



4.1

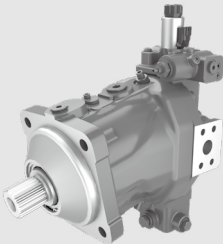
# M60V(E) SERIES

**Bent-axial Piston  
Variable Displacement Motor**

The M60V & M60VE series bent-axial piston variable displacement motor is used in an open or closed circuit. The bent-axial structure ensures a larger displacement and a more compact structure under the same volume.

Apply to open or close circuit

|                         |     |     |     |     |     |     |     |     |     |
|-------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Size:                   | 28  | 60  | 85  | 115 | 160 | 170 | 200 | 215 | 280 |
| Nominal pressure (bar): | 400 | 450 | 450 | 450 | 400 | 450 | 400 | 450 | 450 |
| Max. pressure (bar):    | 450 | 530 | 530 | 530 | 450 | 530 | 450 | 530 | 500 |



## Contents

|                   |       |
|-------------------|-------|
| Technical Data    | 02    |
| Type introduction | 03-05 |
| Hydraulic fluid   | 06-07 |
| Principle         | 08-14 |
| Speed sensor      | 15-17 |
| Installation size |       |
| · M60VE28         | 18-19 |
| · M60V(E)60       | 20-23 |
| · M60V(E)85       | 24-29 |
| · M60V(E) 115     | 30-35 |
| · M60V(E)160      | 36-37 |
| · M60V(E) 170     | 38-41 |
| · M60V(E) 200     | 42-43 |
| · M60V(E) 215     | 44-45 |
| · M60V 280        | 46-47 |

## Features

- Flange and plug-in designs are optional to meet different installation methods.
- Higher pressure and higher speed
- Superior performance in low speed operation provides excellent controllability.
- High activation efficiency.
- Various controllers are optional.
- Wide control range (to an angle of 0° ).
- High torque and long service life.
- Flush valve and high-pressure balance valves are optional.
- Suitable for engineering machinery and general industrial vehicles, especially rotary drilling rigs and cranes.

Technical Data

|                                                                   |                                          |                                     |        |        |        |                                      |        |                                      |        |        |
|-------------------------------------------------------------------|------------------------------------------|-------------------------------------|--------|--------|--------|--------------------------------------|--------|--------------------------------------|--------|--------|
| Size                                                              |                                          | 28                                  | 60     | 85     | 115    | 160                                  | 170    | 200                                  | 215    | 280    |
| Max displacement (cc/rev)                                         |                                          | 28                                  | 62     | 85.2   | 115.6  | 160                                  | 171.8  | 200                                  | 216.5  | 280.1  |
| Min displacement (cc/rev)                                         |                                          | 0                                   |        |        |        |                                      |        |                                      |        |        |
| Direction of rotation                                             |                                          | Clockwise, Counter clockwise        |        |        |        |                                      |        |                                      |        |        |
| Rotation speed (rpm)<br><small>(Not at min. displacement)</small> | Rated                                    | 5550                                | 4450   | 3900   | 3550   | 3100                                 | 3100   | 2900                                 | 2900   | 2500   |
|                                                                   | Max.                                     | 8750                                | 7200   | 6800   | 6150   | 4900                                 | 4900   | 4600                                 | 4800   | 3550   |
| Rotation speed (rpm)<br><small>(At min. displacement)</small>     | Max.                                     | 10450                               | 8400   | 8350   | 7350   | 5500                                 | 5750   | 5100                                 | 5500   | 3550   |
| Pressure (bar)                                                    | Rated                                    | 400                                 | 450    | 450    | 450    | 400                                  | 450    | 400                                  | 450    | 450    |
|                                                                   | Max.                                     | 450                                 | 530    | 530    | 530    | 450                                  | 530    | 450                                  | 530    | 500    |
| Casting pressure                                                  | Rated (bar)                              | 2                                   | 2      | 2      | 2      | 3 <sup>-1</sup>                      | 3      | 3 <sup>-1</sup>                      | 3      | 2      |
|                                                                   | Max. (bar)<br>(Short-time peak pressure) | 5                                   | 5      | 5      | 5      | 6 <sup>-1</sup>                      | 6      | 6 <sup>-1</sup>                      | 6      | 5      |
| Max. output torque (N·m), (ΔP=450bar)                             |                                          | 179<br><small>(ΔP = 400bar)</small> | 444    | 610    | 828    | 1019<br><small>(ΔP = 400bar)</small> | 1230   | 1273<br><small>(ΔP = 400bar)</small> | 1550   | 2006   |
| Weight (Kg)<br><small>(Approximate value)</small>                 |                                          | 21.5                                | 31     | 39     | 46     | 67                                   | 62     | 78                                   | 78     | 101    |
| Oil viscosity (mm <sup>2</sup> /s)                                |                                          | 10~1000, Best range: 16~36          |        |        |        |                                      |        |                                      |        |        |
| Oil Temperature (°C)                                              |                                          | -25 ~ 103                           |        |        |        |                                      |        |                                      |        |        |
| Oil Cleanliness                                                   |                                          | ISO 4406 20/18/15                   |        |        |        |                                      |        |                                      |        |        |
| Moment of inertia (kg·m <sup>2</sup> )                            |                                          | 0.0014                              | 0.0043 | 0.0072 | 0.0110 | 0.0253                               | 0.0213 | 0.0353                               | 0.0303 | 0.0479 |

- 04
1. Higher pressure resistant oil seals are currently under development.  
(Rated at 5bar and short-time peak pressure at 10bar.)

## Type Introduction

| M60V | 200 | E6 | D1 | N | R | S4 | A2 | A | F | E | — | J |
|------|-----|----|----|---|---|----|----|---|---|---|---|---|
| ①    | ②   | ③  | ④  | ⑤ | ⑥ | ⑦  | ⑧  | ⑨ | ⑩ | ⑪ |   | ⑫ |

### Product series

|   |                                                         | 28 | 60 | 85 | 115 | 160 | 170 | 200 | 215 | 280 | Code  |
|---|---------------------------------------------------------|----|----|----|-----|-----|-----|-----|-----|-----|-------|
| ① | Bent-axial Variable Piston Motor<br>(Flange-type motor) | ○  | ●  | ●  | ●   | ●   | ●   | ●   | ●   | ●   | M60V  |
|   | Bent-axial Variable Piston Motor<br>(Plug-in motor)     | ●  | ●  | ●  | ●   | ●   | ●   | ●   | ●   |     | M60VE |

### Size

| ② | Size | 28 | 60 | 85 | 115 | 160 | 170 | 200 | 215 | 280 |
|---|------|----|----|----|-----|-----|-----|-----|-----|-----|
|---|------|----|----|----|-----|-----|-----|-----|-----|-----|

### Control type

|   |                                            | 28                                 | 60 | 85 | 115 | 160 | 170 | 200 | 215 | 280 | Code |
|---|--------------------------------------------|------------------------------------|----|----|-----|-----|-----|-----|-----|-----|------|
| ③ | Electric proportional displacement control | positive characteristic, 12V       | ●  | ●  | ●   | ●   | ●   | ●   | ●   | ●   | E1   |
|   |                                            | positive characteristic, 24V       | ●  | ●  | ●   | ●   | ●   | ●   | ●   | ●   | E2   |
|   |                                            | negative characteristic, 12V       | ●  | ●  | ●   | ●   | ●   | ●   | ●   | ●   | E5   |
|   |                                            | negative characteristic, 24V       | ●  | ●  | ●   | ●   | ●   | ●   | ●   | ●   | E6   |
|   | Electric two-point control                 | positive characteristic, 12V       | ●  | ●  | ●   | ●   | ●   | ●   | ●   |     | ET1  |
|   |                                            | positive characteristic, 24V       | ●  | ●  | ●   | ●   | ●   | ●   | ●   |     | ET2  |
|   |                                            | negative characteristic, 12V       | ●  | ●  | ●   | ●   | ●   | ●   | ●   |     | EW1  |
|   |                                            | negative characteristic, 24V       | ●  | ●  | ●   | ●   | ●   | ●   | ●   |     | EW2  |
|   | Hydraulic proportional control             | positive characteristic (ΔP=10bar) |    | ●  | ●   | ●   | ●   | ●   | ●   |     | H1   |
|   |                                            | positive characteristic (ΔP=25bar) |    | ●  | ●   | ●   | ●   | ●   | ●   |     | H2   |
|   |                                            | negative characteristic (ΔP=10bar) |    | ●  | ●   | ●   | ●   | ●   | ●   |     | H5   |
|   |                                            | negative characteristic (ΔP=25bar) |    | ●  | ●   | ●   | ●   | ●   | ●   |     | H6   |
|   | Hydraulic two-point control                | positive characteristic            |    | ●  | ●   | ●   | ●   | ●   | ●   |     | HT   |
|   |                                            | negative characteristic            |    | ●  | ●   | ●   | ●   | ●   | ●   |     | HW   |
|   | Automatic control high-pressure related    | ΔP ≤ approx, 10bar                 |    | ●  | ●   | ●   | ●   | ●   | ●   |     | V1   |
|   |                                            | ΔP=50bar                           | ●  |    |     |     |     |     |     |     | V3   |
|   |                                            | ΔP=100bar                          |    | ●  | ●   | ●   | ●   | ●   | ●   |     | V2   |

Type introduction

Pressure cut-off

|   |                                        |    |
|---|----------------------------------------|----|
| ④ | With                                   | D1 |
|   | Hydraulic remote control, proportional | T3 |
|   | Without                                | 00 |

Speed sensor

|   |                                             |   |
|---|---------------------------------------------|---|
| ⑤ | Without speed sensor                        | N |
|   | With speed sensor (supply voltage 4.5~8VDC) | M |
|   | With speed sensor (supply voltage 8~32VDC)  | P |
|   | Installation of reserved speed sensor       | A |

Note: Please refer to page 15/48 for specific parameters of the speed sensor.

Port position

|   |      |    |    |    |     |     |     |     |     |     |      |
|---|------|----|----|----|-----|-----|-----|-----|-----|-----|------|
| ⑥ |      | 28 | 60 | 85 | 115 | 160 | 170 | 200 | 215 | 280 | Code |
|   | Rear | ●  | ●  | ●  | ●   | ●   | ●   | ●   | ●   | ●   | R    |
|   | Side | ●  | ●  | ●  | ●   | ●   | ●   | ●   | ●   | ●   | A    |

Mounting flange

|   |                         |    |    |    |     |     |     |     |     |     |      |
|---|-------------------------|----|----|----|-----|-----|-----|-----|-----|-----|------|
| ⑦ | Mounting flange (M60V)  | 28 | 60 | 85 | 115 | 160 | 170 | 200 | 215 | 280 | Code |
|   | 125-4 ISO 3019-2        |    | ●  |    |     |     |     |     |     |     | M4   |
|   | 127-4 SAE J744          |    |    | ●  |     |     |     |     |     |     | C4   |
|   | 140-4 ISO 3019-2        |    |    | ●  |     |     |     |     |     |     | N4   |
|   | 152-4 ISO 3019-1        |    |    |    | ●   | ●   | ●   |     |     |     | D4   |
|   | 160-4 ISO 3019-2        |    |    |    | ●   |     |     |     |     |     | P4   |
|   | 165-4 ISO 3019-2        |    |    |    |     |     |     |     |     | ●   | T4   |
|   | 180-4 ISO 3019-2        |    |    |    |     | ●   | ●   |     |     |     | R4   |
|   | 200-4 ISO 3019-2        |    |    |    |     |     |     | ●   | ●   | ●   | S4   |
|   | Mounting flange (M60VE) | 28 | 60 | 85 | 115 | 160 | 170 | 200 | 215 | 280 | Code |
|   | 135-2 ISO 3019-2        | ●  |    |    |     |     |     |     |     |     | L2   |
|   | 160-2 ISO 3019-2        |    | ●  |    |     |     |     |     |     |     | P2   |
|   | 190-2 ISO 3019-2        |    |    | ●  |     |     |     |     |     |     | Y2   |
|   | 200-2 ISO 3019-2        |    |    |    | ●   | ●   | ●   |     |     |     | S2   |
|   | 260-4 ISO 3019-2        |    |    |    |     |     |     | ●   | ●   |     | E4   |

Type introduction

Input shaft

|   |                      |    |    |    |     |     |     |     |     |     |      |
|---|----------------------|----|----|----|-----|-----|-----|-----|-----|-----|------|
| ⑧ | Drive shaft (M60V)   | 28 | 60 | 85 | 115 | 160 | 170 | 200 | 215 | 280 | Code |
|   | W35×2×16×9g DIN 5480 |    | ●  | ●  |     |     |     |     |     |     | B8   |
|   | W40×2×18×9g DIN 5480 |    |    | ●  | ●   |     |     |     |     |     | B9   |
|   | W45×2×21×9g DIN 5480 |    |    |    | ●   | ●   | ●   |     |     |     | A1   |
|   | W50×2×24×9g DIN 5480 |    |    |    |     | ●   | ●   | ●   | ●   | ●   | A2   |
|   | W60×2×28×9g DIN 5480 |    |    |    |     |     |     |     |     | ●   | A5   |
|   | 13T-8/16 ANSI B92.1  |    |    |    | ●   | ●   | ●   | ●   | ●   |     | A3   |
|   | 14T-12-24 ANSI B92.1 |    |    | ●  |     |     |     |     |     |     | S7   |
|   | 21T-16/32 ANSI B92.1 |    |    |    | ●   |     |     |     |     |     | B1   |
|   | 27T-16/32 ANSI B92.1 |    |    |    |     |     | ●   |     | ●   |     | B4   |
|   | Drive shaft (M60VE)  | 28 | 60 | 85 | 115 | 160 | 170 | 200 | 215 | 280 | Code |
|   | W30×2×14×9g DIN 5480 | ●  | ●  |    |     |     |     |     |     |     | B6   |
|   | W40×2×18×9g DIN 5480 |    |    | ●  | ●   |     |     |     |     |     | B9   |
|   | W45×2×21×9g DIN 5480 |    |    |    |     | ●   | ●   |     |     |     | A1   |
|   | W50×2×24×9g DIN 5480 |    |    |    |     |     | ●   | ●   | ●   |     | A2   |

Seal type

|   |                                |   |
|---|--------------------------------|---|
| ⑨ | O ring seal (ISO 6149)         | A |
|   | Elastomeric sealing (ISO 9974) | E |

Seal Method

|   |                                    |   |
|---|------------------------------------|---|
| ⑩ | FKM (Viton rubber: DIN ISO 1629)   | F |
|   | NBR (Nitrile rubber: DIN ISO 1629) | N |

Note: Please refer to page 7/48 for the temperature range.

Balance valve

|   |                         |   |
|---|-------------------------|---|
| ⑪ | With balance valve, BVD | D |
|   | With balance valve, BVE | E |
|   | With balance valve, BVI | I |
|   | Without                 | 0 |

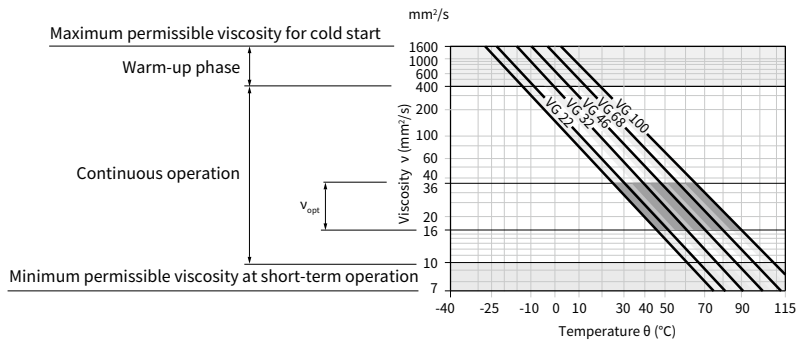
Standard / special version

|    |                                                              |                  |                       |      |  |                       |      |                                                        |
|----|--------------------------------------------------------------|------------------|-----------------------|------|--|-----------------------|------|--------------------------------------------------------|
| ⑫  | Standard version                                             |                  | N                     |      |  |                       |      |                                                        |
|    | Second small displacement (optional only with balance valve) |                  | V                     |      |  |                       |      |                                                        |
|    | Special version                                              | With flush valve |                       |      |  |                       |      |                                                        |
|    |                                                              |                  | Flushing flow (L/min) | Code |  | Flushing flow (L/min) | Code | Opening pressure 16bar, differential pressure ΔP=25bar |
|    |                                                              |                  | 3.5                   | A    |  | 20                    | G    |                                                        |
|    |                                                              |                  | 5                     | B    |  | 25                    | H    |                                                        |
|    |                                                              |                  | 8                     | C    |  | 30                    | M    |                                                        |
|    |                                                              |                  | 10                    | D    |  | 35                    | J    |                                                        |
|    |                                                              |                  | 14                    | E    |  | 40                    | K    |                                                        |
| 17 | F                                                            |                  |                       |      |  |                       |      |                                                        |

Remark: ● = Available; ○ = On request

# Hydraulic fluid

## • Selection diagram



### Notes on selection of hydraulic fluid:

The hydraulic fluid should be selected such that the operating viscosity in the operating temperature range is within the optimum range ( $\nu_{opt}$  see selection diagram).

### Notice:

At no point of the component may the temperature be higher than 115 °C. The temperature difference specified in the table is to be taken into account when determining the viscosity in the bearing. Please contact us if the above conditions cannot be met due to extreme operating parameters.

Hydraulic fluid

•Viscosity and temperature of hydraulic fluids

|                         | Viscosity<br>(mm <sup>2</sup> /s)                    | Shaft<br>seal | Temperature                            | Comment                                                                                                                                                                                                                                           |
|-------------------------|------------------------------------------------------|---------------|----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cold start              | $v_{\max} \leq 7400$<br>(1600)                       | NBR           | $\theta_{St} \geq -40^{\circ}\text{C}$ | $t \leq 3\text{min}$ , without load( $p \leq 725\text{psi}(50\text{bar})$ ),<br>$n \leq 1000\text{rpm}$ Permissible temperature difference<br>between axial piston unit and hydraulic fluid in<br>the system maximum $45^{\circ}\text{F}$ (25 K). |
|                         |                                                      | FKM           | $\theta_{St} \geq -25^{\circ}\text{C}$ |                                                                                                                                                                                                                                                   |
| Warm-up<br>phase        | $v = 7400 \cdots 1850$<br>(1600 $\cdots$ 400)        |               |                                        | $t \leq 15\text{min}$ , $p \leq 0.7 \times p_{\text{nom}}$ and $n \leq 0.5 \times n_{\text{nom}}$                                                                                                                                                 |
| Continuous<br>operation | $v = 1850 \cdots 60$<br>(400 $\cdots$ 10)            | NBR           | $\theta \leq +85^{\circ}\text{C}$      | measured at port T                                                                                                                                                                                                                                |
|                         |                                                      | FKM           | $\theta \leq +110^{\circ}\text{C}$     |                                                                                                                                                                                                                                                   |
|                         | $v_{\text{opt}} = 170 \cdots 82$<br>(36 $\cdots$ 16) |               |                                        | Range of optimum operating viscosity and<br>efficiency                                                                                                                                                                                            |
| Short-term<br>operation | $v_{\min} = 60 \cdots 49$<br>(10 $\cdots$ 7)         | NBR           | $\theta \leq +85^{\circ}\text{C}$      | $t \leq 3\text{min}$ , $p \leq 0.3 \times p_{\text{nom}}$ , measured at port T                                                                                                                                                                    |
|                         |                                                      | FKM           | $\theta \leq +110^{\circ}\text{C}$     |                                                                                                                                                                                                                                                   |

• 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 is to be maintained according to ISO 4406.

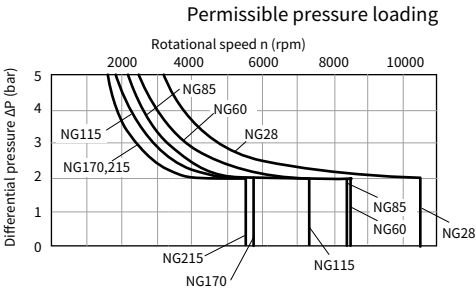
At a hydraulic fluid viscosity of less than 10 mm<sup>2</sup>/s (e.g. due to high temperatures during short-term operation) at the drain port, a cleanliness level of at least 19/17/14 according to ISO 4406 is required.

• Shaft seal

Notice

•Working pressure range valid when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.

•In addition to the hydraulic fluid and the temperature, the service life of the shaft seal is influenced by the rotational speed of the axial piston unit and the case pressure.

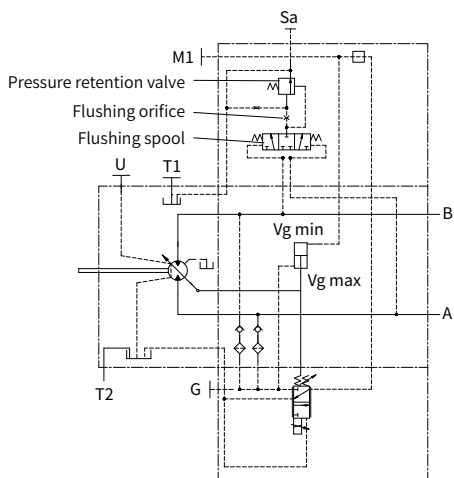


## Principle

- **E-Electric Proportional Control**

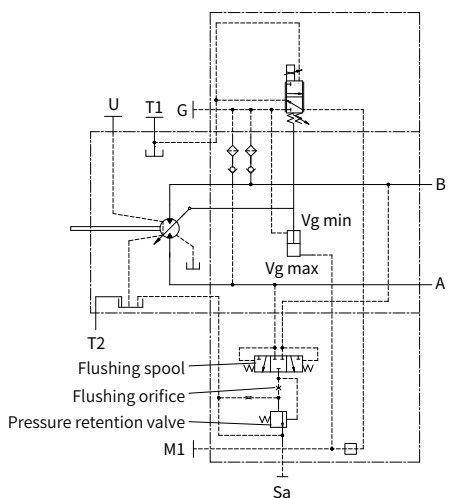
The electric proportional displacement control valve is installed on the motor. The motor displacement is proportional to the electric control current applied to the solenoid.

**E1、E2**



E1, E2 positive control  
Beginning of control at  $V_g$  min  
End of control at  $V_g$  max

## E5、E6



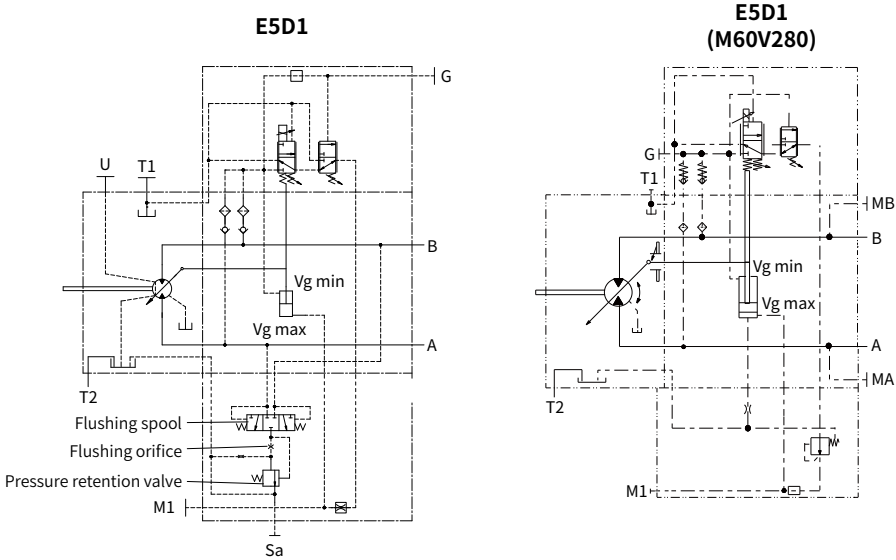
E5, E6 negative control  
Beginning of control at  $V_g$  max  
End of control at  $V_g$  min



# Principle

## • E-Electric Proportional Control

The electric proportional displacement control valve is installed on the motor. The motor displacement is proportional to the electric control current applied to the solenoid.



E5 is negative electric proportional control with 12v solenoid, D1 is pressure control, If the load torque or a reduction in motor swivel angle causes the system pressure to reach the setpoint value of the pressure control, the motor will swivel towards a larger displacement. Setting range of the pressure control valve 80 to 450 bar.

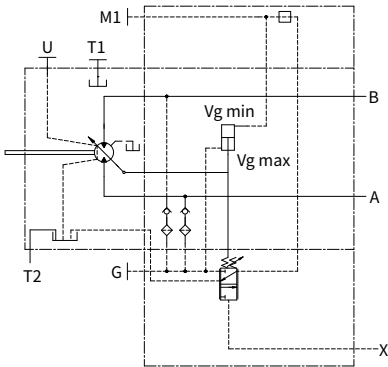
| Technical data, solenoid     | E1、 E5   | E2、 E6  |
|------------------------------|----------|---------|
| Voltage/V                    | 12       | 24      |
| Control current/mA           | 400~1200 | 200~600 |
| Current limit/A              | 1.3      | 0.65    |
| Nominal Resistance (20°C) /Ω | 5.7±0.5  | 23.5±7% |

# Principle

## • H-Hydraulic Proportional Control

The hydraulic proportional displacement control valve is installed on the motor. The motor displacement is proportional to the pilot pressure, X is pilot pressure port.

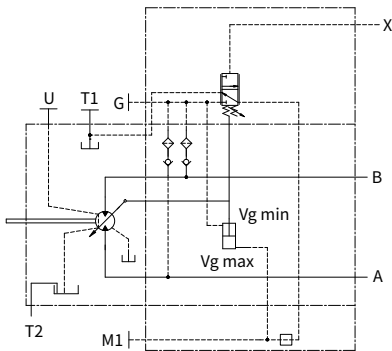
### H1, H2



H1(positive control, increment of pilot pressure is 10 bar). Beginning of control at Vg min, End of control at Vg max. The motor displacement will increase from minimum to maximum when pilot pressure increases by 10 bar.Setting range of the displacement change point of pilot pressure is 2 to 20 bar.

H2(positive control, increment of pilot pressure is 25 bar). Beginning of control at Vg min, End of control at Vg max. The motor displacement will increase from minimum to maximum when pilot pressure increases by 25 bar.Setting range of the displacement change point of pilot pressure is 5 to 35 bar.

### H5, H6



H5(negative control, increment of pilot pressure is 10 bar). Beginning of control at Vg max, End of control at Vg min. The motor displacement will increase from maximum to minimum when pilot pressure increases by 10 bar.Setting range of the displacement change point of pilot pressure is 2 to 20 bar.

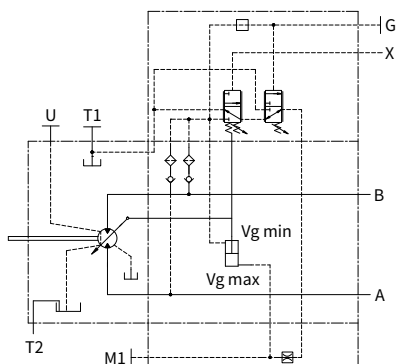
H6(negative control, increment of pilot pressure is 25 bar). Beginning of control at Vg max, End of control at Vg min. The motor displacement will increase from maximum to minimum when pilot pressure increases by 25 bar.Setting range of the displacement change point of pilot pressure is 5 to 35 bar.

## Principle

### •H-Hydraulic Proportional Control

The hydraulic proportional displacement control valve is installed on the motor. The motor displacement is proportional to the pilot pressure, X is pilot pressure port.

**H5D1**



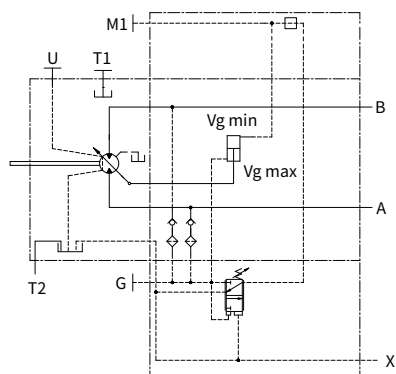
H5D1(negative control, increment of pilot pressure is 10 bar+Pressure control valve).

The hydraulic proportional displacement control valve and the pressure control valve are installed on the motor at the same time. H5 is negative hydraulic proportional control with 10 bar increment of pilot pressure, D1 is pressure control, If the load torque or a reduction in motor swivel angle causes the system pressure to reach the setpoint value of the pressure control, the motor will swivel towards a larger displacement. Setting range of the pressure control valve 80 to 450 bar.

### •V-Automatic High Pressure Related Control

Automatic high pressure related control means the motor displacement will change automatically according to the working pressure, the pilot pressure of control valve is supplied by motor working pressure from A or B port, no external control pressure is required. When the working pressure reached the setpoint valve of control valve, the motor will swivel towards a larger displacement. The displacement is modulated between Vg min and Vg max depending on the load.

**V1**



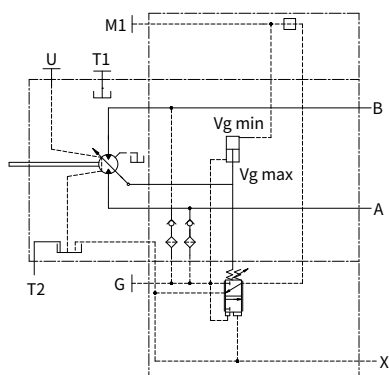
V1(Automatic high pressure related control, increment of working pressure  $\Delta P \leq 10$  bar). Increment of working pressure  $\Delta P \leq 10$  bar, The motor displacement will increase from minimum to maximum. Setting range of the setpoint of control valve pressure is 80 ~ 350bar.

## Principle

### ·V-Automatic High Pressure Related Control

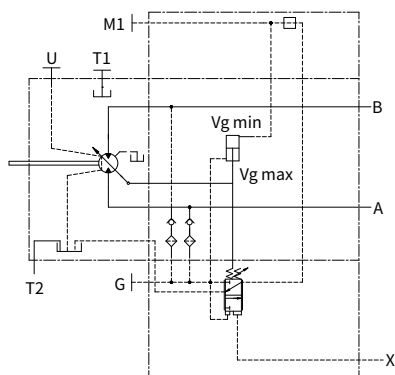
Automatic high pressure related control means the motor displacement will change automatically according to the working pressure, the pilot pressure of control valve is supplied by motor working pressure from A or B port, no external control pressure is required. When the working pressure reached the setpoint valve of control valve, the motor will swivel towards a larger displacement. The displacement is modulated between  $V_g \min$  and  $V_g \max$  depending on the load.

**V2**



V2(Automatic high pressure related control, increment of working pressure  $\Delta P \approx 100\text{bar}$ ). Increment of working pressure  $\Delta P \approx 100\text{bar}$ , The motor displacement will increase from minimum to maximum. Setting range of the setpoint of control valve pressure is 80 ~ 350bar.

**V2T3**



V2T3(Automatic high pressure related control+remote pressure control, increment of working pressure  $\Delta P \approx 100\text{bar}$ ). For the V2T3 control mode, in spite of working pressure from A or B port will provide the control valve pressure, the beginning of control can be influenced by applying a pilot pressure to port X. The beginning of control is reduced by 17 bar per 1 bar pilot pressure.

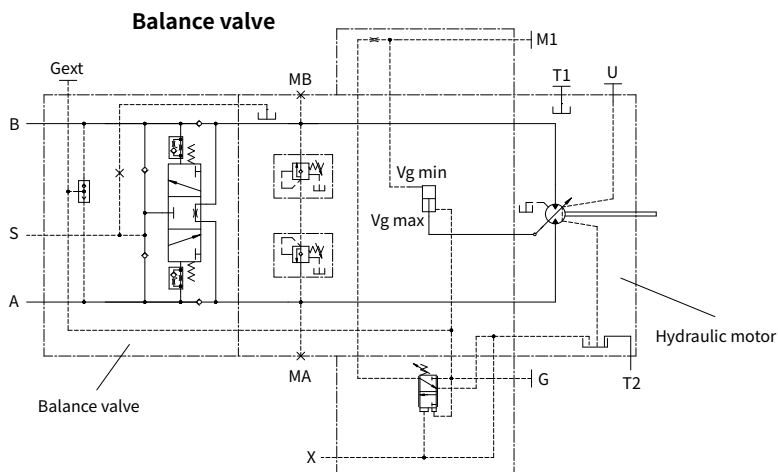
## Principle (With Counter Balance Valve)

### •V1+BVD

#### (Automatic High Pressure Related Control + Counter Balance Valve)

V1+BVD(Automatic High Pressure Related Control + Counter Balance Valve, increment of working pressure  $\Delta P \leq 10$  bar, Spool of balance valve with internal orifice, control system has high pressure relief valves.)

S port is boost port, boost hydraulic fluid can reduce the risk that motor vacuums during braking. When the motor is working (fluid flows from port B to port A), balance valve opened, hydraulic fluid flows out of port A through the balance valve, when the hydraulic system is standby, no fluid flows into port B, balance valve closed, motor will continue to rotate because of the load inertia, hydraulic fluid circulates through the motor by internal orifice of balance valve, the rotatry speed decreases slowly and finally stop. The high pressure relief valves play the role of motor overload protection.



## Principle (With Counter Balance Valve )

### · HA2T3+BVD (Automatic High Pressure Related Control + Remote Pressure control + Counter Balance Valve)

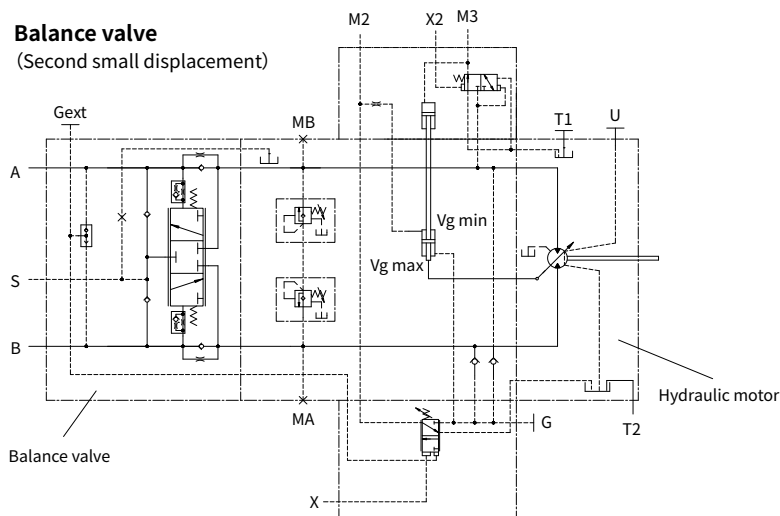
HA2T3BVD(Automatic High Pressure Related Control + Remote pressure control + Counter Balance Valve + Second Small Displacement Control, increment of working pressure  $\Delta P \approx 100\text{bar}$ , Spool of balance valve without internal orifice, control system has high pressure relief valves.)

For the HA2T3 control mode, in spite of working pressure from A or B port will provide the control valve pressure, the beginning of control can be influenced by applying a pilot pressure to port X. The beginning of control is reduced by 17 bar per 1 bar pilot pressure.

S port is boost port, boost hydraulic fluid can reduce the risk that motor vacuums during braking. When the motor is working (fluid flows from port B to port A), balance valve opened, hydraulic fluid flows out of port A through the balance valve, when the hydraulic system is standby, no fluid flows into port B, balance valve closed, second small displacement control valve opened, hydraulic fluid pushes the piston of second small displacement control, motor displacement changes from the minimum to the larger displacement ( $< \text{maximum displacement}$ ), preventing the motor from stalling and sucking out. The high pressure relief valves play the role of motor overload protection.

#### Balance valve

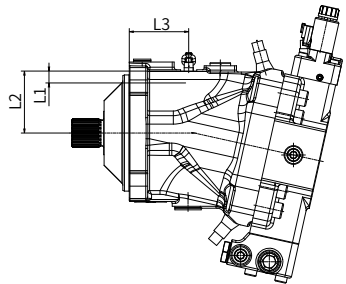
(Second small displacement)



Speed sensor

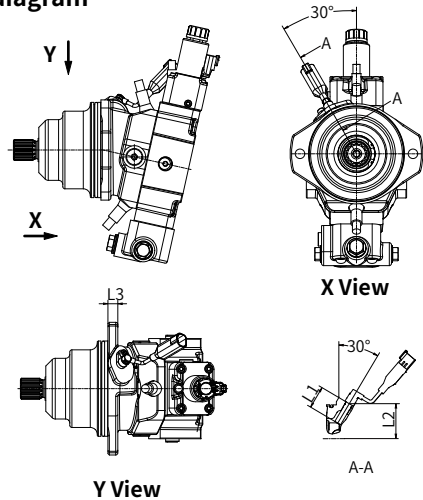
The speed sensor is installed on the motor, which can record the motor speed and detect the direction of rotation of the motor.

• M60V Installation diagram



|                                                 |      |      |      |         |         |       |
|-------------------------------------------------|------|------|------|---------|---------|-------|
| M60V Displacement cc/rev                        | 60   | 85   | 115  | 160/170 | 200/215 | 280   |
| Number of teeth in the speed ring               | 54   | 58   | 67   | 75      | 80      | 78    |
| L1 ( Probe length)mm                            | 18.4 | 18.4 | 18.4 | 18.4    | 18.4    | 32    |
| L2 ( Sensor mounting surface to center axis) mm | 75   | 79   | 88   | 96      | 101     | 110.5 |
| L3 ( Sensor to flange surface) mm               | 66.2 | 75.2 | 77.2 | 91.7    | 95.2    | 82    |
| Gear module                                     | 2    | 2    | 2    | 2       | 2       | 2     |

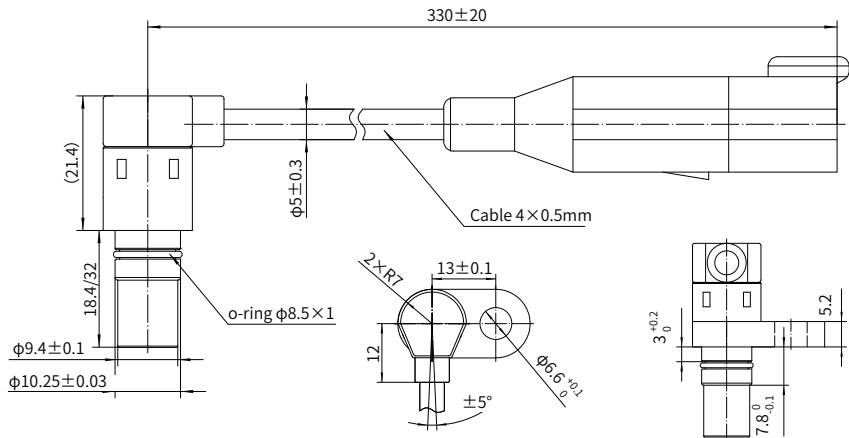
• M60VE Installation diagram



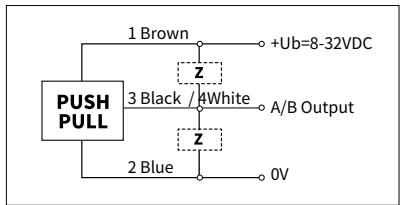
|                                                 |      |      |      |      |         |       |
|-------------------------------------------------|------|------|------|------|---------|-------|
| M60V Displacement cc/rev                        | 28   | 60   | 85   | 115  | 160/170 | 215   |
| Number of teeth in the speed ring               | 40   | 54   | 58   | 67   | 75      | 80    |
| L1 ( Probe length)mm                            | 32   | 32   | 32   | 32   | 32      | 32    |
| L2 ( Sensor mounting surface to center axis) mm | 69.3 | 83.8 | 87.3 | 96.3 | 104.3   | 109.2 |
| L3 ( Sensor to flange surface) mm               | 14   | 16   | 18.5 | 18   | 20      | 25    |
| Gear module                                     | 2    | 2    | 2    | 2    | 2       | 2     |

Speed sensor

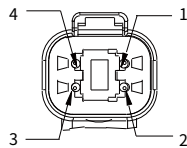
• Installation size



• Wiring diagram



|                                          |                                                              |
|------------------------------------------|--------------------------------------------------------------|
| Current consumption when unloaded        | MAX.15mA                                                     |
| Maximum load current                     | 50mA                                                         |
| Frequency range                          | 0~20kHz                                                      |
| Temperature range for use                | -40~125°C                                                    |
| Protection grade                         | IP67/IP69K                                                   |
| Output pulse count                       | Refer to the table for the number of teeth in the speed ring |
| Rotation recognition                     | Dual frequency output, 90 ° phase difference                 |
| Pressure resistance of measuring surface | 10bar                                                        |



| DEUTSCH DT 04-4P |                    |
|------------------|--------------------|
| PIN              | function           |
| 1                | VDC(8-32V)         |
| 2                | GROUND             |
| 3*               | Frequency signal A |
| 4*               | Frequency signal B |

Note: “\*” PIN3. See 17/48 for the waveform diagram of output 4.

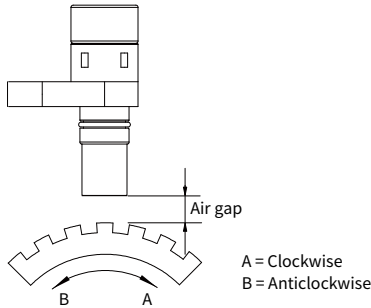


Speed sensor

• Output signal

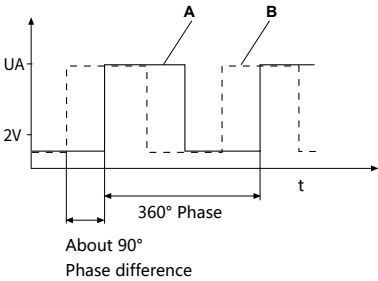
Reverse pulse output:  $I_{max} \leq 50mA$

The frequency signal can be measured within the range of 0Hz to 20kHz.

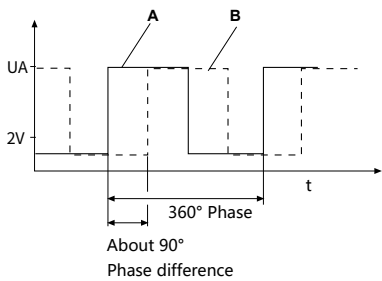


|             |         |
|-------------|---------|
| Gear Module | Air gap |
| Modulus2    | 0.2~2mm |

⌚ Rotate clockwise to output waveform



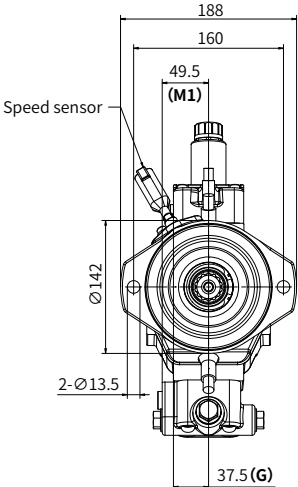
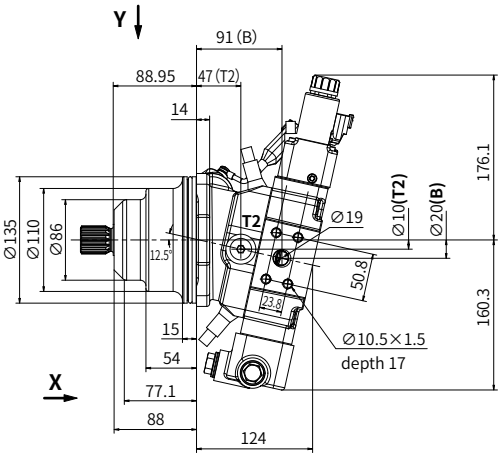
⌚ Rotate counterclockwise to output waveform



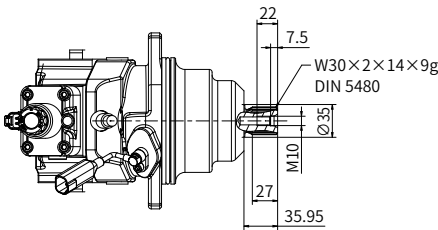
Installation size

M60VE28 Installation size

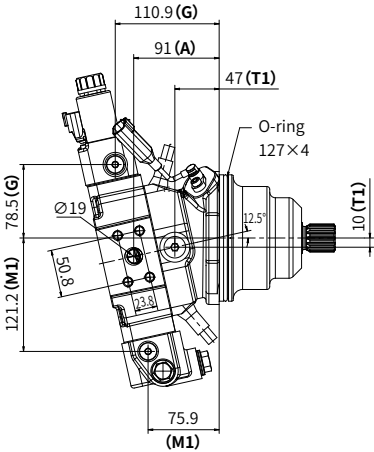
Plug-in motor



X View



Y View



Installation size

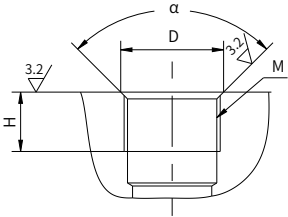
• M60VE28 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60VE28 Port details

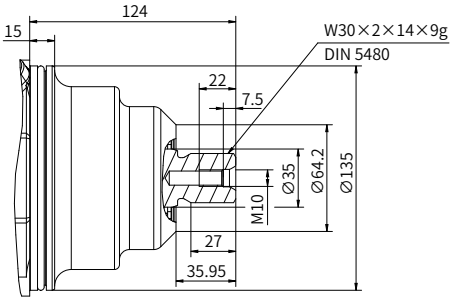
|     | Port name                    | Port size and description         | Tightening torque (N·m) |
|-----|------------------------------|-----------------------------------|-------------------------|
| A、B | Inlet port and Delivery port | SAE J518 3/4" M10×1.5 (depth17mm) | 57                      |
| T1  | Case drain port              | ISO 9974 M18×1.5 (Through hole)   | 45                      |
| T2  |                              | ISO 9974 M18×1.5 (Through hole)   | 45                      |
| G   | Measuring port pressure      | ISO 9974 M14×1.5 (depth 11.5mm)   | 45                      |
| M1  |                              | ISO 9974 M14×1.5 (depth 11.5mm)   | 45                      |

| Port | H  | M       | D    | α   |
|------|----|---------|------|-----|
| T1   | 15 | M18×1.5 | Ø 18 | 90° |
| T2   | 15 | M18×1.5 | Ø 18 | 90° |
| G    | 15 | M14×1.5 | Ø 14 | 90° |
| M1   | 15 | M14×1.5 | Ø 14 | 90° |



• M60VE28 Input shaft type

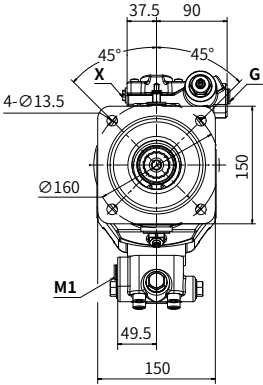
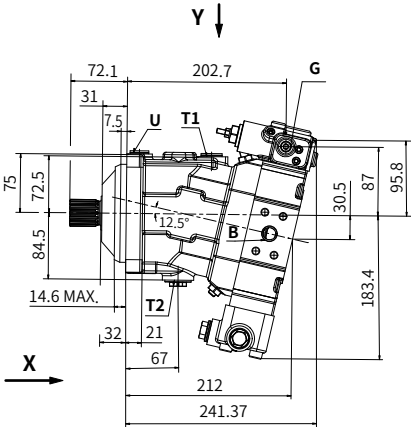
"B6" type shaft



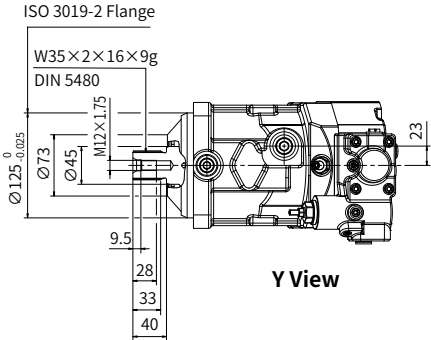
Installation size

M60V 60 Installation size

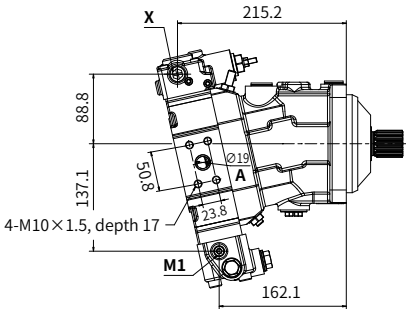
Flange-type motor



X View



Y View



Installation size

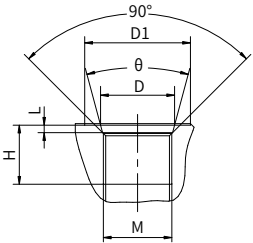
• M60V 60 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60V 60 Port details

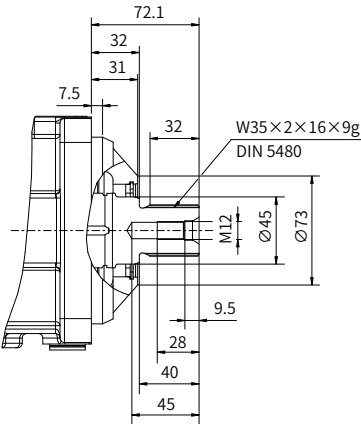
|     | Port name                    | Port size and description          | Tightening torque (N · m) |
|-----|------------------------------|------------------------------------|---------------------------|
| A、B | Inlet port and Delivery port | SAE J518 3/4" M10×1.5 (depth 17mm) | 57                        |
| T1  | Case drain port              | ISO 6149 M22×1.5 (depth 15.5mm)    | 100                       |
| T2  |                              | ISO 6149 M27×2 (depth 19mm)        | - (Plastic plug)          |
| G   | Measuring port pressure      | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                        |
| U   | Flushing port                | ISO 6149 M18×1.5 (depth 14.5mm)    | 70                        |
| M1  | Measuring port pressure      | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                        |
| Sa  | External flushing port       | ISO 6149 M22×1.5 (depth 16.5mm)    | 80                        |

| Port | H    | L   | M       | D      | D1   | θ   |
|------|------|-----|---------|--------|------|-----|
| T1   | 15.5 | 2.4 | M22×1.5 | Ø 23.8 | Ø 34 | 30° |
| T2   | 19   | 3.1 | M27×2   | Ø 29.4 | Ø 35 | 30° |
| G    | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |
| U    | 14.5 | 2.4 | M18×1.5 | Ø 19.8 | Ø 26 | 30° |
| M1   | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |
| Sa   | 16.5 | 2.4 | M22×1.5 | Ø 21.8 | -    | 30° |



• M60V 60 Input shaft type

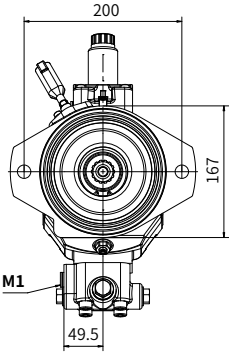
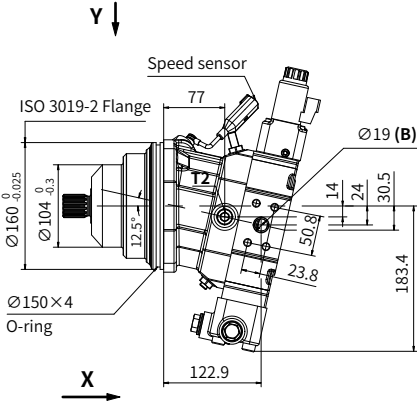
"B8" type shaft



Installation size

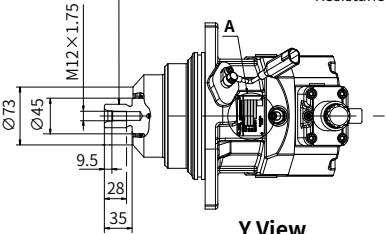
M60VE60 Installation size

Plug-in motor



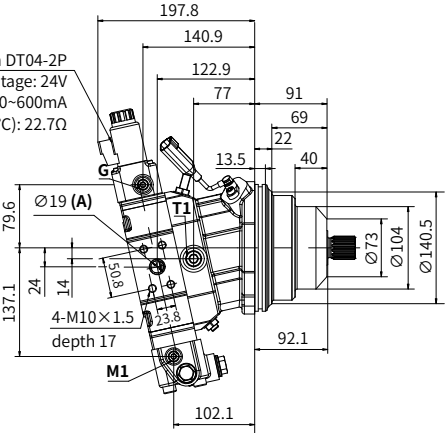
X View

W30×2×14×9g  
DIN5480



Y View

Deutsch DT04-2P  
Rated voltage: 24V  
Control current: 200~600mA  
Resistance (@20°C): 22.7Ω



Installation size

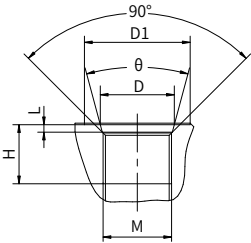
• M60VE60 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60VE60 Port details

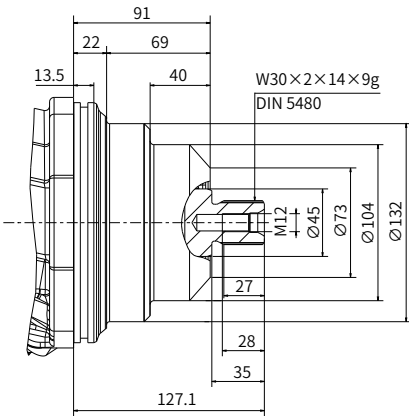
|     | Port name                    | Port size and description          | Tightening torque (N · m) |
|-----|------------------------------|------------------------------------|---------------------------|
| A、B | Inlet port and Delivery port | SAE J518 3/4" M10×1.5 (depth 17mm) | 57                        |
| T1  | Case drain port              | ISO 6149 M22×1.5 (Through hole)    | 100                       |
| T2  |                              | ISO 6149 M22×1.5 (Through hole)    | 100                       |
| G   | Measuring port pressure      | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                        |
| M1  |                              | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                        |

| Port | H    | L   | M       | D      | D1   | θ   |
|------|------|-----|---------|--------|------|-----|
| T1   | 19   | 2.4 | M22×1.5 | Ø 23.8 | Ø 34 | 30° |
| T2   | 19   | 2.4 | M22×1.5 | Ø 23.8 | Ø 34 | 30° |
| G    | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |
| M1   | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |



• M60VE60 Input shaft type

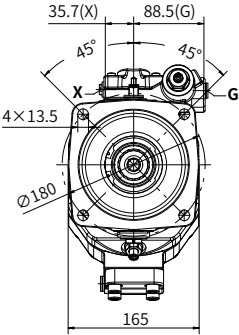
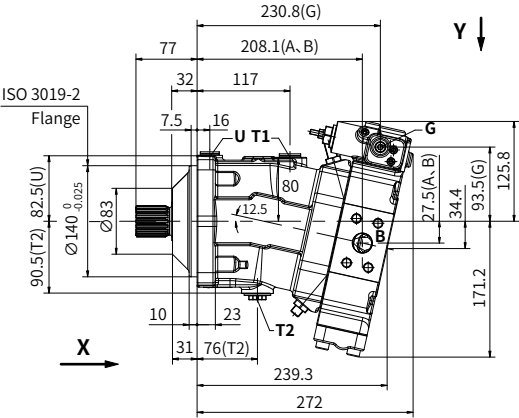
"B6" type shaft



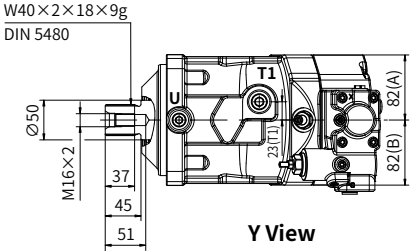
Installation size

M60V 85 Installation size

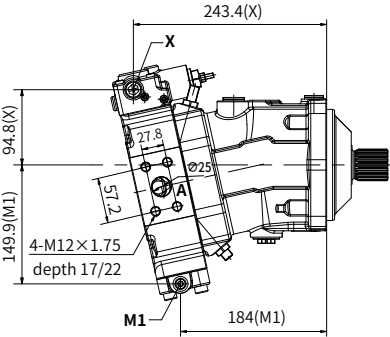
Flange-type motor



X View



Y View





Installation size

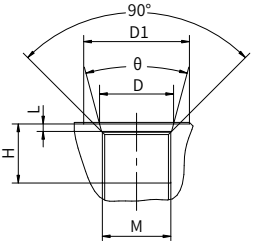
• M60V 85 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60V 85 Port details

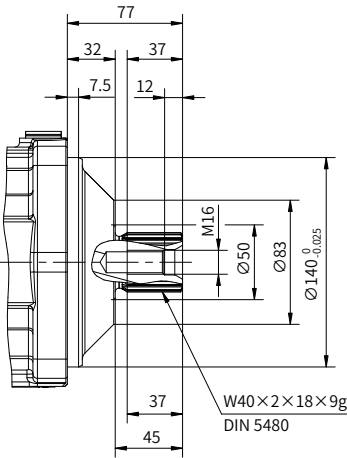
|     | Port name                    | Port size and description         | Tightening torque (N·m) |
|-----|------------------------------|-----------------------------------|-------------------------|
| A、B | Inlet port and Delivery port | SAE J518 1" M12×1.75 (depth 17mm) | 98                      |
| T1  | Case drain port              | ISO 6149 M22×1.5 (depth 15.5mm)   | 45                      |
| T2  |                              | ISO 6149 M27×2 (depth 19mm)       | 210                     |
| G   | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                      |
| U   | Flushing port                | ISO 6149 M18×1.5 (depth 14.5mm)   | 45                      |
| X   | Pilot port                   | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                      |
| M1  | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                      |

| Port | H    | L   | M       | D      | D1   | θ   |
|------|------|-----|---------|--------|------|-----|
| T1   | 15.5 | 2.4 | M22×1.5 | Ø 23.8 | Ø 30 | 30° |
| T2   | 19   | 3.1 | M27×2   | Ø 29.4 | Ø 34 | 30° |
| G    | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |
| U    | 14.5 | 2.4 | M18×1.5 | Ø 19.8 | Ø 28 | 30° |
| X    | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |
| M1   | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | -    | 30° |



• M60V 85 Input shaft type

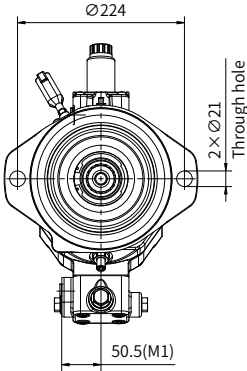
"B9" type shaft



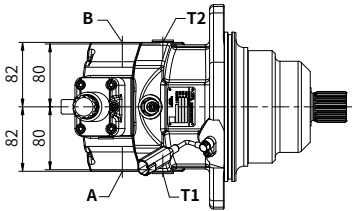
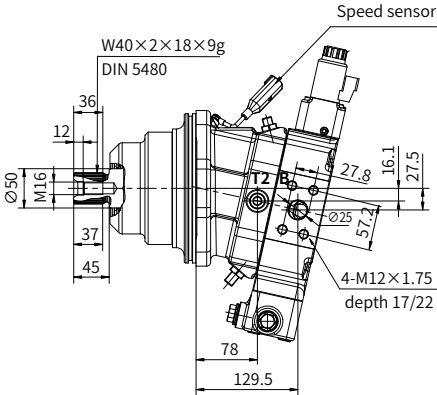
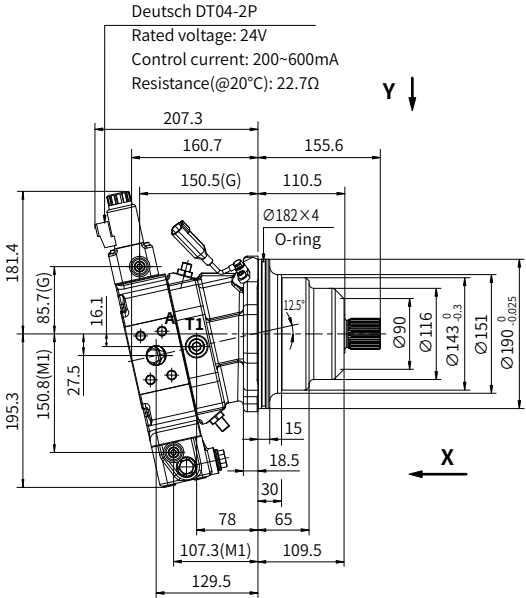
Installation size

M60VE85 Installation size

Plug-in motor



X View



Y View

Installation size

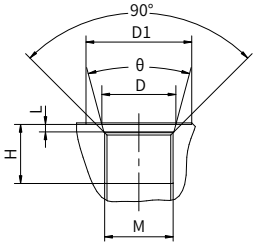
• M60VE85 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60VE85 Port details

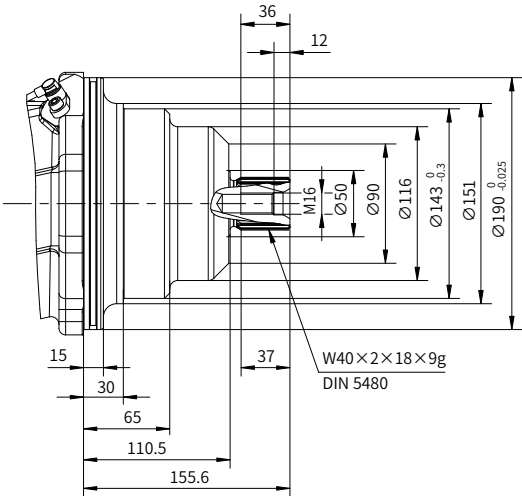
|     | Port name                    | Port size and description         | Tightening torque (N · m) |
|-----|------------------------------|-----------------------------------|---------------------------|
| A、B | Inlet port and Delivery port | SAE J518 1" M12×1.75 (depth 17mm) | 98                        |
| T1  | Case drain port              | ISO 6149 M22×1.5 (depth 15.5mm)   | 45                        |
| T2  |                              | ISO 6149 M22×1.5 (depth 15.5mm)   | 45                        |
| G   | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                        |
| M1  |                              | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                        |

| Port | H    | L   | M       | D      | D1   | θ   |
|------|------|-----|---------|--------|------|-----|
| T1   | 15.5 | 2.4 | M22×1.5 | Ø 23.8 | Ø 29 | 30° |
| T2   | 15.5 | 2.4 | M22×1.5 | Ø 23.8 | Ø 29 | 30° |
| G    | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |
| M1   | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |



• M60VE85 Input shaft type

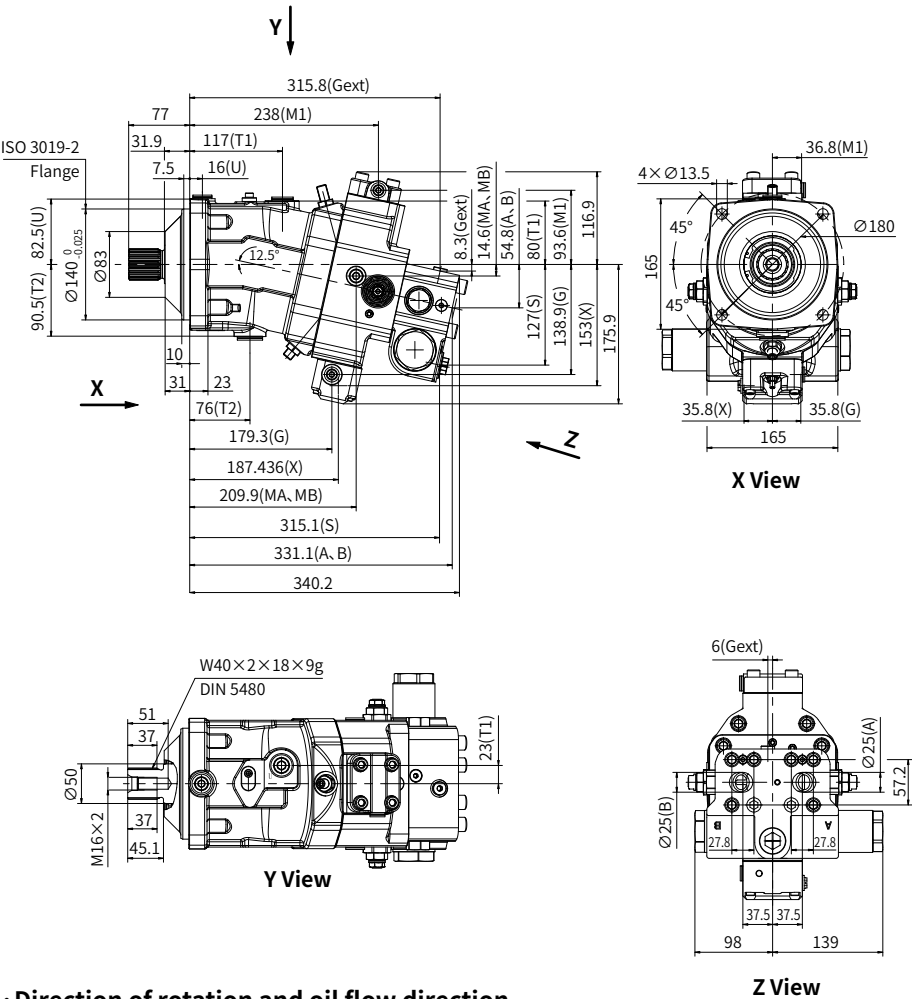
"B9" type shaft



Installation size

M60V 85 Installation size

Flange-type motor,  
With balance valve



• Direction of rotation and oil flow direction

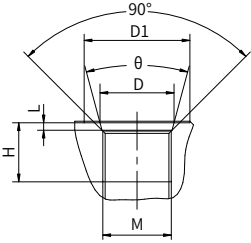
| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

Installation size

• M60V 85 Port details

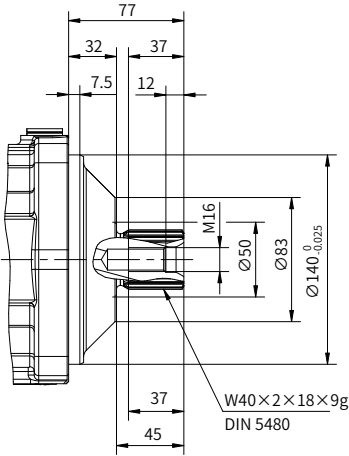
|       | Port name                    | Port size and description       | Tightening torque (N·m) |
|-------|------------------------------|---------------------------------|-------------------------|
| A、B   | Inlet port and Delivery port | SAE J518 1 in                   | 98                      |
| U     | Bearing flushing             | ISO 6149 M18×1.5 (depth 14.5mm) | 45                      |
| T1    | Case drain port              | ISO 6149 M22×1.5 (depth 15.5mm) | 60                      |
| T2    |                              | ISO 6149 M27×2 (depth 19mm)     | 100                     |
| MA、MB | Measuring port               | ISO 6149 M18×1.5 (depth 14.5mm) | 70                      |
| M1    |                              | ISO 6149 M14×1.5 (depth 11.5mm) | 45                      |
| G     | Synchronous control          | ISO 6149 M14×1.5 (depth 11.5mm) | 45                      |
| X     | Pilot port                   | ISO 6149 M14×1.5 (depth 11.5mm) | 45                      |
| S     | Charge port                  | DIN 3852 M22×1.5 (depth 14mm)   | 100                     |
| Gext  | Brake realese port           | DIN 3852 M12×1.5 (depth 12.5mm) | 22                      |

| Port  | H    | L   | M       | D      | D1   | θ   |
|-------|------|-----|---------|--------|------|-----|
| U     | 14.5 | 2.4 | M18×1.5 | ∅ 19.8 | ∅ 28 | 30° |
| T1    | 15.5 | 2.4 | M22×1.5 | ∅ 23.8 | ∅ 30 | 30° |
| T2    | 19   | 3.1 | M27×2   | ∅ 29.4 | ∅ 34 | 30° |
| MA、MB | 14.5 | 2.4 | M18×1.5 | ∅ 19.8 | ∅ 28 | 30° |
| M1    | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | -    | 30° |
| G     | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 22 | 30° |
| X     | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 22 | 30° |
| S     | 14   | 2.4 | M22×1.5 | ∅ 23.8 | ∅ 30 | 30° |
| Gext  | 12.5 | 1.5 | M12×1.5 | ∅ 13.8 | ∅ 19 | 30° |



• M60V 85 Input shaft type

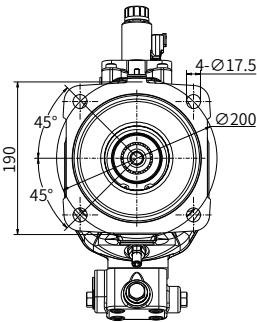
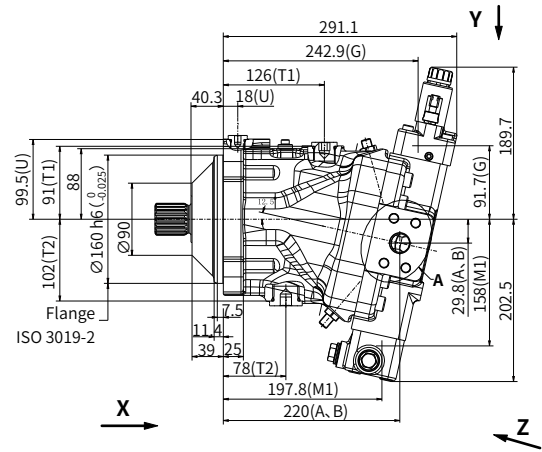
"B9" type shaft



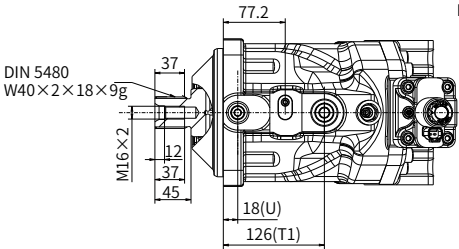
Installation size

M60V 115 Installation size

Flange-type motor

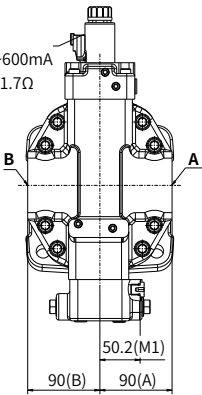


X View



Y View

Deutsch DT04-2P  
Rated voltage: 24V  
Control current: 200~600mA  
Resistance(@20°C): 21.7 $\Omega$



Z View

Installation size

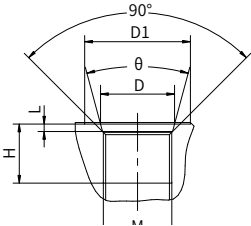
• M60V 115 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60V 115 Port details

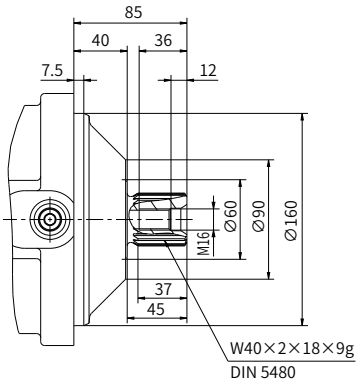
|     | Port name                    | Port size and description         | Tightening torque (N · m) |
|-----|------------------------------|-----------------------------------|---------------------------|
| A、B | Inlet port and Delivery port | SAE J518 1" M12×1.75 (depth 17mm) | 98                        |
| T1  | Case drain port              | ISO 6149 M27×2 (depth 19mm)       | 90                        |
| T2  |                              | ISO 6149 M33×2 (depth 19mm)       | 120                       |
| G   | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                        |
| U   | Flushing port                | ISO 6149 M18×1.5 (depth 14.5mm)   | 45                        |
| X   | Pilot port                   | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                        |
| M1  | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                        |

| Port | H    | L   | M       | D      | D1   | θ   |
|------|------|-----|---------|--------|------|-----|
| T1   | 19   | 3.1 | M27×2   | Ø 29.4 | Ø 34 | 30° |
| T2   | 19   | 3.1 | M33×2   | Ø 35.4 | Ø 43 | 30° |
| G    | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |
| U    | 14.5 | 2.4 | M18×1.5 | Ø 19.8 | Ø 28 | 30° |
| X    | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |
| M1   | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 22 | 30° |



• M60V 115 Input shaft type

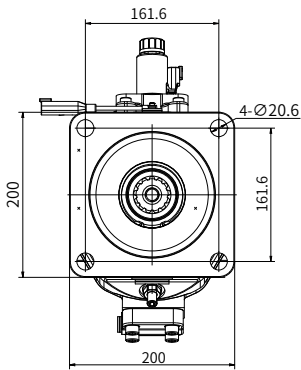
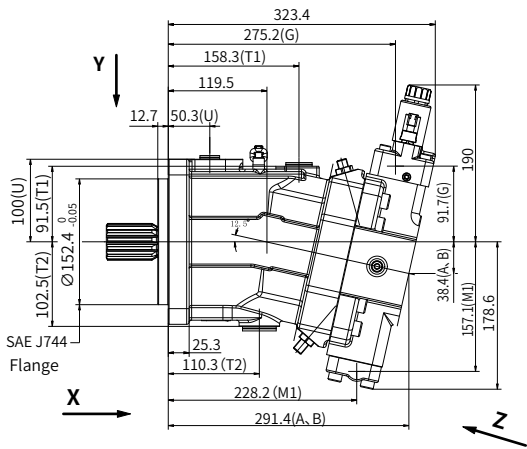
"B9" type shaft



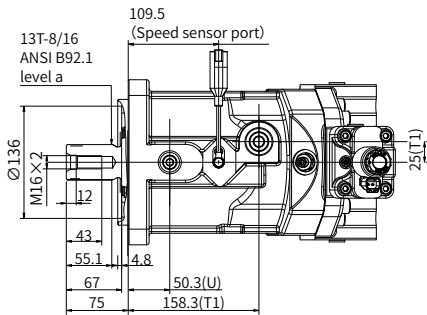
Installation size

M60V 115 Installation size

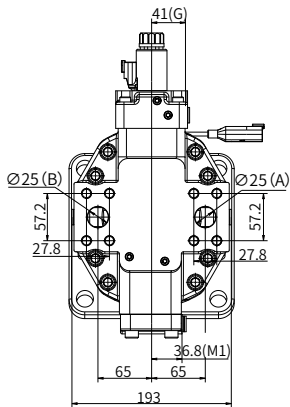
SAE Flange-type motor



X View



Y View



Z View



Installation size

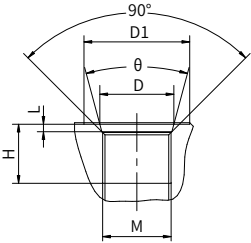
• M60V 115 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60V 115 Port details

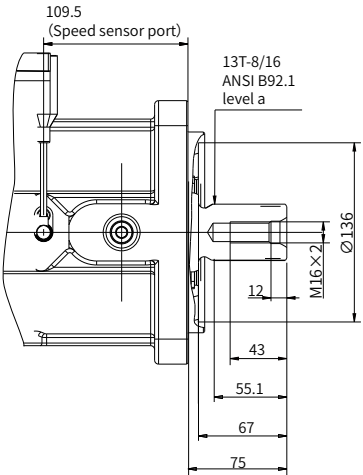
|      | Port name                    | Port size and description         | Tightening torque (N·m) |
|------|------------------------------|-----------------------------------|-------------------------|
| A, B | Inlet port and Delivery port | SAE J518 1" M12×1.75 (depth 17mm) | 98                      |
| T1   | Case drain port              | ISO 6149 M27×2 (depth 19mm)       | 90                      |
| T2   |                              | ISO 6149 M33×2 (depth 19mm)       | 120                     |
| G    | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                      |
| U    | Flushing port                | ISO 6149 M18×1.5 (depth 14.5mm)   | 45                      |
| X    | Pilot port                   | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                      |
| M1   | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)   | 45                      |

| Port | H    | L   | M       | D      | D1   | θ   |
|------|------|-----|---------|--------|------|-----|
| T1   | 19   | 3.1 | M27×2   | ∅ 29.4 | ∅ 34 | 30° |
| T2   | 19   | 3.1 | M33×2   | ∅ 35.4 | ∅ 43 | 30° |
| G    | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 22 | 30° |
| U    | 14.5 | 2.4 | M18×1.5 | ∅ 19.8 | ∅ 28 | 30° |
| X    | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 22 | 30° |
| M1   | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 22 | 30° |



• M60V 115 Input shaft type

"A3" type shaft



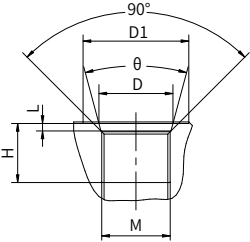


Installation size

• M60V 115 Port details

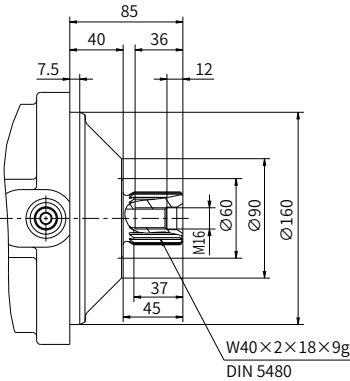
|       | Port name                    | Port size and description       | Tightening torque (N·m) |
|-------|------------------------------|---------------------------------|-------------------------|
| A、B   | Inlet port and Delivery port | SAE J518 1 in                   | 98                      |
| U     | Bearing flushing             | ISO 6149 M18×1.5 (depth 14.5mm) | 45                      |
| TI    | Case drain port              | ISO 6149 M27×2 (depth 19mm)     | 100                     |
| T2    |                              | ISO 6149 M33×2 (depth 19mm)     | 160                     |
| MA、MB | Measuring port               | ISO 6149 M18×1.5 (depth 14.5mm) | 70                      |
| M2、M3 |                              | ISO 6149 M10×1 (depth 11.5mm)   | 15                      |
| G     | Synchronous control          | ISO 6149 M14×1.5 (depth 11.5mm) | 45                      |
| X、X2  | Pilot port                   | ISO 6149 M14×1.5 (depth 11.5mm) | 45                      |
| S     | Charge port                  | ISO 9974 M27×2 (depth 16mm)     | 170                     |
| Gext  | Brake realese port           | ISO 9974 M12×1.5 (depth 12.5mm) | 22                      |

| Port  | H    | L   | M       | D      | D1   | θ   |
|-------|------|-----|---------|--------|------|-----|
| U     | 14.5 | 2.4 | M18×1.5 | ∅ 19.8 | ∅ 28 | 30° |
| TI    | 19   | 3.1 | M27×2   | ∅ 29.4 | ∅ 34 | 30° |
| T2    | 19   | 3.1 | M33×2   | ∅ 35.4 | ∅ 43 | 30° |
| MA、MB | 14.5 | 2.4 | M18×1.5 | ∅ 19.8 | ∅ 28 | 30° |
| M2、M3 | 11.5 | 1   | M10×1   | ∅ 11.1 | ∅ 16 | 24° |
| G     | 11.5 | 2.4 | M14×1.5 | ∅ 19.8 | ∅ 28 | 30° |
| X、X2  | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 22 | 30° |
| S     | 16   | 3.1 | M27×2   | ∅ 29.4 | ∅ 34 | 30° |
| Gext  | 12.5 | 1.5 | M12×1.5 | ∅ 13.8 | ∅ 19 | 30° |



• M60V 115 Input shaft type

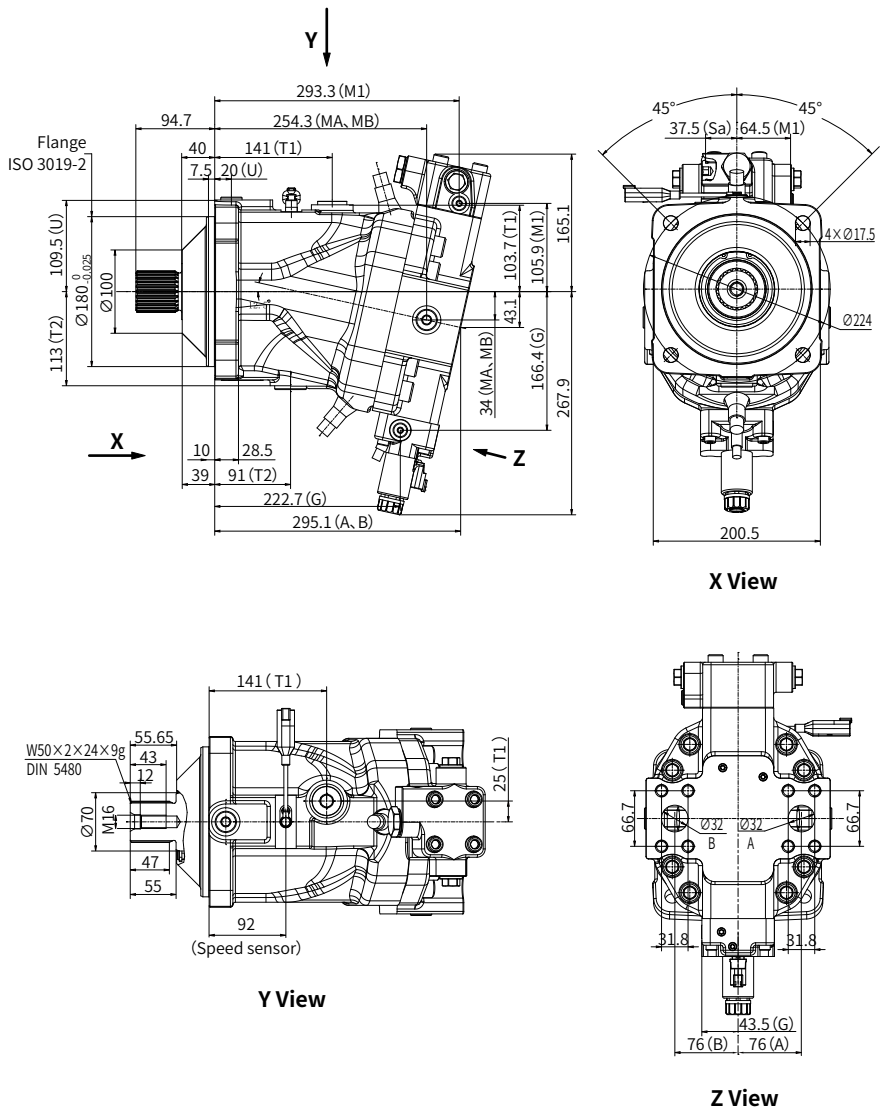
"B9" type shaft



Installation size

M60V 160 Installation size

Flange-type motor



Installation size

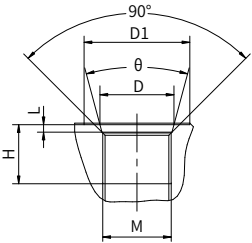
• M60V 160 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60V 160 Port details

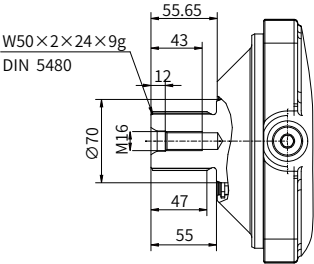
|       | Port name                    | Port size and description              | Tightening torque (N·m) |
|-------|------------------------------|----------------------------------------|-------------------------|
| A、B   | Inlet port and Delivery port | SAE J518 1 1/4" M14×2 (depth 19mm)     | -                       |
| T1    | Case drain port              | DIN 3852 M26×1.5 (depth 23mm ED seals) | 110±10                  |
| T2    |                              | DIN 3852 M26×1.5 (depth 18mm ED seals) | 110±10                  |
| G     | Measuring port               | DIN 3852 M14×1.5 (depth 15mm ED seals) | 40±5                    |
| U     | Flushing port                | DIN 3852 M22×1.5 (depth 20mm ED seals) | 45±5                    |
| GA、GB | Measuring port               | DIN 3852 M14×1.5 (depth 12mm ED seals) | 40±5                    |

| Port  | H  | M       | D    | α   |
|-------|----|---------|------|-----|
| T1    | 23 | M26×1.5 | ∅ 26 | 90° |
| T2    | 18 | M26×1.5 | ∅ 26 | 90° |
| G     | 15 | M14×1.5 | ∅ 14 | 90° |
| U     | 20 | M22×1.5 | ∅ 22 | 90° |
| GA、GB | 12 | M14×1.5 | ∅ 14 | 90° |



• M60V 160 Input shaft type

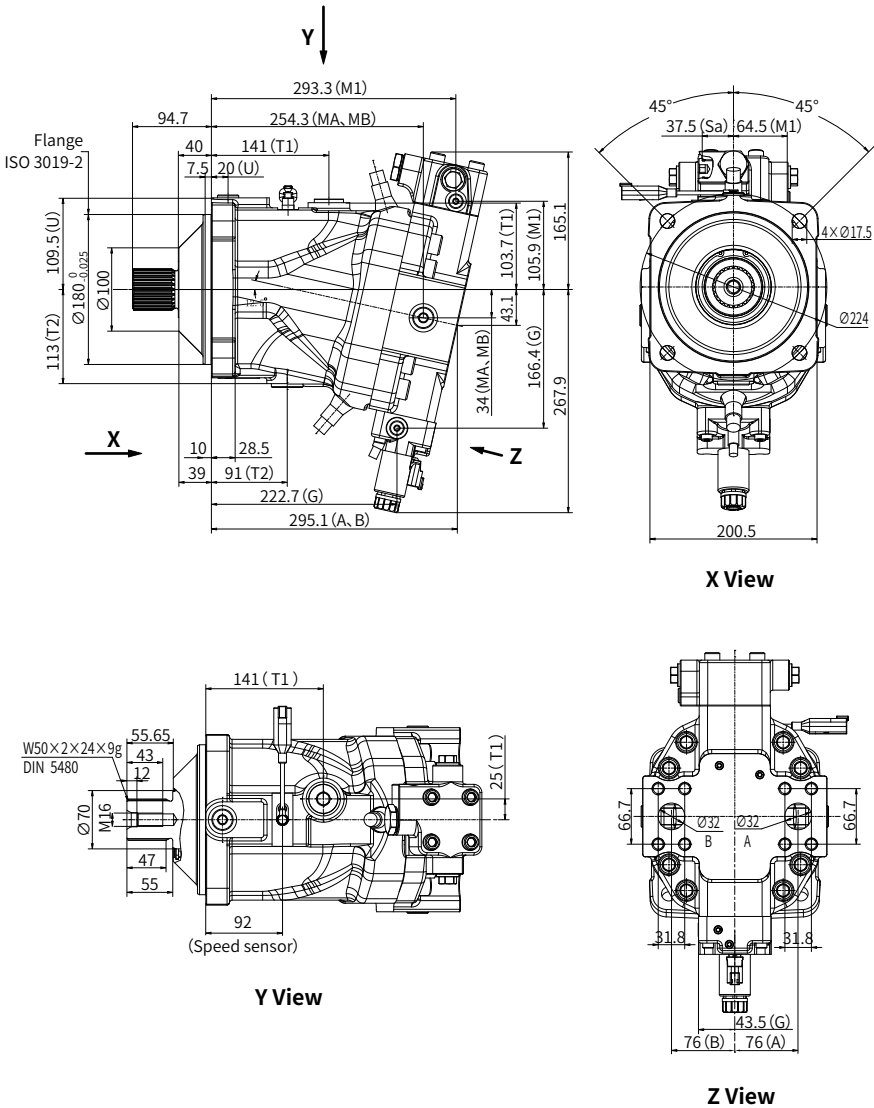
"A2" type shaft



Installation size

M60V 170 Installation size

Flange-type motor



Installation size

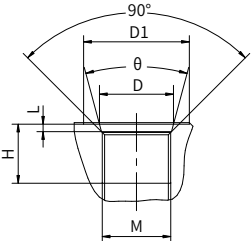
• M60V 170 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60V 170 Port details

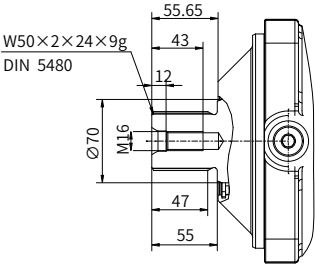
|     | Port name                    | Port size and description          | Tightening torque (N·m) |
|-----|------------------------------|------------------------------------|-------------------------|
| A、B | Inlet port and Delivery port | SAE J518 1 1/4" M14×2 (depth 22mm) | 157                     |
| T1  | Case drain port              | ISO 6149 M27×2 (depth 29mm)        | 210                     |
| T2  |                              | ISO 6149 M33×2 (depth 25.5mm)      | 215                     |
| G   | Measuring port pressure      | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                      |
| U   | Flushing port                | ISO 6149 M22×1.5 (depth 20mm)      | 45                      |
| M1  | Measuring port pressure      | ISO 6149 M14×1.5 (depth 12.5mm)    | 45                      |
| Sa  | External flushing port       | ISO 6149 M22×1.5 (depth 16mm)      | 100                     |

| Port | H    | L   | M       | D      | D1   | θ   |
|------|------|-----|---------|--------|------|-----|
| T1   | 29   | 3.1 | M27×2   | ∅ 29.4 | ∅ 34 | 30° |
| T2   | 25.5 | 3.1 | M33×2   | ∅ 35.4 | ∅ 43 | 30° |
| G    | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 25 | 30° |
| U    | 20   | 2.4 | M22×1.5 | ∅ 23.8 | ∅ 29 | 30° |
| M1   | 12.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 22 | 30° |
| Sa   | 16   | 2.4 | M22×1.5 | ∅ 23.8 | ∅ 30 | 30° |



• M60V 170 Input shaft type

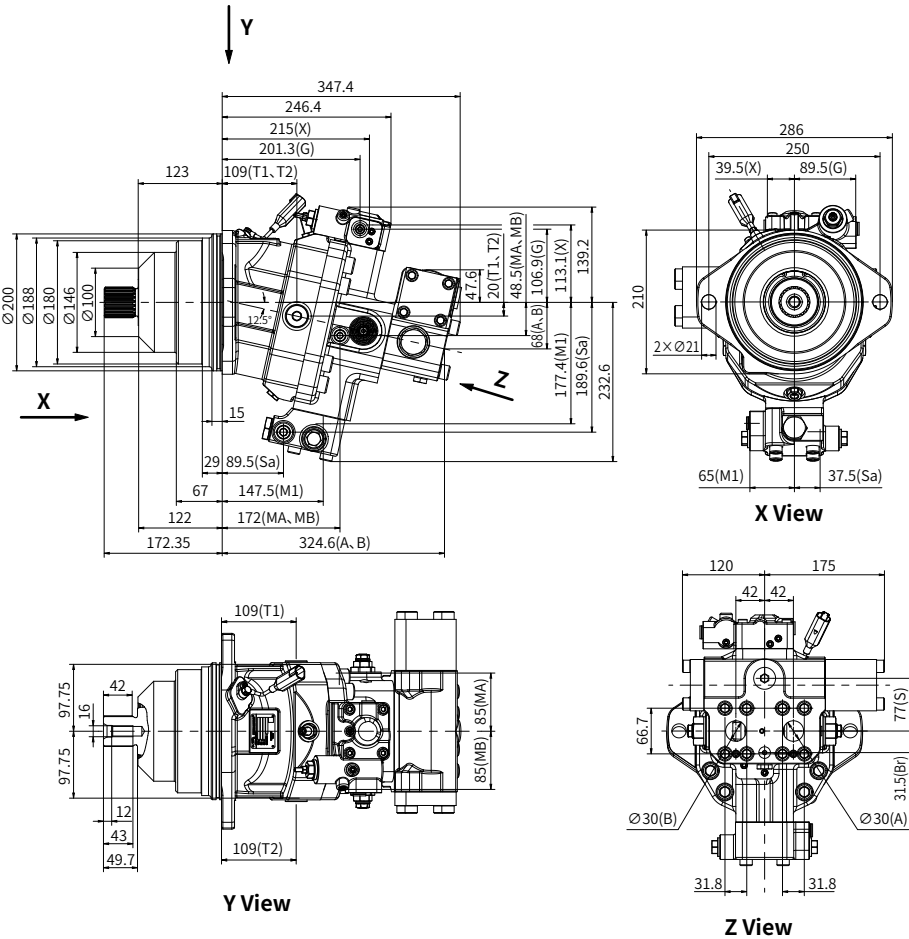
"A2" type shaft



Installation size

M60V 170 Installation size

Plug-in motor,  
With balance valve



• Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

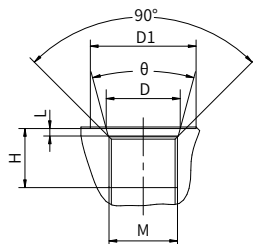


## Installation size

- **M60V 170 Port details**

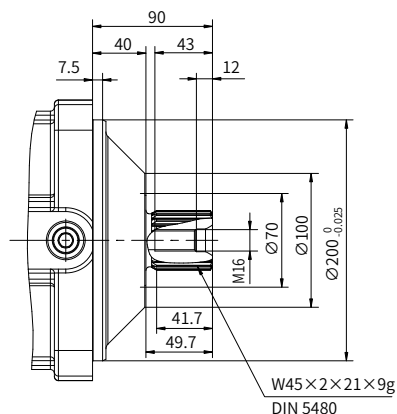
|       | Port name                    | Port size and description       | Tightening torque (N·m) |
|-------|------------------------------|---------------------------------|-------------------------|
| A、B   | Inlet port and Delivery port | SAE J518 1 1/4"                 | 157                     |
|       | Fastening thread             | DIN 13 M14×2 (depth 19mm)       | 157                     |
| T1、T2 | Case drain port              | ISO 6149 M27×2 (depth 19mm)     | 100                     |
| MA、MB | Measuring port               | ISO 6149 M18×1.5 (depth 14.5mm) | 70                      |
| M1    |                              | ISO 6149 M14×1.5 (depth 11.5mm) | 45                      |
| G     | Synchronous control          | ISO 6149 M14×1.5 (depth 11.5mm) | 45                      |
| X     | Pilot port                   | ISO 6149 M14×1.5 (depth 11.5mm) | 45                      |
| Sa    | Flushing port                | ISO 6149 M22×1.5 (depth 16.5mm) | 100                     |
| S     | Charge port                  | ISO 9974 M27×2 (depth 16mm)     | 170                     |
| Br    | Brake realse port            | ISO 9974 M12×1.5 (depth 12mm)   | 22                      |

| Port  | H    | L   | M       | D      | D1   | θ   |
|-------|------|-----|---------|--------|------|-----|
| T1、T2 | 19   | 3.1 | M27×2   | ∅ 29.4 | ∅ 34 | 30° |
| MA、MB | 14.5 | 2.4 | M18×1.5 | ∅ 19.8 | ∅ 28 | 30° |
| M1    | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 25 | 30° |
| G     | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 25 | 24° |
| X     | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 25 | 30° |
| Sa    | 16.5 | 2.4 | M22×1.5 | ∅ 23.8 | ∅ 30 | 30° |
| S     | 16   | 3.1 | M27×2   | ∅ 29.4 | ∅ 34 | 30° |
| Br    | 12   | 1.5 | M12×1.5 | ∅ 13.8 | ∅ 19 | 30° |



- **M60V 170 Input shaft type**

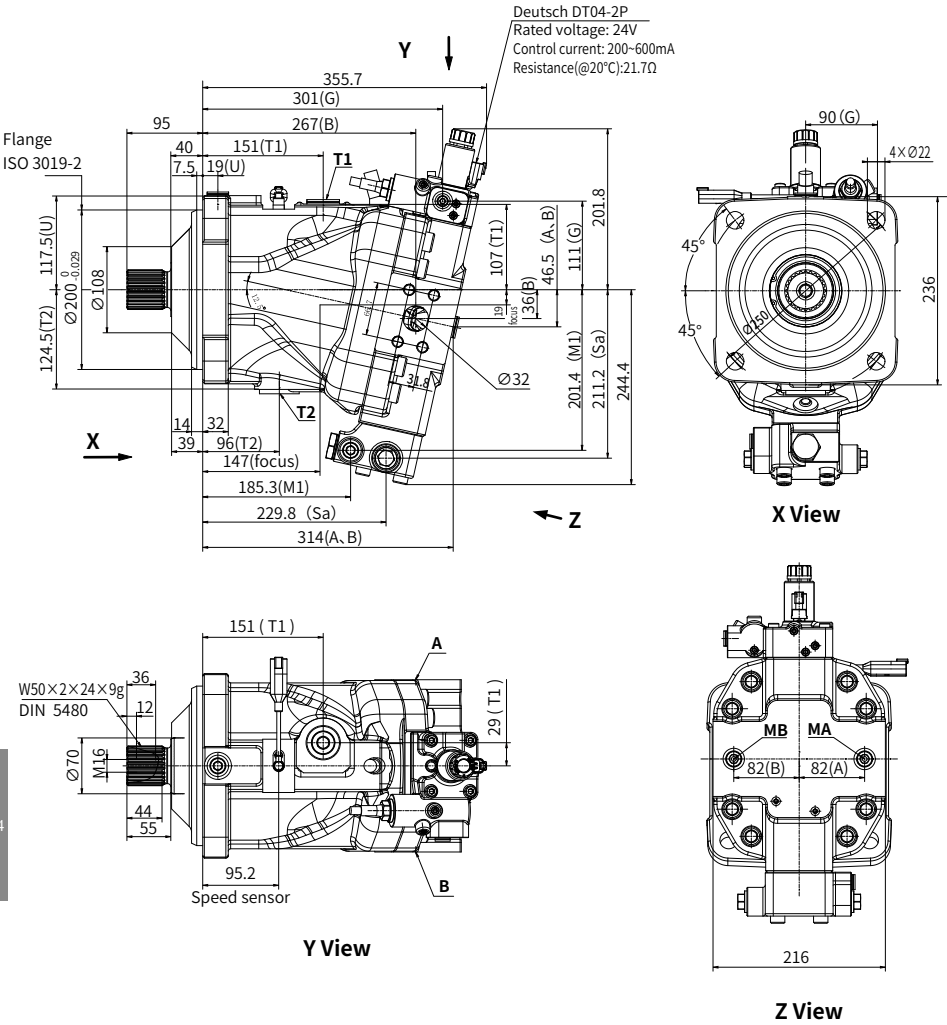
"A1" type shaft



Installation size

M60V 200 Installation size

Flange-type motor



Installation size

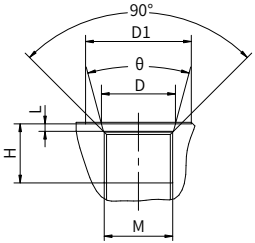
• M60V 200 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60V 200 Port details

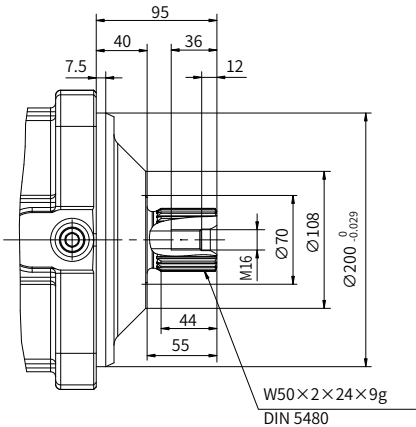
|      | Port name                    | Port size and description          | Tightening torque (N·m) |
|------|------------------------------|------------------------------------|-------------------------|
| A, B | Inlet port and Delivery port | SAE J518 1 1/4" M14×2 (depth 20mm) | 157                     |
| T1   | Case drain port              | ISO 6149 M33×2 (depth 20mm)        | 215                     |
| T2   |                              | ISO 6149 M42×2 (depth 20mm)        | 330                     |
| G    | Measuring port pressure      | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                      |
| U    | Flushing port                | ISO 6149 M22×1.5 (depth 11.5mm)    | 45                      |
| M1   | Measuring port pressure      | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                      |

| Port | H    | L   | M       | D      | D1   | θ   |
|------|------|-----|---------|--------|------|-----|
| T1   | 20   | 3.1 | M33×2   | Ø 35.4 | Ø 43 | 30° |
| T2   | 20   | 3.1 | M42×2   | Ø 44.4 | Ø 52 | 30° |
| G    | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 25 | 30° |
| U    | 11.5 | 2.4 | M22×1.5 | Ø 23.8 | Ø 34 | 30° |
| M1   | 11.5 | 2.4 | M14×1.5 | Ø 15.8 | Ø 25 | 30° |



• M60V 200 Input shaft type

"A2" type shaft

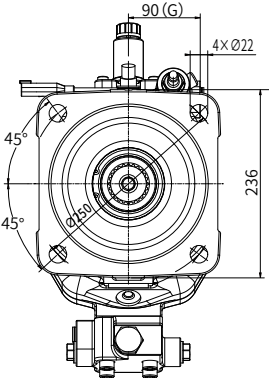
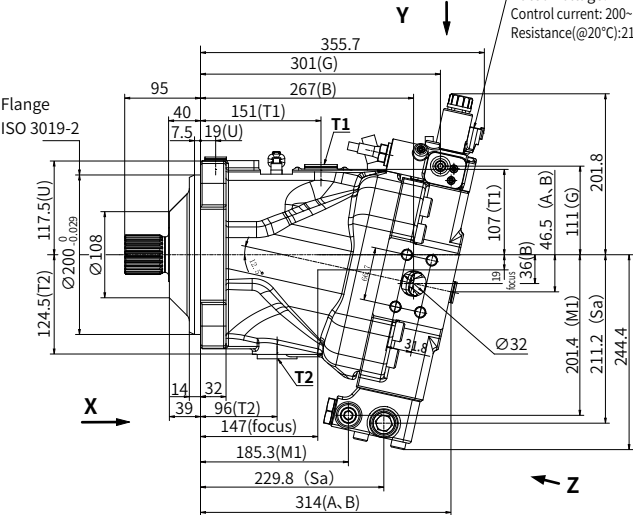


Installation size

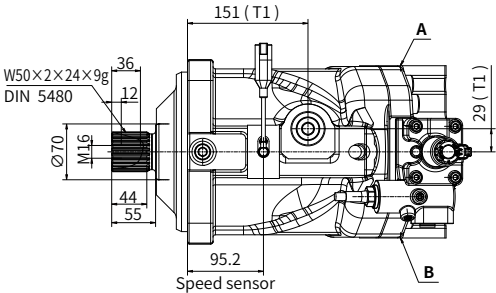
M60V 215 Installation size

Flange-type motor

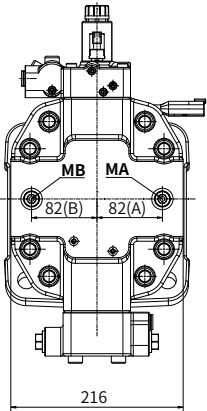
Deutsch DT04-2P  
Rated voltage: 24V  
Control current: 200~600mA  
Resistance(@20°C):21.7Ω



X View



Y View



Z View

Installation size

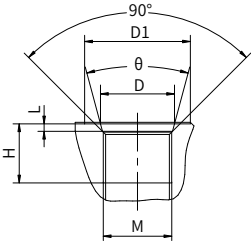
• M60V 215 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60V 215 Port details

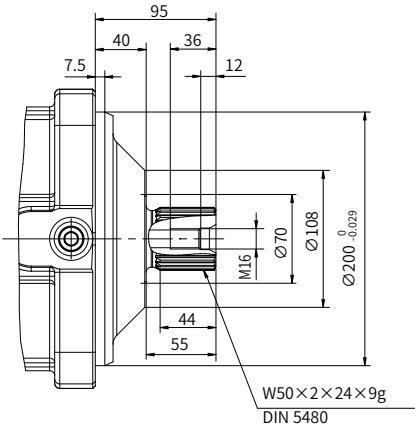
|     | Port name                    | Port size and description          | Tightening torque (N·m) |
|-----|------------------------------|------------------------------------|-------------------------|
| A、B | Inlet port and Delivery port | SAE J518 1 1/4" M14×2 (depth 20mm) | 157                     |
| T1  | Case drain port              | ISO 6149 M33×2 (depth 20mm)        | 215                     |
| T2  |                              | ISO 6149 M42×2 (depth 20mm)        | 330                     |
| G   | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                      |
| U   | Flushing port                | ISO 6149 M22×1.5 (depth 11.5mm)    | 45                      |
| M1  | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                      |

| Port | H    | L   | M       | D      | D1   | θ   |
|------|------|-----|---------|--------|------|-----|
| T1   | 20   | 3.1 | M33×2   | ∅ 35.4 | ∅ 43 | 30° |
| T2   | 20   | 3.1 | M42×2   | ∅ 44.4 | ∅ 52 | 30° |
| G    | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 25 | 30° |
| U    | 11.5 | 2.4 | M22×1.5 | ∅ 23.8 | ∅ 34 | 30° |
| M1   | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 25 | 30° |



• M60V 215 Input shaft type

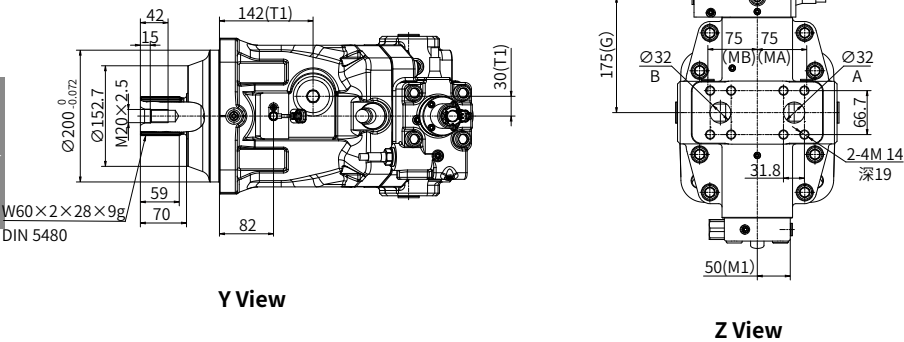
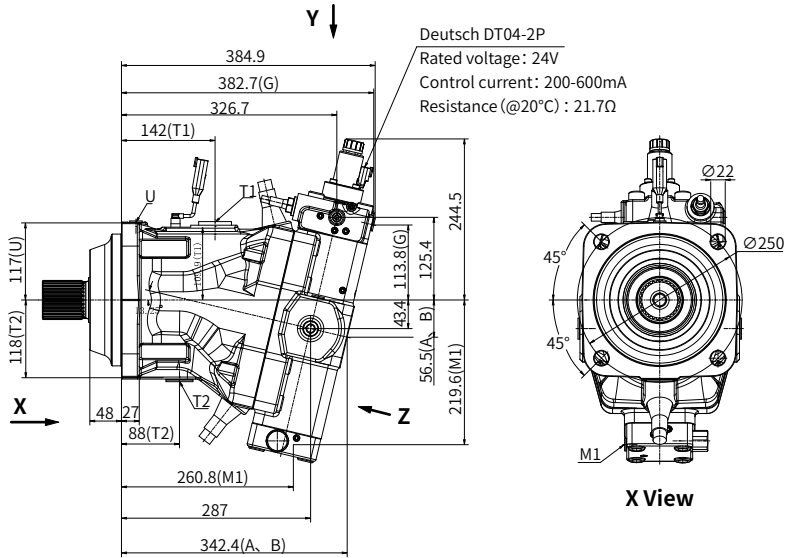
"A2" type shaft



Installation size

M60V 280 Installation size

Flange-type motor



Installation size

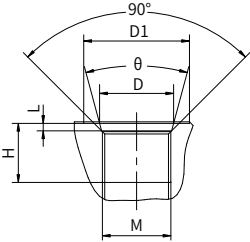
• M60V 280 Direction of rotation and oil flow direction

| Installation | Rotation          |
|--------------|-------------------|
| Flow A → B   | Clockwise         |
| Flow B → A   | Counter-clockwise |

• M60V 280 Port details

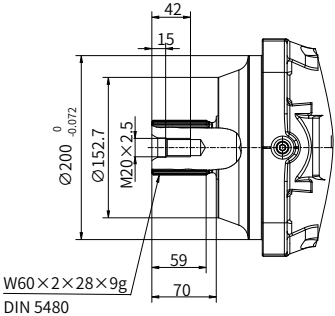
|     | Port name                    | Port size and description          | Tightening torque (N·m) |
|-----|------------------------------|------------------------------------|-------------------------|
| A、B | Inlet port and Delivery port | SAE J518 1 1/4" M14×2 (depth 19mm) | 187                     |
| T1  | Case drain port              | ISO 6149 M42×2 (depth 20mm)        | 330                     |
| T2  |                              | ISO 6149 M33×2 (depth 20mm)        | 215                     |
| G   | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                      |
| U   | Flushing port                | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                      |
| M1  | Measuring port               | ISO 6149 M14×1.5 (depth 11.5mm)    | 45                      |

| Port | H    | L   | M       | D      | D1   | θ   |
|------|------|-----|---------|--------|------|-----|
| T1   | 20   | 3.1 | M33×2   | ∅ 35.4 | ∅ 43 | 30° |
| T2   | 20   | 3.1 | M42×2   | ∅ 44.4 | ∅ 52 | 30° |
| G    | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 25 | 30° |
| U    | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 25 | 30° |
| M1   | 11.5 | 2.4 | M14×1.5 | ∅ 15.8 | ∅ 25 | 30° |



• M60V 280 Input shaft type

"A5" type shaft



|                                    |                                    |
|------------------------------------|------------------------------------|
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