**Rexroth**
Bosch Group

**RE 15 190/07.03**

Replaces: 02.92

# Radial piston hydraulic motors with a fixed displacement Types MKM, MRM

Nominal sizes 11 to 250

Series 1X

Maximum operating pressure 315 bar

Maximum displacement 251 L/min

Maximum torque 1165 Nm



Type MKM 11 AZ 1X/M2 A0

## Overview of contents

Type MKM 90 AZ 1X/M1 A1

## Features

– Wide speed range

– Linear acting backlash compensation control

– Smooth rotation even at very low speeds

– Extremely small moment of inertia permitting high reversal frequency

– Very suitable for control applications

– Suitable for fire resistant fluids



Type MRM 160 AZ 1X/M1 A0

– Very low operating noise level

– Versions with:

  • Shaft for tachometer

  • Through shaft

  • Built-on valves

  • With brakes

# Ordering details

```
                              1X /              *
```

**Motor type**

| | |
|---|---|
| Standard motor | **= MKM** |
| (NS 11, 22, 32, 45, 63, 90, 110) | |
| Motor with backlash compensation control | **= MRM** |
| (NS 11, 80, 125, 160, 250) | |

**Displacement – NS**

| | MKM | MRM | |
|---|:---:|:---:|---|
| 11 cm$^3$ = NS 11 | • | • | = **11** |
| 22 cm$^3$ = NS 22 | • | – | = **22** |
| 33 cm$^3$ = NS 32 | • | – | = **32** |
| 44 cm$^3$ = NS 45 | • | – | = **45** |
| 66 cm$^3$ = NS 63 | • | – | = **63** |
| 81 cm$^3$ = NS 80 | – | • | = **80** |
| 89 cm$^3$ = NS 90 | • | – | = **90** |
| 110 cm$^3$ = NS 110 | • | – | = **110** |
| 126 cm$^3$ = NS 125 | – | • | = **125** |
| 161 cm$^3$ = NS 160 | – | • | = **160** |
| 251 cm$^3$ = NS 250 | – | • | = **250** |

• = Available

**1st shaft end**

| | |
|---|---|
| Cylindrical, key DIN 6885 | **= A** |
| Splined shaft DIN 5480 | **= K** |
| (**only** motor type **MRM** without NS 11) | |
| Internally splined shaft DIN 5480 | **= H** |
| (**only** motor type **MRM** without NS 11) | |

**2nd shaft end**

| | |
|---|---|
| Without 2nd shaft end | **= Z** |
| Cylindrical Ø 10 mm for tacho connection | **= M** |
| Splined Ø 28 mm DIN 5480 | **= M10-** |
| (**only** motor type **MKM** without NS 11) | |

| | |
|---|---|
| Series 10 to 19 | **= 1X** |
| (10 to 19, unchanged installation and connection dimensions) | |

| | |
|---|---|
| NBR seals, suitable for HLP mineral oil to DIN 51 524 part 2 | **= M** |
| FKM seals, suitable for phosphate ester (HFD) for HFB and HFC – pressure reduced to 70 % | **= V** |

**Further details in clear text**
e. g. gear unit tacho/valves

**Holding brake**

| | |
|---|---|
| No code = | **Without** brakes |
| LBD9A2 | |
| LBD11A2 | (see technical data on page 5) |
| LBD124A2 | |
| LBD249A2 | |

**Built-on valves, subplate mounting**
(only in conjunction with line connections **A1**)

| | |
|---|---|
| No code = | None |
| N01 = | Pressure-anti-cavitation valve (pressure stage in clear text) |
| N61 = | Pressure-anti-cavitation valve Valve connection NS 6 to DIN 24 340 |
| N101 = | Pressure-anti-cavitation valve Valve connection NS 10 to DIN 24 340 |

**Additional details**

| | |
|---|---|
| No code = | Standard |
| S99 = | Flushing connection (**not** for NS 11) |
| T = | Increased clearance for very high speeds and very high temperatures |

**Pipe connections**

| | |
|---|---|
| A0= | Threaded connection, radial |
| A1= | Flange connection, radial (for NS 80, 125, 160, 250-SAE 3/4") |
| B5= | Threaded connections, axial (**only** NS 22, 32, 45, 63, 90, 110) |

**Flange version**

| | |
|---|---|
| 1 = | Face mounting - standard version (**not** for type **MKM** NS 11) |
| 2 = | Flange mounting |
| 3 = | Face mounting (**only** for NS 22, 32, 45, 63, 90, 110) |

**Ordering example: MKM 45 AZ1X/M2A0**

## Technical data (for applications outside these parameters, please consult us!)

### General

| Design | Radial piston motor, fixed displacement | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Type | MKM; MRM | | | | | | | | | | | |
| Mounting style | Flange mounting; front face mounting | | | | | | | | | | | |
| Connection type | Threaded; flange (depending on version) | | | | | | | | | | | |
| Installation | Optional | | | | | | | | | | | |
| Shaft loading, bearing life | See page 6 | | | | | | | | | | | |

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Nominal size | | $NS$ | | 11[1] | 11[2] | 22 | 32 | 45 | 63 | 80 | 90 | 110 | 125 | 160 | 250 |
| Moment of inertia | $J$ | kg cm$^2$ | | 2.63 | 2.63 | 2.8 | 2.8 | 3.3 | 3.3 | 17 | 3.9 | 4.1 | 17 | 23 | 23 |
| Weight | $m$ | kg | | 12 | 12 | 17.4 | 17.4 | 18.8 | 18.8 | 40 | 21.4 | 21.4 | 40 | 58 | 58 |

### Hydraulic

| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Displacement | | $V$ | cm$^3$ | 11 | 11 | 22 | 33 | 44 | 66 | 81 | 89 | 110 | 126 | 161 | 251 |
| Torque | Specific theoretic | $T$ | Nm/bar | 0.17 | 0.17 | 0.35 | 0.52 | 0.7 | 1.05 | 1.29 | 1.41 | 1.75 | 2 | 2.56 | 4 |
| | Specific average | $T$ | Nm/bar | 0.15 | 0.15 | 0.32 | 0.48 | 0.63 | 0.95 | 1.16 | 1.27 | 1.59 | 1.8 | 2.38 | 3.7 |
| | Continuous | $T$ | Nm | 21 | 24 | 50 | 76.8 | 100 | 152 | 290 | 178 | 223 | 360 | 595 | 740 |
| | Max. | $T$ | Nm | 31.5 | 37.5 | 78 | 120 | 157 | 237 | 365 | 266 | 334 | 567 | 750 | 1165 |
| Pressure differential | Continuous pressure | $\Delta p$ | bar | 140 | 160 | 160 | 160 | 160 | 160 | 250 | 140 | 140 | 200 | 250 | 200 |
| | Operating pressure, max | $\Delta p$ | bar | 210 | 250 | 250 | 250 | 250 | 250 | 315 | 210 | 210 | 315 | 315 | 315 |
| | Peak pressure [3] | $\Delta p$ | bar | 250 | 315 | 315 | 315 | 315 | 315 | 400 | 250 | 250 | 350 | 400 | 350 |
| Max. summated pressure in ports A + B | | $p$ | bar | 250 | 315 | 315 | 315 | 315 | 315 | 400 | 250 | 250 | 350 | 400 | 350 |
| Leakage fluid pressure | | $p$ | bar | 1.5 bar (special seals for higher pressures on request.) | | | | | | | | | | | |
| Speed range | From | $n$ | min$^{-1}$ | 10 | 5 | 10 | 10 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| | Up to | $n$ | min$^{-1}$ | 3000 | 3600 | 2250 | 1500 | 1800 | 1200 | 800 | 900 | 750 | 600 | 800 | 600 |
| | | | | For speeds $\leq$ 10 min$^{-1}$ please take the operating instructions into account, depending on the application minimum speeds of 0.1 min$^{-1}$ are possible in closed loop applications. | | | | | | | | | | | |
| Power | Continuous | $P$ | kW | 3.5 | 4.7 | 6 | 6 | 9.5 | 9.5 | 12 | 8.5 | 8.5 | 12 | 24 | 24 |
| | Intermittent | $P$ | kW | 4.3 | 5.8 | 7.5 | 7.5 | 11 | 11 | 15 | 10 | 10 | 15 | 30 | 30 |

$P_{continuous}$ Continuous working power (with a max. return pressure of 10 bar): If continuously exceeded, then rotary group flushing should be provided.
$P_{intermittent}$ Power that intermittently (max. 10 % ED within an operating period of one hour) can be demanded.

| Pressure fluid | HLP mineral oil to DIN 51 524 part 2 |
|---|---|
| | HFB and HFC fluids – pressures reduced to 70 %, |
| | Phosphate ester (HFD), FKM seals required |
| Pressure fluid temperature range | $\vartheta$ | °C | – 30 to + 90 |
| Viscosity range | $\nu$ | mm$^2$/s | 20 to 150 recommended operating range 30 to 50, up to 1000 on start-up |
| Cleanliness class to ISO code | | | Maximum permissible degree of contamination of the pressure fluid is to ISO 4406 class 20/18/15 |

The cleanlines class stated for the components must be adhered too in hydraulic systems. Effective filtration prevents faults from occurring and at the same time increases the component service life.
For the selection of filters see catalogue sheets RE 50 070, RE 50 076 and RE 50 081.

### Technical data for the holding brake

| Design | | | Spring pressure multiple disc brake, static holding brake; dynamic operation only in the case of an emergency | | | |
|---|---|---|---|---|---|---|
| Brake type | | | LBD9A2 | LBD11A2 | LBD124A2 | LBD249A2 |
| Static braking moment (wet running) | $T_ü$ | Nm | 17 | 190 | 400 | 740 |
| Dynamic braking moment (wet running) | $T_s$ | Nm | 11 | 140 | 300 | 500 |
| Air pressure | $p$ | bar | 20 – 250 | 30 – 320 | 30 – 320 | 30 – 320 |
| Weight | $m$ | kg | 8 | 9.5 | 28 | 32 |
| Motor type cross reference | | | MKM 11 A2 MRM 11 A2 | MKM 22 A1 MKM 32 A1 MKM 45 A1 MKM 63 A1 MKM 90 A1 MKM 110 A1 | MRM 80 K2 MRM 125 K2 | MRM 160 K2 MRM 250 K2 |

[1] MKM;   [2] MRM
[3] Definition to DIN 24 312 peak pressure = pressure curve which temporarily exceeds the maximum operating pressure and at which the motor continues to remain operable.

**Section X-X**
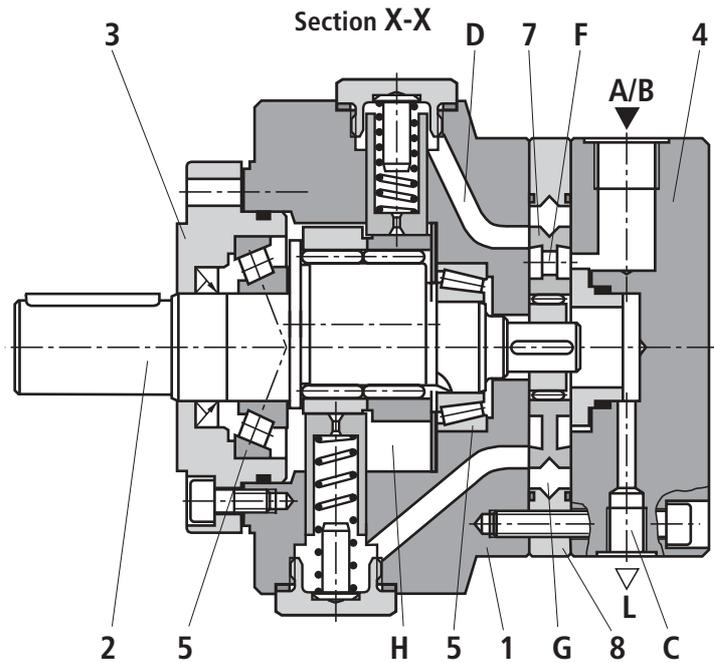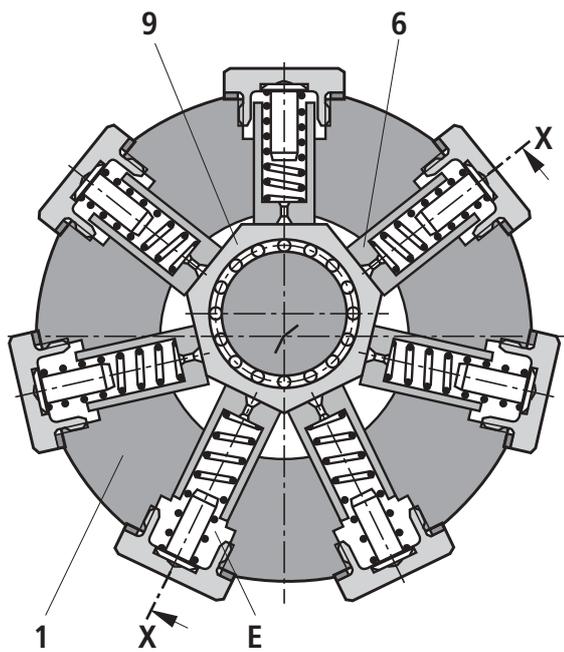
Types MKM and MRM hydraulic motors are fixed displacement external radial piston motors.

### Design

The main components are housing (1), crankshaft (2), cover (3), cover plate (4), tapered roller bearings (5), pistons (6), control (7).

### Rotary group details

The radial pistons (6) act on the crankshaft (2) via needle bearings (9) or via heptagonal rings with needle bearings.

*Crankshaft bearings:*

Pre-stressed, generously sized tapered roller bearings (5) in the X-arrangement.

*Power transmission pistons (6) – crankshaft (2):*

Via needle bearings (9) (or heptagon ring with needle bearings)

Low friction losses, very long life, not sensitive to contamination, also suitable for maximum pressures and motor speeds, high starting torque, no stick/slip at low motor speeds, minimal leakage and high efficiency.

### Operating medium, feed and return

The operating medium is supplied to and carried away from the motor by way of ports A or B. The cylinder chambers (E) are filled or emptied by way of the control and the channels (D) in the housing (1).

### Torque generation; operating stroke

The operating medium in the cylinder chambers (E), which are at present connected to the supply, are pressurised. The pistons (6) are pushed from the outside (external loading!) onto the eccentric of the crankshaft (operating stroke) and the crankshaft rotates.

### Operating medium return

The pistons (6), which are again pushed outwards by the rotation of the crankshaft (2) eccentric, expel the fluid from the cylinder chambers (E), which are at present connected to the return flow line.

### Control

*Design:*

A flat distributor which moves in a linear manner.

*Purpose:*

Distribution of incoming flow to the cylinder chambers, collection of return flow.

*Operating principle:*

The control plate (7) incorprates an inner annular area (F) and forms with the annulus (8) an external annular chamber (G). By offsetting the control plate (7) radially between the motor housing (1) and locking cover (4) with the help of the eccentric which is connected firmly relative to the crankshaft (2) the inner and the outer annular areas are alternately brought into contact with the cylinders. The annular areas themselves open out into ports A or B on the outside.

### Leakages

Leakages occurring at piston (6) and control (7) are collected in the motor casing (H) and discharged via drain port (C).

### Flushing

With high powers and/or temperatures we recommend the use of rotary group flushing.

Dependent on the type, 1 to 4 litres of flushing oil is fed into the drain connection L (4) and is then passed together with the motor leakage via the flushing port S99 to tank.

## MKM
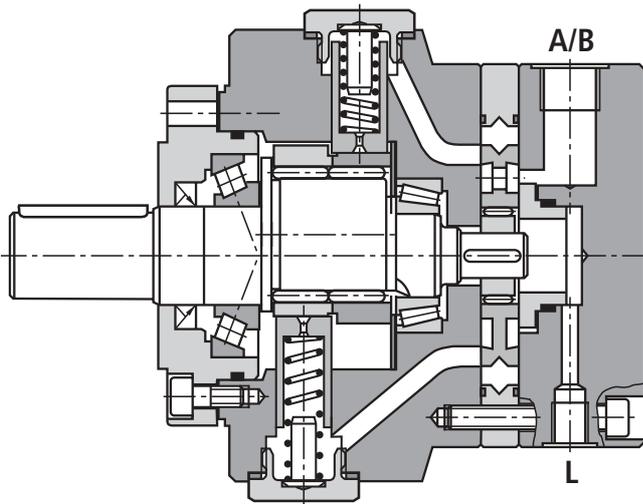


### Rotary group

– 7, 14 or 21 radially arranged pistons
– Power transmission piston - crankshaft: by means of pistons via heptagonal ring with needle cage

### Control

– Needle cage between the control plate and eccentric
– A flat distributor plate that moves in a linear manner with gap seals to counter internal leakage and gap compensating sealing against external leakage.
– Hydrostatic spring supported pressing of the pressure piece onto the control plate
– Reduction in external leakage with minimal friction losses

## MRM
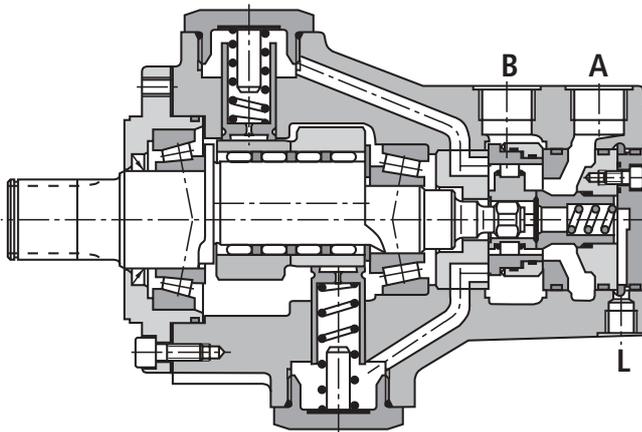


### Rotary group

– 5 or 10 radially arranged pistons
– Power transmission piston - crankshaft: by means of hydrostatically unloaded pistons and pentagonal ring with needle cage

### Control

– Roller bearings between the control rings and eccentric
– A flat distributor plate that moves in a linear manner with backlash compensation
– Hydrostatic spring supported pressing of the control rings onto the flat surfaces
– Hydrostatic backlash compensation of the flat eccentric surfaces, spring supported via the pressure piece
– Reliable backlash compensation even at high reversing frequencies
– Only very slight leakage with minimal friction losses
– The miniaturised shuttle valve ensures: that within the ring chamber. between the control lands. the higher pressure that the motor is being subjected too is applied

## Symbols

With one shaft end
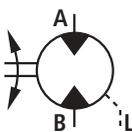
With 2 shaft ends
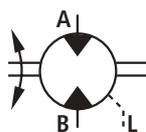
With holding brake
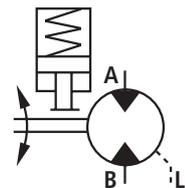
# Bearing life, shaft strength

$L_{n-hyd10}$ is the modified nominal bearing life using mineral oil with a viscosity of $n = 36$ mm$^2$/s in operating hours where 10 % of the bearings may fail. 90 % achieve a higher bearing life. The average mean bearing life $L_{n-hyd50}$ with mineral oil is approximately five times $L_{n-hyd10}$. In practice a minimum of $L_{n-hyd50}$ can be expected for hydraulic drives with mineral oil. As the operating speed is incorporated into the calculation approximatly as a proportionate figure, the table value is converted accordingly.

| Type | Speed $n$ (min$^{-1}$) | $L_{n-hyd10}$ in operating hours at a defined $\Delta p$ and speed $n$ with no external forces on the drive shaft. | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 100 bar | 140 bar | 160 bar | 180 bar | 210 bar | 250 bar | 315 bar |
| MKM / MRM11 | 1000 | >100000 | 88950 | 56995 | 38489 | 23024 | | |
| MKM 22/32 | 500 | >100000 | >100000 | 81400 | 54969 | 32883 | 18388 | |
| MKM 45/63 | 350 | 43679 | 14228 | 9119 | 6157 | 3683 | 2059 | |
| MKM 90/110 | 250 | 15719 | 5121 | 3281 | 2216 | 1325 | | |
| MRM 80 | 400 | >100000 | >100000 | >100000 | >100000 | 97424 | 54484 | 25217 |
| MRM 125 | 400 | >100000 | 85030 | 54484 | 36792 | 22009 | 12308 | 5697 |
| MRM 160 | 400 | >100000 | 38925 | 24941 | 16843 | 10075 | 5634 | 2608 |
| MRM 250 | 300 | 31319 | 10203 | 6537 | 4415 | 2641 | 1477 | 684 |

| Type | Speed $n$ (min$^{-1}$) | $L_{n-hyd10}$ in operating hours at a defined $\Delta p$ and speed $n$<br>MKM 11, 22, 32, 45, 63  max. permissible radial force at the centre of the output shaft = 4500 N<br>MKM 90, 110          max. permissible radial force at the centre of the output shaft =  3000 N<br>MRM 80, 125, 160, 250  max. permissible radial force at the centre of the output shaft =  10 000 N | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | 100 bar | 140 bar | 160 bar | 180 bar | 210 bar | 250 bar | 315 bar |
| MKM / MRM11 | 1000 | 4963 | 4485 | 4235 | 3983 | 3614 | | |
| MKM 22/32 | 500 | 5838 | 5092 | 4717 | 4353 | 3839 | 3225 | |
| MKM 45/63 | 350 | 9319 | 5898 | 4713 | 3788 | 2767 | 1704 | |
| MKM 90/110 | 250 | 11423 | 4689 | 3098 | 2115 | 1281 | | |
| MRM 80 | 400 | 27172 | 22727 | 20610 | 18623 | 15923 | 12872 | 9118 |
| MRM 125 | 400 | 20998 | 15203 | 12872 | 10897 | 8514 | 6190 | 3810 |
| MRM 160 | 400 | 25074 | 14939 | 11648 | 9167 | 6523 | 4289 | 2344 |
| MRM 250 | 300 | 14150 | 6882 | 4977 | 3681 | 2421 | 1387 | 656 |

## MKM 11



Flow $qv$ in L/min

Torque $T$ in Nm →
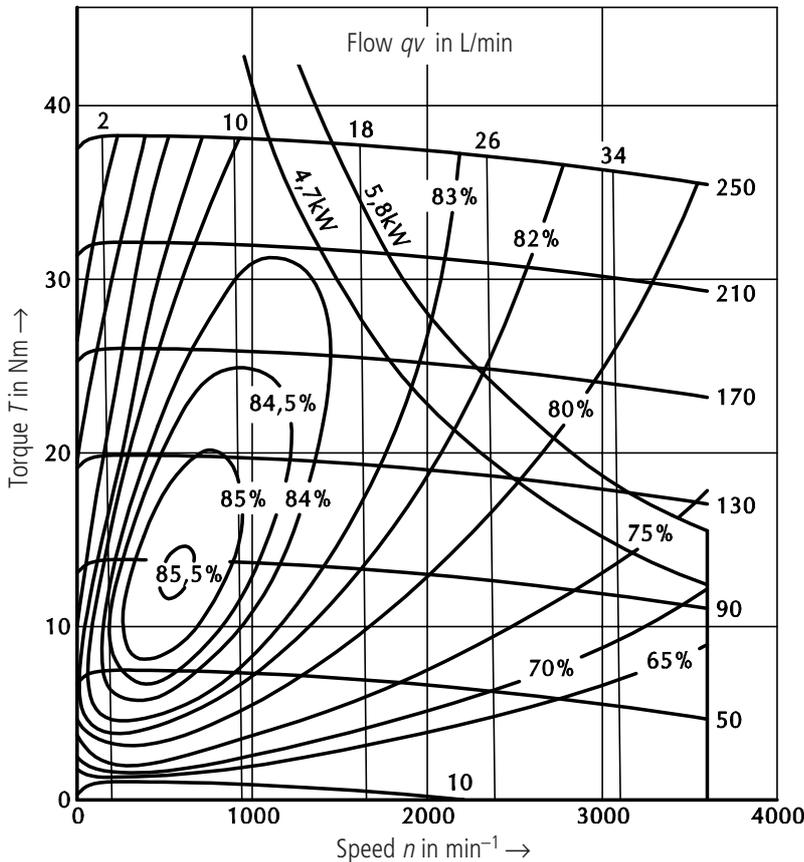
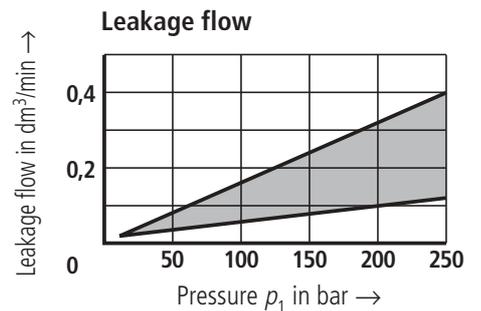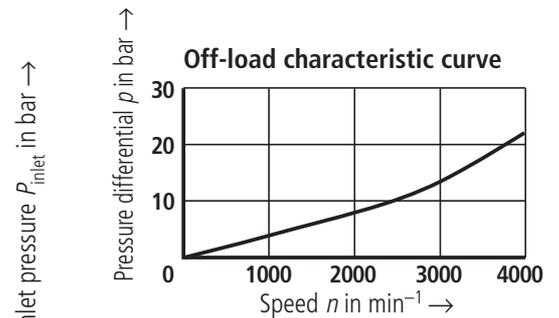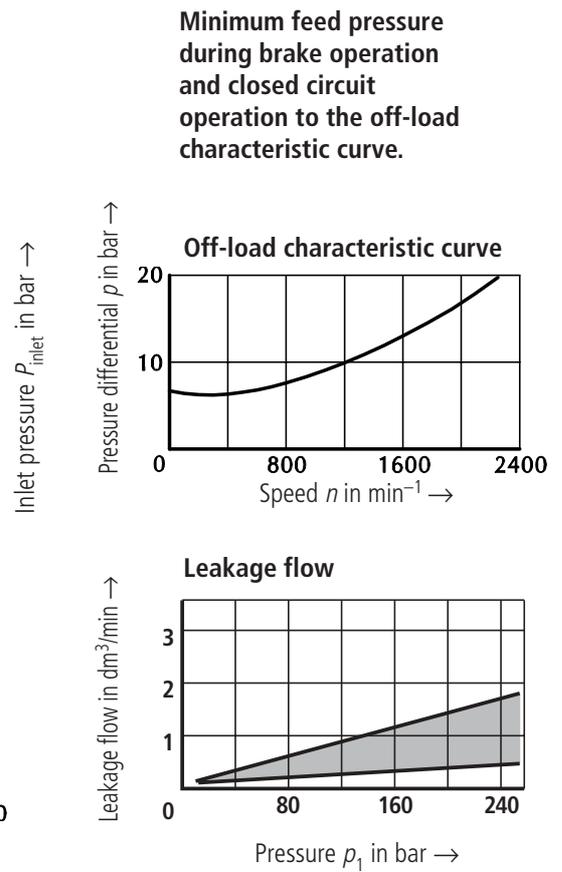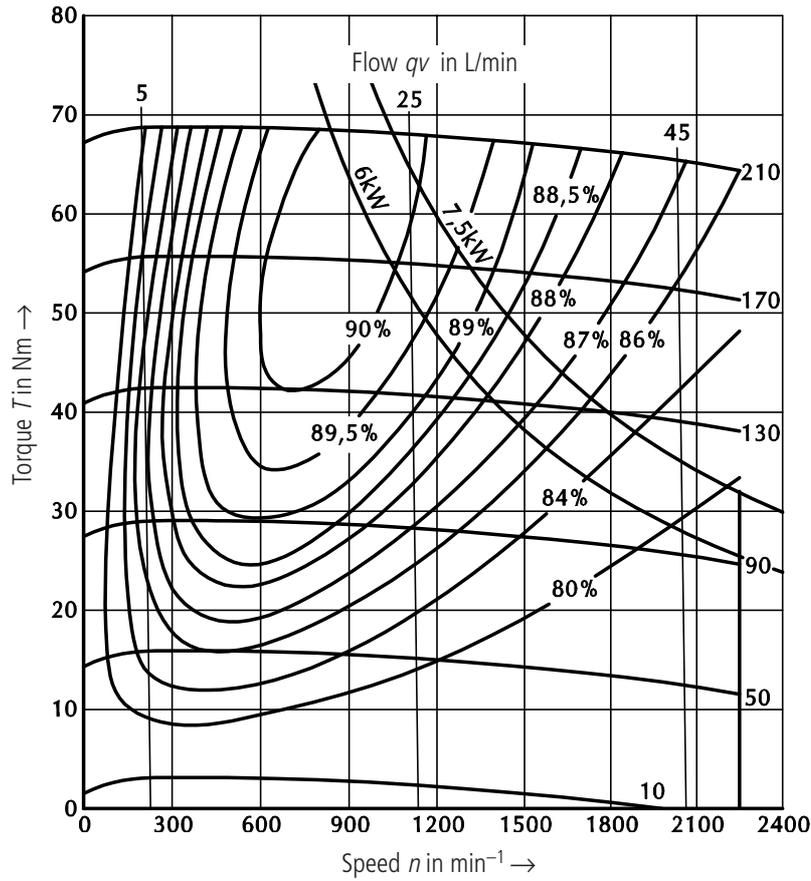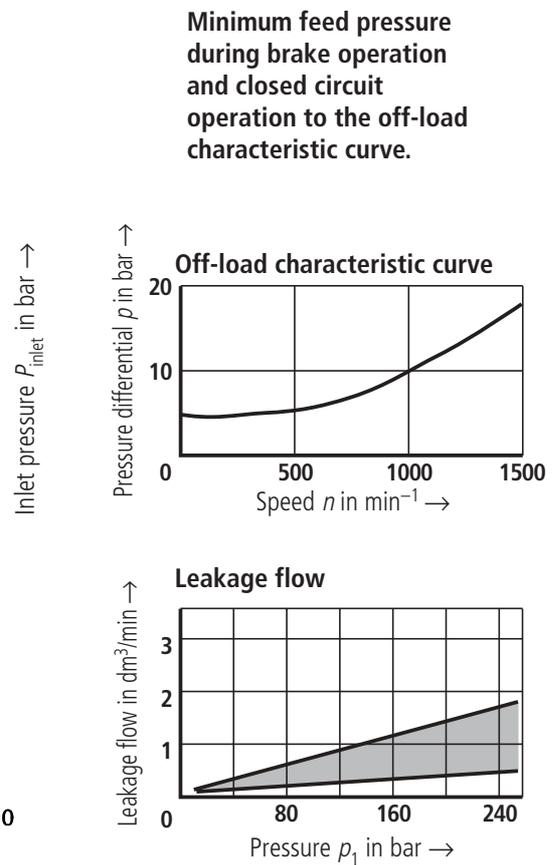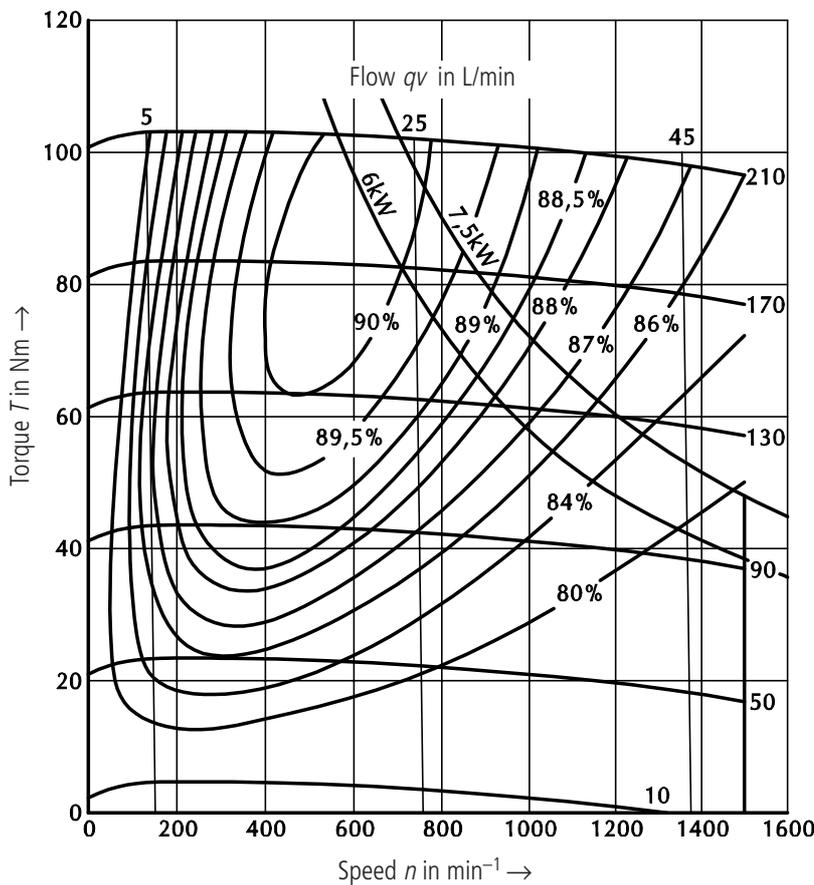Speed $n$ in min⁻¹ →

Inlet pressure $P_{inlet}$ in bar →

**Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.**

### Off-load characteristi curve
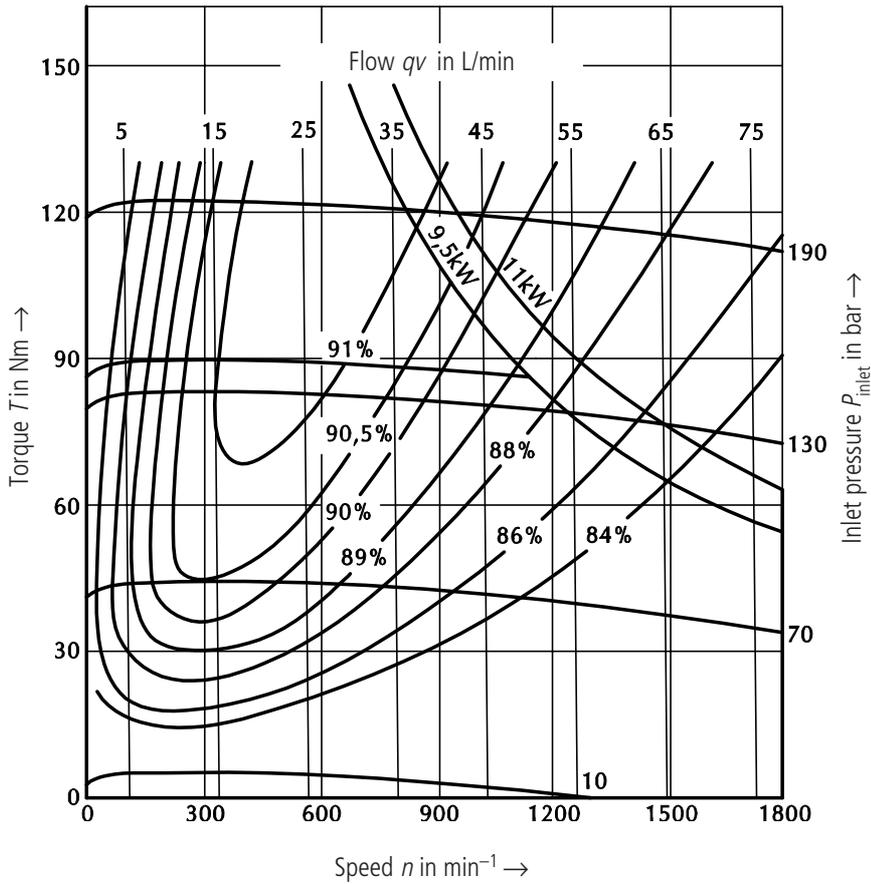


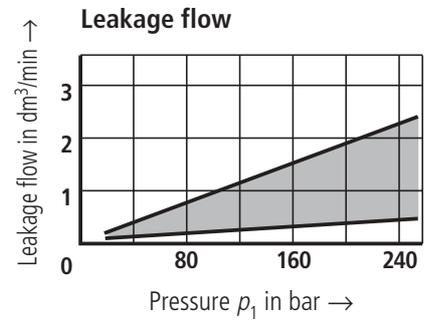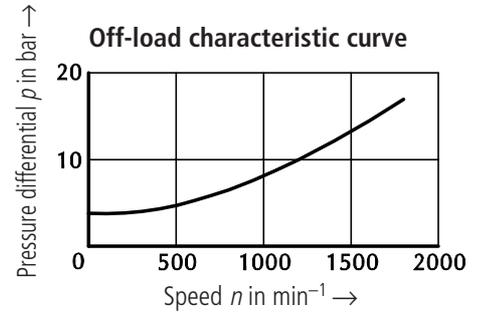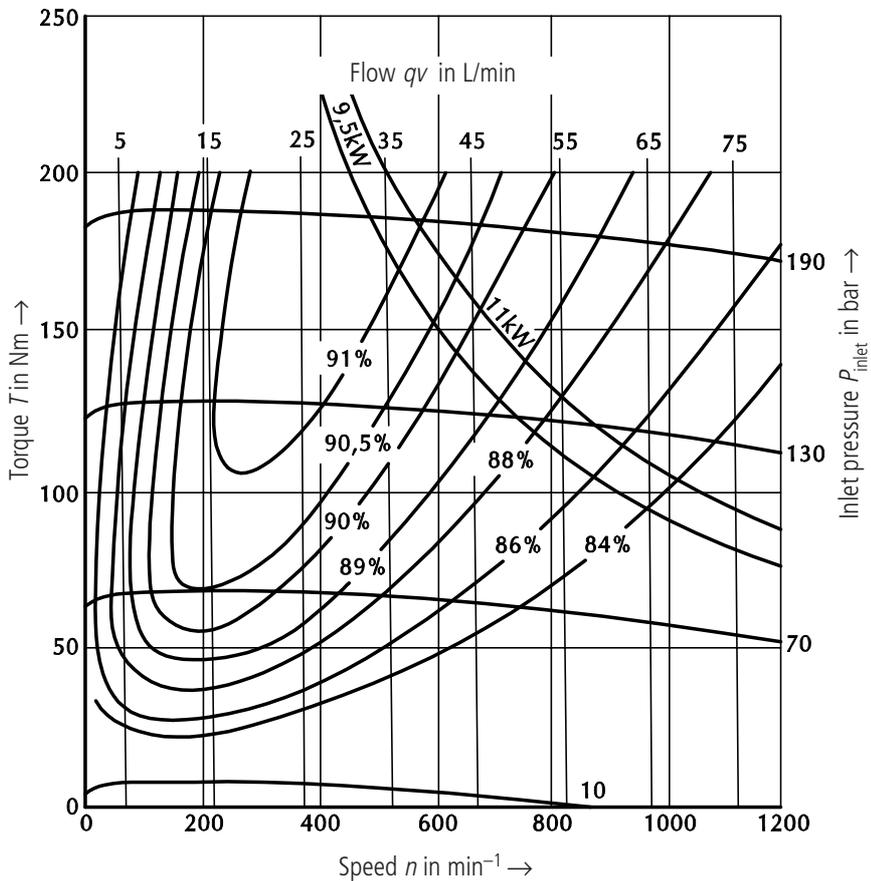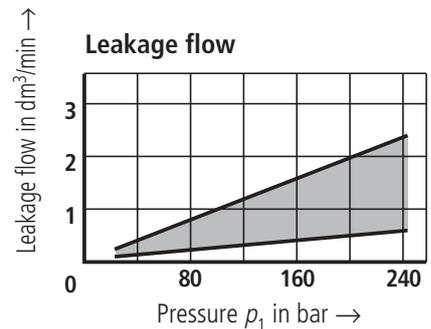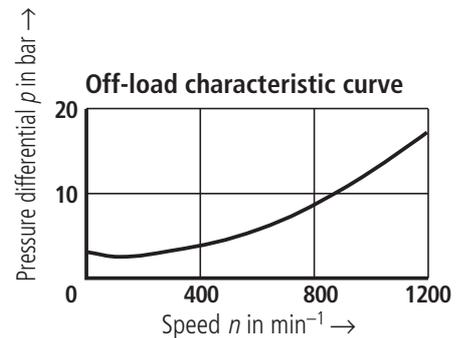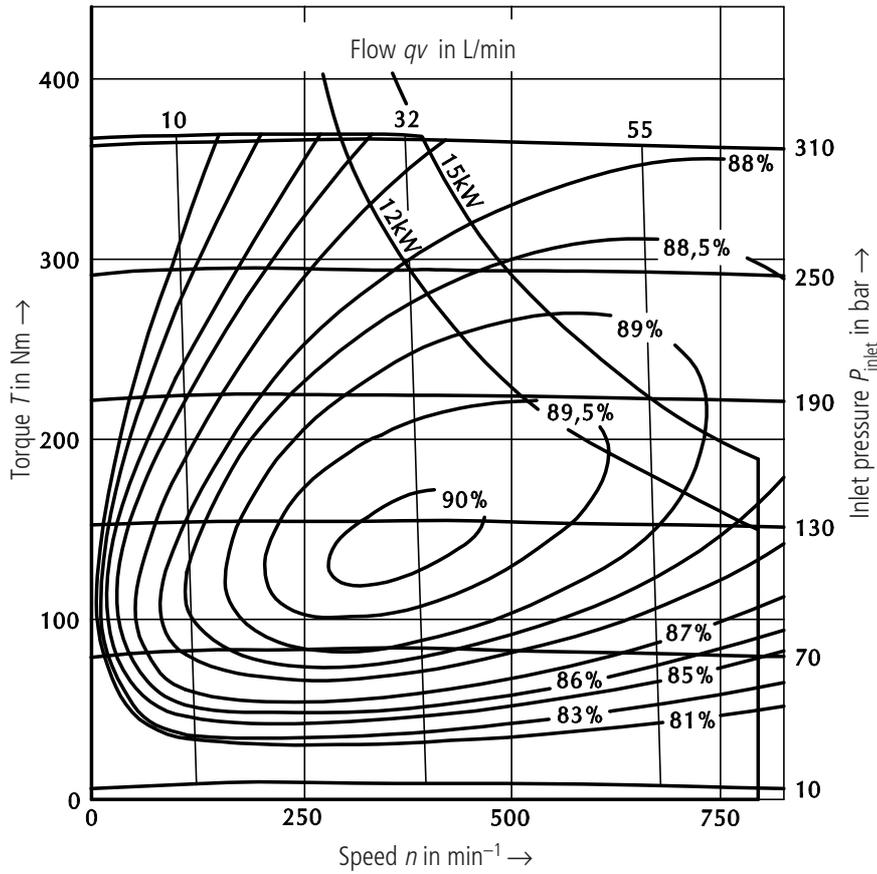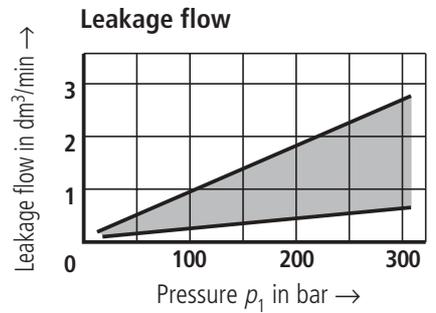Pressure differential $p$ in bar →

Speed $n$ in min⁻¹ →

### Leakage flow



Leakage flow in dm³/min →

Pressure $p_1$ in bar →

## MRM 11



Flow $qv$ in L/min

Torque $T$ in Nm →
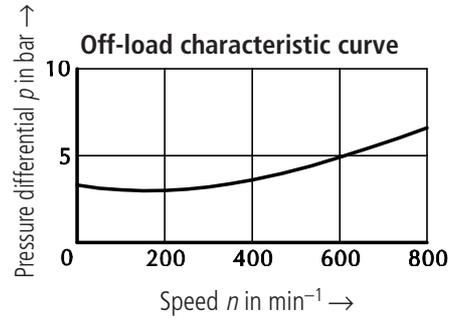
Speed $n$ in min⁻¹ →

Inlet pressure $P_{inlet}$ in bar →
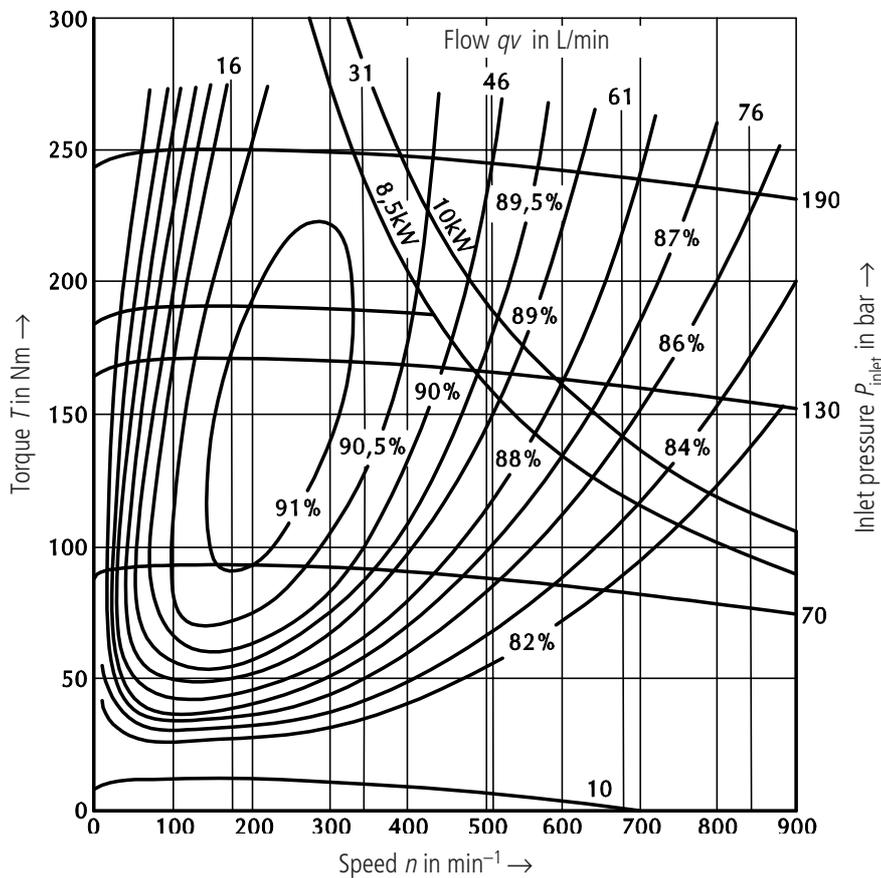
**Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.**

### Off-load characteristic curve



Pressure differential $p$ in bar →

Speed $n$ in min⁻¹ →

### Leakage flow



Leakage flow in dm³/min →

Pressure $p_1$ in bar →

# Characteristic curves (average value) measured at $v = 36$ mm$^2$/s; $\vartheta_{oil} = 50$ °C; $p_{outlet} = 0$ bar; $p_{leakage\ oil} = 0$ bar

## MKM 22



Torque $T$ in Nm → (vertical axis)
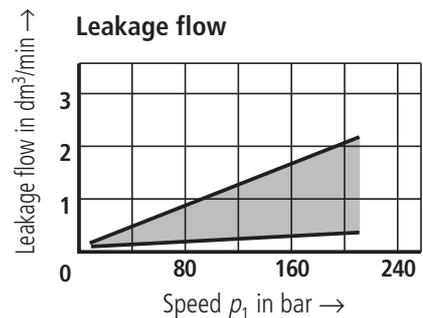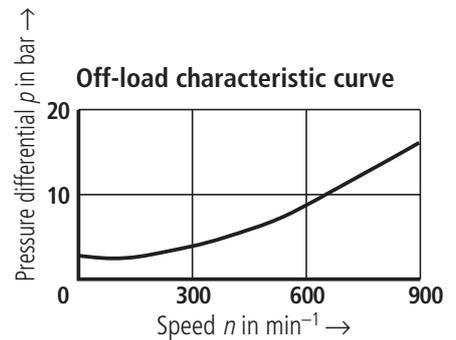Speed $n$ in min$^{-1}$ → (horizontal axis)
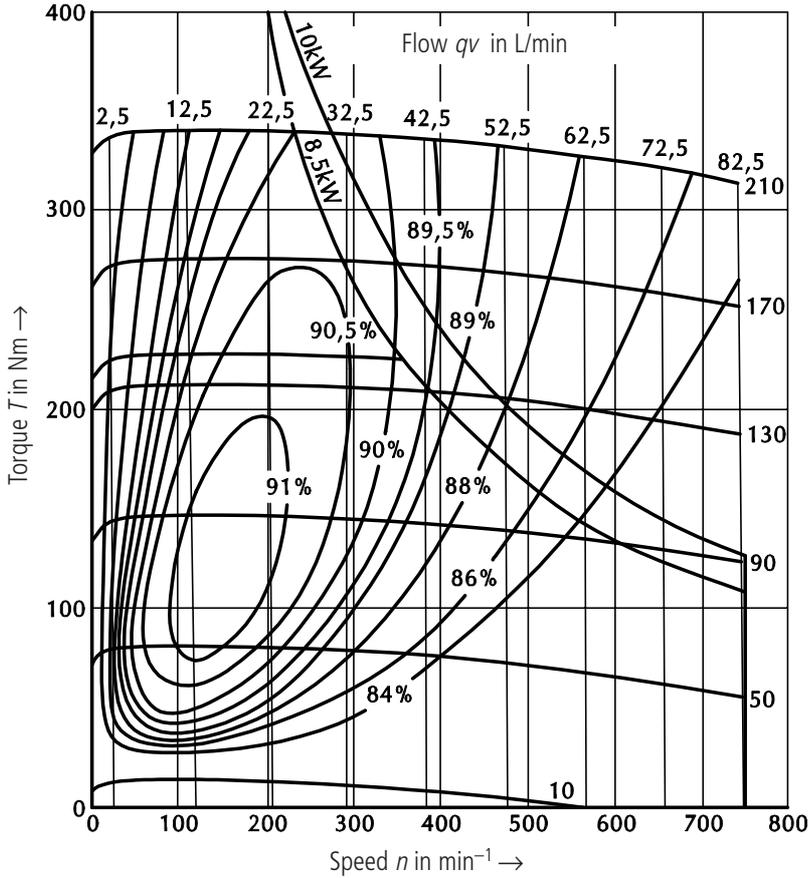Flow $qv$ in L/min
Inlet pressure $P_{inlet}$ in bar →

**Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.**

**Off-load characteristic curve**



Pressure differential $p$ in bar →
Speed $n$ in min$^{-1}$ →

**Leakage flow**



Leakage flow in dm$^3$/min →
Pressure $p_1$ in bar →

## MKM 32



Torque $T$ in Nm → (vertical axis)
Speed $n$ in min$^{-1}$ → (horizontal axis)
Flow $qv$ in L/min
Inlet pressure $P_{inlet}$ in bar →

**Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.**

**Off-load characteristic curve**
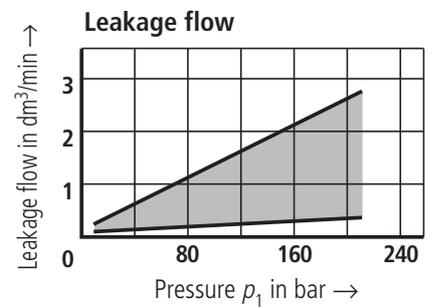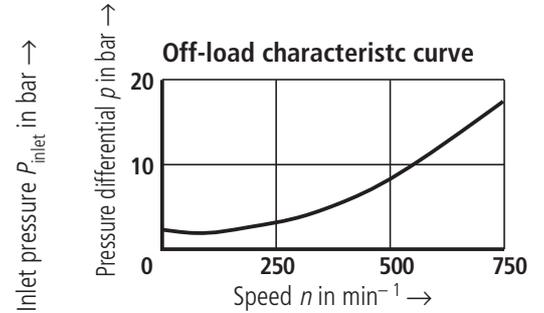


Pressure differential $p$ in bar →
Speed $n$ in min$^{-1}$ →

**Leakage flow**



Leakage flow in dm$^3$/min →
Pressure $p_1$ in bar →

# Characteristic curves (average value) measured at $v = 36$ mm²/s; $\vartheta_{oil} = 50$ °C; $p_{outlet} = 0$ bar; $p_{leakage\ oil} = 0$ bar

## MKM 45



Flow $qv$ in L/min
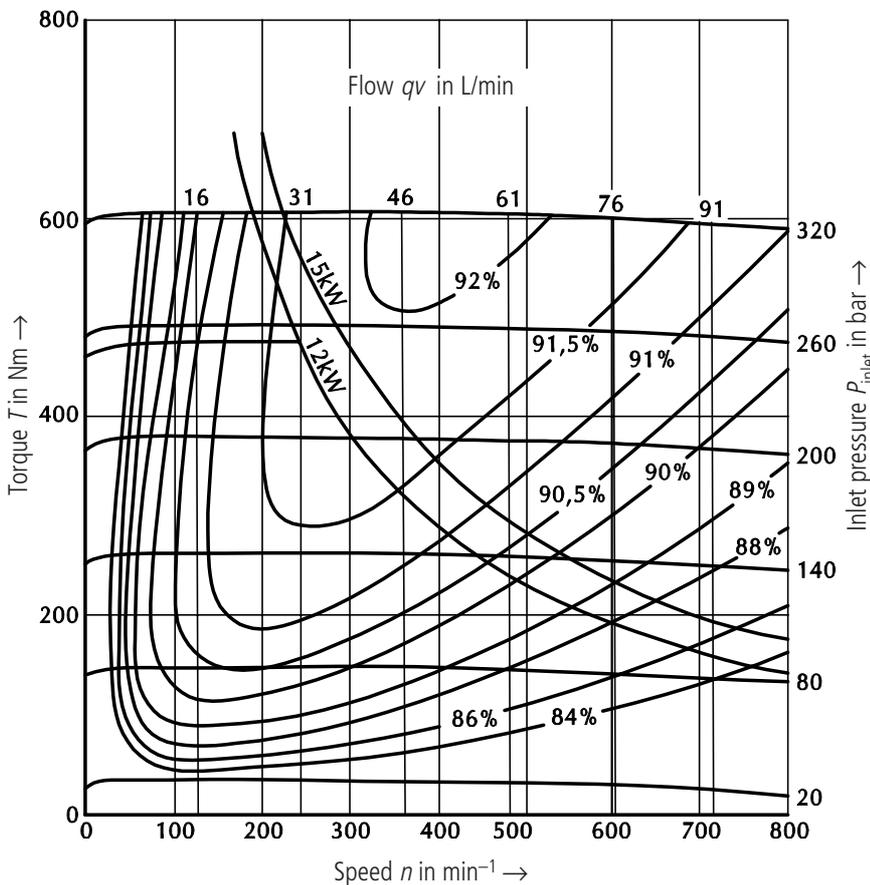
Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.

### Off-load characteristic curve



### Leakage flow



## MKM 63



Flow $qv$ in L/min

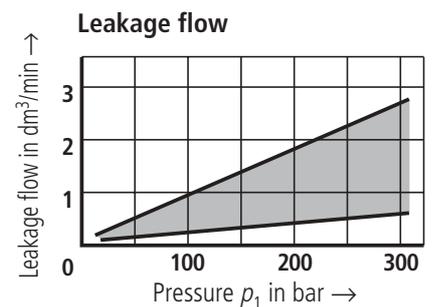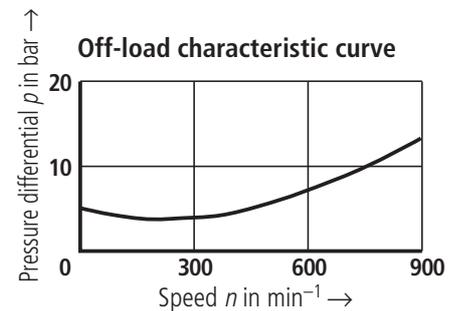Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.

### Off-load characteristic curve



### Leakage flow

# Characteristic curves (average value) measured at $v = 36$ mm²/s; $\vartheta_{oil} = 50\,°C$; $p_{outlet} = 0$ bar; $p_{leakage\;oil} = 0$ bar
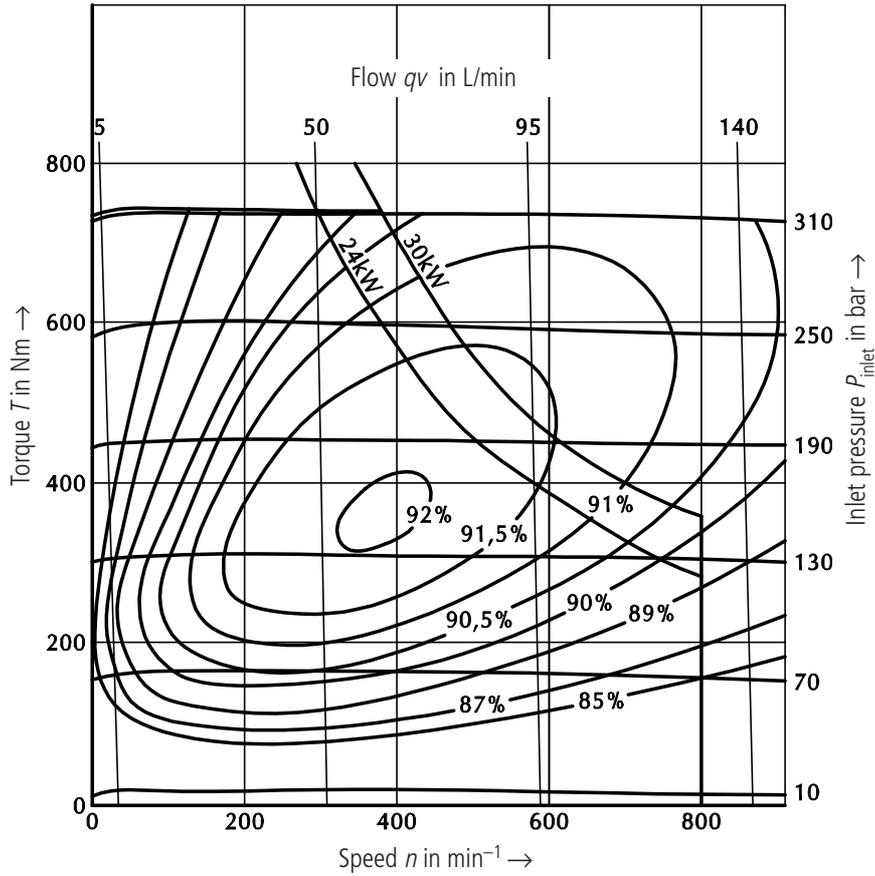
## MRM 80



Flow $qv$ in L/min

**Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.**

**Off-load characteristic curve**



**Leakage flow**



## MKM 90



Flow $qv$ in L/min

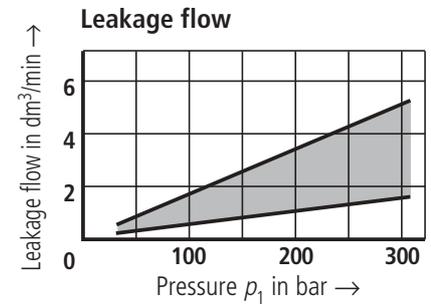**Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.**

**Off-load characteristic curve**



**Leakage flow**

# Characteristic curves (average value) measured at $v = 36$ mm$^2$/s; $\vartheta_{oil} = 50\ °C$; $p_{outlet} = 0$ bar; $p_{leakage\ oil} = 0$ bar

## MKM 110



Torque $T$ in Nm →
Speed $n$ in min$^{-1}$ →
Flow $qv$ in L/min
Inlet pressure $P_{inlet}$ in bar →

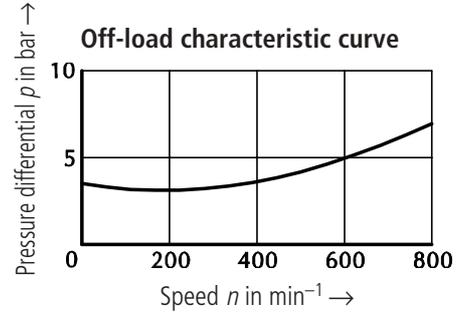**Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.**

### Off-load characteristc curve



Pressure differential $p$ in bar →
Speed $n$ in min$^{-1}$ →

### Leakage flow



Leakage flow in dm$^3$/min →
Pressure $p_1$ in bar →

## MRM 125



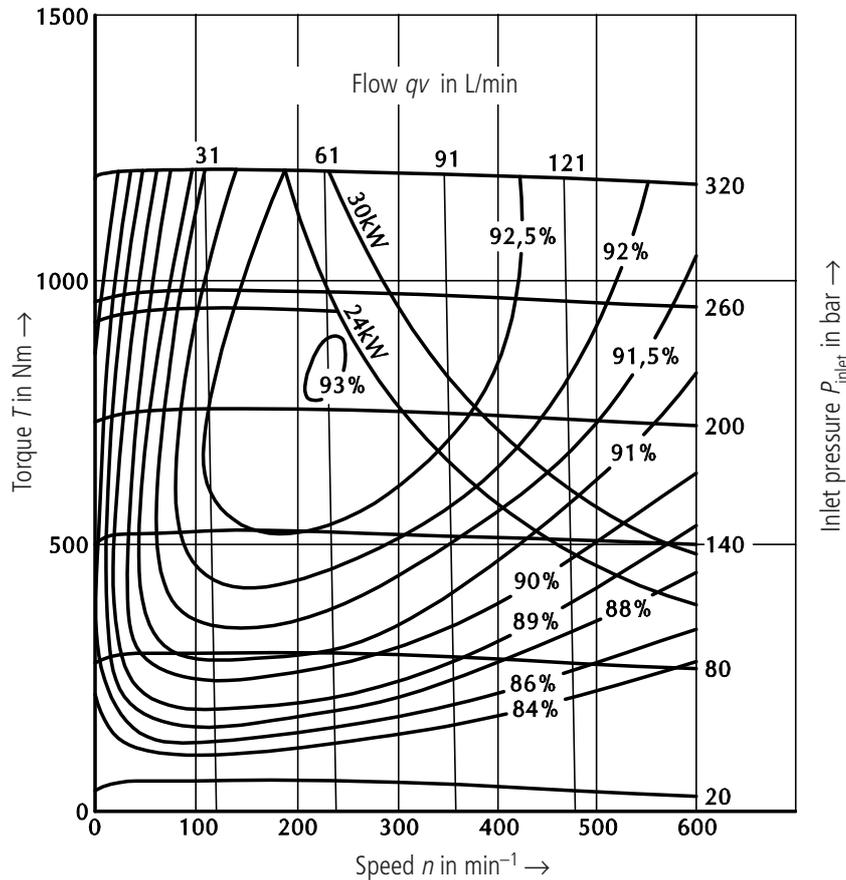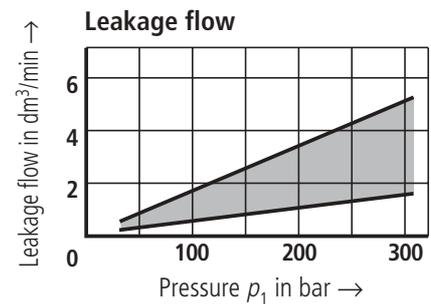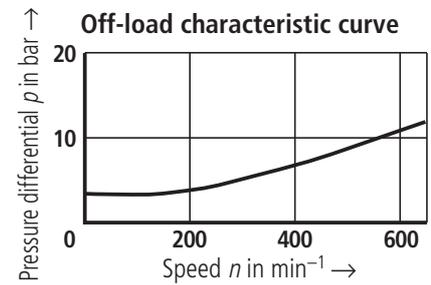Torque $T$ in Nm →
Speed $n$ in min$^{-1}$ →
Flow $qv$ in L/min
Inlet pressure $P_{inlet}$ in bar →

**Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.**

### Off-load characteristic curve



Pressure differential $p$ in bar →
Speed $n$ in min$^{-1}$ →

### Leakage flow



Leakage flow in dm$^3$/min →
Pressure $p_1$ in bar →

**Characteristic curves (average value)** measured at $v = 36$ mm$^2$/s; $\vartheta_{oil} = 50$ °C; $p_{outlet} = 0$ bar; $p_{leakage\ oil} = 0$ bar

**MRM 160**



Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.

**Off-load characteristic curve**



**Leakage flow**



**MRM 250**



Minimum feed pressure during brake operation and closed circuit operation to the off-load characteristic curve.

**Off-load characteristic curve**



**Leakage flow**

**Flange version „2" (ISO 3019/2)**
**Pipe connection „A0"**



"X"

**View "X"**



**1** Port A
**2** Port B
**3** Direction of rotation viewed on the shaft end
   **Right:** With flow from
   port B to A
   **Left:** With flow from
   port A to B
**4** Leakage port
**5** Key A 5 x 5 x 20
   DIN 6885
**6** Counterbore for O-ring 21.89 x 2.62
**7** Type MKM 11
**8** Type MRM 11

**Pipe connection "A1"**

# Unit dimensions: MKM 22, 32, 45, 63, 90 and 110 (dimensions in mm)

## Flange version „1"
### Pipe connection „A0"



## Flange version "2"
DIN ISO 3019/2



| Type | L1 | Piston row(s) |
|---|---|---|
| MKM 22 | 208 | 1 |
| MKM 32 | 208 | 1 |
| MKM 45 | 226 | 2 |
| MKM 63 | 226 | 2 |
| MKM 90 | 248 | 3 |
| MKM 110 | 248 | 3 |

**1** Port A

**2** Port B

**3** Direction of rotation viewed on the shaft end

**Right:** With flow from port B to A

**Left:** With flow from port A to B

**4** Leakage port G1/4

**5** Flushing connection 2 x G1/4 (version **„S99"**)

**6** Key A 8 x 7 x 45 DIN 6885

**7** Counterbore for O-ring 21.89 x 2.62

## Flange version "3"



## Pipe connection "A1"



## Pipe connection "B5"

**Flange version „1" with splined shaft „K"**
**Pipe connection „A0"**



**Flange version "2"**
with through holes



**1**  Port A G 1

**2**  Port B G 1

**3**  Direction of rotation viewed on the shaft end
   **Right:**  With flow from
         port B to A
   **Left:**   With flow from
         port A to B

**4**  Leakage port G 3/8
   Counterbore Ø 28 mm, offset 72° in relation
   to ports  A and B

**5**  Flushing connection G 3/8 (version **„S99"**)

**6**  Key A 12 x 8 x 56 DIN 6885

**7**  Shaft groove for retaining ring DIN 471

**8**  Splined shaft connection DIN 5480
   W40 x 2 x 18 x 7h

**9**  Splined shaft connection DIN 5480
   N45 x 2 x 21 x 9H

**Shaft version "A"**



**Shaft version "H"**

## Unit dimensions: MRM 160 and 250 (dimensions in mm)

**Flange version „1" with splined shaft „K"**
**Pipe connection „A0"**
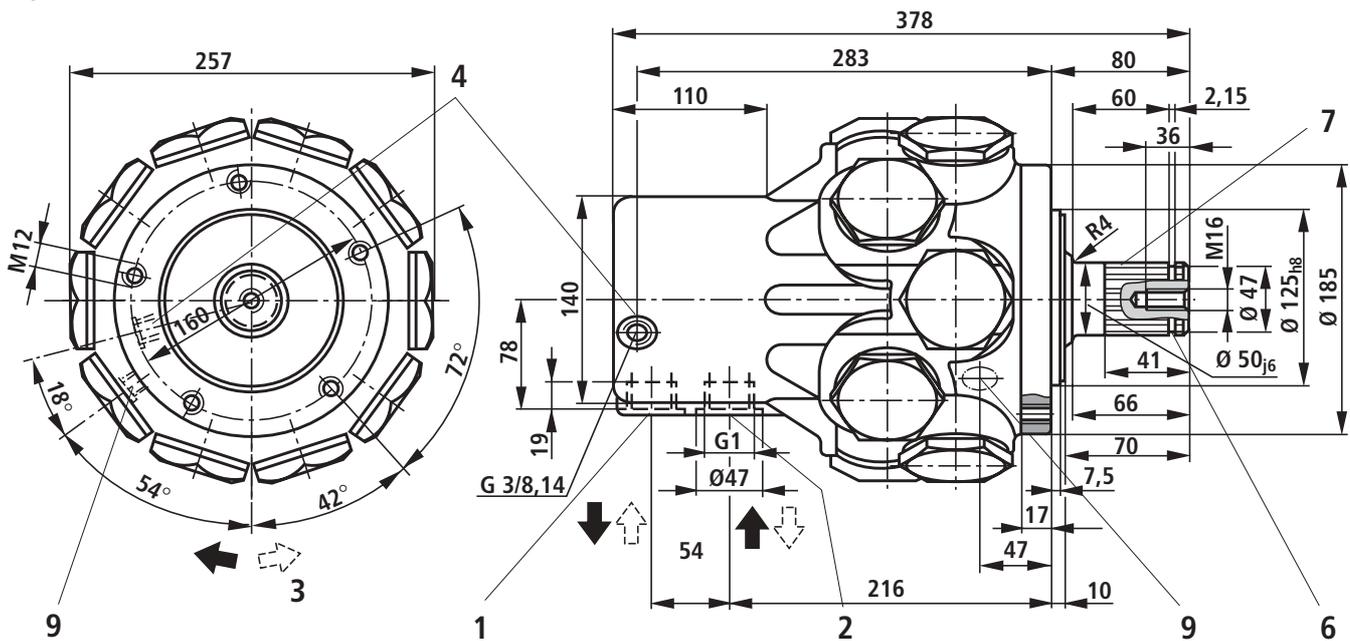


**Flange version "2"**
with through holes
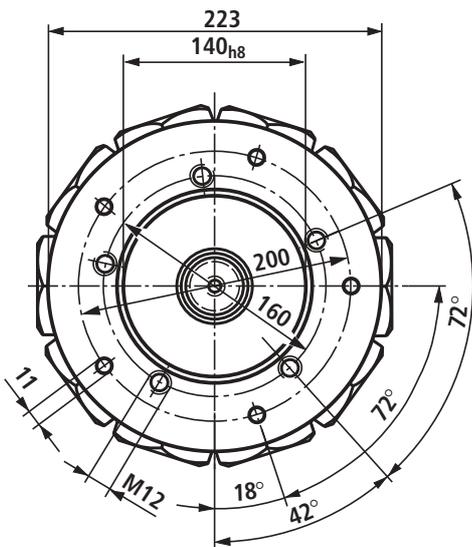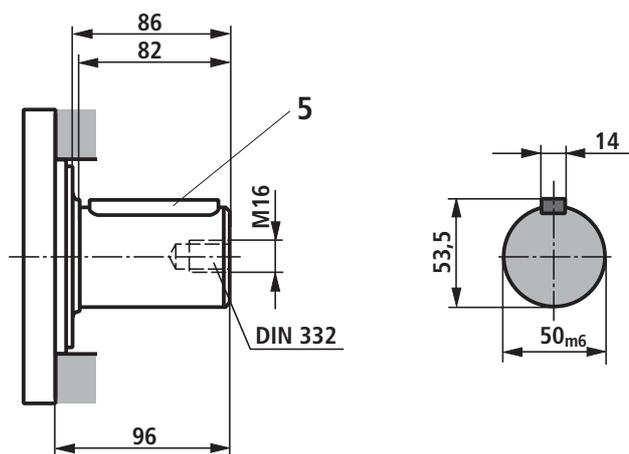


**1** Port A  G 1

**2** Port B  G 1

**3** Direction of rotation viewed on the shaft end
    **Right:** With flow from
              port B to A
    **links:** With flow from
              port A to B

**4** Leakage port
    Counterbore Ø 28 mm, offset 72 ° in relation
    to ports  A and B

**5** Key A 14 x 9 x 70 DIN 6885

**6** Shaft groove for retaining ring DIN 471

**7** Splined shaft connection DIN 5480
    W50 x 2 x 24 x 7h

**8** Splined shaft connection DIN 5480
    N45 x 2 x 21 x 9H

**9** Flushing connection G 3/8 (version **„S99"**)

**Shaft version "A"**
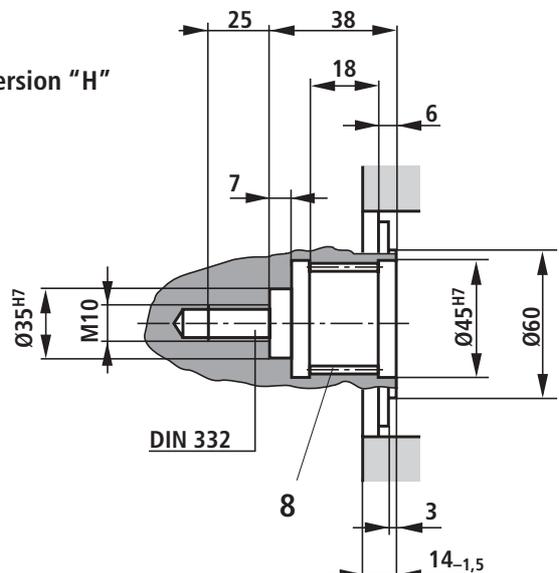


**Shaft version "H"**

**MRM 80, MRM 125**
**Flange version "1"**
**with splined shaft "K"**
**Pipe connection "A1"**

For dimensions
see page 15
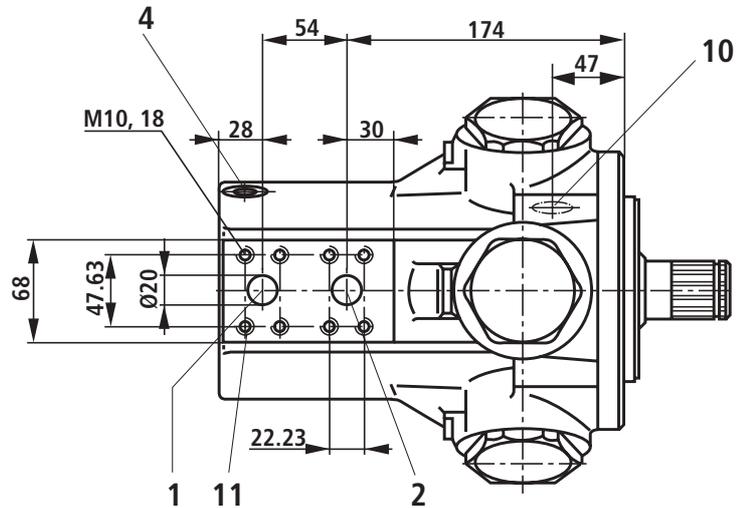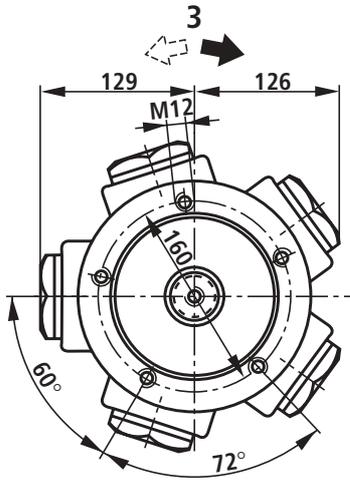


**1** Port A SAE J 518 3/4" standard

**2** Port B SAE J 518 3/4" standard

**3** Direction of rotation viewed on the shaft end
  **Right:** With flow from
  port B to A
  **Left:** With flow from
  port A to B

**4** Leakage port G 3/8
  Counterbore Ø 28 mm, offset 72° in relation
  to ports A and B

**10** Flushing connection G 3/8 (version **"S99"**)

**11** Flange height from centre of shaft 80$^{+0.5}$ mm

**MRM 160, MRM 250**
**Flange version "1"**
**with splined shaft "K"**
**Pipe connection "A1"**

For dimensions
see page 16

## Motor with tachometer shaft (dimensions in mm)

Ordering detail **"M"**

One size of tachometer shaft for all types, for measuring the motor speed, transmits a maximum torque of 5 Nm (for higher output torques please consult us).

**6 x 8 deep, on one P.C.D. of Ø 63**

## Motor with through shaft (dimensions in mm)

Ordering detail **"M10–"** (only for MKM 22 to 110)

All of the radial piston motors of series MKM without the MKM 11 can be supplied with a through shaft, ordering detail M10-, for transmitting the full motor torque.

**Splined shaft DIN 5480 W 28 x 1.25 x 21 x 7h**

## Valve design: pressure relief, anti-cavitation/feed, MKM...N01 (dimensions in mm)

Series MKM radial piston motors with two direct operated pressure relief valves, gauge port G 1/4, anti-cavitation/feed via two 0.1 bar check valves and G 1/2 pipe connections.
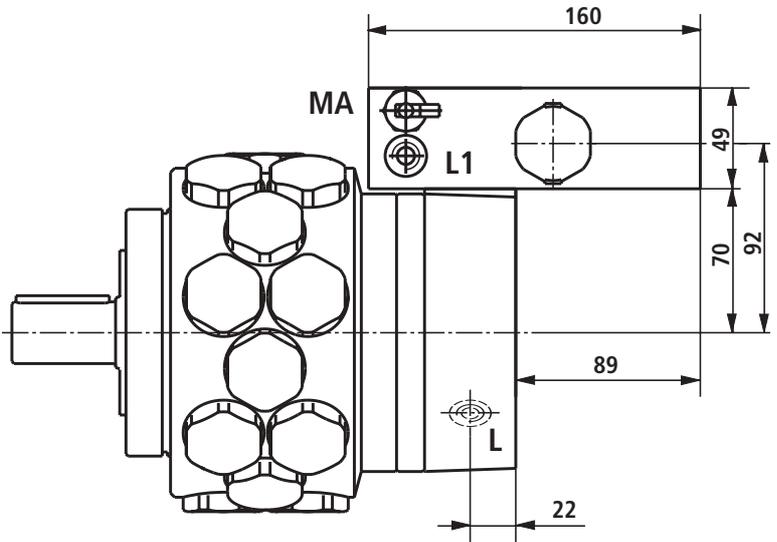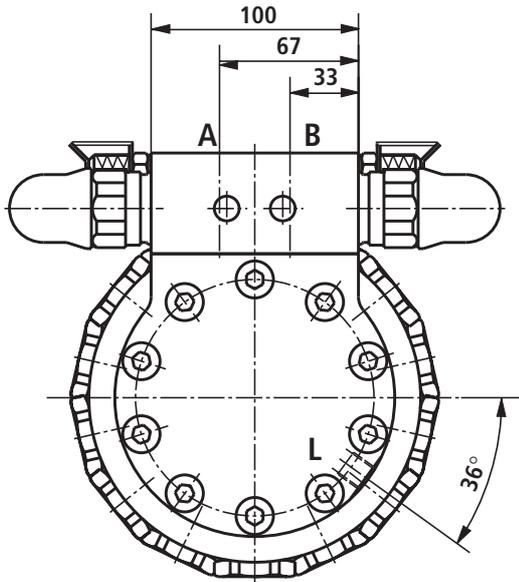
| | Port | | Counter bore | |
|---|---|---|---|---|
| | Thread | Depth | Ø | Depth |
| A | G 1/2 | 16 | 28 | $1.3^{+0.1}$ |
| B | G 1/2 | 16 | 28 | $1.3^{+0.1}$ |
| L | G 1/4 | 14 | 25 | $1.3_{-0.3}$ |
| L1 | G 1/4 | 14 | 20 | 1 |
| L2 | G 1/4 | 14 | 20 | 1 |
| MA | G 1/4 | 12 | 20 | 1 |
| MB | G 1/4 | 12 | 20 | 1 |
| Pressure stage I | | | Up to 100 bar | |
| Pressure stage II | | | Up to 200 bar | |
| Pressure stage III | | | Up to 315 bar | |
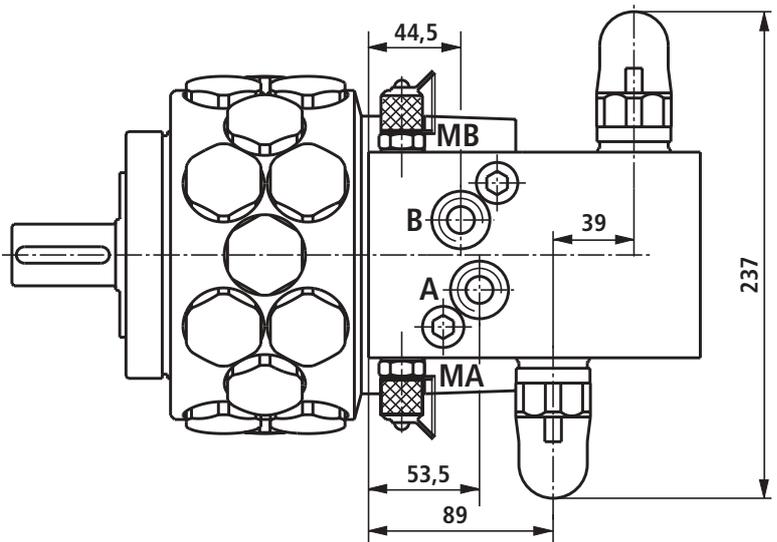
**Note:**

The valve cartridges are **not** included within the scope of supply, they must be ordered separately!

Pressure stage to be stated in clear text!
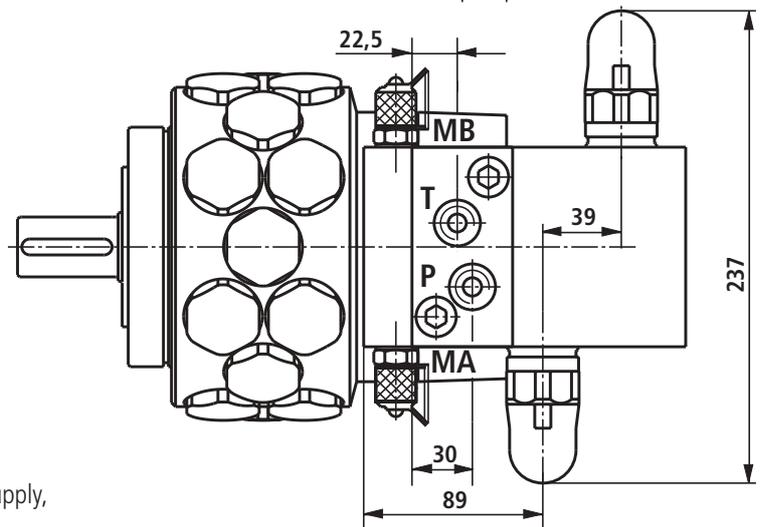
## Symbol (Version „MKM...N01"), function
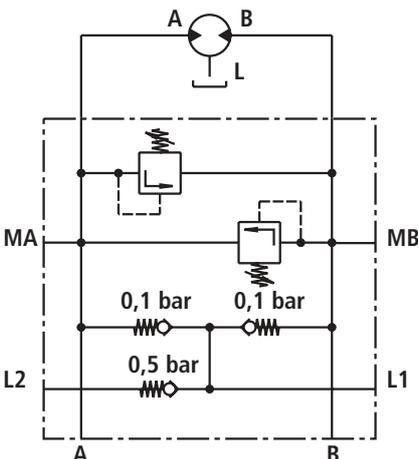
Two individually adjustable DBDS 10 K1X/... valves protect the drive from overloads. Via port L1 and two 0.1 bar check valves the occurring leakage is fed back into the drive. A flow control valve can be screwed into port L1 so that the feed flow can be controlled. For the anti-cavitation function, the motor connection L is connected to L1 on the block and L2 is connected to tank. The leakage back pressure of 0.5 bar causes the motor leakage oil to be fed into the circuit.

## Valve design: pressure relief, anti-cavitation/feed, valve connection NS 6, MKM...N61 (in mm)

Series MKM radial piston motors with two direct operated pressure relief valves, gauge ports G 1/4, anti-cavitation/feed via two 0.1 bar check valves, G 1/2 pipe connections and valve connections NS 6 to DIN 24 340 form A6 (CETOP 3).
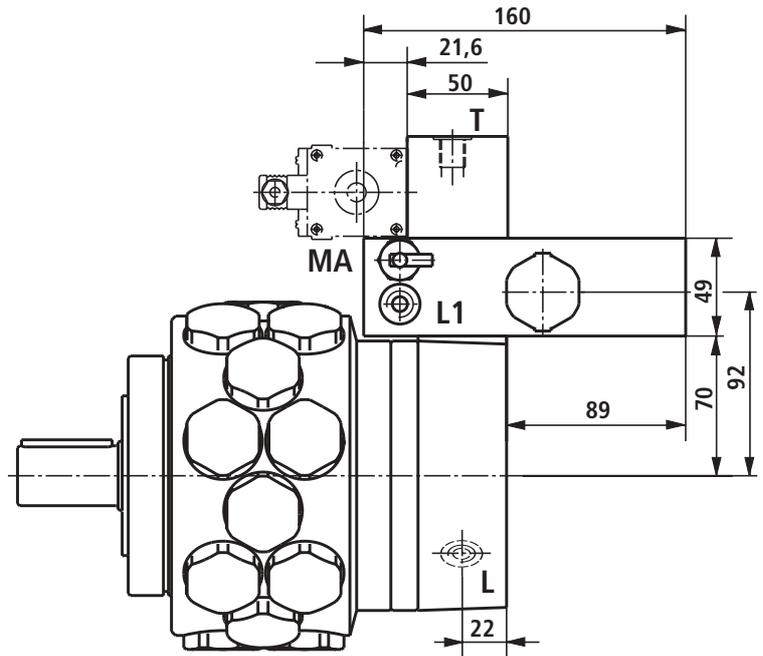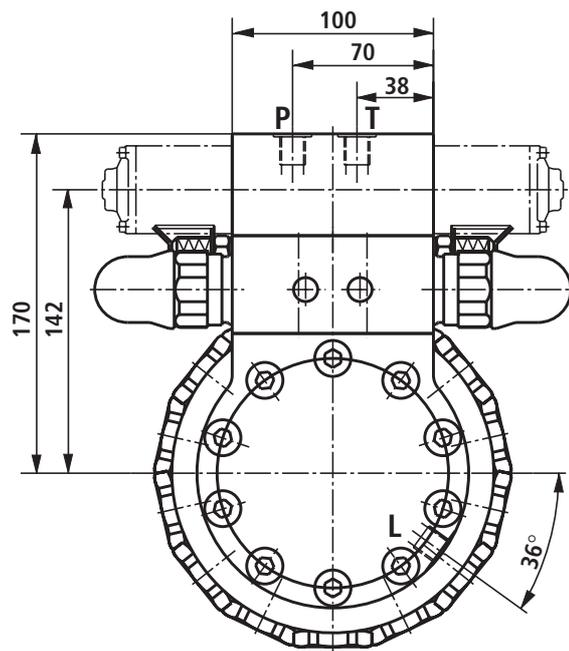
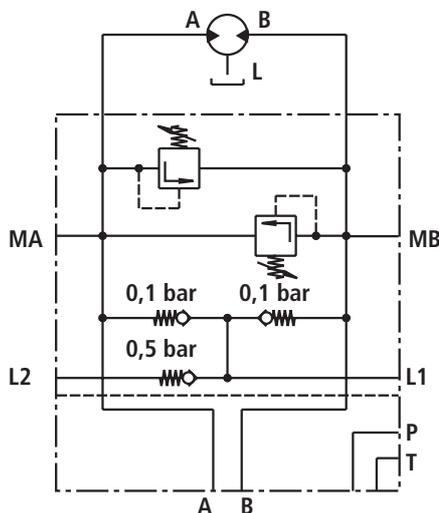| | Port | | Counter bore | |
|---|---|---|---|---|
| | Thread | Depth | Ø | Depth |
| A, B | G 1/2 | 16 | 28 | $2.1^{+0.1}$ |
| P, T | G 3/8 | 12 | 23 | $0.5^{+0.1}$ |
| L | G 1/4 | 14 | 25 | $1.3_{-0.3}$ |
| L1, L2 | G 1/4 | 14 | 20 | 1 |
| MA, MB | G 1/4 | 12 | 20 | 1 |
| Pressure stage I | | | Up to 100 bar | |
| Pressure stage II | | | Up to 200 bar | |
| Pressure stage III | | | Up to 315 bar | |

### Note:

The valve cartridges are **not** included within the scope of supply, they must be ordered separately!

Pressure stage to be stated in clear text!

## Symbol (version „MKM...N61"), function

With this block design valves with a porting pattern to DIN 24 340 form A6 are bolted directly onto the motor.

Two individually adjustable DBDS 10 K1X/... valves protect the drive from overloads. Via port L1 and two 0.1 bar check valves, the occurring leakage is fed back into the drive. A flow control valve can be screwed into port L1 so that the feed flow can be controlled. For the anti-cavitation function the motor connection L is connected to L1 on the block and L2 is connected to tank. The leakage back pressure of 0.5 bar causes the motor leakage oil to be fed into the circuit.
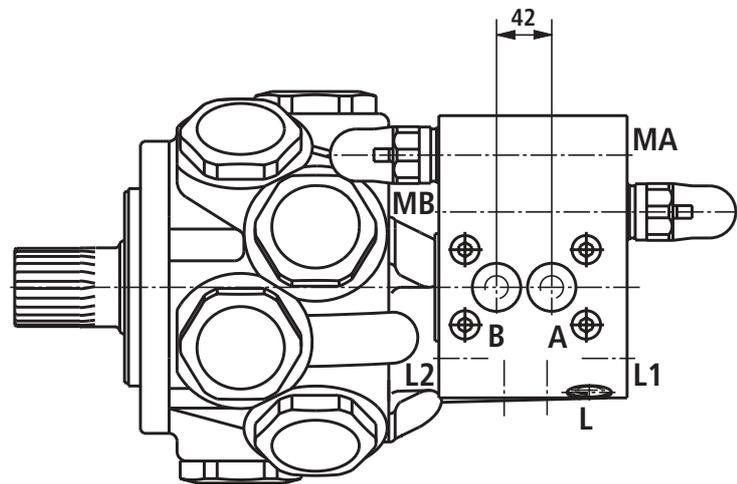
## Valve design: pressure relief, anti-cavitation/feed, valve connection NS 10, MKM...N101 (in mm)

Series MKM radial piston motors with two direct operated pressure relief valves, gauge port G 1/4, anti-cavitation/feed via two 0.1 bar check valves and valve connection DIN 24 340 form A10 (CETOP 5).

| | Port | | Counter bore | |
|---|---|---|---|---|
| | Thread | Depth | Ø | Depth |
| A, B | G 1/2 | 16 | 28 | $2.1^{+0.1}$ |
| P, T | G 1/2 | 14 | 28 | 0.5 |
| L | G 1/4 | 14 | 25 | $1.3_{-0.3}$ |
| L1, L2 | G 1/4 | 14 | 20 | 1 |
| MA, MB | G 1/4 | 12 | 20 | 1 |
| Pressure stage I | | | Up to 100 bar | |
| Pressure stage II | | | Up to 200 bar | |
| Pressure stage III | | | Up to 315 bar | |

### Note:

The valve cartridges are **not** included within the scope of supply, they must be ordered separately!

Pressure stage to be stated in clear text!

## Symbol (version „MKM...N101"), function

With this block design, directional, proportional or servo valves with a porting pattern to DIN 24 340 form A10 are bolted directly onto the motor.
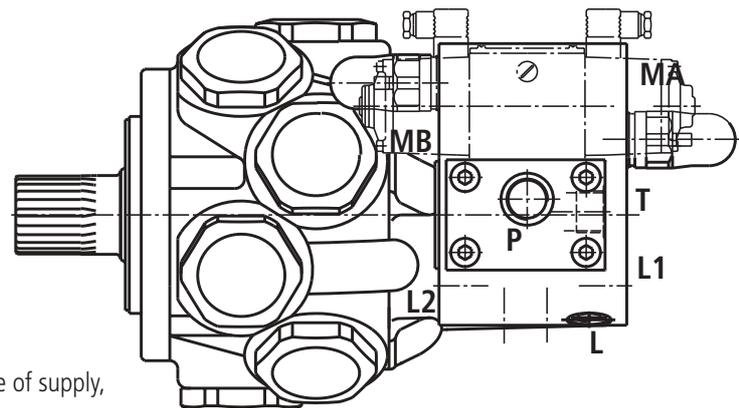
Two individually adjustable DBDS 10 K1X/... valves protect the drive from overloads. Via port L1 and two 0.1 bar check valves the occurring leakage is fed back into the drive. A flow control valve can be screwed into port L1 so that the feed flow can be controlled. For anti-cavitation function the motor connection L is connected to L1 on the block and L2 is connected to tank. The leakage back pressure of 0.5 bar causes the motor leakage oil to be fed into the circuit.

## Valve design: pressure relief, anti-cavitation/feed, MRM...N01 (dimensions in mm)

Series MRM radial piston motors with two direct operated pressure relief valves, gauge ports G1/4, anti-cavitation/feed via two 0.1 bar check valves and G 3/4 pipe connections.
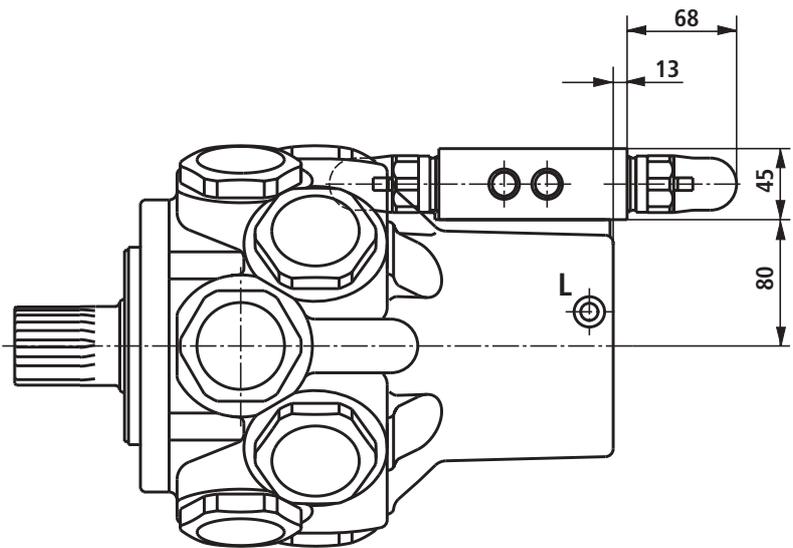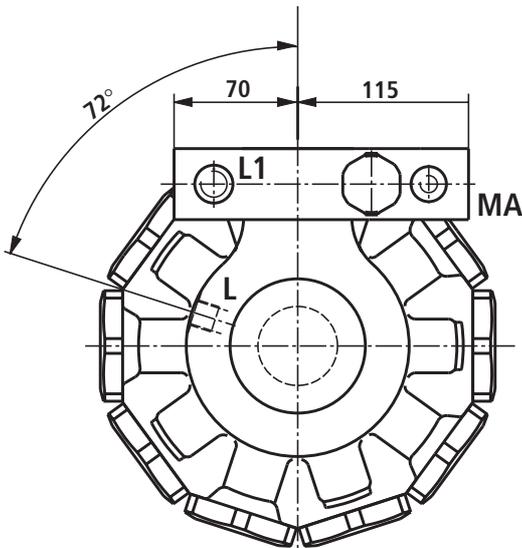
| | Port | | Counter bore | |
|---|---|---|---|---|
| | Thread | Depth | Ø | Depth |
| A, B | G 3/4 | 17 | 33 | $2.1^{+0.1}$ |
| L | G 3/8 | 14 | 28 | 1.5 |
| L1, L2 | G 3/8 | 14 | 24 | 1 |
| MA, MB | G 1/4 | 14 | 20 | 1 |
| Pressure stage I | | | Up to 100 bar | |
| Pressure stage II | | | Up to 200 bar | |
| Pressure stage III | | | Up to 315 bar | |

**Note:**

The valve cartridges are **not** included within the scope of supply, they must be ordered separately!

Pressure stage to be stated in clear text!
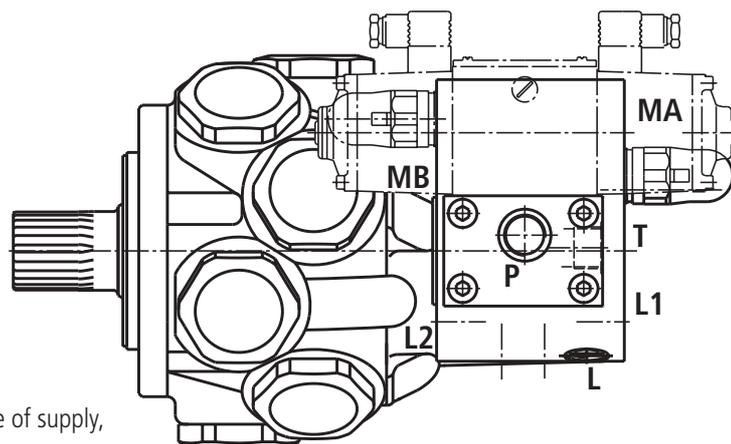
## Symbol (version „MRM...N01"), function
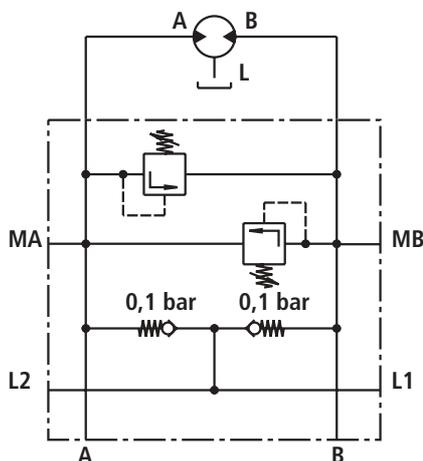
Two individually adjustable DBDS 10 K1X/... valves protect the drive from overloads. Via port L1 and two 0.1 bar check valves the occurring leakage is fed back into the drive. A flow control valve can be screwed into port L1 so that the feed flow can be controlled. When there is sufficient back pressure L1 can be connected with the tank line.

## Valve design: pressure relief, anti-cavitation/feed, valve connection NS 6, MRM...N61 (in mm)

Series MRM radial piston motors with two direct operated pressure relief valves, gauge port G 1/4, anti-cavitation/feed via two 0.1 bar check valves and valve connection DIN 24 340 form A6 (CETOP 3).
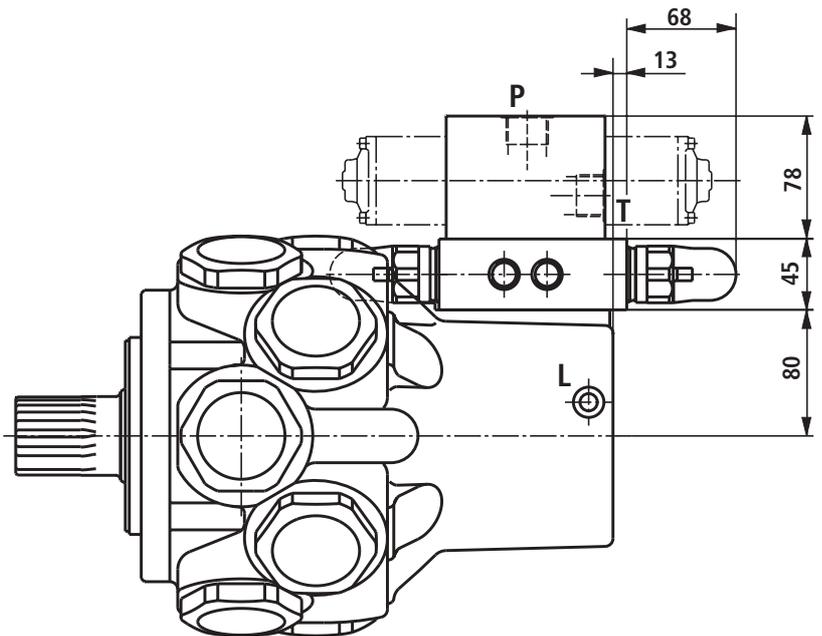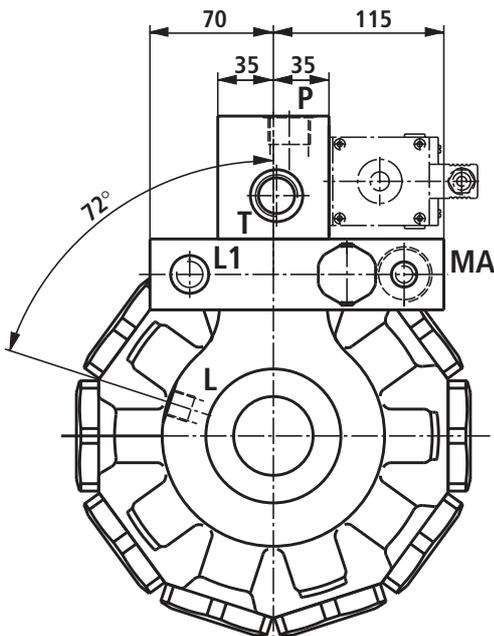
| Port | | | Counter bore | |
|---|---|---|---|---|
| | Thread | Depth | Ø | Depth |
| P, T | G 1/2 | 17 | 28 | 1 |
| L | G 3/8 | 14 | 28 | 1.5 |
| L1, L2 | G 3/8 | 14 | 24 | 1 |
| MA, MB | G 1/4 | 14 | 20 | 1 |
| Pressure stage I | | | Up to 100 bar | |
| Pressure stage II | | | Up to 200 bar | |
| Pressure stage III | | | Up to 315 bar | |

**Note:**

The valve cartridges are **not** included within the scope of supply, they must be ordered separately!

Pressure stage to be stated in clear text!

## Symbol (version „MRM...N61"), function
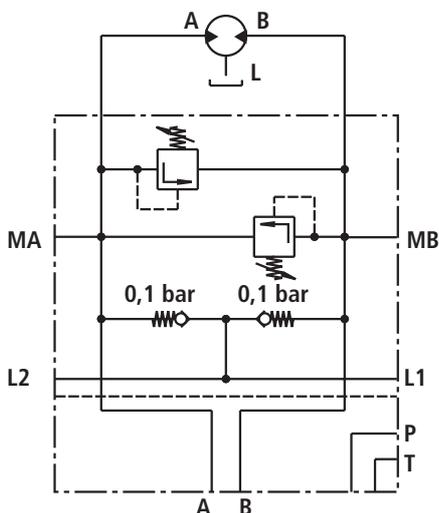
With this block design, valves with a porting pattern to DIN 24 340 form A6 are bolted directly onto the motor, due to the low entrapped volume of oil, this gives the drive good open loop or closed loop control characteristics.

Two individually adjustable DBDS 10 K1X/... valves protect the drive from overloads. Via port L1 and two 0.1 bar check valves the occurring leakage is fed back into the drive. A flow control valve can be screwed into port L1 so that the feed flow can be controlled. When there is sufficient back pressure L1 can be connected with the tank line. L2 is plugged.

## Valve design: pressure relief, anti-cavitation/feed, valve connection NS 10, MRM...N101 (in mm)

Series MRM radial piston motors with two direct operated pressure relief valves, gauge port G 1/4, anti-cavitation/feed via two 0.1 bar check valves and valve connection DIN 24 340 form A10 (CETOP 5).
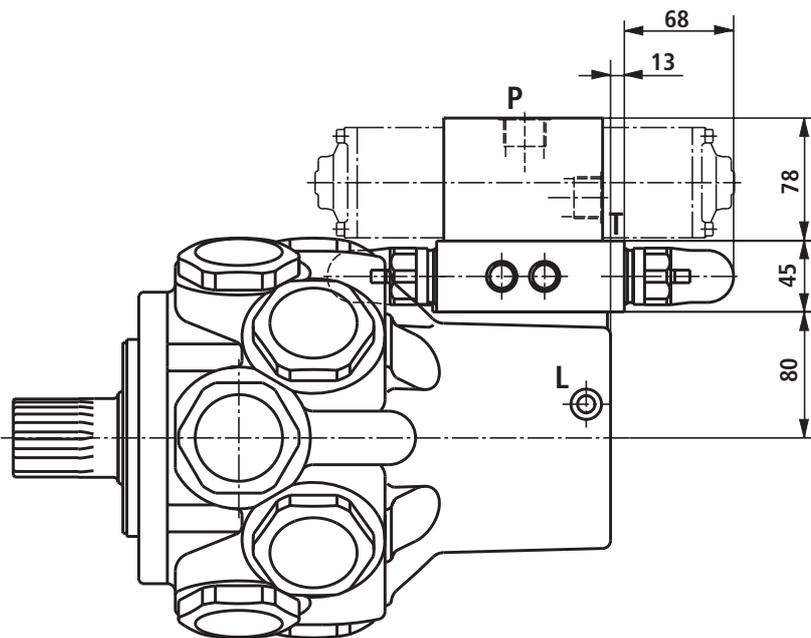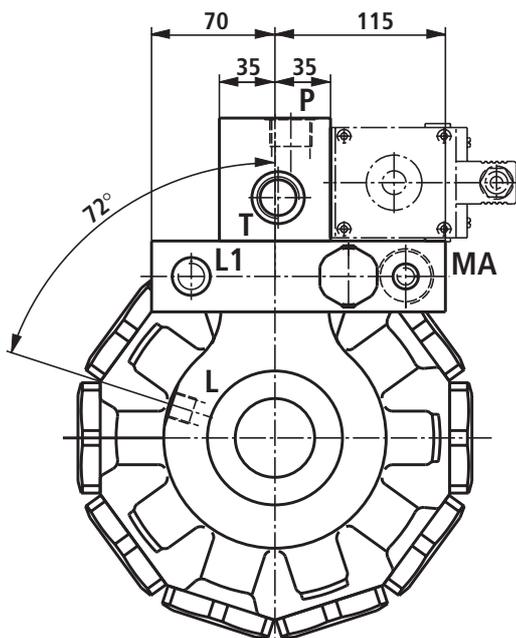
| | Port | | Counter bore | |
|---|---|---|---|---|
| | Thread | Depth | Ø | Depth |
| P, T | G 3/4 | 18 | 33 | 0.5 |
| L | G 3/8 | 14 | 28 | 1.5 |
| L1, L2 | G 3/8 | 14 | 24 | 1 |
| MA, MB | G 1/4 | 14 | 20 | 1 |
| Pressure stage I | | | Up to 100 bar | |
| Pressure stage II | | | Up to 200 bar | |
| Pressure stage III | | | Up to 315 bar | |

### Note:

The Valve cartridges are **not** included within the scope of supply, they must be ordered separately!

Pressure stage to be stated in clear text!

## Symbol (version „MRM...N101"), function
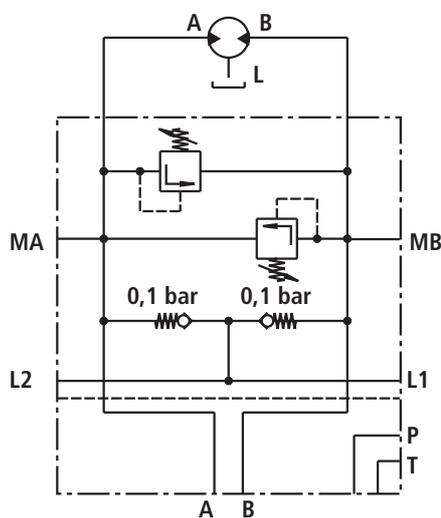
With this block design, valves with a porting pattern to DIN 24 340 form A10 are bolted directly onto the motor, due to the low entrapped volume of oil, this gives the drive good open loop or closed loop control characteristics.

Two individually adjustable DBDS 10 K1X/... valves protect the drive from overloads. Via port L1 and two 0.1 bar check valves the occurring leakage is fed back into the drive. A flow control valve can be screwed into port L1 so that the feed flow can be controlled. When there is sufficient back pressure L1 can be connected with the tank line. L2 is plugged.

## Holding brake type LBD9A2 for motor types MKM 11 and MRM 11 (dimensions in mm)
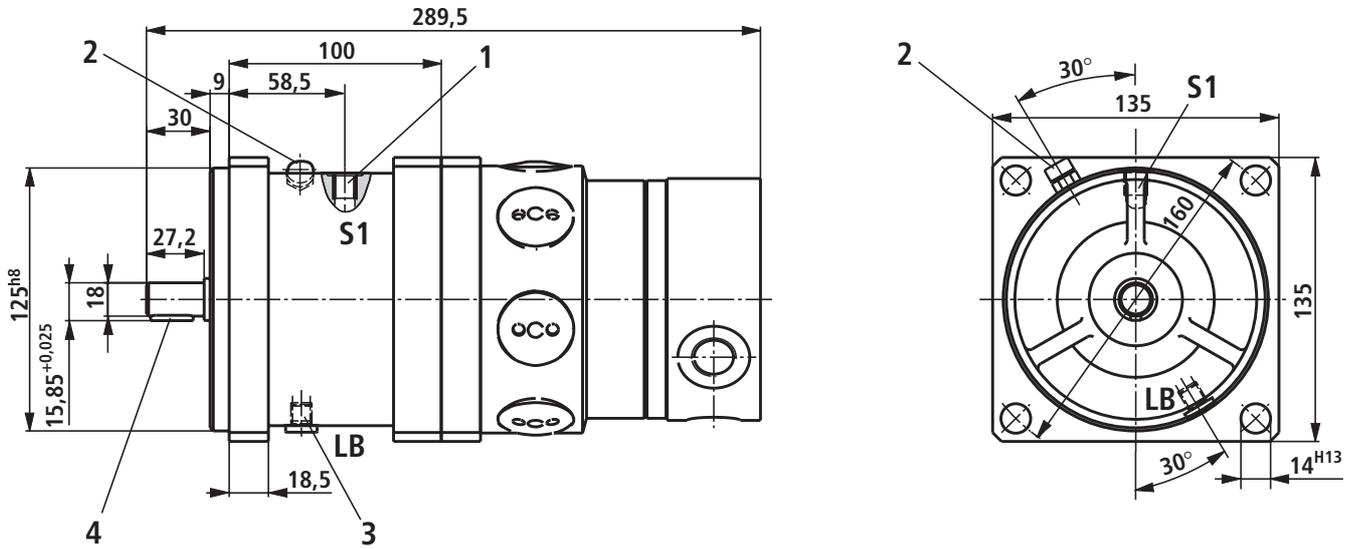
**1** Control line G 1/4 to bleed the brake
**2** Breather filter (brake) M12 x 1.5
**3** Brake drain oil connection M12 x 1.5
**4** Key A5x5x20 DIN 6885

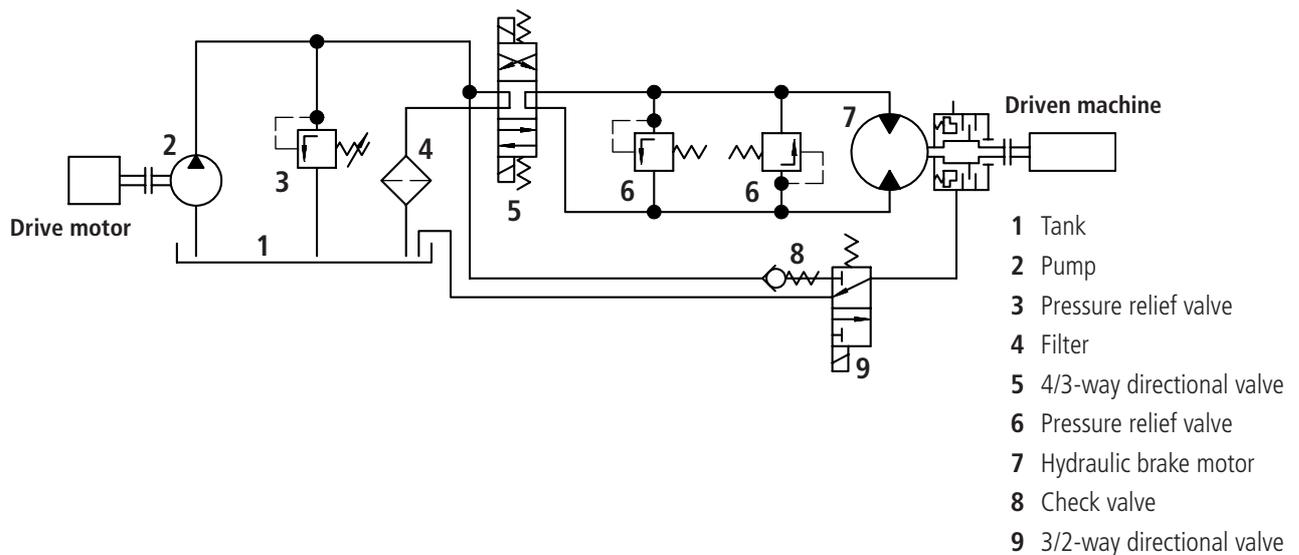## Holding brake type LBD11A2 for motor types MKM 22 to 110 (dimensions in mm)
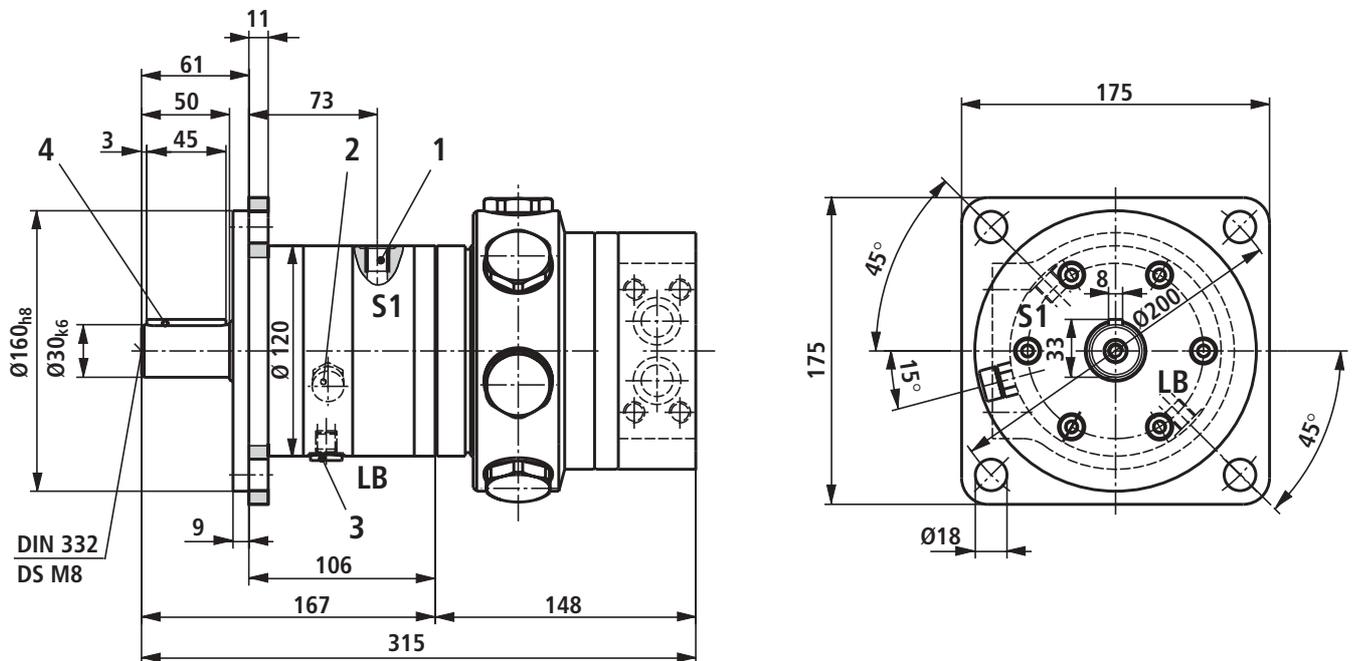
**1** Control line G 1/4 to bleed the brake
**2** Breather filter (brake) M12 x 1.5
**3** Brake drain oil connection M12 x 1.5
**4** Key A8 x 7 x 45 DIN 6885

## Holding brake type LBD124A2 for motor types MRM 80 / MRM 125 (dimensions in mm)



1   Control line G 1/4 to bleed the brake
2   Breather filter (brake) M12 x 1.5
3   Brake drain oil connection M12 x 1.5
4   Key A12 x 8 x 56 DIN 6885

## Holding brake type LBD249A2 for motor types MRM 160 / MRM 250 (dimensions in mm)



1   Control line G 1/4 to bleed the brake
2   Breather filter (brake) M12 x 1.5
3   Brake drain oil connection M12 x 1.5
4   Key A14 x 9 x 70 DIN 6885

# Circuit example

## Open circuit with brake control



**Drive motor**

**Driven machine**

**1** Tank
**2** Pump
**3** Pressure relief valve
**4** Filter
**5** 4/3-way directional valve
**6** Pressure relief valve
**7** Hydraulic brake motor
**8** Check valve
**9** 3/2-way directional valve

# Storage, assembly, commissioning

### Storage

As delivered all of the connection holes in the motor housing are plugged with plastic plugs. The internal components are coated with hydraulic oil from the run on the test rig. The drive shaft and connection flange are protected by an anti-corrosion oil. The motor can be stored in this condition, in a dry room, for approx. 6 months.

For longer storage periods the motor is to be fully filled with a water emulsifing hydraulic oil H-LPD. All ports are to be plugged or have blanking flanges, these are to be oil tight. After no later than 12 months the hydraulic oil must be replaced and the drive shaft rotated by hand approx. 10 times.

### Mounting, assembly

– The installation orientation is optional.

– Never use a hammer to drive on the couplings, pinions, etc., use screws to pull them on. Use the threaded hole in the drive shaft.

– The mounting surface must be flat and rigid.

– Use fixing screws with a minimum tensile strength class of 10.9, with reversal operation used location bolts.

– Correctly line up the motor during assembly.

– Tighten the bolts to the prescribed tightening torque.

The brakes have a leakage oil connection and a breather filter M12x1.5. Both of the connections can be exchanged. Fit the filter to the highest point so that oil cannot run out.

When installing the holding brake apply it with pilot pressure so that the shaft can be rotated.
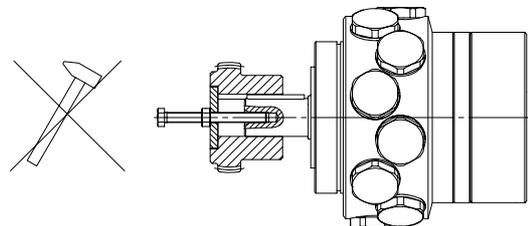


### Drain oil line

Lay the drain oil line so that the motor housing cannot drain, if necessary fit a check valve with maximum opening pressure of 0.2.

**max. 0,2 bar**
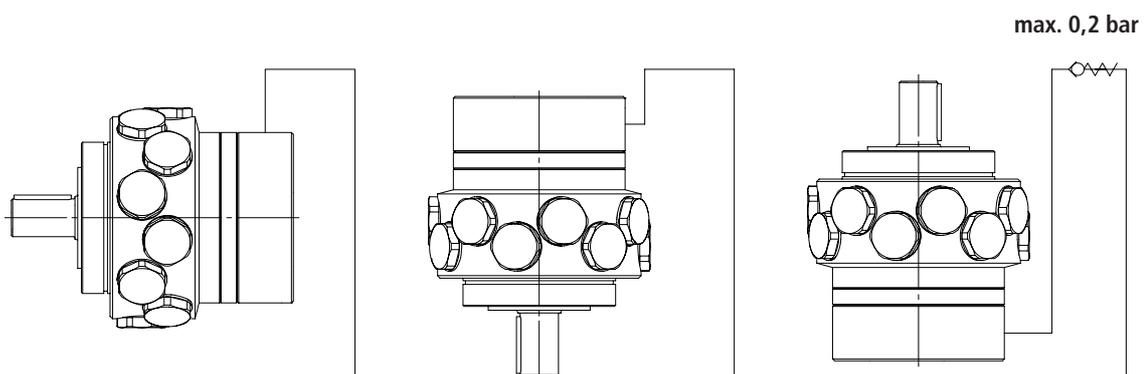
# Storage, assembly, commissioning

## Flushing connection

Flushing the motor with approx. 1 - 3 L/min (dependent on the type) is recommended for high temperatures and powers. Leakage and flushing fluid is passed back to the reservoir. The maximum permissible housing pressure in the leakage chamber is 1.5 bar.
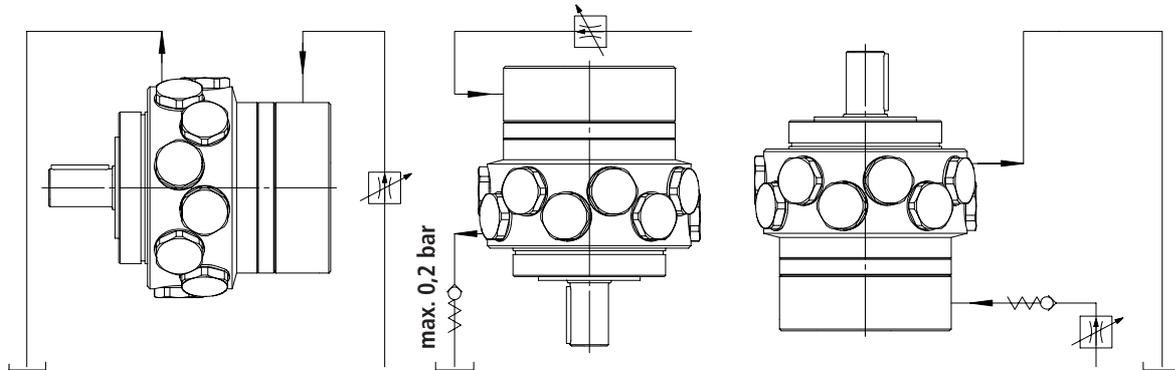


## Commissioning

### Motor

Before the initial commissioning the motor has to be filled with filtered operating medium via the drain connection. Drive the motor at a low power until leakage oil escapes, then full power can be applied.

For motors with a separate flushing circuit first switch on the flushing circuit then the motor.

Check the housing pressure: maximum of 1.5 bar leakage pressure.

### Brake

Fill the brake before commissioning via the breather filter, remove the filter to access the filling point (wet running).

| LBD9A2 | LBD11A2 | LBD124A2 | LBD249A2 |
|--------|---------|----------|----------|
| 0.01 litre | 0.01 litre | 0.02 litre | 0.04 litre |

Switch the holding brake more than once and check for correct function.

During operation the motor and holding brake must not become warmer than the operating medium.