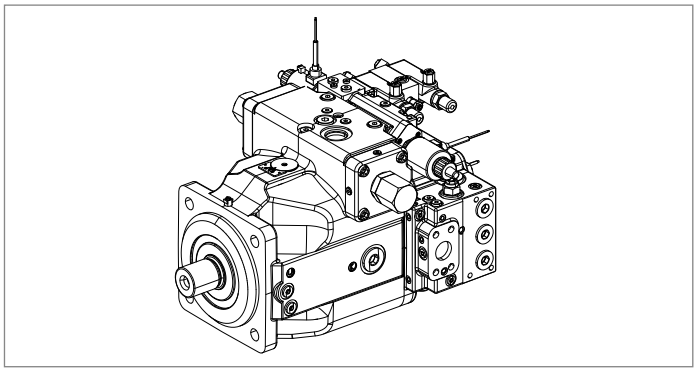
RE 92105-01-X-B2/2019.08.06
Replaces: 08.2017

rexroth
A Bosch Company

# Axial piston variable pump A4CSG Series 30

## for explosive areas II 2G Ex h IIC T4-T1 Gb X and II 3G Ex h IIC T4-T1 Gc X

**Part II of instruction manual in accordance with ATEX Directive (2014/34/EU) data sheet**



- Sizes 250, 355, 500
- Nominal pressure 350 bar
- Maximum pressure 400 bar
- Closed circuit

**Information on explosion protection**

- Application per Directive 2014/34/EU (ATEX)
- Gas: II 2G Ex h IIC T4-T1 Gb X according to DIN EN ISO 80079-36 :2016, DIN EN ISO 80079-37:2016
- Gas: II 3G Ex h IIC T4-T1 Gc X according to DIN EN ISO 80079-36 :2016, DIN EN ISO 80079-37:2016

**Features of the ATEX version**

The ATEX version is an advanced development of the A4CSG for compliance with Directive 2014/34/EU (ATEX). External features distinguishing it from the standard pump as per data sheet 92105 are the ground terminal, the Ex marking and the CE marking on the name plate.
For ATEX category II 2G Ex h IIC T4-T1 Gb X, an additional temperature sensor for monitoring the operation data is supplied.

**Temperature classes per DIN EN ISO 80079-36**

Depending on the two temperature classes, T3 and T4, observe the maximum permissible temperatures (see "Hydraulic fluid" and "Operating data monitoring – X parameters").

**Contents**

## Type code

| 01 | 02 | 03 | 04 | | 05 | 06 | | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A4CS** | **G** | | | **/** | **30** | | **–** | | | | **35** | | | **4** | | |

**Axial piston unit**

| | | |
|---|---|---|
| 01 | Swashplate design, variable, nominal pressure 350 bar, maximum pressure 400 bar | **A4CS** |

**Operating mode**

| | | |
|---|---|---|
| 02 | Pump, closed circuit | **G** |

**Size**

| | | | | |
|---|---|---|---|---|
| 03 | Geometric displacement, see "Technical data" page 9 | **250** | **355** | **500**[1] |

**Control device**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 04 | Proportional control | hydraulic control, pilot-pressure related (HD1T and HD1U not available) | see 92080 | ● | ● | ● | **HD...** |
| | | electrohydraulic | see 92084 | ● | ● | ● | **EP** |

**Series**

| | | |
|---|---|---|
| 05 | Series 3, index 0 | **30** |

**Directions of rotation**

| | | | | |
|---|---|---|---|---|
| 06 | Viewed on drive shaft | clockwise | | **R** |
| | | counter-clockwise | | **L** |

| **Sealing material** | | **250** | **355** | **500** | |
|---|---|---|---|---|---|
| 07 | FKM (fluoroelastomer) and ATEX version II 2G Ex h IIC T4-T1 Gb X | ● | ● | ● | **R** |
| | FKM (fluoroelastomer) and ATEX version II 3G Ex h IIC T4-T1 Gc X | ● | ● | ● | **A** |

| **Drive shaft** | | **250** | **355** | **500** | |
|---|---|---|---|---|---|
| 08 | Parallel keyed shaft DIN 6885 | ● | ● | ● | **P** |
| | Splined shaft DIN 5480 | ● | ● | ● | **Z** |

| **Mounting flange** | | | **250** | **355** | **500** | |
|---|---|---|---|---|---|---|
| 09 | Based on ISO 3019-2 (metric) | 4-hole | ● | ● | – | **B** |
| | | 8-hole | – | – | ● | **H** |

**Working port**

| | | |
|---|---|---|
| 10 | SAE flange ports **A** and **B**, positioned laterally opposite each other, metric fastening thread | **35** |
| | SAE flange port **S**, positioned laterally offset from **A** and **B** by 90°, metric fastening thread | |

**Boost pump**

| | | | | | |
|---|---|---|---|---|---|
| 11 | With integrated boost pump | ● | ● | ● | **F** |

● = Available ○ = On request – = Not available

**Notices**

- When ordering, please indicate the equipment group, category, explosion group, temperature class and type of protection required for your intended ATEX application.
- Potential equalization: The pump must be grounded. For: Grounding points, please refer to the drawings starting on page 21. Compared to the standard pump, the technical data is restricted in terms of temperature, case pressure and bearing flushing/ installation position.
- To avoid mechanically generated sparks from aluminum contaminants with iron oxide and/or rust particles on the surface[2], the pump comes painted to protect against corrosion. Please contact your Rexroth partner for available colors.
- The service life of the bearings must be calculated. The load cycle forms the basis for this. Please contact us.

1) -S2145 only up to 3 bar case pressure for temperature class T4
2) See DIN EN ISO 80079-36, 6.4.2.1

## Type code

| 01 | 02 | 03 | 04 | | 05 | 06 | | 07 | 08 | 09 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **A4CS** | **G** | | | **/** | **30** | | **–** | | | | **35** | | | **4** | | |

| | **Through drive**[3] **(for mounting options, see page** page 36) | | | **250** | **355** | **500** | |
|---|---|---|---|---|---|---|---|
| 12 | With through-drive shaft, without hub, without intermediate flange, closed with cover | | | ● | ● | ● | **99** |
| | With through drive for mounting a second unit | | | | | | |
| | Flange ISO 3019-2 (metric) | Hub for splined shaft DIN 5480 | | | | | |
| | 125, 4-hole | W32×2×14x9g | | ○ | ● | ● | **31**[4] |
| | 140, 4-hole | W40×2×18x9g | | ○ | ○ | ● | **33**[4] |
| | 160, 4-hole | W50×2×24x9g | | ● | ● | ● | **34**[4] |
| | 224, 4-hole | W60×2×28x9g | | ● | ○ | ● | **35** |
| | 224, 4-hole | W70×3×22x9g | | – | ● | ● | **77** |
| | 315, 8-hole | W80×3×25x9g | | – | – | ● | **43** |
| | 400, 8-hole | W90×3×28x9g | | – | – | – | **76**[4] |
| | Flange ISO 3019-2 (metric) | Hub for splined shaft SAE J744 | | | | | |
| | 80, 2-hole | 3/4 in | (19-4) | ● | ● | ● | **B2**[4] |
| | 100, 2-hole | 7/8 in | (22-4) | ● | ● | ● | **B3**[4] |
| | 100, 2-hole | 1 in | (25-4) | ● | ● | ● | **B4**[4] |
| | 125, 4-hole | 1 in | (25-4) | ○ | ○ | ○ | **E1**[4] |
| | 125, 2-hole | 1 1/4 in | (32-4) | ● | ● | ● | **B5**[4] |
| | 160, 4-hole | 1 1/4 in | (32-4) | ○ | ○ | ○ | **B8**[4] |
| | 125, 2-hole | 1 1/2 in | (38-4) | ● | ● | ● | **B6**[4] |
| | 180, 4-hole | 1 1/2 in | (38-4) | ○ | ○ | ○ | **B9**[4] |
| | 180, 4-hole | 1 3/4 in | (44-4) | ○ | ○ | ○ | **B7**[4] |
| | Flange SAE J744 | Hub for splined shaft SAE J744 | | | | | |
| | 82-2 (A) | 5/8 in | (16-4) | ● | ● | ● | **01**[4] |
| | 82-2 (A) | 3/4 in | (19-4) | ○ | ● | ● | **52**[4] |
| | 101-2 (B) | 7/8 in | (22-4) | ● | ● | ● | **68**[4] |
| | 101-2 (B) | 1 in | (25-4) | ○ | ● | ● | **04**[4] |
| | 127-2 (C) | 1 1/4 in | (32-4) | ● | ● | ● | **07**[4] |
| | 127-4 (C) | 1 1/4 in | (32-4) | ○ | ○ | ○ | **15**[4] |
| | 127-2 (C) | 1 1/2 in | (38-4) | ● | ● | ● | **24**[4] |
| | 152-4 (D) | 1 3/4 in | (44-4) | ● | ● | ● | **17**[4] |

**Valves**

| | | | | | |
|---|---|---|---|---|---|
| 13 | Boost, control pressure relief and flushing valve integrated;<br>pilot operated high-pressure relief valve integrated | ● | ● | ● | **4** |

**Filtration (see** page 46)

| | | | | | |
|---|---|---|---|---|---|
| 14 | Without filter | ● | ● | ● | **N** |
| | With threaded port for filter in the boost circuit | ● | ● | ● | **D** |

**Special version (optional)**

| | | | | | |
|---|---|---|---|---|---|
| 15 | Without special version | ● | ● | ● | |
| | With double shaft seal | ● | ● | – | **-S1111** |
| | With double shaft seal and active flushing | – | – | ● | **-S2145** |

● = Available ○ = On request – = Not available

**Notices**
Please observe the project planning notes on page 50!
For information on storing and preserving axial piston units, see Data Sheet 90312.

3) All attachment pumps must comply with the application-specific ATEX classification.
4) For Equipment Category II 2G Ex h IIC T4-T1 Gb X not available

## Hydraulic fluids

The A4CSG variable pump is designed for operation with HLP mineral oil according to DIN 51524.
See the following data sheets for application instructions and requirements for hydraulic fluids before the start of project planning:

- 90220: Hydraulic fluids based on mineral oils and related hydrocarbons

**Explanation regarding the selection of hydraulic fluid**
Selection of hydraulic fluid shall make sure that the operating viscosity in the operating temperature range is within the optimum range ($v_{opt}$; see selection diagram).

**Please note**
The leakage temperature which is influenced by pressure and rotational speed is always above the reservoir temperature.

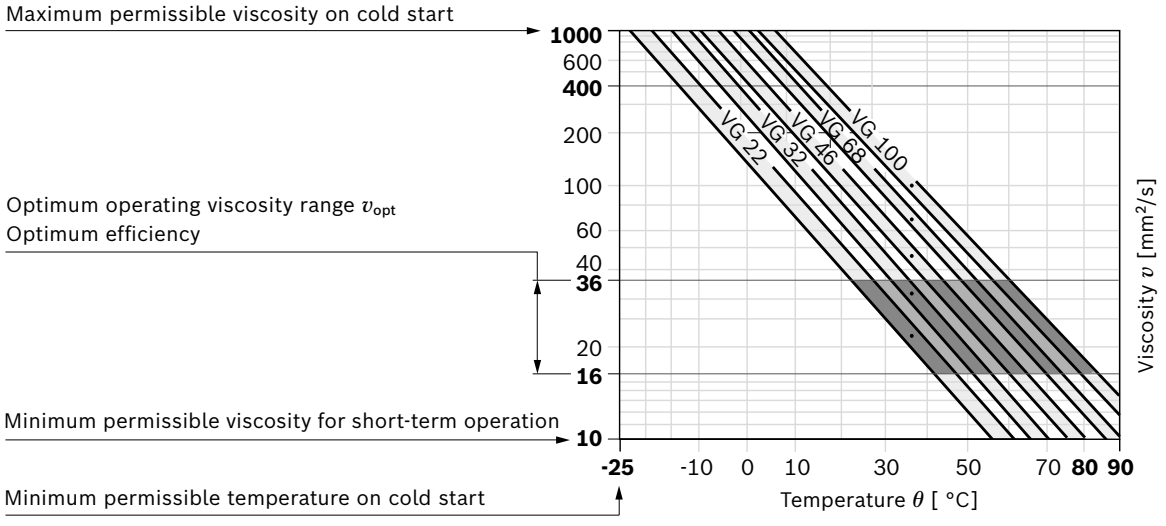
**Temperature class T4 and T3 as to ATEX:**
For safety instructions, see “Operating data monitoring – X parameters” on page 5.

**Ignition temperature of hydraulic fluid**
The pump is approved for temperature classes T4 to T1 according to DIN EN ISO 80079-36 and -37.
Under DIN EN ISO 80079-37, only hydraulic fluids with an ignition temperature at least 50 K above the maximum surface temperature of the approved temperature class should be used. Example: For the temperature class T4, the ignition temperature of the hydraulic fluid should be ≥ 185 °C.

**Viscosity and temperature of hydraulic fluids**

| | Viscosity | Temperature | Comment |
|---|---|---|---|
| Cold start | $v_{max}$ ≤ 1000 mm²/s | $\theta_{St}$ ≥ -25 °C | $t$ ≤ 3 min, without load ($p$ ≤ 50 bar)<br>Maximum permissible temperature difference between axial piston unit<br>and hydraulic fluid in the system maximum 25 K |
| Warm-up phase | $v$ = 1000 to 100 mm²/s | $\theta$ ≥ -25 °C | For $p_{nom}$, 0.5 × $n_{max}$ und $t$ ≤ 15 min |
| Continuous operation | $v$ = 100 to 16 mm²/s | T3<br>$\theta$ = -25 °C to +90 °C<br>T4<br>$\theta$ = -25 °C to +80 °C | Measured at the drain port<br>Observe the permissible temperature range of the shaft seal |
| | $v_{opt}$ = 36 to 16 mm²/s | | optimal operating viscosity and efficiency range |
| Short-term operation | $v_{min}$ ≤ 10 mm²/s | T3<br>$\theta$ = -25 °C to +90 °C<br>T4<br>$\theta$ = -25 °C to +80 °C | $t$ < 3 min, $p$ < 0.3 × $p_{nom}$ |

▼ **Selection diagram**



# Operating data monitoring – X parameters

**Safety instructions**
**Temperature class T3–T1**
**ATEX category II 3G Ex h IIC T3–T1 Gc X**
To observe the **maximum leakage temperature of 90 °C**, at least one of the following measures must be taken and checked regularly:

- Check the leakage temperature at port **T** or **R**(**L**) (maximum distance 30 cm)
- Check the maximum inlet temperature of 60 °C at the suction port
- Check a maximum inlet temperature that must be determined for the following operating points when commissioning:
  - Maximum working pressure and maximum possible flow
  - Maximum working pressure and minimum flow

Also monitor the reservoir level. Take appropriate action if the temperature exceeds limits.

When the minimum boost pressure of 8 bar is not reached, switch off the system immediately.

**ATEX category II 2G Ex h IIC T3–T1 Gb X**
To observe the **maximum leakage temperature of 90 °C**, the following measures must be taken:

- Install the supplied temperature sensor on the unit according to the specifications in chapter 7.4.9 of the instruction manual.
- Continuously monitor the leakage temperature of each pump with a temperature sensor on ports **T** or **R(L)** (maximum distance to port 30 cm).
- Connect both temperature sensors with a switching-off for the system at the limit temperature of 90 °C.
- This shut-off function should be tested during commissioning; see Chapter 8.1.1 of the instruction manual.
- Reservoir level monitoring is also required.

When the minimum boost pressure of 8 bar is not reached, switch off the system immediately.

**Operating conditions for T3 and T4**

| Size | T3 | T4 |
|---|---|---|
| 250 | ● | ● |
| 355 | ● | ● |
| 500 | ● | ● |
| 500...-S2145 | ● | ●[1)] |

1) Just up to maximum 3 bar case pressure

**Safety instructions**
**Temperature class T4**
The size 500...–S2145 is approved just up to 3 bar case pressure for temperature class T4.
**ATEX category II 3G Ex h IIC T4 Gc X**
To observe the **maximum leakage temperature of 80 °C**, at least one of the following measures must be taken and checked regularly:

- Check the leakage temperature at port **T** or **R**(**L**) (maximum distance 30 cm)
- Check the maximum inlet temperature of 50 °C at the suction port
- Check a maximum inlet temperature that must be determined for the following operating points when commissioning:
  - Maximum working pressure and maximum possible flow
  - Maximum working pressure and minimum flow

Also monitor the reservoir level. Take appropriate action if the temperature exceeds limits.

When the minimum boost pressure of 8 bar is not reached, switch off the system immediately.

**ATEX category II 2G Ex h IIC T4 Gb X**
To observe the **maximum leakage temperature of 80 °C**, the following measures must be taken:

- Install the supplied temperature sensor on the unit according to the specifications in chapter 7.4.9 of the instruction manual.
- Continuously monitor the leakage temperature of each pump with a temperature sensor on ports **T** or **R(L)** (maximum distance to port 30 cm).
- Connect both temperature sensors with a switching-off for the system at the limit temperature of 80°C.
- This shut-off function should be tested during commissioning; see Chapter 8.1.1 of the instruction manual.
- Reservoir level monitoring is also required.

When the minimum boost pressure of 8 bar is not reached, switch off the system immediately.

# Leakage temperature monitoring for ATEX category II 2G Ex h IIC T4-T1 Gb X

The temperature of the leakage is monitored by a sensor with measuring resistance PT100 EN 60751 of accuracy class B, which is supplied as loose part. The sensor must be installed in port $\mathbf{U}_1$ (cf. schematic and installation drawings on the following pages).

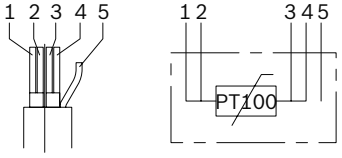
### Electrical data

Port on certified explosion-proof current circuits with the following peak values:

- $U_i$ = 30 V
- $P_i$ = 750 mW

The inner inductivity and capacity are small enough to be neglected.

### Electric port, sensor




Cable Sensor

| Number | Color | Port |
|---|---|---|
| 1 | white | left |
| 2 | yellow | |
| 3 | Brown | right |
| 4 | green | |
| 5 | Black | shielding |

### Notice – evaluation electronics for temperature monitoring

The necessary evaluation electronics are not included in the scope of delivery. The sensor must be operated via an explosion-proof current circuit. The protection class must be at least that of the sensor (see “Information on explosion protection” on page 1).

## Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.
A cleanliness level of at least 20/18/15 under ISO 4406 should be maintained.
At a hydraulic fluid viscosity of less than 10 mm²/s (e.g. due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 under ISO 4406 is required.
For example, viscosity is 10 mm²/s at:

- HLP 32 a temperature of 73 °C
- HLP 46 a temperature of 85 °C

A "threaded port for filter in the boost circuit" is optionally available with order designation **D** .
The filter elements must comply with the application-related ATEX classification. They are not part of the delivery.

### Bearing flushing

Bearing flushing is required for a safe, continuous operation under the following operating conditions:

- When installed vertically (drive shaft up) for lubricating the front bearing and shaft seal
- When operated at temperature and viscosity limits when using mineral oil
- For above-reservoir installation

Port "**U**" at the front flange of the variable displacement pump is used for bearing flushing. The flushing fluid flows through the front bearing and discharges with the pump drain at the drain port.
The following flushing flows are recommended depending on size:

| Size | | | 250 | 355 | 500 |
|---|---|---|---|---|---|
| recommended flushing flow | $q_{sp}$ | l/min | 10 | 15 | 20 |

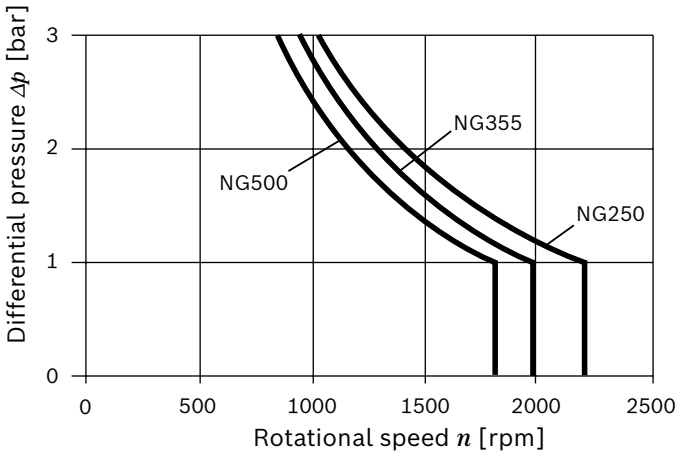
For the flushing flows stated, there is a pressure differential of approximately 3 bar between the port "**U**" (including fitting) and the drain chamber.

**Notice about bearing flushing for series 30**
When using bearing flushing on port **U**, the throttle screw in port **U** must be turned in to the end stop.

## Shaft seal

### Permissible pressure load

The service life of the shaft seal ring is affected by the rotational speed of the axial piston unit and the leakage pressure (case pressure). Momentary (t < 0.1 s) pressure peaks of up to 6 bar are permitted. The service life of the shaft seal decreases with increasing frequency of pressure peaks and increasing mean differential pressure.
The pressure in the housing must be equal to or greater than the ambient pressure.




| Case pressure at port K2, K3, R(L), T | | |
|---|---|---|
| Maximum pressure static $p_{L\,max}$ | 3 bar[1)] | |
| Maximum pressure dynamic $p_{L\,max}$ | 5 bar[2)] | |
| Pressure peaks $p_{L\,peak}$ | 6 bar | t < 0.1 s |

**Notice**
At case pressure 0 to 3 bar without special version.
At case pressure 1 to 5 bar with special version S1111 and S2145

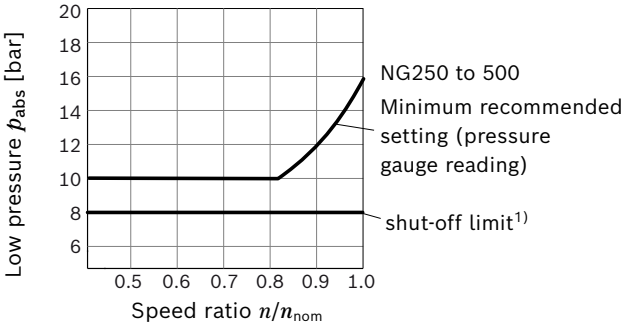
- For size 500 and temperature class T4 just up to maximum 3 bar case pressure.

1) Permissible differential pressure on shaft seal (housing pressure to ambient pressure), not to exceed $p_{L\,max.}$ A drain line to the reservoir is required.
2) Only with double shaft seal, see type code position 15

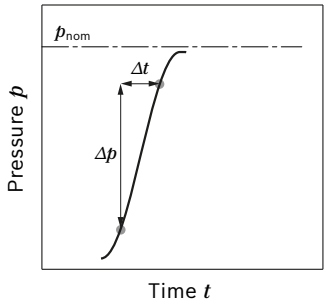
## Working pressure range

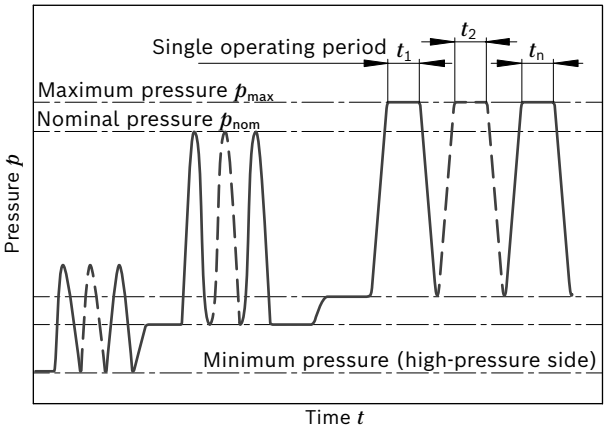
| **Pressure at working port A or B** | | | **Definition** |
|---|---|---|---|
| Nominal pressure $p_{nom}$ | | 350 bar | The nominal pressure corresponds to the maximum design pressure. |
| Maximum pressure $p_{max}$ | | 400 bar | The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period. |
| Single operating period | | 1 s | |
| Total operating period | | 300 h | |
| Minimum pressure (high-pressure side) | | 15 bar | Minimum pressure on the high-pressure side (**A** or **B**) required to prevent damage to the axial piston unit. |
| Minimum pressure (low-pressure side) | | Speed-related (see diagram) | Minimum pressure on the low-pressure side (**A** or **B**) required to prevent damage to the axial piston unit. The low pressure is applied at port **$M_{K4}$** when the flushing slide is deflected. |
| Rate of pressure change $R_{A\,max}$ | | 16000bar/s | Maximum permissible pressure build-up and reduction speed during a pressure change across the entire pressure range. |
| **Boost pressure** | | | |
| Minimum boost pressure $p_{Sp}$ (at $n_{nom}$) | | 16 bar | NG250 to 500 series 30 |
| Maximum static boost pressure $p_{Sp\,max}$ | | 30 bar | Measuring port: **$M_{K4}$** (Please contact us for multiple coupled pumps.) |
| Permissible pressure peaks in boost pressure | minimum | 4 bar | |
| | maximum | 40 bar | |
| **Pressure at suction port S (version with integrated boost pump)** | | | |
| Minimum pressure $p_{S\,min}$ | | ≥0.8 bar absolute | Minimum pressure at suction port **S** (inlet) that is required in order to avoid damage to the axial piston unit. |
| Maximum pressure $p_{S\,max}$ | | 30 bar abs. | |
| **Control pressure for EP and HD control** | | | |
| Minimum required control pressure $p_{St\,min}$ | | Double boost pressure at NG 355 +5 bar | Measuring port **$M_1$** (small stroking chamber) |

▼ **Required low pressure depending on the Speed ratios**




▼ **Rate of pressure change**




Total operating period = $t_1 + t_2 + ... + t_n$

**Notice**
Working pressure range applies when using hydraulic fluids based on mineral oils.
All assembled parts must meet the ATEX classification for the application in question.

1) See also "Monitoring the operational data" on page 5

# Technical data

| Size | | NG | | 250 | 355 | 500 |
|---|---|---|---|---|---|---|
| Geometric displacement, per revolution | Variable pump | $V_{g\,max}$ | $cm^3$ | 250 | 355 | 500 |
| | Integrated boost pump | $V_{g\,Sp}$ | $cm^3$ | 63 | 80 | 98 |
| Rotational speed[1] | maximum at $V_{g\,max}$ | $n_{nom}$ | rpm | 1800 | 1800 | 1800 |
| | minimum[2] | $n_{min}$ | rpm | 800 | 800 | 800 |
| Flow (variable pump) with $V_{g\,max}$ and | $n_{max}$ | $q_v$ | L/min | 450 | 638 | 900 |
| | $n_E$ = 1500 rpm | $q_{VE}$ | L/min | 375 | 532 | 750 |
| Power[3] at $V_{g\,max}$, Δp = 350 bar and | $n_{max}$ | $P$ | kW | 262 | 373 | 525 |
| | $n_E$ = 1500 rpm | $P_E$ | kW | 219 | 311 | 438 |
| Torque[3] at $V_{g\,max}$ and | $\Delta p$ = 350 bar | $T$ | Nm | 1391 | 1976 | 2783 |
| | $\Delta p$ = 100 bar | $T$ | Nm | 398 | 564 | 795 |
| Rotary stiffness of drive shaft | P | $c$ | kNm/rad | 527 | 800 | 1145 |
| | Z | $c$ | kNm/rad | 543 | 770 | 1209 |
| Moment of inertia of the rotary group | | $J_{TW}$ | $kgm^2$ | 0.0959 | 0.19 | 0.3325 |
| Maximum angular acceleration[4] | | $\alpha$ | $rad/s^2$ | 775 | 600 | 540 |
| Case volume | | $V$ | L | 10 | 8 | 14 |
| Weight (pump with EP control and integrated boost pump without filter) approx. | | $m$ | kg | 260 | 275 | 390 |

| **Determining the operating characteristics** | | | | | | |
|---|---|---|---|---|---|---|
| Flow | $q_v$ | = | $\frac{V_g \times n \times \eta_v}{1000}$ | | | [l/min] |
| Torque | $T$ | = | $\frac{V_g \times \Delta p}{20 \times \pi \times \eta_{hm}}$ | | | [Nm] |
| Power | $P$ | = | $\frac{2 \pi \times T \times n}{60000}$ | = | $\frac{q_v \times \Delta p}{600 \times \eta_t}$ | [kW] |

**Key**

$V_g$ Displacement per revolution [$cm^3$]
$\Delta p$ Differential pressure [bar]
$n$ Rotational speed [rpm]
$\eta_v$ Volumetric efficiency
$\eta_{hm}$ Hydraulic-mechanical efficiency
$\eta_t$ Total efficiency ($\eta_t = \eta_v \times \eta_{hm}$)

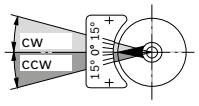
**Notices**

- Theoretical values, without efficiency and tolerances; values rounded
- Exceeding the maximum/dropping below the minimum values can lead to a loss of function, reduction in service life or destruction of the axial piston unit, thereby nullifying explosion protection. We recommend checking loads through tests or calculation/simulation and comparing them with the permissible values.

**Flow direction**

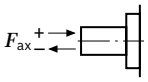
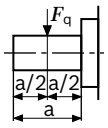
| Direction of rotation | | Swiveling range* |
|---|---|---|
| right | left | |
| **B** to **A** | **A** to **B** | clockwise |
| **A** to **B** | **B** to **A** | counter-clockwise |

* cf. swivel angle indicator




1) The values are applicable:
   – for the optimum viscosity range from $\nu_{opt}$ = 36 to 16 $mm^2/s$
   – with hydraulic fluid on the basis of mineral oils
2) Lower values on request
3) Without boost pump
4) The data are valid for values between the minimum required and maximum permissible rotational speed.
   Valid for external excitation (e. g. diesel engine 2 to 8 times rotary frequency; cardan shaft twice the rotary frequency).
   The limit value is only valid for a single pump.
   The load capacity of the connection parts must be considered.

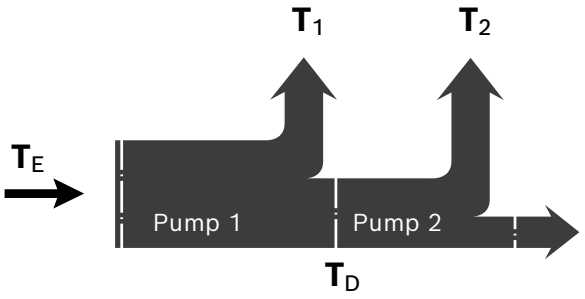
## Permissible radial and axial loading of the drive shaft

| Size | | NG | | 250 | 355 | 500 |
|---|---|---|---|---|---|---|
| Permissible axial force |  | + $F_{ax\ max}$ | N | 1800 | 2000 | 2000 |
| | | − $F_{ax\ max}$ | N | 1800 | 2000 | 2000 |
| Permissible radial force |  | $F_{q\ max}$ | N | 2000 | 2200 | 2500 |

## Permissible input and through drive torques

| Size | NG | | 250 | 355 | 500 |
|---|---|---|---|---|---|
| Torque at $V_{g\,max}$ and $\Delta_p$ = 350 bar[1] | $T_{max}$ | Nm | 1391 | 1976 | 2783 |
| Input torque for drive shaft, maximum[2] | | | | | |
| P DIN 6885 | $T_{E\,max}$ | Nm | 2300 | 3557 | 5200 |
| | ∅ | mm | 60 | 70 | 80 |
| Z DIN 5480 | $T_{E\,max}$ | Nm | 2782 | 3952 | 5566 |
| | ∅ | in | 60 | 70 | 80 |
| Maximum through drive torque ($T_{max} = T_{D\,max}$) | | | | | |
| | $T_{D\,max}$ | Nm | 1391 | 1976 | 2783 |

▼ **Distribution of torques**




| | | | |
|---|---|---|---|
| Torque at 1st Pump | $T_1$ | | |
| Torque at 2nd Pump | $T_2$ | | |
| Torque at 3rd Pump | $T_3$ | | |
| Input torque | $T_E$ | = | $T_1 + T_2 + T_3$ |
| | $T_E$ | < | $T_{E\,max}$ |
| Through-drive torque | $T_D$ | = | $T_2 + T_3$ |
| | $T_D$ | < | $T_{D\,max}$ |

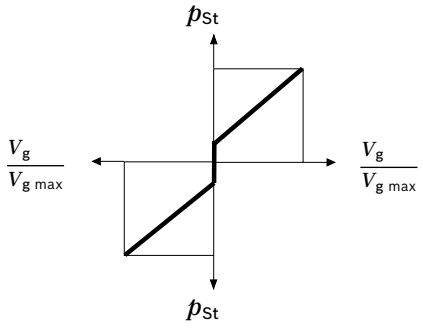
1) Efficiency not considered
2) For drive shafts free of radial force

# HD – hydraulic control, pilot-pressure related

**HD – Proportional control, hydraulic, pilot-pressure related**
(see data sheet 92080)
(HD1T and HD1U is not available)
Stepless adjustment of the pump displacement according to the pilot pressure. The control is proportional to the specified pilot pressure setpoint value (difference between **X1**, **X2**).
For version **F** with integrated boost pump, the control is supplied internally with the control pressure from the boost circuit. This saves using a separate control pressure pump.

Optional:
- Control characteristics (HD1, HD2, HD3)
- Pressure control (HD.A, HD.B, HD.D)
- Remote pressure control (HD.GA, HD.GB, HD.G)
- Power control (HD1P)

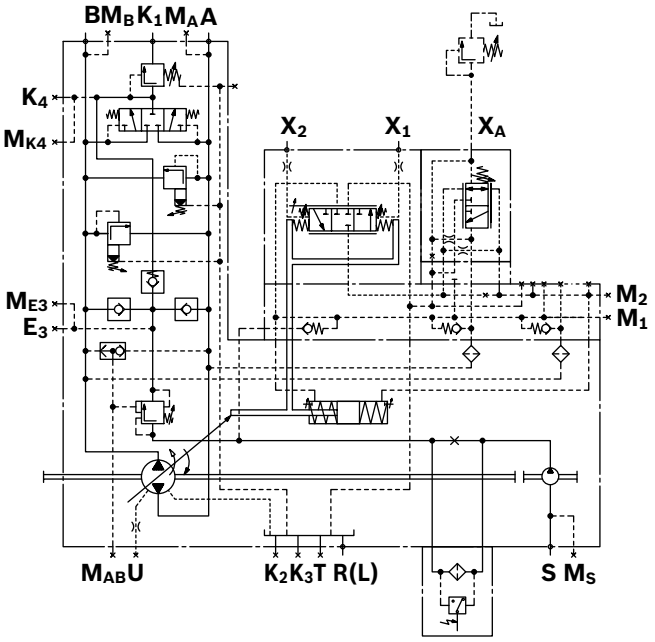
▼ **Characteristic curve**




**Notice**
The spring feedback in the controller and pump control spring centering are no safety devices.
The controller can stick in an undefined position due to internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the flow in the axial piston unit will no longer respond correctly to the operator's specifications.
Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop). If necessary, make sure these are appropriately implemented.

▼ **Circuit diagram**

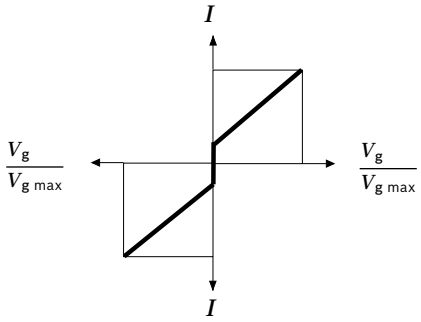
**Example: Standard A4CSG 500 HD1...F..4M**



# EP – Electrohydraulic control with proportional solenoids

**EP – Proportional control, electrohydraulic**
(see data sheet 92084)
The EP control adjusts the pump displacement proportionally to the current at the solenoid. Current-regulated control units with pulse width modulation are recommended for controlling the solenoids.
For version **F** with integrated boost pump, the control is supplied internally with the control pressure from the boost circuit. This saves using a separate control pressure pump.
The proportional solenoids should not be operated with a current higher than the rated current. In addition, each proportional solenoid must be protected by a fuse corresponding to its rated current (maximum 3 $I_{rated}$ in accordance with IEC/EN 60127-2) or a motor protection switch with short circuit and thermal fast-triggering mechanism (set to rated current).

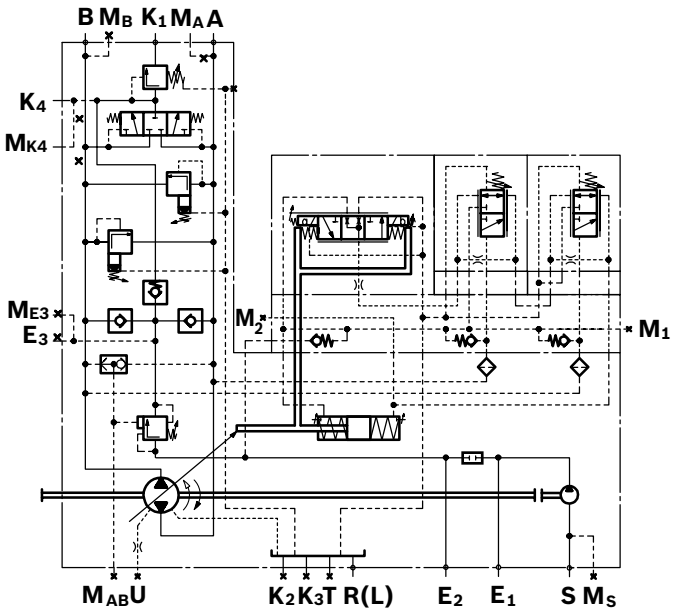
▼ **Characteristic curve**




**Notice**
The spring feedback in the controller and pump control spring centering are no safety devices.
The controller can stick in an undefined position due to internal contamination (contaminated hydraulic fluid, abrasion or residual contamination from system components). As a result, the flow in the axial piston unit will no longer respond correctly to the operator's specifications.
Check whether the application on your machine requires additional safety measures to bring the driven consumer to a safe position (immediate stop). If necessary, make sure these are appropriately implemented.

▼ **Circuit diagram**

**Example: Standard A4CSG 500 EPD...F..4D**




The breaking capacity of this fuse should be equal to or greater than the possible short circuit current of the supply voltage source.

Optional:
- Pressure control (EPA, EPB, EPD)
- Remote pressure control (EPGA, EPGB, EPG)

**Ground connection**
All solenoids and pumps should have a ground connection. For ground connection points, refer to the relevant installation drawing in the chapter "Dimensions".
Current-regulated control units with PWM signal (pulse width modulation) are recommended for controlling the solenoids. These must comply with the application-related ATEX classification.

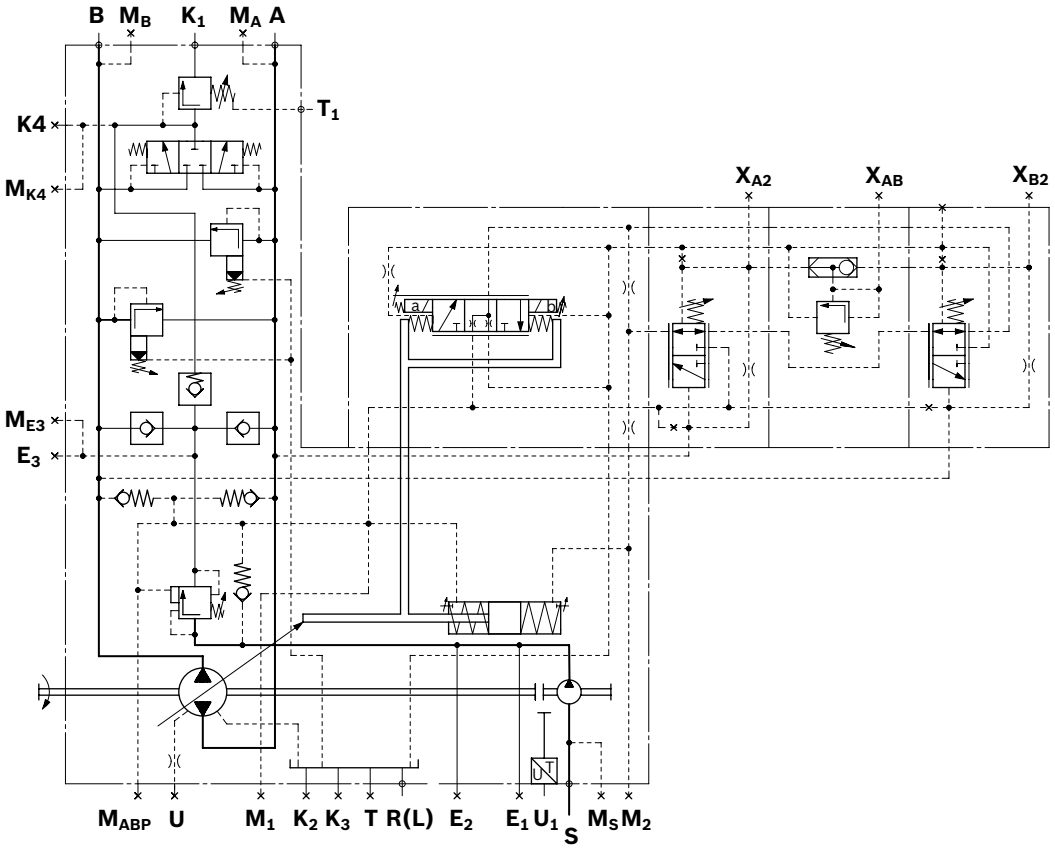
## Solenoid technical data

Axial piston units come with the following solenoids.

| **Size** | | | **250** | **355** | **500** |
|---|---|---|---|---|---|
| Proportional solenoid type | | | GRCE 063 AGD G01 | GRCE 063 AGD G01 | GRCE 063 AGD G02 |
| Version | | | 001 | 001 | 001 |
| Characterization | | | R913030728 – 24 VDC | R913030728 – 24 VDC | R913030730 – 24 VDC |
| Tube | | | FHTP 062 924251 or MSM 924251-P | FHTP 062 924251 or MSM 924251-P | FHTP 062 924299 or MSM 924299-P |
| Mounting nut | | | | MSM 472794 | |
| O-ring | | | | 31 x 2.5 – 70Sh A NBR | |
| Solenoid body – variant | | | | FHMPE 063 926635 – 001 | |
| Resistance | $R_{20}$ | *Ω* | | 20.2 | |
| Rated current | $I_{nom}$ | *A DC* | | 0.800 | |
| Maximum current control range | $I_G$ = 1.1 x $I_{nom}$ | *A* | | 0 to 0.880 | |
| Rated voltage | $U_R$ | *V* | | 24.2 | |
| Limit power | $P_L$ | *W* | | 24.9 | |
| Waviness | W | % | | 48 | |
| Duty cycle | ED | | | S1 (100 %) | |
| Ambient temperature | $T_A$ | °C | | -30 to +65 | |
| Temperature class | | | | T4 | |
| Supply | | | | Current source must be suitable for a protection class III appliance (extra-low protective voltage). | |
| Connection line | | | | FL4G11Y 2 X 1.5 $mm^2$ | |
| Diode for limiting disconnect overvoltage | | | | Internally molded 1.5 KE68CA maximum 90 V | |
| Disconnect overvoltage | | | | Maximum 90 V | |
| Maximum switching frequency | | | | 4 switches/s | |
| Explosion protection according to RL 94/9/EC and IECEx | | | | CE 0637 Ex II 2G Ex mb IIC T4 Gb<br>II 2D Ex mb IIIC T130 °C Db | |
| In compliance with standards | | | | EN 60079-0: 2012 EN 60079-18: 2009<br>IEC 60079-0: 2011 IEC 60079-18: 2009 | |
| EC type examination certificate | | | | IBExU 13 ATEX 1040 X | |
| IECEx certificate of conformity | | | | IECEx IBE 13.0017 X | |
| IP rating per IEC/EN 60529 | | | | Minimum IP67 | |
| Appliance protection class according to DIN VDE 0580 | | | | III | |
| EC declaration of conformity | | | DC013315-001 | DC013315-001 | DC013316-001 |

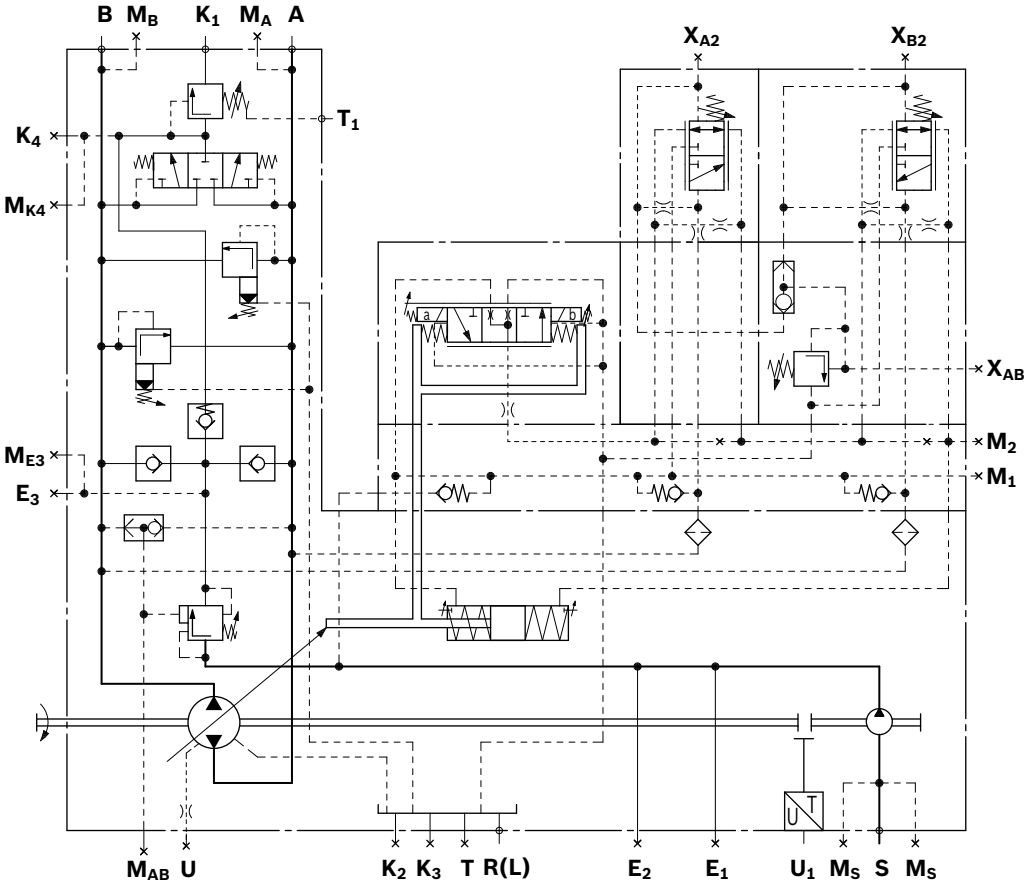
## Circuit diagrams

▼ **Circuit diagram A4CSG 250, 355...EP....ATEX category II 2G Ex h IIC T4-T1 Gb X**



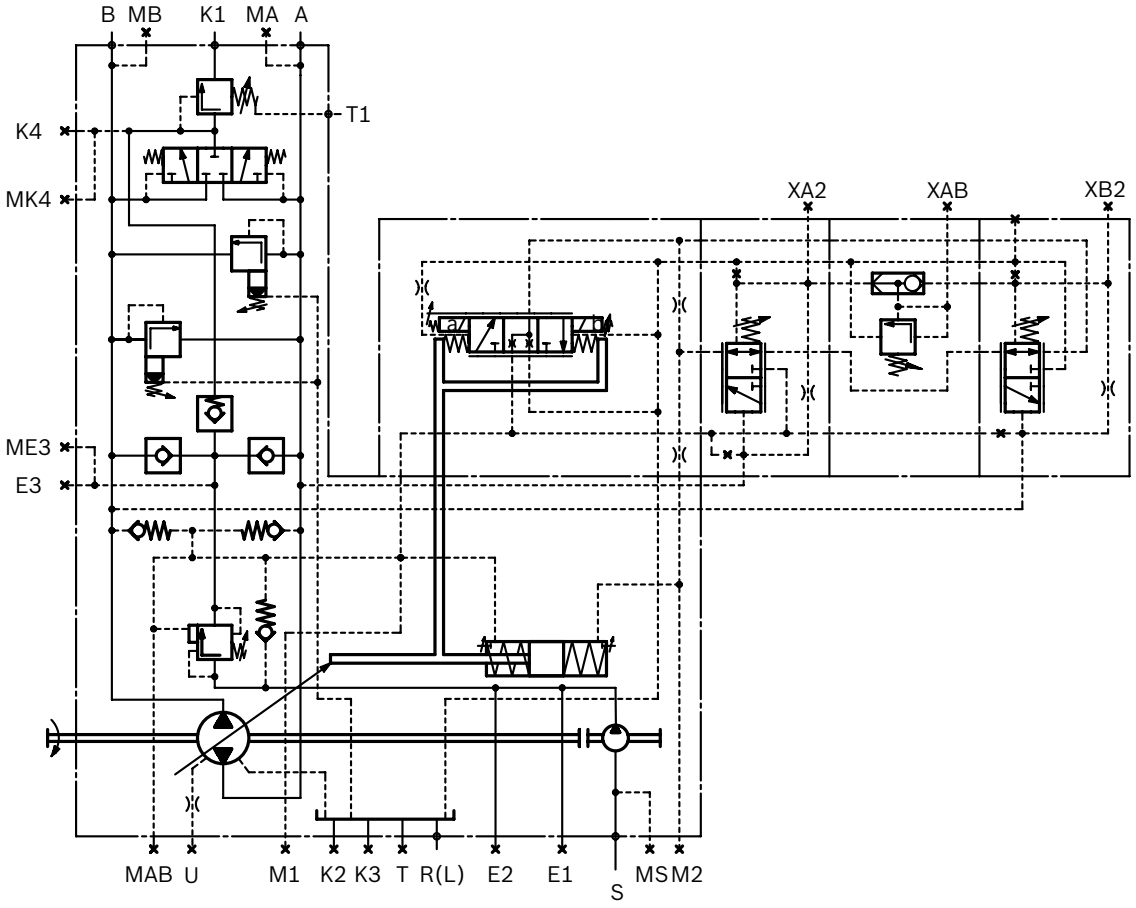

| Ports | |
|---|---|
| **A, B** | Working port (high-pressure series) |
| **S** | Suction port |
| **MS** | Suction pressure measuring |
| **$K_1$** | Flushing port |
| **$K_2$, $K_3$** | Flushing port |
| **MA, MB, MABP** | Working pressure measurement |
| **M1, M2** | Control pressure measuring |
| **E1** | Filter, supply |
| **E2** | Filter, return |
| **E3** | Boost port (external) |
| **$M_{E3}$** | Measuring boost pressure |
| **$K_4$** | Accumulator port |
| **$M_{K4}$** | Measuring flushing pressure |
| **R(L)** | Fluid filling, air bleeding |
| **T** | Fluid drain |
| **$T_1$** | Pressure relief valve relief port |
| **U** | Flushing port (bearing flushing) |
| **$U_1$** | Measured value transducer, temperature |
| **$X_{A2}$, $X_{B2}$, $X_{AB}$** | Pilot pressure port for pressure controller |

▼ **A4CSG 500...EP circuit diagram.... ATEX category II 2G Ex h IIC T4-T1 Gb X**



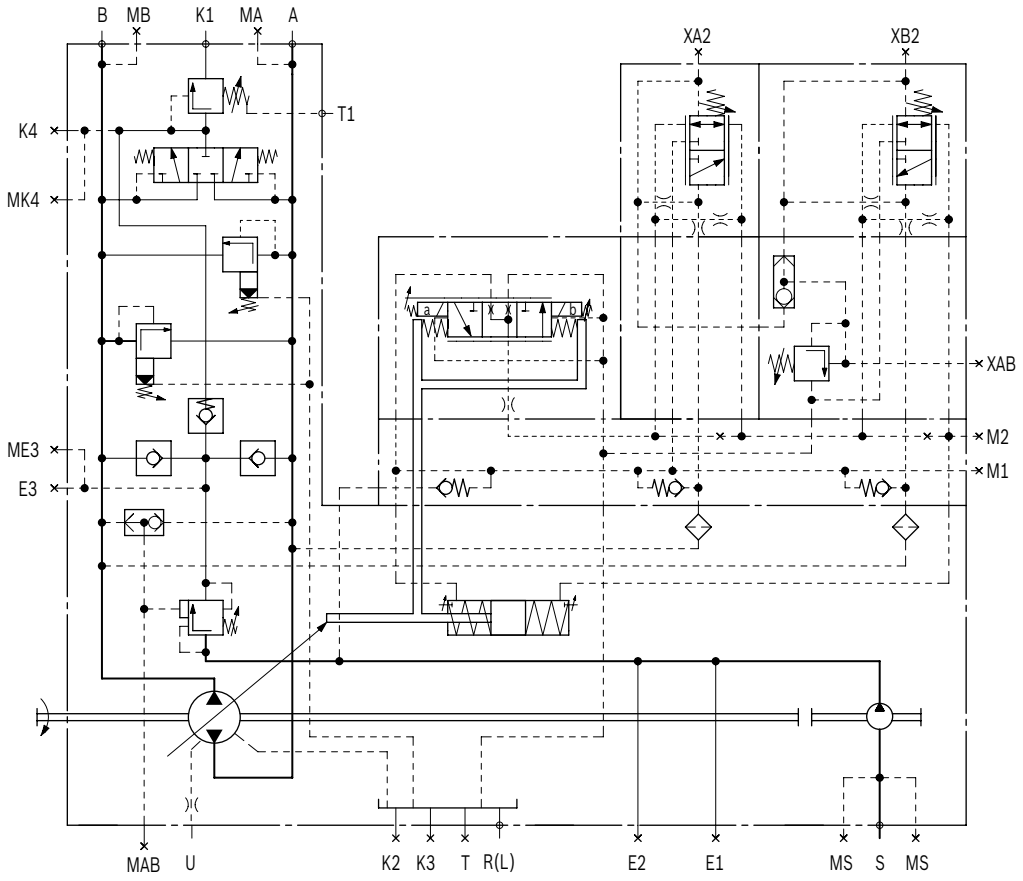

| Ports | |
|---|---|
| **A, B** | Working port (high-pressure series) |
| **S** | Suction port |
| **MS** | Suction pressure measuring |
| **$K_1$** | Flushing port |
| **$K_2$, $K_3$** | Flushing port |
| **MA, MB, MAB** | Working pressure measurement |
| **M1, M2** | Control pressure measuring |
| **E1** | Filter, supply |
| **E2** | Filter, return |
| **E3** | Boost port (external) |
| **$M_{E3}$** | Measuring boost pressure |
| **$K_4$** | Accumulator port |
| **$M_{K4}$** | Measuring flushing pressure |
| **R(L)** | Fluid filling, air bleeding |
| **T** | Fluid drain |
| **$T_1$** | Pressure relief valve relief port |
| **U** | Flushing port (bearing flushing) |
| **$U_1$** | Measured value transducer, temperature |
| **$X_{A2}$, $X_{B2}$, $X_{AB}$** | Pilot pressure port for pressure controller |

▼ **Circuit diagram A4CSG 250, 355 EP....ATEX category II 3G Ex h IIC T4-T1 Gc X**




| Ports | |
|---|---|
| **A, B** | Working port (high-pressure series) |
| **S** | Suction port |
| **MS** | Suction pressure measuring |
| **$K_1$** | Flushing port |
| **$K_2$, $K_3$** | Flushing port |
| **MA, MB, MAB** | Working pressure measurement |
| **M1, M2** | Control pressure measuring |
| **E1** | Filter, supply |
| **E2** | Filter, return |
| **E3** | Boost port (external) |
| **$M_{E3}$** | Measuring boost pressure |
| **$K_4$** | Accumulator port |
| **$M_{K4}$** | Measuring flushing pressure |
| **R(L)** | Fluid filling, air bleeding |
| **T** | Fluid drain |
| **$T_1$** | Pressure relief valve relief port |
| **U** | Flushing port (bearing flushing) |
| **$X_{A2}$, $X_{B2}$, $X_{AB}$** | Pilot pressure port for pressure controller |

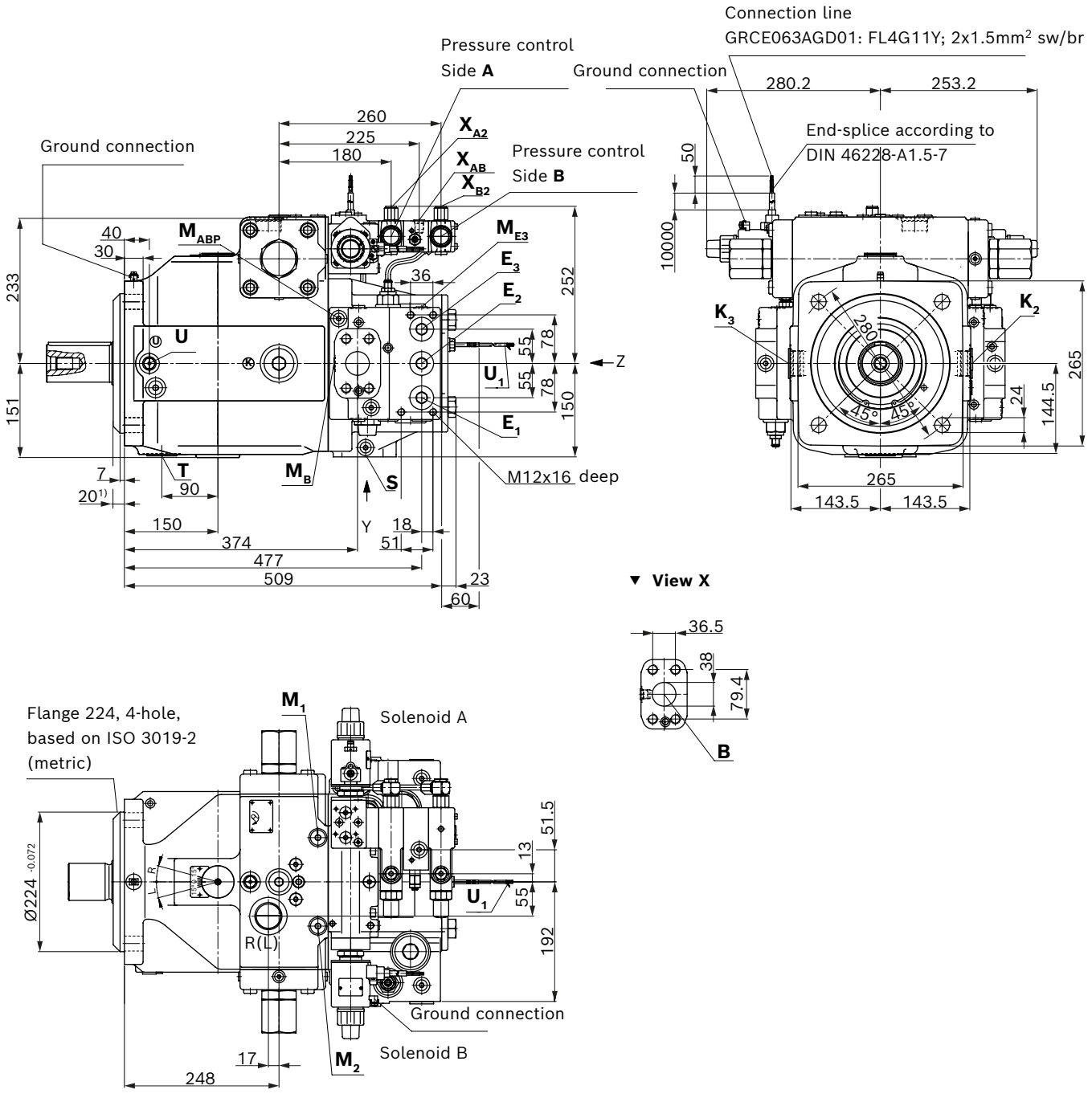
▼ **A4CSG 500...EP circuit diagram.... ATEX category II 3G Ex h IIC T4-T1 Gc X**




| **Ports** | |
|---|---|
| **A, B** | Working port (high-pressure series) |
| **S** | Suction port |
| **MS** | Suction pressure measuring |
| **$K_1$** | Flushing port |
| **$K_2$, $K_3$** | Flushing port |
| **MA, MB, MAB** | Working pressure measurement |
| **M1, M2** | Control pressure measuring |
| **E1** | Filter, supply |
| **E2** | Filter, return |
| **E3** | Boost port (external) |
| **$M_{E3}$** | Measuring boost pressure |
| **$K_4$** | Accumulator port |
| **$M_{K4}$** | Measuring flushing pressure |
| **R(L)** | Fluid filling, air bleeding |
| **T** | Fluid drain |
| **$T_1$** | Pressure relief valve relief port |
| **U** | Flushing port (bearing flushing) |
| **$X_{A2}$, $X_{B2}$, $X_{AB}$** | Pilot pressure port for pressure controller |

# Dimensions, size 250...-S1111 ATEX category II 2G Ex h IIC T4-T1 Gb X

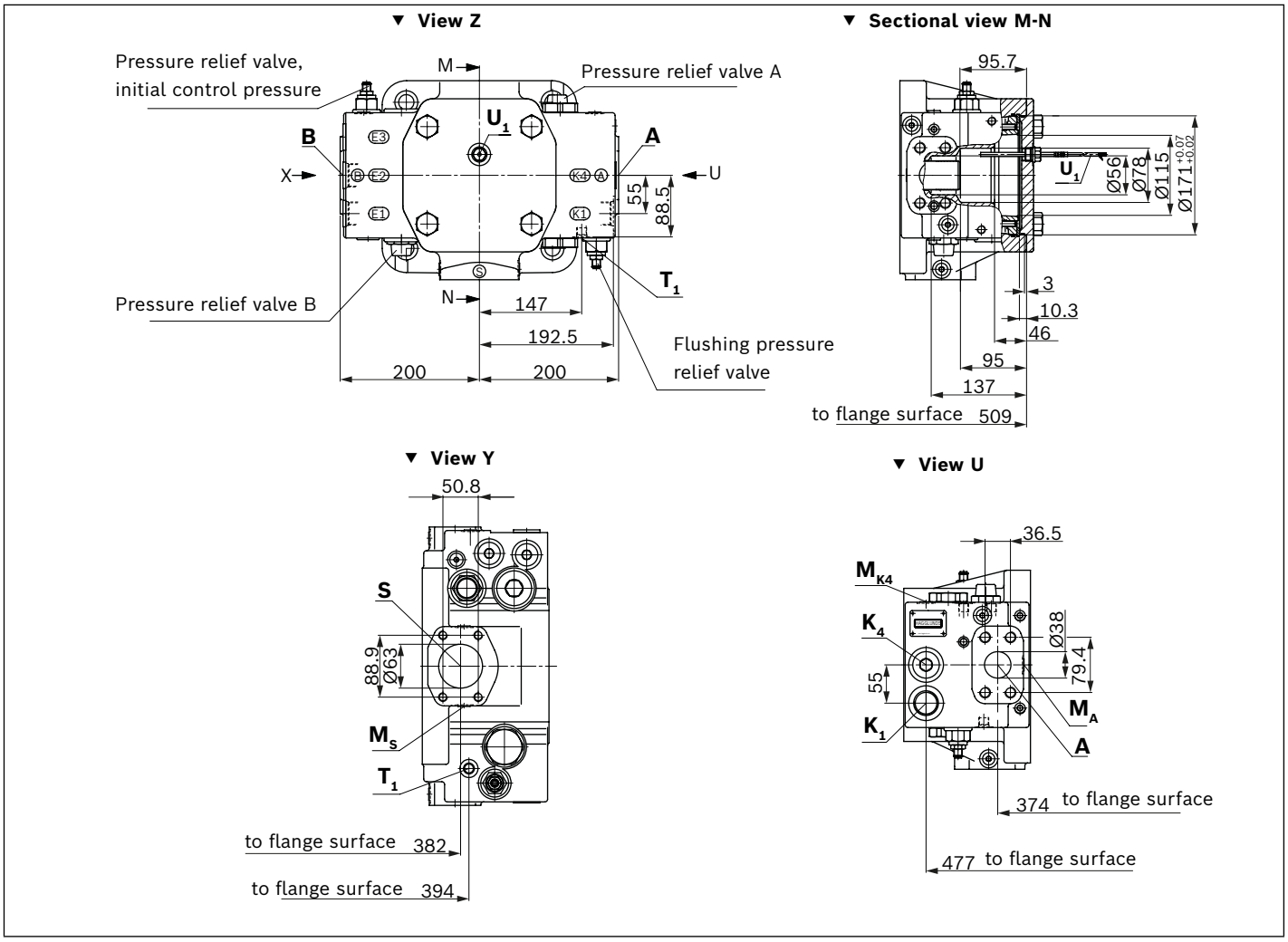
### Remote-controlled electrohydraulic control with proportional solenoid and pressure control




Connection table, see page 20

1) 10 mm shorter for version with single shaft seal

**Remote-controlled electrohydraulic control with proportional solenoid and pressure control**



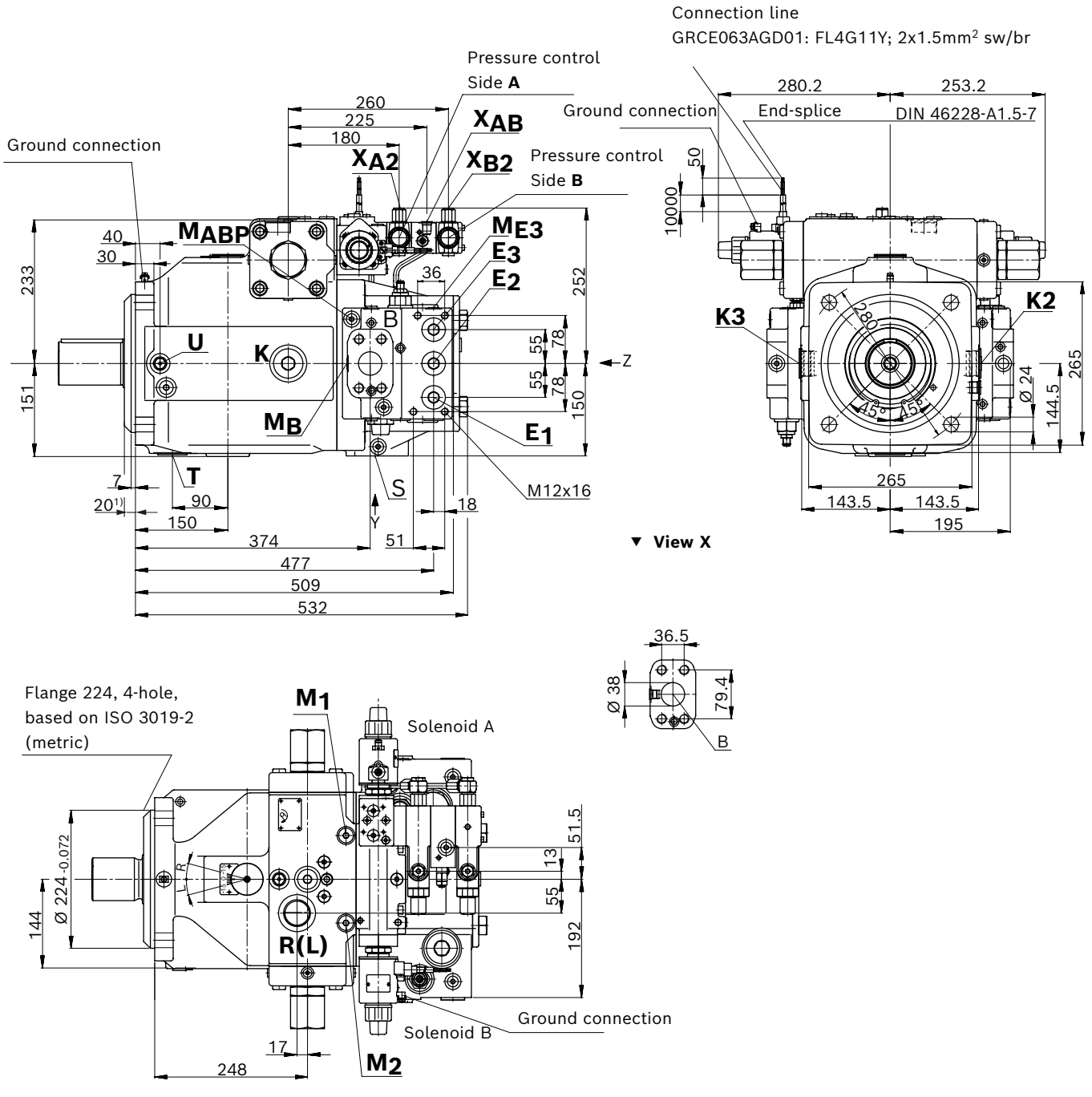
| Ports | | Standard | Size | $p_{max\ abs}$ [bar][1] | State[5] |
|---|---|---|---|---|---|
| **A, B** | Working line (high-pressure series) | SAE J518[2] | 1 1/2 in | 400 | O |
| | Fastening thread A/B | DIN 13 | M16 × 2; 21 deep | | |
| **S** | Suction port (standard pressure series) | SAE J518[2] | 2 1/2 in | 30 | O |
| | Fastening thread S | DIN 13 | M12 × 1.75; 17 deep | | |
| **$M_A$, $M_B$, $M_{ABP}$** | Measuring working pressure A/B | DIN 3852 | M14 × 1.5; 12 deep | 400 | X |
| **$M_S$** | Measuring suction | DIN 3852 | M14 × 1.5; 12 deep | 30 | X |
| **T** | Fluid drain | DIN 3852[3] | M42 × 2; 20 deep | 4 | X[4] |
| **$E_1$** | Filter, supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$E_2$** | Filter, return | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$K_1$** | Flushing port | DIN 3852 | M33 × 2; 18 deep | 5 | O |
| **$K_2$, $K_3$** | Fluid filling + air bleeding | DIN 3852[3] | M42 × 2; 20 deep | 4 | X[4] |
| **R(L)** | Return flow (drain port) | | | 4 | O[4] |
| **U** | Bearing flushing | DIN 3852[3] | M14 × 1.5; 12 deep | 7 | X |
| **$E_3$** | Boost pressure supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{E3}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$K_4$** | Accumulator port | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{K4}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$M_1$, $M_2$** | Control pressure measuring | DIN 3852 | M18 × 1.5; 12 deep | 400 | X |
| **$X_{A2}$, $X_{B2}$, $X_{AB}$** | Pilot pressure, remote control pressure controller | DIN 3852 | M14 × 1.5; 12 deep | 350 | O |
| **$U_1$** | Measure value transducer, temperature[6] | | | | |

Drive shaft, see page 23

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
3) The countersink may be deeper than specified in the standard.
4) Depending on the installation position, T, $K_2$, $K_3$ or R(L) must be connected (see also from page 47)
5) O = Must be connected (comes plugged)
X = Plugged (in normal operation)
6) Temperature sensor must be installed.

# Dimensions, size 250...-S1111 ATEX category II 3G Ex h IIC T4-T1 Gc X

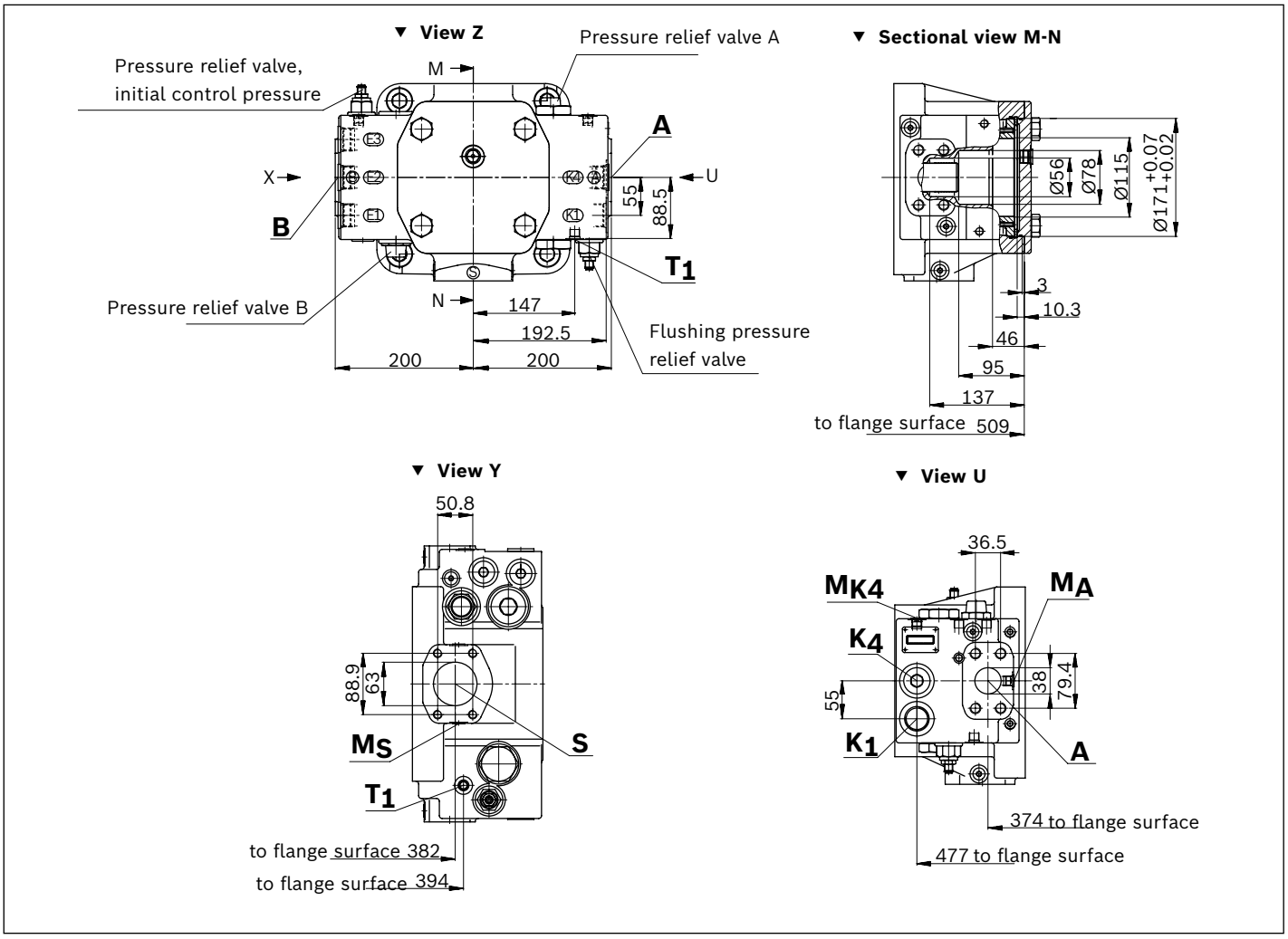
**Remote-controlled electrohydraulic control with proportional solenoid and pressure control**




Connection table, see page 23

1) 10 mm shorter for version with single shaft seal

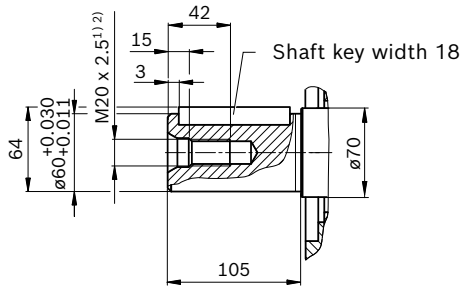
**Remote-controlled electrohydraulic control with proportional solenoid and pressure control**



## Drive shaft

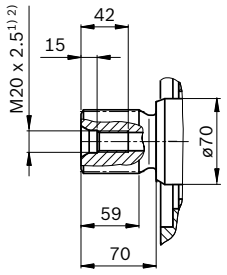
▼ **Parallel keyed shaft DIN 6885**

**P –** AS18x11x100




▼ **Splined shaft DIN 5480**

**Z** – W60x2x28x9g

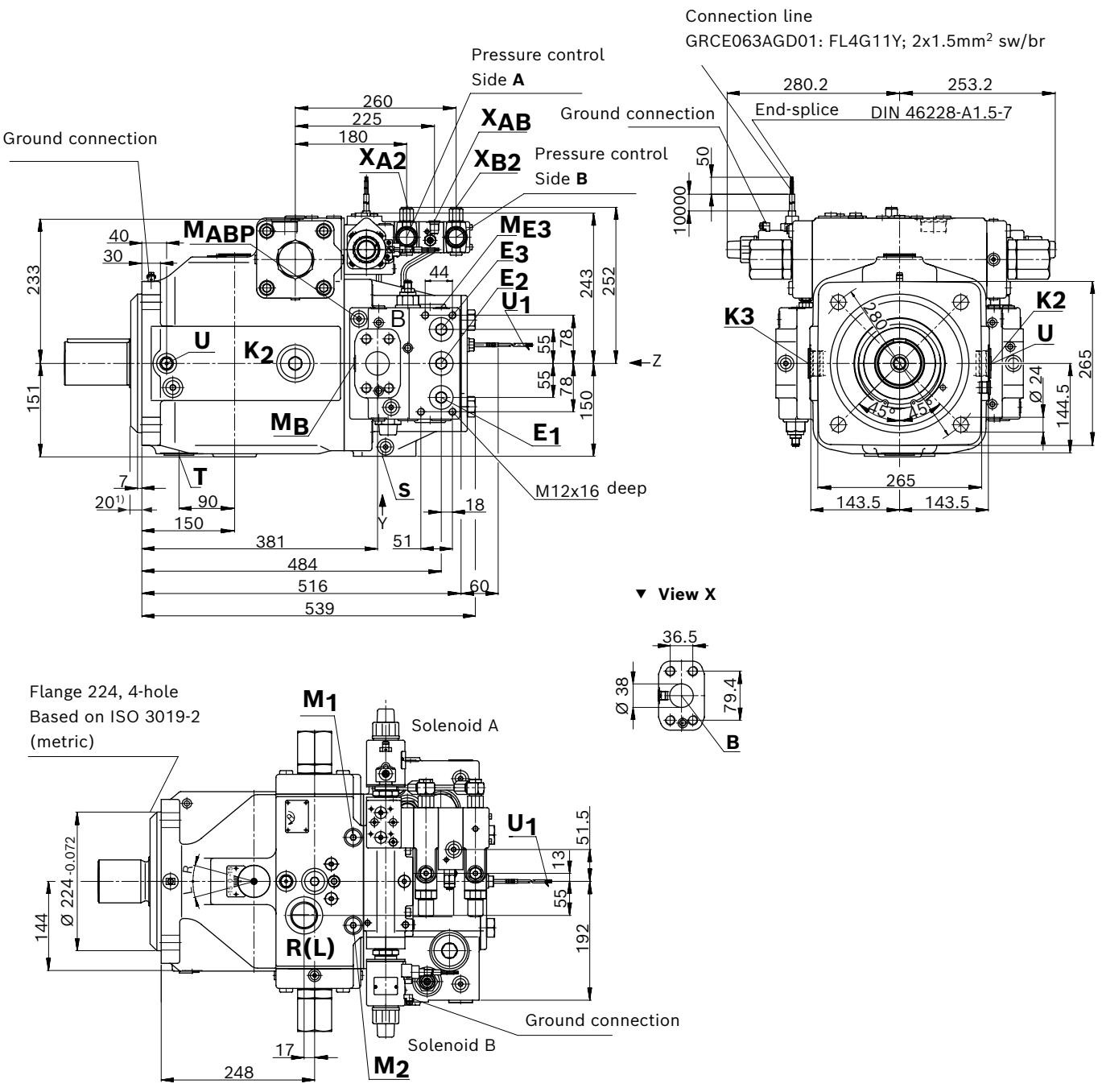



| Ports | | Standard | Size | $p_{max\ abs}$ [bar][3)] | State[7)] |
|---|---|---|---|---|---|
| **A, B** | Working line (high-pressure series) | SAE J518[4)] | 1 1/2 in | 400 | O |
| | Fastening thread A/B | DIN 13 | M16 × 2; 21 deep | | |
| **S** | Suction port (standard pressure series) | SAE J518[4)] | 2 1/2 in | 30 | O |
| | Fastening thread S | DIN 13 | M12 × 1.75; 17 deep | | |
| **$M_A$, $M_B$, $M_{ABP}$** | Measuring working pressure A/B | DIN 3852 | M14 × 1.5; 12 deep | 400 | X |
| **$M_S$** | Measuring suction | DIN 3852 | M14 × 1.5; 12 deep | 30 | X |
| **T** | Fluid drain | DIN 3852[5)] | M42 × 2; 20 deep | 4 | X[6)] |
| **$E_1$** | Filter, supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$E_2$** | Filter, return | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$K_1$** | Flushing port | DIN 3852 | M33 × 2; 18 deep | 5 | O |
| **$K_2$, $K_3$** | Fluid filling + air bleeding | DIN 3852[5)] | M42 × 2; 20 deep | 4 | X[6)] |
| **R(L)** | Return flow (drain port) | | | 4 | O[6)] |
| **U** | Bearing flushing | DIN 3852[5)] | M14 × 1.5; 12 deep | 7 | X |
| **$E_3$** | Boost pressure supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{E3}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$K_4$** | Accumulator port | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{K4}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$M_1$, $M_2$** | Control pressure measuring | DIN 3852 | M18 × 1.5; 12 deep | 400 | X |
| **$X_{A2}$, $X_{B2}$, $X_{AB}$** | Pilot pressure, remote control pressure controller | DIN 3852 | M14 × 1.5; 12 deep | 350 | O |

1) Center bore according to DIN 332
2) Thread according to DIN 13
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, $K_2$, $K_3$ or R(L) must be connected (see also from page 47)
7) O = Must be connected (comes plugged)
X = Plugged (in normal operation)

# Dimensions, size 355...-S1111 ATEX category II 2G Ex h IIC T4-T1 Gb X

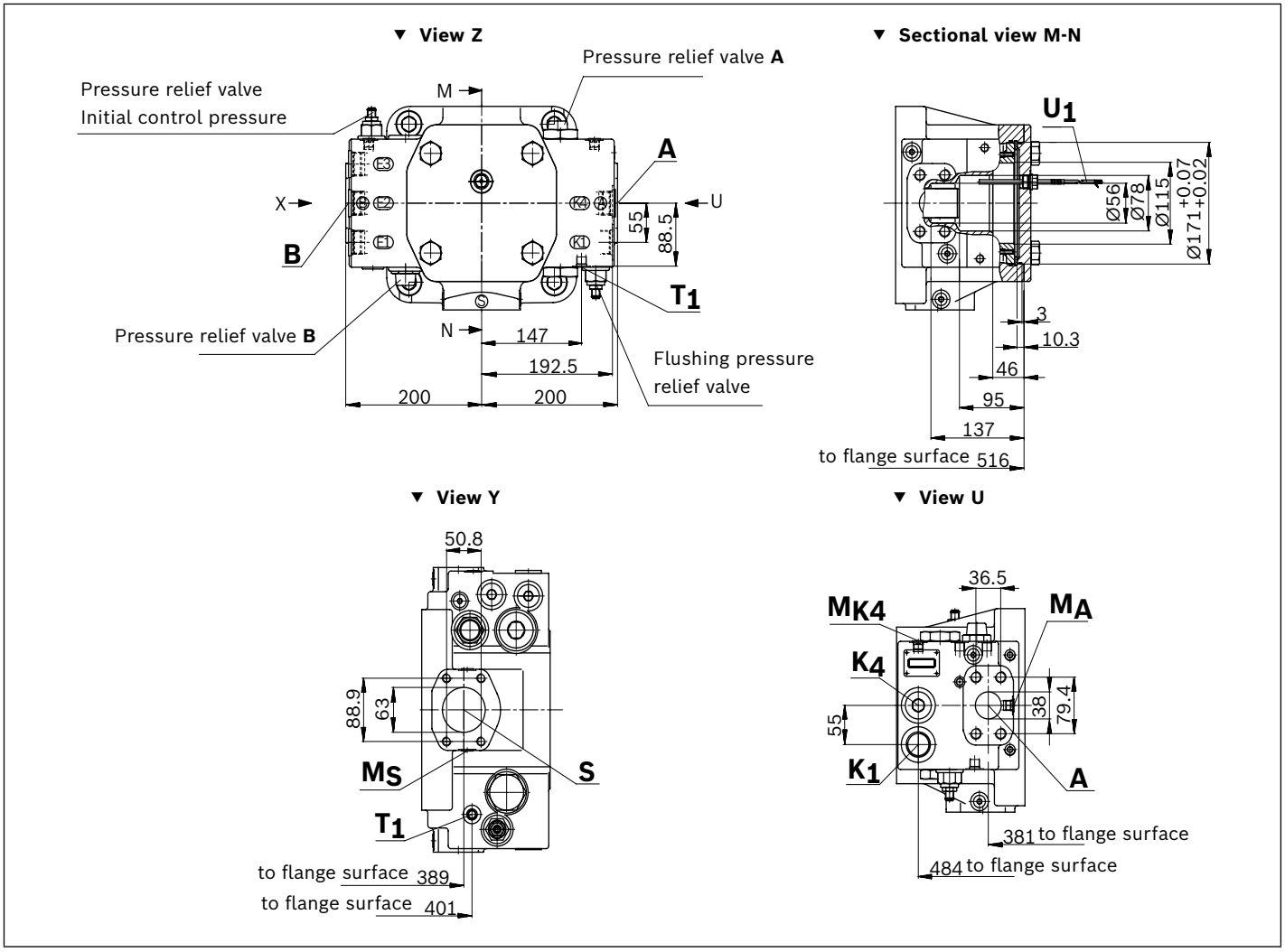
### Remote-controlled electrohydraulic control with proportional solenoid and pressure control




Connection table, see page 26

1) 10 mm shorter for version with single shaft seal

**Remote-controlled electrohydraulic control with proportional solenoid and pressure control**



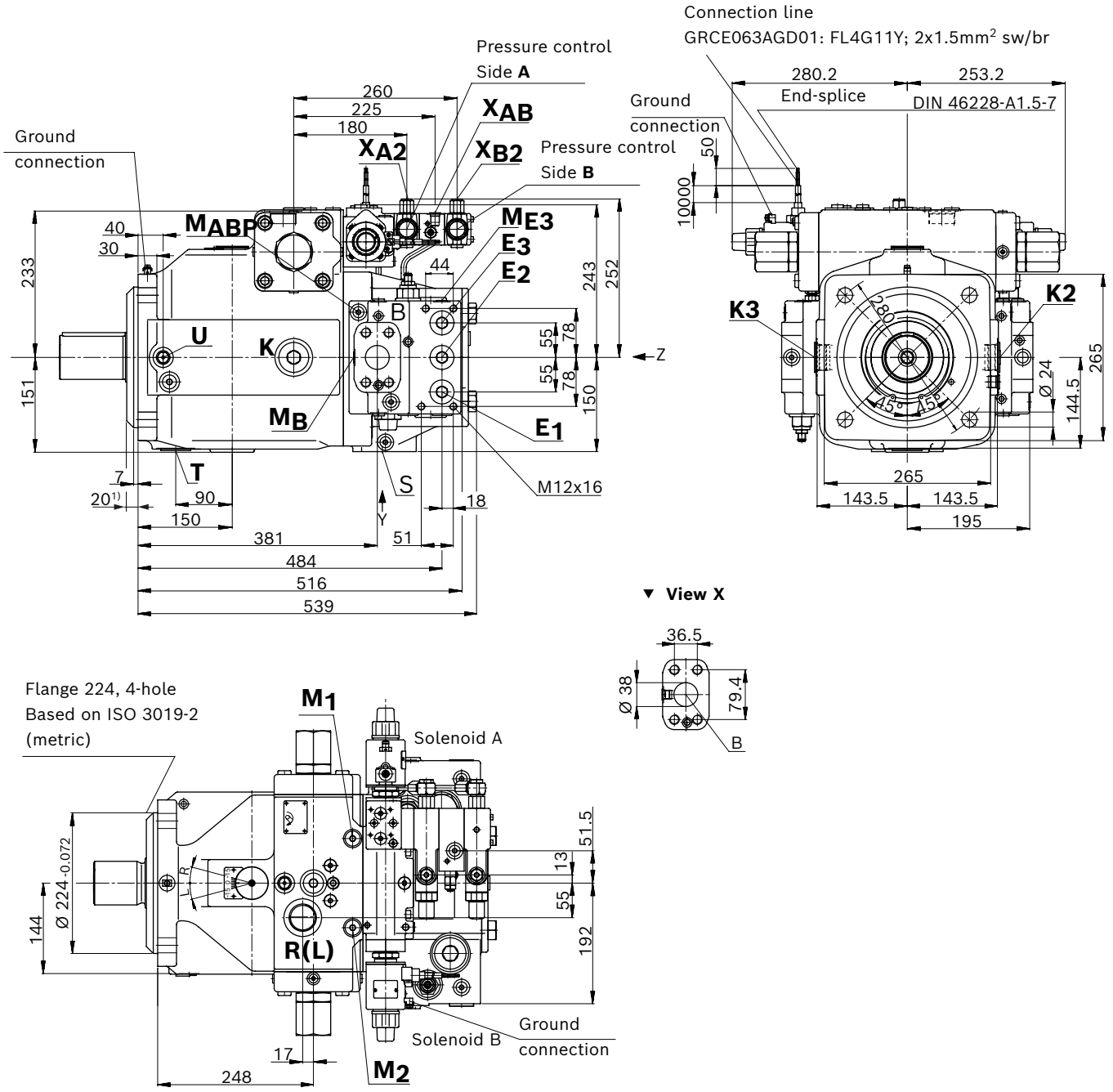
| Ports | | Standard | Size | $p_{max\ abs}$ [bar][1] | State[5] |
|---|---|---|---|---|---|
| **A, B** | Working line (high-pressure series) | SAE J518[2] | 1 1/2 in | 400 | O |
| | Fastening thread A/B | DIN 13 | M16 × 2; 21 deep | | |
| **S** | Suction port (standard pressure series) | SAE J518[2] | 2 1/2 in | 30 | O |
| | Fastening thread S | DIN 13 | M12 × 1.75; 17 deep | | |
| **$M_A$, $M_B$, $M_{ABP}$** | Measuring working pressure A/B | DIN 3852 | M14 × 1.5; 12 deep | 400 | X |
| **$M_S$** | Measuring suction | DIN 3852 | M14 × 1.5; 12 deep | 30 | X |
| **T** | Fluid drain | DIN 3852[3] | M42 × 2; 20 deep | 4 | X[4] |
| **$E_1$** | Filter, supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$E_2$** | Filter, return | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$K_1$** | Flushing port | DIN 3852 | M33 × 2; 18 deep | 5 | O |
| **$K_2$, $K_3$** | Fluid filling + air bleeding | DIN 3852[3] | M42 × 2; 20 deep | 4 | X[4] |
| **R(L)** | Return flow (drain port) | | | 4 | O[4] |
| **U** | Bearing flushing | DIN 3852[3] | M18 × 1.5; 12 deep | 7 | X |
| **$E_3$** | Boost pressure supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{E3}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$K_4$** | Accumulator port | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{K4}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$M_1$, $M_2$** | Control pressure measuring | DIN 3852 | M18 × 1.5; 12 deep | 400 | X |
| **$X_{A2}$, $X_{B2}$, $X_{AB}$** | Pilot pressure, remote control pressure controller | DIN 3852 | M14 × 1.5; 12 deep | 350 | O |
| **$U_1$** | Measure value transducer, temperature[6] | | | | |

Drive shaft, see page 29

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
3) The countersink may be deeper than specified in the standard.
4) Depending on the installation position, T, $K_2$, $K_3$ or R(L) must be connected (see also from page 47)
5) O = Must be connected (comes plugged)
X = Plugged (in normal operation)
6) Temperature sensor must be installed.

# Dimensions, size 355...-S1111 ATEX category II 3G Ex h IIC T4-T1 Gc X

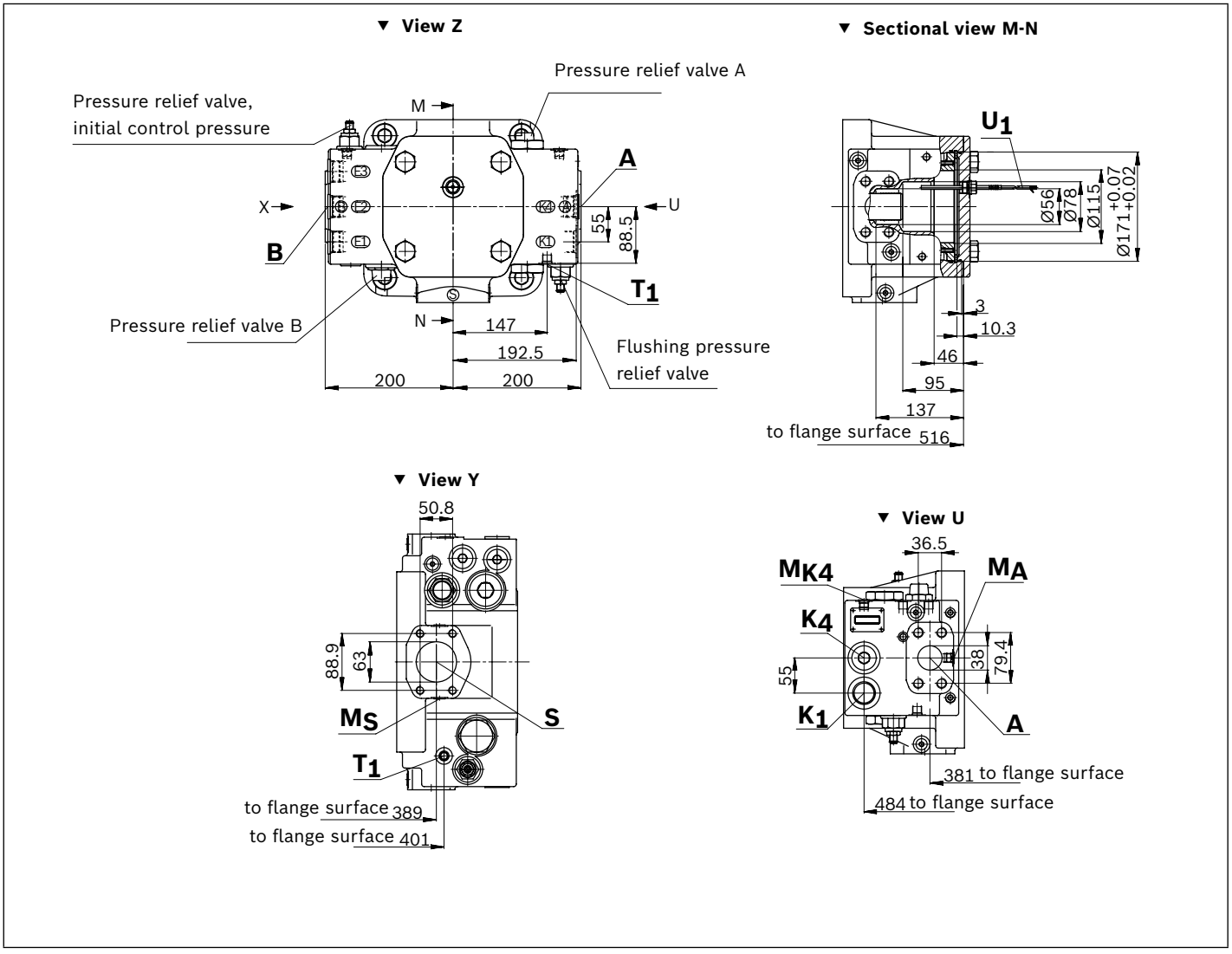
### Remote-controlled electrohydraulic control with proportional solenoid and pressure control




Connection table, see page 29

1) 10 mm shorter for version with single shaft seal

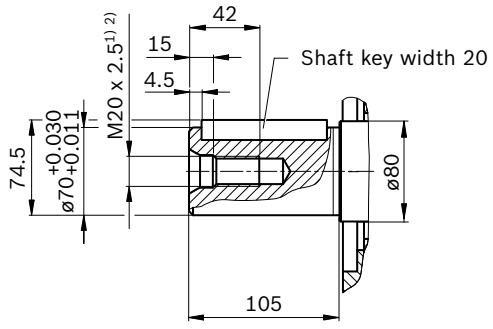
**Remote-controlled electrohydraulic control with proportional solenoid and pressure control**



## Drive shaft

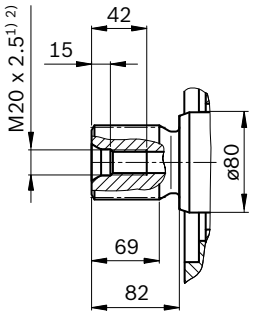
▼ **Parallel keyed shaft DIN 6885**

**P –** AS20x12x100




▼ **Splined shaft DIN 5480**

**Z – W70x3x22x9g**

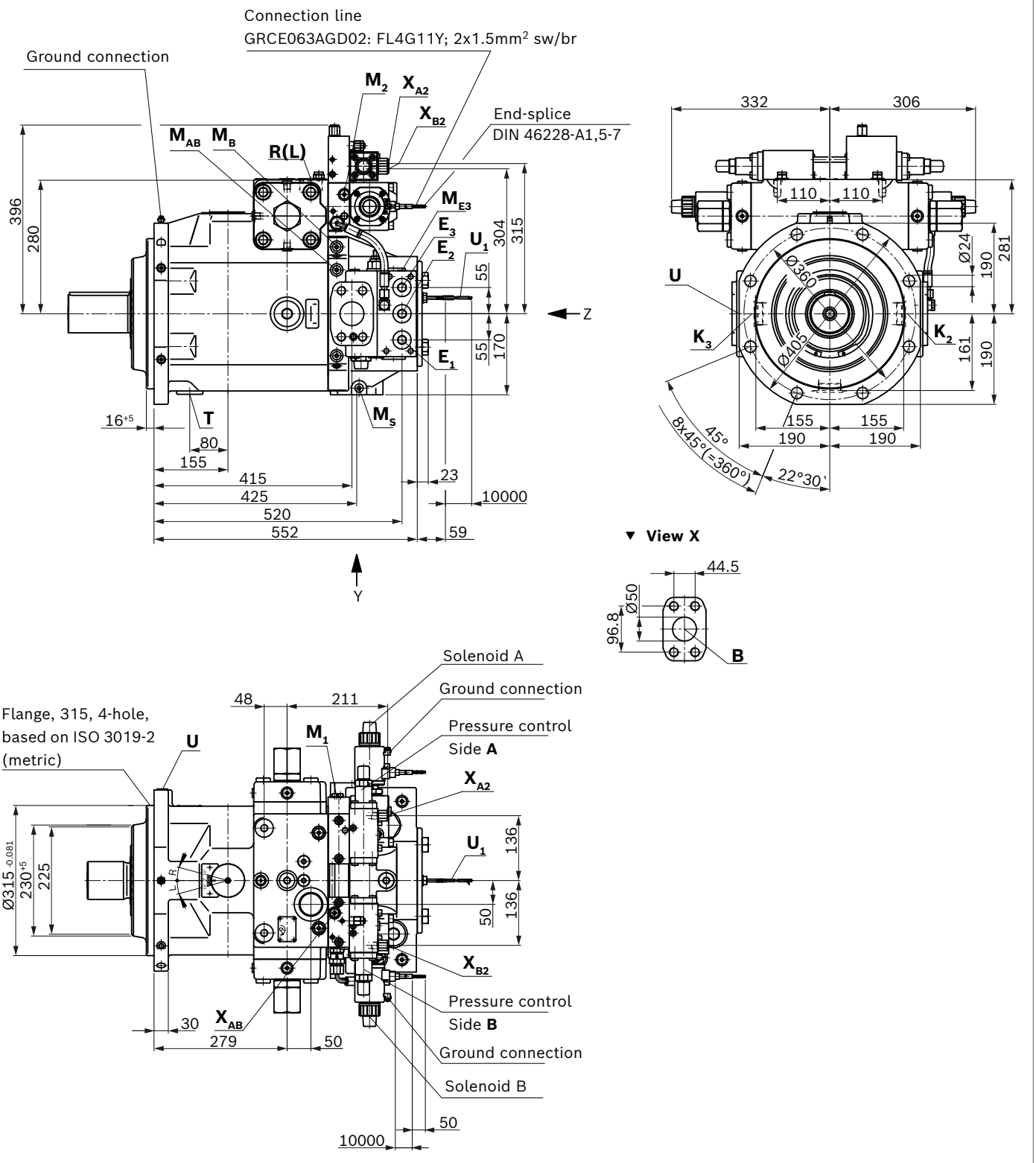



| Ports | | Standard | Size | $p_{max\ abs}$ [bar][3)] | State[7)] |
|---|---|---|---|---|---|
| **A, B** | Working line (high-pressure series) | SAE J518[4)] | 1 1/2 in | 400 | O |
| | Fastening thread A/B | DIN 13 | M16 × 2; 21 deep | | |
| **S** | Suction port (standard pressure series) | SAE J518[4)] | 2 1/2 in | 30 | O |
| | Fastening thread S | DIN 13 | M12 × 1.75; 17 deep | | |
| **$M_A$, $M_B$, $M_{ABP}$** | Measuring working pressure A/B | DIN 3852 | M14 × 1.5; 12 deep | 400 | X |
| **$M_S$** | Measuring suction | DIN 3852 | M14 × 1.5; 12 deep | 30 | X |
| **T** | Fluid drain | DIN 3852[5)] | M42 × 2; 20 deep | 4 | X[6)] |
| **$E_1$** | Filter, supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$E_2$** | Filter, return | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$K_1$** | Flushing port | DIN 3852 | M33 × 2; 18 deep | 5 | O |
| **$K_2$, $K_3$** | Fluid filling + air bleeding | DIN 3852[5)] | M42 × 2; 20 deep | 4 | X[6)] |
| **R(L)** | Return flow (drain port) | | | 4 | O[6)] |
| **U** | Bearing flushing | DIN 3852[5)] | M18 × 1.5; 12 deep | 7 | X |
| **$E_3$** | Boost pressure supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{E3}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$K_4$** | Accumulator port | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{K4}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$M_1$, $M_2$** | Control pressure measuring | DIN 3852 | M18 × 1.5; 12 deep | 400 | X |
| **$X_{A2}$, $X_{B2}$, $X_{AB}$** | Pilot pressure, remote control pressure controller | DIN 3852 | M14 × 1.5; 12 deep | 350 | O |

1) Center bore according to DIN 332
2) Thread according to DIN 13
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, $K_2$, $K_3$ or R(L) must be connected (see also from page 47)
7) O = Must be connected (comes plugged)
X = Plugged (in normal operation)

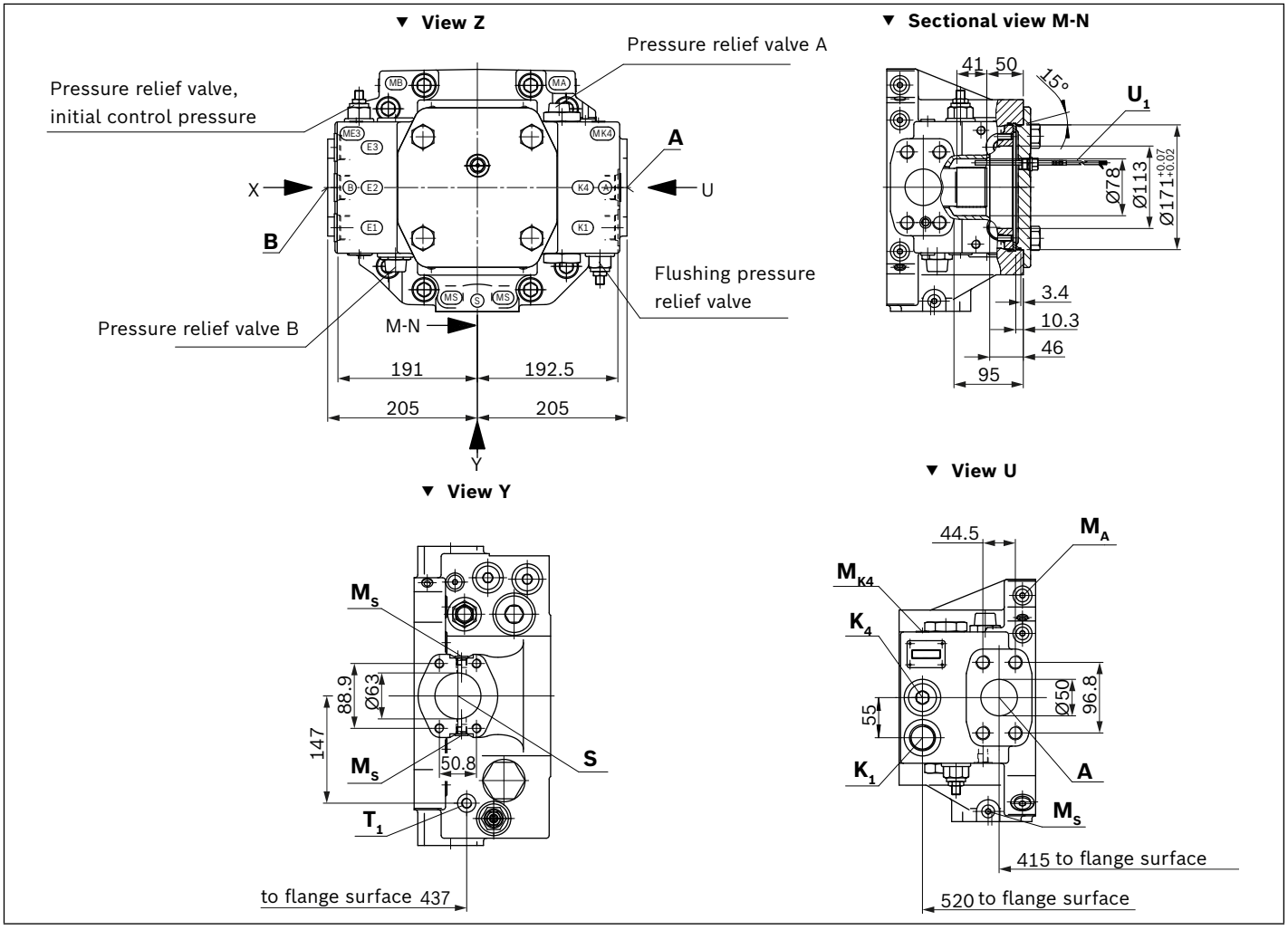
# Dimensions, size 500...-S2145 ATEX category II 2G Ex h IIC T4-T1 Gb X

### Remote-controlled electrohydraulic control with proportional solenoid and pressure control




Connection table, see page 32

**Remote-controlled electrohydraulic control with proportional solenoid and pressure control**



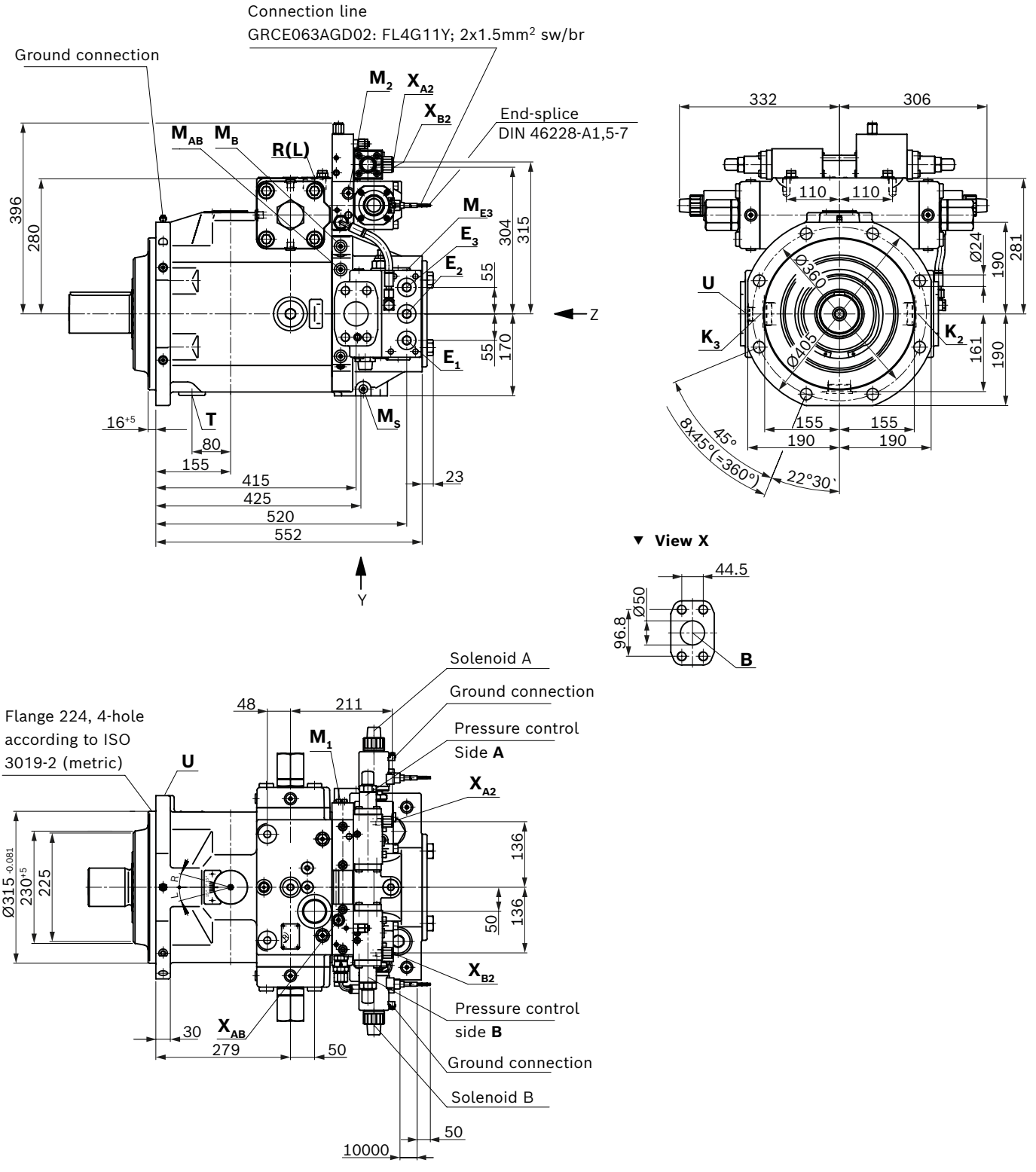
| Ports | | Standard | Size | $p_{max\ abs}$ [bar][1] | State[5] |
|---|---|---|---|---|---|
| **A, B** | Working line (high-pressure series) | SAE J518[2] | 2 in | 400 | O |
| | Fastening thread A/B | DIN 13 | M20 × 2.5; 24 deep | | |
| **S** | Suction port (standard pressure series) | SAE J518[2] | 2 1/2 in | 30 | O |
| | Fastening thread S | DIN 13 | M12 × 1.75; 17 deep | | |
| **$M_A$, $M_B$, $M_{ABP}$** | Measuring working pressure A/B | DIN 3852 | M14 × 1.5; 12 deep | 400 | X |
| **$M_S$** | Measuring suction | DIN 3852 | M14 × 1.5; 12 deep | 30 | X |
| **T** | Fluid drain | DIN 3852[3] | M48 × 2; 22 deep | 4 | X[4] |
| **$E_1$** | Filter, supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$E_2$** | Filter, return | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$K_1$** | Flushing port | DIN 3852 | M33 × 2; 18 deep | 5 | O |
| **$K_2$, $K_3$** | Fluid filling + air bleeding | DIN 3852[3] | M48 × 2; 22 deep | 4 | X[4] |
| **R(L)** | Return flow (drain port) | | | 4 | O[4] |
| **U** | Bearing flushing | DIN 3852[3] | M18 × 1.5; 12 deep | 7 | X |
| **$E_3$** | Boost pressure supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{E3}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$K_4$** | Accumulator port | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{K4}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$M_1$** | Measuring stroking chamber pressure | DIN 3852 | M22 × 1.5; 14 deep | 400 | X |
| **$M_2$** | Measuring stroking chamber pressure | DIN 3852 | M14 × 1.5; 12 deep | 400 | X |
| **$X_{A2}$, $X_{B2}$, $X_{AB}$** | Pilot pressure, remote control pressure controller | DIN 3852 | M14 × 1.5; 12 deep | 350 | O |
| **$U_1$** | Measure value transducer, temperature[6] | | | | |

Drive shaft, see page 35

1) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
2) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
3) The countersink may be deeper than specified in the standard.
4) Depending on the installation position, T, $K_2$, $K_3$ or R(L) must be connected (see also from page 47)
5) O = Must be connected (comes plugged)
X = Plugged (in normal operation)
6) Temperature sensor must be installed.

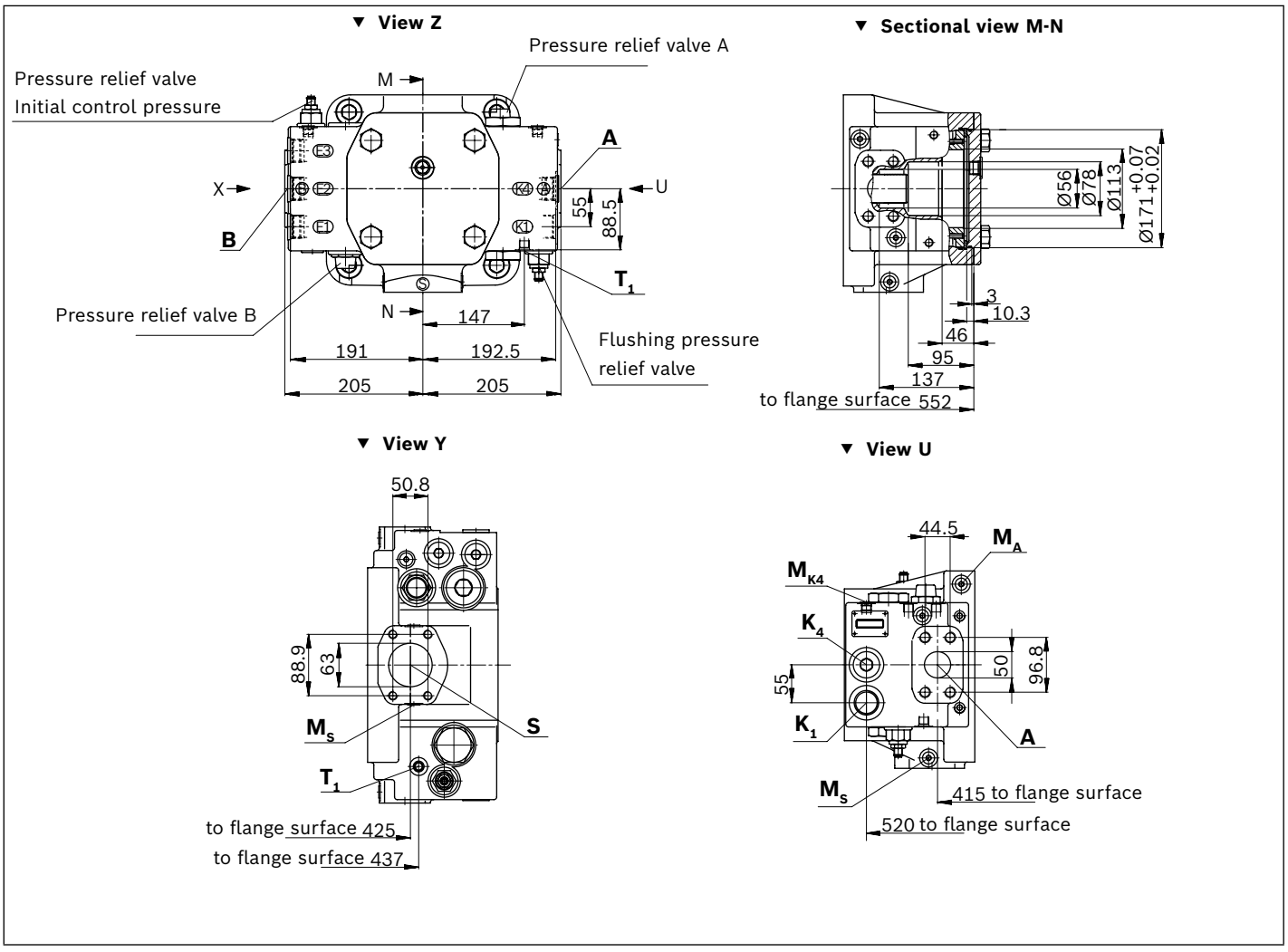
# Dimensions, size 500...-S2145 ATEX category II 3G Ex h IIC T4-T1 Gc X

### Remote-controlled electrohydraulic control with proportional solenoid and pressure control




Connection table, see page 35

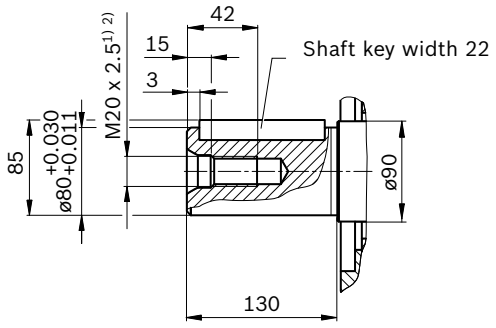
**Remote-controlled electrohydraulic control with proportional solenoid and pressure control**



## Drive shaft

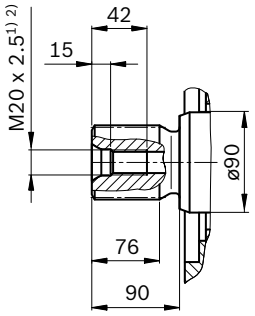
▼ **Parallel keyed shaft DIN 6885**

**P –** AS25x14x125




▼ **Splined shaft DIN 5480**

**Z** – W90x3x28x9g




| Ports | | Standard | Size | $p_{max\ abs}$ [bar][3)] | State[7)] |
|---|---|---|---|---|---|
| **A, B** | Working line (high-pressure series) | SAE J518[4)] | 2 in | 400 | O |
| | Fastening thread A/B | DIN 13 | M20 × 2.5; 24 deep | | |
| **S** | Suction port (standard pressure series) | SAE J518[4)] | 2 1/2 in | 30 | O |
| | Fastening thread S | DIN 13 | M12 × 1.75; 17 deep | | |
| **$M_A$, $M_B$, $M_{ABP}$** | Measuring working pressure A/B | DIN 3852 | M14 × 1.5; 12 deep | 400 | X |
| **$M_S$** | Measuring suction | DIN 3852 | M14 × 1.5; 12 deep | 30 | X |
| **T** | Fluid drain | DIN 3852[5)] | M48 × 2; 22 deep | 4 | X[6)] |
| **$E_1$** | Filter, supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$E_2$** | Filter, return | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$K_1$** | Flushing port | DIN 3852 | M33 × 2; 18 deep | 5 | O |
| **$K_2$, $K_3$** | Fluid filling + air bleeding | DIN 3852[5)] | M48 × 2; 22 deep | 4 | X[6)] |
| **R(L)** | Return flow (drain port) | | | 4 | O[6)] |
| **U** | Bearing flushing | DIN 3852[5)] | M18 × 1.5; 12 deep | 7 | X |
| **$E_3$** | Boost pressure supply | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{E3}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$K_4$** | Accumulator port | DIN 3852 | M33 × 2; 18 deep | 40 | X |
| **$M_{K4}$** | Measuring boost pressure | DIN 3852 | M14 × 1.5; 12 deep | 40 | X |
| **$M_1$** | Measuring stroking chamber pressure | DIN 3852 | M22 × 1.5; 14 deep | 400 | X |
| **$M_2$** | Measuring stroking chamber pressure | DIN 3852 | M14 × 1.5; 12 deep | 400 | X |
| **$X_{A2}$, $X_{B2}$, $X_{AB}$** | Pilot pressure, remote control pressure controller | DIN 3852 | M14 × 1.5; 12 deep | 350 | O |

1) Center bore according to DIN 332
2) Thread according to DIN 13
3) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.
4) Only dimensions according to SAE J518, metric fastening thread is a deviation from the standard.
5) The countersink may be deeper than specified in the standard.
6) Depending on the installation position, T, $K_2$, $K_3$ or R(L) must be connected (see also from page 47)
7) O = Must be connected (comes plugged)
X = Plugged (in normal operation)

## Combination pumps A4CSG + A4CSG

The variable pump A4CSG can be supplied with through drive despite the integrated boost pump, in accordance with the type code on page 3.
If no further pumps are to be mounted at the factory, then the simple type designation is sufficient.
The scope of delivery then includes for all through drives except F/99: hub, mounting bolts, seal and, if applicable, an intermediate flange for F/99: with through-drive shaft, without hub, without intermediate flange; unit closed fluid-tight with pressure-tight cover

By using combination pumps, it is possible to have independent circuits without the need for splitter gearboxes.
When ordering combination pumps, the type designations of the 1st and 2nd pumps must be linked by a "**+**".

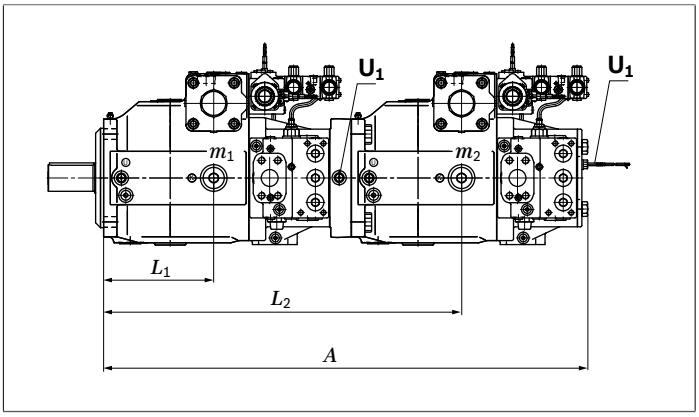
- **Order example:**
  **A4CSG 500 EPG / 30 R – APH35F434M +**
  **A4CSG 500 EPG / 30 R – AZH35F994M**

For through drives **F/01**, **04**, **07**, **24**, **52**, **68** and **B6**, various possible attachment angle positions are available.
As standard, the second pump is attached at the same angle as the supplied screws are shown in the drawing ”Dimensions, through drive” on page 38.
If this angle differs, please contact us.
If a **gear pump** is to be **mounted at the factory as an attachment pump**, please contact us.

**Notices**

- All attachment pumps must match the ATEX classification for the application in question.

Maximum permissible drive and through-drive torques, see page page 9.




$m_1$, $m_2$ [kg]
$L_1$, $L_2$ [mm]

$$T_m = \left(m_1 \cdot L_1 + m_2 \cdot L_2\right) \frac{1}{102} \text{ [Nm]}$$

**Total length A**

| A4CSG | A4CSG (2. Pump with through drive F/99, without filter) | | |
|---|---|---|---|
| **(1. pump)** | **NG250** | **NG355** | **NG500** |
| **NG250** | 1079 | – | – |
| **NG355** | 1086 | 1114 | – |
| **NG500** | 1143 | 1150 | 1235 |

**Permissible mass moment of inertia**

| Size | | | 250 | 355 | 500 |
|---|---|---|---|---|---|
| Permissible mass moment of inertia | $T_m$ | Nm | 9300 | 9300 | 15600 |
| Permissible mass moment of inertia with dynamic mass acceleration $10g \triangleq 98.1$ m/sec$^2$ | $T_m$ | Nm | 930 | 930 | 1560 |
| Weight | $m_1$ | kg | 260 | 275 | 390 |
| Distance from center of gravity | $l_1$ | mm | 270 | 280 | 300 |

1) To air bleed the stroking chamber, use the highest port on the control (see data sheet of the controller)

## Overview of mounting options on A4CSG

| **Through drive - A4CSG** | | | **Mounting option 2nd Pump** | | |
|---|---|---|---|---|---|
| **Flange** | **Hub for splined shaft[1)]** | **Code** | **A4CSG NG (shaft)** | **A4VSO/G NG (shaft)** | **A10V(S)O/31/32[4)] NG (shaft)** |
| **Flange ISO 3019-2 (metric)** | | | | | |
| 80, 2-hole | 3/4 in (19-4) | **F/B2** | – | – | 18 (S)/31 |
| 100, 2-hole | 7/8 in (22-4) | **F/B3** | – | – | 28 (S)/31 |
| | 1 in (25-4) | **F/B4** | – | – | 45 (S)/31 |
| 125, 2-hole | 1 1/4 in (32-4) | **F/B5** | – | – | 71 (S)/31 |
| | 1 1/2 in (38-4) | **F/B6** | – | – | 100 (S)/31 |
| 125, 4-hole | W32 | **F/K1** | – | 40 (Z) | – |
| 140, 4-hole | W40 | **F/33** | – | 71 (Z) | – |
| 160, 4-hole | W50 | **F/34** | – | 125, 180 (Z) | – |
| 224, 4-hole | W60 | **F/35** | 250 (Z) | 250 (Z) | – |
| | W70 | **F/77** | 355 (Z) | | – |
| 315, 8-hole | W80 | **F/43** | 500 (Z) | | – |
| **Flange SAE J744 (ISO 3019-1)[2)]** | | | | | |
| 82-2 (A) | 5/8 in (16-4) | **F/01** | – | – | – |
| | 3/4 in (19-4) | **F/52** | – | – | 18 (S)/31 |
| 101-2 (B) | 7/8 in (22-4) | **F/68** | – | – | 28 (S)/31 |
| | 1 in (25-4) | **F/04** | – | – | 45 (S)/31 |
| 127-2 (C) | 1 1/4 in (32-4) | **F/07** | – | – | 71 (S)/31 |
| | 1 1/2 in (38-4) | **F/24** | – | – | 100 (S)/31 |
| 152-4 (D) | 1 3/4 in (44-4) | **F/17** | – | – | 140 (S)/31[3)] |

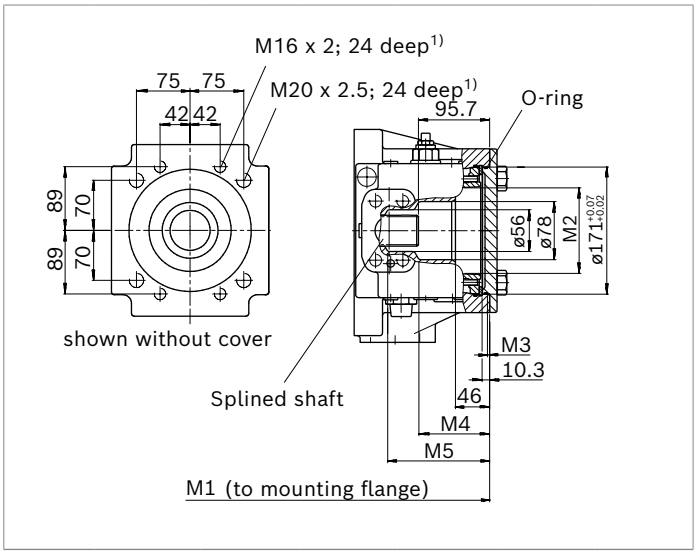
1) According to DIN 5480 (e.g. W32) or according to SAE J744 (e.g. 3/4 in)
2) 2 = 2-hole, 4 = 4-hole
3) On request
4) If a through drive for an A10V(S)O with R-shaft is desired, please contact us.

## Dimensions, through drive

| With through-drive shaft | Splined shaft DIN 5480 | Availability across sizes | | | Code |
|---|---|---|---|---|---|
| without hub or intermediate flange, | **Diameter** | **250** | **355** | **500** | **F/** |
| plugged with fluid-tight, pressure-tight cover and O-ring for retrofitting | W42x1.25x32x9g | ● | ● | – | **99** |
| | W55x1.25x42x9g | – | – | ● | **99** |

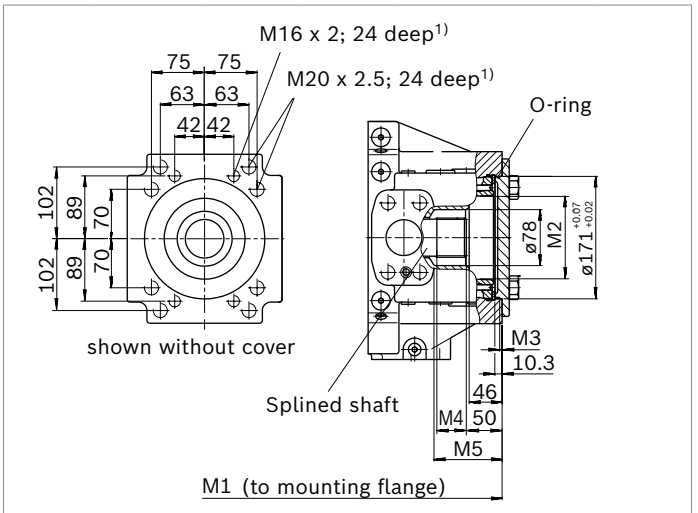
● = Available – = Not available

▼ **F/99**




| 99 | NG | M1 | M2 | M3 | M4 | M5 |
|---|---|---|---|---|---|---|
| | **250** | 509 | ø115 | 3 | 95 | 137 |
| | **355** | 516 | | | | |

▼ **F/99**



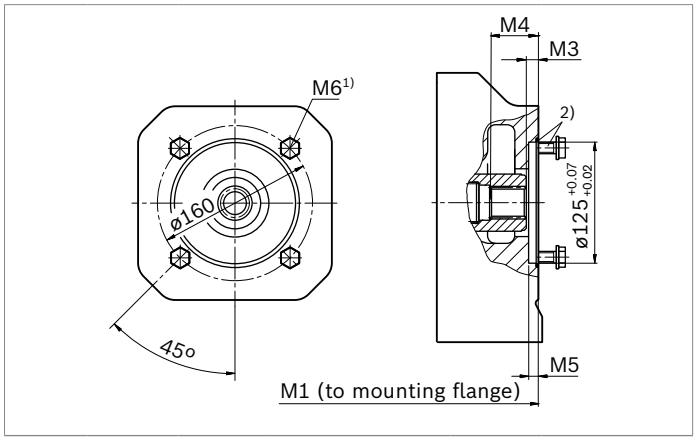

| 99 | NG | M1 | M2 | M3 | M4 | M5 |
|---|---|---|---|---|---|---|
| | **500** | 552 | ø115 | 3.4 | 41 | 95 |

1) Thread according to DIN 13, see instruction manual for details on tightening torques

| Flange ISO 3019-2 | | Availability across sizes | | | Code |
|---|---|---|---|---|---|
| **Diameter** | **Hub for splined shaft DIN 5480** | **250** | **355** | **500** | **F/** |
| 125, 4-hole | W32x2x14x9g | ○ | ● | ● | **31** |
| 140, 4-hole | W40x2x18x9g | ○ | ○ | ● | **33** |
| 160, 4-hole | W50x2x24x9g | ● | ● | ● | **34** |
| 224, 4-hole | W60x2x28x9g | ● | ○ | ○ | **35** |

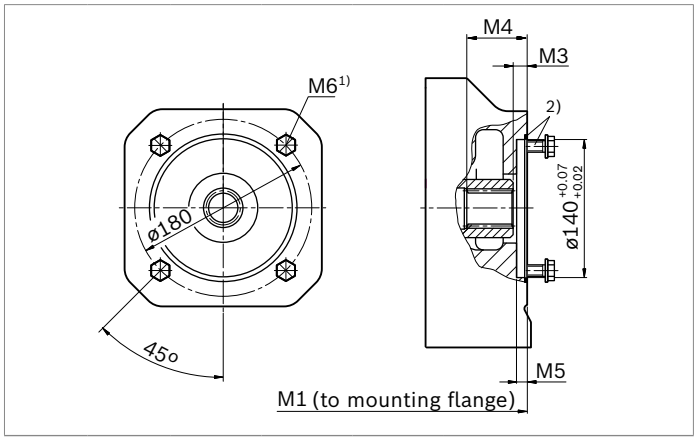
● = Available ○ = On request

▼ **F/31**



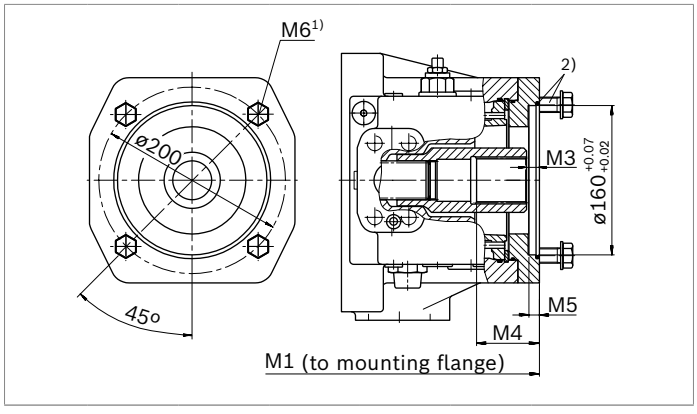

| 31 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **355** | 539 | 11.5 | 46 | 10 | M12; 18 deep |
| | **500** | 575 | 12.5 | 51 | | |

▼ **F/33**



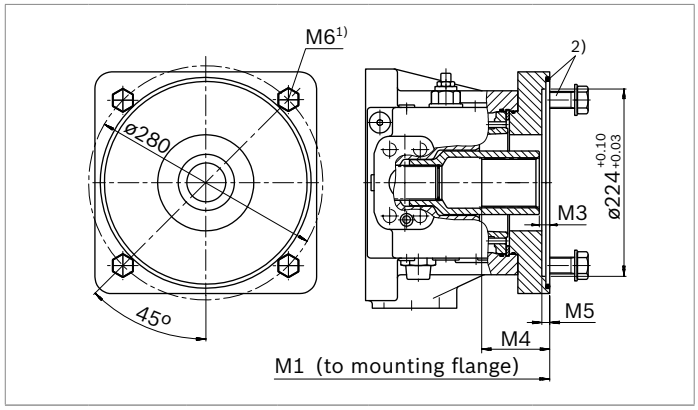

| 33 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **355** | 541 | 12.5 | 60 | 10 | M12; 14.5 deep |
| | **500** | 577 | 14.5 | 50 | | |

▼ **F/34**




| 34 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **250** | 531 | 12.5 | 66 | 10 | M16; 22 deep |
| | **355** | 538 | | | | |
| | **500** | 574 | | 67 | | |

▼ **F/35**




| 35 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **250** | 547 | 12.5 | 81 | 8 | M20; 30 deep |
| | **355** | 554 | | | | |
| | **500** | 611 | | | | |

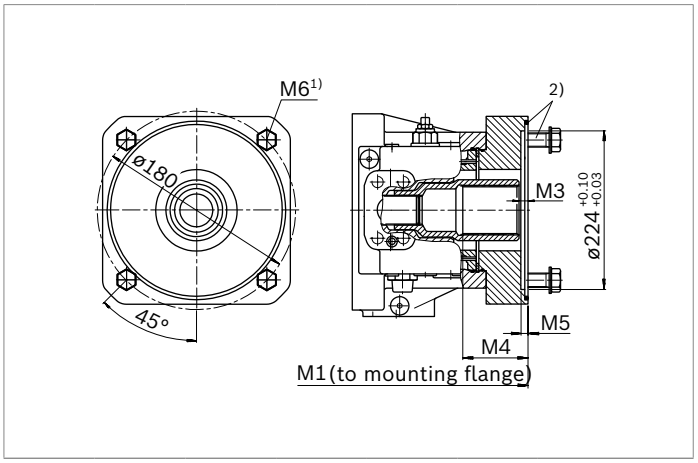
1) Thread according to DIN 13, see instruction manual for details on tightening torques

2) 4 mounting bolts and O-ring seal are included in the scope of delivery.

| Flange ISO 3019-2 | | Availability across sizes | | | Code |
|---|---|---|---|---|---|
| **Diameter** | **Hub for splined shaft DIN 5480** | **250** | **355** | **500** | **F/** |
| 224, 4-hole | W70x3x22x9g | ○ | ● | ● | **77** |
| 315, 8-hole | W80x3x25x9g | ○ | ○ | ● | **43** |

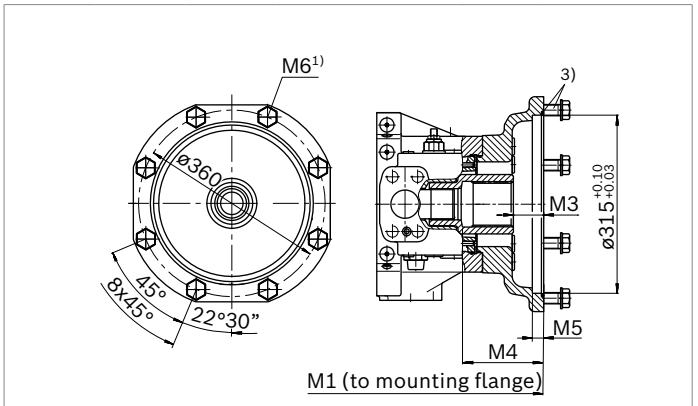
● = Available ○ = On request

▼ **F/77**




| 77 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **355** | 575 | 12.4 | 92 | 8 | M20; 30 deep |
| | **500** | 611 | 12.5 | 94.5 | | |

▼ **F/43**



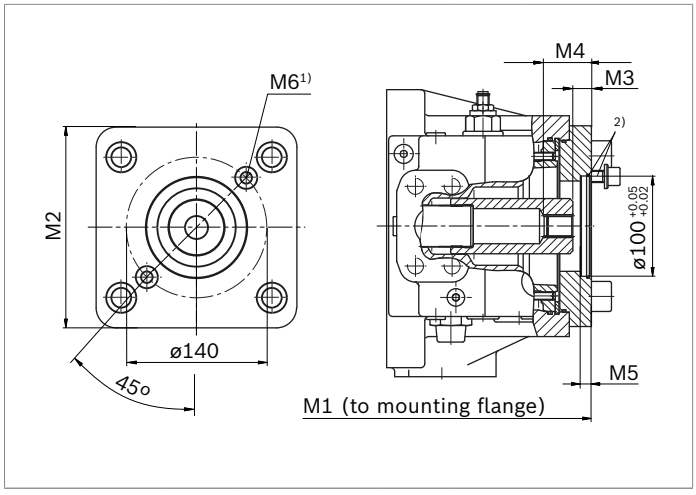

| 43 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **500** | 660 | 53.5 | 143 | 20 | M20; 26 deep |

1) Thread according to DIN 13, see instruction manual for details on tightening torques
2) 4 mounting bolts and O-ring seal are included in the scope of delivery.
3) 8 mounting bolts and O-ring seal are included in the scope of delivery.

| Flange ISO 3019-2 | | Availability across sizes | | | Code |
|---|---|---|---|---|---|
| **Diameter** | **Hub for splined shaft SAE J744** | **250** | **355** | **500** | **F/** |
| 100, 2-hole | 7/8 in 13T 16/32DP | ● | ● | ○ | **B3** |
| 125, 2-hole | 1 1/4 in 14T 12/24DP | ● | ○ | ○ | **B5** |
| 125, 2-hole | 1 1/2 in 17T 12/24DP | ○ | ● | ○ | **B6** |

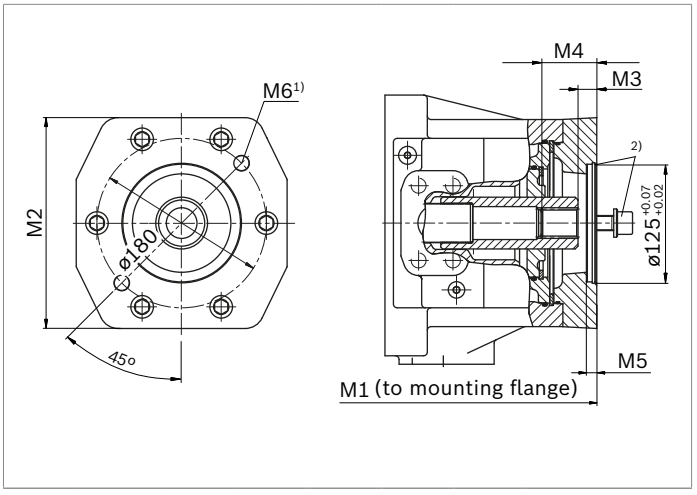
● = Available ○ = On request

▼ **F/B3**



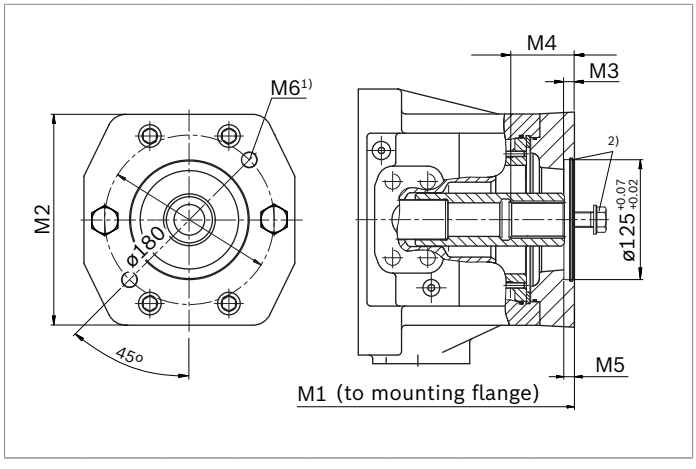

| B3 | NG | M1 | M2 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|---|
| | **250** | 531 | 200 | 18.5 | 43.5 | 10 | M12; 18 deep |
| | **355** | 538 | 200 | 18.5 | 43.5 | 10 | |

▼ **F/B5**




| B5 | NG | M1 | M2 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|---|
| | **250** | 545 | 224 | 19.9 | 58 | 10 | M16; 24 deep |
| | **355** | 552 | 224 | 19.9 | 58 | 10 | |

▼ **F/B6**




| B6 | NG | M1 | M2 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|---|
| | **355** | 552 | 224 | 10 | 66 | 10.4 | M16; 24 deep |

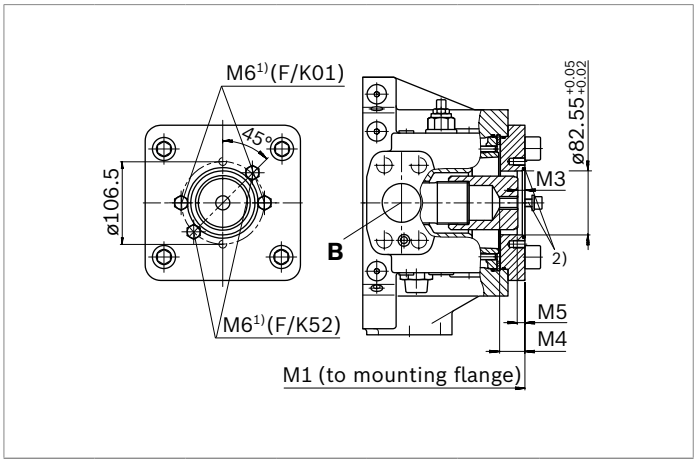
1) Thread according to DIN 13, see instruction manual for details on tightening torques

2) 2 mounting bolts and O-ring seal are included in the scope of delivery.

| Flange SAE J744 (ISO 3019-1) | | Availability across sizes | | | Code |
|---|---|---|---|---|---|
| **Diameter** | **Hub for splined shaft SAE J744** | **250** | **355** | **500** | **F/** |
| 82-2 (A) | 5/8 in 9T 16/32DP | ● | ● | ● | **01** |
| 82-2 (A) | 3/4 in 11T 16/32DP | ○ | ● | ● | **52** |
| 101-2 (B) | 7/8 in 13T 16/32DP | ● | ● | ● | **68** |
| 101-2 (B) | 1 in 15T 16/32DP | ○ | ● | ● | **04** |

● = Available ○ = On request

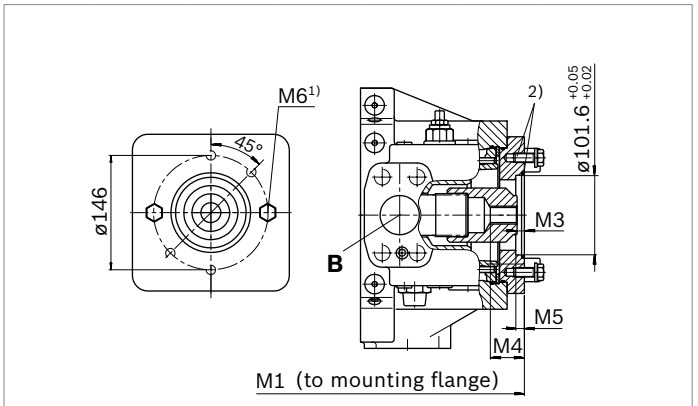
▼ **F/01; F/52**




| 01 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **250** | 531 | 10.5 | 33 | 10 | M10; 15 deep |
| | **355** | 538 | | | | |
| | **500** | 574 | 9.3 | | | |

| 52 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **355** | 531 | 19.5 | 40.5 | 10 | M10; 15 deep |
| | **500** | 574 | | | | |

▼ **F/68; F/04**




| 68 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **250** | 531 | 18.5 | 43.5 | 10 | M12; 15 deep |
| | **355** | 538 | | | | |
| | **500** | 574 | | | | |

| 04 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **355** | 538 | 18.9 | 48.4 | 10 | M12; 15 deep |
| | **500** | 574 | 19.4 | | | |

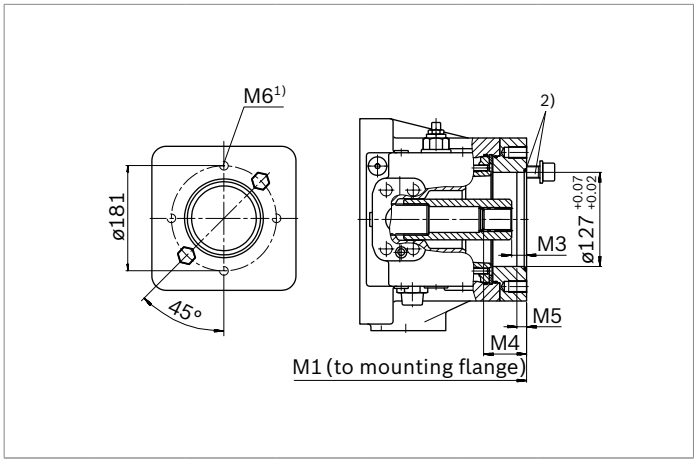
1) Thread according to DIN 13, see instruction manual for details on tightening torques

2) 2 mounting bolts and O-ring seal are included in the scope of delivery.

| Flange SAE J744 (ISO 3019-1) | | Availability across sizes | | | Code |
|---|---|---|---|---|---|
| **Diameter** | **Hub for splined shaft SAE J744** | **250** | **355** | **500** | **F/** |
| 127-2 (C) | 1 1/4 in 14T 12/24DP | ● | ● | ● | **07** |
| 127-2 (C) | 1 1/2 in 17T 12/24DP | ○ | ● | ● | **24** |
| 152-4 (D) | 1 3/4 in 13T 8/16DP | ● | ● | ● | **17** |

● = Available ○ = On request

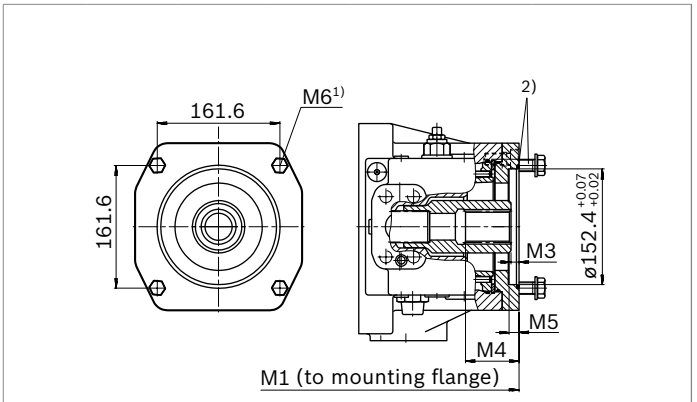
▼ **F/K07; F/24**




| 07 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **250** | 545 | 19.9 | 58 | 13 | M16; 24 deep |
| | **355** | 552 | | | | |
| | **500** | 588 | 18.3 | | | |

| 24 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **250** | 545 | 10.4 | 75 | 13 | M16; 24 deep |
| | **355** | 552 | | | | |
| | **500** | 588 | 10.3 | 67 | | |

▼ **F/17**




| 17 | NG | M1 | M3 | M4 | M5 | M6 |
|---|---|---|---|---|---|---|
| | **250** | 531 | 10.4 | 73 | 13 | M16; 22 deep |
| | **355** | 538 | | | | |
| | **500** | 600 | | | | M16; 32 deep |

1) Thread according to DIN 13, see instruction manual for details on tightening torques.

2) 2 mounting bolts and O-ring seal are included in the scope of delivery.

3) 4 mounting bolts and O-ring seal are included in the scope of delivery.

## Integrated boost pump and valve technology (version F..)

### High-pressure relief valves (Pos. 5)

Two pilot operated pressure relief valves use pressure limitation to prevent damage to the hydraulic pump resulting from overpressure. A pressure relief valve is assigned to each pressure side.
Protection is provided by reducing the high pressure to the low-pressure side.
Pressure limitation is set by default to 350 bar. If another setting is required, please state this in the plain text.

- Maximum set value for pressure controller: 350 bar.
- Cracking pressure of high-pressure relief valve: at least 30 bar above the set value of the pressure controller.
- Maximum cracking pressure of high-pressure relief valve: 400 bar.
- In all operating conditions, the high-pressure relief valves may be subjected to current for maximum 5 seconds (as a rule < 1 second).

### Boost-pressure relief valve (Pos. 3)

direct operated
The boost pressure can be set on the boost-pressure relief valve.

### Boost pressure

To prevent damage to the system, low pressure protection is recommended, which monitors the static pressure component. The ports $\mathbf{M_{E3}}$ or $\mathbf{M_{K4}}$, for example, are suitable for low pressure monitoring. To prevent any impermissible drop in boost pressure a low pressure accumulator can be connected to the ports $\mathbf{E_2}$, $\mathbf{E_3}$ or $\mathbf{K_4}$.
The design of the accumulator
and the choice of the optimum connection location must be selected according to the hydraulic transmission behavior of the system and the operating conditions, taking the available boost volume into account. Depending on the quantity of system case drain fluid, it may be necessary to increase the boost volume with a larger or additional boost pump.

### Integrated boost pump (Pos. 9)

Standard size

| NG | 250 | 355 | 500 |
|---|---|---|---|
| $cm^3$ | 63[1)] | 80[1)] | 98 |

### Control pressure relief valve (for EP and HD) (Pos. 8)

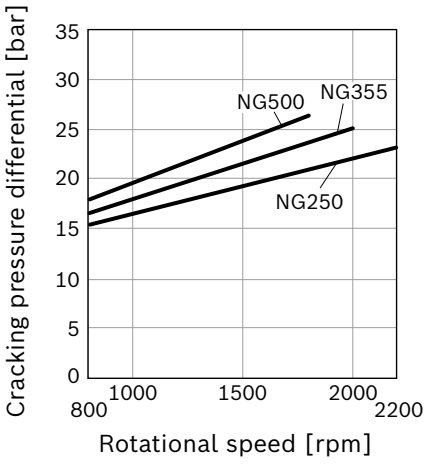
Direct operated, high-pressure-related relief
At low working pressure, the auxiliary pump pressure is regulated to the set the value (e.g. 32 bar). This pressure is needed by the HD and EP controls to swivel out reliably. Using this valve saves the use of a separate control pressure pump.
If the working pressure exceeds the pressure of the boost pump, control is provided by the check valve via the high pressure. At the same time, the increase in working pressure relieves the control pressure relief valve.
This reduces the boost pump pressure to the set boost pressure (e.g. 16 bar).
**This function leads to energy savings, improved efficiency and a longer service life of the auxiliary pump.**
For settings, see page 8.

### Control fluid filter (Pos. 10)

The HD and EP controls of size 500 with internal control pressure supply from the high pressure are equipped with 0.2 mm coarse dirt filters as standard (independently of the filtration order designation)
Dimensions as shown from page 30. For the circuit diagram, see page 11 in this data sheet (part II).

### Flushing valve (Pos. 04)

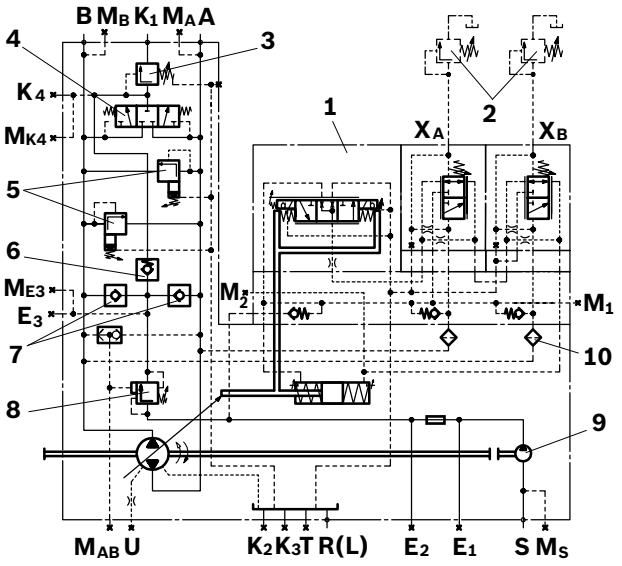
To open the flushing valve safely, at least a pressure differential shown in the diagram between **A** and **B** is necessary. The required pressure differential depends on the rotational speed of the corresponding size. The circuit temperature needs to be monitored to avoid any damage to the system.




1) Larger boost pumps available on request

▼ **Circuit diagram**

**Example A4CSG...EPG...F..4N II3G...**
Sizes 500. Additional sizes available on request.




**Circuit diagram** NG 500

| Components | |
|---|---|
| **1** | EPG control |
| **2** | **Pressure relief valves** (not included in the scope of delivery) |
| **3** | Boost-pressure relief valve |
| **4** | **Flushing valve** |
| **5** | High-pressure relief valves |
| **6** | Bypass valve |
| **7** | Boost check valves |
| **8** | Control pressure relief valve |
| **9** | Integrated boost pump |
| **10** | Control fluid filter for HD and EP (NG 500) |

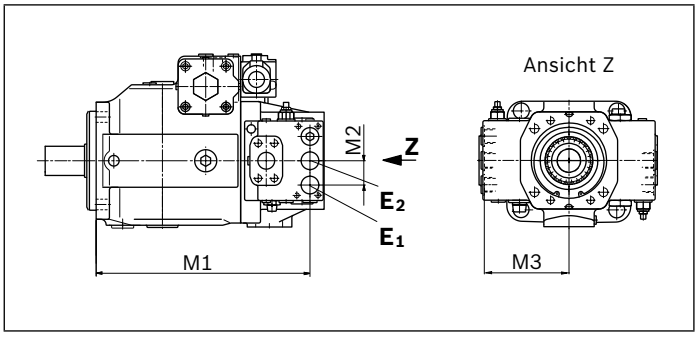
| Ports | | $p_{max\ abs}$ [bar] | State |
|---|---|---|---|
| **A, B** | Working line (pressure port) | 400 | O |
| **S** | Suction port | 30 | O |
| **$M_A$, $M_B$, $M_{AB}$** | Measuring working pressure A/B | 400 | X |
| **$M_S$** | Measuring suction | 30 | X |
| **T** | Fluid drain | 4 | X |
| **$E_1$** | Filter, supply | 40 | X |
| **$E_2$** | Filter, return | 40 | X |
| **$K_1$** | Flushing port | 5 | O |
| **$K_2$, $K_3$** | Fluid filling + air bleeding | 4 | X |
| **R(L)** | Return flow (drain port) | 4 | O |
| **U** | Bearing flushing | 7 | X |
| **$E_3$** | Boost pressure supply | 40 | X |
| **$M_{E3}$** | Measuring boost pressure | 40 | X |
| **$K_4$** | Accumulator port | 40 | X |
| **$M_{K4}$** | Measuring boost pressure | 40 | X |
| **$M_1$** | Measuring stroking chamber pressure | 400 | X |
| **$M_2$** | Measuring stroking chamber pressure | 400 | X |
| **$X_A$, $X_B$** | Pilot pressure, remote control pressure controller | 350 | O |

## Filtration types[1)2)]

Regardless of the selected boost circuit filtration, the HD and EP controls in size 500 is equipped with 0.2 mm control fluid coarse dirt filters as standard. (see circuit diagram)

**Without filter in the boost circuit (version N)**
Ports $E_1$ and $E_2$ are delivered plugged, pressure-proof and internally connected.
A boost circuit filter can be connected to these ports later on.
The internal passage between **$E_1$** and **$E_2$** must be plugged for this purpose (please contact us).
For unit dimensions, see pages 12 to 19.
See circuit diagram on page 29.

**Ports for external boost circuit filtration (version D)**
Ports $E_1$ and $E_2$ are intended for a filter port.
These ports are open and are only plugged with plastic screws for transportation.
The internal passage between **$E_1$** and **$E_2$** is plugged.

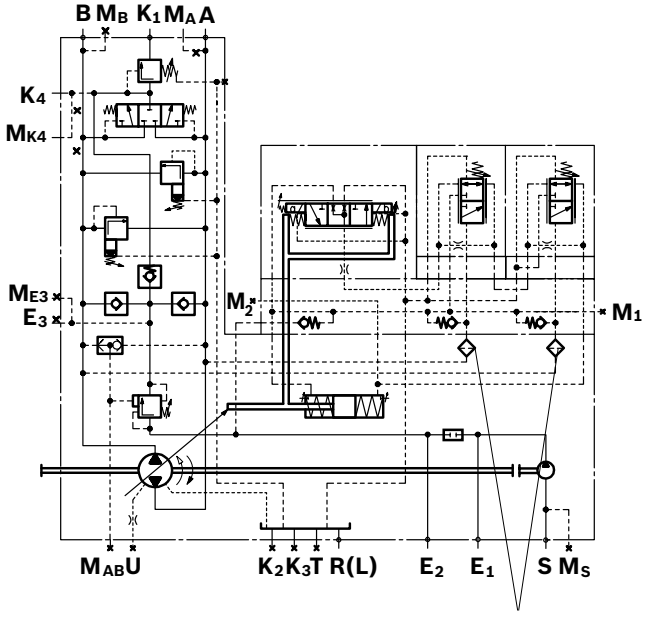



| NG | M1 | M2 | M3 | Port E1/E2 | Standard |
|---|---|---|---|---|---|
| **250** | 477 | 55 | 193 | M33 × 2; 18 deep | DIN 3852 |
| **355** | 484 | 55 | 193 | M33 × 2; 18 deep | DIN 3852 |
| **500** | 520 | 55 | 193 | M33 × 2; 18 deep | DIN 3852 |

| Ports | | $p_{max\ abs}$ [bar] | State |
|---|---|---|---|
| **E1** | Filter, supply | 50 | O |
| **E2** | Filter, return | 50 | O |

▼ **Circuit diagram** [1)]

**Example A4CSG...EPD...F..4D**
Size 500. Additional sizes available on request.




Control fluid filter for HD and EP
(Sizes 500 and 750)

1) For components and ports, see page 30
2) All attachment pumps must match the ATEX classification for the application in question.

# Installation instructions

### General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines.
Especially with the "drive shaft upwards" installation position and above-reservoir installation, bearing flushing is required for lubrication of the front bearing and of the shaft seal at port **U**. See page 7.
The leakage in the housing area must be directed to the reservoir via the highest drain port (**T**, **R**(**L**), $\mathbf{K_2}$, $\mathbf{K_3}$).
If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible housing pressure of all connected units is not exceeded in any operating conditions, particularly at cold start. If this is not possible, separate drain lines must be laid if necessary.
To achieve favorable noise values, decouple all connecting lines using elastic elements and avoid above-reservoir installation.
In all operating conditions, the suction lines and the drain lines must flow into the reservoir below the minimum fluid level. The permissible suction height $h_S$ results from the total pressure loss. However, it must not be higher than $h_{S\ max}$ = 800 mm. The minimum suction pressure at port **S** must not fall below 0.8 bar absolute during operation either.
For external boost pressure supply (version **K..**), please refer to the attachment pump data sheet for details on the minimum suction pressure.
When designing the reservoir, ensure that there is an adequate distance between the suction line and the drain line. This minimizes oil turbulence and carries out degassing, which prevents the heated hydraulic fluid from being sucked directly back in again.

### Installation position

See the following examples **1** to **10**.
Further installation positions are available upon request.
Recommended installation position: **1**.

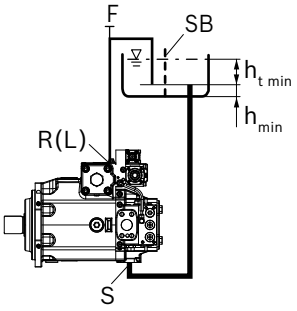
**Notices**

- You can expect installation positions **3**, **4**, **8** and **9** to affect the control device. Gravity, dead weight and case pressure can cause minor characteristic shifts and changes in response time.

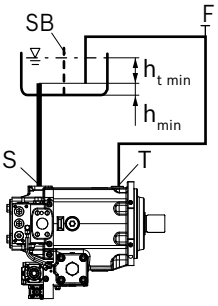
### Below-reservoir installation (recommended)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.

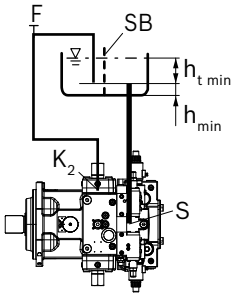
| Installation position | Air bleed | Filling |
|---|---|---|
| **1** | **R(L), F** | **R(L)** |



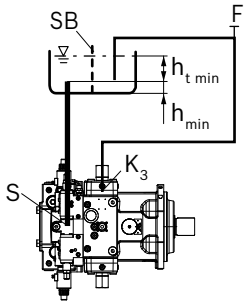

| Installation position | Air bleed | Filling |
|---|---|---|
| **2** | **T; F** | **T** |



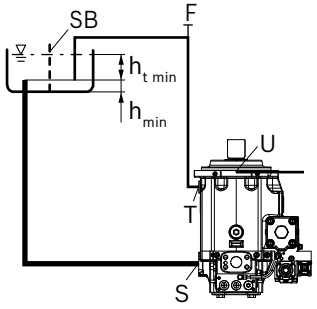

| Installation position | Air bleed | Filling |
|---|---|---|
| **3** | **$K_2$, F** | **$K_2$** |




| Installation position | Air bleed | Filling |
|---|---|---|
| **4** | **$K_3$; F** | **$K_3$** |




| Installation position | Air bleed | Filling |
|---|---|---|
| **5** | **T; F** | **T** |




| Key | |
|---|---|
| **S** | Suction port |
| **T**, **$K_2$**, **$K_3$**, **R(L)** | Fluid filling + air bleeding (drain port) |
| **A, B** | Pressure port |
| **U** | Bearing flushing port |
| **SB** | Baffle (baffle plate) |
| **$h_{t\ min}$** | Minimum required immersion depth (200 mm) |
| **$h_{min}$** | Minimum required distance to reservoir bottom (100 mm) |
| **$h_{s\ max}$** | Maximum permissible suction height 800 mm for version F. For version K, observe the external boost pump specification. |

**Notice**

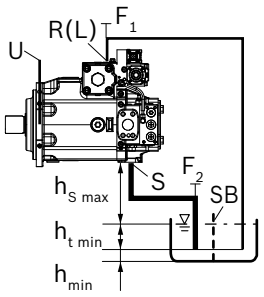
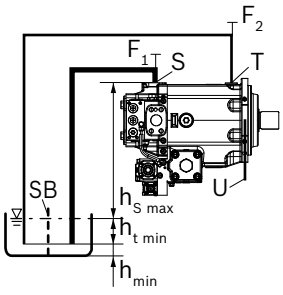
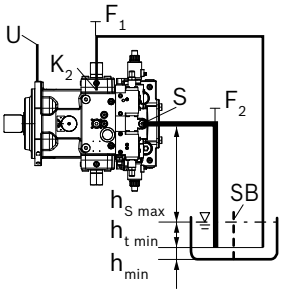
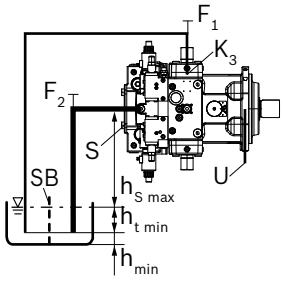
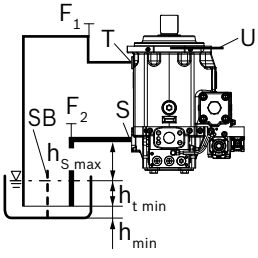
- With installation position 5, only operate the axial piston unit with bearing flushing.
- Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

### Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. A check valve in the drain line is to be avoided. Exceptions may be permissible, please consult us first.

**Notice**

- With above-reservoir installation, only operate the axial piston unit with bearing flushing.
- Port **F** is part of the external piping and must be provided on the customer side to make filling and air bleeding easier.

| Installation position | Air bleed | Filling |
|---|---|---|
| **6**  | **R(L), F** | **R(L)** |
| **7**  | **T; F** | **T** |
| **8**  | **$K_2$; F** | **$K_2$; F** |
| **9**  | **$K_3$; F** | **$K_3$; F** |
| **10**  | **T; F** | **T** |

| Key | |
|---|---|
| **S** | Suction port |
| **T**, **$K_2$**, **$K_3$**, **R(L)** | Fluid filling + air bleeding (drain port) |
| **A, B** | Pressure port |
| **U** | Bearing flushing port |
| **SB** | Baffle (baffle plate) |
| **$h_{t\ min}$** | Minimum required immersion depth (200 mm) |
| **$h_{min}$** | Minimum required distance to reservoir bottom (100 mm) |
| **$h_{s\ max}$** | Maximum permissible suction height 800 mm for version F. For version K, observe the external boost pump specification. |

## Project planning notes

- The Axial piston variable pump A4CSG ATEX is designed for use in a closed circuit.
- The project planning, assembly and commissioning of the axial piston unit require the involvement of qualified skilled persons.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, please request a binding installation drawing.
- The specified data and notes contained herein must be observed.
- Depending on the operating conditions of the axial piston unit (working pressure, fluid temperature), the characteristic curve may shift.
- The characteristic curve may also shift due to the dither frequency or control electronics.
- Preservation: Our axial piston units are supplied as standard with preservative protection for a maximum of 12 months. If longer preservation is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply under optimal storage conditions, which can be found in data sheet 90312 or in the instruction manual.
- Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the proper contact at Bosch Rexroth if you require reliability parameters (e.g. $MTTF_d$) for functional safety.
- Depending on the type of control used, electromagnetic effects can be produced when using solenoids. The use of the direct current (DC) on the electromagnet does not produce any electromagnetic interference (EMI), nor is the electromagnet influenced by EMI. A possible electromagnetic interference (EMI) exists if the solenoid is supplied with modulated direct current (e.g. PWM signal). Electromagnetic interference (EMI) potential exists when operating and controlling a solenoid with a modulated direct voltage signal (e.g. PWM signal). Appropriate testing and measures should be taken by the machine manufacturer to ensure other components or operators (e.g. with pacemaker) are not affected by this potential.
- Pressure cut-off / Pressure controllers are not safeguards against pressure overload. Be sure to add a pressure relief valve to the hydraulic system. Be sure to add a pressure relief valve to the hydraulic system.
- For drives that are operated for a long period with constant rotational speed, the natural frequency of the hydraulic system can be stimulated by the excitation frequency of the pump (rotational speed frequency ×9). This can be prevented with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.
- Working ports:
  - The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
  - The working ports and function ports are only intended to accommodate hydraulic lines.

## Safety instructions

- During and shortly after operation, there is a risk of getting burnt on the axial piston unit and especially on the solenoids. Take the appropriate safety measures (e.g. by wearing protective clothing).
- Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in an undefined position due to contamination (e.g. impure hydraulic fluid, abrasion or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to bring the driven consumer into a safe position (e.g. safe stop) and ensure any measures are appropriately implemented.

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