

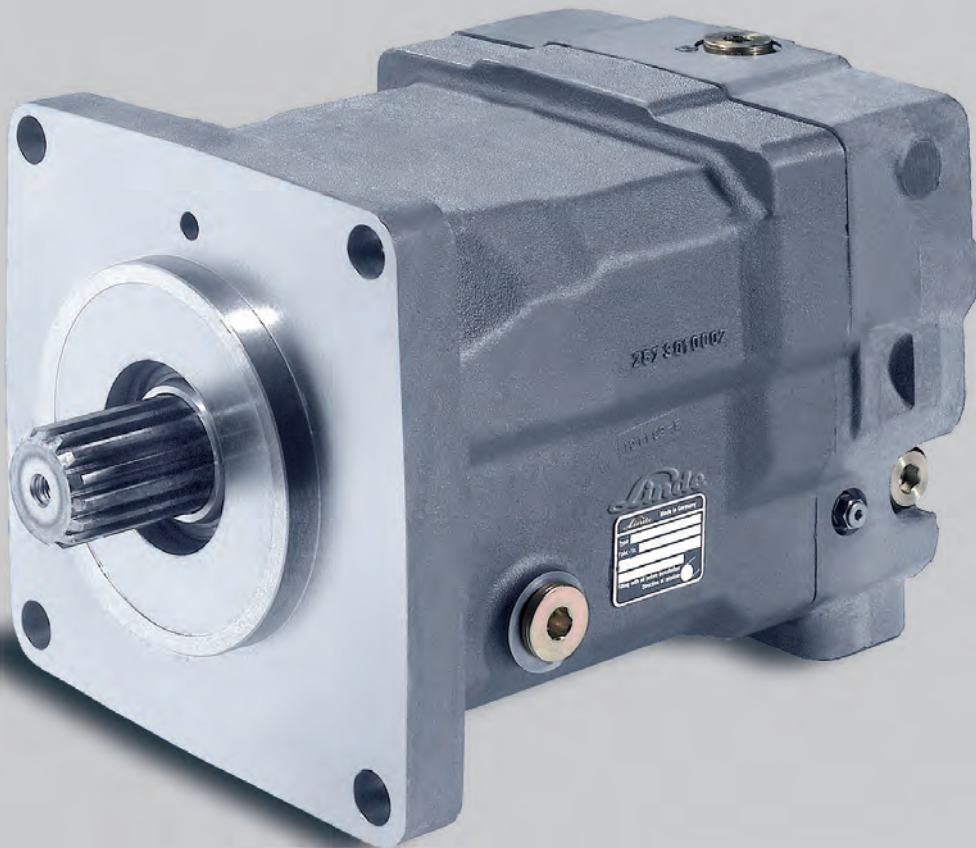
HMF/A/V/R-02.  
Hydraulic motors for  
closed and open loop operation

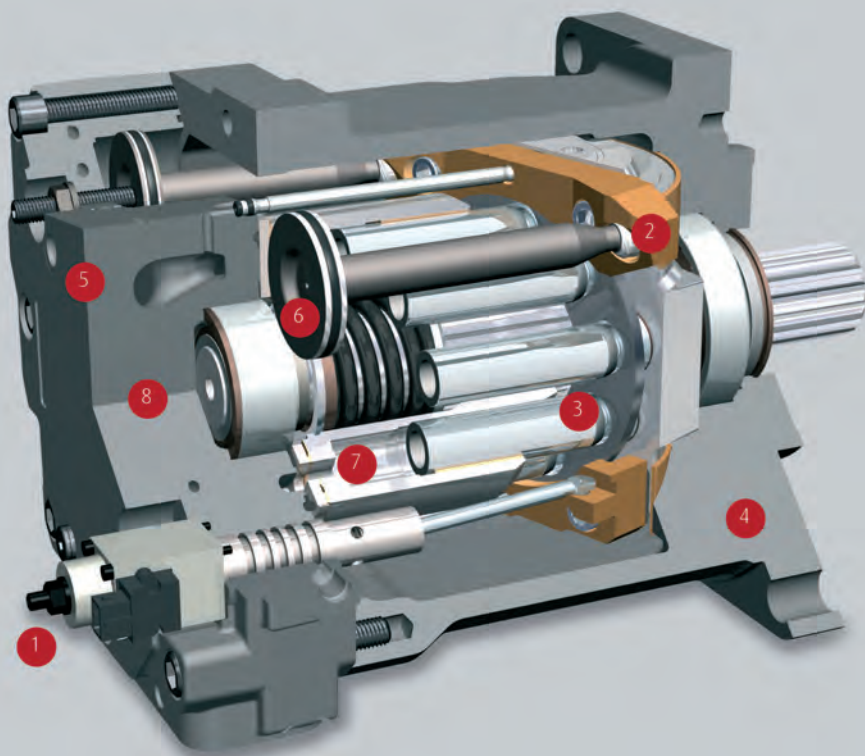
Linde Hydraulics

*Linde*

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- 1 control**  
optional swashing to 0 cc /rev
- 2 swash plate**  
hydrostatic bearing
- 3 piston-slipper assembly**  
21° swash angle
- 4 housing**  
monoshell for high rigidity
- 5 valve plate housing**  
highly integrated
- 6 control piston**  
integrated, hydraulically captured
- 7 rotating group**  
precise torque transmission even at low speeds
- 8 optional Trough-Drive**  
available with two shaft ends for torque transmission

## Design characteristics

- >> high pressure axial piston motor in swash plate design for closed and open loop systems
- >> optimised start-up and low-speed characteristics
- >> optionally with purge valves for circuit and case flushing
- >> HP valves possible
- >> through-shaft with bare shaft end or coupling flange
- >> SAE High pressure ports, radial or axial
- >> SAE mounting flange with ANSI or SAE spline shaft
- >> plug-in version optional
- >> speed sensor optional

## Product advantages

- >> smooth low-speed operation
- >> high starting torque
- >> lower emissions through speed reduction
- >> compact design
- >> high power density
- >> high reliability
- >> long service life
- >> highly dynamic response characteristics
- >> simplified drive line

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## Linde Hydraulics product range

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### Product range

| Product          |                         | Application                    | Linde product name |
|------------------|-------------------------|--------------------------------|--------------------|
| Pump             | Self-regulating pump    | open loop operation            | HPR-02             |
|                  | Variable pump           | closed loop operation          | HPV-02             |
| Motor            | Variable motor          | closed and open loop operation | HMV-02, CMV        |
|                  | Regulating motor        | closed and open loop operation | HMR-02             |
|                  | Fixed motor             | closed and open loop operation | HMV-02; CMF        |
|                  |                         | open loop operation            | HMV-02 P           |
| Valve Technology | LSC manifold plate      | closed and open loop operation | HMA-02             |
|                  | Monoblock               | open loop operation            | VT modular         |
|                  | Electronic control unit | open loop operation            | Monoblock          |
| Electronics      | Peripheral equipment    | closed and open loop operation | LINC               |
|                  | Software                | diagnosis and configuration    | LinDiag®           |

## Content HMF / A / V / R-02.

|                                            |    |                               |    |
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The data on which this brochure is based correspond to the current state of development. We reserve the right to make changes in case of technical progress. The dimensions and technical data of the individual installation drawings are prevailing. The features listed in this data sheet are not available in all combinations and nominal sizes. Our sales engineers will be happy to provide advice regarding the configuration of your hydraulic system and on product selection.

For the construction of the components the safety principles of ISO 13849-2:2013, tables C.1 and C.2, were used where applicable. According to ISO 13849-1:2008 it is the responsibility of the user to fulfill the standards and safety principles of ISO 13849-2:2012, Tables C.1 and C.2, for the implementation and operation of the components.

## General technical data.

### Overview of technical data

| Rated size                                                 |                                                                    |                                     | 28         | 35   | 55   | 63   | 75   | 85   |
|------------------------------------------------------------|--------------------------------------------------------------------|-------------------------------------|------------|------|------|------|------|------|
| Displacement<br>HMV-02 can be set to 0 cc/rev displacement | Maximum $V_{max}$                                                  | cc/rev                              | 28.6       | 35.6 | 54.7 | 63   | 75.9 | 85.6 |
|                                                            | Minimum $V_{min}$<br>only for variable and regulating motors       | cc/rev                              | -          | -    | 18.3 | -    | 25.3 | -    |
| Speed                                                      | Max. operating speed at $V_{max}$                                  | rpm                                 | 4500       | 4500 | 4300 | 3900 | 3800 | 3600 |
|                                                            | Maximum speed at $V_{max}^*$                                       | rpm                                 | 4800       | 4800 | 4400 | 4200 | 4100 | 3850 |
|                                                            | Max. operating speed at $V_{min}$                                  | rpm                                 | -          | -    | 4700 | -    | 4400 | -    |
|                                                            | Maximum speed at $V_{min}^*$                                       | rpm                                 | -          | -    | 5300 | -    | 5000 | -    |
| Pressure                                                   | Nominal pressure                                                   | bar                                 | 450        |      |      |      |      |      |
|                                                            | Maximum pressure**                                                 | bar                                 | 500        |      |      |      |      |      |
|                                                            | Permissible housing pressure                                       | bar                                 | 2.5        |      |      |      |      |      |
| Torque                                                     | Output torque<br>( $\Delta p=430$ bar)                             | Nm                                  | 196        | 244  | 374  | 431  | 519  | 586  |
| Power                                                      | Corner power (theoretical)                                         | kW                                  | 92         | 115  | 161  | 176  | 207  | 221  |
| Permissible shaft loads                                    | Axial input /output force                                          | N                                   | 2000       |      |      |      |      |      |
|                                                            | Radial                                                             | N                                   | on request |      |      |      |      |      |
| Perm. housing temp.                                        | Perm. housing temperature<br>with minimum perm. viscosity > 10 cSt | °C                                  | 105        |      |      |      |      |      |
| Weights                                                    | Fixed displacement motor<br>with 2-hole mounting flange            | kg                                  | 16         | 16   | 19   | 24   | 26   | 33   |
|                                                            | Variable and regulating motor<br>with 2- or 4-hole mounting flange | kg                                  | -          | -    | 28   | -    | 32   | -    |
|                                                            | Moment of inertia                                                  | kgm <sup>2</sup> x 10 <sup>-2</sup> | 0.25       | 0.25 | 0.49 | 0.72 | 0.79 | 0.97 |

\* highest transient speed, that can temporarily occur

\*\* highest transient pressure, that can temporarily occur

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### Standard Linde name plate

Each Linde Hydraulics unit features a name plate showing the type and the serial number. For a single order via 'open variant' a customer-specific number or free text with up to 15 characters can be stamped on the name plate.

|            |                          |                                                                                                              |
|------------|--------------------------|--------------------------------------------------------------------------------------------------------------|
| Type       | HMV 105-02<br>0001       | Series 02 variable motor with the rated size of 105<br>the last 4 figures of the Bill of Material 2340000001 |
| Serial-No. | H2X<br>234<br>T<br>12345 | Type number of HMV 105-02<br>Letter indicating year of production<br>Serial number                           |
| Part No.   | 12345678                 | Free text field for up to 15 characters                                                                      |



## General technical data.

### Overview of technical data

| Rated size                                                 |                                                                    |                                     | 105        | 135   | 165   | 210  | 280   |
|------------------------------------------------------------|--------------------------------------------------------------------|-------------------------------------|------------|-------|-------|------|-------|
| Displacement<br>HMV-02 can be set to 0 cc/rev displacement | Maximum $V_{max}$                                                  | cc/rev                              | 105        | 135.6 | 165.6 | 210  | 281.9 |
|                                                            | Minimum $V_{min}$<br>only for variable and regulating motors       | cc/rev                              | 35         | 45.2  | 55.2  | 70   | 93    |
| Speed                                                      | Max. operating speed at $V_{max}$                                  | rpm                                 | 3700       | 3200  | 3100  | 2700 | 2400  |
|                                                            | Maximum speed at $V_{max}^*$                                       | rpm                                 | 3800       | 3500  | 3400  | 3000 | 2700  |
|                                                            | Max. operating speed at $V_{min}$                                  | rpm                                 | 4100       | 3700  | 3500  | 3200 | 2900  |
|                                                            | Maximum speed at $V_{min}^*$                                       | rpm                                 | 4700       | 4000  | 3900  | 3500 | 3200  |
| Pressure                                                   | Nominal pressure                                                   | bar                                 | 450        |       |       |      |       |
|                                                            | Maximum pressure**                                                 | bar                                 | 500        |       |       |      |       |
|                                                            | Permissible housing pressure                                       | bar                                 | 2.5        |       |       |      |       |
| Torque                                                     | Output torque<br>( $\Delta p=430$ bar)                             | Nm                                  | 719        | 928   | 1133  | 1438 | 1929  |
| Power                                                      | Corner power (theoretical)                                         | kW                                  | 309        | 360   | 415   | 482  | 586   |
| Permissible shaft loads                                    | Axial input /output force                                          | N                                   | 2000       |       |       |      |       |
|                                                            | Radial                                                             | N                                   | on request |       |       |      |       |
| Perm. housing temp.                                        | Perm. housing temperature<br>with minimum perm. viscosity > 10 cSt | °C                                  | 105        |       |       |      |       |
| Weights                                                    | Fixed displacement motor<br>with 2-hole mounting flange            | kg                                  | 33         | 39    | 75    | 100  | -     |
|                                                            | Variable and regulating motor<br>with 2- or 4-hole mounting flange | kg                                  | 42         | 56    | 76    | 101  | 146   |
|                                                            | Moment of inertia                                                  | kgm <sup>2</sup> x 10 <sup>-2</sup> | 1.44       | 2.15  | 3.06  | 4.68 | 9.36  |

\* highest transient speed, that can temporarily occur

\*\* highest transient pressure, that can temporarily occur

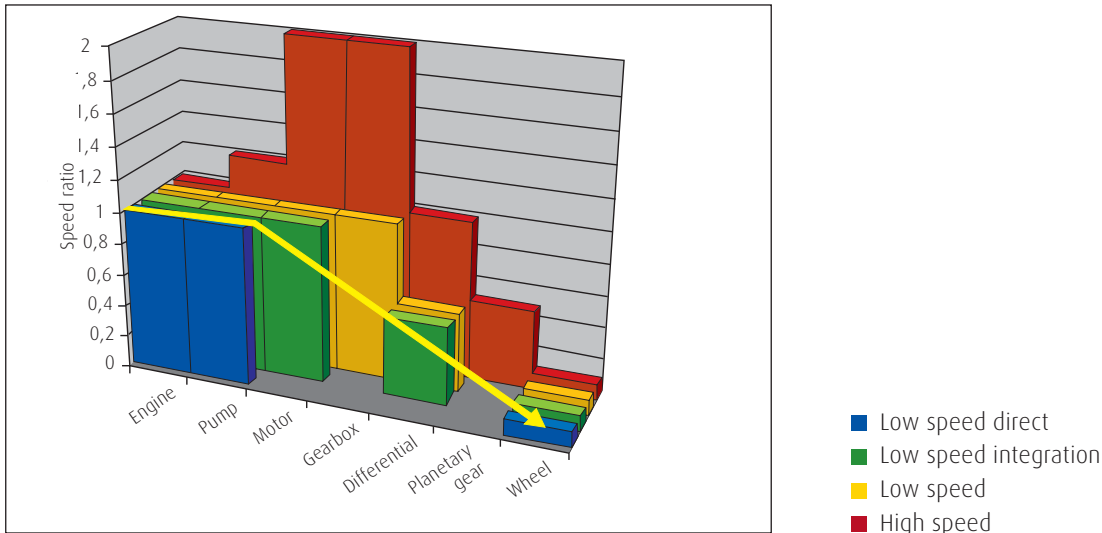
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# Transmission concept.

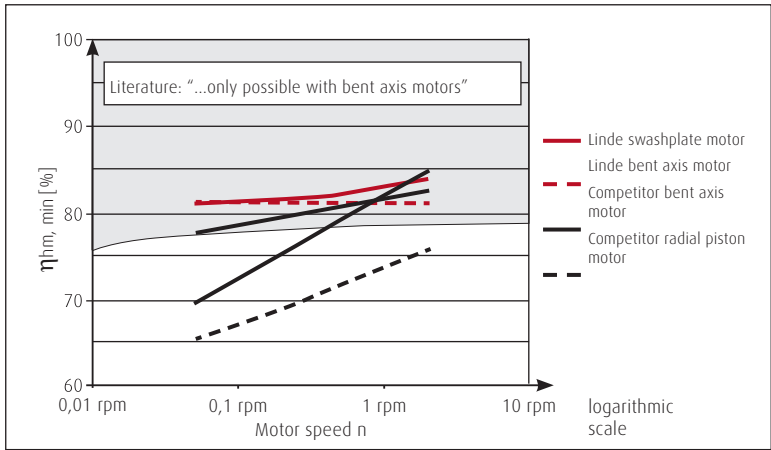
Equipment manufacturers profit by the Linde Hydraulics transmission concept. Due to the direct conversion of the prime mover speed into wheel speed it is possible to reduce the number of drive line components and the energy losses in the operating cycle.

## Speed steps of transmission concepts



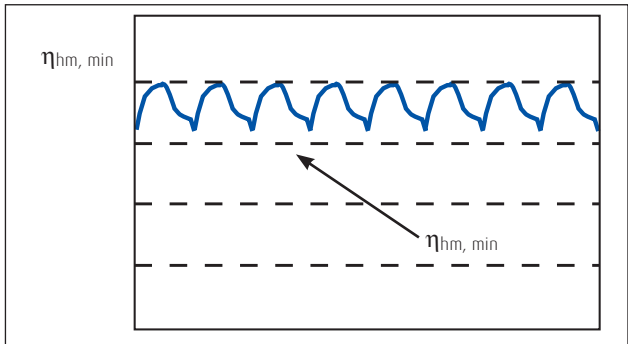
## Starting torque

Linde hydraulic motors offer uniformly high torque for smooth start up. Right from the start.

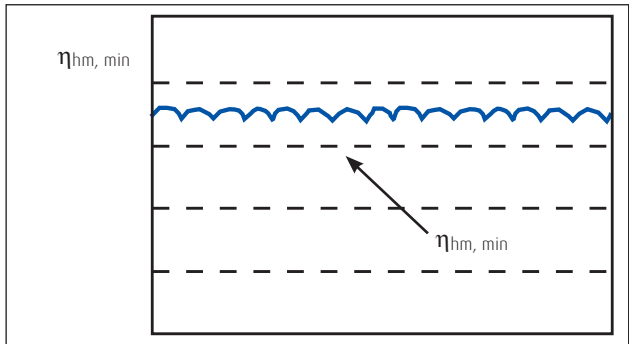


## Torque at 350 bar and 2 rpm

of a bent axis motor



of a swashplate motor



# Operational parameters. Life time recommendations

Linde high pressure units are designed for excellent reliability and long service life. The actual service life of a hydraulic unit is determined by numerous factors. It can be extended significantly through proper maintenance of the hydraulic system and by using high-quality hydraulic fluid.

### Beneficial conditions for long service life

- >> Speed lower continuous maximum speed
- >> Operating pressure less than 300 bar  $\Delta p$  on average
- >> Max. pressure only at reduced displacement
- >> Viscosity 15 ... 30 cSt
- >> Power continuous power or lower
- >> Purity of fluid 18/16/13 in accordance with ISO 4406 or better

### Adverse factors affecting service life

- >> Speed between continuous maximum speed and intermittent maximum speed
- >> Operating pressure more than 300 bar  $\Delta p$  on average
- >> Viscosity less than 10 cSt
- >> Power continuous operation close to maximum power
- >> Purity of fluid lower than 18/ 16/ 13 in accordance with ISO 4406

## Operational parameters. Filtration

In order to guarantee long-term proper function and high efficiency of the hydraulic motors the purity of the pressure fluid must comply with the following criteria according to Linde Works Standard WN 51 210. High purity oil can extend the service time of the hydraulic system significantly.

- >> For reliable proper function and long service life 18/16/13 in accordance with ISO 4406 or better
- >> Minimum requirements 20/18/15 in accordance with ISO 4406
- >> Commissioning The minimum purity requirement for the hydraulic oil is based on the most sensitive system component. For commissioning we recommend a filtration in order to achieve the required purity.
- >> Filling and operation of hydraulic systems The required purity of the hydraulic oil must be ensured during filling or topping up. When drums, canisters or large-capacity tanks are used the oil generally has to be filtered. We recommend the implementation of suitable measures (e.g. filters) to ensure that the required minimum purity of the oil is also achieved during operation
- >> International standard

|                                   |                                        |
|-----------------------------------|----------------------------------------|
| Code number according to ISO 4406 | purity class according to SAE AS 4059E |
| 18/16/13                          | corresponds to 8A/7B/7C                |
| 20/18/15                          | 9A/8B/8C                               |

# Operational parameters. Pressure fluids

In order to ensure the functional performance and high efficiency of the hydraulic motors the viscosity and purity of the operating fluid should meet the different operational requirements. Linde recommends using only hydraulic fluids which are confirmed by the manufacturer as suitable for use in high pressure hydraulic installations or approved by the original equipment manufacturer.

### Permitted pressure fluids

- >> Mineral oil HLP to DIN 51 524-2
- >> Biodegradable fluids in accordance with ISO 15 380 on request
- >> Other pressure fluids on request

Linde offers an oil testing service in accordance with VDMA 24 570 and the test apparatus required for in-house testing. Prices available on request.

### Recommended viscosity ranges

|                                      |                 |            |
|--------------------------------------|-----------------|------------|
| Pressure fluid temperature range     | [°C]            | -20 to +90 |
| Working viscosity range              | [mm²/s] = [cSt] | 10 to 80   |
| Optimum working viscosity            | [mm²/s] = [cSt] | 15 to 30   |
| Max. viscosity (short time start up) | [mm²/s] = [cSt] | 1000       |

In order to be able to select the right hydraulic fluid it is necessary to know the working temperature in the hydraulic circuit. The hydraulic fluid should be selected such that its optimum viscosity is within the working temperature range (see tables).

The temperature should not exceed 90 °C in any part of the system. Due to pressure and speed influences the leakage fluid temperature is always higher than the circuit temperature. Please contact Linde if the stated conditions cannot be met in special circumstances.

### Viscosity recommendations

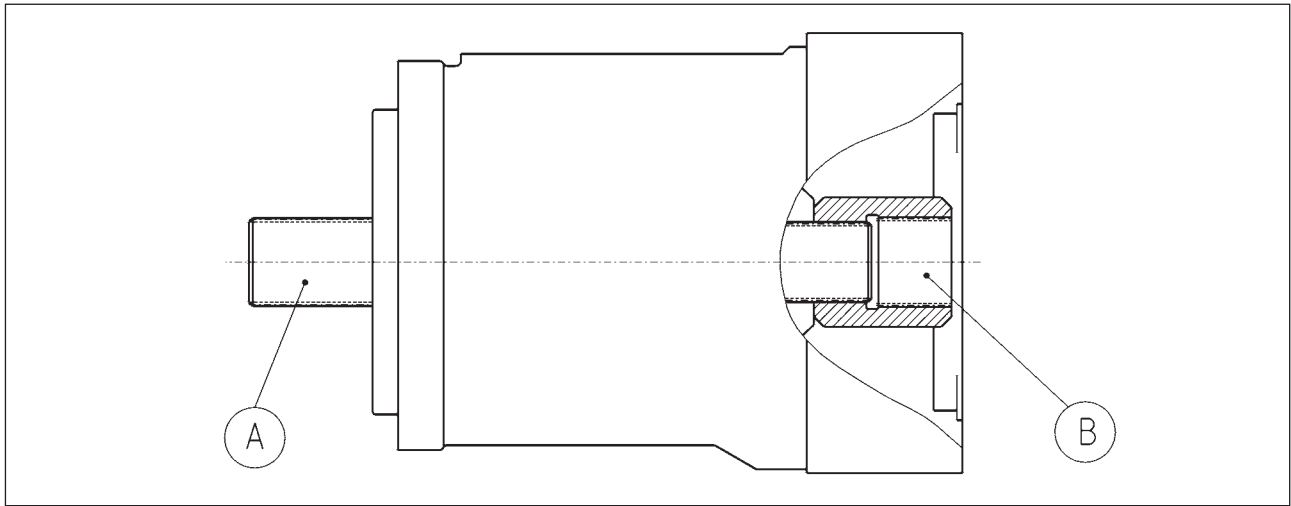
|                          |                                          |
|--------------------------|------------------------------------------|
| Working temperature [°C] | Viscosity class [mm²/s] = [cSt] at 40 °C |
| approx. 30 to 40         | 22                                       |
| approx. 40 to 60         | 32                                       |
| approx. 60 to 80         | 46 or 68                                 |

Further information regarding installation can be found in the operating instructions.

# Torque transmission.

Depending on the selected components, different torques may be transferred. Please ensure that the load transfer components such as mounting flange and PTO through-shaft are designed adequately. Our sales engineers will be pleased to provide design advice.

## Torque transmission of the hydraulic motor



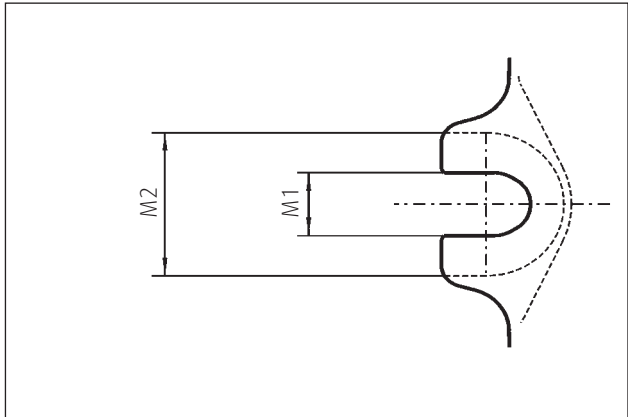
The diagram Torque transmission of HMF / A / V / R-02 shows the output side A and the PTO through-shaft B of a motor. The information on the following pages refers to

- >> mounting flange and drive shaft A
- >> PTO flange and through shaft B

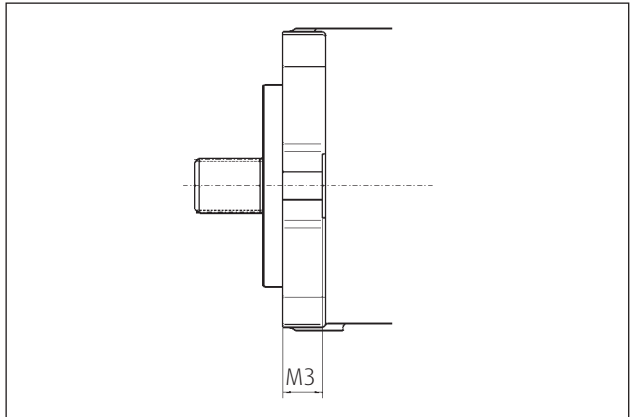
### A) Flange profile

| Bolt hole dimensions |    | Rated size HMF / A / V / R-02 |      |      |      |      |     |     |       |
|----------------------|----|-------------------------------|------|------|------|------|-----|-----|-------|
|                      |    | 50/55                         | 75   | 105  | 135  | 165  | 210 | 280 | 135 D |
| M1 inside diameter   | mm | 17.5                          | 17.5 | 17.5 | 21.5 | 21.5 | 22  | 22  | 21.5  |
| M2 outside diameter  | mm | 40                            | 34   | 34   | 40   | 40   | -   | -   | 40    |
| M3 length            | mm | 20                            | 20   | 20   | 20   | 25   | 30  | 30  | 20    |

#### Bolt hole diameter



#### Bolt hole length



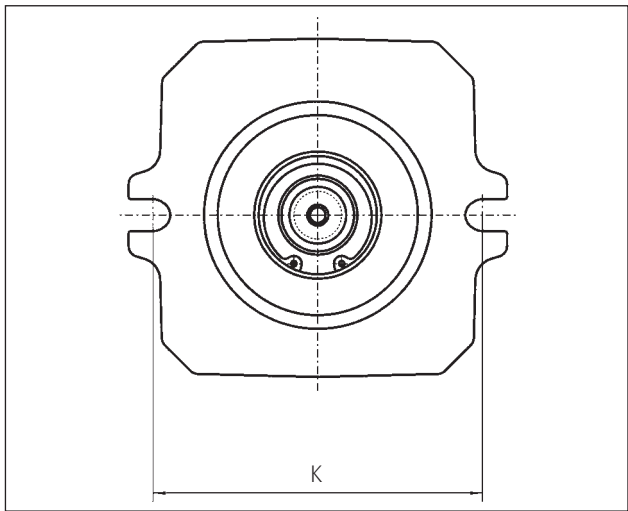
# Torque transmission. Mounting flange

## Mounting suggestions

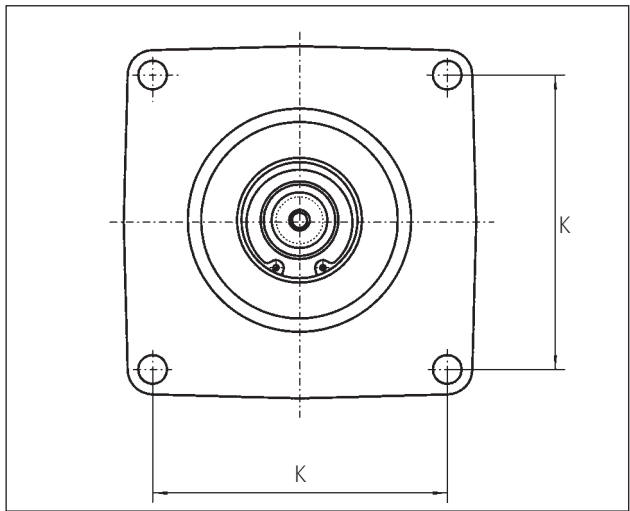
| Mounting flange dimensions<br>in accordance with SAE J744 | For rated size | Mounting  |       |                   |                     | Dimensions |        |        |
|-----------------------------------------------------------|----------------|-----------|-------|-------------------|---------------------|------------|--------|--------|
|                                                           |                | Washer    | Screw | Torque (8.8) [Nm] | Torque (10.9)* [Nm] | K [mm]     | H [mm] | V [mm] |
| SAE B, B-B                                                | 28 & 35        | 12.5x25x4 | M12   | 80                | 110                 | 146.0      | -      | -      |
| SAE C, C-C 2-holes                                        | 55-105         | 17x33x10  | M16   | 195               | 275                 | 181.0      | -      | -      |
| SAE D 2-holes                                             | 135 & 165      | 21x37x8   | M20   | 385               | 540                 | 228.6      | -      | -      |
| SAE D 2-holes<br>with 4 additional bolt holes             | 135 D          | -         | M16   | -                 | 275                 | 228.6      | 230    | 190    |
| SAE E 4-holes                                             | 210 & 280      | -         | M20   | 385               | 540                 | 224.5      | -      | -      |

\*) Option for standard design, necessary for tandem units

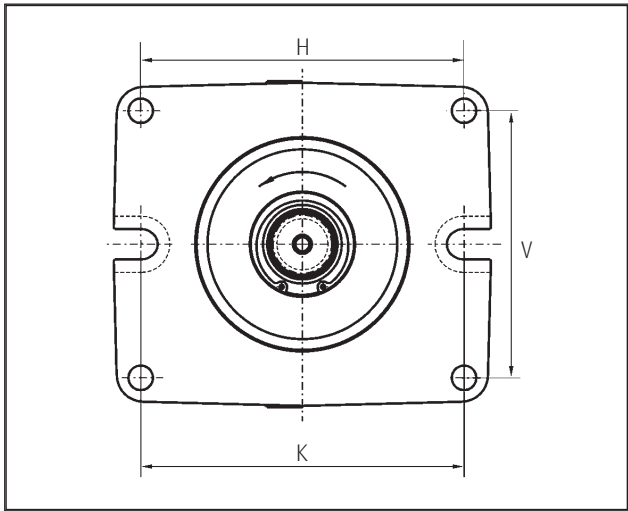
### 2-hole flange



### 4-hole flange



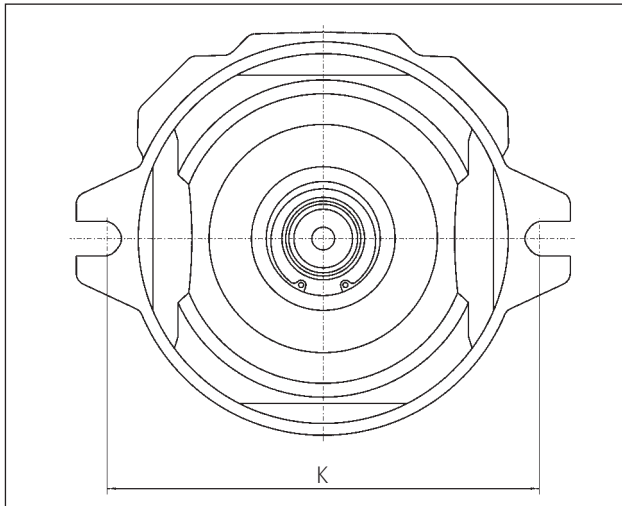
### 2-hole flange with 4 additional bolt holes



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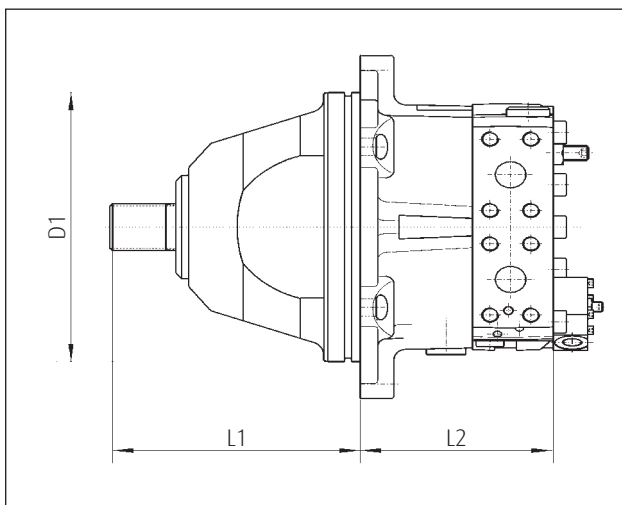
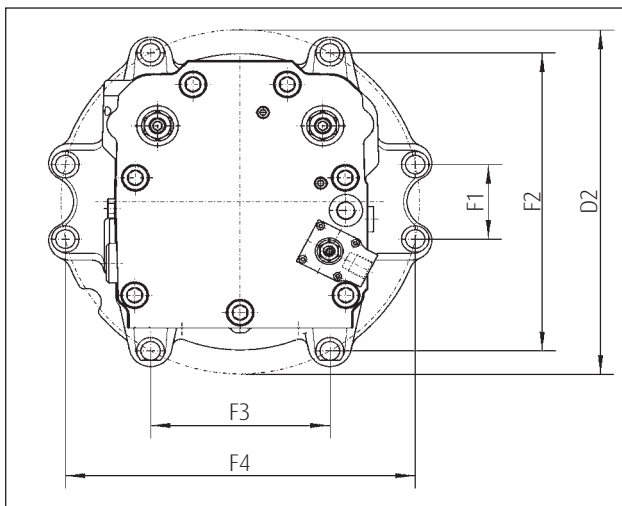
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Plug-in housing for HMF/V/R 75-02



|            |     |
|------------|-----|
| Rated size | 75  |
| D1 [mm]    | 190 |
| D2 [mm]    | 251 |
| K [mm]     | 224 |
| L1 [mm]    | 158 |
| L2 [mm]    | 124 |

Plug-in housing for HMF/V/R 105-02 und 135-02



|            |       |     |
|------------|-------|-----|
| Rated size | 105   | 135 |
| D1 [mm]    | 216   |     |
| D2 [mm]    | 282   |     |
| F1 [mm]    | 55.8  |     |
| F2 [mm]    | 223.4 |     |
| F3 [mm]    | 129   |     |
| F4 [mm]    | 251.8 |     |
| L1 [mm]    | 169   |     |
| L2 [mm]    | 132   | 175 |

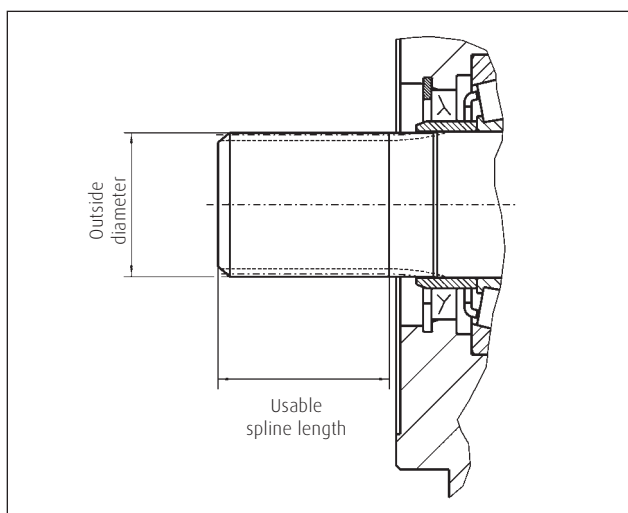
A) Dimensions drive shafts

| Shaft Spline<br>(in accordance with<br>ANSI B92.1) | SAE J744<br>code<br>for centering<br>and shaft | Outside<br>diameter<br>[mm] | Usable<br>spline<br>length<br>[mm] | Shaft<br>type | Available for rated size |       |    |     |     |     |     |     |       |
|----------------------------------------------------|------------------------------------------------|-----------------------------|------------------------------------|---------------|--------------------------|-------|----|-----|-----|-----|-----|-----|-------|
|                                                    |                                                |                             |                                    |               | 28/35                    | 50/55 | 75 | 105 | 135 | 165 | 210 | 280 | 135 D |
| 16/32, 15 t                                        | B-B                                            | 24.98                       | 29                                 | 1             | x                        |       |    |     |     |     |     |     |       |
| 12/24, 14 t                                        | C                                              | 31.22                       | 30                                 | 2             |                          |       | x  |     |     |     |     |     |       |
| 16/32, 21 t                                        |                                                | 34.51                       | 39.5                               | 1             |                          | x     | x  |     |     |     |     |     |       |
| 16/32, 23 t                                        |                                                | 37.68                       | 38.5                               | 1             |                          |       |    | x   |     |     |     |     |       |
| 8/16, 13 t                                         | D                                              | 43.71                       | 50                                 | 2             |                          |       |    |     | x   | x   |     |     |       |
| 16/32, 27 t                                        |                                                | 44.05                       | 62                                 | 1             |                          |       |    |     | x   | x   |     |     | x     |
| 8/16, 15 t                                         | F                                              | 50.06                       | 58                                 | 1             |                          |       |    |     |     |     | x*  | x   |       |
| 16/32, 33 t                                        |                                                | 53.57                       | 58                                 | 1             |                          |       |    |     |     |     |     | x*  |       |

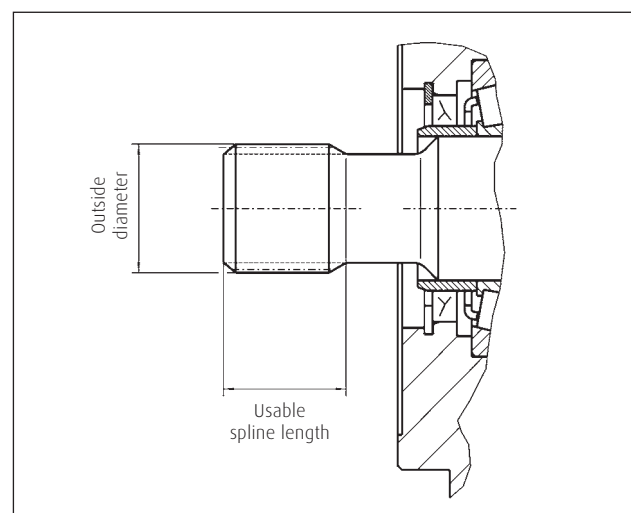
\*) Recommended shaft for tandem configurations

A) Linde Hydraulics shaft types

Type 1. Without undercut



Type 2. With undercut



A) Shaft torque

| Shaft        |    | 16/32<br>15 t | 16/32<br>21 t | 16/32<br>21 t | 16/32<br>23 t | 16/32<br>27 t | 16/32<br>27 t | 8/16<br>15 t | 16/32<br>33 t |
|--------------|----|---------------|---------------|---------------|---------------|---------------|---------------|--------------|---------------|
| Cont. torque | Nm | 283           | 435           | 604           | 836           | 1079          | 1318          | 1671         | 2243          |
| Max. torque  | Nm | 422           | 649           | 900           | 1245          | 1608          | 1964          | 2490         | 3343          |

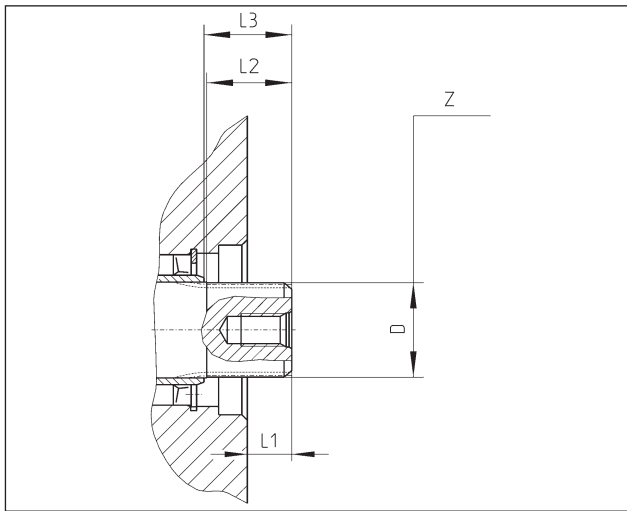
# Torque transmission. PTO Through-Drive Motor

Based on a standard Series 02 variable hydraulic motor with single shaft end, the PTO Through-Drive Motor features two shaft ends for torque transfer. This enables the hydraulic motor to be installed directly in the drive line without transfer gearbox, reducing noise emission and fuel consumption. At the same time the overall efficiency increases.

## B) PTO dimensions for HMV-02

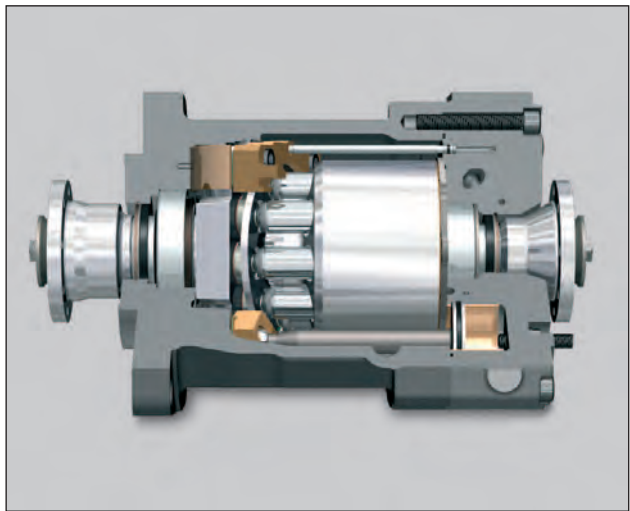
| Rated size                                             |    | 105         | 135         | 165         | 210         | 280         |
|--------------------------------------------------------|----|-------------|-------------|-------------|-------------|-------------|
| Z drive shaft profile<br>in accordance with ANSI B92.1 |    | 16/32, 19 t | 16/32, 21 t | 16/32, 22 t | 16/32, 24 t | 16/32, 27 t |
| D shaft diameter                                       | mm | 31.2        | 34.51       | 36.05       | 39.27       | 44.05       |
| L1 shaft end length-housing                            | mm | 30.1        | 16.2        | -0.5        | 20.9        | 18          |
| L2 usable spline length                                | mm | 41.5        | 31          | 31          | 44          | 47          |
| L3 bearing stop                                        | mm | 49.6        | 32          | 32.8        | 57.2        | 62          |
| Continuous torque                                      | Nm | 418         | 540         | 659         | 836         | 1122        |
| Max. torque                                            | Nm | 736         | 1068        | 1305        | 1654        | 2221        |

## B) PTO dimensions



## PTO Through-Drive motor w. coupling flanges

For a direct installation into the drive line



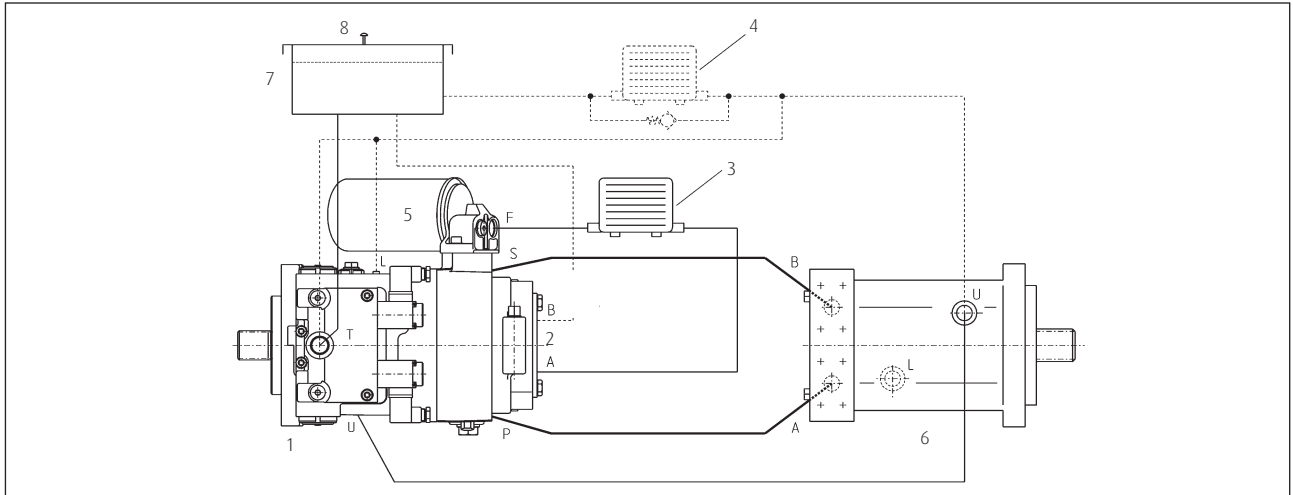
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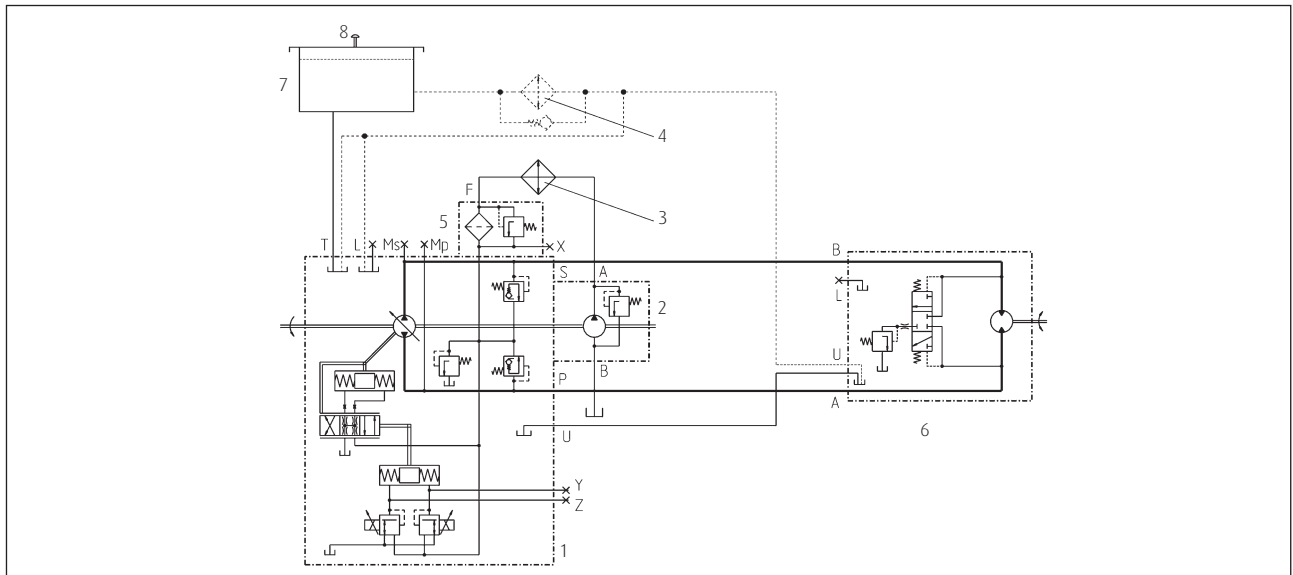
## The closed loop.

Representation of the hydraulic components of a closed loop hydrostatic drive: Variable electro-hydraulic controlled HPV-02 E1 pump (top view) and fixed displacement motor HMF-02 plus filter, cooler and oil tank. The function diagram and the circuit diagram show two types of cooling.

### Function diagram



### Circuit diagram



- 1 Hydraulic pump HPV-02 R E1
- 2 Charge pump
- 3 Option 1: Cooler in charge circuit
- 4 Option 2: Cooler in the return line

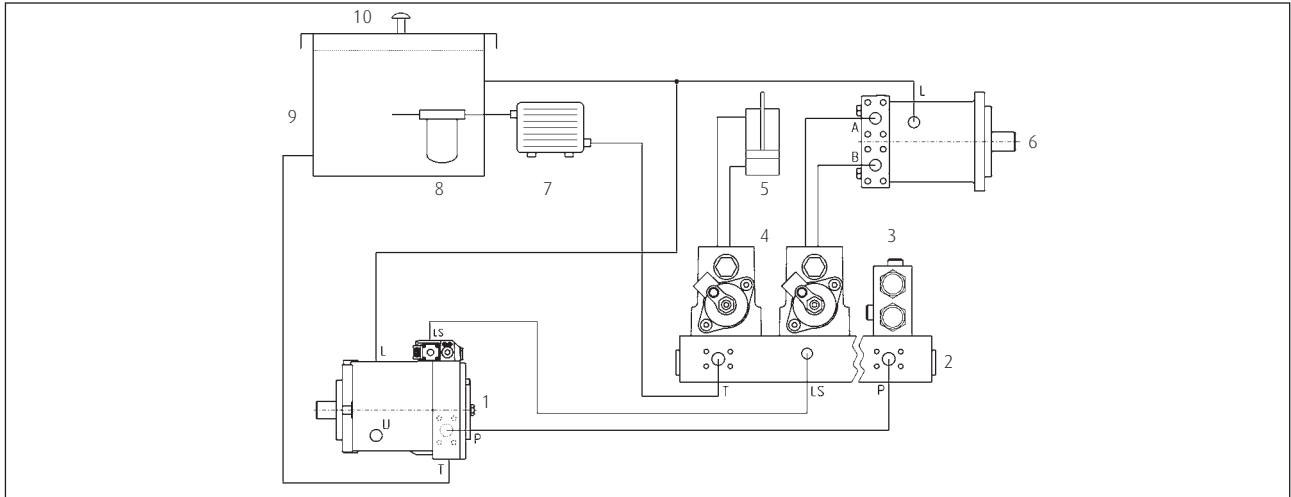
- 5 Filter
- 6 Hydraulic motor HMF-02
- 7 Tank
- 8 Venting valve

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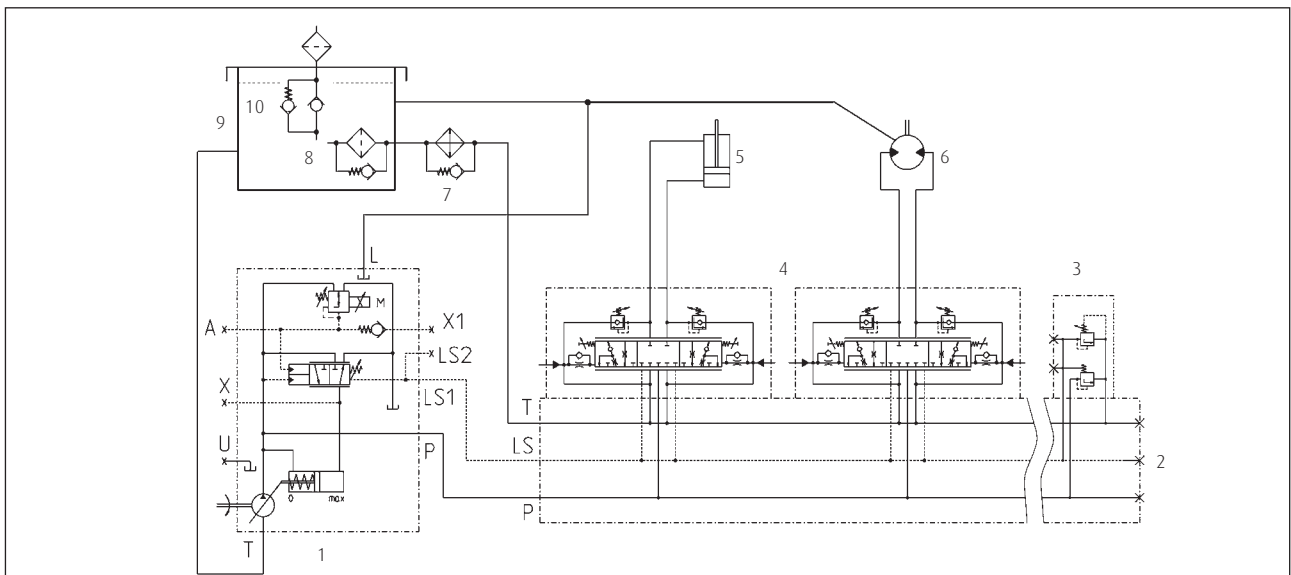
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Representation of hydraulic components in an open loop circuit, based on the LSC system as an example: A HPR-02 regulating pump with load sensing function for energy-saving flow on demand control and VW load sensing directional control valves for load-independent and simultaneous movements of several consumers without mutual influencing. The system is complemented with proven Linde products such as electronic controllers, swing drive and hydraulic motors.

## Function diagram



## Circuit diagram



- |                              |                          |
|------------------------------|--------------------------|
| 1 Hydraulic pump HPR-02 E1L  | 6 Hydraulic motor HMF-02 |
| 2 Manifold valve plate       | 7 Cooler                 |
| 3 Pressure relief function   | 8 Filter                 |
| 4 Directional control valves | 9 Tank                   |
| 5 Hydraulic cylinder         | 10 Venting valve         |

Further information about the LSC system is available in the data sheets "HPR-02" and "VT modular" or directly from our sales engineers.

## Functions. Purge and case flushing

Purge and case flushing is used

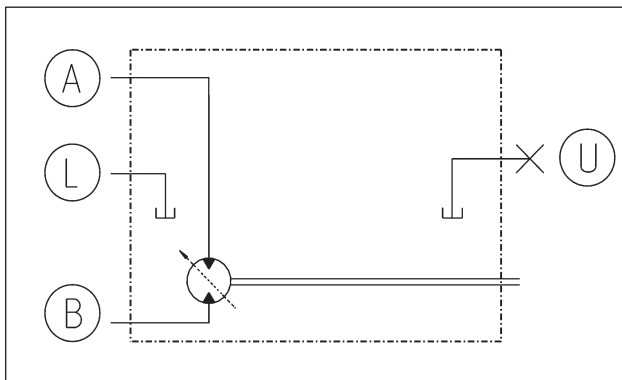
- >> for reducing the temperature of the motor and the system in the open and closed loop circuits
- >> for replacing the oil in the circuit
- >> to enhance filtration and
- >> for removing air from the system

For equipment options for Series 02 motors please refer to the model code.

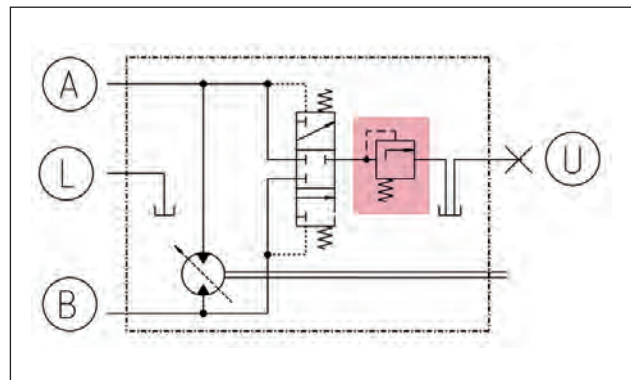
### Purge flow in closed loop circuit

| Version         | Purge valve pressure CBV setting     | Diagram | Purge Flow | Diameter of orifice |
|-----------------|--------------------------------------|---------|------------|---------------------|
| Standard        | 10 bar<br>with 20 bar feed pressure  | 3       | 10 l/min   | 2.5 mm              |
| Standard        | 14 bar<br>with 20 bar feed pressure  | 2       | 10 l/min   | without orifice     |
| Restricted      | 10 bar<br>with 20 bar feed pressure  | 3       | 5 l/min    | 2 mm                |
| Restricted      | 14 bar<br>with 20 bar feed pressure  | 3       | 5 l/min    | 2.5 mm              |
| Increased       | 10 bar<br>with 20 bar feed pressure  | 2       | 20 l/min   | without orifice     |
| Flow controlled | 14 bar<br>with >20 bar feed pressure | 4       | 4 l/min    | with flow regulator |

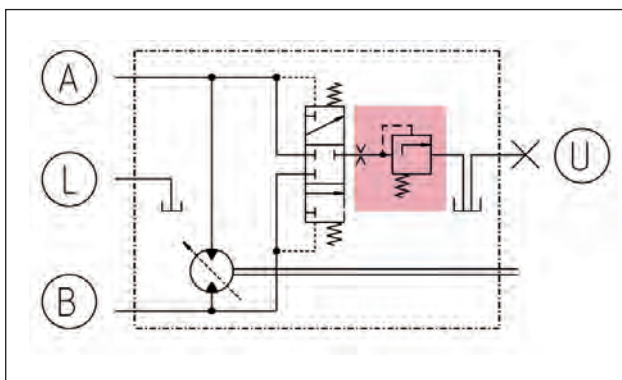
#### Purge valve 1. Without (0 l/min)



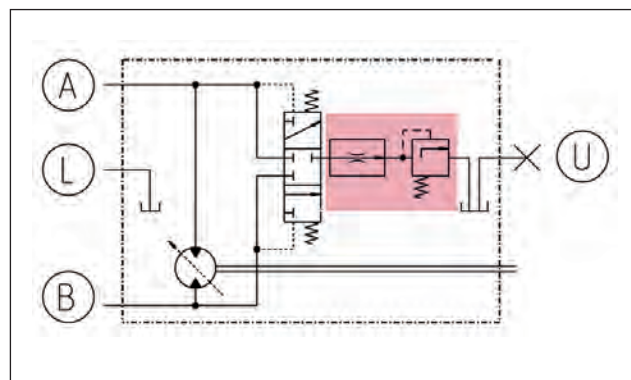
#### Purge valve 2. Standard and increased



#### Purge valve 3. Restricted



#### Purge valve 4. Flow controlled

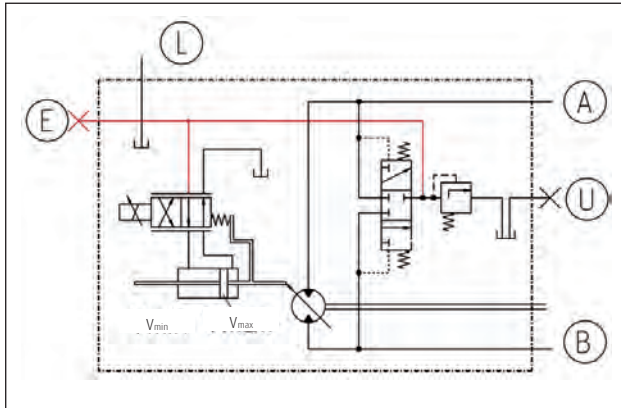


## Functions. Servo Supply Pressure Feed

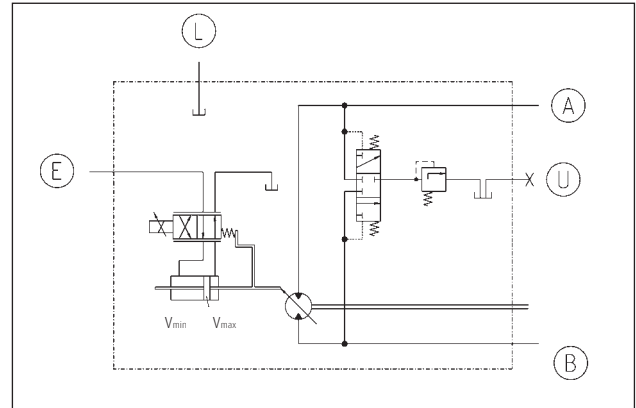
Servo supply pressure delivers the force needed to change the position of the swash plate in variable displacement and pressure regulated motors. For equipment options for Series 02 motors please refer to the model code.

For HMV-02 variable motors

Internal supply. Purge circuit

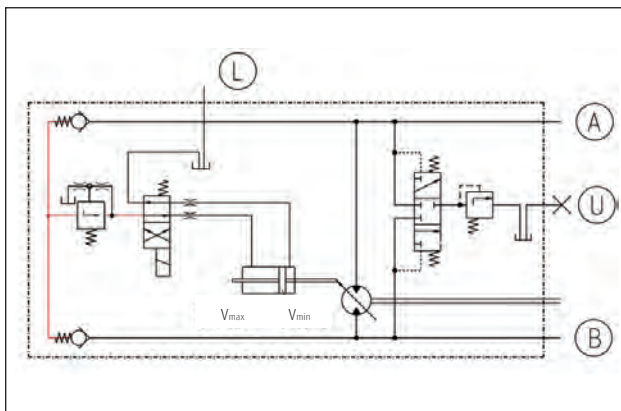


External supply. Purge circuit



For HMR-02 Regulating motors

Internal supply. High pressure circuit



A, B Work ports  
L, U Case drain / vent connections  
E Make-up connection

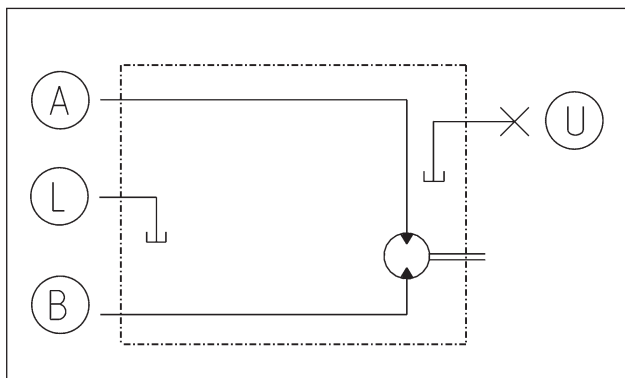
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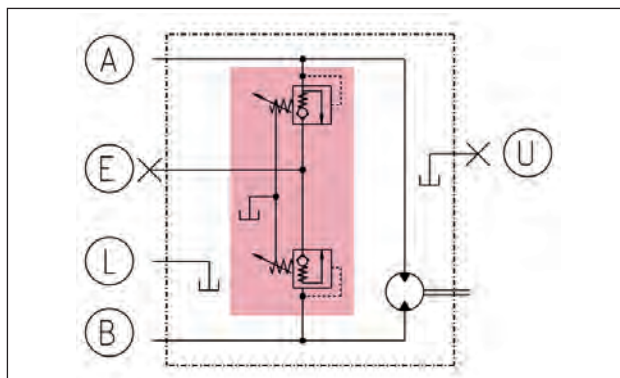
## Functions. Crossline relief (secondary) protection

The secondary valves (crossline relief valves) protect the system from pressure overload by using two interlinked pressure relief valves (combined with check valves). It is recommended for applications where this protective function is not provided by other means (e.g. through primary protection at the pump or LS valves). The secondary protection includes a make up function. It prevents cavitation and is required in an open loop circuit if the motor requires more oil than is supplied. For special situations like in the swing gear drive the installation of controllable secondary valves is recommended. For equipment options for Series 02 motors please refer to the model code.

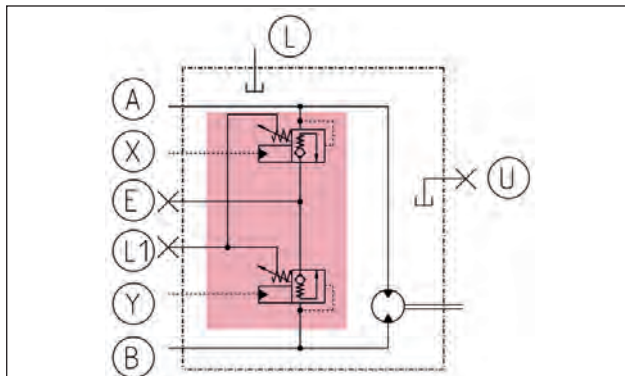
Without crossline relief valve



With crossline relief valve protection



With dual pressure crossline relief valve protection



- A, B Work ports
- L, L1, U Case drain/vent connections
- X, Y Control connection for dual pressure crossline relief valve
- E Make up connection

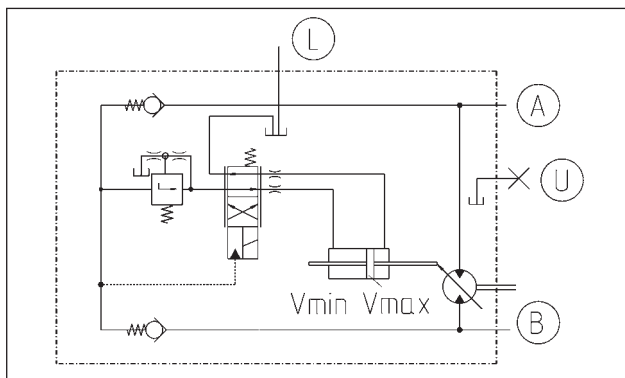
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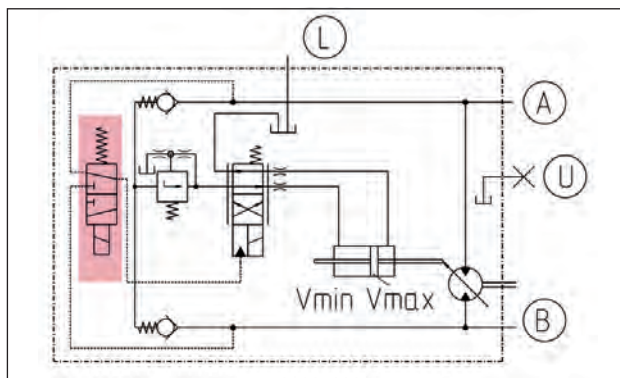
## Functions. Signal selection for pressure regulator

Pressure regulated motors shift to maximum displacement at high operating pressure, irrespective of which side is under pressure. In propel drives this can have undesirable effects. For example, if the motor shifts to maximum displacement during the transition phase from straight travel with low system pressure to overrun (deceleration, downhill travel) with high pressure on the reverse side, an extremely strong vehicle braking effect will occur. The signal selection for pressure regulator prevents the regulator being subjected to this braking pressure and, therefore, ensures that the motor remains at minimum displacement. For equipment options for Series 02 motors please refer to the model code.

Without signal selection  
for pressure regulator



With signal selection for  
pressure regulator



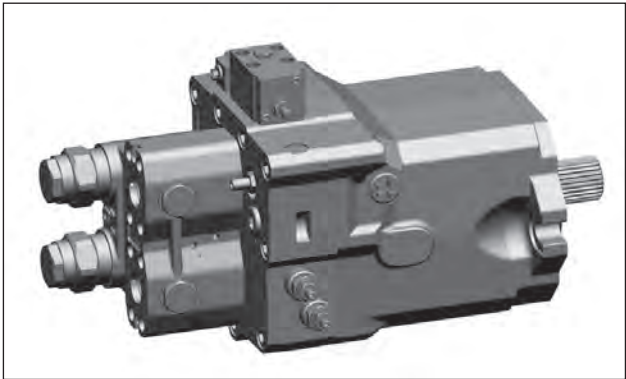
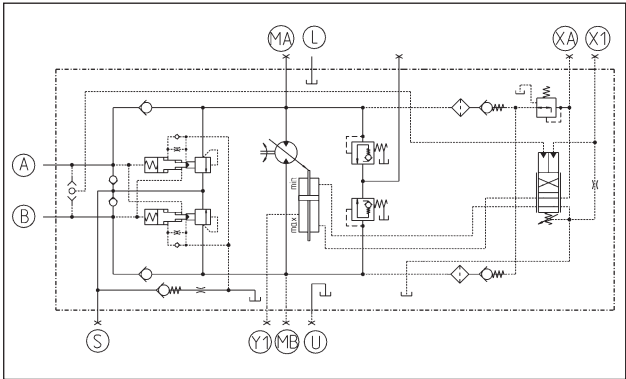
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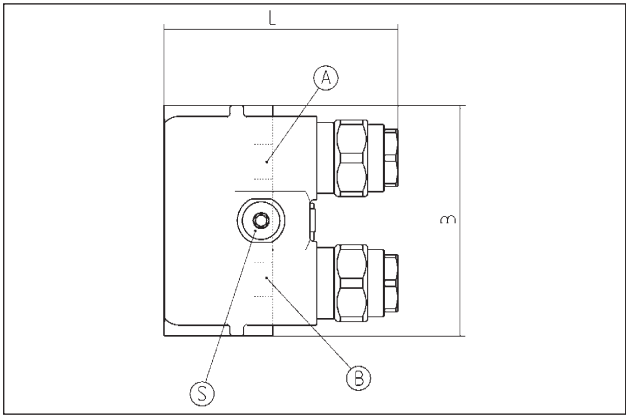
# Functions. Counterbalance valve

The counterbalance (brake) valve prevents the motor over speeding during an over-run situation. To achieve this, the motor return flow is automatically and continuously metered such that it always matches the input flow. Different braking responses are possible. The integrated make-up function simultaneously prevents cavitation. A purge and case flushing function is also integrated. Counterbalance (brake) valves are typically used for drive systems in open loop circuits. The function of the high pressure relief valves can be integrated in the counterbalance valves. Further types of counterbalance valves are shown in section "Dimensions. HMR-02".

With counterbalance (brake) valve, here: axial attachment



## Dimensions

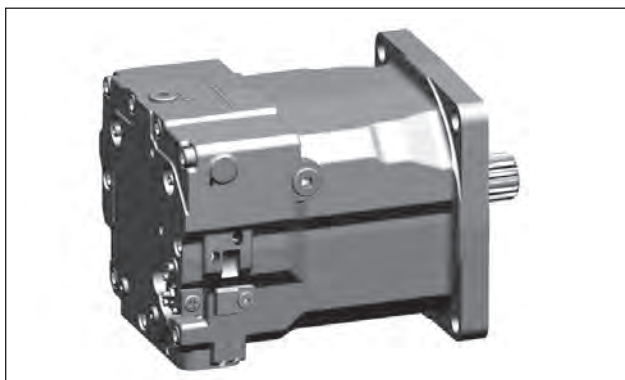


|             |       |       |
|-------------|-------|-------|
| Brake valve | 1"    | 1 ¼"  |
| Length L    | 168.5 | 168.5 |
| Width B     | 165.7 | 195   |
| Height      | 136.6 | 143   |

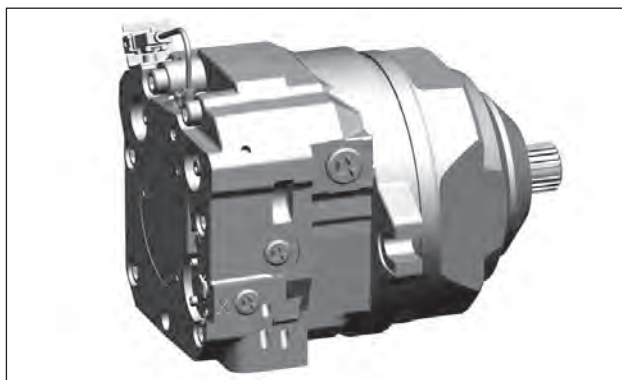
## Functions. Speed sensor

Speed sensors electronically register the motor speed and send an associated input signal to electronic drive controls. Examples are shown below.

Without speed sensor

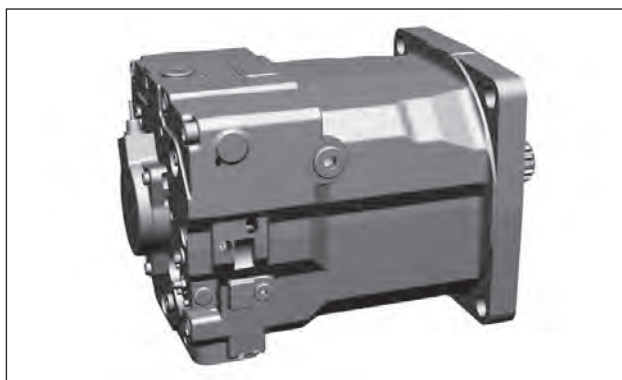


With speed sensor



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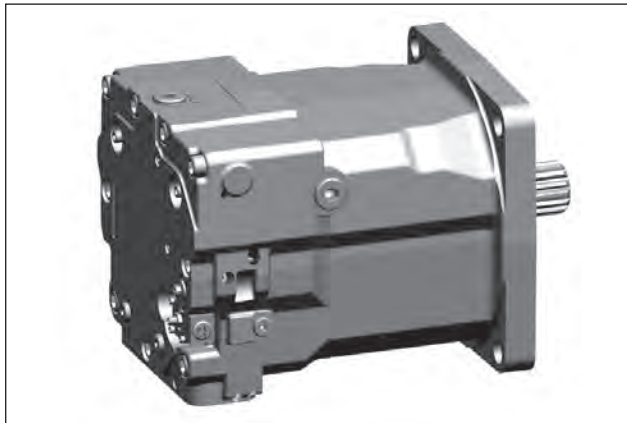
# Motor types.

Based on the respective system requirements, Linde Hydraulics offers fixed displacement, variable displacement and regulating motors with high starting torque for open and closed loop operation. Optional auxiliary functions, zero displacement capacity and PTO through-shaft enable higher machine design flexibility and increase the efficiency of the travel drive. The motors are optionally controlled electrically, hydraulically or pneumatically.

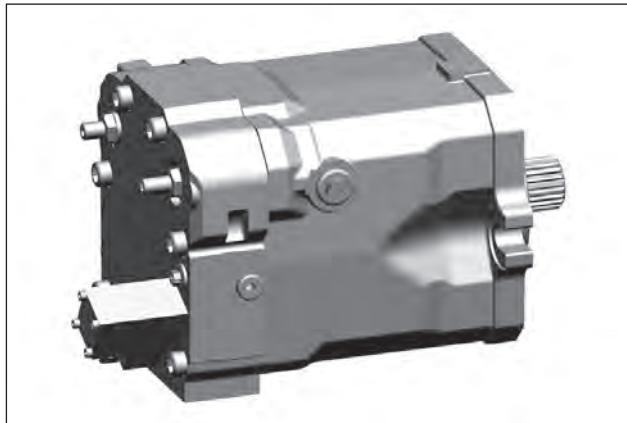
## Function overview

| Motor type                  | Control/function                                                                         | Product name                  |
|-----------------------------|------------------------------------------------------------------------------------------|-------------------------------|
| Fixed displacement motor    |                                                                                          | HMF-02                        |
|                             | with swing drive function                                                                | HMF-02 P                      |
|                             | displacement adjustable                                                                  | HMA-02                        |
| Regulating motor            | V <sub>max</sub> pneumatic                                                               | HMR-02                        |
|                             | V <sub>max</sub> hydraulic, low pressure                                                 | HMR-02                        |
|                             | V <sub>max</sub> hydraulic, high pressure                                                | HMR-02                        |
|                             | V <sub>max</sub> electric                                                                | HMR-02                        |
| Variable displacement motor | stepless variable control, hydraulic                                                     | HMV-02 H1                     |
|                             | stepless variable control, electric                                                      | HMV-02 E1, E4, E6             |
|                             | two position control (flip-flop), hydraulic                                              | HMV-02 H2                     |
|                             | two position control (flip-flop), electric                                               | HMV-02 E2                     |
|                             | hydraulic stepless variable control w/ pressure override and electric pressure selection | HMV-02 EH1P<br>HMV-02 EH1P CA |

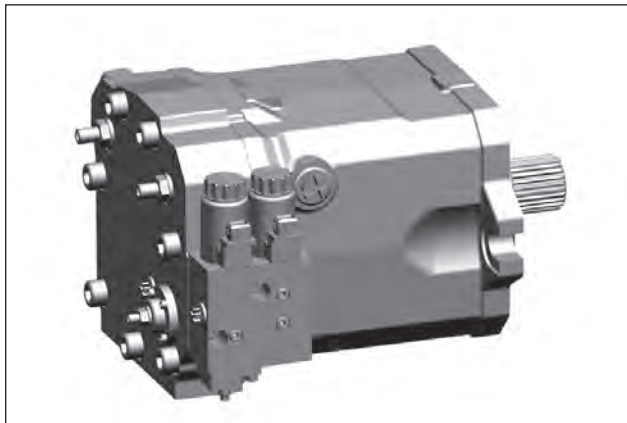
HMV-02 H



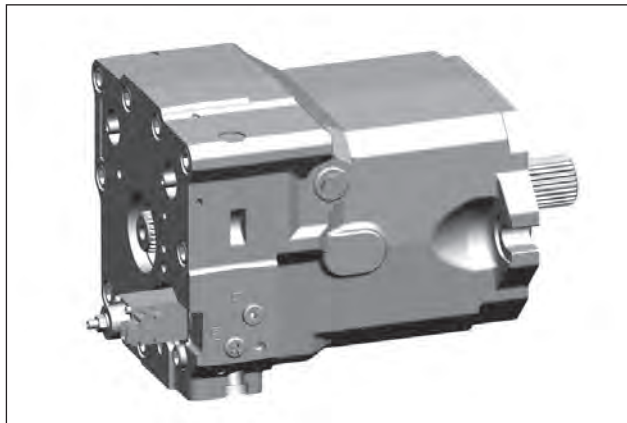
HMV-02 E



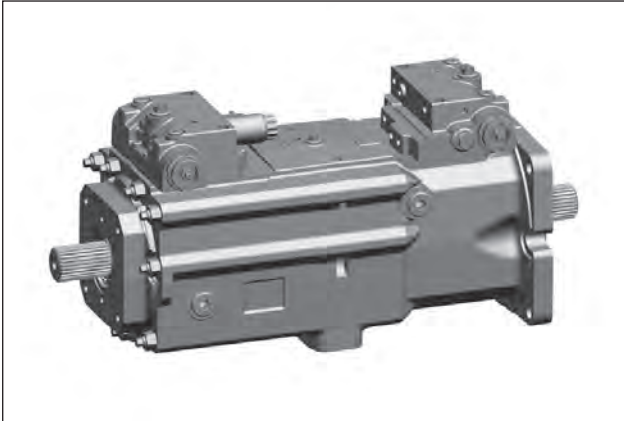
HMV-02 EH1P



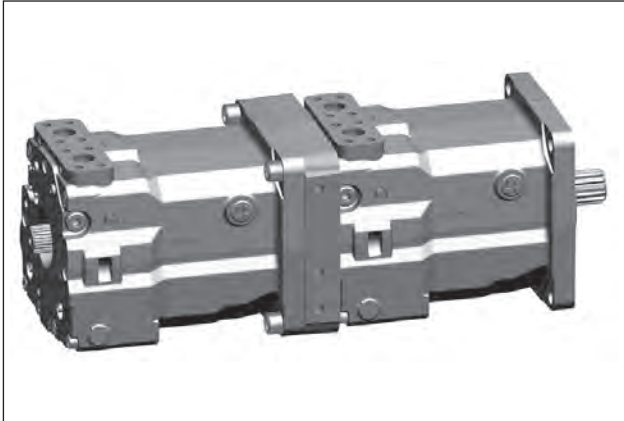
HMV-02 PTO



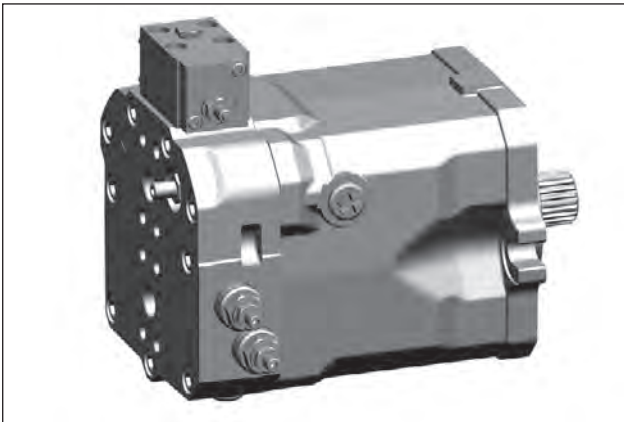
HMV D-02



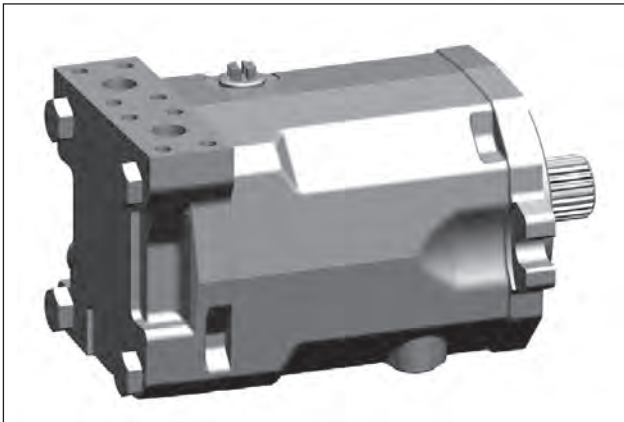
HMV T-02



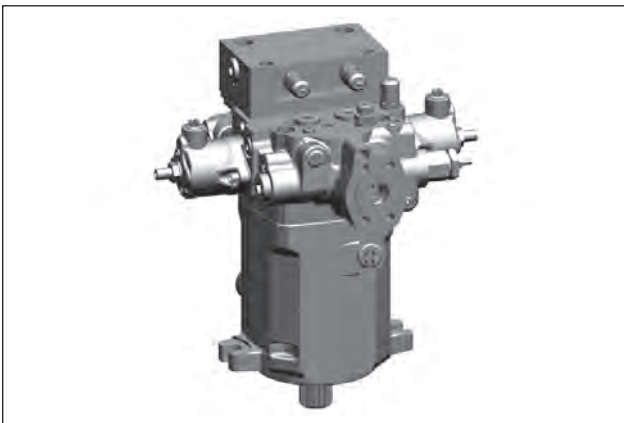
HMR-02



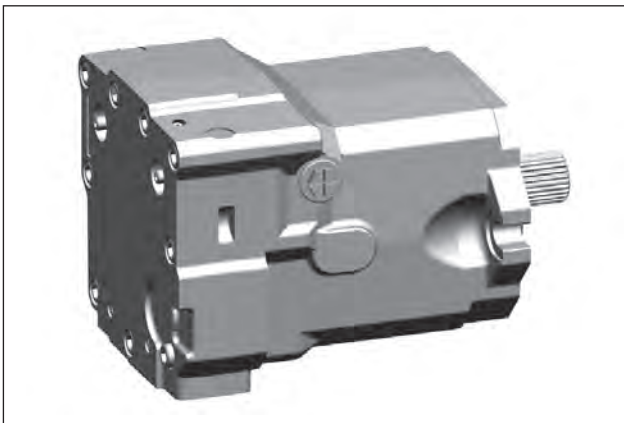
HMF-02

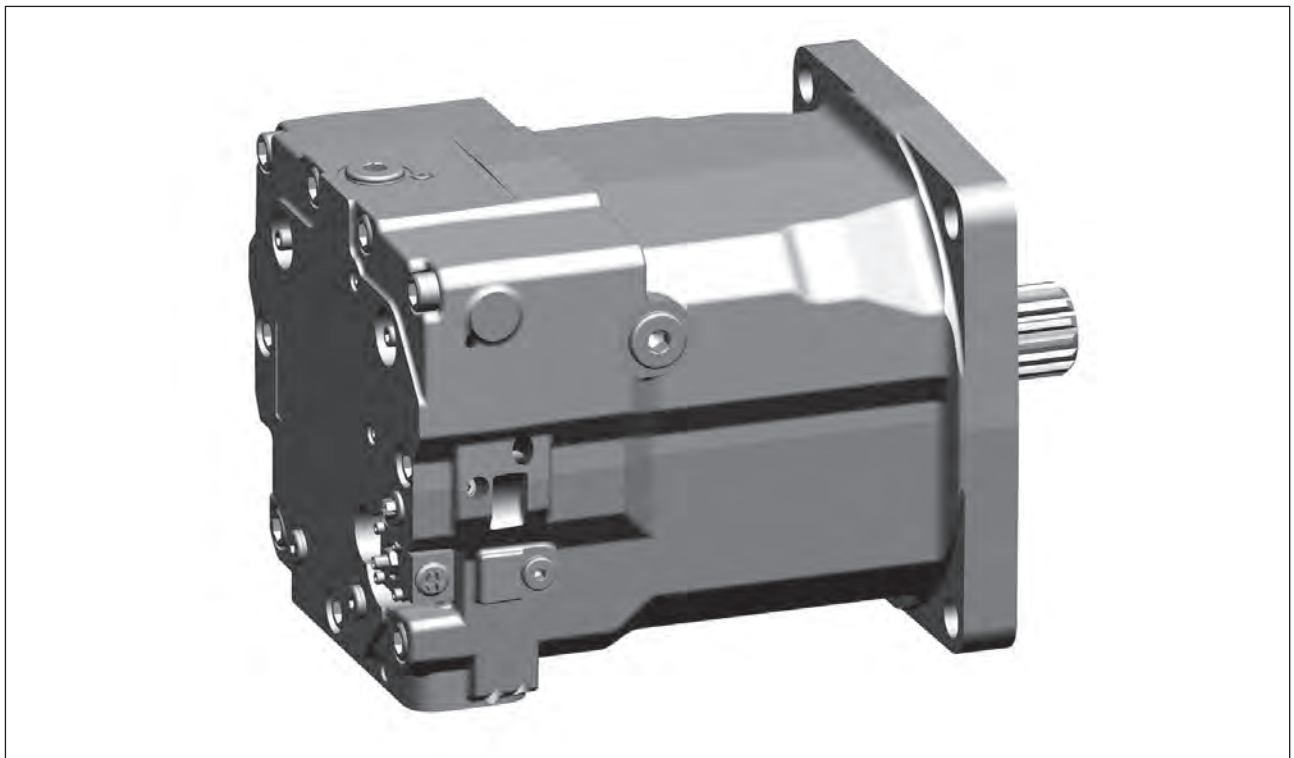


HMF-02 P



HMA-02





### Further features

- >> stepless or two position control
- >> electric or hydraulic control
- >> override pressure control possible
- >> signal selection for pressure regulator possible
- >> can be set to 0 cc/rev
- >> double motor available

### Product benefits

- >> smooth low-speed operation
- >> high starting torque
- >> wide torque/speed conversion range
- >> highly dynamic response characteristics
- >> compact design
- >> high power density
- >> high reliability
- >> long service life
- >> simplified drive line

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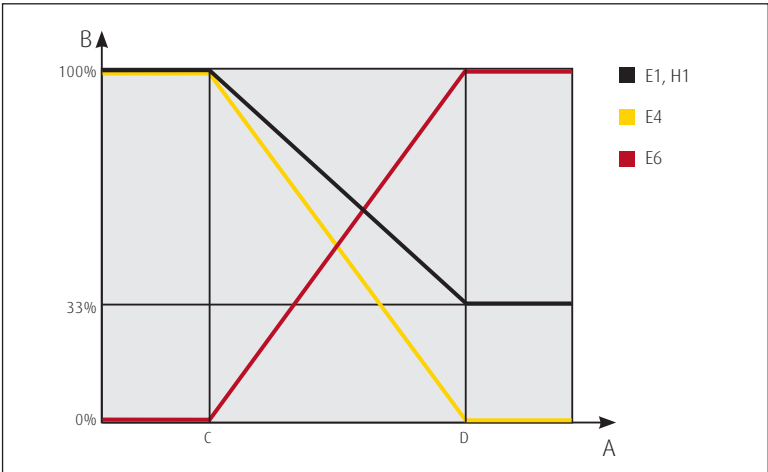
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# Motor types. H MV-02 H1 and E1 stepless

Motors with stepless variable control are suitable for open and closed loop circuit. Without control signal they shift to maximum displacement  $V_{max}$ . Displacement control is hydraulic or via an electric proportional control signal. Servo pressure supply can be applied internally or externally, see section "Functions. Servo pressure supply". The following data are independent of the nominal motor size.

## Stepless variable control features

|                                                                                                        |                                         |                                                |     |                                                                                  |     |
|--------------------------------------------------------------------------------------------------------|-----------------------------------------|------------------------------------------------|-----|----------------------------------------------------------------------------------|-----|
| External servo pressure supply                                                                         | Minimum tripping                        |                                                | bar | 20                                                                               |     |
|                                                                                                        | Maximum permissible                     |                                                | bar | 40                                                                               |     |
| Hydraulic control<br>if $V_{\max, \text{eff}} > V_{\min, \text{nominal}}$ ,<br>the resolution is lower | Control range                           |                                                | bar | $\Delta=6$                                                                       |     |
|                                                                                                        | Control begin                           |                                                | bar | 7, 8, 9 or 9.5                                                                   |     |
|                                                                                                        | Maximum permissible pressure            |                                                | bar | 40                                                                               |     |
| Electric control                                                                                       | Connector type                          |                                                |     | DIN EN 175301-803, Deutsch, AMP Junior Timer, (2-pin, Cod.1)                     |     |
|                                                                                                        | Rated voltage = max. continuous voltage |                                                | V   | 12                                                                               | 24  |
|                                                                                                        | Voltage type                            |                                                |     | DC voltage                                                                       |     |
|                                                                                                        | Power input                             |                                                | W   | 15.6                                                                             |     |
|                                                                                                        | Rated current = max. continuous current |                                                | mA  | 1300                                                                             |     |
|                                                                                                        | Control current                         | Swash begin                                    | mA  | 450                                                                              | 225 |
|                                                                                                        |                                         | Swash end                                      | mA  | 1200                                                                             | 600 |
|                                                                                                        | Relative duty cycle                     |                                                | %   | 100                                                                              |     |
|                                                                                                        | Protection class                        |                                                |     | IP54 (DIN), IP67 (Deutsch), IP 6K6K (AMP)                                        |     |
|                                                                                                        | Control types                           | Digital control via Pulse Width Modulation PWM |     | 100 Hz rectangle, Pulse duty ratio variable over control range                   |     |
|                                                                                                        |                                         | Analog                                         |     | Direct current with dither overlay (dither frequency nom. 35 Hz, duty cycle 1:1) |     |
| Minimum response time with standard orifice with 20 bar servo pressure                                 |                                         |                                                | s   | 0.5 - 1                                                                          |     |



- A

Control pressure /current
- B

Motor displacement
- C

Swash begin
- D

Swash end
- Characteristic E1, H1 control
- Characteristic E4 control
- Characteristic E6 control

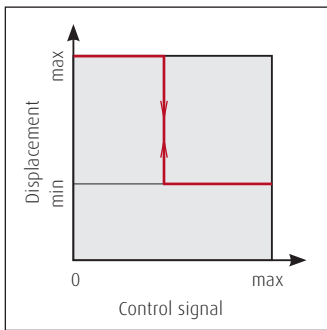
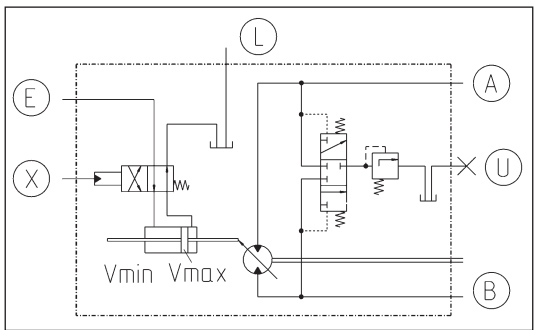
# Motor types. H MV-02 H2 and E2 two position

Two position motors are suitable for open and closed loop operation. Without control signal they are set to maximum displacement  $V_{max}$ . Adjustment between  $V_{min}$  and  $V_{max}$  is smooth and with short response time. The required switching signal can optionally be hydraulic or electric, the servo pressure supply internal or external, see section Functions. Servo pressure supply. The following data are independent of the rated motor size.

## Two position control features

|                                                                        |                                                |     |                                                              |    |
|------------------------------------------------------------------------|------------------------------------------------|-----|--------------------------------------------------------------|----|
| External servo pressure supply                                         | Minimum tripping                               | bar | 20                                                           |    |
|                                                                        | Maximum permissible tripping                   | bar | 40                                                           |    |
| Hydraulic control                                                      | Shifting pressure Minimum tripping             | bar | 20                                                           |    |
|                                                                        | Shifting pressure Maximum permissible tripping | bar | 40                                                           |    |
| Electric Control                                                       | Connector type                                 |     | DIN EN 175301-803, Deutsch, AMP Junior Timer, (2-pin, Cod.2) |    |
|                                                                        | Rated voltage = max. continuous voltage        | V   | 12                                                           | 24 |
|                                                                        | Voltage type                                   |     | DC voltage                                                   |    |
|                                                                        | Power input (cold)                             | W   | ≤ 26                                                         |    |
|                                                                        | Relative duty cycle                            | %   | 100                                                          |    |
|                                                                        | Protection class                               |     | IP54 (DIN), IP67 (Deutsch), IP 6K6K (AMP)                    |    |
| Minimum response time with standard orifice with 20 bar servo pressure |                                                | s   | 0.5 - 1                                                      |    |

## Two position motor with hydraulic control pressure and external servo supply pressure



- A,B Work port connections
- L,U Case drain/vent connections
- E Servo supply pressure connection
- X Control connection

# Motor types. HMV-02 EH1P stepless with pressure override

This motor is used primarily for closed loop operation together with speed-dependent hydraulic pump, type HPV-02 CA. Alternatively, with hydraulically or electro-hydraulically pilot-operated drives for which a high pressure regulating function is also required. Without control signal the motor shifts to maximum displacement  $V_{max}$ . Stepless variable control to lower displacement is hydraulic, with control pressure generated by the speed dependent pump. The motor is also equipped with a system pressure override which, at a predefined setting, automatically increases its displacement in response to system related torque demand. The following data are independent of the rated motor size.

## Features of stepless variable control with pressure override

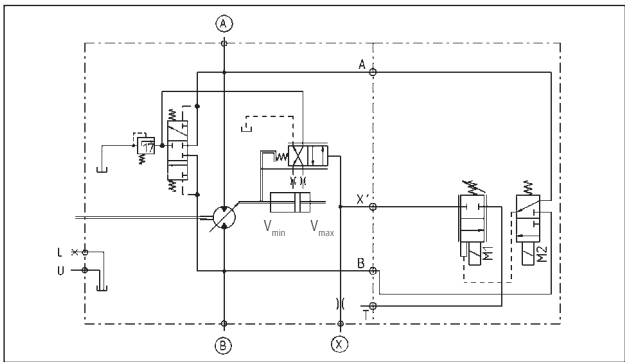
|                                                                        |                                                                                                           |     |                                     |
|------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|-----|-------------------------------------|
| Hydraulic control signal                                               | Control pressure range                                                                                    | bar | 8 to 14                             |
|                                                                        | Maximum premissible pressure                                                                              | bar | 40                                  |
| Hydraulic pressure override                                            | Regulation begin pressure adjustable, please specify with order                                           | bar | 190-260                             |
|                                                                        | Regulation end pressure                                                                                   | bar | 5 % above regulation begin pressure |
| Electric control signal                                                | Electric $V_{max}$ control and signal selection for pressure regulator, see E2 control for technical data |     |                                     |
| Minimum response time with standard orifice with 20 bar servo pressure |                                                                                                           | s   | 0.5 - 1                             |

### Auxiliary functions

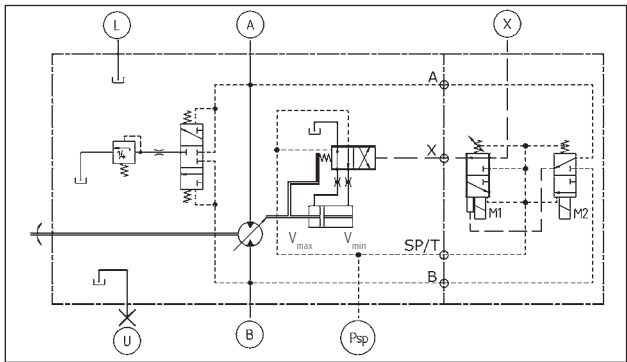
- >> Electric  $V_{max}$  control, independent of signal pressure, for maximum displacement motor operation
- >> Electric selection of pressure signal for pressure regulator. For details, see “Functions. Signal selection for pressure regulator”



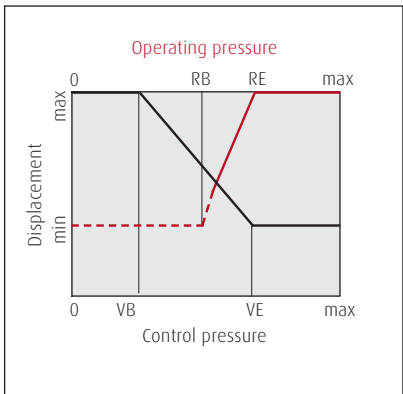
EH1P. Case pressure as reference, «Bleed» regulation



EH1P-CA. Feed pressure as reference, «Non-Bleed» regulation



## Characteristic EH1P & EH1P-CA

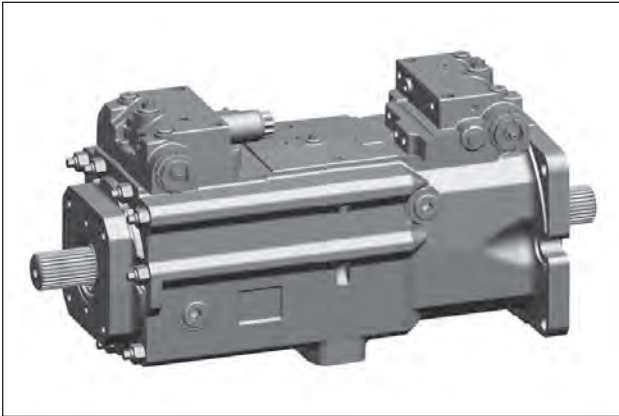


- |    |                            |     |                                                      |
|----|----------------------------|-----|------------------------------------------------------|
| VB | Swash begin                | A,B | Port connections                                     |
| VE | Swash end                  | L,U | Case drain / vent connections                        |
| RB | Start of pressure override | X   | Control pressure connections                         |
| RE | End of pressure override   | M1  | Solenoid for maximum displacement override           |
|    |                            | M2  | Solenoid for signal selection for pressure regulator |

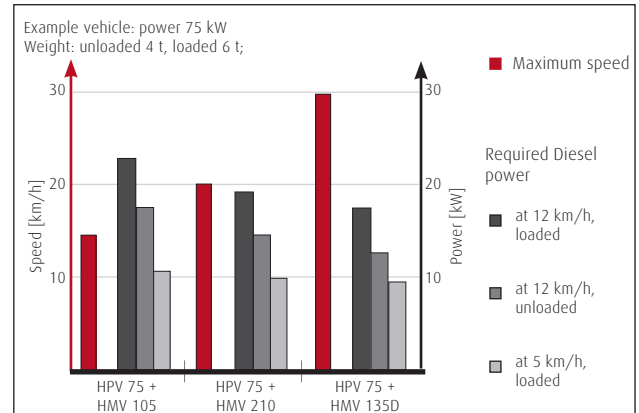
## Motor types. HMV D-02 double motor

The double motor consists of two Series 02 variable motors arranged back-to-back. In addition to a wide torque/speed conversion range it offers the option of direct installation in the drive line, since one or two shaft ends are optionally available for torque output. Noise emission and fuel consumption are reduced because no transfer gearbox is required. At the same time the overall efficiency increases. The performance comparison diagram shows the required drive capacity for different design variants at four operating points.

### HMV D-02



### Performance comparison



#### Further features

- >> two HMV-02 arranged back-to-back
- >> connection for high pressure, servo and control pressure for each motor
- >> motor control optionally through one signal or two separate signals
- >> both motors can be set to 0 cc/rev
- >> possible conversion ratio 1:6
- >> optionally two shaft ends for direct installation in the drive line

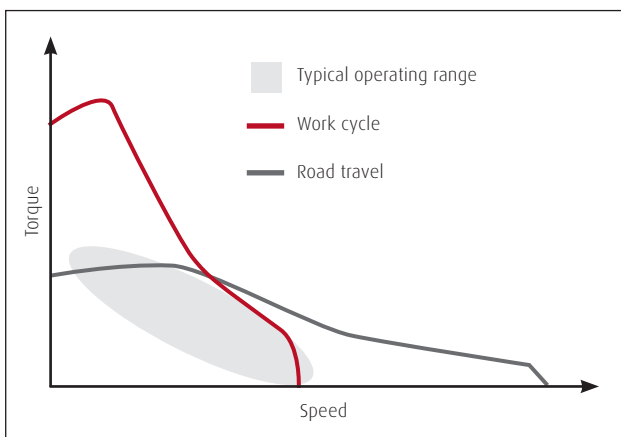
#### Product benefits

- >> wide conversion range for stepless acceleration
- >> simplified drive line
- >> high tractive effort and high terminal speed
- >> highly dynamic response characteristics
- >> high starting torque

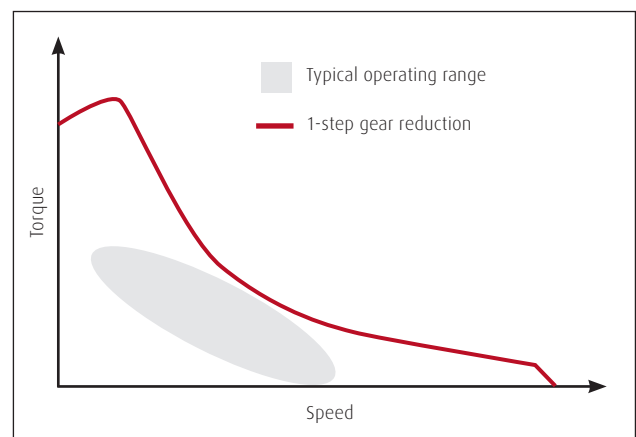
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### 2-pos. gearbox/conventional transmission



### Stepless with double motor

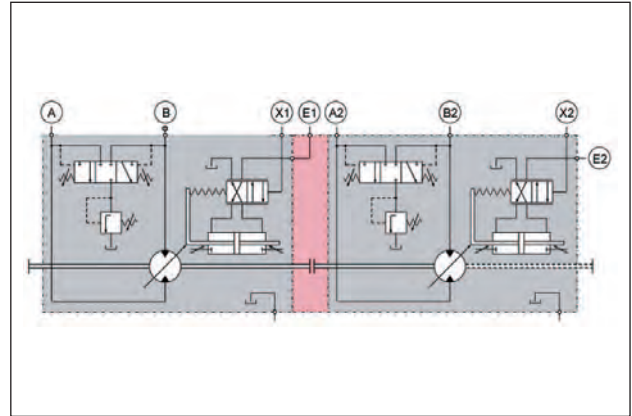
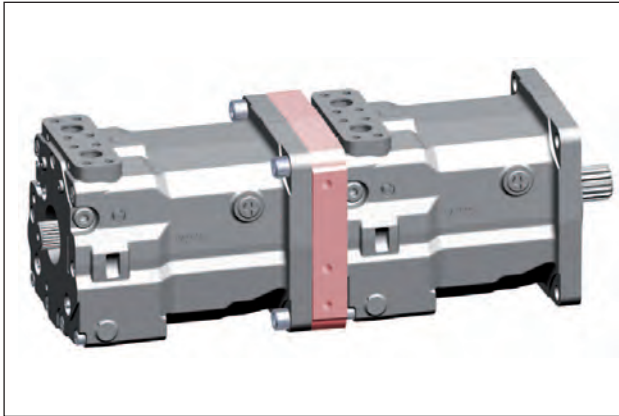


## Motor types. HMV T-02 tandem motor

The tandem motor consists of two HMV-02, arranged face-to-back and connected with a tandem flange. Unlike the double motor, the tandem motor can also be integrated directly into the driveline and is available with one or two shaft ends.

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### Further features

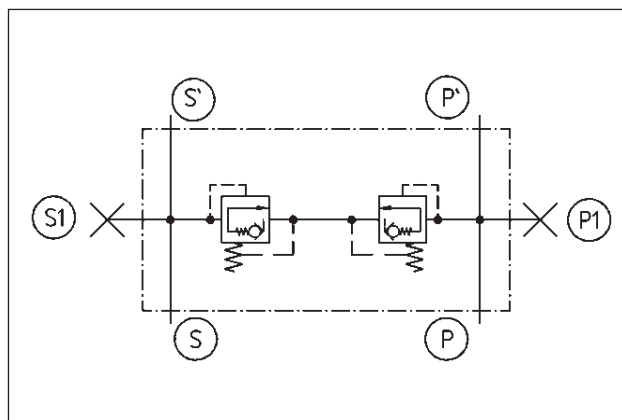
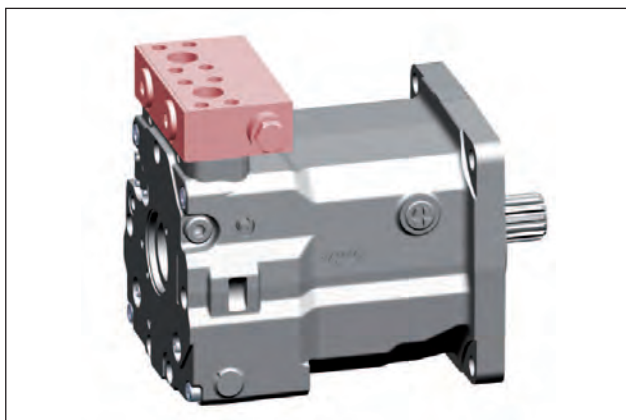
- >> two HMV, arranged face-to-back
- >> available as HMV 210-02 and 280-02
- >> separate connections for high pressure and feed pressure
- >> individual control
- >> both motors can be set to 0 cc/rev
- >> same mounting flange as single motor

### Benefits

- >> doubled torque at same gearbox interface
- >> simple torque increase in existing applications
- >> higher speed as with single motors of the same size and as with bent axis motors
- >> more slender outline as single motors of the same size
- >> direct driveline-integration, no need for gearbox

## Motor equipment. Cross over relief valve block

The cross over relief valve block offers additional high pressure protection for the series 02 motors. It is mounted to the radial high pressure ports. As well as this protective function, the block offers tee connectors for the high pressure connections in order to connect an additional motor to the system without the need for long hoses.



### Further features

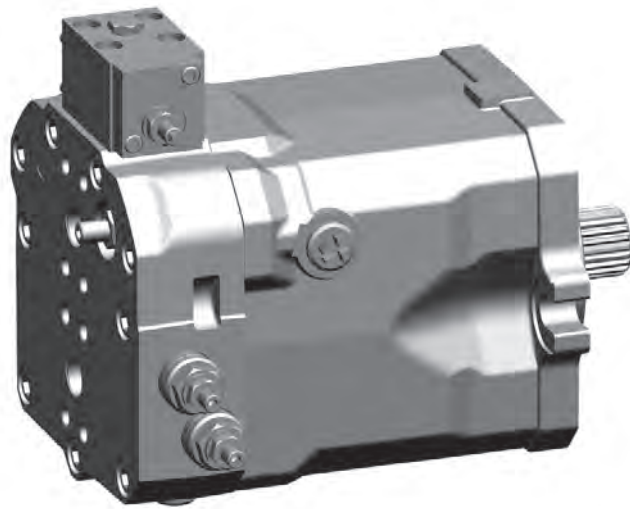
- >> modular add-on functionality
- >> for radial high-pressure connections
- >> for all HMV/HMR/HMA-02 motors

### Benefits

- >> additional high pressure relief in closed circuit application
- >> pressure relief exceeding the pump relief valve capability, for example while breaking hydraulically with high displacement ratio HMV  $V_{min}/V_{max}$
- >> connection of a second motor with minimized hydraulic hose length, for example tandem motors

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### Further features

- >> optionally with purge valve for circuit and case flushing in closed loop circuit
- >> system pressure regulation, no external control lines required
- >> signal selection for pressure regulator for closed loop circuit
- >> counterbalance (brake) valve CBV optional

### Product benefits

- >> smooth low-speed operation
- >> high starting torque
- >> wide conversion range
- >> compact design
- >> high power density
- >> high reliability
- >> long service life
- >> highly dynamic response characteristics
- >> simplified drive line

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# Motor types. HMR-02

Linde regulating motors are suitable for open and closed loop operation. They are high-pressure regulated and shift to minimum displacement  $V_{min}$  at system pressures below the regulation begin point. When the defined high pressure regulation set point is reached, the motor smoothly increases displacement to match the torque required by the system. The following data are independent of the rated motor size.

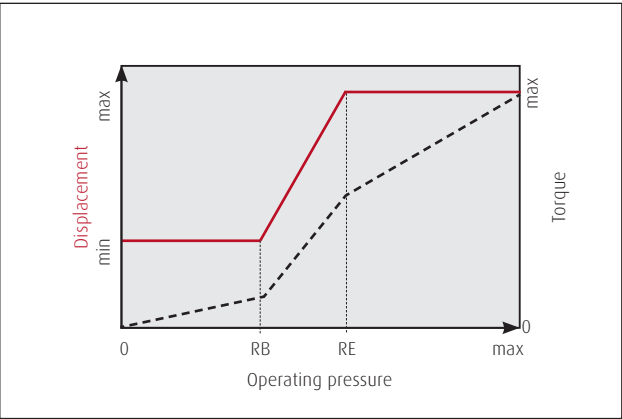
### Typical equipment options

- >> Open loop circuit. Secondary (crossline relief) valves or counterbalance (brake) valves
- >> Closed loop circuit. Electric signal selection for pressure regulator

### Regulating motor features

|                                                                        |                                                                     |     |                                                              |    |
|------------------------------------------------------------------------|---------------------------------------------------------------------|-----|--------------------------------------------------------------|----|
| Hydraulic regulation                                                   | Regulation begin pressure adjustable, please specify with the order | bar | 190 to 260                                                   |    |
|                                                                        | Regulation end pressure                                             | bar | 5% above regulation begin pressure                           |    |
| Pneumatic $V_{max}$ override control                                   | Shift pressure min/max                                              | bar | 4 to 8                                                       |    |
| Hydraulic $V_{max}$ override control                                   | Shift pressure min/max Low pressure                                 | bar | 20 to 30                                                     |    |
|                                                                        | Shift pressure min/max High pressure                                | bar | 30 to 420                                                    |    |
| Electronic control signal                                              | Connector type                                                      |     | DIN EN 175301-803, Deutsch, AMP Junior Timer (2-pin, Cod. 2) |    |
|                                                                        | Rated voltage = max. continuous voltage                             | V   | 12                                                           | 24 |
|                                                                        | Voltage type                                                        |     | DC Voltage                                                   |    |
|                                                                        | Power input (cold)                                                  | W   | $\leq 26$                                                    |    |
|                                                                        | Relative duty cycle                                                 | %   | 100                                                          |    |
|                                                                        | Protection class                                                    |     | IP54 (DIN), IP67 (Deutsch), IP 6K6K (AMP)                    |    |
| Minimum response time with standard orifice with 20 bar servo pressure |                                                                     | s   | 0.3 - 0.6                                                    |    |

### Regulating motor characteristic



- RB Regulation begin
- RE Regulation end
- Displacement
- - - Torque

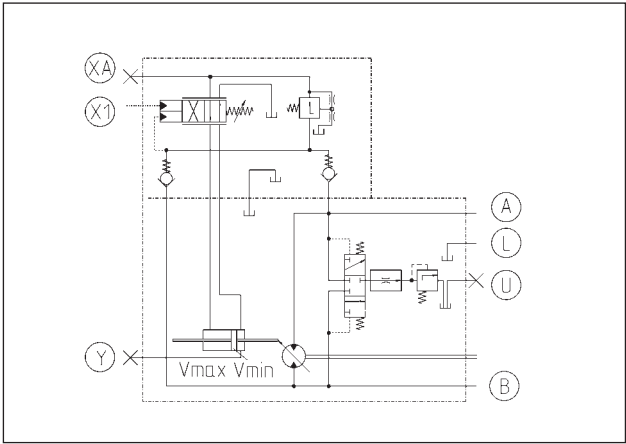
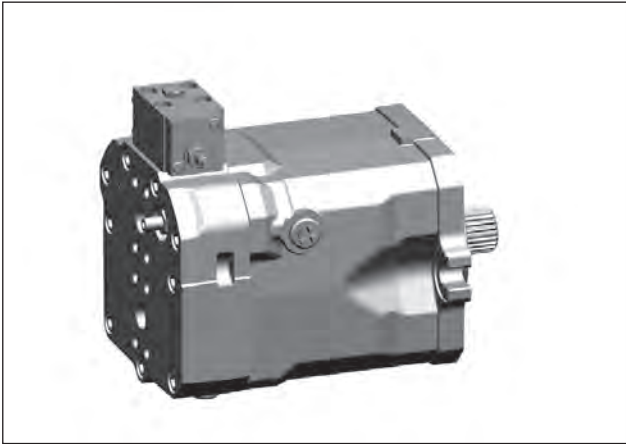
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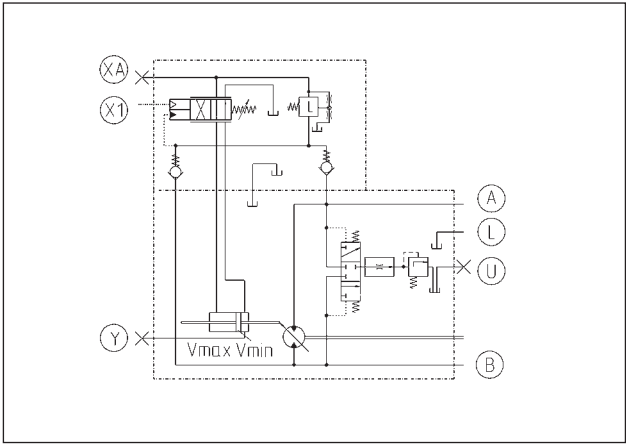
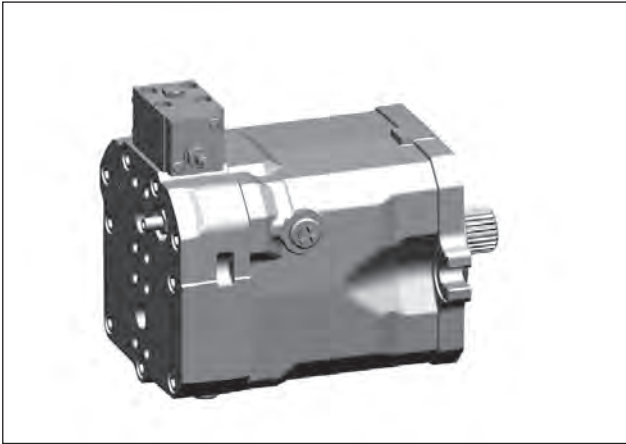
Motor types. HMR with Vmax override control

The additional  $V_{max}$  control enables fixed displacement motor operation independent of the control pressure.

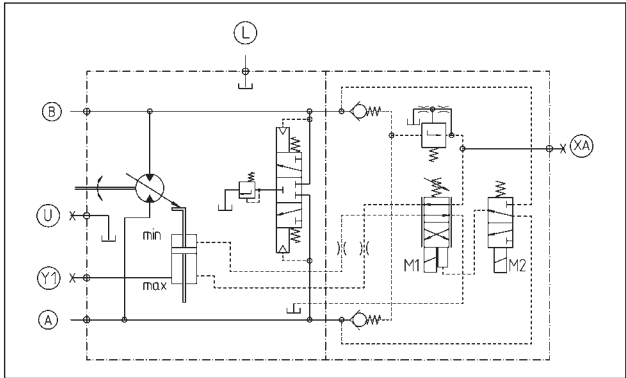
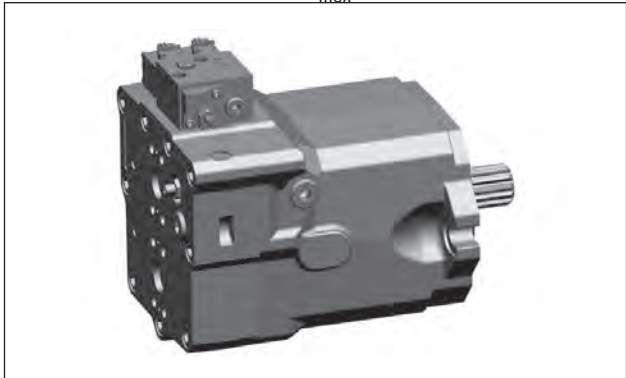
Regulating motor with hydraulic  $V_{max}$  override control



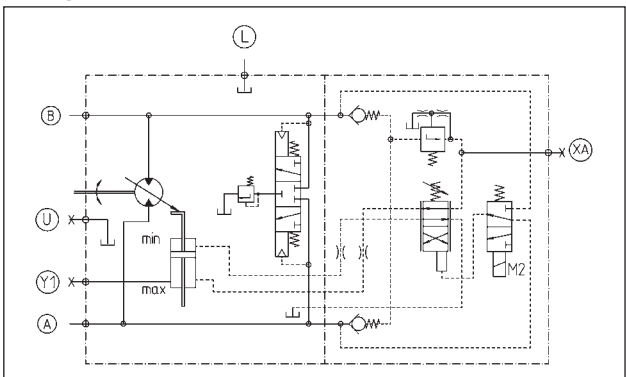
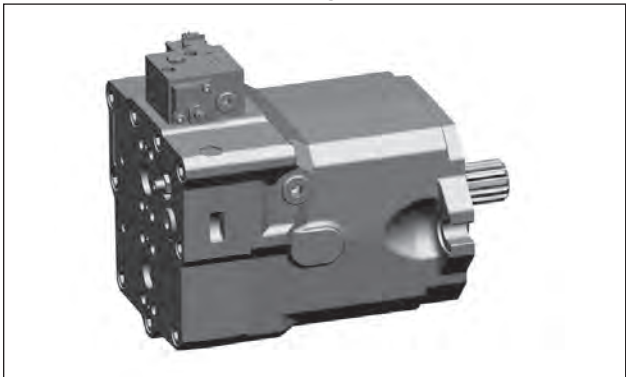
Regulating motor with pneumatic  $V_{max}$  override control

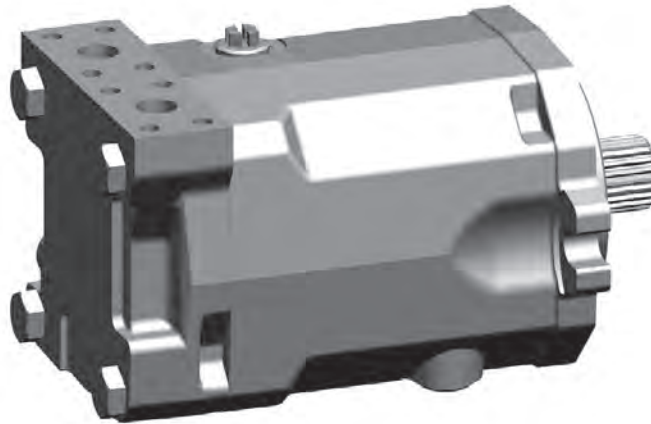


HMR-02 with electric  $V_{max}$  override control and signal selection for pressure regulator



HMR-02 with electric signal selection for pressure regulator





### Further features

- >> optimised start-up and low-speed characteristics
- >> optionally with purge valves for purge and case flushing
- >> fixed and dual setting secondary valves optional

### Product benefits

- >> smooth low-speed operation
- >> high starting torque
- >> compact design
- >> high power density
- >> high reliability
- >> long service life

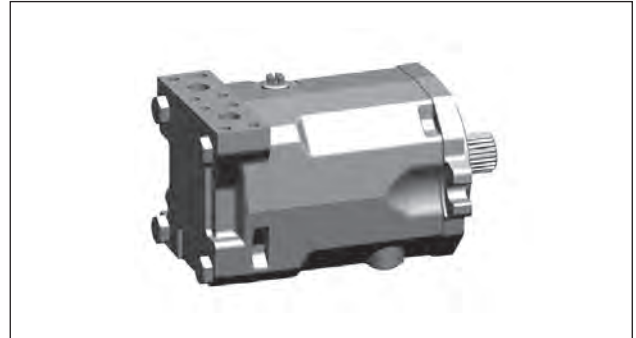
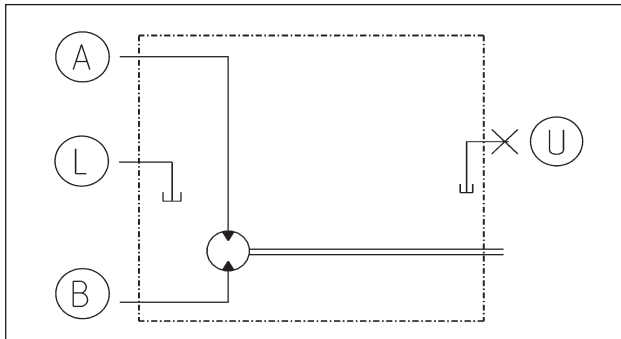
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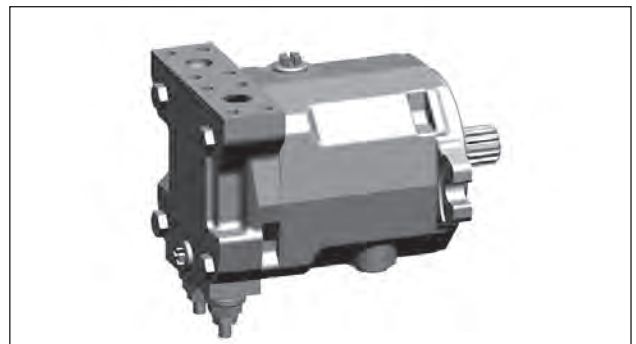
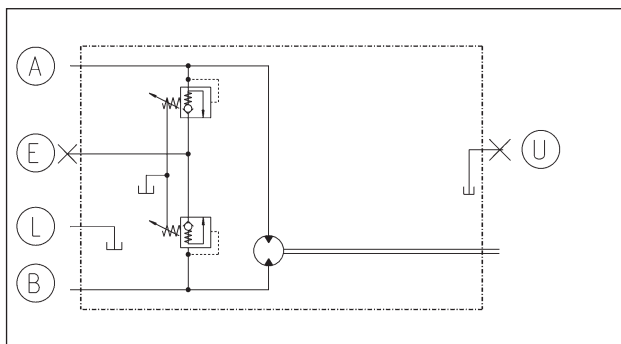
## Motor types. HMF-02

The HMF-02 motor is a high-pressure fixed displacement motor for open and closed loop operation. Secondary valves enable customised definition of motor start-up and slowdown. With dual setting secondary valves the maximum acceleration and braking torque is additionally available. The settings and shifting ranges can be adjusted according to project-specific requirements, see sections “Functions. Crossline (secondary) protection” and “HMF-02 P”.

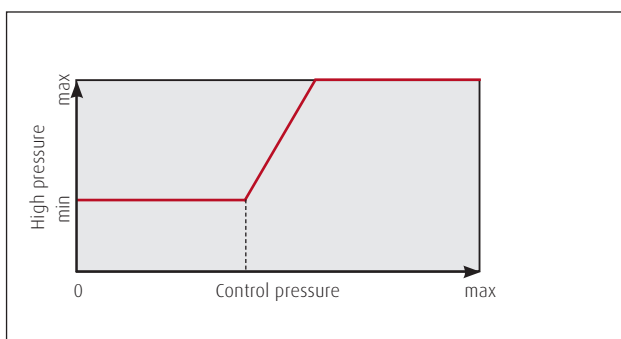
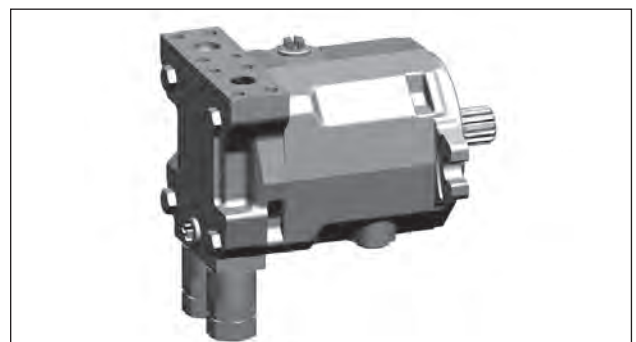
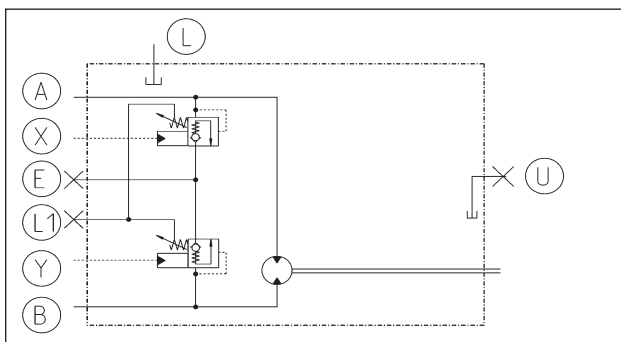
### Fixed displacement motor HMF-02



### Fixed displacement motor with crossline relief valves fixed setting



### Motor with dual pressure crossline relief valves



- A, B Work ports
- L, L1, U Case drain / vent connections
- X, Y Control connections for dual pressure crossline relief valve
- E Make up connection

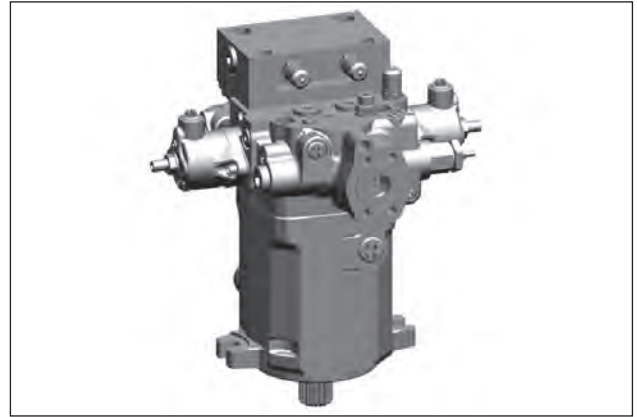
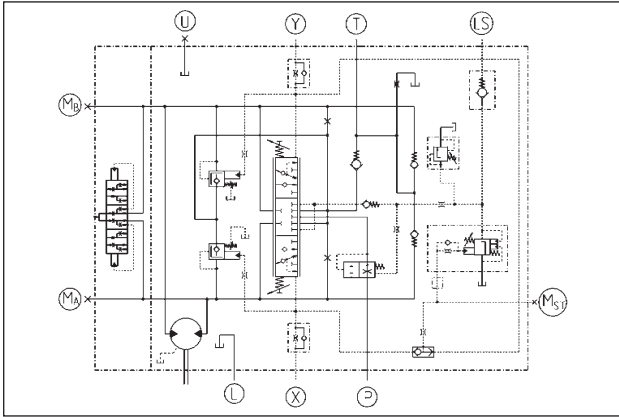
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## Motor types. HMF-02 P

The HMF-02 motor is a high-pressure fixed displacement motor for open loop operation. With integrated LS directional control valve and TC torque control it combines the benefits of the Series 02 with all auxiliary functions typically required for application in swing and winch drives. The HMF-02 P is available in the rated sizes 35, 55, 75 and 105. Differing from the standard HMF, the nominal pressure is 280 bar, the peak pressure is 300 bar.

### HMF-02 P with integrated swing function



#### Features

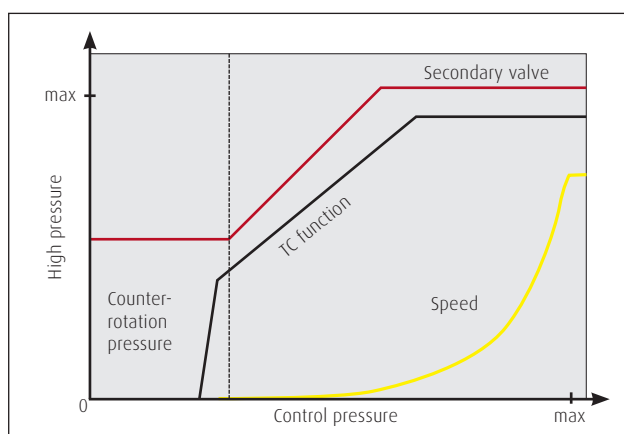
- >> directional control valve function
- >> torque control function
- >> HP valves with controllable characteristic curve
- >> priority function
- >> secondary protection combined with make-up function
- >> purge and case flushing function
- >> anti reaction valve

#### Product benefits

- >> smooth low-speed operation
- >> high starting torque
- >> torque and speed control
- >> controllable counter-rotation
- >> compact design
- >> high power density
- >> high reliability
- >> long service life

### TC function

For powerful and dynamic application in swing drives the TC function enables control pressure-dependent acceleration. Once the maximum rotating speed is reached, torque control is superimposed and pressure level is reduced for energy-saving operation. If the control valve is reset to the neutral position, no additional control signal is generated and the rotary motion slows down uniformly. Active counter-rotation is possible with controllable secondary valves. A counteractive control signal is generated, and the rotary motion is decelerated along the characteristic counter-rotation pressure curve.



- |      |                               |
|------|-------------------------------|
| P, T | Work port connections         |
| L, U | Case drain / vent connections |
| LS   | LS-pressure connection        |
| M    | Gauge ports                   |

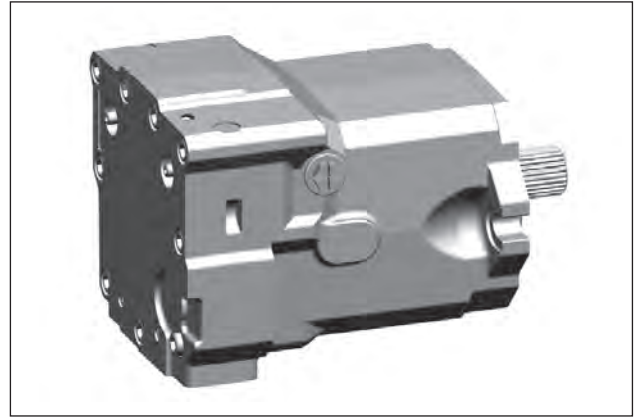
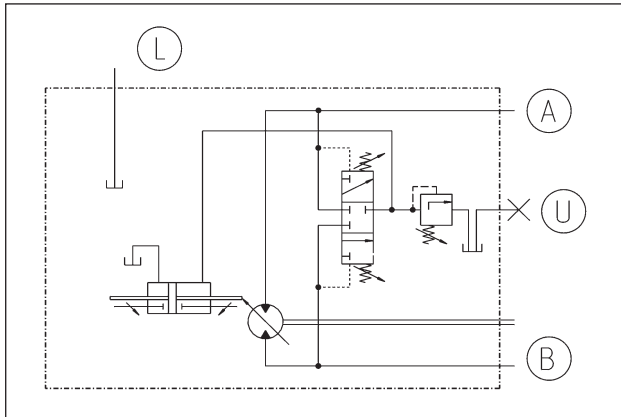
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## Motor types. HMA-02

The HMA-02 motor is a high-pressure motor with adjustable displacement for open and closed loop operation. For application which requires dependent on the situation a reduced or increased displacement, the HMA-02 offers the expected flexibility. Since the displacement can be adjusted on request stepless at a screw. For a well-adjusted torque.

### HMA-02 the adjustable fixed displacement motor



A, B      Work port connections  
L, U      Case drain / vent connections

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## Dimensions. HMV-02

| Rated size                                                 |                   | 55                                       | 75  | 105 | 135   | 165   | 210   | 280   |
|------------------------------------------------------------|-------------------|------------------------------------------|-----|-----|-------|-------|-------|-------|
| D1 [mm]                                                    |                   | 127                                      |     |     | 152.4 |       | 165.1 |       |
| B1 [mm]                                                    |                   | 181                                      |     |     | 228.6 |       | 224.5 |       |
| B2 [mm]                                                    |                   | 208                                      |     |     | 258   |       | 269   |       |
| B3 [mm]                                                    |                   | 86                                       | 95  | 96  | 108   | 125   | 134   | 156   |
| B4 [mm]                                                    |                   | 95                                       |     | 96  | 108   | 125   | 134   | 156   |
| B5 [mm]                                                    |                   | 86                                       | 95  | 96  | 108   | 125   | *     | *     |
| B6 [mm]                                                    |                   | 85                                       | 95  | 96  | 108   | 125   | *     | *     |
| B7 [mm]<br>with electric override control                  |                   | -                                        | 180 | 181 | 193   | 210   | *     | *     |
| B8 [mm]<br>with electric override control                  |                   | -                                        | 180 | 181 | 193   | 210   | *     | *     |
| H1 [mm]                                                    |                   | 80                                       | 86  | 91  | 98    | 98    | 135   |       |
| H2 [mm]                                                    |                   | 83                                       | 93  | 99  | 103   | 98    | 135   |       |
| H3 [mm]                                                    |                   | 84                                       | 93  | 95  | 108   | 120   | 134   | 151.5 |
| H4 [mm]                                                    |                   | 90                                       | 105 | 106 | 114   | 132   | 133   | 152.5 |
| H5 [mm]                                                    |                   | 84                                       | 93  | 96  | 107   | 118   | *     | *     |
| H6 [mm]                                                    |                   | 90                                       | 105 |     | 114   | 132   | *     | *     |
| H7 [mm]<br>with electric override control                  |                   | -                                        | 88  |     |       | 102.5 | *     | *     |
| H8 [mm]<br>with electric override control                  |                   | -                                        | 92  |     |       | 77.5  | *     | *     |
| L1 [mm]                                                    |                   | 41                                       | 56  |     | 75    |       |       |       |
| L2 [mm]                                                    |                   | 212                                      | 226 | 247 | 270   | 314   | 336   | 381   |
| L3 [mm] control                                            | hydraulic control | 33                                       |     |     |       | 5     | 5     | 8     |
|                                                            | electric control  | 75                                       |     |     |       | 58    | 55    | 59    |
| L4 [mm]                                                    |                   | 217                                      | 231 | 252 | 275   | 305   | *     | *     |
| L5 [mm] control                                            | hydraulic control | 18                                       |     |     |       | 5     | *     | *     |
|                                                            | electric control  | 70                                       |     |     |       | 58    | *     | *     |
| L6 [mm]<br>with electric override control                  |                   | -                                        | 33  |     |       | 32.5  | *     | *     |
| L7 [mm]<br>with electric override control                  |                   | -                                        | 28  |     |       | 32.5  | *     | *     |
| L8 [mm]<br>with electric override control                  |                   | -                                        | 80  |     |       | 80.5  | *     | *     |
| L, U                                                       |                   | M22x1.5                                  |     |     | M27x2 |       |       | M33x2 |
| E<br>Port for external servo pressure supply               |                   | M14x1.5                                  |     |     |       |       |       |       |
| X<br>Port for hydraulic control                            |                   | M14x1.5                                  |     |     |       |       |       |       |
| M, M1<br>Solenoid for electric control                     |                   | see section Motor types. HMV-02 stepless |     |     |       |       |       |       |
| M2<br>Solenoid for signal selection for pressure regulator |                   | see section Motor types. HMV-02 stepless |     |     |       |       |       |       |

\*) Product design on demand

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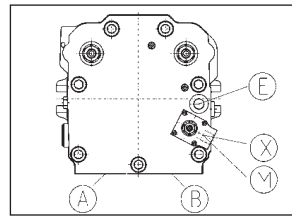
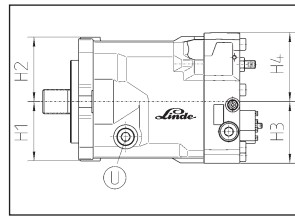
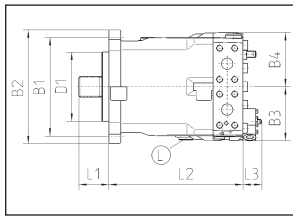
Metric connection thread according to ISO 6149-1

Locking thread for the SAE high pressure-connections, metric according to ISO 261  
Hexagon socket head cap screws according to ISO 4762

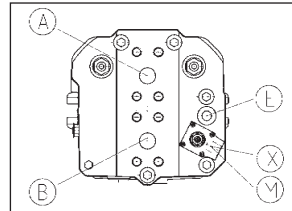
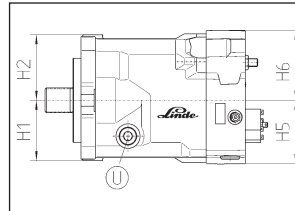
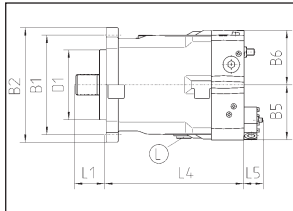
Further threads, dimensions and versions with speed sensor are available on request

## Dimensions. HMV-02

### Radial high pressure-connections

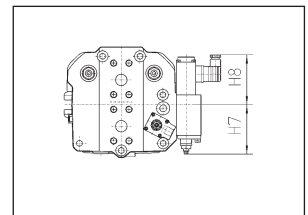
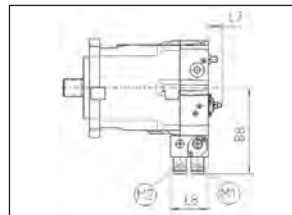
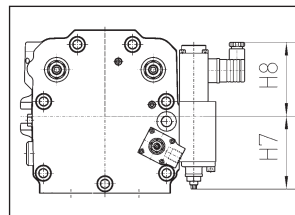
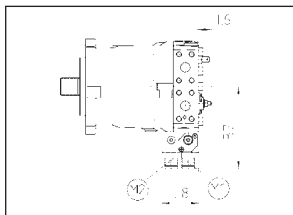


### Axial high pressure-connections



### HMV-02 with electric override control

#### Radial high pressure-connections



#### Axial high pressure-connections

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## Dimensions. HMR-02

| Rated size                                                                                                      |           | 75                              | 105 | 135   | 165   | 210     | 280 |
|-----------------------------------------------------------------------------------------------------------------|-----------|---------------------------------|-----|-------|-------|---------|-----|
| D1 [mm]                                                                                                         |           | 127                             |     | 152.4 |       | 165.1   | *   |
| B1 [mm]                                                                                                         |           | 181                             |     | 228.6 |       | 224.5   | *   |
| B2 [mm]                                                                                                         |           | 208                             |     | 256   |       | 269     | *   |
| B3 [mm]<br>sec. relief valve                                                                                    | without   | 95                              | 99  | 108   | -     | 134     | *   |
|                                                                                                                 | with      | 135                             | 136 | 140   | -     | 134     | *   |
| B4 [mm]<br>sec. relief valve                                                                                    | without   | 95                              | 105 | 108   | -     | 134     | *   |
|                                                                                                                 | with      | 12                              | 105 | 114   | -     | 134     | *   |
| B5 [mm]<br>sec. relief valve                                                                                    | without   | 95                              | 99  | 108   |       | *       | *   |
|                                                                                                                 | with      | 135                             | 139 | 141   | 148   | *       | *   |
| B6 [mm]                                                                                                         |           | 102                             | 105 | 114   | 125   | *       | *   |
| B7 [mm]                                                                                                         | pneumatic | 74                              |     |       | -     | *       | *   |
|                                                                                                                 | hydraulic | 62                              |     |       | 46    | *       | *   |
| B8 [mm]                                                                                                         |           | 78                              |     |       |       | *       | *   |
| B9 [mm]                                                                                                         |           | 103                             |     |       |       | 108     | *   |
| B10 [mm]                                                                                                        |           | 89                              |     |       | 169   | 97.5    | *   |
| B11 [mm]                                                                                                        |           | 130                             |     |       | 107   | 97.5    | *   |
| H1 [mm]                                                                                                         |           | 86                              | 91  | 96    | 98    | 135.5   | *   |
| H2 [mm]                                                                                                         |           | 93                              | 99  | 100   | 105   | 135.5   | *   |
| H3 [mm]                                                                                                         |           | 93                              | 98  | 108   | -     | 134     | *   |
| H4 [mm]                                                                                                         |           | 102                             |     | 110   | -     | 133.5   | *   |
| H5 [mm]                                                                                                         |           | 56                              |     |       |       |         | *   |
| H6 [mm]                                                                                                         |           | 91                              | 96  | 107   | 118   | 134     | *   |
| H7 [mm]                                                                                                         |           | 102                             | 107 | 109   | 125   | 133.5   | *   |
| H8 [mm]                                                                                                         |           | 81                              |     |       |       |         | *   |
| H9 [mm]                                                                                                         |           | 85                              |     |       | 102   | 168.5   | *   |
| L1 [mm]                                                                                                         |           | 56                              |     | 75    |       |         | *   |
| L2 [mm]                                                                                                         |           | 229                             | 247 | 270   | -     | 336     | *   |
| L3 [mm]                                                                                                         |           | 231                             | 252 | 275   | 304   | -       | *   |
| L4 [mm]                                                                                                         |           | 53                              |     |       |       |         | *   |
| L5 [mm]<br>regulator with electric maximum displacement override and<br>signal selection for pressure regulator |           | 80                              |     |       |       |         | *   |
| L6 [mm]                                                                                                         |           | 127                             |     |       | 120   | 143     | *   |
| L, U                                                                                                            |           | M22x1.5                         |     |       | M27x2 | M27x2   | *   |
| X1<br>port for hyd./pneum. max. displ. override                                                                 |           | M14x1.5                         |     |       |       | M14x1.5 | *   |
| M1<br>solenoid for electric maximum displacement override                                                       |           | see section Motor types. HMR-02 |     |       |       |         |     |
| M2<br>solenoid for signal selection for pressure regulator                                                      |           | see section Motor types. HMR-02 |     |       |       |         |     |

\*) Product design on demand

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Metric connection thread according to ISO 6149-1

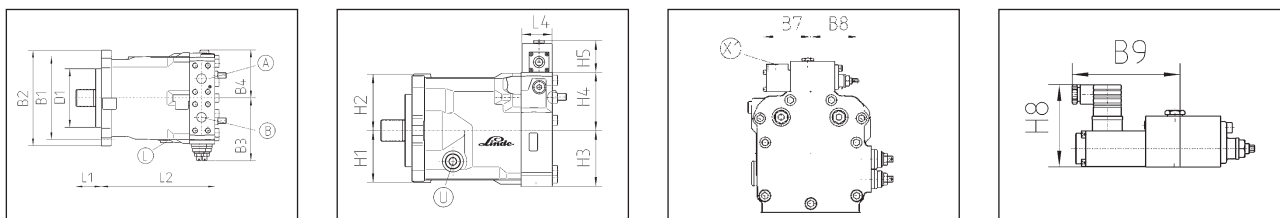
Locking thread for the SAE high pressure-connections, metric according to ISO 261

Hexagon socket head cap screws according to ISO 4762

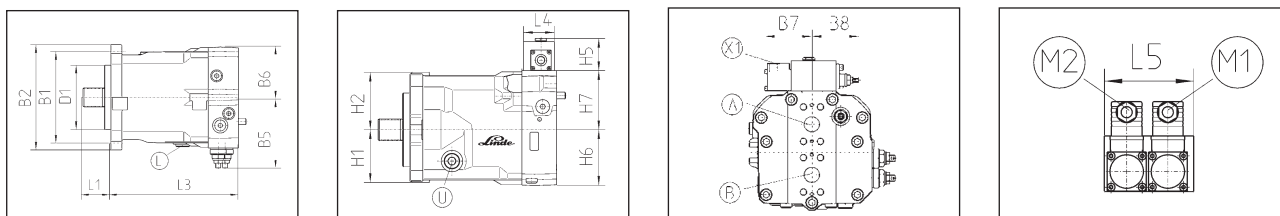
Further threads, dimensions and versions with speed sensor are available on request

## Dimensions. HMR-02

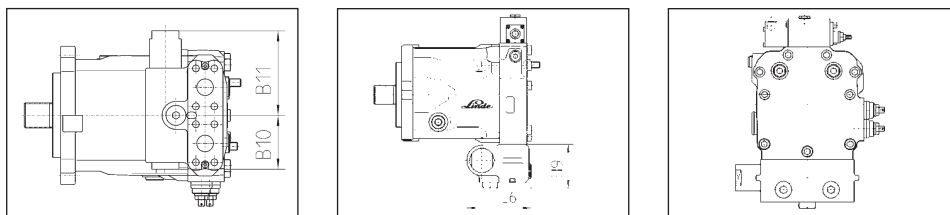
### Radial high pressure-connections



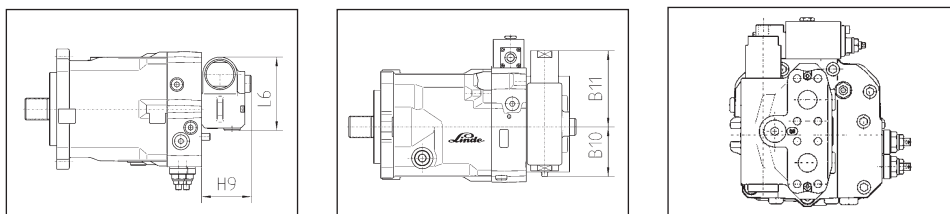
### Axial high pressure-connections



### HMR-02 with brake valve. Radial high pressure-connections



### HMR-02 with brake valve. Axial high pressure-connections



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## Dimensions. HMF-02

| Rated Size                                     | 28                            | 35* | 50* | 75*     | 105* | 135   | 165<br>HMA | 210<br>HMA |
|------------------------------------------------|-------------------------------|-----|-----|---------|------|-------|------------|------------|
| D1 [mm]                                        | 101.6                         |     | 127 |         |      | 152.4 |            | 165.1      |
| B1 [mm]                                        | 146                           |     | 181 |         |      | 228.6 |            | 224.5      |
| B2 [mm]                                        | 162                           |     | 200 |         |      | 250   | 258        | 269        |
| B3 [mm]                                        | 146                           |     |     | 166     |      |       | 250        | 268        |
| B4 [mm]                                        | 149                           |     |     | 169     |      |       | 250        | 268        |
| H1 [mm]                                        | 61                            | 70  | 73  | 82      | 86   | 98    | 135        |            |
| H2 [mm]                                        | 61                            | 70  | 73  | 82      | 86   | 98    | 135        |            |
| H3 [mm]<br>crossover relief<br>valves          | without                       | 67  | 72  | 78      | 83   | 89    | 120        | 134        |
|                                                | with fixed setting            | 108 | 116 | 119     | 128  | 137   | -          | -          |
|                                                | with dual pressure<br>setting | 129 | 137 | 140     | 149  | 158   | -          | -          |
| H4 [mm]                                        | 69                            |     |     | 79      | 83   | 88    | 132        | 133        |
| H5 [mm]                                        | 64                            | 69  | 75  | 80      | 86   | 132   | 133        |            |
| L1 [mm]                                        | 41                            | 56  |     |         | 75   |       |            |            |
| L2 [mm]                                        | 193                           | 202 | 229 | 254     | 277  | 314   | 336        |            |
| L3 [mm]                                        | 191                           | 200 | 227 | 252     | 275  | 305   | 336        |            |
| L, U                                           | M22x1.5                       |     |     |         |      |       | M27X2      |            |
| E<br>connection for anti-cavitation oil supply | M18x1.5                       |     |     | M22x1.5 |      |       | -          | -          |

\*) For dimensions of HMF 35-02 P, 55-02 P, 75-02 P and 105-02 P, please see the installation drawing

Metric connection thread according to ISO 6149-1

Locking thread for the SAE high pressure-connections. Metric according to ISO 261

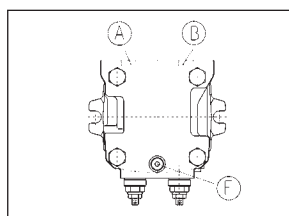
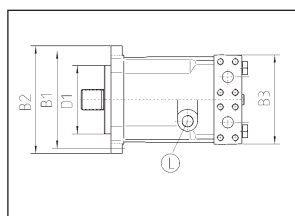
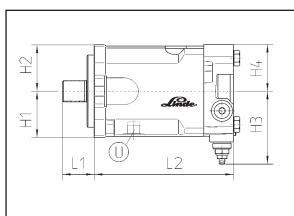
Hexagon socket head cap screws according to ISO 4762

Further threads are available on request

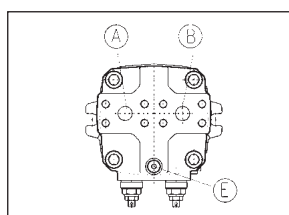
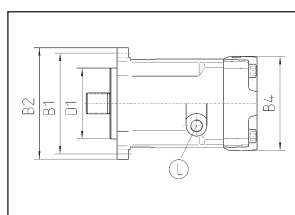
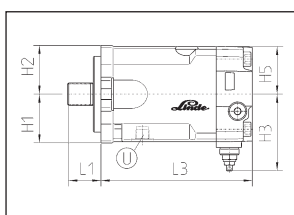
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### Radial high pressure-connections

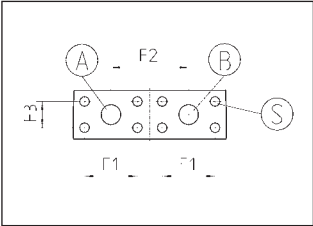


### Axial high pressure-connections



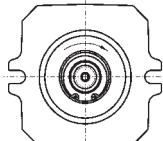
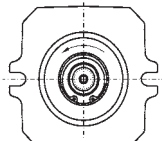
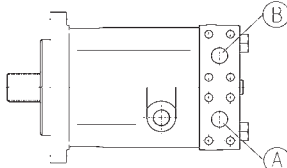
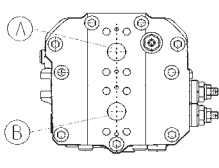
# Dimensions.

## Connections



| Rated size | 28/35 | 50/55 | 75   | 105 | 135 | 165  | 210 | 280 | 135D |
|------------|-------|-------|------|-----|-----|------|-----|-----|------|
| F1 [mm]    | 50.8  |       | 57.2 |     |     | 66.6 |     |     | 57.2 |
| F2 [mm]    | 74    |       | 84   |     |     | 102  |     |     | 84   |
| F3 [mm]    | 23.8  |       | 27.8 |     |     | 31.8 |     |     | 27.8 |
| A,B [mm]   | ¾"    |       | 1"   |     |     | 1 ¼" |     |     | 1 ¼" |
| S [mm]     | M10   |       | M12  |     |     | M14  |     |     | M12  |

## Input flow and drive shaft rotation

|                                                                                                                                                                       |                  |                                          |                                                                                    |                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| High pressure at port                                                                                                                                                 |                  | Shaft output<br>direction<br>of rotation |  |  |
|   | HMV-02           | B                                        | A                                                                                  |                                                                                     |
|                                                                                                                                                                       | HMV-02 [E6]      | A                                        | B                                                                                  |                                                                                     |
|                                                                                                                                                                       | HMR-02<br>HMA-02 | B                                        | A                                                                                  |                                                                                     |
|                                                                                                                                                                       | HMF-02           | A                                        | B                                                                                  |                                                                                     |

# Modular system features.

The Series 02 motors are based on a modular system with the following characteristics. This enables our distribution partners to configure the product according to your requirements. The latest characteristics and available options can be taken from the model code, which is available on our homepage.

- >> V<sub>min</sub>
  - >> Mounting flange
  - >> Drive shaft
  - >> V<sub>max</sub> control
  - >> Control orifice
  - >> Secondary valves
  - >> Direction of HP-connections
  - >> Purge valve setting
  - >> Shuttle valve
  - >> Drain port U, L1, L2
  - >> Coupling flange
- >> PTO Through-Drive
  - >> Port threads
  - >> Type of control
  - >> Remote control pressure
  - >> Start of control
  - >> Voltage for E-controls
  - >> Connectors for E-controls
  - >> Displacement fixing
  - >> Speed sensor
  - >> Pilot pressure compensation
  - >> Surface treatment