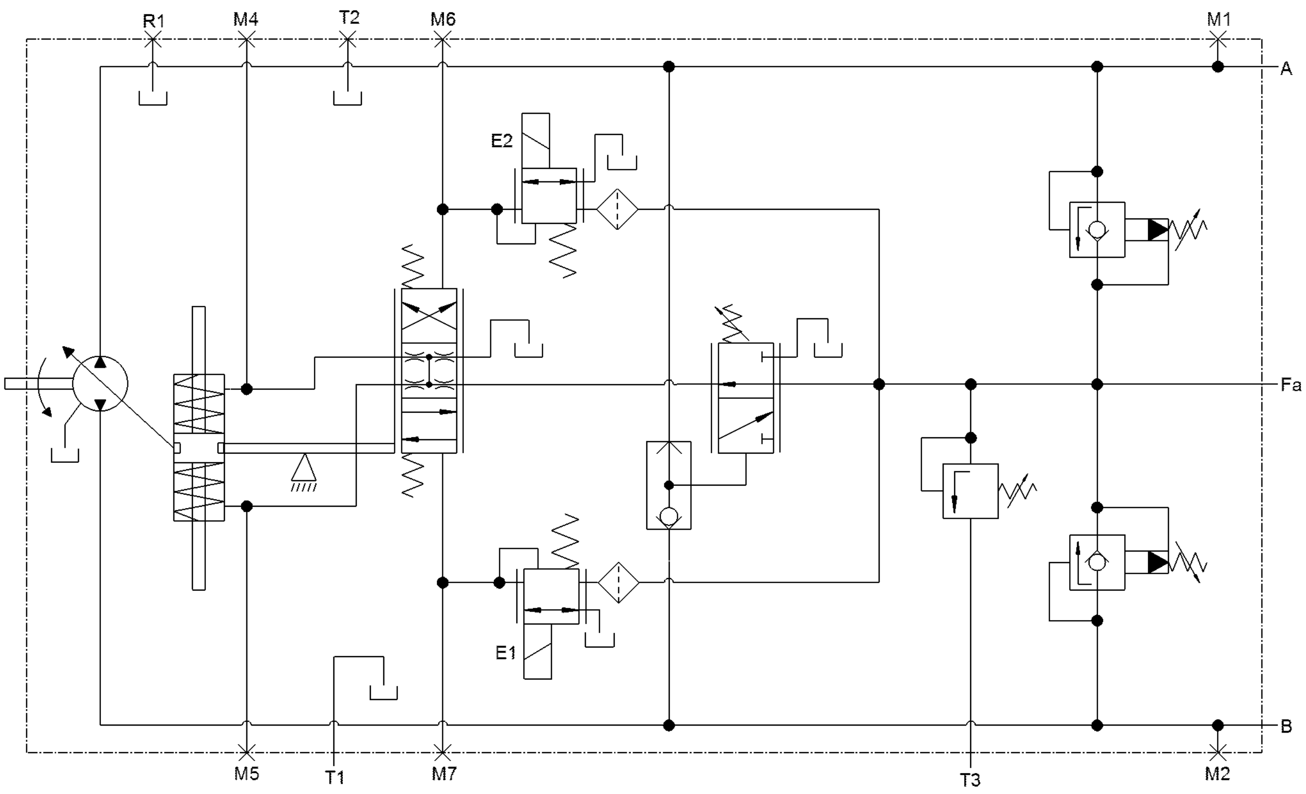
### 3.2.7 EL- control




| | | | |
|---|---|---|---|
| A, B | Working connections SAE J 518 | T3 | Return for feed pressure ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| T1 | Leakage oil connection ISO 9974-1 | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| E1, E2 | Pressure control valve, AMP Junior Timer plug-in terminal, 2-pin, PWM= 100 Hz, Un= 24V, Imax.= 750 mA | T2 | Oil drain ISO 9974-1 |

**Note**
Magnet E1 switched, direction of rotation: R = Oil outlet at connection A, L = Oil outlet at connection B
Magnet E2 switched, direction of rotation: R = Oil outlet at connection B, L = Oil outlet at connection A

### 3.2.8 EL-DA- control



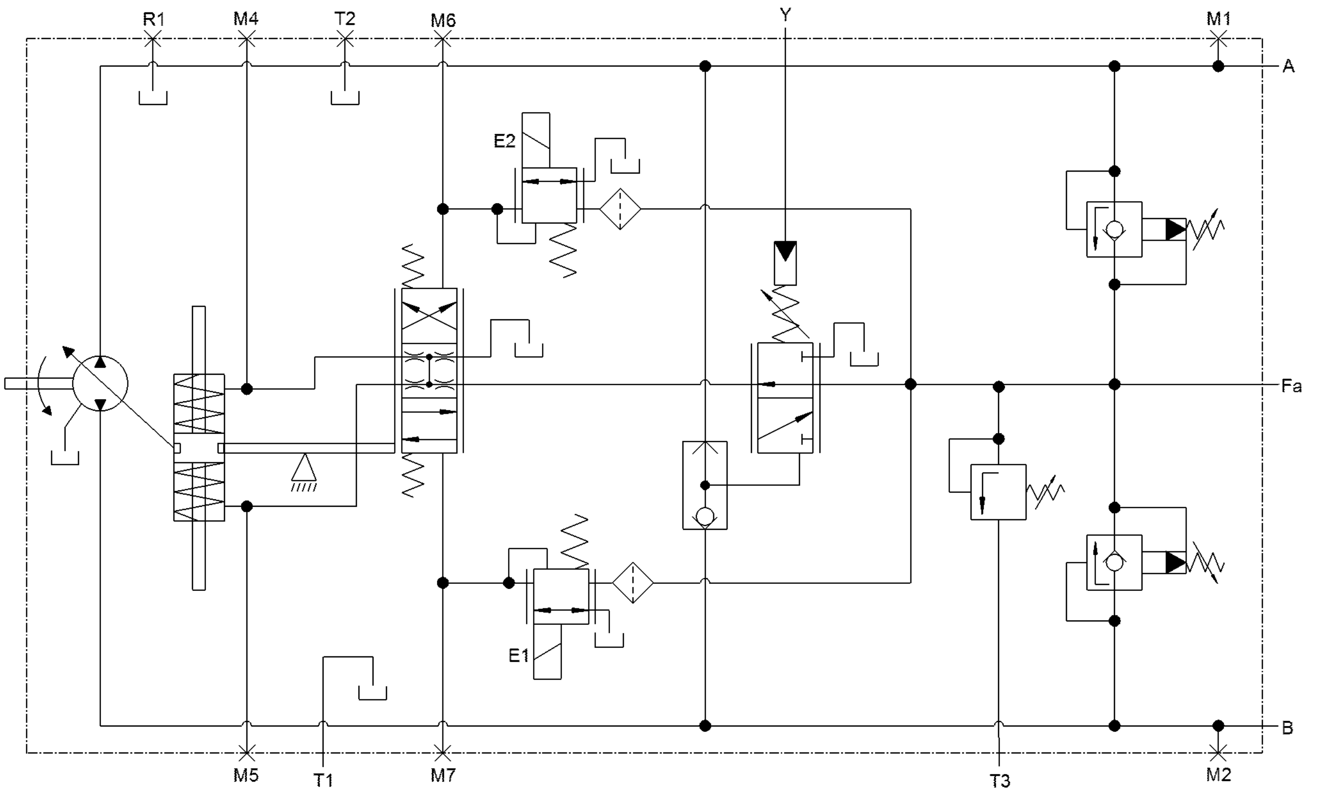

HF2-DB-017

| | | | |
|---|---|---|---|
| A, B | Working connections SAE J 518 | T3 | Return for feed pressure ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| T1 | Flushing connection ISO 9974-1 | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| E1, E2 | Pressure control valve, AMP Junior Timer plug-in terminal, 2-pin, PWM= 100 Hz, Un= 24V, Imax.= 750 mA | T2 | Tank connection ISO 9974-1 |

**Note**
Magnet E1 switched, direction of rotation: R = Oil outlet at connection A, L = Oil outlet at connection B
Magnet E2 switched, direction of rotation: R = Oil outlet at connection B, L = Oil outlet at connection A

# 3 Activation and control type

### 3.2.9 EL-DA1- control



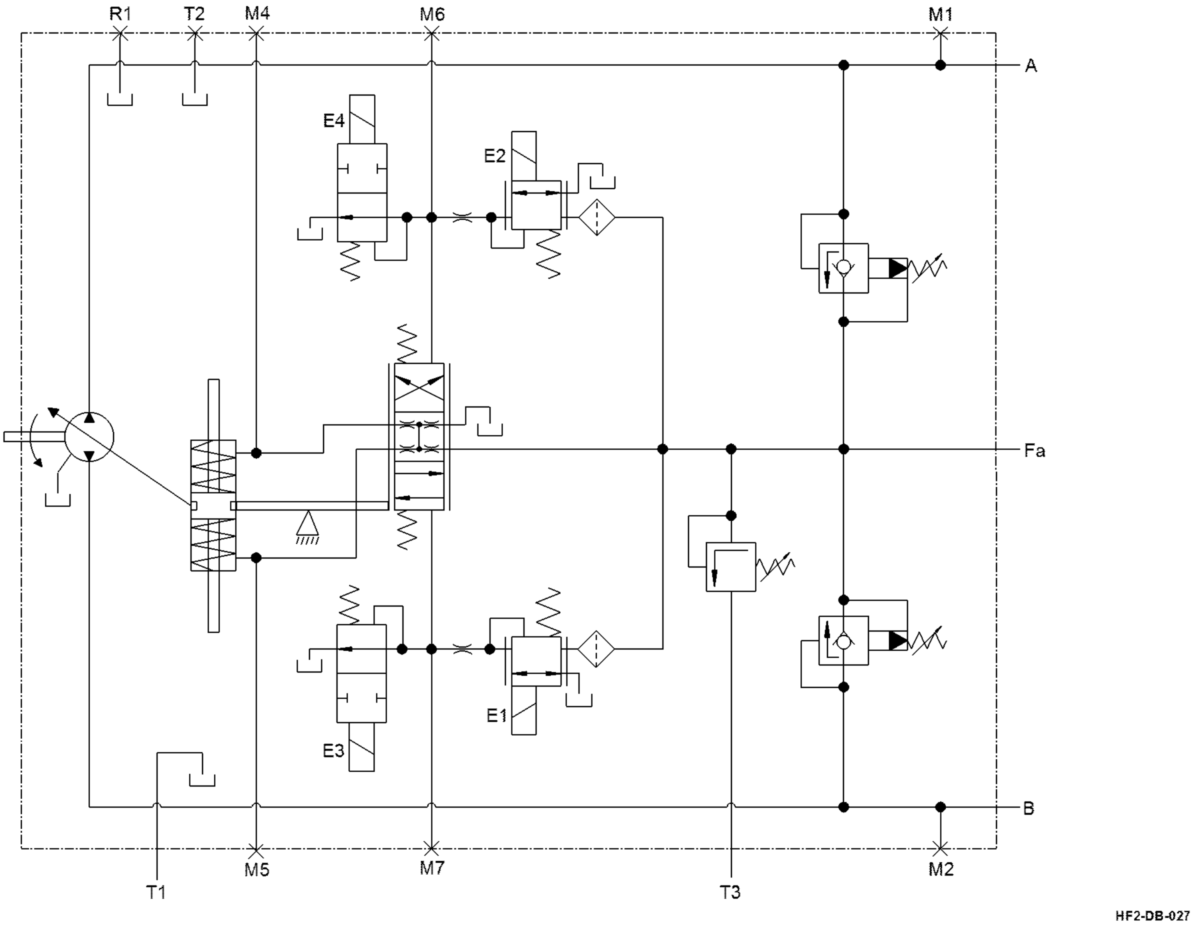

HF2-DB-026

| | | | |
|---|---|---|---|
| A, B | Working connections SAE J 518 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | Y | DA1 override signal ISO 9974-1 |
| T1, T2 | Tank connection ISO 9974-1 | - | - |
| E1, E2 | Pressure control valve, AMP Junior Timer plug-in terminal, 2-pin, PWM= 100 Hz, Un= 24V, Imax.= 750 mA | T3 | Return for feed pressure ISO 9974-1 |
| E5 | Rotation angle sensor to ISP ID.No. 11118356 Connector 3-pin, DT04-3P Deutsch Co. | M1, M2 | High pressure measuring connections ISO 9974-1 |

**Note**
Magnet E1 switched, direction of rotation: R = Oil outlet at connection B, L = Oil outlet at connection A
Magnet E2 switched, direction of rotation: R = Oil outlet at connection A, L = Oil outlet at connection B

# 3 Activation and control type

### 3.2.10 ELS- control

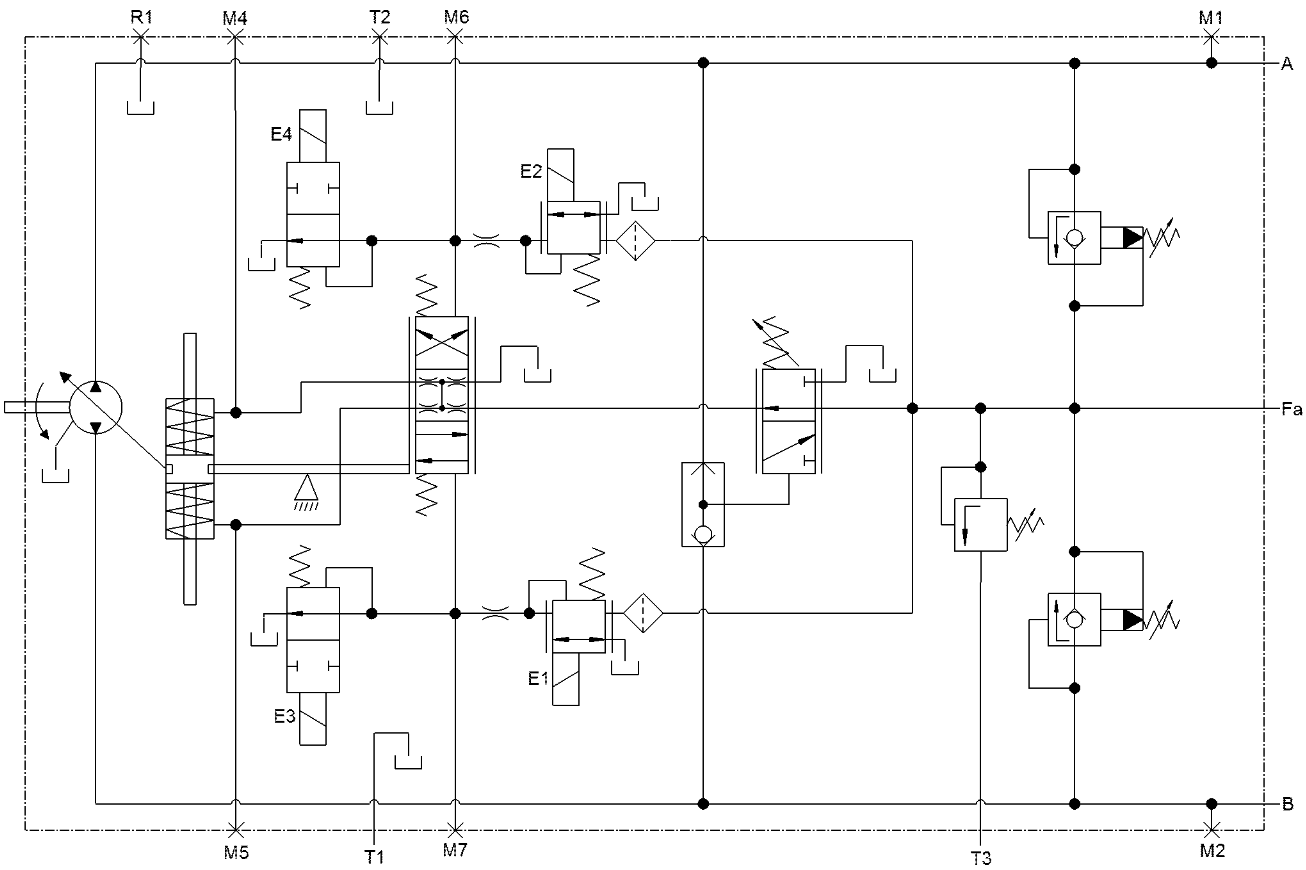



| | | | |
|---|---|---|---|
| A, B | Working connections SAE J 518 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | - | - |
| E1, E2 | Pressure control valve, AMP Junior Timer plug-in terminal, 2-pin, PWM= 100 Hz, Un= 24V, Imax.= 750 mA | T1, T2 | Tank connection ISO 9974-1 |
| E3, E4 | Shut-off valve, plug-in terminal: Deutsch connector DT04-2P, IG=0.58 A-100% ED UN=24V, R=25 Ohm | T3 | Return for feed pressure ISO 9974-1 |
| E5 | Rotation angle sensor to ISP ID.No. 11118356 Connector 3-pin, DT04-3P Deutsch Co. | M1, M2 | High pressure measuring connections ISO 9974-1 |

**Note**
Magnet E1 switched, direction of rotation: R = Oil outlet at connection A, L = Oil outlet at connection B
Magnet E2 switched, direction of rotation: R = Oil outlet at connection B, L = Oil outlet at connection A

# 3 Activation and control type

### 3.2.11 ELS-DA- control



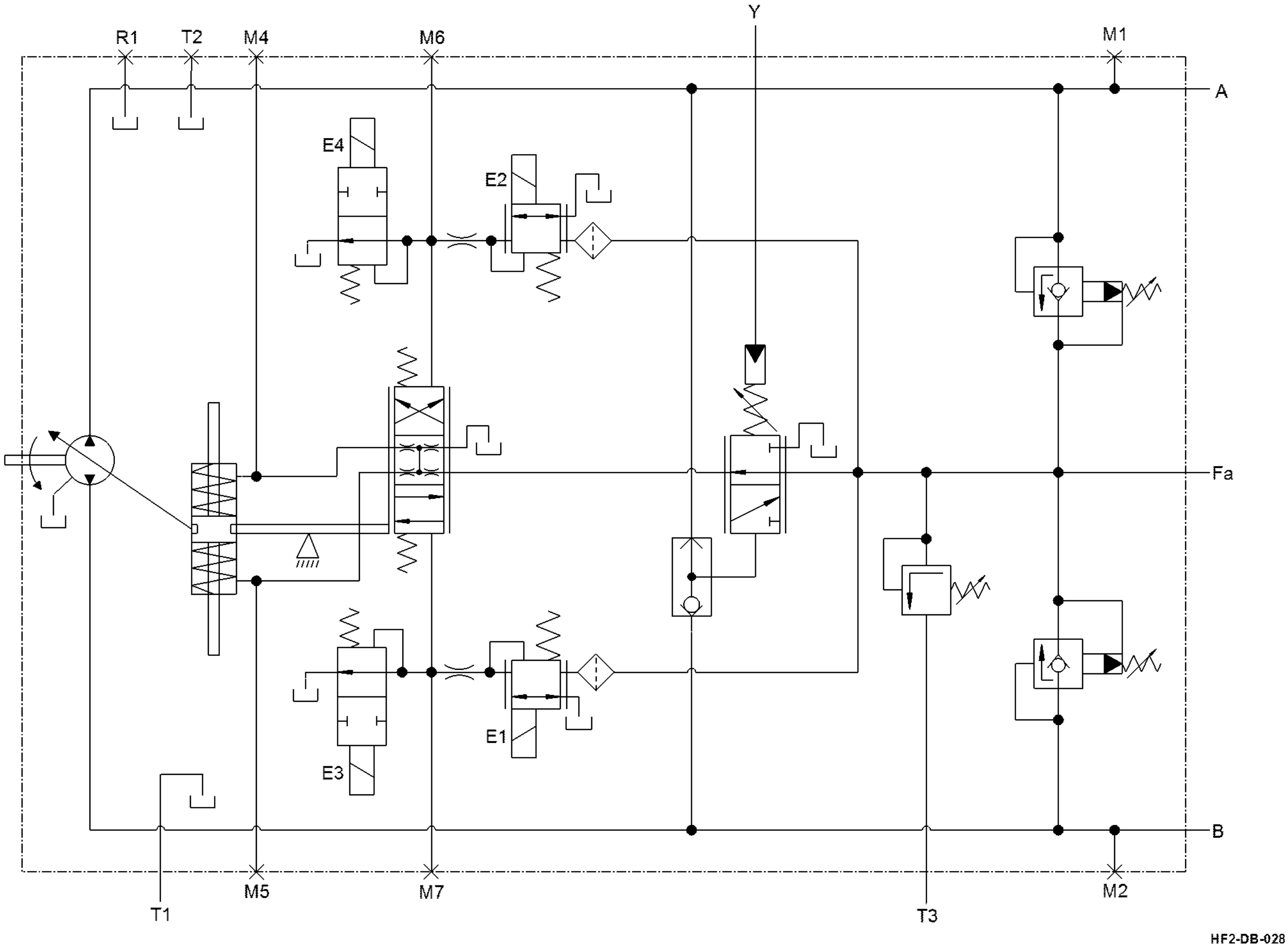

HF2-DB-018

| | | | |
|---|---|---|---|
| A, B | Working connections SAE J 518 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | - | - |
| E1, E2 | Pressure control valve, AMP Junior Timer plug-in terminal, 2-pin, PWM= 100 Hz, Un= 24V, Imax.= 750 mA | T1, T2 | Tank connection ISO 9974-1 |
| E3, E4 | Shut-off valve, plug-in terminal: Deutsch connector DT04-2P, IG=0.58 A-100% ED UN=24V, R=25 Ohm | T3 | Return for feed pressure ISO 9974-1 |
| E5 | Rotation angle sensor to ISP ID.No. 11118356 Connector 3-pin, DT04-3P Deutsch Co. | M1, M2 | High pressure measuring connections ISO 9974-1 |

**Note**
Magnet E1 switched, direction of rotation: R = Oil outlet at connection A, L = Oil outlet at connection B
Magnet E2 switched, direction of rotation: R = Oil outlet at connection B, L = Oil outlet at connection A

# 3 Activation and control type

### 3.2.12 ELS-DA1- control

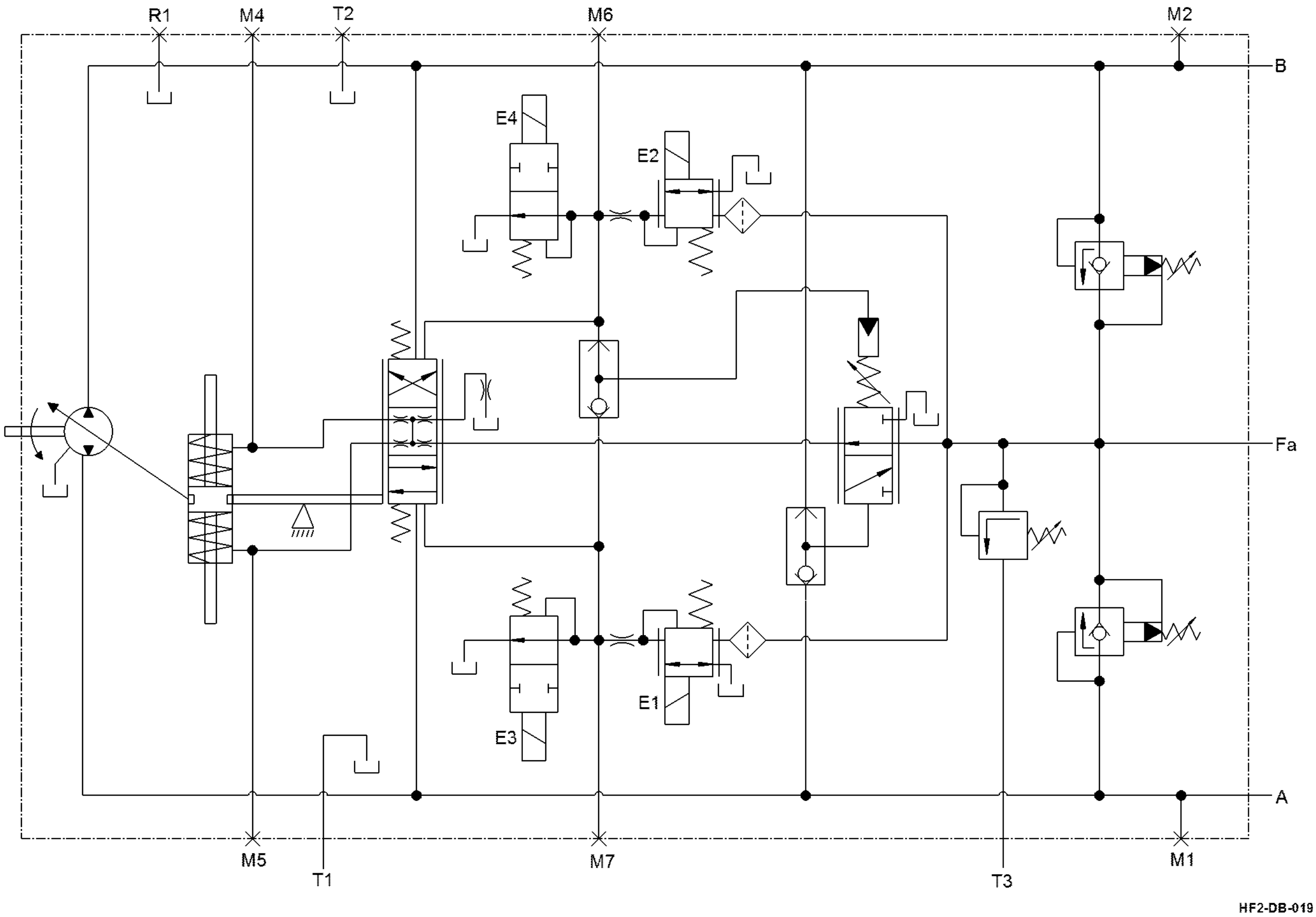



| | | | |
|---|---|---|---|
| A, B | Working connections SAE J 518 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | Y | DA1 override signal ISO 9974-1 |
| T1, T2 | Tank connection ISO 9974-1 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| E1, E2 | Pressure control valve, AMP Junior Timer plug, 2-pin, PWM= 100 Hz, U= 24V, Imax.= 750 mA | T3 | Return for feed pressure ISO 9974-1 |
| E3, E4 | Shut-off valve, plug-in terminal: Deutsch connector DT04-2P, IG=0.585 A-100% ED UN=24V, R=25 Ohm | - | - |

**Note**
Magnet E1 switched, direction of rotation: R = Oil outlet at connection A, L = Oil outlet at connection B
Magnet E2 switched, direction of rotation: R = Oil outlet at connection B, L = Oil outlet at connection A

# 3 Activation and control type

### 3.2.13 TCE- control, anti-clockwise rotation

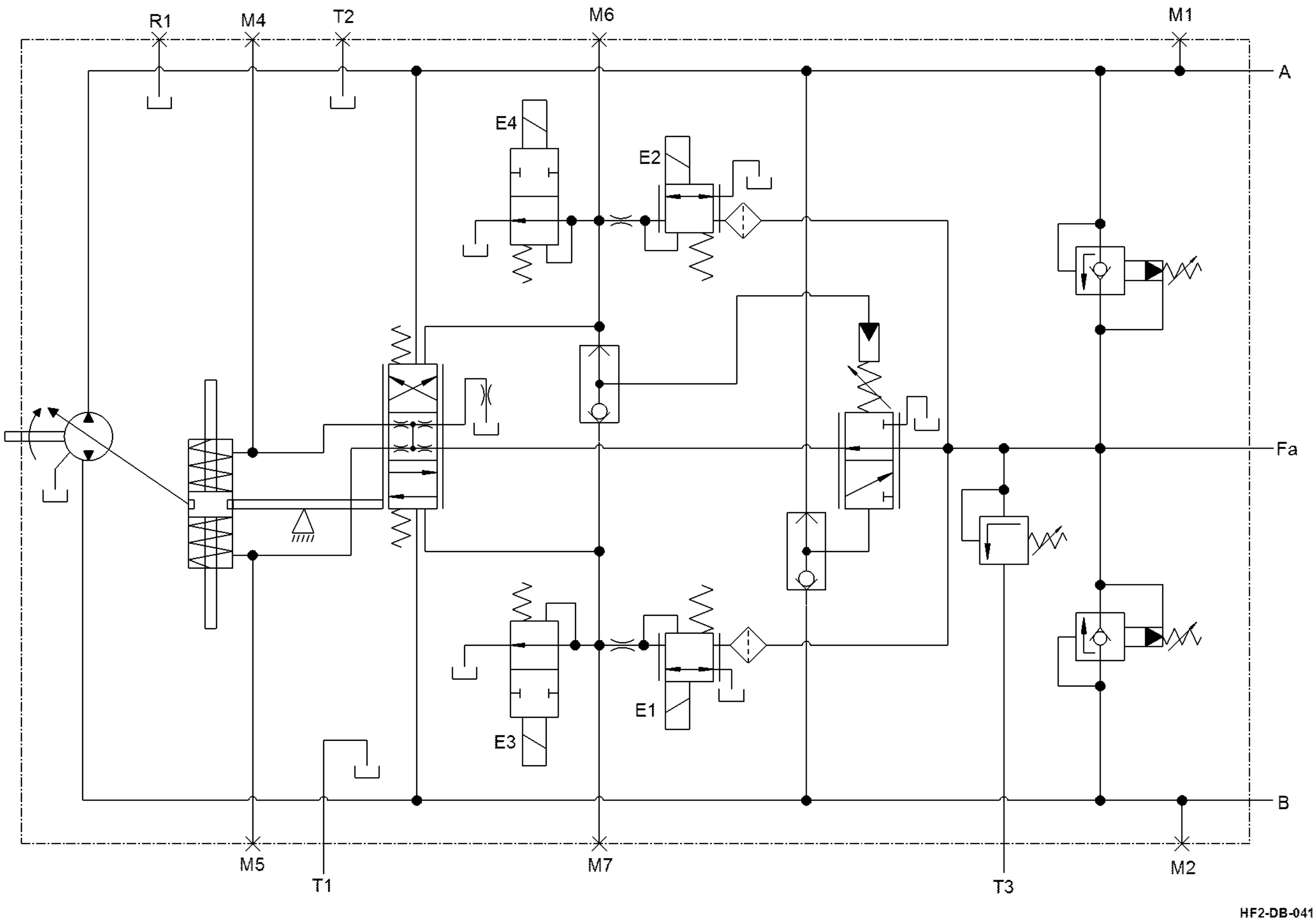



| | | | |
|---|---|---|---|
| A, B | Working connections SAE J 518 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| E1, E2 | Pressure control valve, AMP Junior Timer plug-in terminal, 2-pin, PWM= 100 Hz, Un= 24V, Imax.= 750 mA | T1, T2 | Tank connection ISO 9974-1 |
| E3, E4 | Shut-off valve, plug-in terminal: Deutsch connector DT04-2P, IG=0.58 A-100% ED UN=24V, R=25 Ohm | T3 | Oil return for feed pressure valve ISO 9974-1 |

**Note**
Magnet E1 switched, direction of rotation: L = Oil outlet at connection B
Magnet E2 switched, direction of rotation: L = Oil outlet at connection A

# 3 Activation and control type

### 3.2.14 TCE- control, clockwise rotation

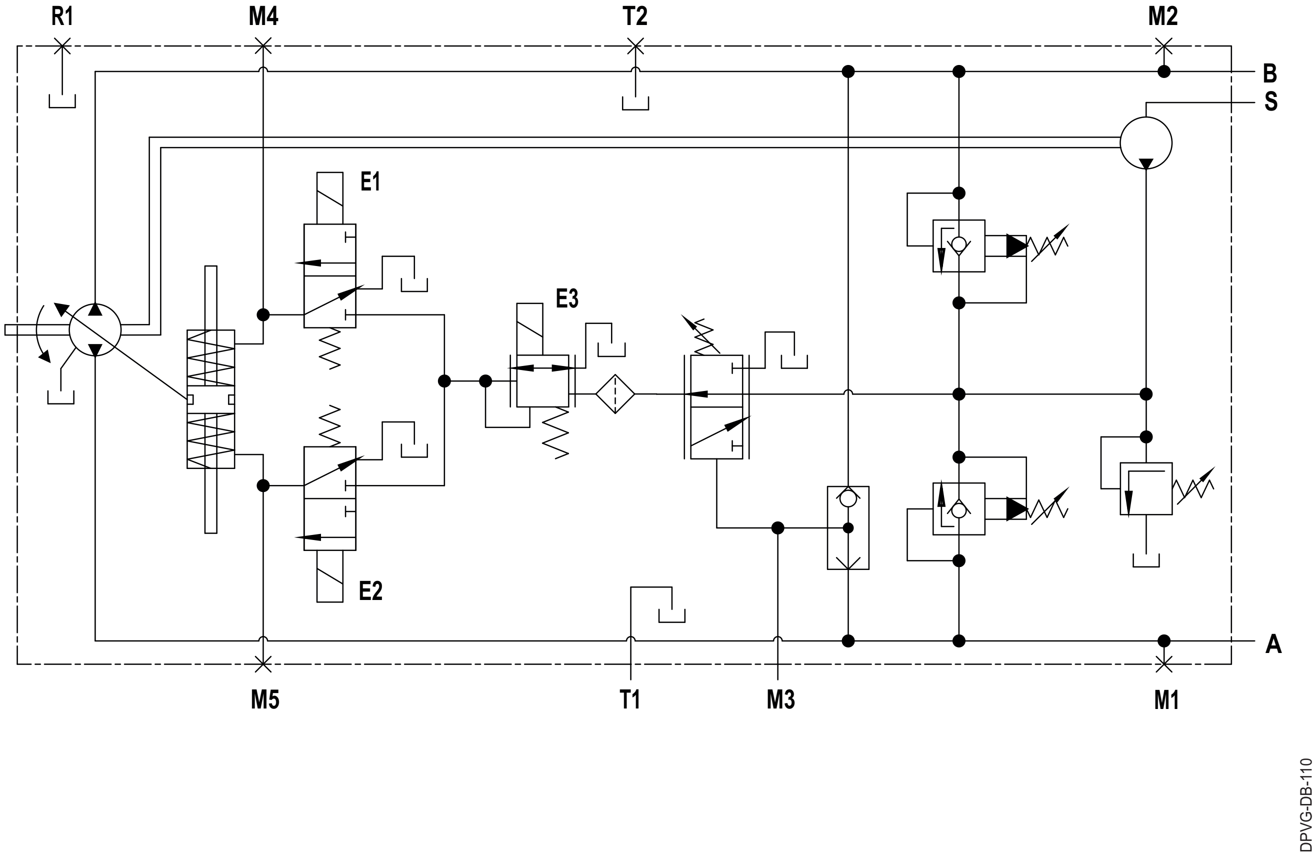



| | | | |
|---|---|---|---|
| A, B | Working connections SAE J 518 | M1, M2 | High pressure measuring connections ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| Fa | Feed pressure connection ISO 9974-1 | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| E1, E2 | Pressure control valve, AMP Junior Timer plug-in terminal, 2-pin, PWM= 100 Hz, Un= 24V, Imax.= 750 mA | T1, T2 | Tank connection ISO 9974-1 |
| E3, E4 | Shut-off valve, plug-in terminal: Deutsch connector DT04-2P, IG=0.58 A-100% ED UN=24V, R=25 Ohm | T3 | Oil return for feed pressure valve ISO 9974-1 |

**Note**
Magnet E1 switched, direction of rotation: R = Oil outlet at connection A
Magnet E2 switched, direction of rotation: R = Oil outlet at connection B

# 3 Activation and control type

### 3.2.15 DS-DA- control

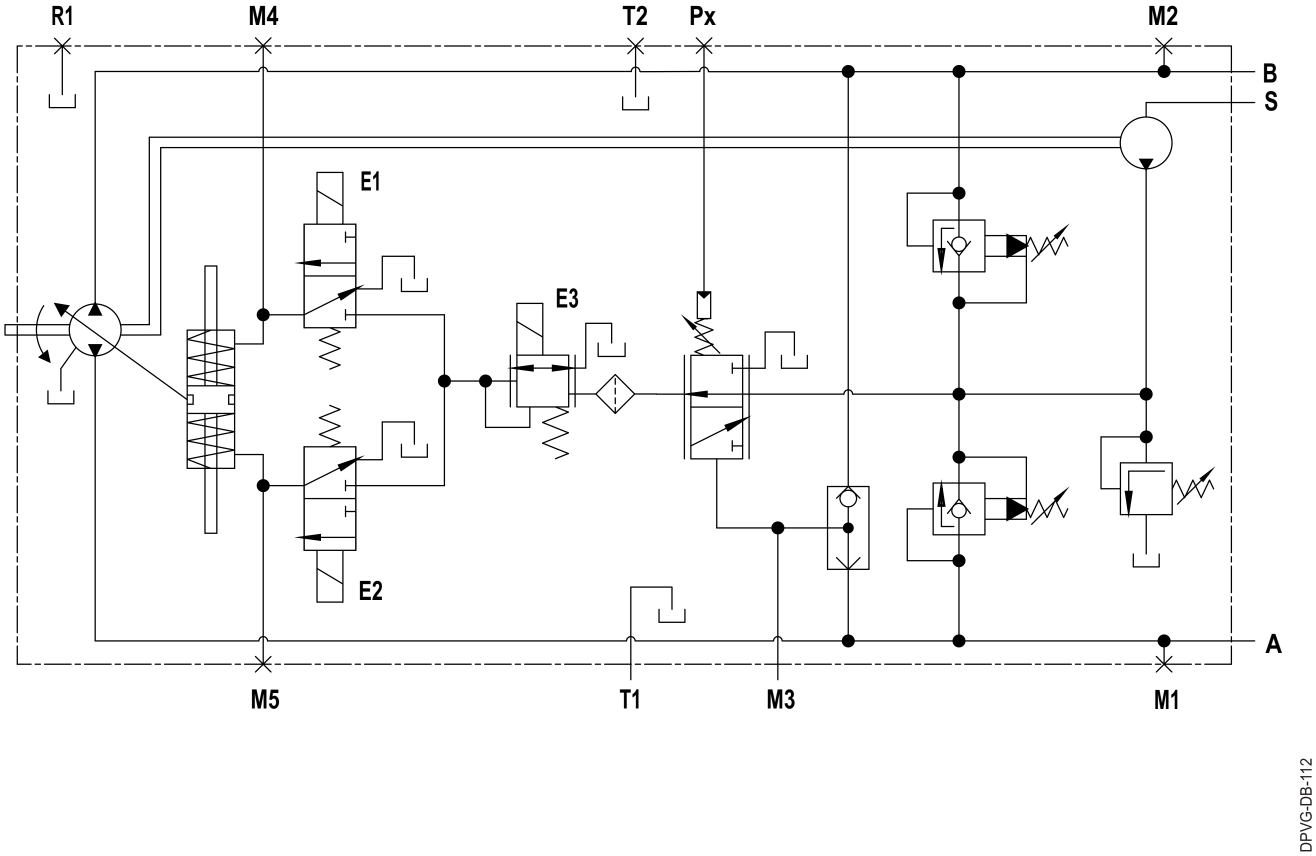



| A, B | Working connections SAE J 518 | T1, T2 | Tank connection ISO 9974-1 |
|---|---|---|---|
| R1 | Vent connection ISO 9974-1 | S | Suction port ISO 9974-1 |
| E1, E2 | Switching valve, Deutsch plug-in terminal DT04-2P, IG=0.58 A-100% ED UN=24V, R=25 Ohm | M1, M2, M3 | High pressure measuring connections ISO 9974-1 |
| E3 | Pressure control valve, Deutsch plug-in terminal DT04-2P, PWM = 100 Hz, UN=24V, Imax = 750 mA | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |

**Note**
Magnet E1 switched, direction of rotation: L = Oil outlet at connection A
Magnet E2 switched, direction of rotation: L = Oil outlet at connection B

# 3 Activation and control type

### 3.2.16 DS-DA1- control




| | | | |
|---|---|---|---|
| A, B | Working connections SAE J 518 | S | Suction port ISO 9974-1 |
| R1 | Vent connection ISO 9974-1 | M1, M2, M3 | High pressure measuring connections ISO 9974-1 |
| E1, E2 | Switching valve, Deutsch plug-in terminal DT04-2P, IG=0.58 A-100% ED UN=24V, R=25 Ohm | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| E3 | Pressure control valve, Deutsch plug-in terminal DT04-2P, PWM = 100 Hz, UN=24V, Imax = 750 mA | Px | DA1 override signal ISO 9974-1 |
| T1, T2 | Tank connection ISO 9974-1 | - | - |

**Note**
Magnet E1 switched, direction of rotation: L = Oil outlet at connection A
Magnet E2 switched, direction of rotation: L = Oil outlet at connection B

# 3 Activation and control type

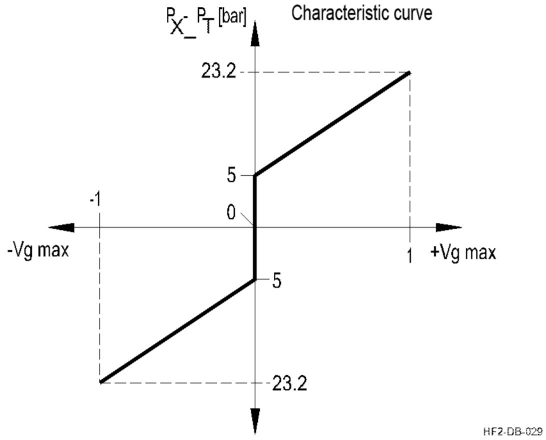
## 3.3 Control functions

- SD- function / steering-pressure proportional hydraulic regulation, see chapter 3.3.1
- DA- function / pressure cut-off, see chapter 3.3.2
- DA1- function / pressure cut-off with override, see chapter 3.3.3
- TCH- function / hydraulically activated torque control with pressure cut-off, see chapter 3.3.4
- DZH- function / hydraulically controlled speed regulation with mechanical stroke limitation and with pressure cut-off, see chapter 3.3.4
- EL- function / electro-proportional regulation, see chapter 3.3.6
- ELS- function / electro-proportional regulation with safety valve, see chapter 3.3.7
- TCE- function / electrically activated torque control with pressure cut-off, see chapter 3.3.8
- DS- function / direct control, see chapter 3.3.9

### 3.3.1 SD- function

SD- control is suitable for applications which require a proportionally controlled volume flow.

**Characteristic**




By adjusting the drive from $V_{g\ min}$ towards $V_{g\ max}$, the pump swivels to a larger displacement volume $V_g$ with increasing SD- steering pressure at X1 / X2.

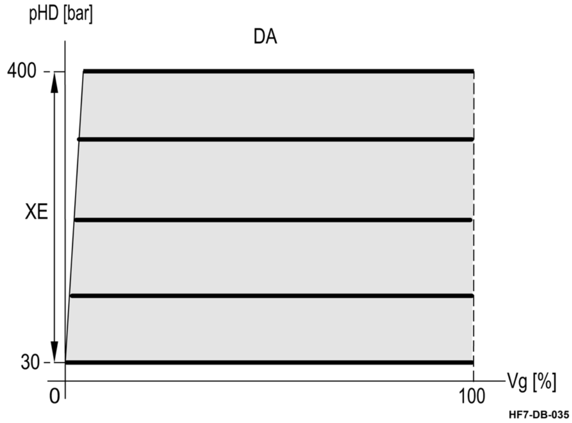
If X1 / X2 is activated, the spool moves in the control unit. By means of mechanical transmission via an adjusting lever, the deflection directly leads to the swivel yoke / pan-tilt, for pivoting the swivel yoke / pan-tilt against the spring force of the return springs, in $V_{g\ max}$ direction.

If the activating signal at X1 / X2 is weakening, missing or defective, the pump swivels towards $V_{g\ min}$.

# 3 Activation and control type

### 3.3.2 DA- function

**Characteristic**




The DA pressure control ensures that the minimization or limitation of the volume flow of the axial piston unit upon reaching a permanently set high pressure value pHD. Swivelling in the direction of $V_{g\ min}$ protects the hydraulic system from damage and overload.

Swivelling continues in direction $V_{g\ min}$ only until the volume flow of the axial piston unit exactly matches the consumer need at this pressure stage.

With its function, the pressure control ensures that the pressure is kept constant even when the volume flow in the system changes. This compensates all internal and external leakage oil losses.

XE setting range approx. 30 - 400 bar.

**Options**
- Additional internal design measures for vibration damping on request.
- Pressure cut-off with override function: see chapter 3.3.3

### 3.3.3 DA1- function

In the closed circuit, the override function DA1 corresponds to a two-stage pressure cut-off with two pressure stages.

- Pressure stage 1, e.g.: 250 bar, or
- Pressure stage 2, e.g.: 400 bar

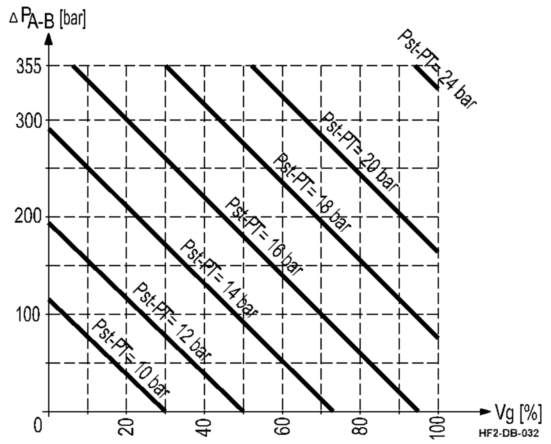
The DA1- function on the DA- axle in the pressure control has the task of overriding the set DA- cut-off pressure of pressure stage 1 (e.g. 250 bar) via an externally supplied steering pressure pY-pT at port Y and thereby increasing the high pressure to the set DA- cut-off pressure of pressure stage 2 (e.g. to 400 bar).

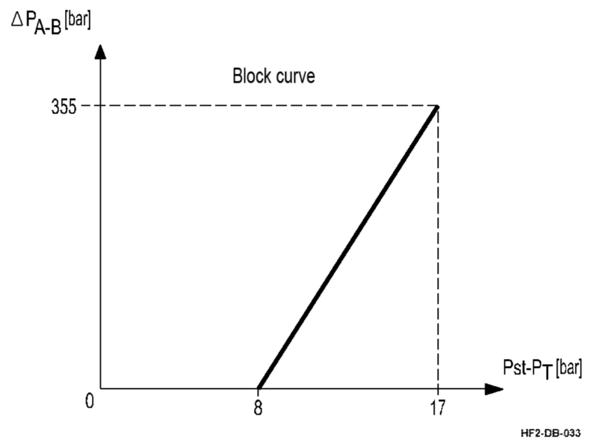
It is therefore suitable for systems or devices that need a controlled way to increase torque or are subject to a multiple use. Examples are working hydraulics in wheeled excavators and their driving hydraulic system.

### 3.3.4 TCH- function

In the TCH function, the displacement volume $V_g$ of the hydraulic pump can be set in several stages dependent on the steering pressure at X1 / X2- (pst-pT) and proportional to the high pressure pHD. In this manner, constant rotational speeds of the rotary ring are realized, while at the same time being able to limit the maximum power consumption.

**Characteristic**




With increasing steering pressure at X1 / X2, the hydraulic pump swivels in the direction $V_{g\ max}$ and at the same time with increasing pressure difference $\Delta P_{A-B}$ it swivels in the direction $V_{g\ min.}$ (See diagram)

The respective high pressure is fed back to the pilot control valve and counteracts the control signal.

When the drive is stationary, the pressure differential $\Delta P_{A-B}$ can be established in the system in proportion to the control signal at X1 / X2, e.g. to hold a superstructure when working on a slope. (See block curve)

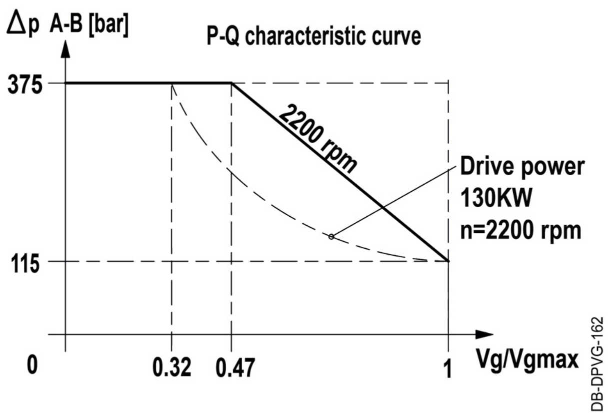
The TCH function is combined with the DA function (see chapter 3.3.2) and is particularly suitable for e.g. turn-table controls.

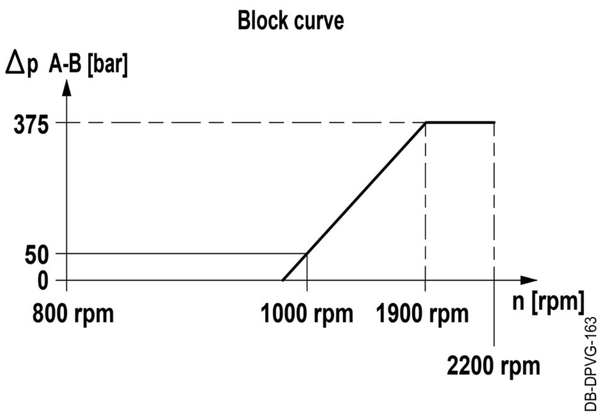
# 3 Activation and control type

### 3.3.5 DZH- function

Depending on the drive speed, the steering pressure is generated continuously in proportion to the speed.

**Characteristic**




The generated volume of the feed pump flows through a measuring orifice via the "FA" port.

A "delta p" pressure is generated at this measuring orifice, which is reported to the pressure booster. This booster translates this into a steering pressure which is proportional to the "delta p" at the measuring orifice and therefore also proportional to the speed.

When steering pressure is applied to the piston of the servo control, the pump swivels out proportionally. An increasing drive speed produces a larger swivel angle.

The operating pressure acts on the servo control via the pistons and causes the pump to swivel back. An increasing operating pressure produces a smaller swivel angle.

The applied operating pressure thereby counteracts the applied speed-dependent steering pressure. This provides the speed-dependent pressure control (block curve).

In combination with this, a constant-torque control is imposed via the depression of the diesel speed.

The start-up speed is reached when the steering pressure overcomes the preload force of the pressure spring via the piston.

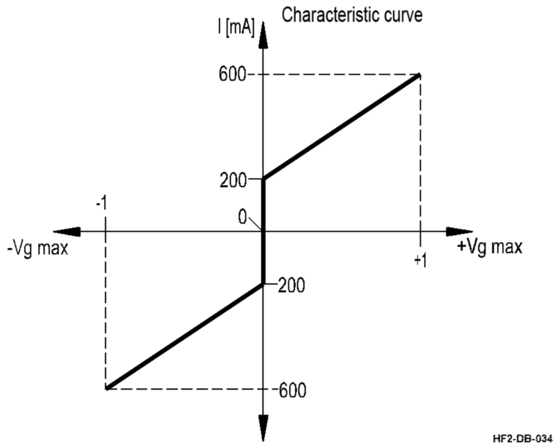
The direction of travel can be selected using the 3/2-way valves. These two valves simultaneously reduce the steering pressure at the piston proportionally depending on the steering pressure at port X1 or X2.

This results in the pump swivelling back when the speed is high (for inching function and deceleration on coasting).

# 3 Activation and control type

### 3.3.6 EL- function

**Characteristic**




For the EL function, the displacement volume $V_g$ of the axial piston unit is adjusted proportionally and continuously via an electromagnet.

The EL function is subordinate to the DA function, i.e. the control-current-dependent EL function is only executed below the set value for the pressure cut-off.

By adjusting the drive from $V_{g\ min}$ towards $V_{g\ max}$, the axial piston unit swivels to a larger displacement volume $V_g$ with increasing control current = I at the proportional magnet DRE.

If E1 / E2 is activated, the spool moves in the control unit. By means of mechanical transmission via an adjusting lever, the deflection directly leads to the swivel yoke / pan-tilt, for pivoting the swivel yoke / pan-tilt against the spring force of the return springs, in $V_{g\ max}$ direction.

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

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

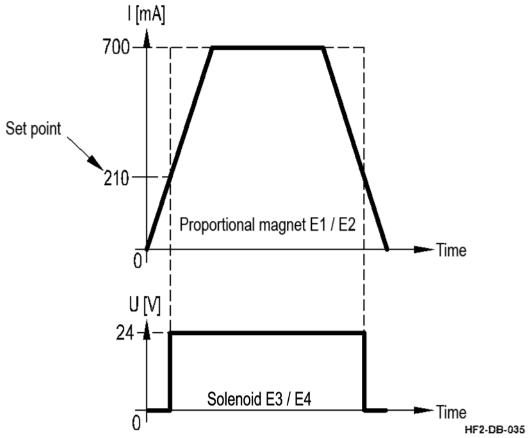
**Options**

- Safety function: see chapter 3.3.7

# 3 Activation and control type

### 3.3.7 ELS- function

**Characteristic**




If the current consumption at the proportional magnet DRE exceeds a defined value (for example, 210 mA), a solenoid E3 / E4 is additionally supplied with voltage and closes a channel against tank pressure pT in the respective shut-off valve. This process is repeated with each activation of the proportional magnet DRE.

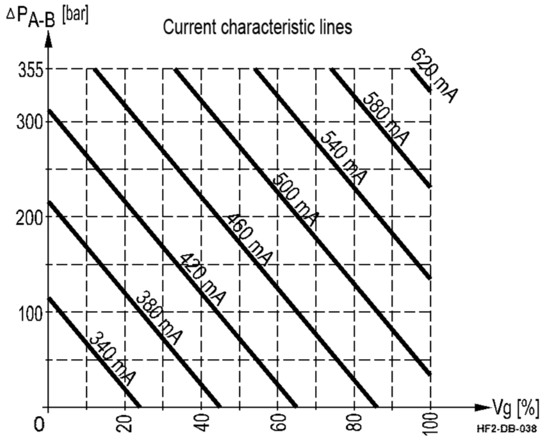
In case of a damage of the proportional magnet (for example, clamping caused by abrasion), the solenoid E3 / E4 is de-energized by switching off the control current I at E1 / E2 by the machine operator, and the channel to the tank pressure pT opens in the respective shut-off valve, and the steering pressure is relieved. The axial piston unit pivots in direction $V_{g\ min}$.

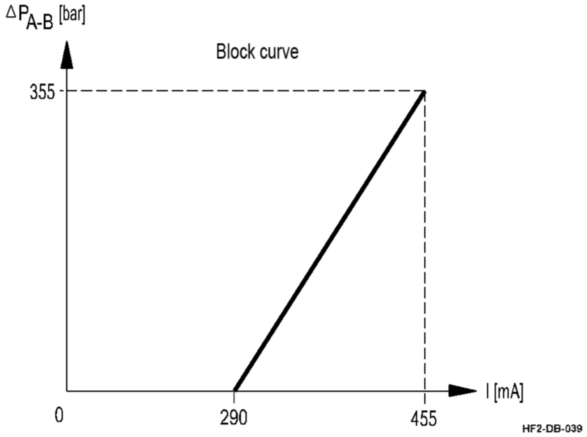
# 3 Activation and control type

### 3.3.8 TCE- function

In the TCE function, the displacement volume $V_g$ of the hydraulic pump can be set in several stages dependent on the control current = I [mA] and proportionally to the high pressure pHD. In this manner, constant rotational speeds of the rotary ring are realized, while at the same time being able to limit the maximum power consumption.

**Characteristic**




The hydraulic pump swivels with increasing control current = I [mA] at the DRE- proportional magnet E1 / E2 in the $V_{g\ max}$ direction and at the same time. it pivots with increasing pressure difference $\Delta P_{A-B}$ in the direction $V_{g\ min.}$ (See diagram)

The respective high pressure is fed back to the pilot control valve and counteracts the control signal.

When the drive is stationary, one can establish the pressure difference $\Delta P_{A-B}$ in the system in proportion to the control current = I [mA] at the DRE- proportional magnet E1 / E2, for holding the superstructure when working on a slope. (See block curve)

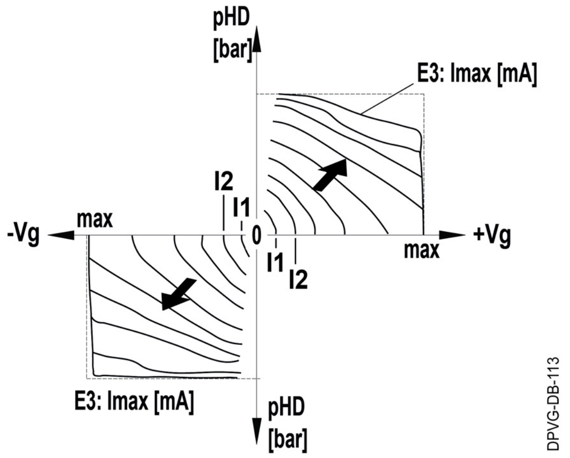
The TCE function is combined with the DA function (see chapter 3.3.2) and is particularly suitable e.g. for turntable controls.

# 3 Activation and control type

### 3.3.9 DS- function

In the DS function, the displacement volume $V_g$ of the hydraulic pump can be set continuously in each flow direction. The displacement volume $V_g$ of the hydraulic pump is influenced by the current at the proportional magnet E3, the system pressure, and the pump drive speed.

**Characteristic**




Depending on the activation at E1 or E2, the hydraulic fluid outlet is at working connection A or B.

**Note**
Magnet E1 switched, direction of rotation: L = Oil outlet at connection A
Magnet E2 switched, direction of rotation: L = Oil outlet at connection B

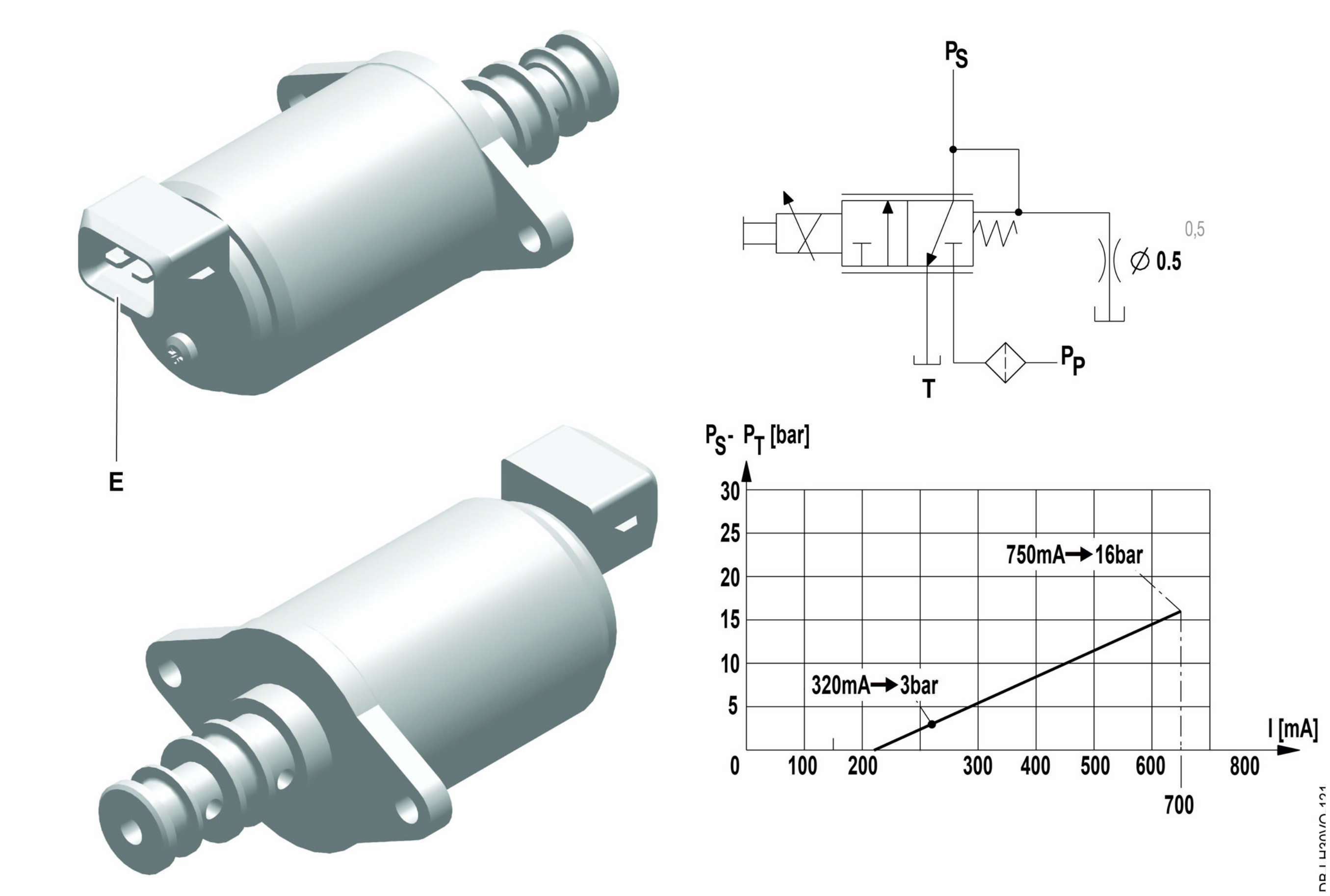
As the current at E3 increases, the hydraulic pump flow rate increases as well.
As the system pressure increases, the hydraulic pump flow rate decreases.
As the pump drive speed increases, the hydraulic pump flow rate increases.

The DS function is combined with the DA function (see chapter 3.3.2) and is particularly suitable for e.g. travel drives.

# 3 Activation and control type

## 3.4 Electrical components

### 3.4.1 Pressure control valve (DRE) variant 1



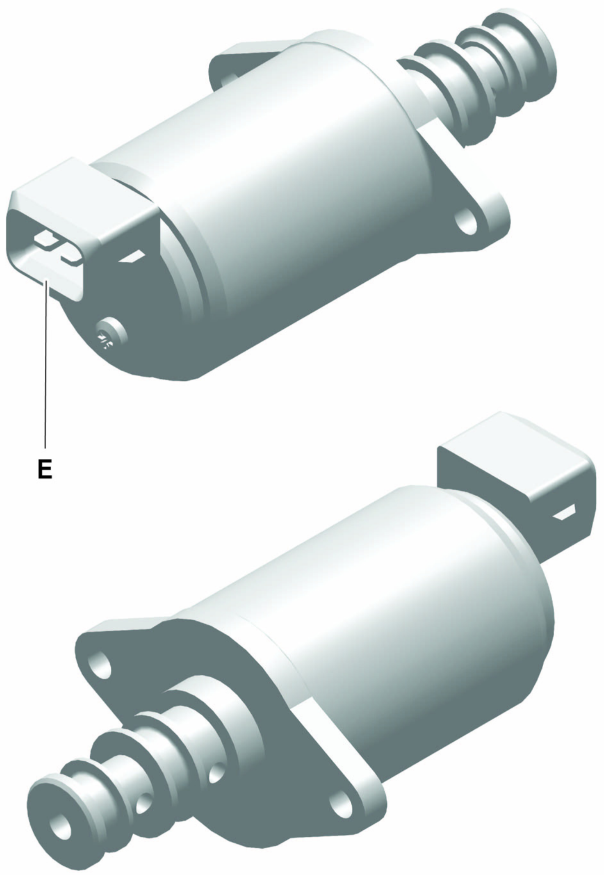

| | | | |
|---|---|---|---|
| T | Tank | PS | Output DRE |
| PP | Input DRE | E | Connection AMP Junior Timer |

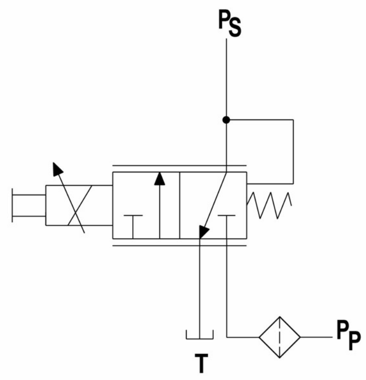
**General information**

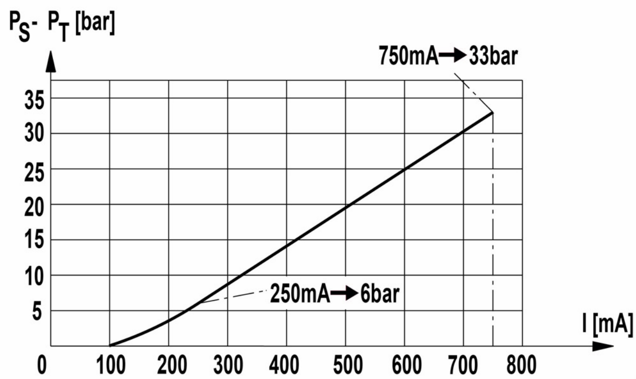
| Technical data of pressure control valve | |
|---|---|
| Rated voltage U | 24 V |
| Current $I_{max.}$ | 750 mA |
| Supply pressure $p_{max.}$ | 50 bar |
| Magnet characteristic curve: flat around the regulating position | - |
| AMP JUNIOR TIMER plug-in terminal, 2-pin | - |

# 3 Activation and control type

### 3.4.2 Pressure control valve (DRE) variant 2



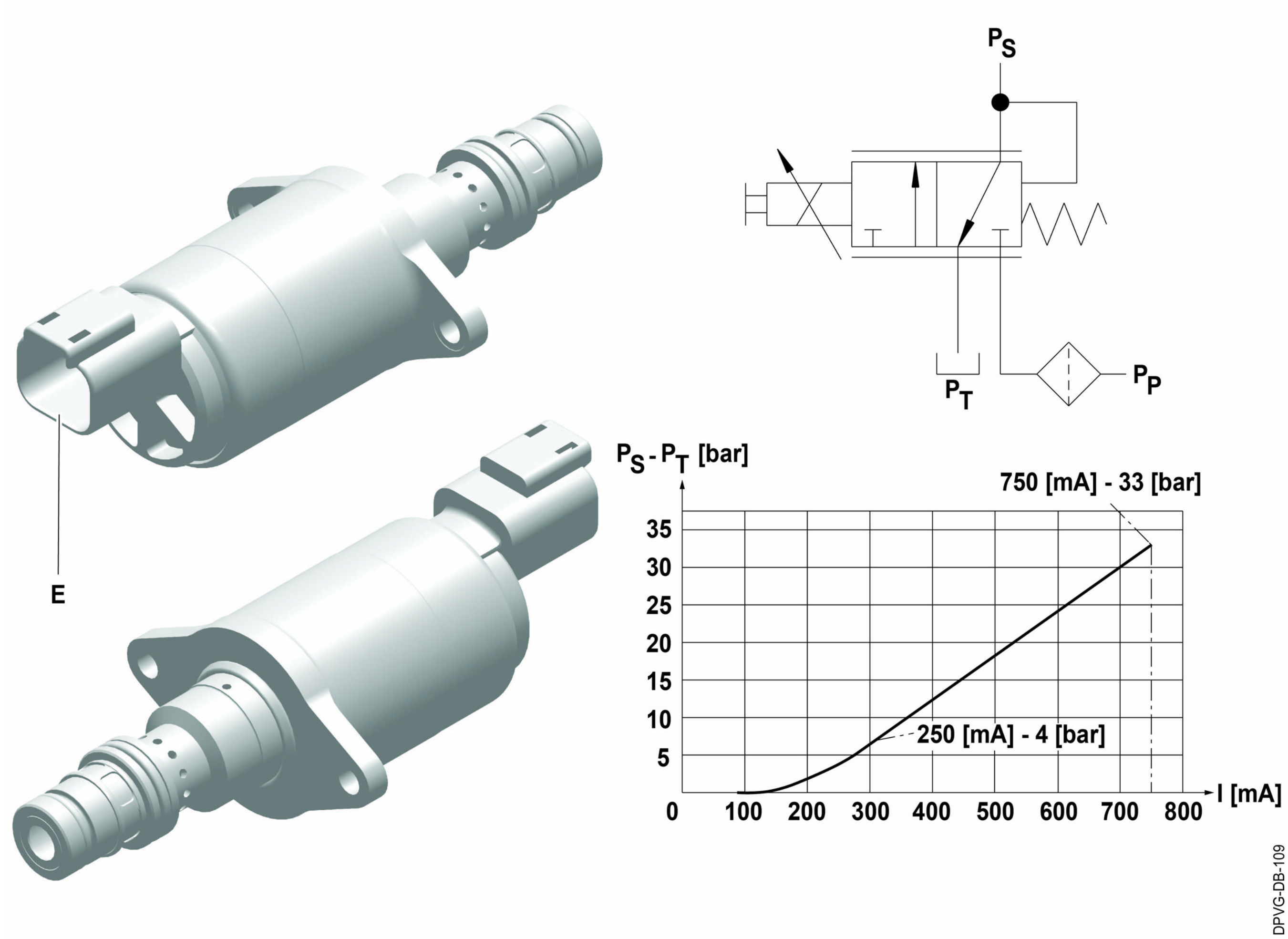

| | | | |
|---|---|---|---|
| T | Tank | PS | Output DRE |
| PP | Input DRE | E | Connection AMP Junior Timer |

**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 Pressure control valve (DRE) variant 3



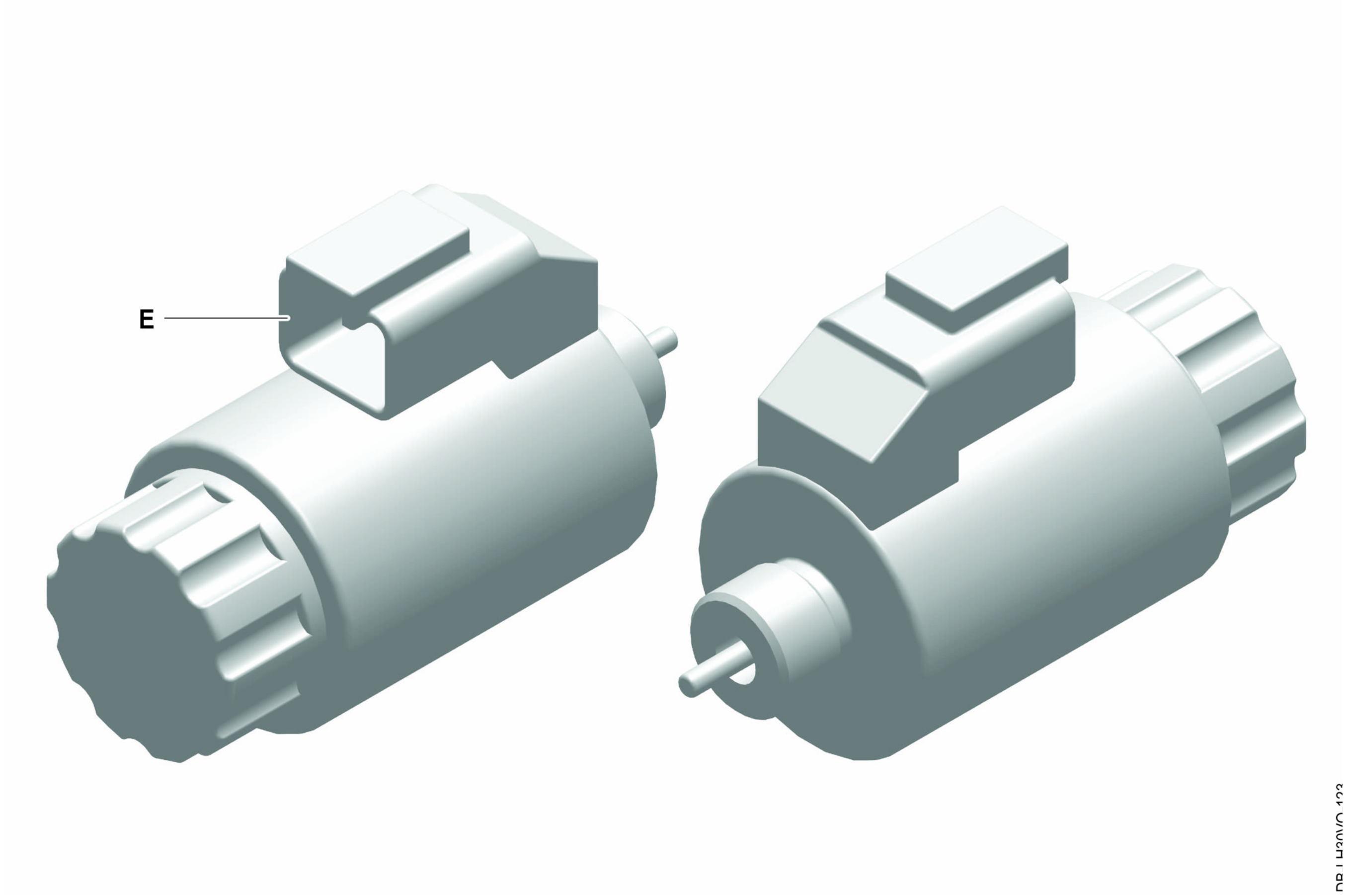

| | | | |
|---|---|---|---|
| E | Deutsch plug-in terminal DT04-2P | PS | Output DRE |
| PT | Tank | PP | Input DRE |

**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 | - |
| Deutsch plug-in terminal DT04-2P | - |

# 3 Activation and control type

### 3.4.4 Solenoid (safety function)




| | | | |
|---|---|---|---|
| E | Deutsch plug-in terminal DT04-2P | - | - |

**General information**

| Technical data - solenoid | |
|---|---|
| Rated voltage U | 24 V |
| Current $I_{max.}$ | 585 mA |
| Resistor | 25 Ω |
| Deutsch plug-in terminal DT04-2P | - |

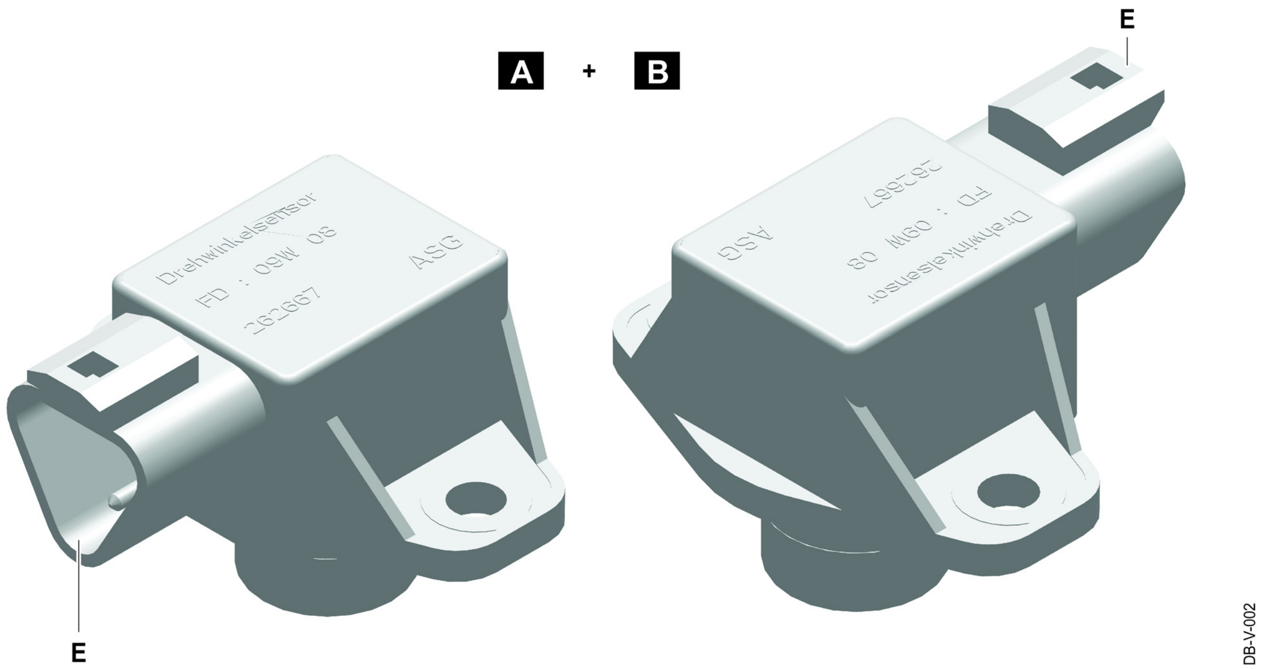
# 3 Activation and control type

### 3.4.5 Sensors

| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

**Rotation angle sensor**

| | |
|---|---|
| **0** | without sensor |
| **W** | with 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<br>-27°<br>0°<br>+27° | 0.5 VDC<br>2.5 VDC<br>4.5 VDC | Output signal<br>-27°<br>0°<br>+27° | 4 mA<br>12 mA<br>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 DPVG. Dimensions for variants 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, along with its installation position, must be coordinated with Liebherr at the conceptual design stage of the axial piston unit and must be approved by Liebherr.

**ATTENTION**
Lack of lubrication on the hydraulic product!
Damage of 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)

### 4.1.1 Suction line

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

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

# 4 Installation conditions

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

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

#### 4.1.2 Leakage oil lines

To prevent draining of the axial piston unit during long downtimes, the leakage oil line must be routed in a bend so that it runs at the minimum dimension 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.

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

At low temperatures with high viscosities, it is essential to observe the maximum housing pressure for axial piston units with multiple driving gears and with a shared leakage oil line. (for additional information see: 2.3 Permitted pressure range) If the maximum housing pressure is outside the tolerance limit, a separate leakage oil line must be connected for each driving gear.

#### 4.1.3 Hydraulic fluid tank

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

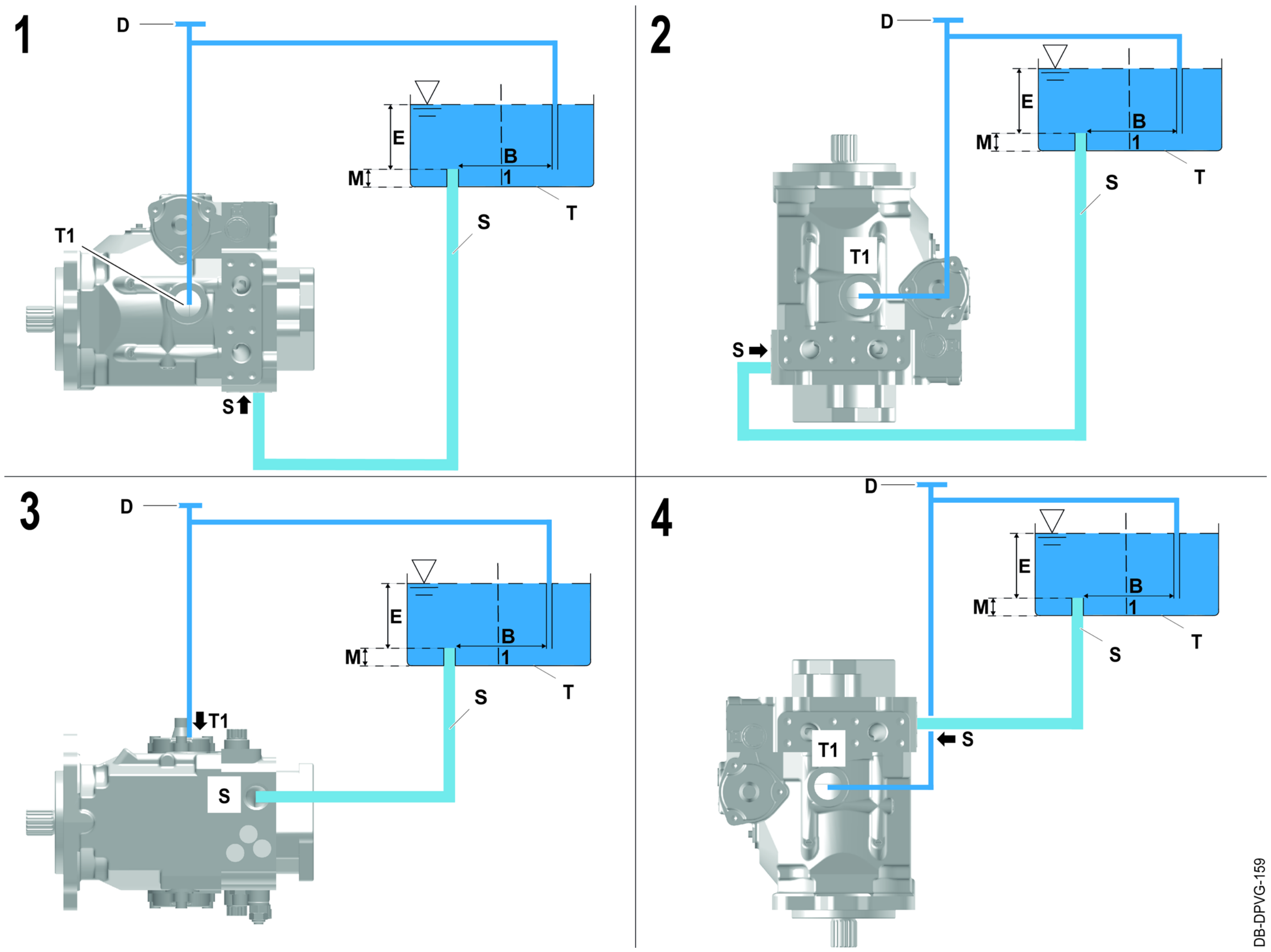
Make sure that the lines are connected according to recommendations and that they open into the hydraulic fluid tank. (for additional information see: 4.1.1 Suction line and for additional information see: 4.1.2 Leakage oil lines)

# 4 Installation conditions

## 4.2 Installation variants

### 4.2.1 Under-the-tank installation variant

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

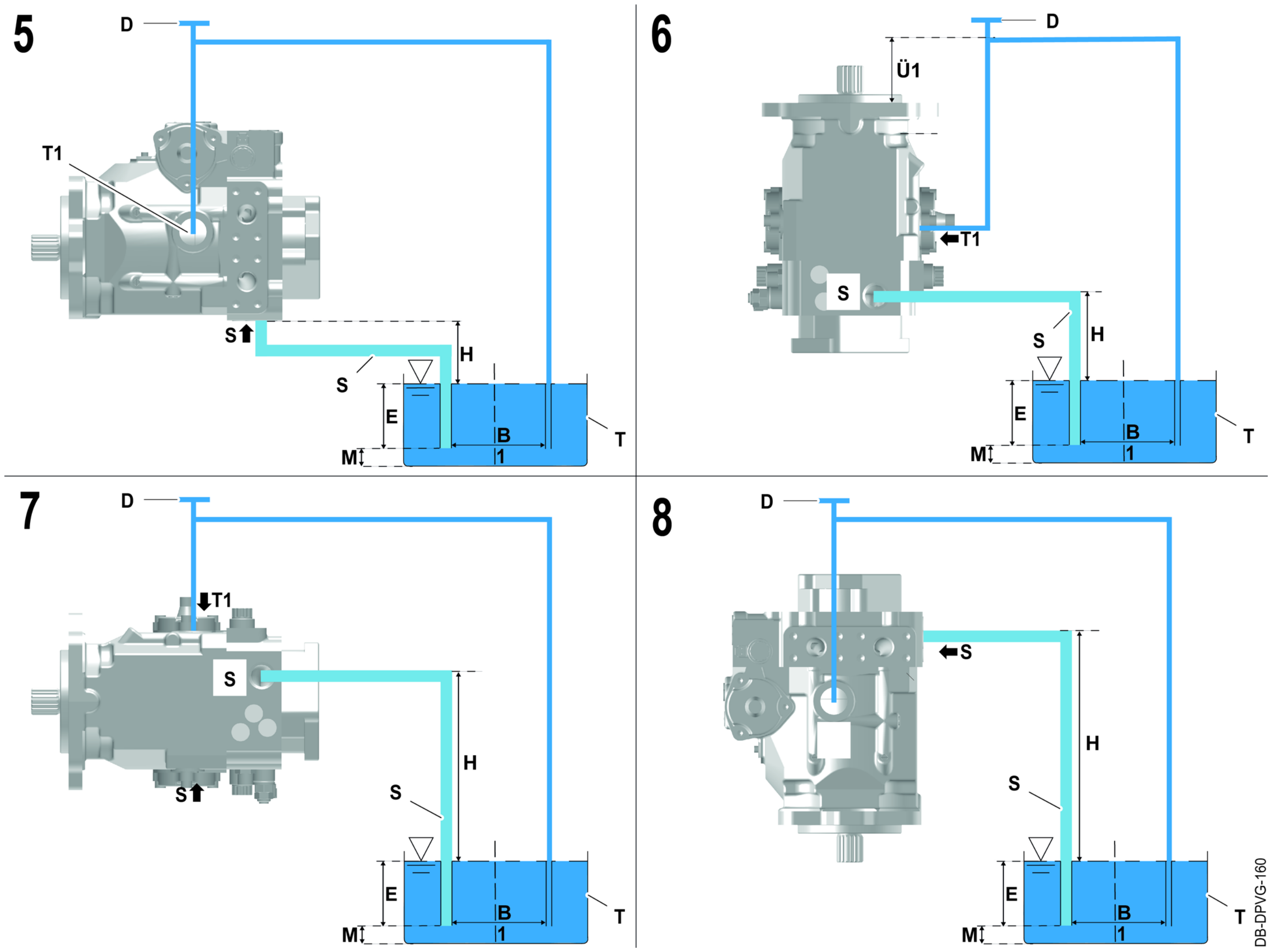



| | | | |
|---|---|---|---|
| 1 | Baffle (to calm the hydraulic fluid in the tank) | M | Minimum line end distance from tank bottom = 115 mm |
| B | Distance between suction port and leakage oil connection in the tank (the larger the better) | S | Suction line connection |
| D | Fill and vent connection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

#### 4.2.2 Over-the-tank installation variant

**ATTENTION**
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)!
Damage of the hydraulic product.
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 |
| B | Distance between suction port and leakage oil connection in the tank (the larger the better) | S | Suction line connection |

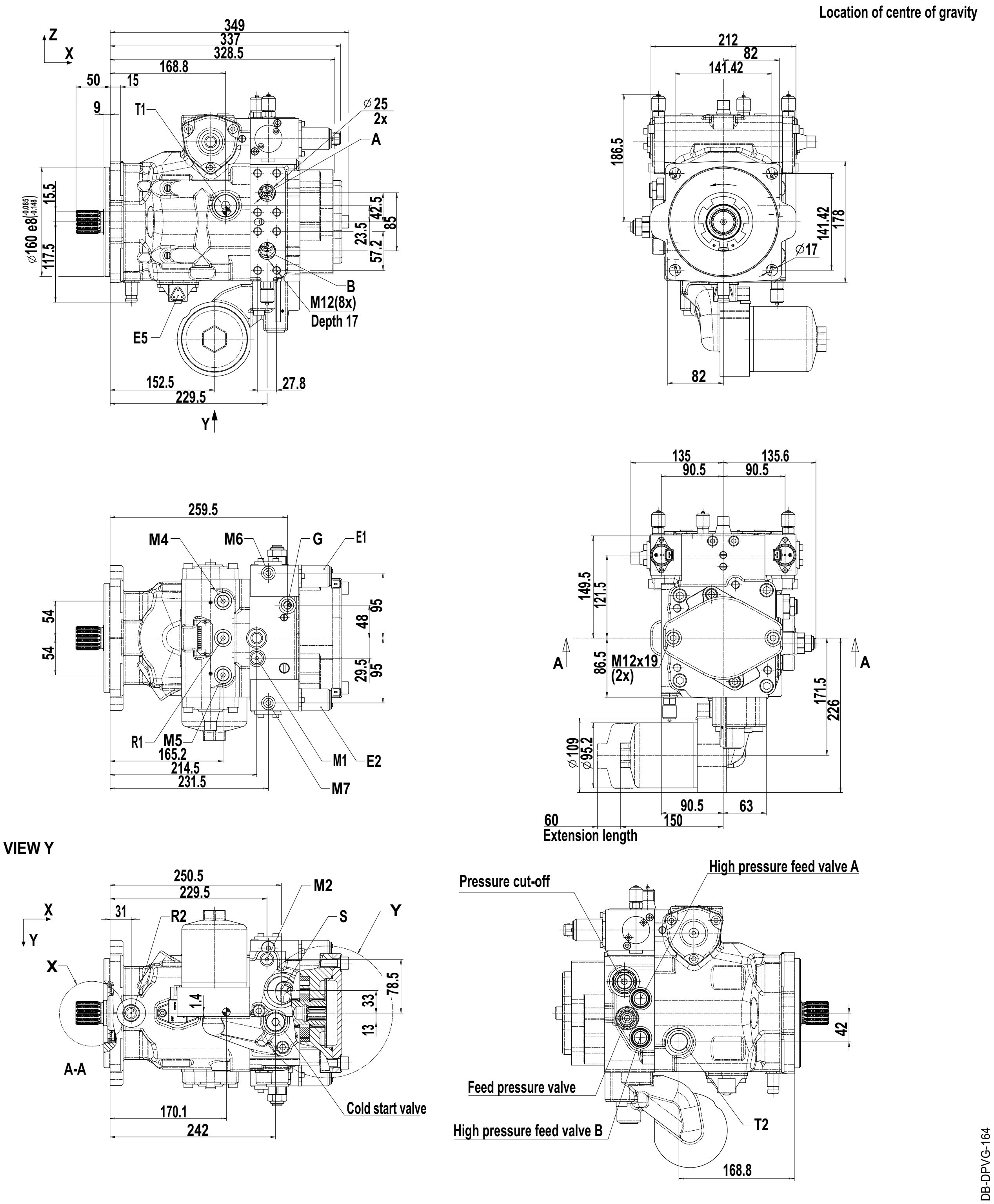
# 4 Installation conditions

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

# 5 Dimensions

## 5.1 NS 085

### 5.1.1 Nominal size 085, EL-DA control type




| A / B | Working connection<br>SAE J 518 - 1", 6000 psi |
|---|---|
| R1 | Ventilation ISO 9974-1 M12x1.5 |

| T1, T2 | Leakage oil connection M26x1.5 |
|---|---|
| - | - |

# 5 Dimensions

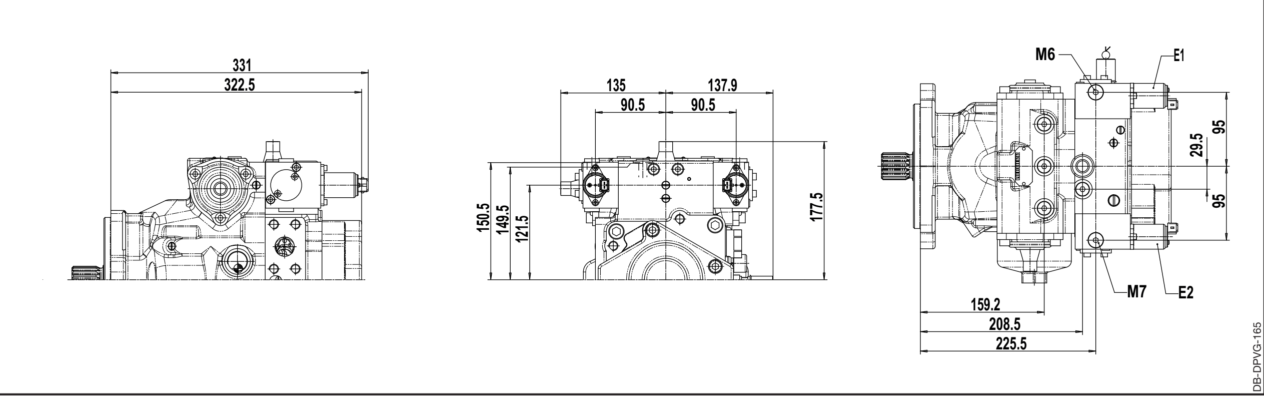
| | | 
|---|---|
| G | Adjusting pressure supply ISO 9974-1, M12x1.5 min 30 bar - max 40 bar |
| M1 / M2 | High-pressure measuring connection Minimess 1620 Form F M12x1.5-M16x2 |
| M4 / M5 | Adjusting pressure measuring connection ISO 9974-1 M12x1.5 |
| M6 / M7 | Steering pressure measuring connection Minimess 1620 Form F M14x1.5-M16x2 |

| | |
|---|---|
| S | Feed pump suction port ISO 9974-1 M42x2 |
| R2 | Ventilation Minimess 1620 Form F M12x1.5-M16x2 |
| E1 / E2 | Pressure control valve, plug: AMP Junior Timer 2-pin, PWM= 100 Hz, U= 24 V, Imax.= 750 mA |
| E5 | Angle sensor; plug: Deutsch 3-pin DT-04-3P power supply U= 24 V, |

### 5.1.2 Nominal size 085, other control types

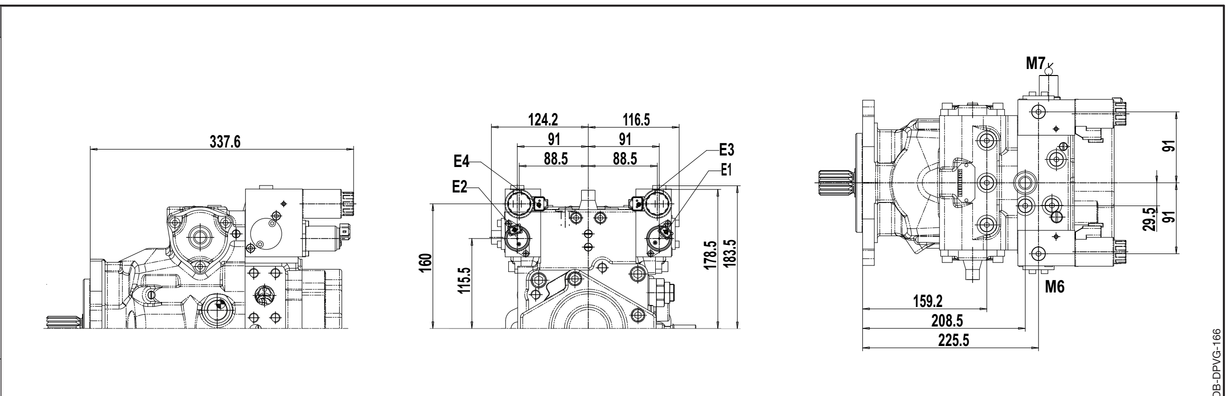
**EL**

- E1/ E2: Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz
- M6/ M7: Steering pressure measuring connection ISO 9974-1 M12x1.5



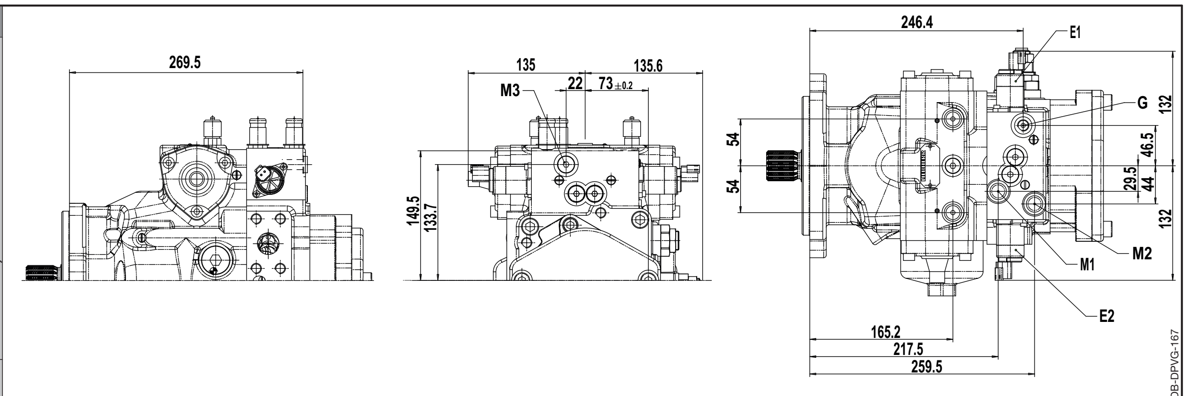

**ELS-DA**

- E1/ E2: Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz
- E3/ E4: Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω
- M6/ M7: Steering pressure measuring connection ISO 9974-1 M12x1.5




**DS1-DA**

- E1/ E2: PCV, plug: Deutsch DT04-2P Un = 24 V Imax= 750 mA PWM 100Hz
- G: Adjusting pressure supply ISO 9974-1 M12x1.5, min 30 bar - max 40 bar
- M1/ M2: High-pressure measuring connection, Minimess 1260 Form F G1/4-M16x2
- M3: Balanced high-pressure measuring connection, ISO 1179-1 G1/4-N

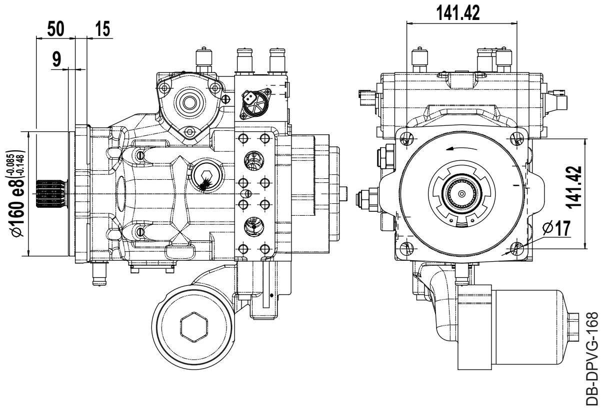


# 5 Dimensions

## 5.2 Nominal size 085, mounting flange

| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

ISO 3019-2

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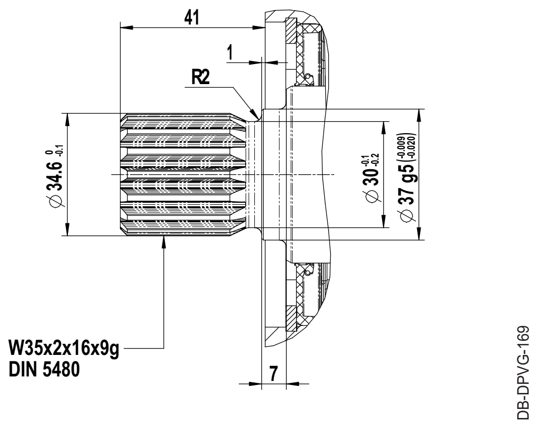
## 5.3 Nominal size 085, shaft end

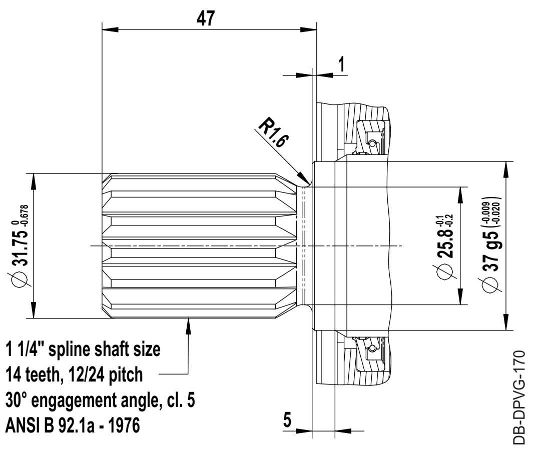
| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

W35x2x16x9g splined shaft DIN 5480




1

ANSI B92.1a splined shaft 1 1/4 in 14T 12/24 pitch

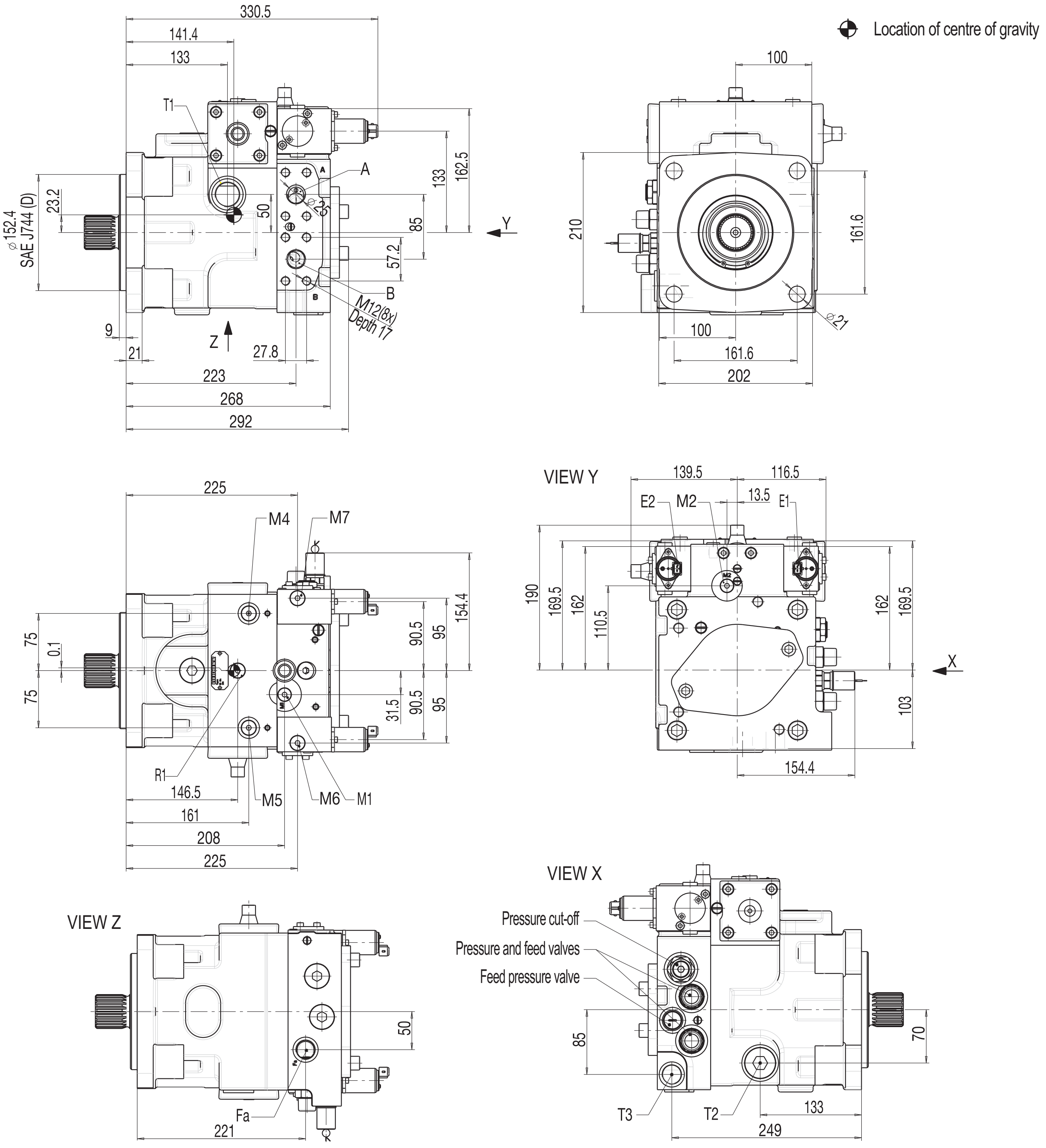



2

# 5 Dimensions

## 5.4 NS 108

### 5.4.1 Nominal size 108, EL-DA control type

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| A / B | Working connection<br>SAE J 518 - 1", 6000 psi |
|---|---|
| R1 | Ventilation M14x1.5 |

| T1, T2 | Leakage oil connection M33x2 |
|---|---|
| Fa | Feed pressure connection M26x1.5 |

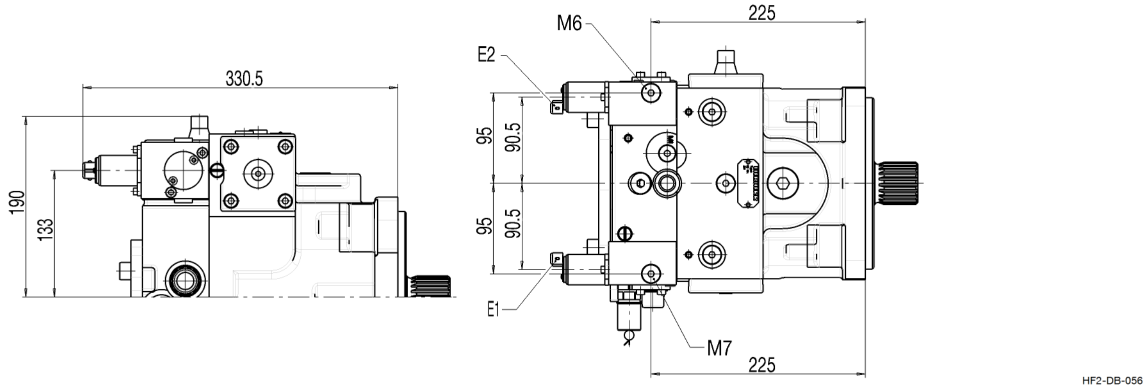
# 5 Dimensions

| | |
|---|---|
| M1 / M2 | High pressure measuring connection M12x1.5 |
| M4 / M5 | Adjusting pressure measuring connection M14x1.5 |
| T3 | Return for feed pressure valve |

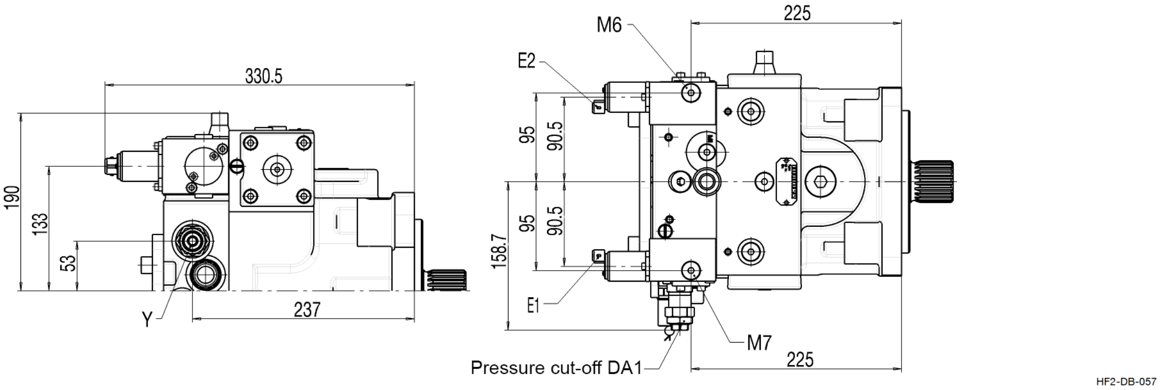
| | |
|---|---|
| M6 / M7 | Steering pressure measuring connection M14x1.5 |
| E1 / E2 | Pressure control valve, plug: AMP Junior Timer 2-pin, PWM= 100 Hz, U= 24 V, Imax.= 750 mA |
| - | - |

### 5.4.2 Nominal size 108, other control types

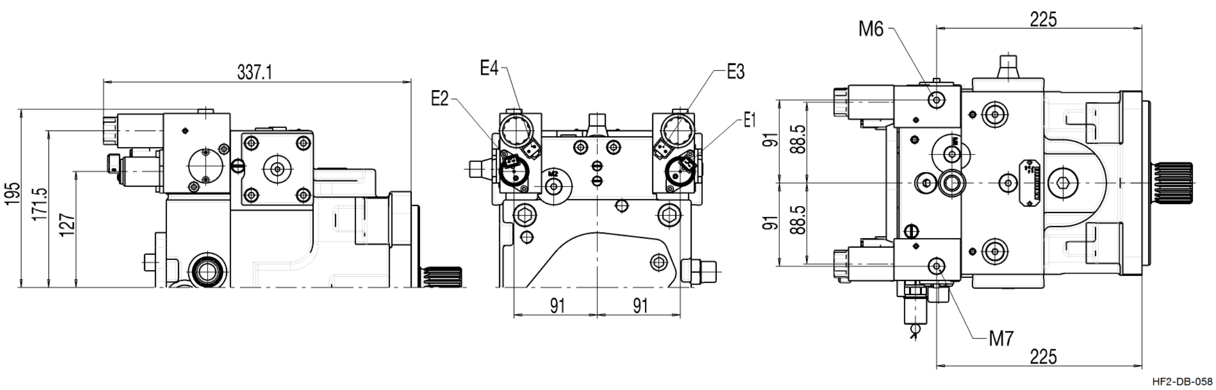
| EL | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |




| EL-DA1 | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |
| Y | DA override ISO 9974-1 -M12x1.5 |

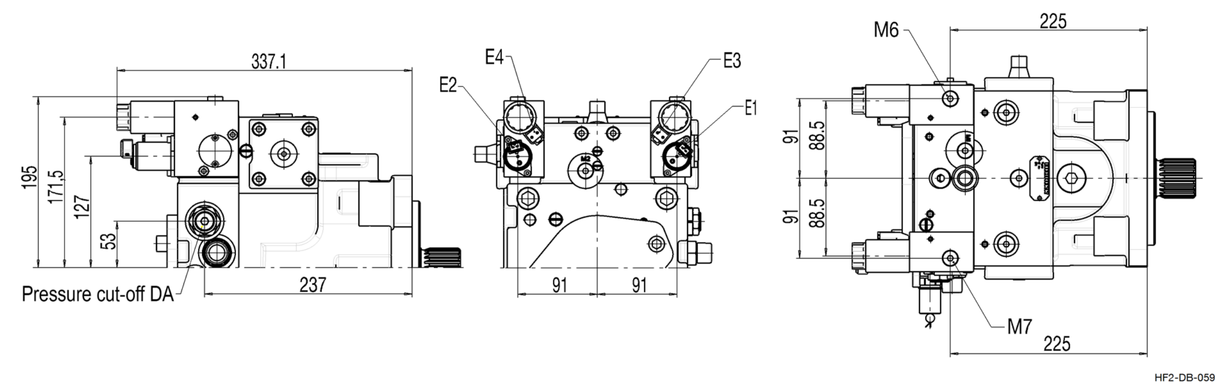



| ELS | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |

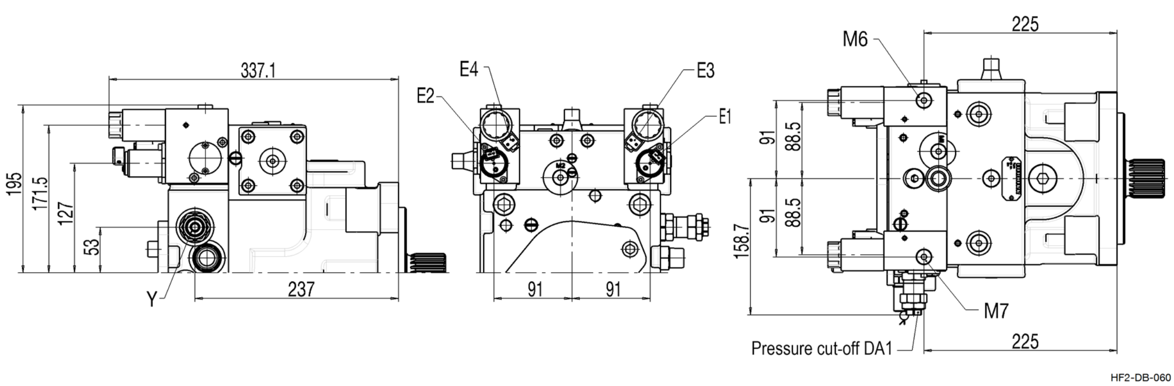


# 5 Dimensions

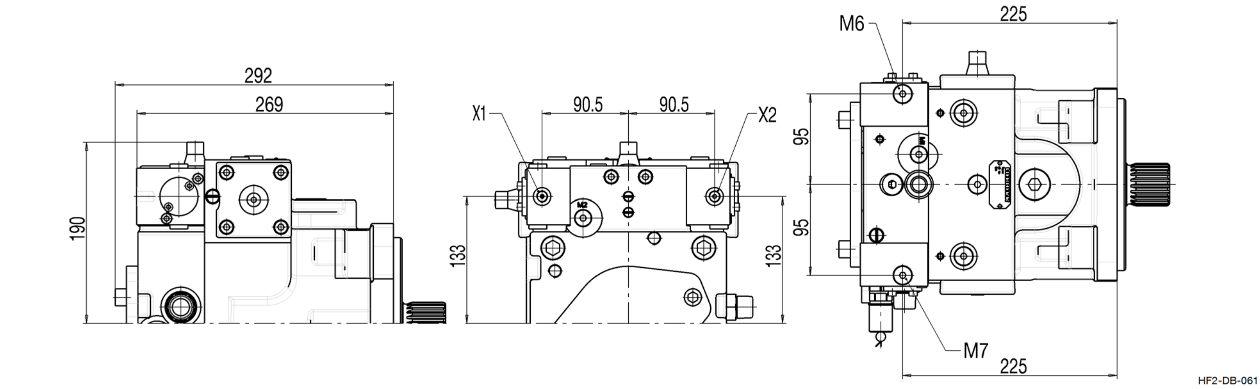
| ELS-DA | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |




| ELS-DA1 | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |
| Y | DA override ISO 9974-1-M12x1.5 |




| SD | |
|---|---|
| X1/ X2 | Steering pressure connection ISO 9974-1 M12x1.5 |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |

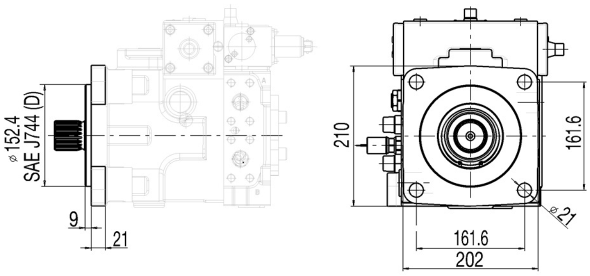


# 5 Dimensions

## 5.5 Nominal size 108, mounting flange

| DPV | G | | / | 000 | | 1 | | | | A | O | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

**SAE D (SAE J744)**

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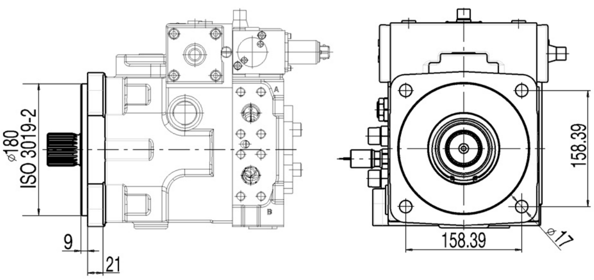
**ISO 3019-2**

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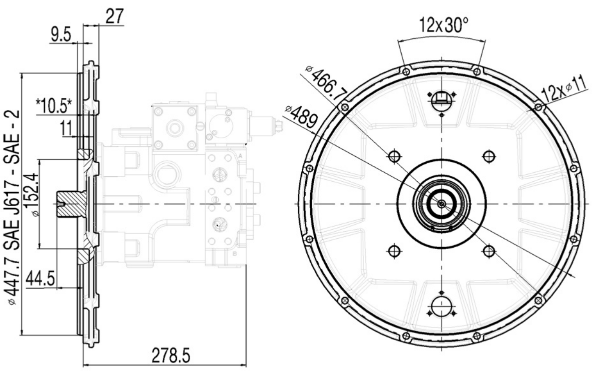
**Diesel engine flange SAE 2 (SAE J617)**

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12

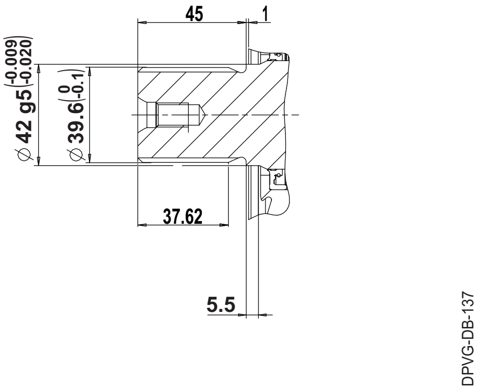
10.5*) Shift from mounting flange

# 5 Dimensions

## 5.6 Nominal size 108, shaft end

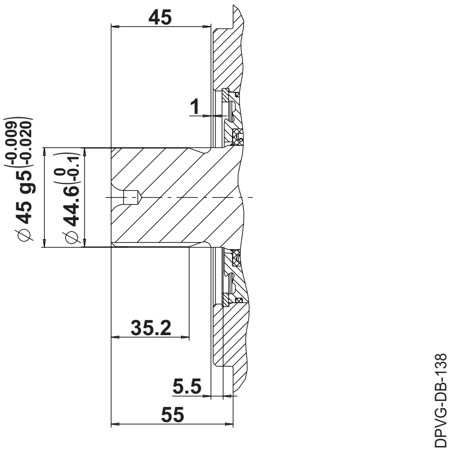
| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

W40x2x18x9g splined shaft DIN 5480



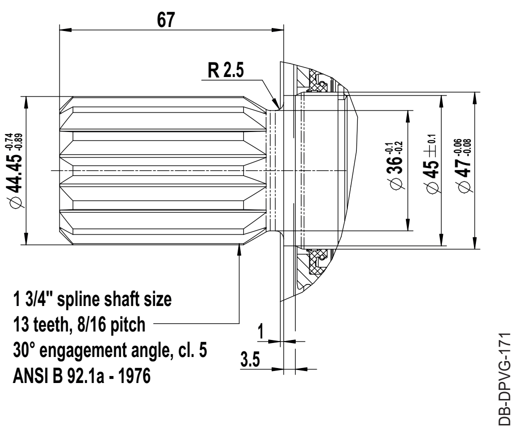

1

W45x2x21x9g splined shaft DIN 5480




1

ANSI B92.1a splined shaft 1 3/4 in 13T 8/16 pitch

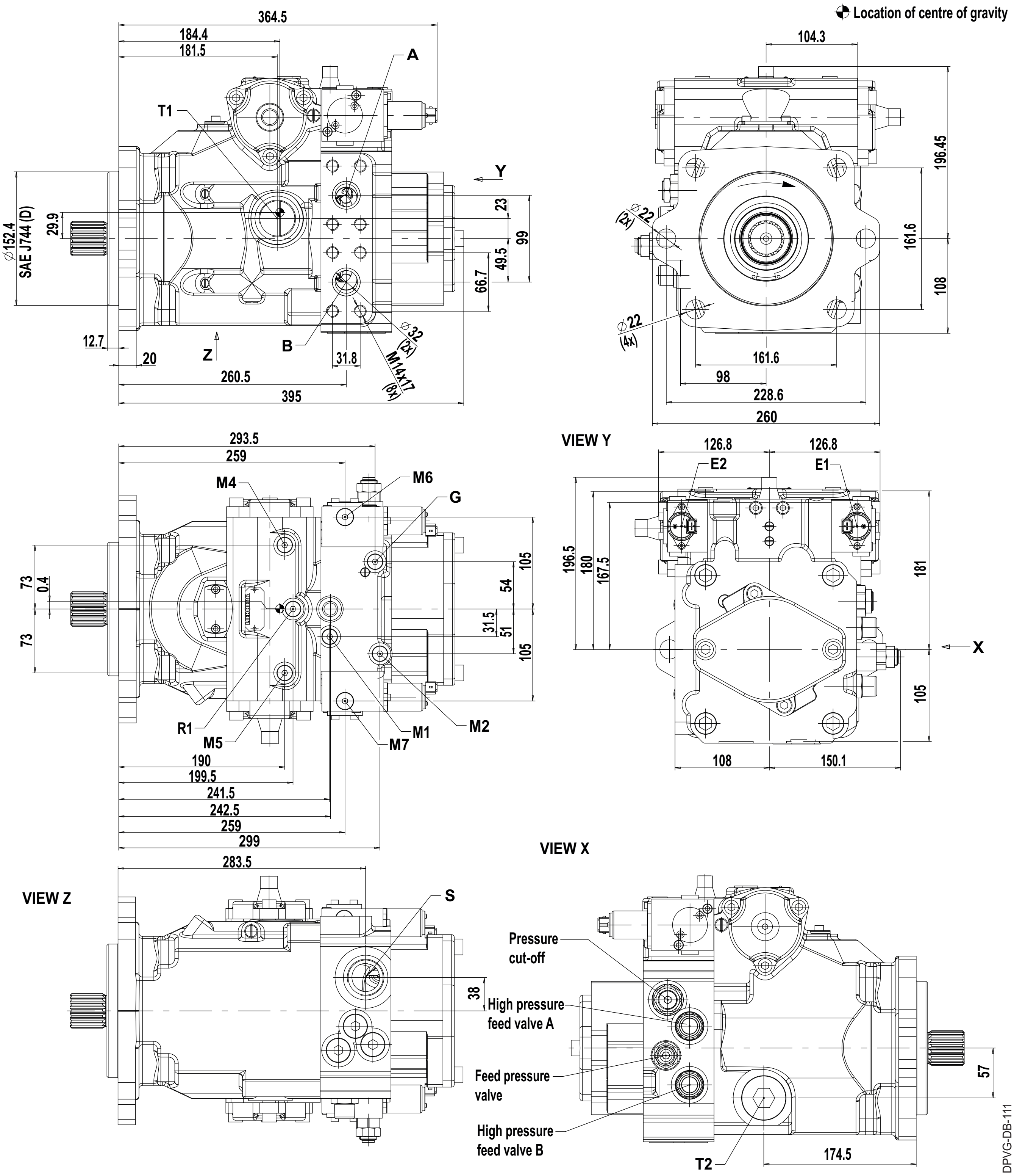



2

# 5 Dimensions

## 5.7 NS 140

### 5.7.1 Nominal size 140, EL-DA control type




| | |
|---|---|
| A, B | Working connections SAE J 518 |
| R1 | Vent connection ISO 9974-1 |

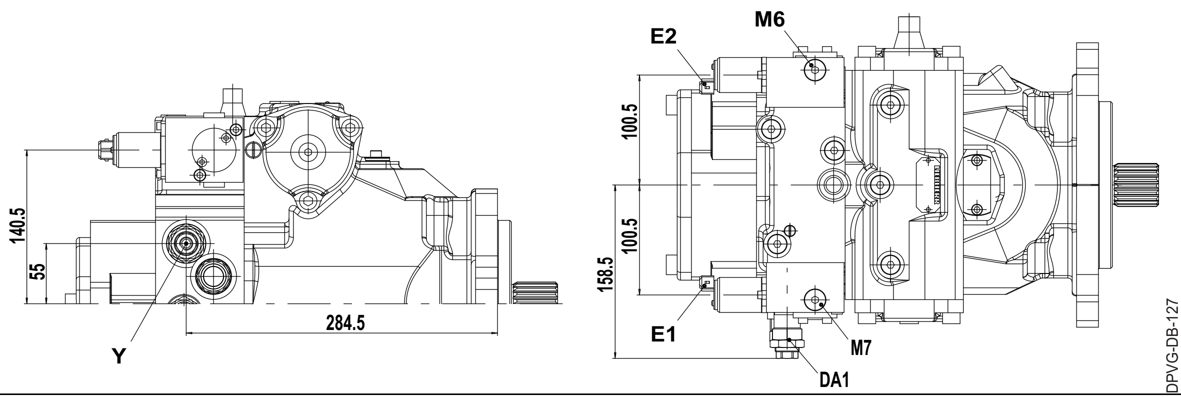
| | |
|---|---|
| T1, T2 | Leakage oil connection ISO 9974-1 |
| M1, M2 | High pressure measuring connections ISO 9974-1 |

# 5 Dimensions

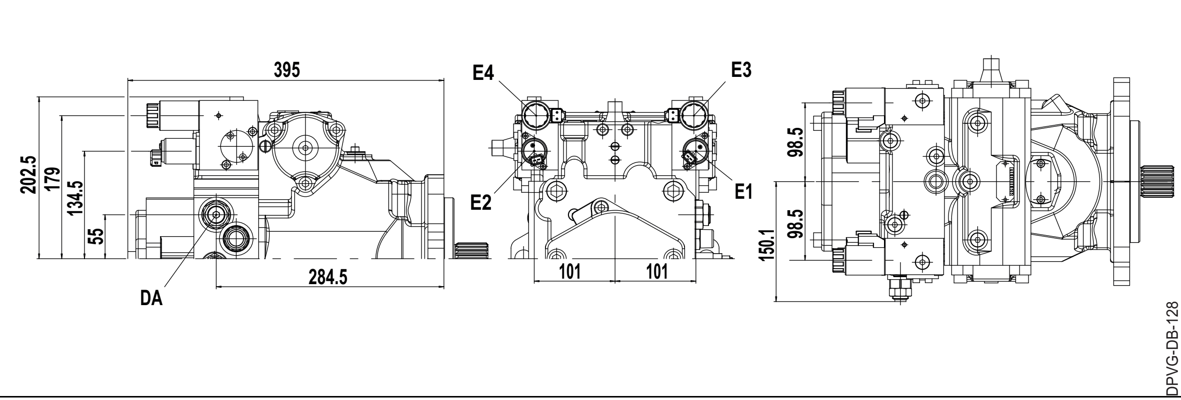
| | | | | |
|---|---|---|---|---|
| G | Pressure connection for auxiliary circuits ISO 9974-1 | | M4, M5 | Adjusting pressure measuring connections ISO 9974-1 |
| E1, E2 | Pressure control valve, AMP Junior Timer plug-in terminal, 2-pin, PWM= 100 Hz, Un= 24V, Imax.= 750 mA | | M6, M7 | Steering pressure measuring connections ISO 9974-1 |
| S | Gear pump suction port ISO 9974-1 | | - | - |

### 5.7.2 Nominal size 140, other control types

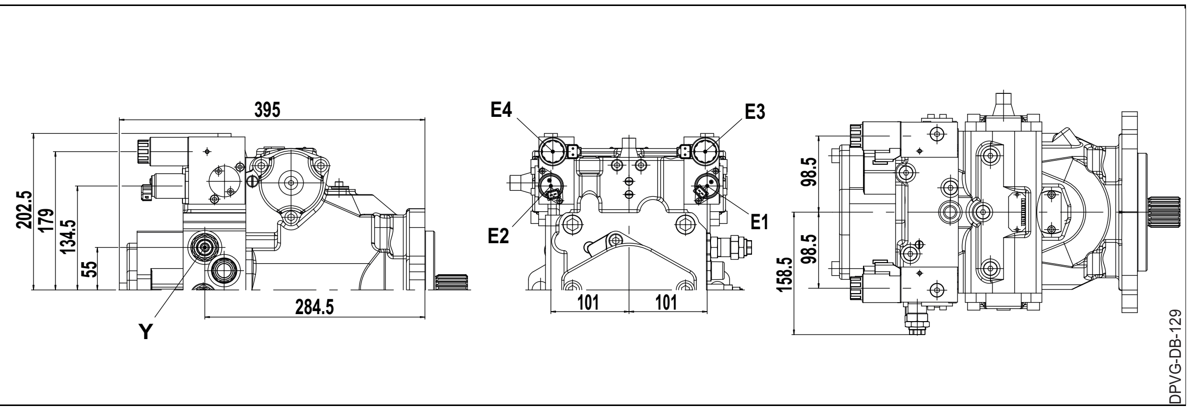
| EL-DA1 | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| M6/ M7 | Steering pressure measuring connection |
| Y | DA override ISO 9974-1-M12x1.5 |
| - | - |




| ELS / ELS-DA | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2 connector |
| M6/ M7 | Steering pressure measuring connection |
| - | - |

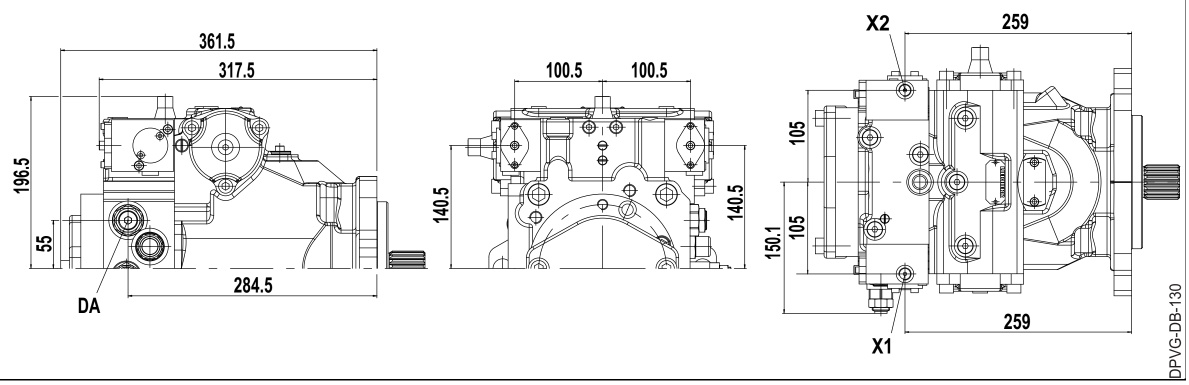



| ELS-DA1 | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2 connector |
| M6/ M7 | Steering pressure measuring connection |
| Y | DA override ISO 9974-1-M12x1.5 |

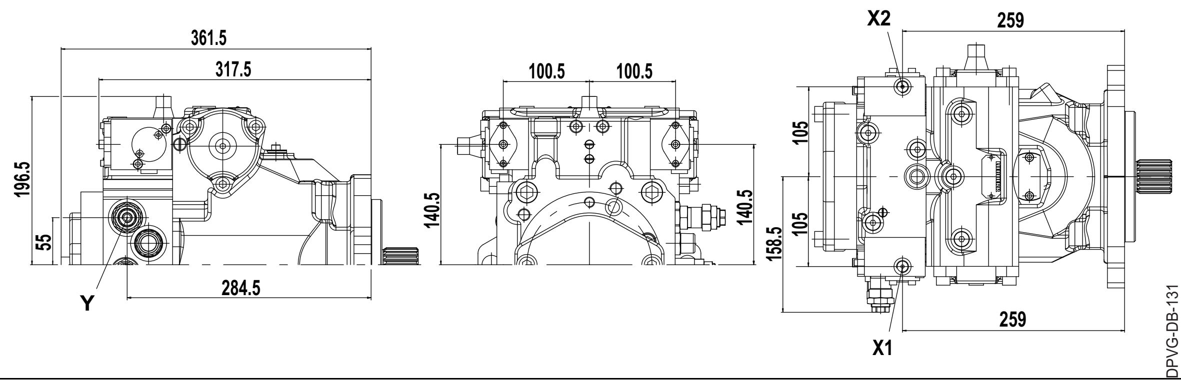


# 5 Dimensions

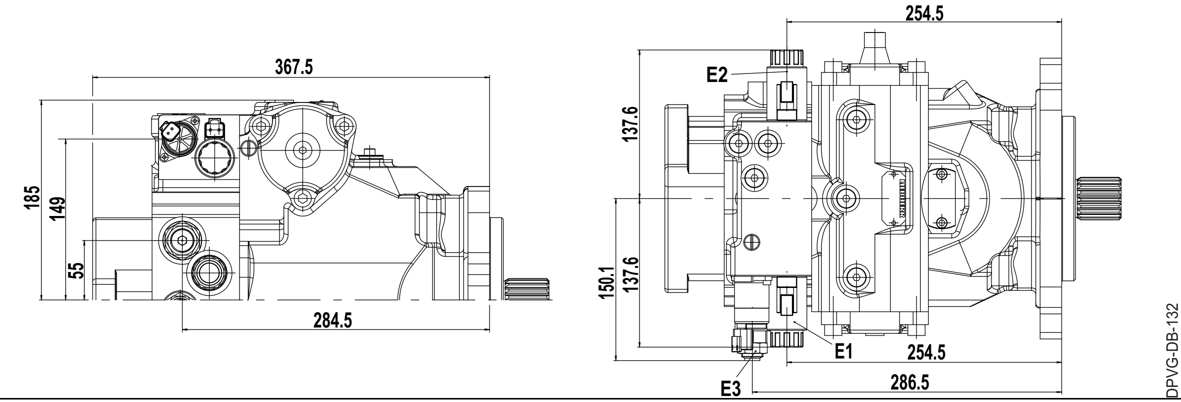
| SD / SD-DA | | | |
|---|---|---|---|
| Steering pressure connection ISO 9974-1-M12x1.5 | - | - | - |
| X1/ X2 | - | - | - |



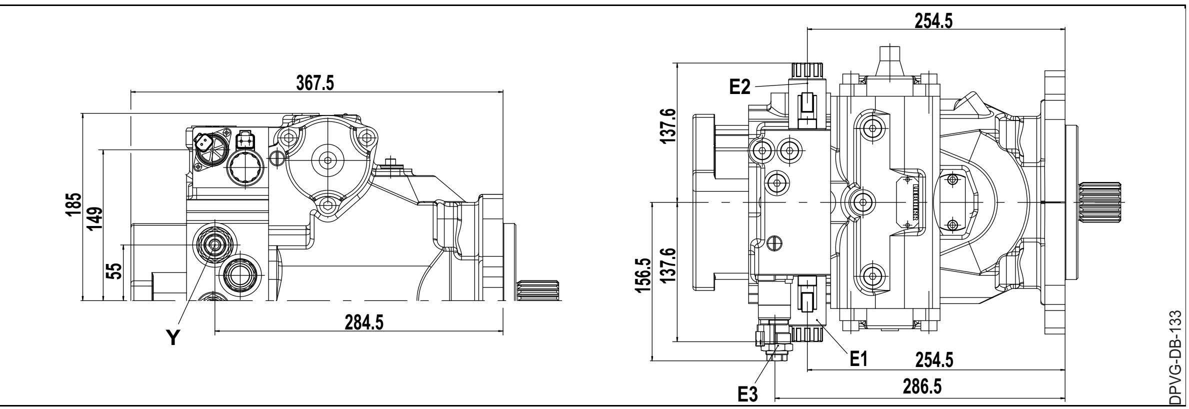

| SD-DA1 | | | |
|---|---|---|---|
| Steering pressure connection ISO 9974-1-M12x1.5 | DA override ISO 9974-1-M12x1.5 | - | - |
| X1/ X2 | Y | - | - |




| DS-DA | | | |
|---|---|---|---|
| Switching valve Deutsch DT04-2 connector | Pressure control valve, plug: AMP Junior - Timer 2-pin Un = 24 V, Imax= 750 mA | - | - |
| E1/ E2 | E3 | - | - |




| DS-DA1 | | | |
|---|---|---|---|
| Switching valve Deutsch DT04-2 connector | Pressure control valve, plug: AMP Junior - Timer 2-pin Un = 24 V, Imax= 750 mA | DA override ISO 9974-1-M12x1.5 | - |
| E1/ E2 | E3 | Y | - |

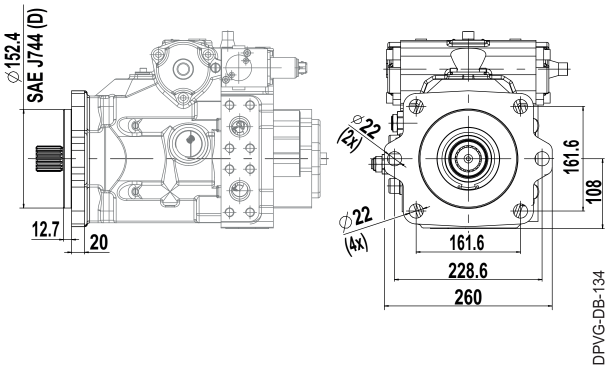


# 5 Dimensions

## 5.8 Nominal size 140, mounting flange

| DPV | G | | / | 000 | | 1 | | | | A | O | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

SAE D (SAE J744)

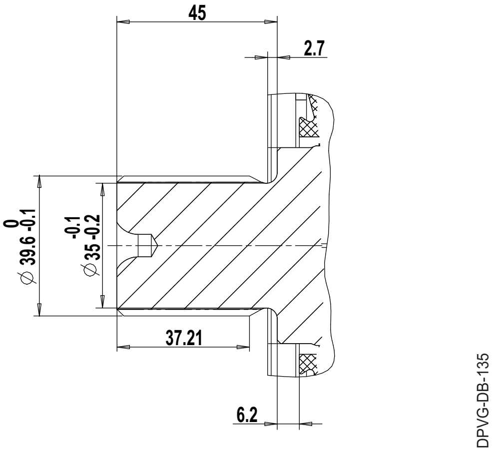



24

## 5.9 Nominal size 140, shaft end

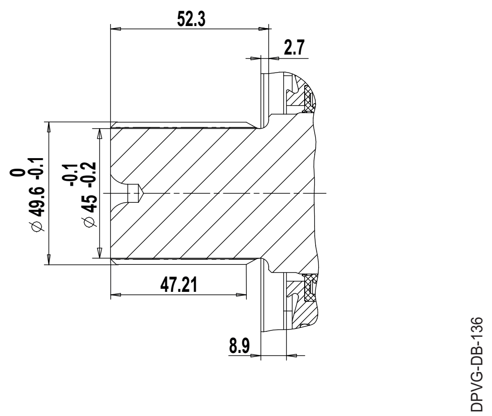
| DPV | G | | / | 000 | | 1 | | | | A | O | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

W40x2x18x9g splined shaft DIN 5480




1

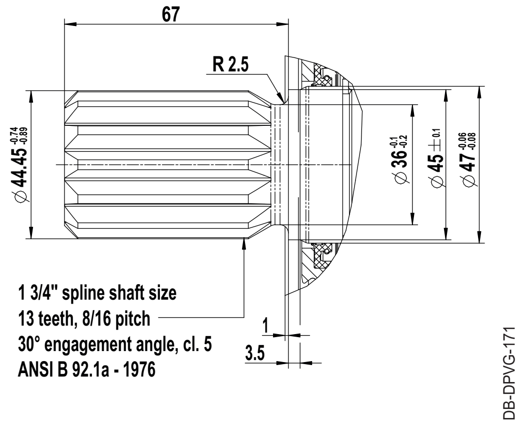
W50x2x24x9g splined shaft DIN 5480




1

# 5 Dimensions

**ANSI B92.1a splined shaft 1 3/4 in 13T 8/16 pitch**

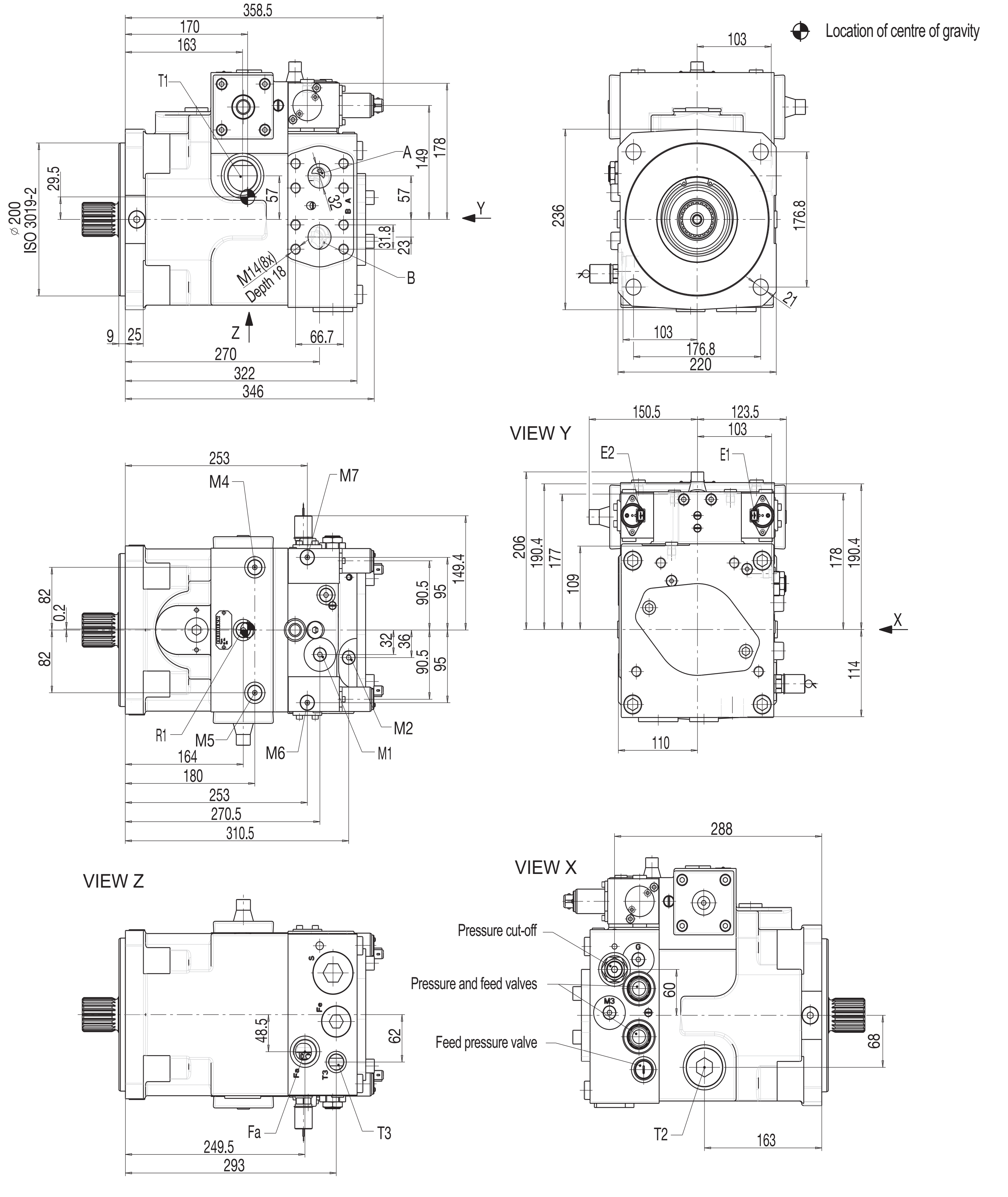



2

# 5 Dimensions

## 5.10 NS 165

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




HF2-DB-069

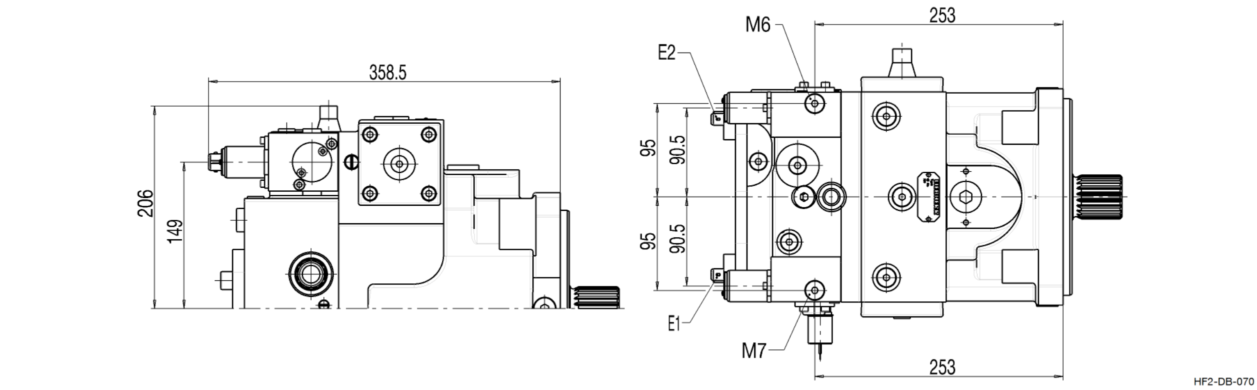
# 5 Dimensions

| | | | | |
|---|---|---|---|---|
| A / B | Working connection<br>SAE J 518 - 11/4", 6000 psi | | T1, T2 | Leakage oil connection M42x2 |
| R1 | Ventilation M14x1.5 | | Fa | Feed pressure connection M33x2 |
| M1 / M2 | High pressure measuring connection M12x1.5 | | M6 / M7 | Steering pressure measuring connection M14x1.5 |
| M4 / M5 | Adjusting pressure measuring connection M14x1.5 | | E1 / E2 | Pressure control valve, plug: AMP Junior Timer 2-pin, PWM= 100 Hz, U= 24 V, Imax.= 750 mA |
| T3 | Return for feed pressure valve M22x1.5 | | - | - |

### 5.10.2 Nominal size 165, other control types

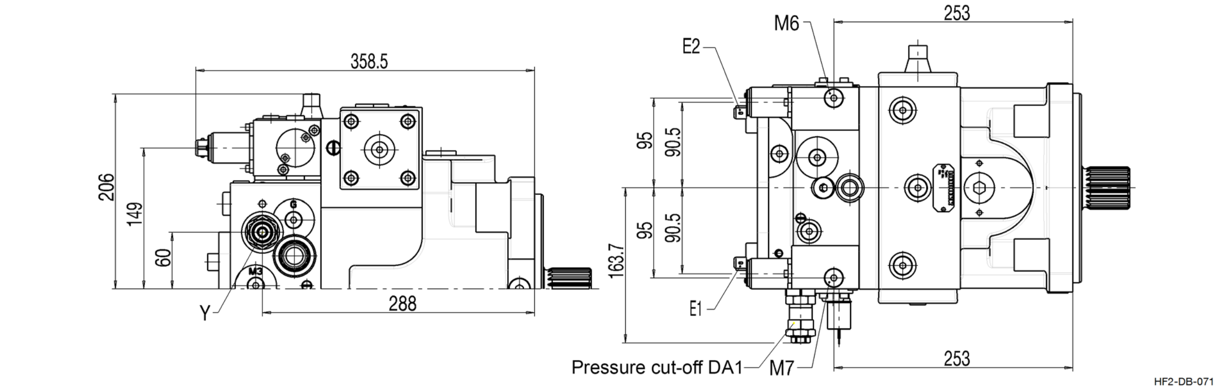
**EL**

| | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |



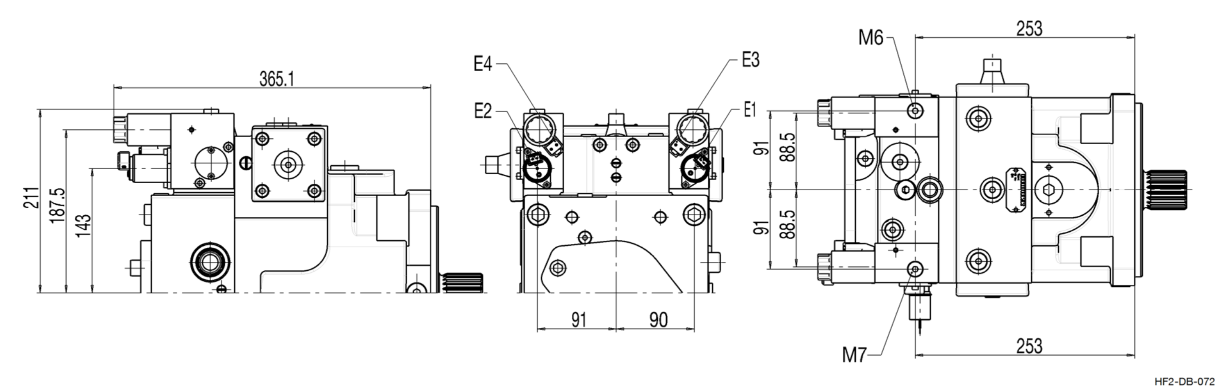

**EL-DA1**

| | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |
| Y | DA override ISO 9974-1 -M12x1.5 |




**ELS**

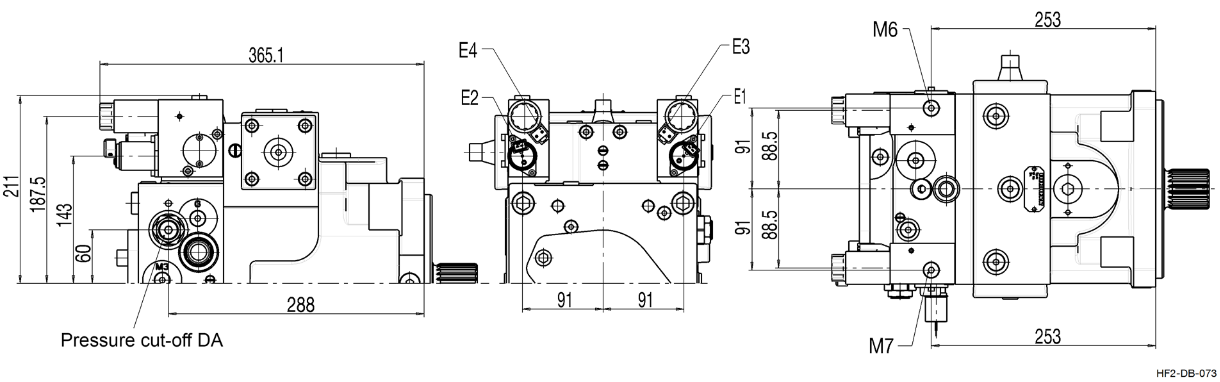
| | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |



# 5 Dimensions

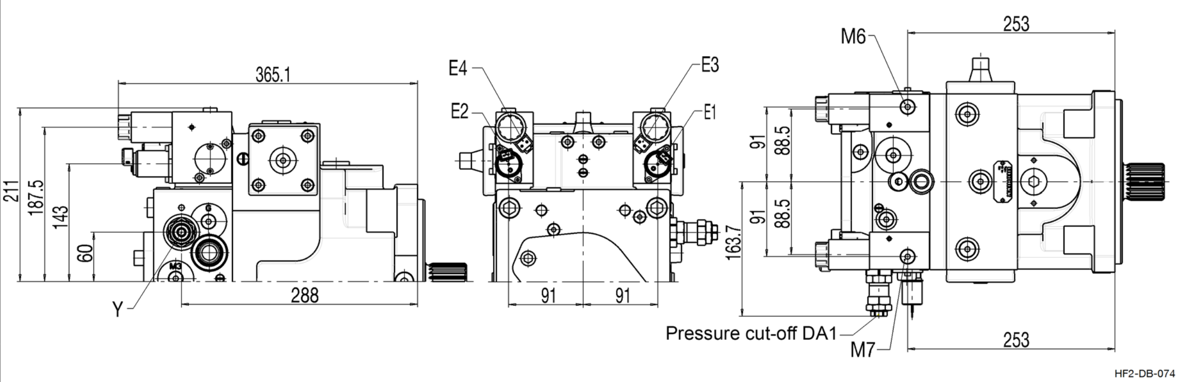
**ELS-DA**

| | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |



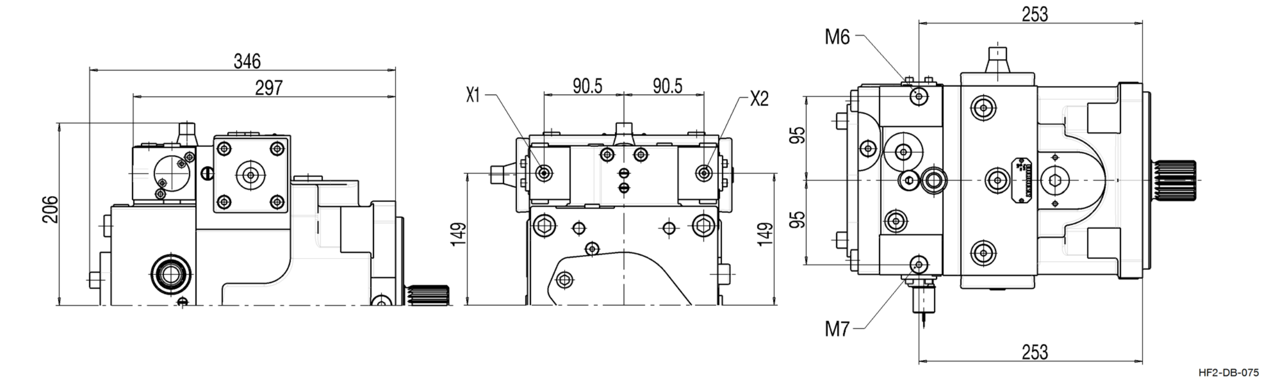

**ELS-DA1**

| | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |
| Y | DA override ISO 9974-1-M12x1.5 |



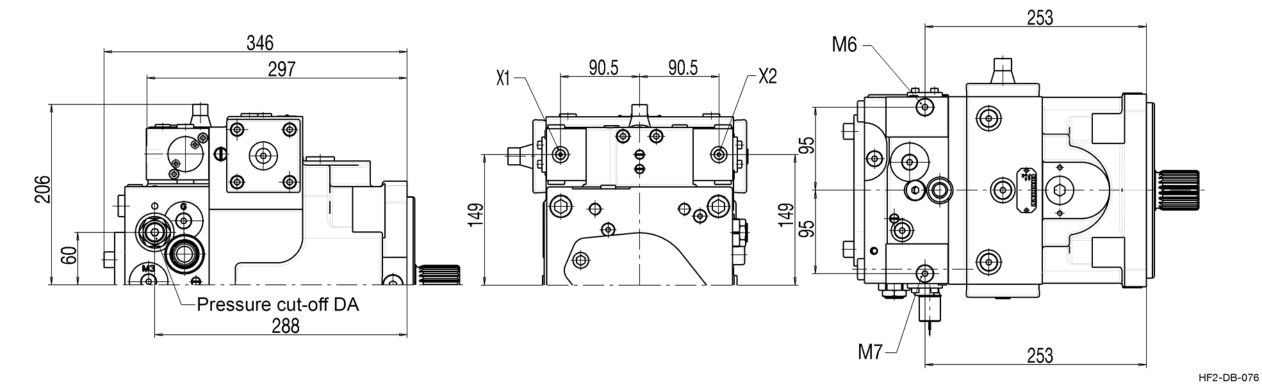

**SD**

| | |
|---|---|
| X1/ X2 | Steering pressure connection ISO 9974-1 M12x1.5 |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |




**SD-DA**

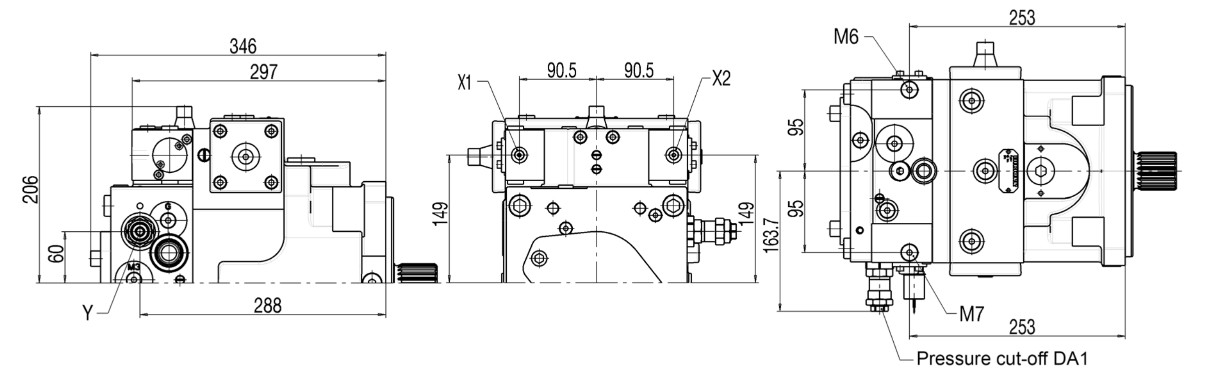
| | |
|---|---|
| X1/ X2 | Steering pressure connection ISO 9974-1 M12x1.5 |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |



# 5 Dimensions

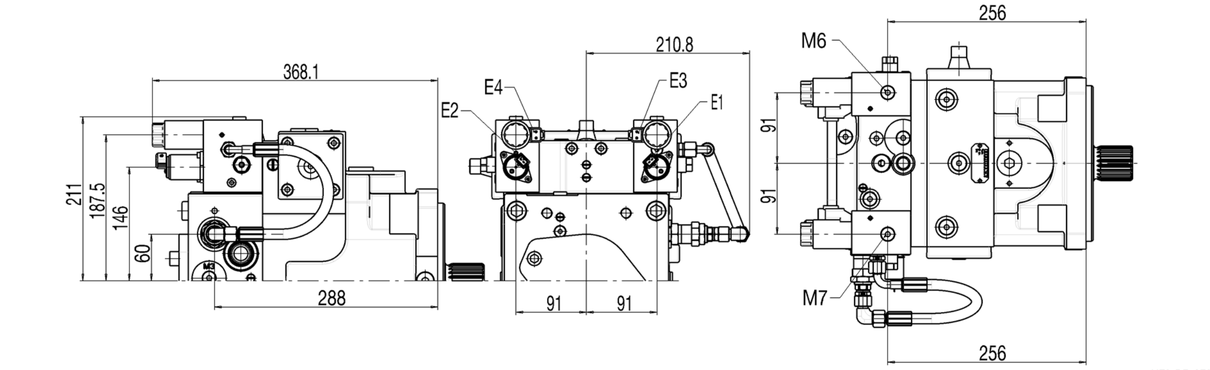
SD-DA1

| | |
|---|---|
| X1/ X2 | Steering pressure connection ISO 9974-1 M12x1.5 |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |
| Y | DA1 override ISO 9974-1 M12x1.5 |



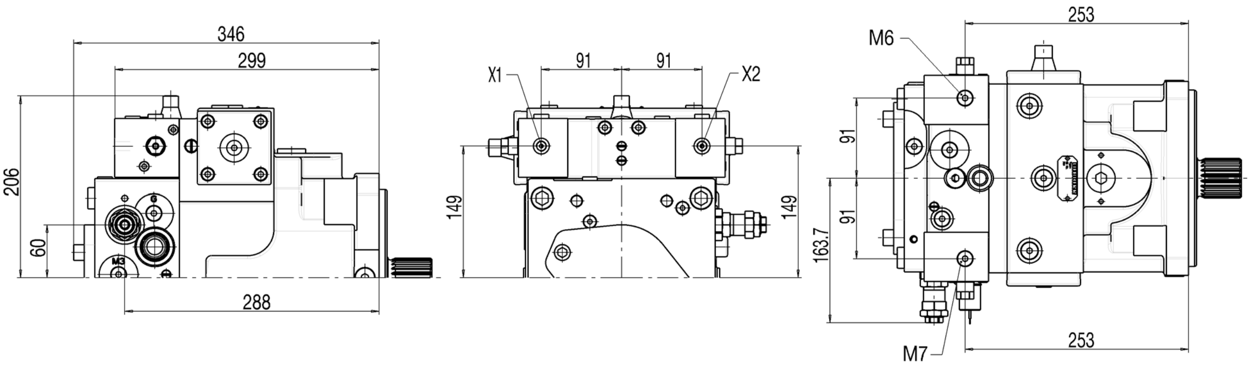

TCE

| | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |



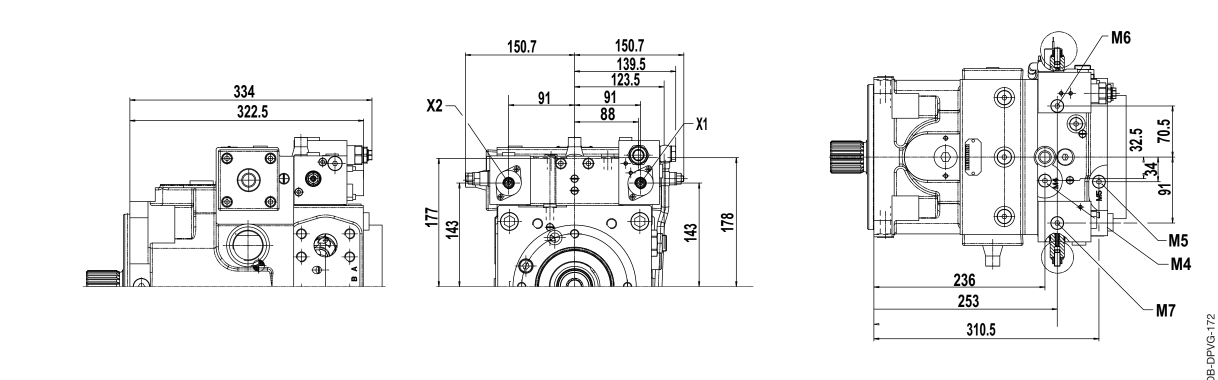

TCH

| | |
|---|---|
| X1/ X2 | Steering pressure connection ISO 9974-1 M12x1.5 |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |




DZH-M-DA

| | |
|---|---|
| X1/ X2 | Steering pressure connection ISO 9974-1 M16x1.5 |
| M4/ M5 | High pressure measuring connection ISO 9974-1 M12x1.5 |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |

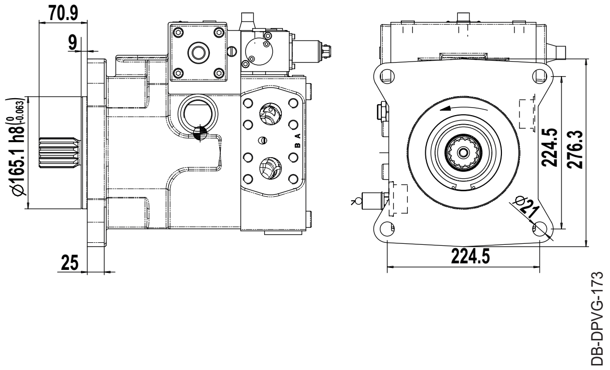


# 5 Dimensions

## 5.11 Nominal size 165, mounting flange

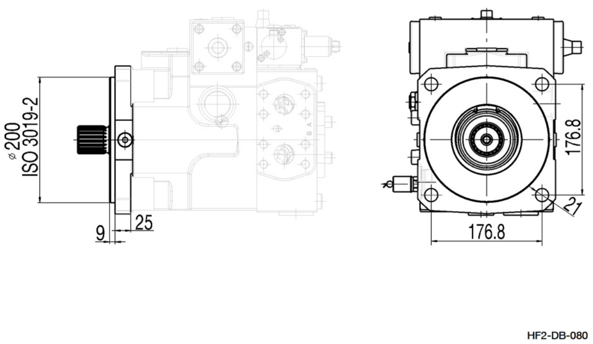
| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

SAE E (SAE J744)




25

ISO 3019-2

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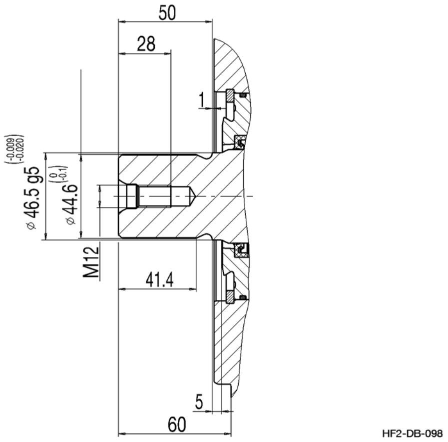
## 5.12 Nominal size 165, shaft end

| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

W45x2x21x9g splined shaft DIN 5480

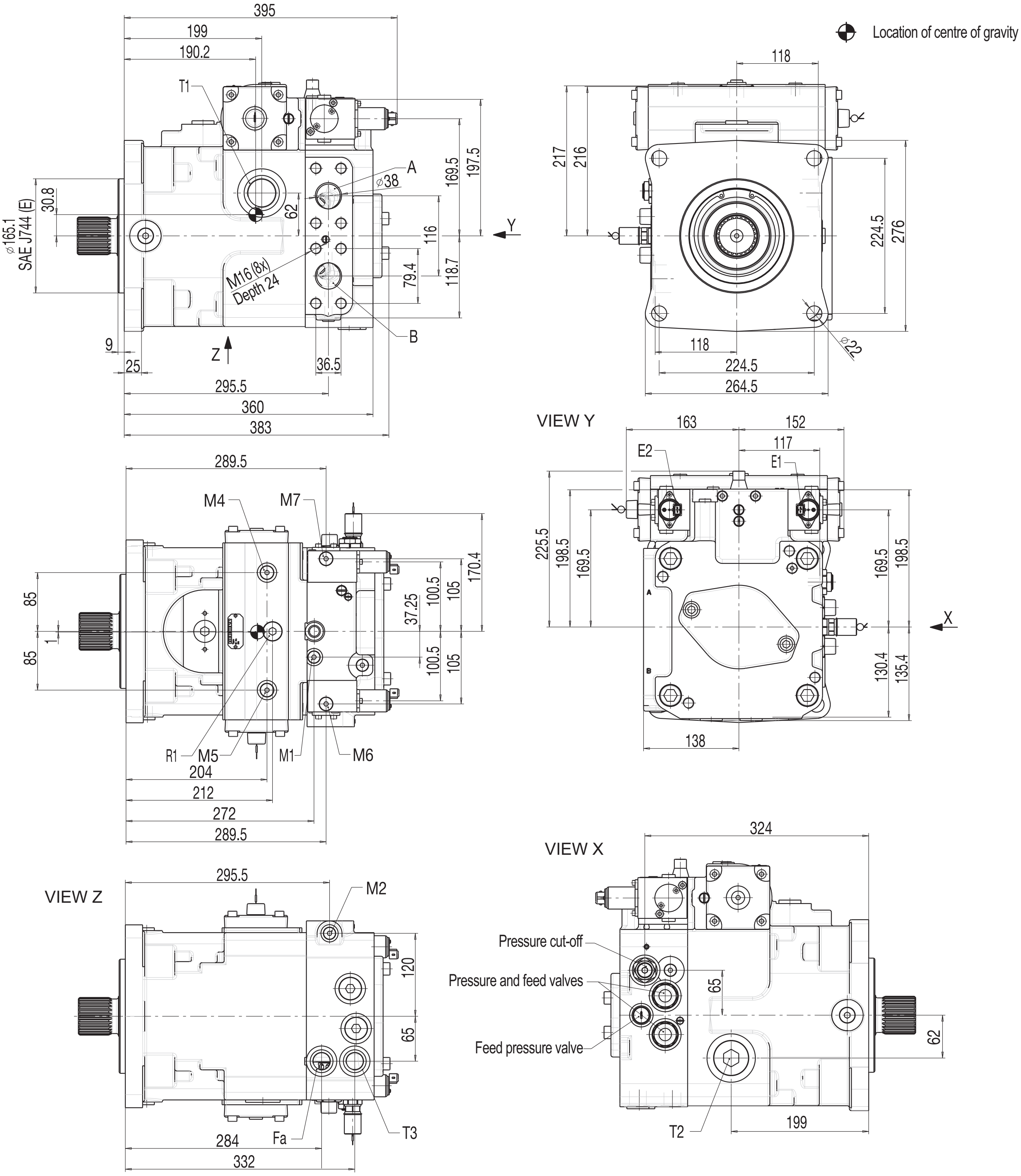



1

# 5 Dimensions

## 5.13 NS 280

### 5.13.1 Nominal size 280, EL-DA control type




HF2-DB-082

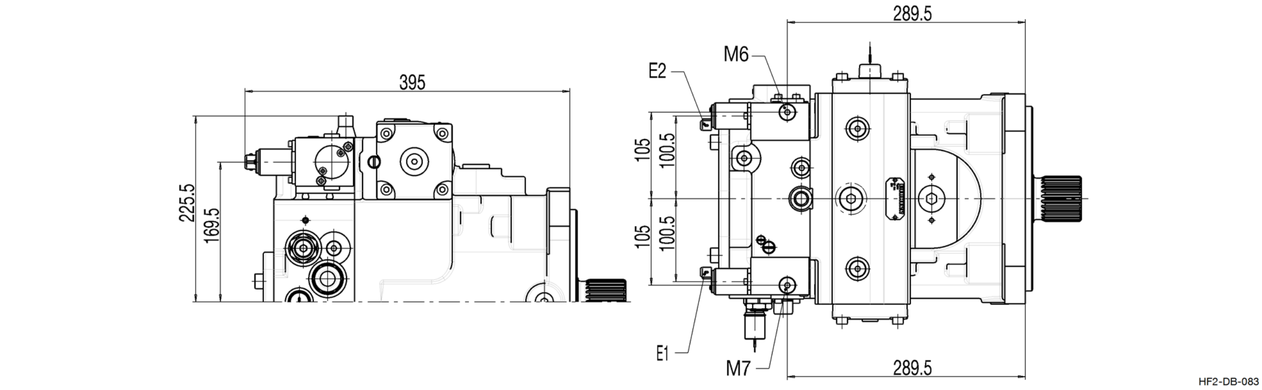
*) Dimensions for NS 280 - swivel yoke version.
Dimensions of swing rocker version on request.

# 5 Dimensions

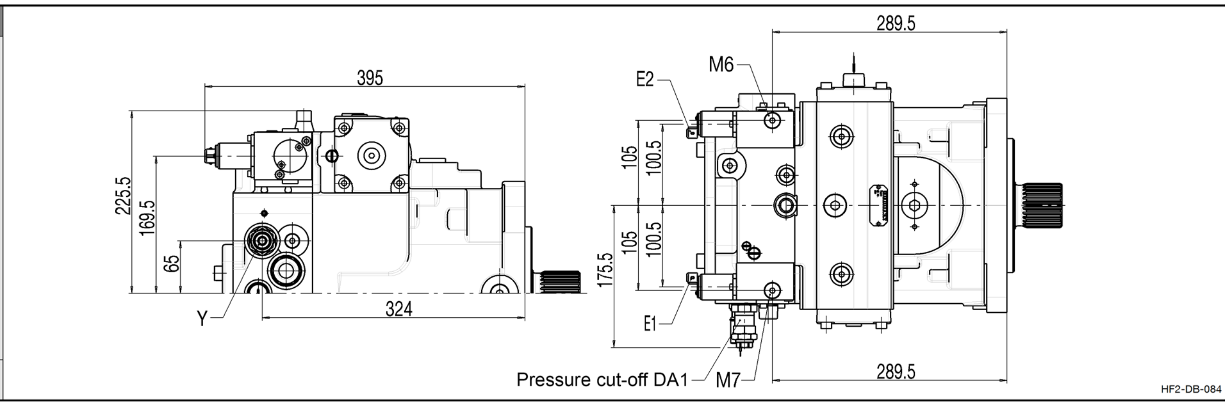
| | | | |
|---|---|---|---|
| A / B | Working connection SAE J 518 - 1 1/2", 6000 psi | T1, T2 | Leakage oil connection M42x2 |
| R1 | Ventilation M22x1.5 | Fa | Feed pressure connection M26x1.5 |
| M1 / M2 | High pressure measuring connection M12x1.5 | M6 / M7 | Steering pressure measuring connection M14x1.5 |
| M4 / M5 | Adjusting pressure measuring connection M14x1.5 | E1 / E2 | Pressure control valve, plug: AMP Junior Timer 2-pin, PWM= 100 Hz, U= 24 V, Imax.= 750 mA |
| T3 | Return for feed pressure valve M26x1.5 | - | - |

### 5.13.2 Nominal size 280, other control types

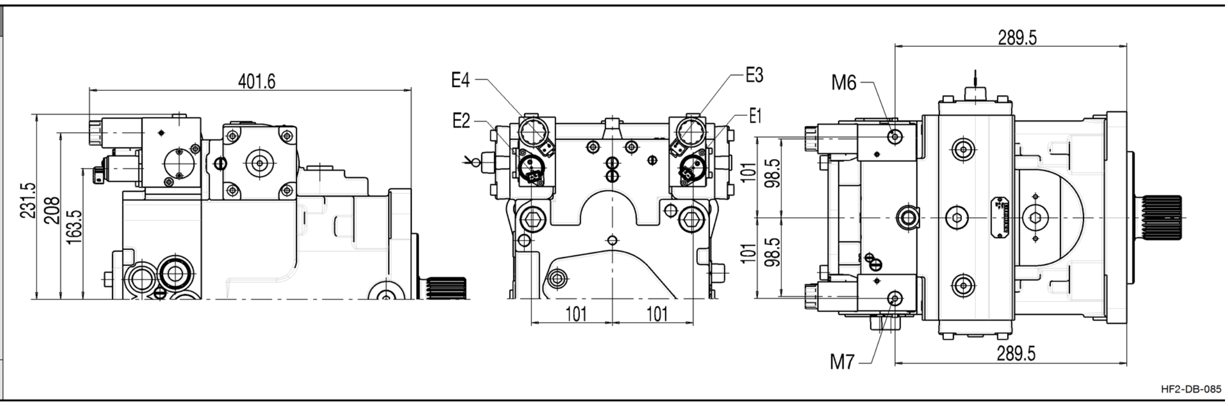
| EL | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |




| EL-DA1 | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |
| Y | DA override ISO 9974-1-M 12x1.5 |

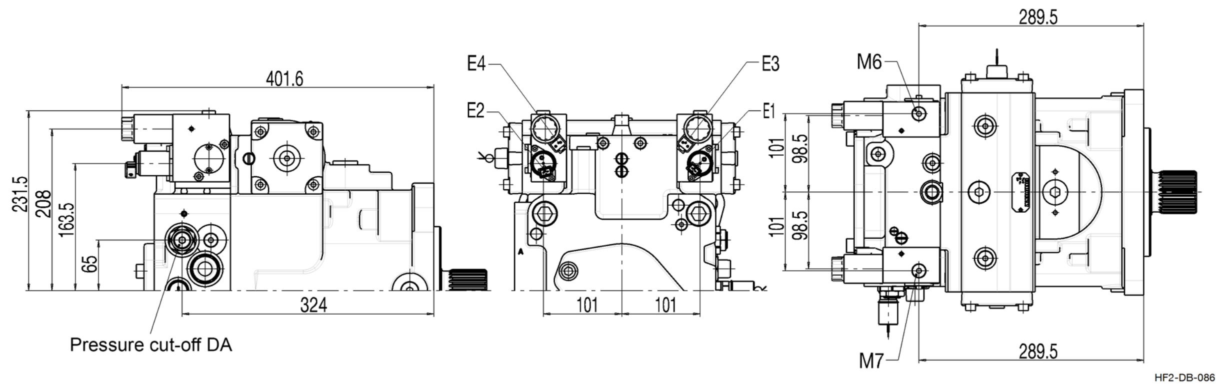



| ELS | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |

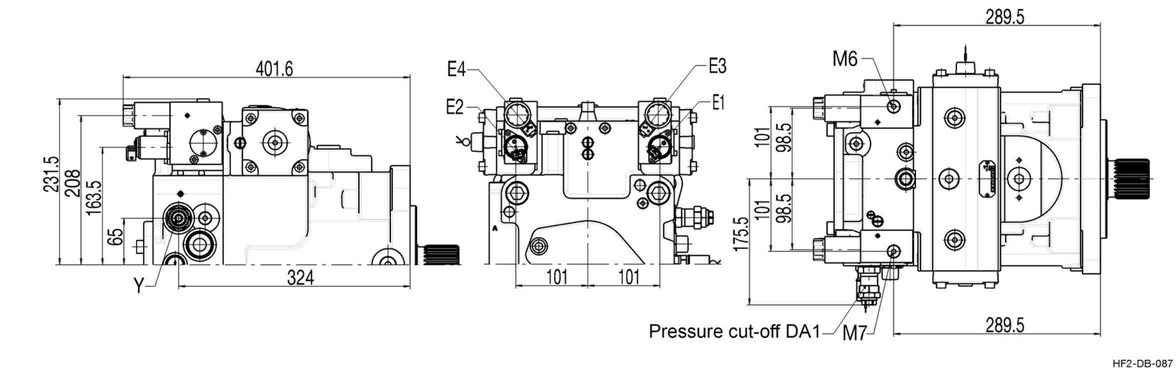


# 5 Dimensions

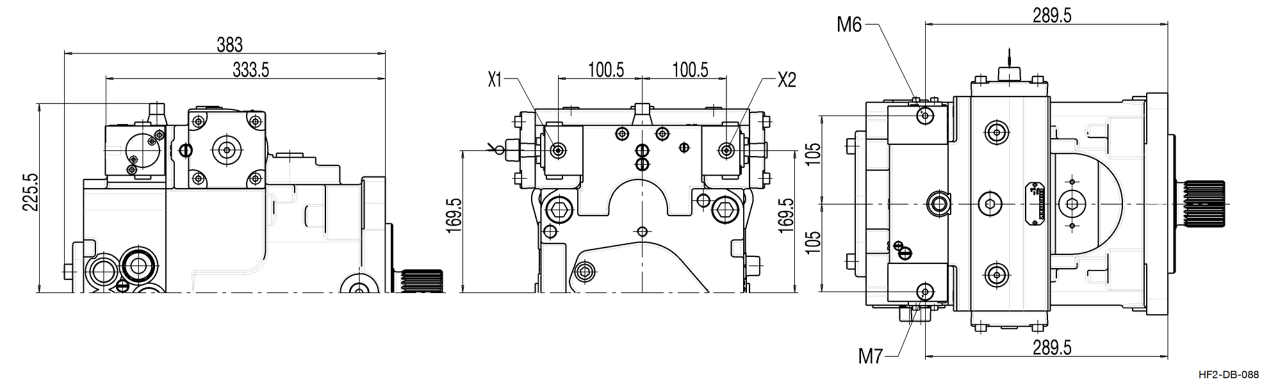
| ELS-DA | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |



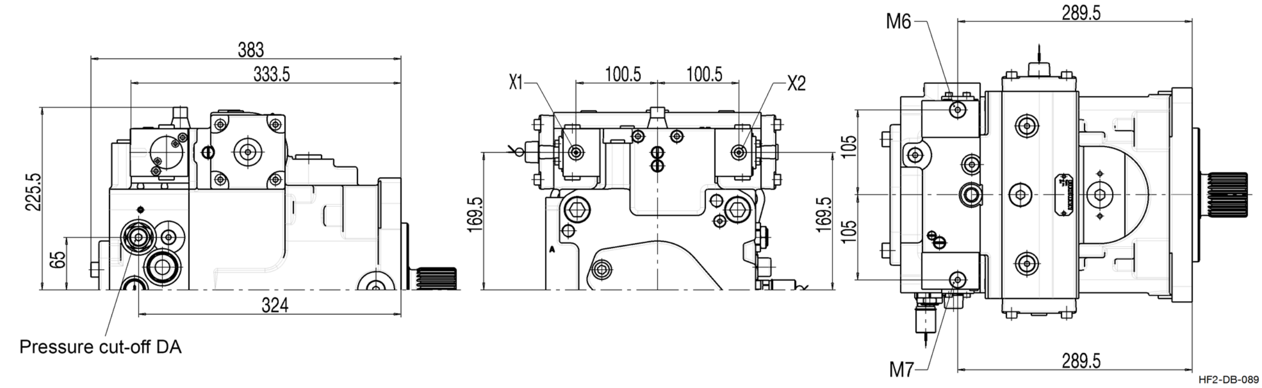

| ELS-DA1 | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |
| Y | DA override ISO 9974-1-M12x1.5 |




| SD | |
|---|---|
| X1/ X2 | Steering pressure connection ISO 9974-1 M12x1.5 |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |

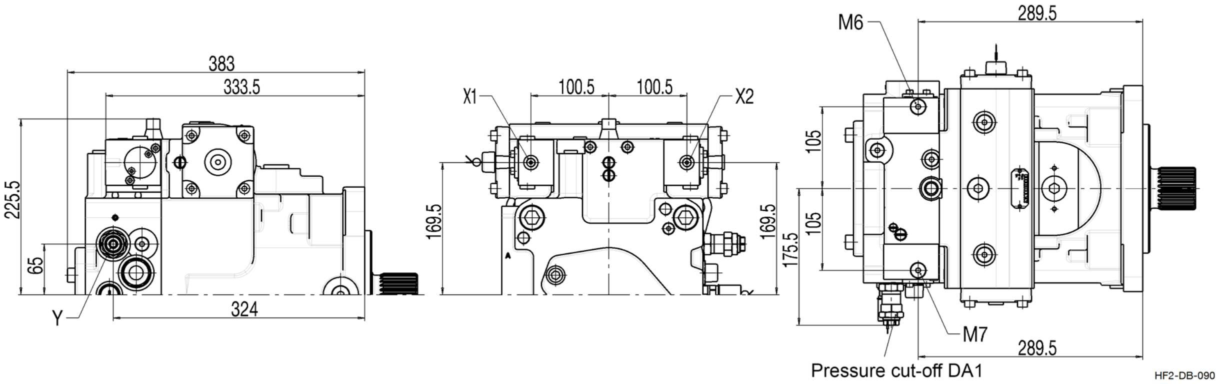



| SD-DA | |
|---|---|
| X1/ X2 | Steering pressure connection ISO 9974-1 M12x1.5 |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |

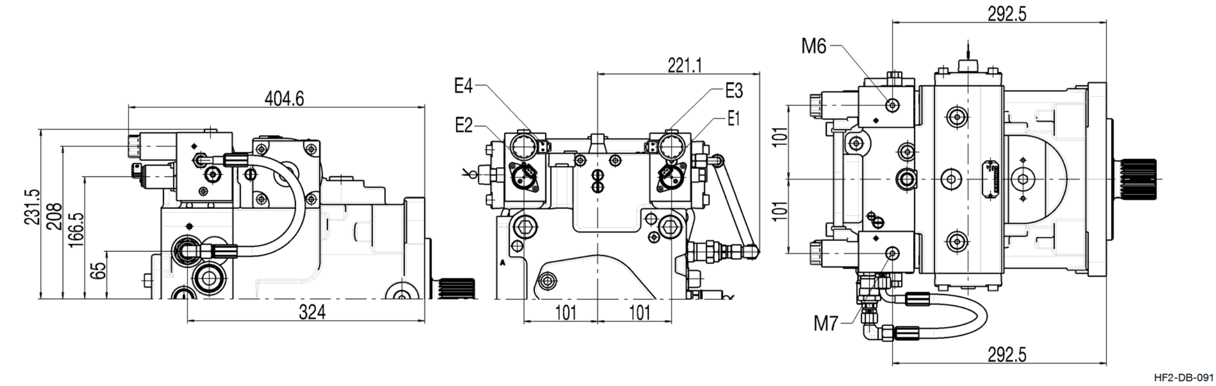


# 5 Dimensions

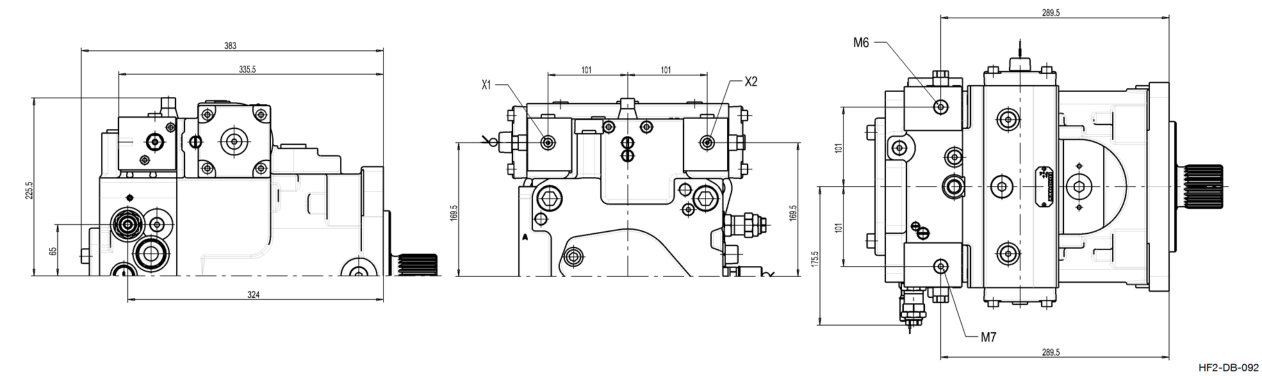
| SD-DA1 | |
|---|---|
| X1/ X2 | Steering pressure connection ISO 9974-1 M12x1.5 |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M14x1.5 |
| Y | DA1 override ISO 9974-1 M12x1.5 |



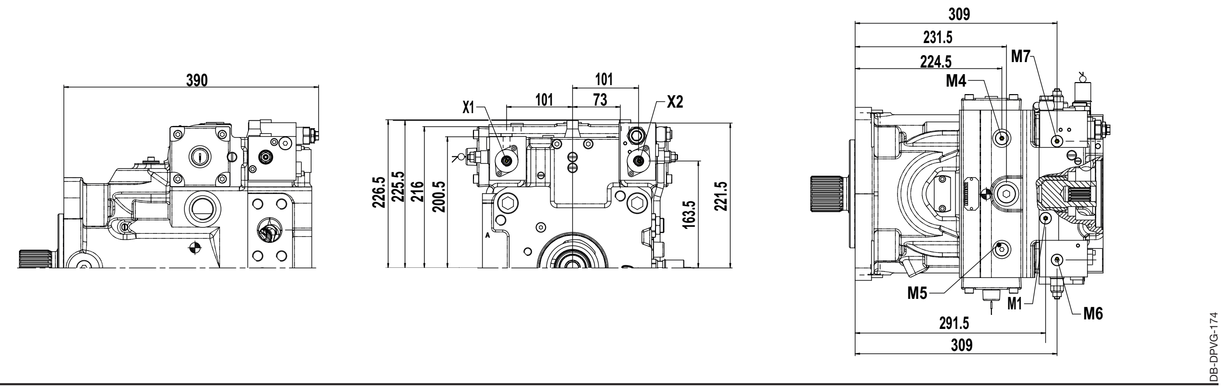

| TCE | |
|---|---|
| E1/ E2 | Plug: AMP Junior - Timer 2-pin Un = 24 V Imax= 750 mA PWM 100 Hz |
| E3/ E4 | Shut-off valve Deutsch DT04-2P connector IG=0.585 A-100% ED U= 24V R= 25Ω |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |




| TCH | |
|---|---|
| X1/ X2 | Steering pressure connection ISO 9974-1 M12x1.5 |
| M6/ M7 | Steering pressure measuring connection ISO 9974-1 M12x1.5 |




| DZH-M-DA | |
|---|---|
| X1/ X2 | **Steering pressure connection ISO 9974-1 M16x1.5** |
| M4/ M5 | **Adjusting pressure measuring connection ISO 9974-1 M14x1.5** |
| M6/ M7 | **Steering pressure measuring connection ISO 9974-1 M12x1.5** |

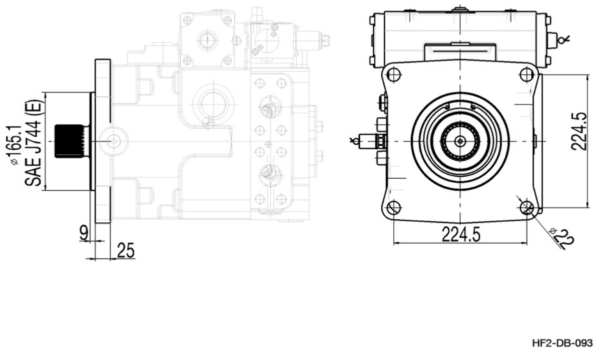


# 5 Dimensions

## 5.14 Nominal size 280, mounting flange

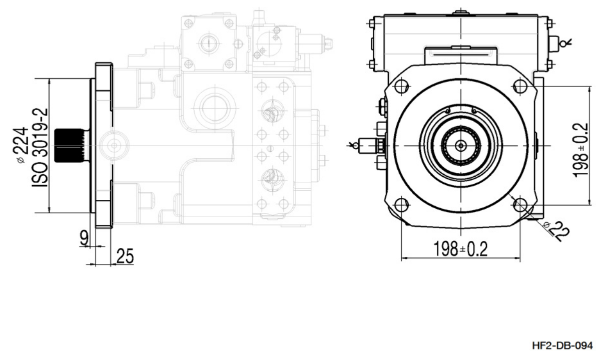
| DPV | G | | / | 000 | | 1 | | | | A | O | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

SAE E, (SAE J744)




25

ISO 3019-2

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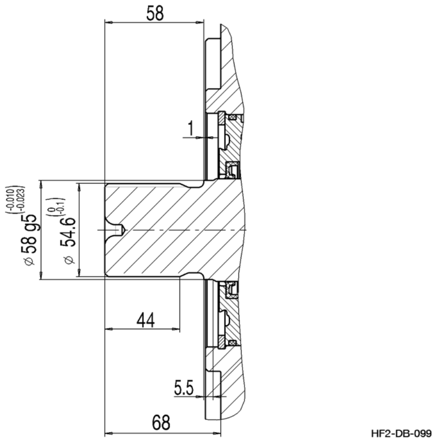
## 5.15 Nominal size 280, shaft end

| DPV | G | | / | 000 | | 1 | | | | A | O | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

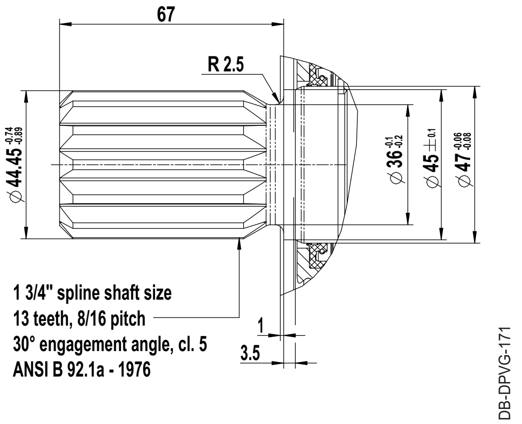
W55x2x26x9g splined shaft DIN 5480




1

# 5 Dimensions

### ANSI B92.1a splined shaft 1 3/4 in 13T 8/16 pitch



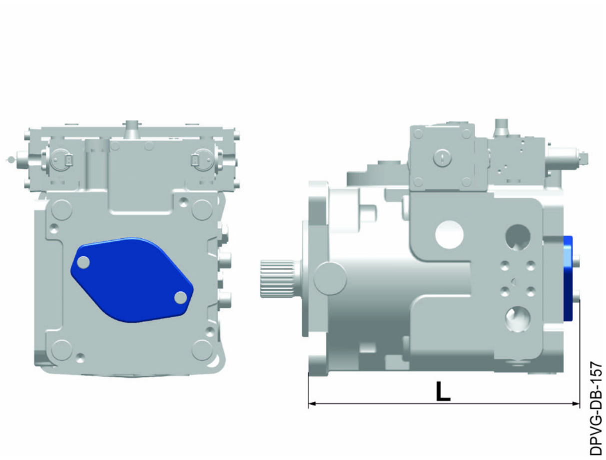

2

## 5.16 Through drive

| DPV | G | | / | 000 | | 1 | | | | A | 0 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | 2. | 3. | / | 4. | 5. | 6. | 7. | 8. | 9. | 10. | 11. | 12. | 13. | 14. | 15. |

### 5.16.1 Axial piston unit without through-drive / with preparation for through-drive mounting kit

**Note**
Preparation for through-drive mounting kit, closed with cover.
To use the through-drive, the selected through-drive mounting kit including coupling ferrule (see installation drawing) must be ordered separately, the cover removed and the through-drive mounting kit installed.




**0000** 2-hole (NS 085 = 4-hole)

| NS | L |
|---|---|
| 085 | 322.5 |
| 108 | 292 |
| 140 | 395 |
| 165 | 346 |
| 280 | 383 |

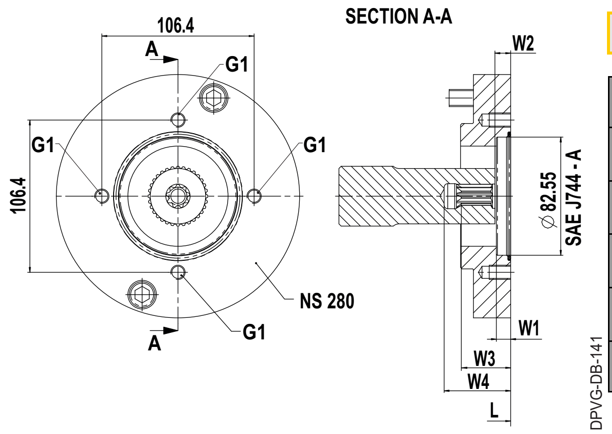
L) up to mounting flange

# 5 Dimensions

## 5.17 Through-drive - hole open

### 5.17.1 SAE A

**Gearing: ANSI B92.1a-1976 5/8“ 9T 16/32 DP**



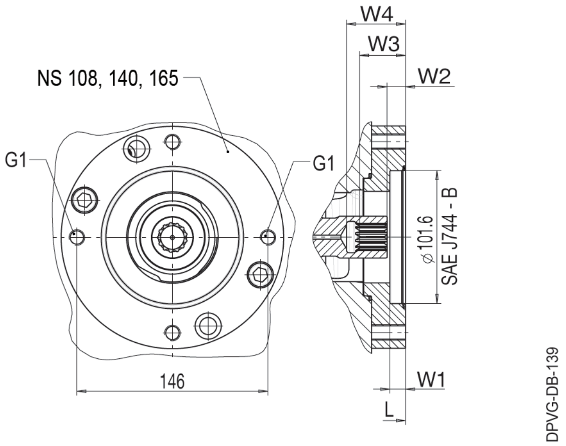

**A11D** 2-hole

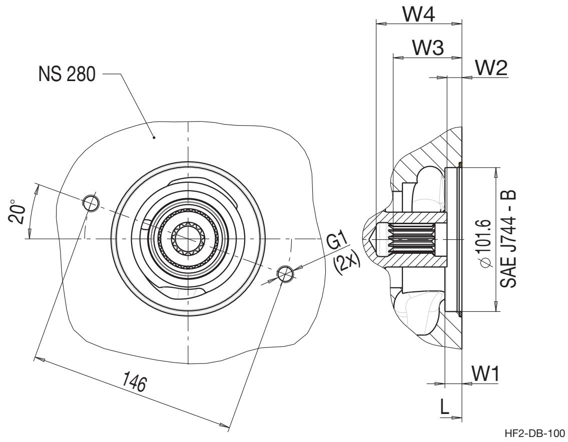
| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) |
|---|---|---|---|---|---|---|
| 085 | - | - | - | - | - | - |
| 108 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 140 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 165 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 280 | 10 | 11 | 34.5 | 46.5 | 386 | M10x1.5: 15 deep |

L*) up to mounting flange/ ☐= on request

### 5.17.2 SAE B

**Gearing: ANSI B92.1a-1976 7/8“ 13T 16/32 DP**




2-hole: **B11D**

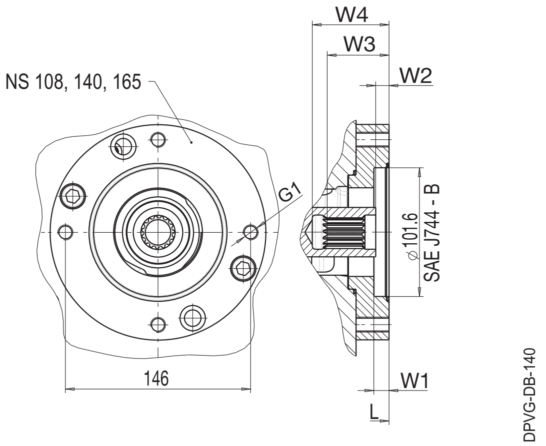
4-hole: **B12D**

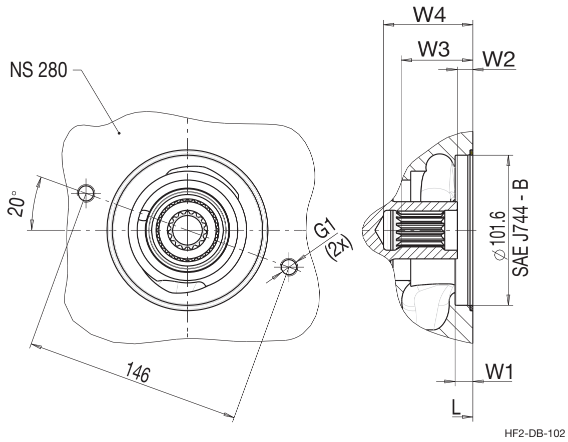
| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 108 | 12 | 10.5 | 48.5 | 60.5 | 294 | M12x1.75: 26 deep | - |
| 140 | 12 | 10.5 | 48.5 | 60.5 | 338.5 | M12x1.75: 26 deep | |
| 165 | 12 | 14.1 | 35.1 | 45.1 | 348 | M12x1.75: 26 deep | - |
| 280 | 12 | 10.5 | 48.5 | 60.5 | 386 | M12x1.75: 18 deep | - |

L*) up to mounting flange / ☐= on request

### 5.17.3 SAE BB

**Gearing: ANSI B92.1a-1976 1“ 15T 16/32 DP**




2-hole: **B21D**

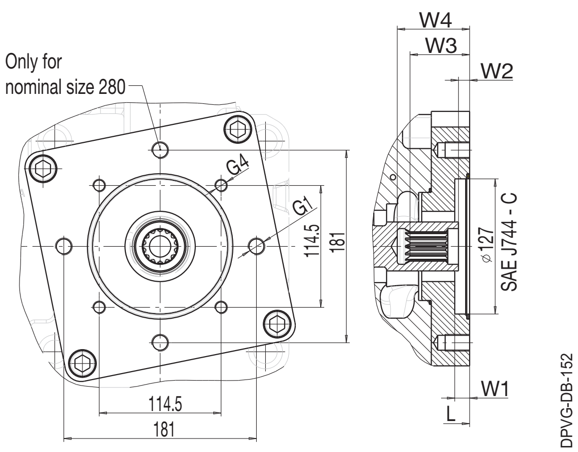
4-hole: **B22D**

| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 108 | 12 | 10.5 | 48.5 | 60.5 | 294 | M12x1.75: 26 deep | - |
| 140 | 12 | 10.5 | 48.5 | 60.5 | 338.5 | M12x1.75: 26 deep | |
| 165 | 12 | 10.5 | 49 | 60.5 | 348 | M12x1.75: 26 deep | - |
| 280 | 12 | 10.5 | 48.5 | 60.5 | 386 | M12x1.75: 18 deep | - |

L*) up to mounting flange / ☐= on request

### 5.17.4 SAE C

**Gearing: ANSI B92.1a-1976 1 1/4" 14T 12/24 DP**




**C11D** 2-hole

**C12D** 4-hole

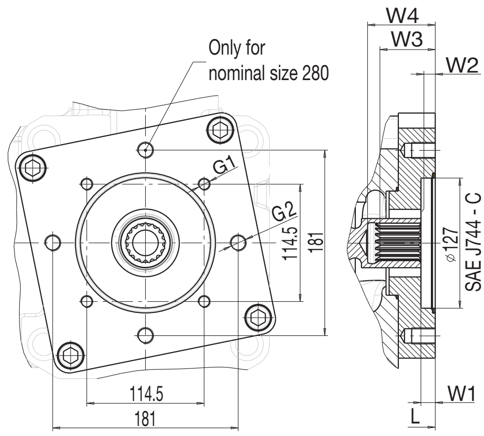
| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 108 | 14 | 23 | 53 | 65 | 304 | M16x2: 23 deep | M12x1.75: 18 deep |
| 140 | 14 | 10.5 | 56 | 68 | 362 | M16x2: 25 deep | M12x1.75: 19 deep |
| 165 | 14 | 13 | 54 | 59.5 | 358 | M16x2: 23 deep | M12x1.75: 18 deep |
| 280 | 14 | 10.5 | 56 | 68 | 396 | M16x2: 23 deep | M12x1.75: 18 deep |

L*) up to mounting flange/ ☐= on request

# 5 Dimensions

#### 5.17.5 SAE CC

**Gearing: ANSI B92.1a-1976 1 1/2" 17T 12/24 DP**




DPVG-DB-153

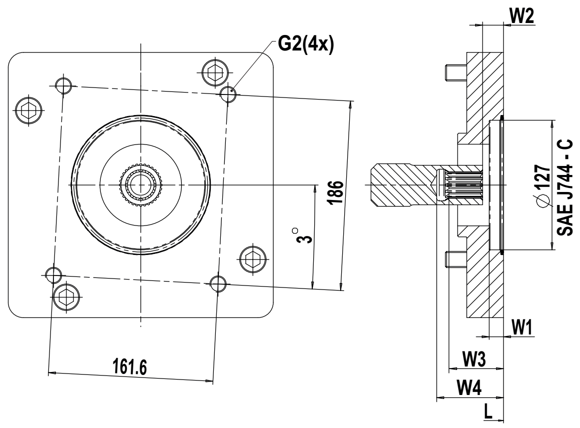
| C21D | 2-hole |
|---|---|
| C22D | 4-hole |

| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 108 | 14 | 13 | 53 | 65 | 304 | M16x2: 23 deep | M12x1.75: 18 deep |
| 140 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 165 | 14 | 13 | 54 | 65 | 358 | M16x2: 23 deep | M12x1.75: 18 deep |
| 280 | 14 | 14 | 54 | 66 | 396 | M16x2: 23 deep | M12x1.75: 18 deep |

L*) up to mounting flange/ ☐= on request

#### 5.17.6 SAE C

**Gearing: DIN 5480 N30x2x14x10E**




DPVG-DB-146

| C31D | 2-hole |
|---|---|
| C32D | 4-hole |

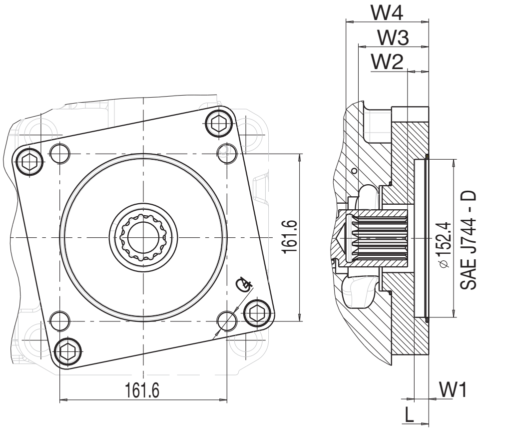
| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 108 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 140 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 165 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 280 | 14 | 20.5 | 53.5 | 65.5 | 396 | ☐ | M16x2: 23 deep |

L*) up to mounting flange/ ☐= on request

# 5 Dimensions

### 5.17.7 SAE D

**Gearing: ANSI B92.1a-1976 1 3/4“ 13T 8/16 DP**




DPVG-DB-154

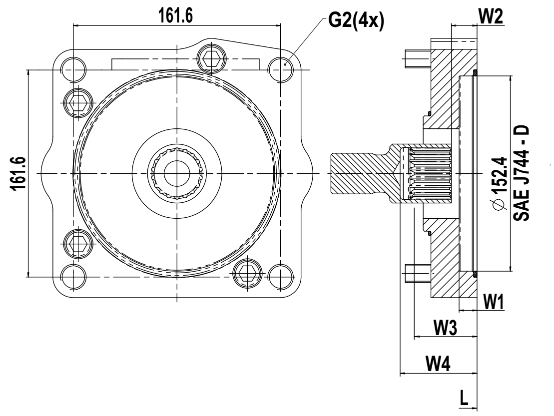
**D11D** 2-hole

**D12D** 4-hole

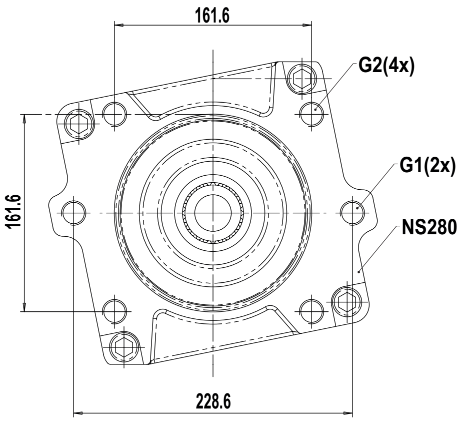
| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | - | - | - | - | - | - | - |
| 108 | 14 | 16.5 | 64 | 78 | 314 | ☐ | M20x2.5: 36 deep |
| 140 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 165 | 14 | 21.5 | 68 | 80 | 358 | ☐ | M20x2.5: 36 deep |
| 280 | 14 | 20.5 | 68 | 80 | 396 | ☐ | M20x2.5: 36 deep |

L*) up to mounting flange/ ☐= on request

**Gearing: DIN 5480 N40x2x18x10E**




DPVG-DB-142




DPVG-DB-144

2-hole: **D31D**

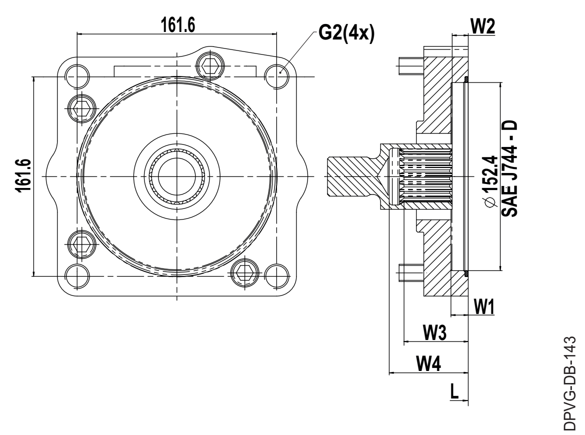
4-hole: **D32D**

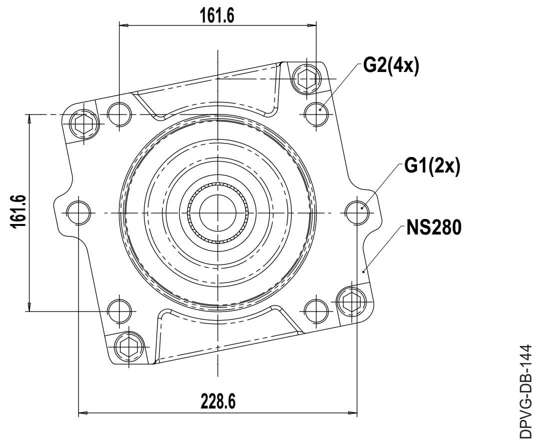
| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | - | - | - | - | - | - | - |
| 108 | 14 | 20 | 49 | 60 | 304 | ☐ | M20x2.5: 27 deep |
| 140 | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ | ☐ |
| 165 | 14 | 20 | 49 | 60 | 358 | ☐ | M20x2.5: 27 deep |
| 280 | 14 | 20.5 | 49.5 | 60.5 | 396 | M20x2.5: 27 deep | M20x2.5: 27 deep |

L*) up to mounting flange/ ☐= on request

# 5 Dimensions

**Gearing: DIN 5480 N45x2x21x10E**



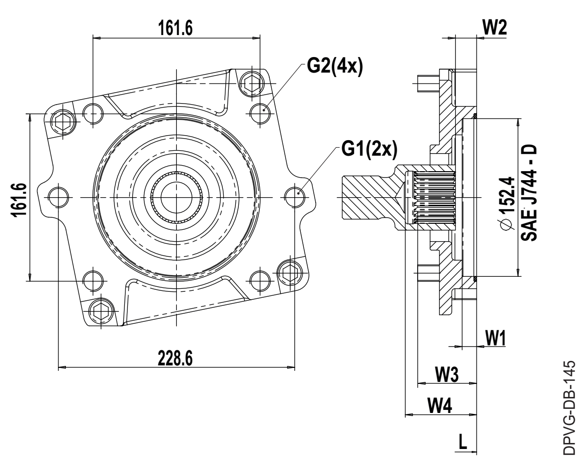

2-hole: **D31D**

4-hole: **D32D**

| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| **085** | - | - | - | - | - | - | - |
| **108** | 14 | 13 | 52 | 64 | 304 | □ | M20x2.5: 27 deep |
| **140** | □ | □ | □ | □ | □ | □ | □ |
| **165** | 14 | 20 | 59 | 70 | 358 | □ | M20x2.5: 27 deep |
| **280** | 14 | 19 | 55 | 67 | 396 | M20x2.5: 27 deep | M20x2.5: 27 deep |

L*) up to mounting flange/ □= on request

**Gearing: DIN 5480 N50x2x24x10E**




**D31D** 2-hole

**D32D** 4-hole

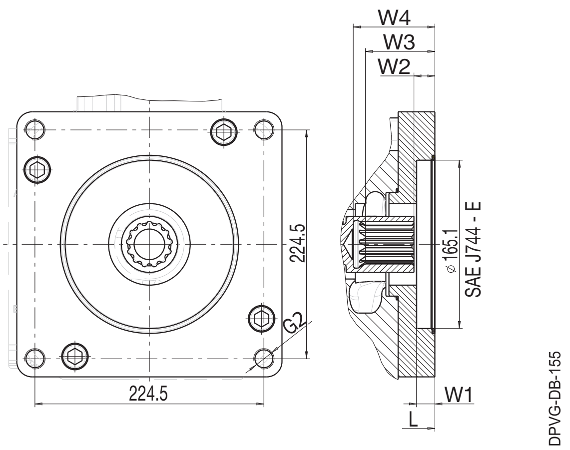
| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| **085** | - | - | - | - | - | - | - |
| **108** | □ | □ | □ | □ | □ | □ | □ |
| **140** | □ | □ | □ | □ | □ | □ | □ |
| **165** | □ | □ | □ | □ | □ | □ | □ |
| **280** | 14 | 20.5 | 57 | 69 | 396 | M20x2.5: 27 deep | M20x2.5: 27 deep |

L*) up to mounting flange/ □= on request

# 5 Dimensions

### 5.17.8 SAE E

**Gearing: ANSI B92.1a-1976 1 3/4“ 13T 8/16 DP**

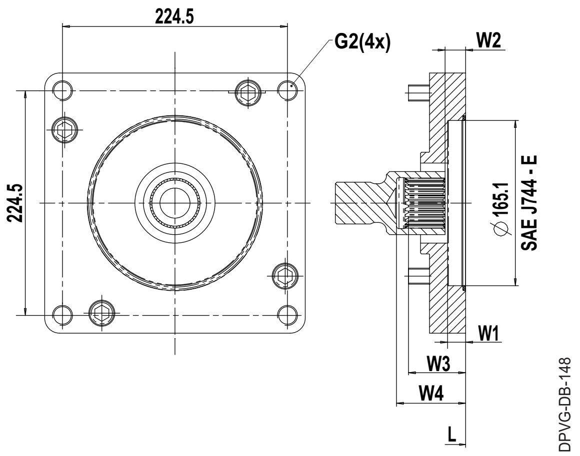



**E11D** 2-hole
**E12D** 4-hole

| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | - | - | - | - | - | - | - |
| 108 | - | - | - | - | - | - | - |
| 140 | - | - | - | - | - | - | - |
| 165 | - | - | - | - | - | - | - |
| 280 | 12 | 10.5 | 48.5 | 60.5 | 396 | - | M20x2.5: 36 deep |

L*) up to mounting flange/ -= not possible

**Gearing: DIN 5480 N50x2x24x10E**



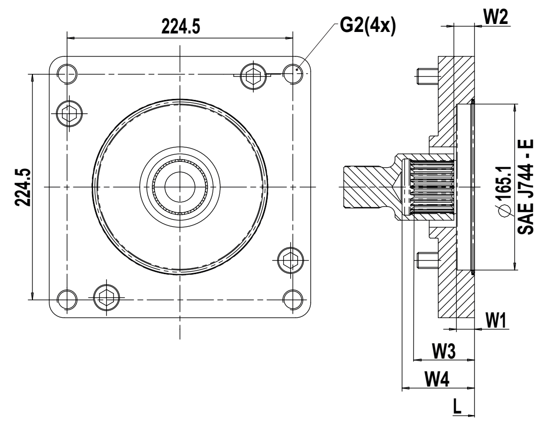

**E31D** 2-hole
**E32D** 4-hole

| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | - | - | - | - | - | - | - |
| 108 | - | - | - | - | - | - | - |
| 140 | - | - | - | - | - | - | - |
| 165 | - | - | - | - | - | - | - |
| 280 | 18 | 20.5 | 57 | 69 | 396 | - | M20x2.5: 36 deep |

L*) up to mounting flange/ -= not possible

# 5 Dimensions

**Gearing: DIN 5480 N55x2x26x10E**




**E31D** 2-hole
**E32D** 4-hole

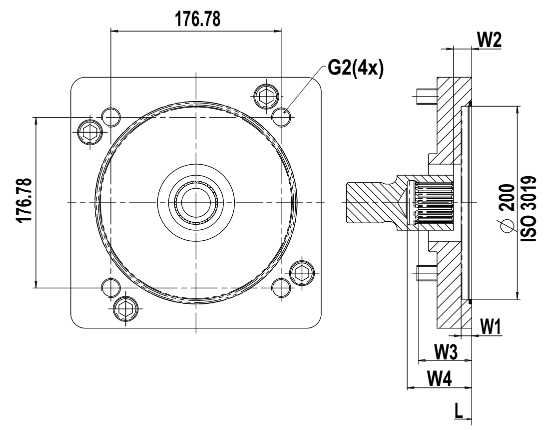
| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | - | - | - | - | - | - | - |
| 108 | - | - | - | - | - | - | - |
| 140 | - | - | - | - | - | - | - |
| 165 | - | - | - | - | - | - | - |
| 280 | 18 | 20.5 | 60 | 72 | 396 | - | M20x2.5: 36 deep |

DPVG-DB-149

L*) up to mounting flange/ -= not possible

**5.17.9 ISO 3019-2 / DIN 5480**

**⌀ 200 ISO 3019-2 / gearing: DIN 5480 N45x2x21x10E**



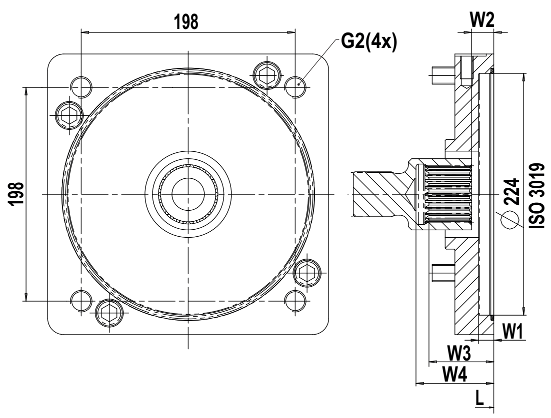

**V31D** 2-hole
**V32D** 4-hole

| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | - | - | - | - | - | - | - |
| 108 | - | - | - | - | - | - | - |
| 140 | - | - | - | - | - | - | - |
| 165 | - | - | - | - | - | - | - |
| 280 | 11 | 19 | 55 | 67 | 396 | - | M20x2.5: 36 deep |

DPVG-DB-150

L*) up to mounting flange/ -= not possible

**⌀ 224 ISO 3019-2 / gearing: DIN 5480 N55x2x26x10E**




**W31D** 2-hole
**W32D** 4-hole

| NS | W1 | W2 | W3 | W4 | L | G1 (2-hole) | G2 (4-hole) |
|---|---|---|---|---|---|---|---|
| 085 | - | - | - | - | - | - | - |
| 108 | - | - | - | - | - | - | - |
| 140 | - | - | - | - | - | - | - |
| 165 | - | - | - | - | - | - | - |
| 280 | 14 | 20.5 | 60 | 72 | 396 | - | M20x2.5: 36 deep |

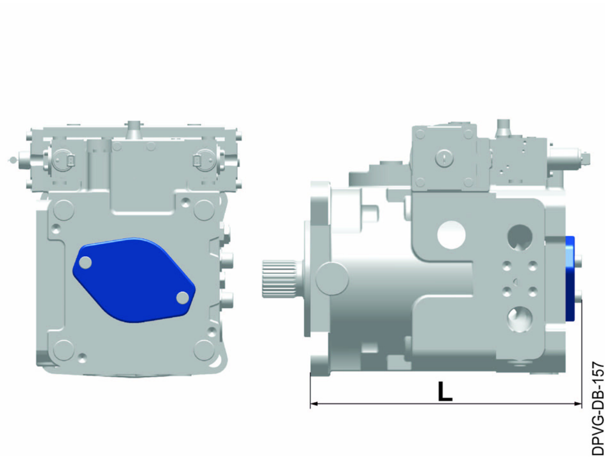
DPVG-DB-151

L*) up to mounting flange /-= not possible

# 5 Dimensions

### 5.18 Through-drive - hole closed with cover

**Gearing: none**

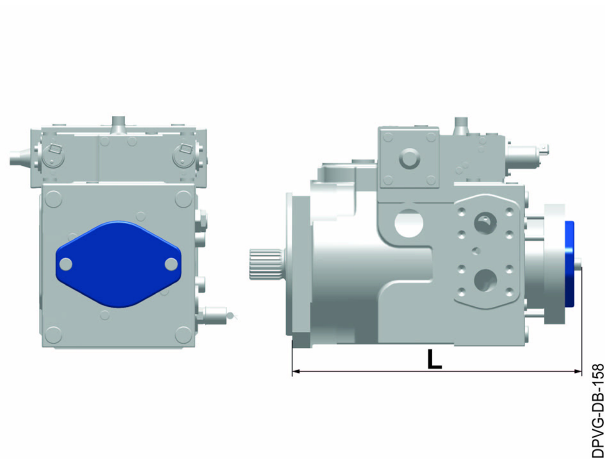



**B01G** 2-hole (NS 085 = 4-hole)

| NS | L |
|---|---|
| 085 | 322.5 |
| 108 | 328 |
| 140 | ☐ |
| 165 | ☐ |
| 280 | 383 |

L) up to mounting flange / ☐= on request

**Gearing: ANSI B92.1a-1976 7/8“ 13T 16/32 DP**




**B11G** 2-hole

| NS | L |
|---|---|
| 085 | 349* |
| 108 | ☐ |
| 140 | ☐ |
| 165 | 404* |
| 280 | ☐ |

L) up to mounting flange / ☐= on request

*) in combination with feed pump

**Note**
Other through-drive versions “hole closed with cover” possible upon request.
Additional details upon request.

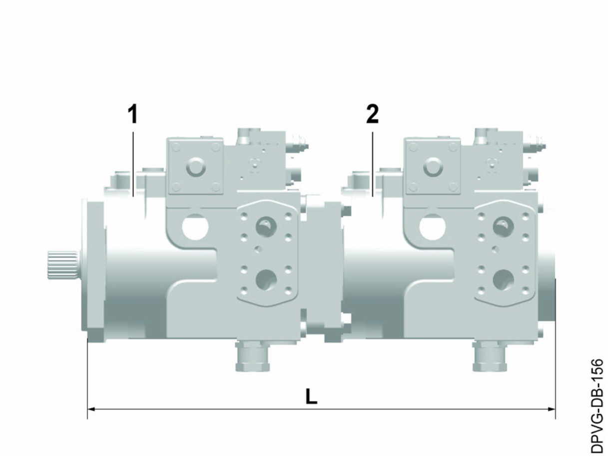
# 5 Dimensions

## 5.19 Multi-circuit pump in tandem design

**General information**
Multi axial piston units of two or more single units can be supplied on request.

In this case, the base axial piston pump P1 must be connected with another axial piston pump P2 by an intermediate flange 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.




| | |
|---|---|
| 1 | Base axial piston pump |
| 2 | Flanged axial piston pump |

| | |
|---|---|
| L | Multi-circuit pump overall length in mm |
| - | - |

**Note**
Multi-circuit pump overall length on request.

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Liebherr Machines Bulle SA Rue Hans-Liebherr 7 1630 Bulle/FR, Switzerland
Phone +41 26 013 31 11 , Fax +41 26 013 34 85 info.lmb@liebherr.com www.liebherr.com

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Liebherr Machines Bulle SA Rue Hans-Liebherr 7 1630 Bulle/FR, Switzerland
Phone +41 26 013 31 11 , Fax +41 26 013 34 85 info.lmb@liebherr.com www.liebherr.com