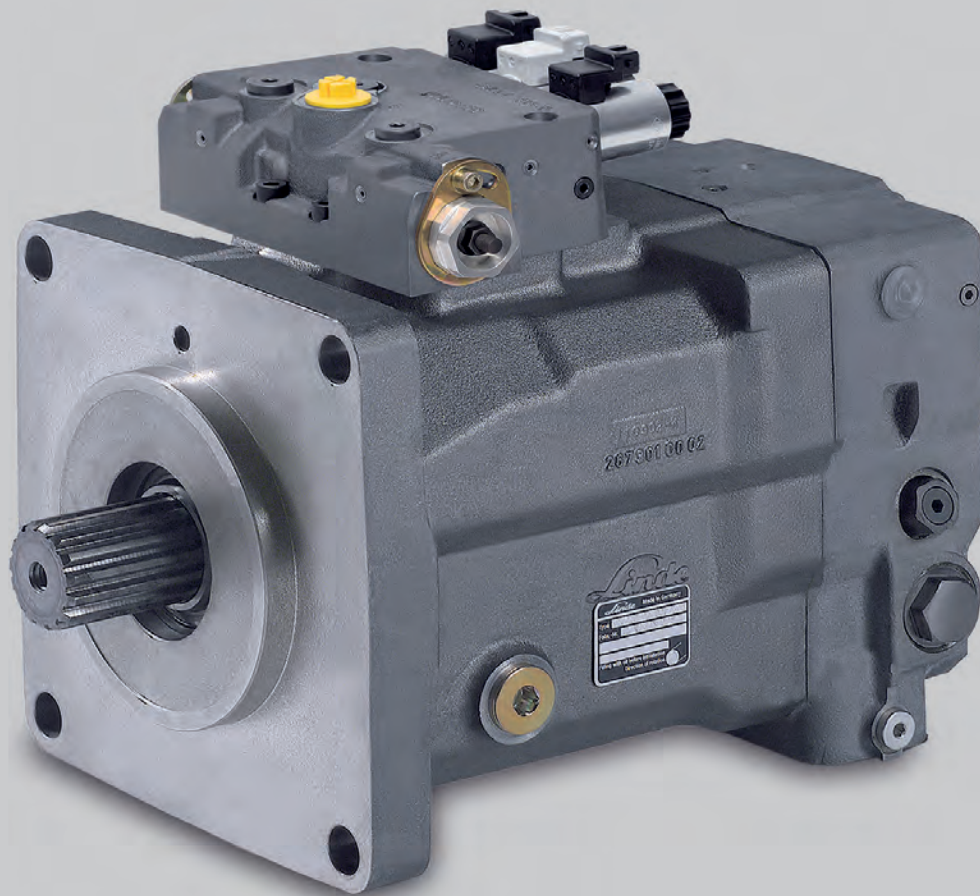


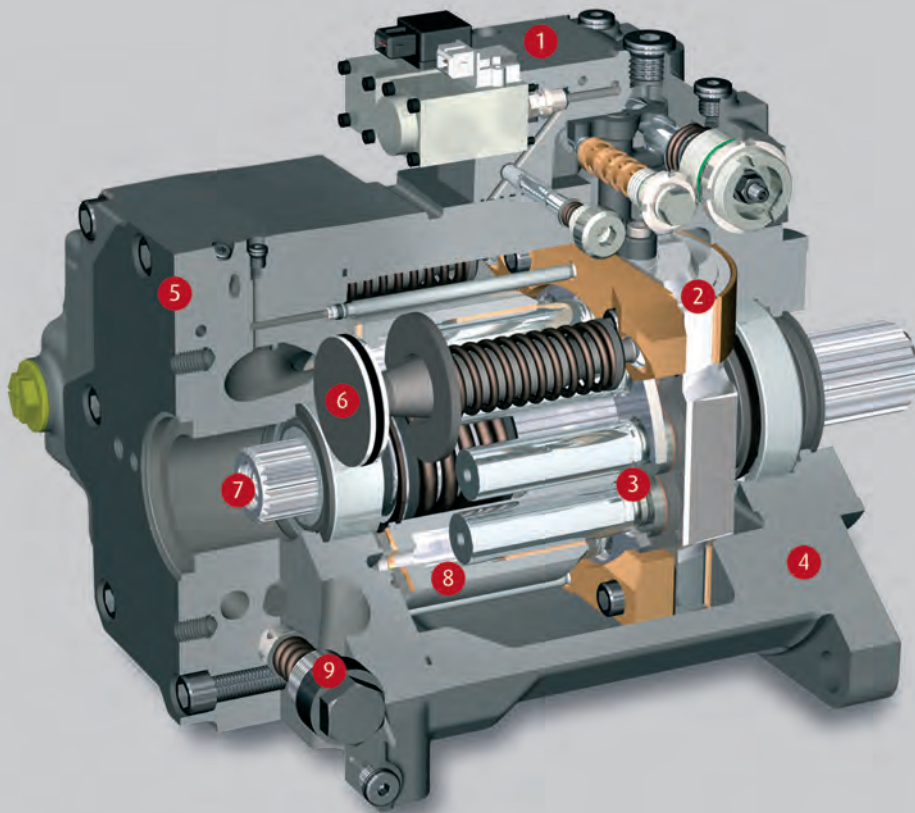
# HPV-02.

Variable pumps for  
closed loop operation.

Linde Hydraulics

*Linde*





- 1 control device**  
modular design, precise and load-independent
- 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 through shaft**  
for additional pumps
- 8 cylinder barrel**  
compact due to 21° technology
- 9 integrated pressure relief valves**  
for system and boost pressure

## Design characteristics

- >> axial piston pump in swashplate design for high pressure closed loop systems
- >> clockwise or counter clockwise rotation
- >> exact and rugged servo control devices (mechanical, hydraulic, electro-hydraulic)
- >> integrated high pressure relief valves with make-up function
- >> integrated low pressure relief valves for boost, control and cooler circuits
- >> replaceable cartridge filter
- >> SAE high pressure ports
- >> SAE mounting flange with ANSI or SAE spine shaft
- >> through shaft SAE A, B, B-B, C, D and E
- >> boost pressure pumps for internal and external suction, integrated cold start relief valve optional
- >> hydrostatic bearings of the rotating group compensate for axial forces
- >> optional tandem and multiple pumps

## Product advantages

- >> compact design
- >> high power density
- >> dynamic response
- >> high reliability
- >> long service life
- >> noise-optimized
- >> precise and load-independent servo control

## Data Sheets Linde Hydraulics.

Find the right products for your application.

### Product range

| Product          |                      | Application                    | Linde product name |
|------------------|----------------------|--------------------------------|--------------------|
| Pump             | Self-regulating pump | open loop operation            | HPR-02             |
|                  | <b>Variable pump</b> | <b>closed loop operation</b>   | <b>HPV-02</b>      |
| 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 | HMF-02, CMF        |
|                  |                      | open loop operation            | HMF-02 P           |
|                  |                      | closed and open loop operation | HMA-02             |
| Valve Technology | LSC manifold plate   | open loop operation            | VT modular         |
|                  | Pilot valve block    | open loop operation            | VD7S               |
| Electronics      | Electronic Control   | closed and open loop operation | iCon               |
|                  | Software             | diagnosis and configuration    | LinDiag®           |

## Content HPV-02.

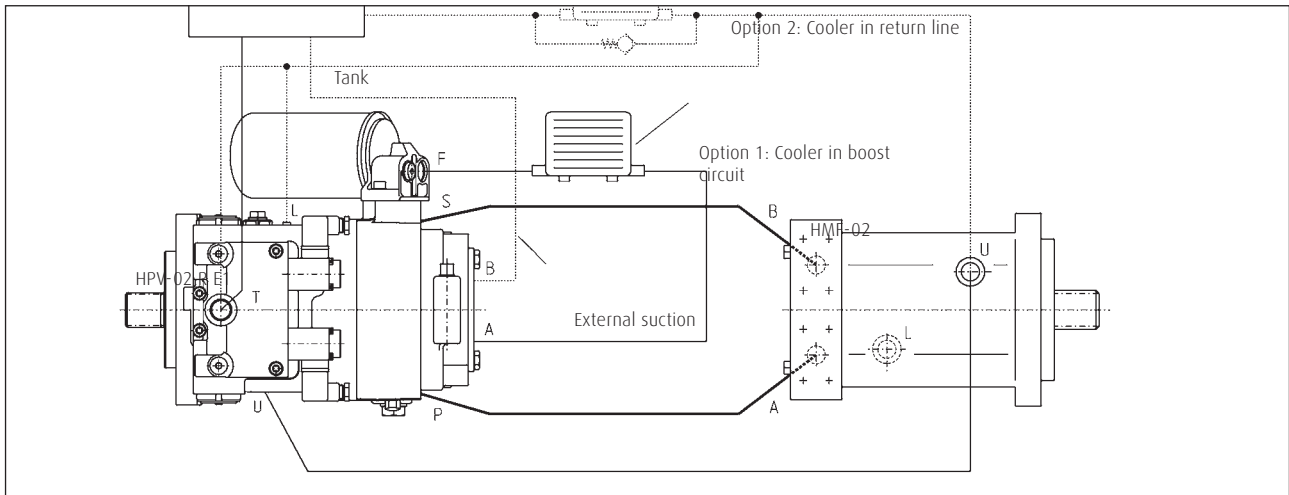
|                              |    |                         |    |
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| General technical data       | 5  | >> M-controls           | 25 |
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The data on which this brochure is based correspond to the 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.

## The closed loop.

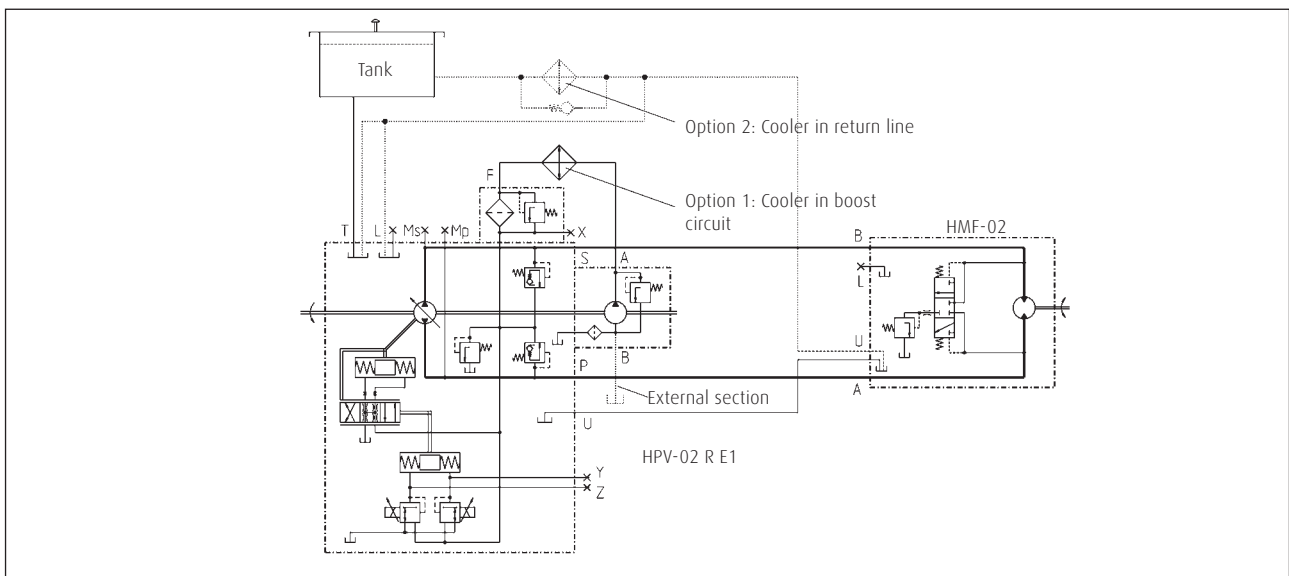
Representation of the hydraulic components of a closed loop hydrostatic drive: Variable electro-hydraulic controlled pump HPV-02 E1 and fixed displacement motor HMF-02 plus filter, cooler and oil tank. The function diagram and the circuit diagram show two types of cooling.

### Function diagram



### Circuit diagram

The boost pump is shown with internal and external suction.



### 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       | HPV105-02<br>R<br>2553   | Series 02 variable pump, rated size 105<br>Right hand rotation<br>the last 4 figures of the Bill of Material |
| Serial-No. | H2X<br>264<br>T<br>12345 | Type number of HPV 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.

The table shows the complete capacity range of the pumps, while the diagram below shows the recommended practical range for the different nominal sizes of the HPV-02 pump with control limit between 200 bar  $\Delta p_{min}$  and 280 bar  $\Delta p_{max}$ . It enables initial selection of the required nominal pump size.

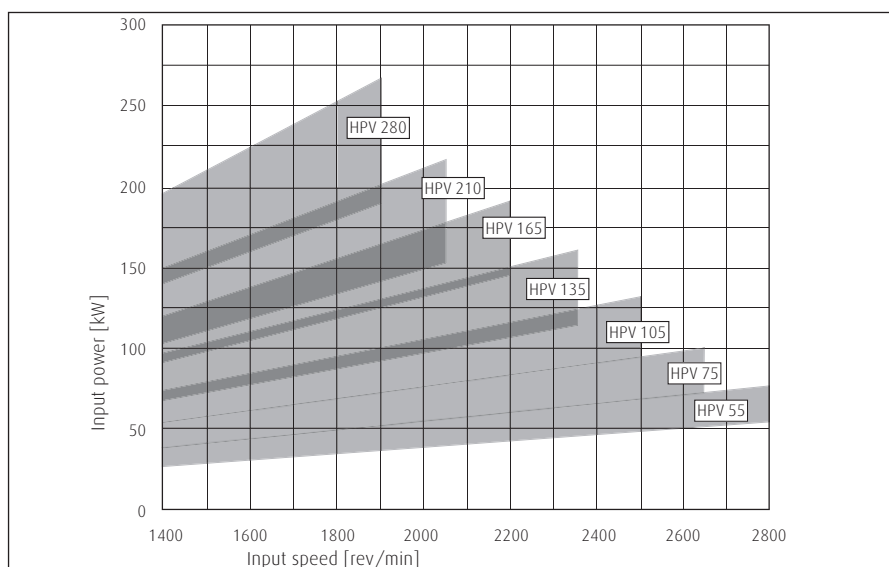
### Overview of technical data

| Rated size                                                      |                                                                    |                                        | 55         | 75   | 105  | 135   | 165   | 210   | 280   |
|-----------------------------------------------------------------|--------------------------------------------------------------------|----------------------------------------|------------|------|------|-------|-------|-------|-------|
|                                                                 | Maximum displacement                                               | cc/rev                                 | 54.7       | 75.9 | 105  | 135.7 | 165.6 | 210.1 | 281.9 |
| Speed                                                           | Max. operating speed                                               | rpm                                    | 3900       | 3400 | 3200 | 3000  | 2750  | 2300  | 2400  |
|                                                                 | Maximum speed*                                                     | rpm                                    | 4150       | 3600 | 3400 | 3200  | 2950  | 2500  | 2550  |
|                                                                 | Min. operating speed                                               | U/min                                  | 500        |      |      |       |       |       |       |
| Pressure                                                        | Nominal pressure                                                   | bar                                    | 450        |      |      |       |       |       |       |
|                                                                 | Maximum pressure**                                                 | bar                                    | 500        |      |      |       |       |       |       |
|                                                                 | Perm. housing pressure                                             | bar                                    | 2.5        |      |      |       |       |       |       |
| Torque                                                          | Torque<br>( $\Delta p=430$ bar; charge pressure=20 bar)            | Nm                                     | 374        | 519  | 719  | 929   | 1133  | 1438  | 1929  |
| Power                                                           | Corner power (theoretical)                                         | kW                                     | 153        | 185  | 241  | 292   | 326   | 346   | 485   |
| Permissible shaft loads                                         | Axial                                                              | N                                      | 2000       |      |      |       |       |       |       |
|                                                                 | Radial                                                             | N                                      | on request |      |      |       |       |       |       |
| Perm. housing temperature                                       | Perm. housing temperature<br>with minimum perm. viscosity > 10 cSt | °C                                     | 90         |      |      |       |       |       |       |
| Weights<br>inclusive IGP (Size 55-135)<br>or EGP (Size 210-280) | Weight, approx.<br>Without oil, with H1 control                    | kg                                     | 46         | 49   | 66   | 72    | 113   | 132   | 164   |
|                                                                 | Filling volume HPV-02<br>housing with filter                       | dm <sup>3</sup>                        | 2.1        | 2.8  | 3.4  | 3.8   | 4.2   | 4.8   | 5.5   |
|                                                                 | Maximum moment of inertia                                          | kgm <sup>2</sup> x<br>10 <sup>-2</sup> | 0.54       | 0.84 | 1.49 | 2.2   | 3.11  | 4.77  | 9.38  |

\* highest transient speed, that can temporarily occur

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

### Recommended operating range of HPV-02



# 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 Δp on average
- >> Max. pressure only at reduced displacement
- >> Viscosity 15 ... 30 cSt
- >> Power continuous power or lower
- >> Purity of fluid 18/16/13 in ac. 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 Δp on average
- >> Viscosity less than 10 cSt
- >> Power continuous operation close to max. power
- >> Purity of fluid lower than 18/16/13 in acc. with ISO 4406

## Operational parameters. Filtration

In order to guarantee long-term proper function and high efficiency of the hydraulic pumps 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 4059  
18/16/13 corresponds to 8A/7B/7C  
20/18/15 9A/8B/8C

## Filters

Units of the HPV-02 series can be equipped with a pure charge pressure manifold or with a combined charge pressure and filter flange manifold. The following filter sizes are available, depending on the rated size of the unit. Further details about the mounting of the charge pressure manifold see section "Dimensions. Modular System".

| Filter | 55 | 75 | 105 | 135 | 165 | 210 | 280 |
|--------|----|----|-----|-----|-----|-----|-----|
| Nr. 2  | x  |    |     |     |     |     |     |
| Nr. 3  | x  | x  | x   | x   | x   | x   | x   |

# Operational parameters. Pressure Fluids and mounting orientation

In order to ensure the functional performance and high efficiency of the hydraulic pumps 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.

### Recommend 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                                 |

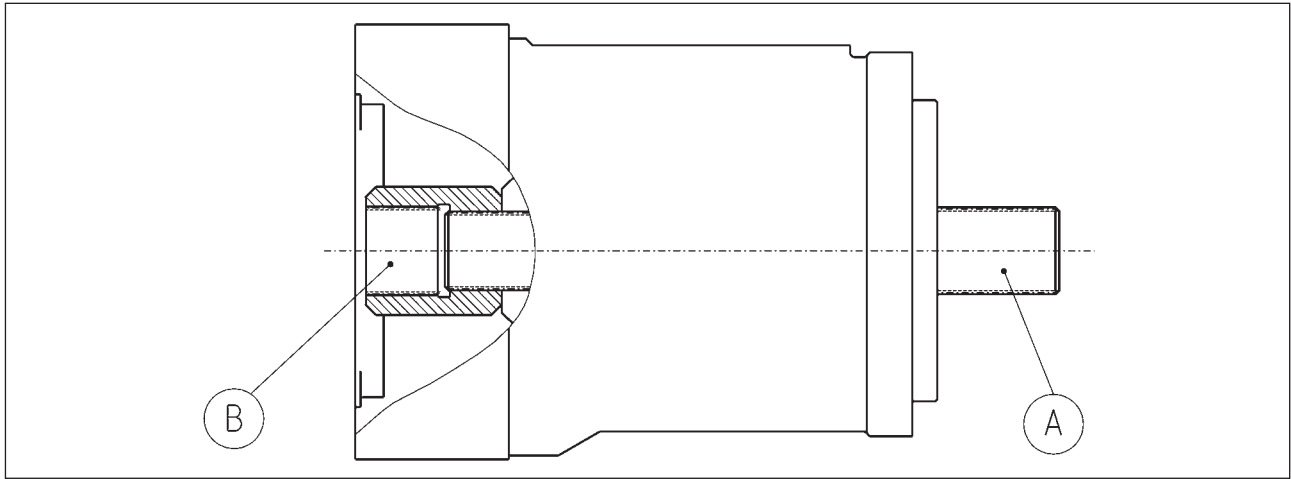
### Mounting orientation

The preferred mounting orientation is generally horizontal. Special pump configurations for vertical mounting with the drive shaft pointing either upward or downward are available for selected rated sizes and have to be requested separately. For further information concerning the installation of the unit please refer to the operating instructions manual.

# Torque transmission.

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

## Torque transmission of HPV-02

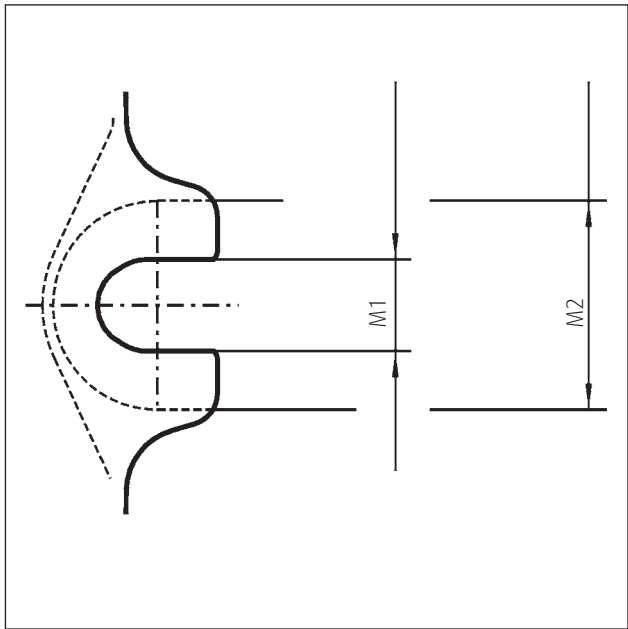


This shows the input side (A) und PTO-/output side (B) of a HPV-02 pump. The information on the following pages refers to  
>> mounting flange and drive shaft (A)  
>> PTO flange and through shaft (B).

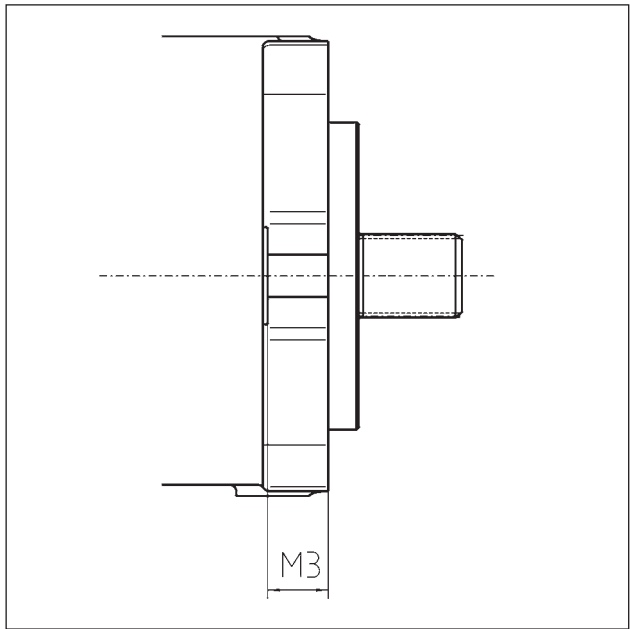
### A) Flange profile

| Bolt hole dimensions |    |      |      |      |      |      |     |     |
|----------------------|----|------|------|------|------|------|-----|-----|
|                      |    | 55   | 75   | 105  | 135  | 165  | 210 | 280 |
| M1 inside diameter   | mm | 17.5 | 17.5 | 17.5 | 21.5 | 21.5 | 22  | 22  |
| M2 outside diameter  | mm | 34   | 40   | 34   | 40   | 40   | 38  | 39  |
| M3 length            | mm | 20   | 20   | 25   | 20   | 25   | 30  | 30  |

#### Bolt hole diameter



#### Bolt hole length

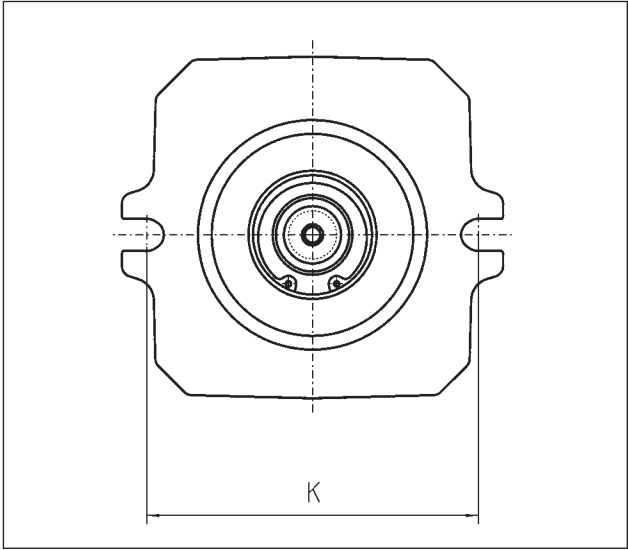


# Torque transmission. Mounting flange

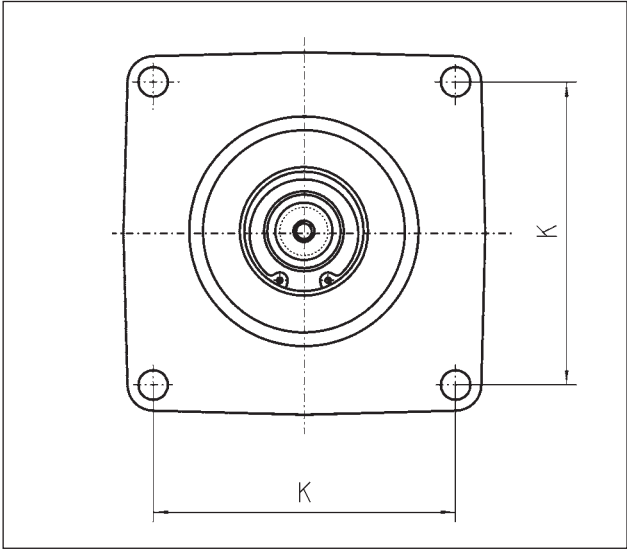
| Mounting flange<br>in accordance with SAE J744        | For rated<br>size | Mounting |       |                      |                     | Dimensions |           |           |           |
|-------------------------------------------------------|-------------------|----------|-------|----------------------|---------------------|------------|-----------|-----------|-----------|
|                                                       |                   | Washer   | Screw | Torque (8.8)<br>[Nm] | Torque (10.9)* [Nm] | K<br>[mm]  | H<br>[mm] | V<br>[mm] | G<br>[mm] |
| SAE C, 2 hole                                         | 55, 75, 105       | 17x33x10 | M16   | 195                  | 275                 | 181.0      | -         | -         | -         |
| SAE C, 2 hole<br>with 4 additional threads M12        | 75 & 105          | 17x33x10 | M16   | 195                  | 275                 | 181.0      | -         | -         | 114       |
| SAE D, 2 hole                                         | 135               | 21x37x8  | M20   | 385                  | 540                 | 228.6      | -         | -         | -         |
| SAE D, 2 hole<br>with 4 additional threads M16        | 135               | 21x37x8  | M20   | 385                  | 540                 | 228.6      | -         | -         | 138       |
| SAE D 2 hole<br>with additional bolt holes (d=17.5mm) | 135 & 165         | 21x37x8  | M20   | 385                  | 540                 | 228.6      | 230       | 190       | -         |
| SAE E, 4 hole                                         | 210 & 280         | -        | M20   | 385                  | 540                 | 224.5      | -         | -         | -         |

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

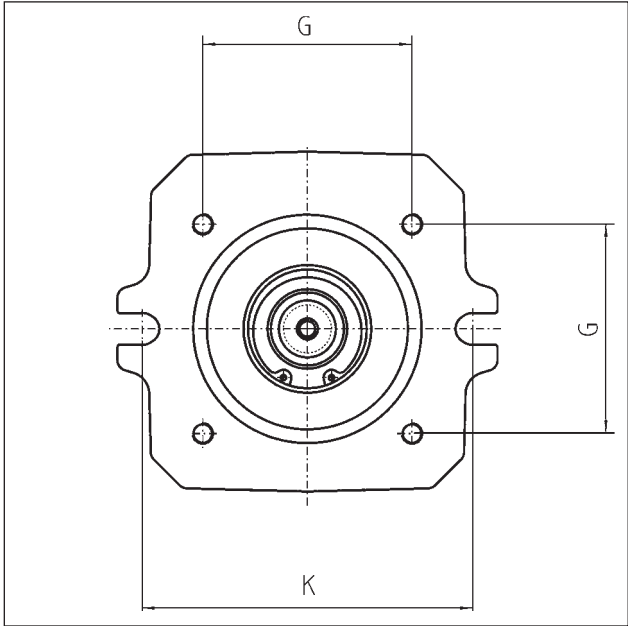
2-hole flange



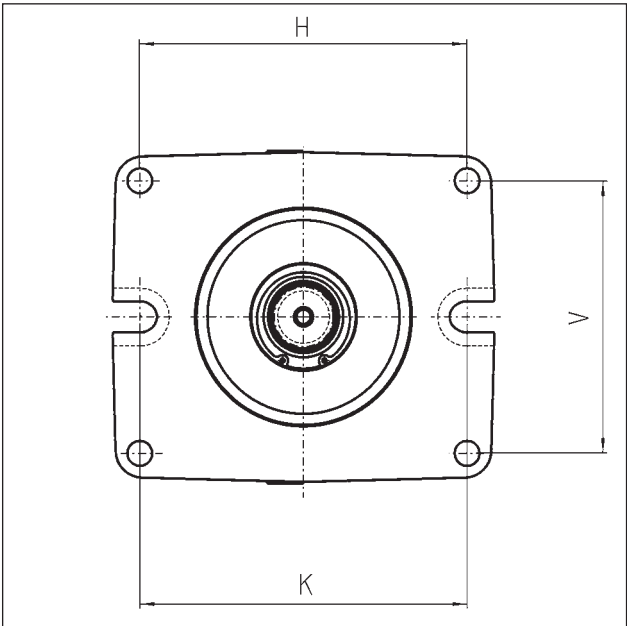
4-hole flange



2-hole flange  
with 4 additional threaded holes



2-hole flange  
with 4 additional bolt holes



## A) Dimensions ANSI and SAE drive shafts

| Shaft spline<br>(in accordance with<br>ANSI B92.1) | SAE-J744<br>code<br>(for centring and<br>shaft) | Outside<br>diameter<br>[mm] | Useable spline<br>length<br>[mm] | Shaft type | Available for rated size |    |     |     |     |     |     |
|----------------------------------------------------|-------------------------------------------------|-----------------------------|----------------------------------|------------|--------------------------|----|-----|-----|-----|-----|-----|
|                                                    |                                                 |                             |                                  |            | 55                       | 75 | 105 | 135 | 165 | 210 | 280 |
| 12/24, 14 t                                        | C                                               | 31.22                       | 30                               | 2          | x                        | x  | x   |     |     |     |     |
| 16/32, 21 t                                        |                                                 | 34.51                       | 39.5                             | 1          | x*                       | x* |     |     |     |     |     |
| 12/24, 17 t                                        | C-C                                             | 37.68                       | 30                               | 2          |                          |    | x   | x   |     |     |     |
| 16/32, 23 t                                        |                                                 | 37.68                       | 38.5                             | 1          |                          |    | x*  |     |     |     |     |
| 8/16, 13 t                                         | D, E                                            | 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*  |

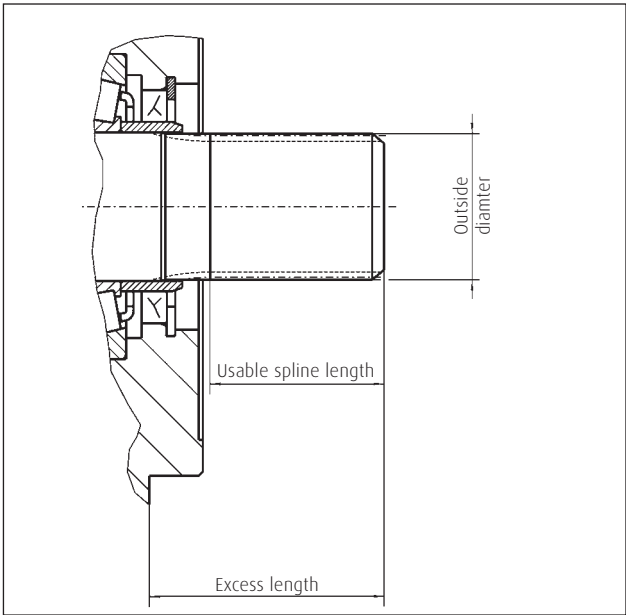
\*) Recommended for tandem configurations

## A) Maximum input torque

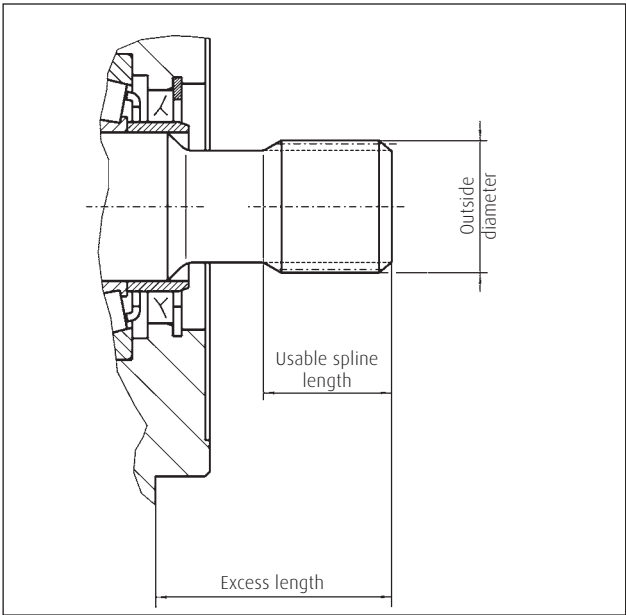
| Rated size        |    | 55            | 75            | 105           | 135           | 165           | 210          | 280           |
|-------------------|----|---------------|---------------|---------------|---------------|---------------|--------------|---------------|
| Shaft             |    | 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 |
| Continuous torque | Nm | 435           | 604           | 836           | 1080          | 1318          | 1672         | 2243          |
| Maximum torque    | Nm | 649           | 900           | 1245          | 1609          | 1964          | 2491         | 3343          |
| Excess length     | mm | 54            | 55            | 55            | 75            | 75            | 75           | 75            |

## A) Linde Hydraulics shaft types

### Type 1. Without undercut



### Type 2. With undercut



# Torque transmission. PTO flange

Linde pumps can be combined into tandem and multiple pumps. The combination options are determined by the permitted transfer torque. The following data refers to the PTO (pump output side, without further attachments).

## B) PTO dimensions

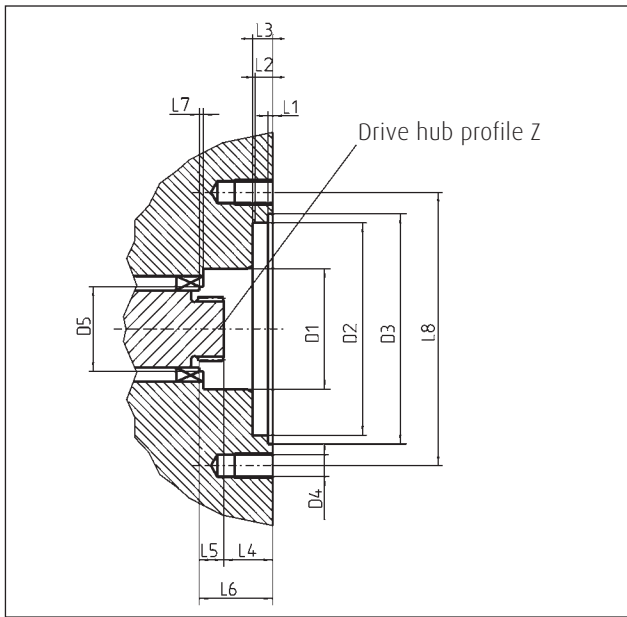
| Rated size                                           |    | 55             | 75             | 105            | 135            | 165            | 210            | 280            |
|------------------------------------------------------|----|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| Z Drive hub profile<br>in accordance with ANSI B92.1 |    | 16/32,<br>15 t | 16/32,<br>18 t | 16/32,<br>19 t | 16/32,<br>21 t | 16/32,<br>22 t | 16/32,<br>24 t | 16/32,<br>27 t |
| D1                                                   | mm | 40             | 42             | 48             | 52             | 63             | 63             | 72             |
| D2 spigot pilot diameter                             | mm | 82.55          |                |                |                |                |                |                |
| D3                                                   | mm | 88             |                |                |                | 89.5           | 89.5           |                |
| D4                                                   | mm | M 10           |                |                |                |                |                | M12            |
| D5 max. bearing clearance                            | mm | 30             | 35             | 38             | 43             | 44.5           | 47             | 49             |
| L1                                                   | mm | 1.5            |                |                |                | 1.9            |                |                |
| L2 adapter length                                    | mm | 7              |                |                |                | 8              |                |                |
| L3                                                   | mm | 9              |                |                |                |                |                |                |
| L4 minimum distance                                  | mm | 35             | 39             | 33             | 35             | 37             | 38.5           | 50.5           |
| L5 usable spline length                              | mm | 14             | 18             | 19             | 20             | 25             | 29             | 30.6           |
| L6 distance to bearing                               | mm | 51             | 57.5           | 53             | 55.9           | 63.1           | 68.3           | 83             |
| L7 min. bearing clearance                            | mm | 3              | 3              | 3              | 4              | 3              | 3              | -              |
| L8 hole distance 2-hole                              | mm | 106.4          |                |                |                |                |                | 146            |

## B) Output shaft transfer torque

| Rated size                 |    | 55  | 75  | 105 | 135  | 165  | 210  | 280  |
|----------------------------|----|-----|-----|-----|------|------|------|------|
| Continuous transfer torque | Nm | 218 | 302 | 418 | 540  | 659  | 836  | 1122 |
| Max. transfer torque       | Nm | 431 | 598 | 763 | 1069 | 1305 | 1655 | 2221 |

## Torque transmission. Output shaft

### B) PTO dimensions



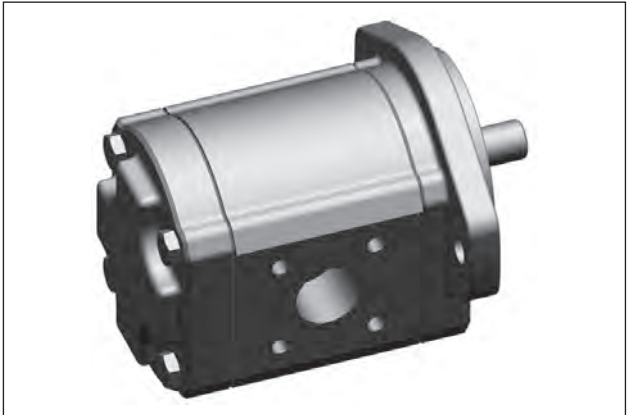
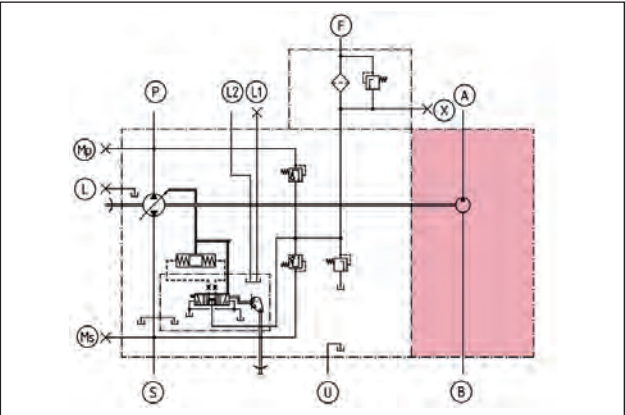
# Gear pumps.

Two types of gear pumps are available: internal gear pump IGP and external gear pump EGP. The possible combinations of and with IGP and EGP are determined by the PTO option and the permitted shaft torque. Both types can be used as charge pump for the main circuit or the control and cooling circuit. The allowable pressure at the suction port is between 0.8 bar (abs.) and 3.0 bar (abs.). The charge pressure relief valves for the rated sizes 55-135 are integrated in the port plate housing, and for the rated sizes 165-280 in the charge pressure manifold of the HPV-02.

## Technical data

|                                                                                                                |            |                                         |                  |                                         |                  |                   |                   |
|----------------------------------------------------------------------------------------------------------------|------------|-----------------------------------------|------------------|-----------------------------------------|------------------|-------------------|-------------------|
| Displacement volume                                                                                            | cc/rev     | 16                                      | 19               | 22.5                                    | 31               | 38                | 44                |
| Standard charge pump for HPV-02                                                                                | Rated size | 55-105                                  |                  | 75-135                                  | 165              | 210               | 280               |
| Type of gear pump                                                                                              |            | IGP                                     | EGP              | IGP                                     | EGP              | EGP               | EGP               |
| Mounting flange and drive shaft profile                                                                        |            | SAE A 16/32, 18 t                       | SAE A 16/32, 9 t | SAE A 16/32, 18 t                       | SAE A 16/32, 9 t | SAE A 16/32, 13 t | SAE A 16/32, 13 t |
| Type of suction                                                                                                |            | internal, external                      | external         | internal, external                      | external         | external          | external          |
| Max. perm. operating pressure<br><small>observe max. permissible rated pressures for filter and cooler</small> | bar        | 40                                      | 210              | 40                                      | 165              | 275               | 220               |
| Standard PTO flange and shaft spline                                                                           |            | SAE A 16/32, 9 t                        | -                | SAE A 16/32, 9 t                        | -                | -                 | -                 |
| Continuous output torque                                                                                       | Nm         | 175<br><small>75 Nm with SAE A</small>  | -                | 175<br><small>75 Nm with SAE A</small>  | -                | -                 | -                 |
| Max. output torque                                                                                             | Nm         | 250<br><small>107 Nm with SAE A</small> | -                | 250<br><small>107 Nm with SAE A</small> | -                | -                 | -                 |
| Cold start relief valve                                                                                        |            | integrated                              | -                | integrated                              | -                | -                 | -                 |

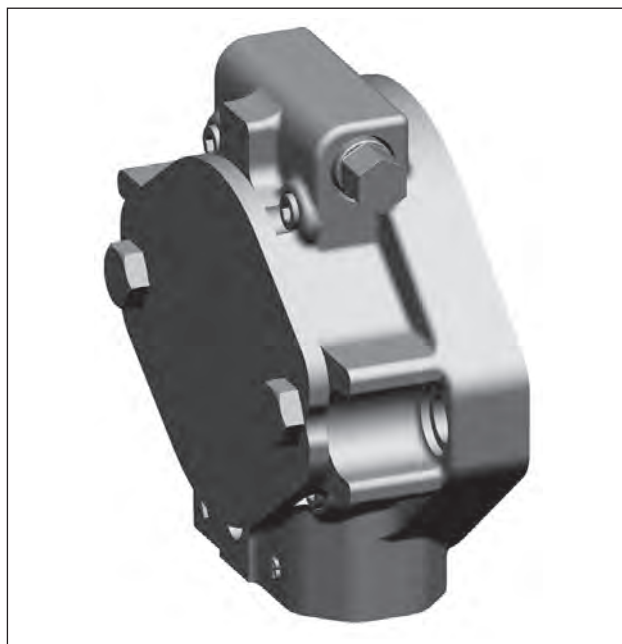
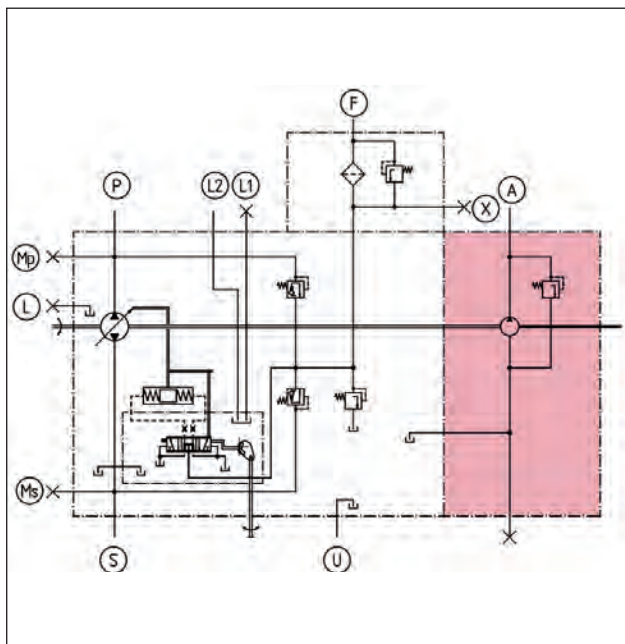
## External gear pump EGP



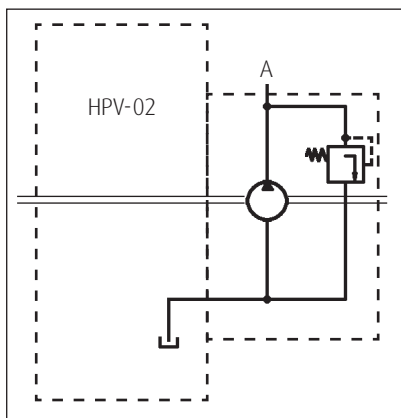
## Gear pumps.

The IGP charge pumps include a cold start relief valve and a through drive for attaching additional pumps. The suction can be internal, external or combined. IGP types are available in rated sizes of 16 cc/rev and 22.5 cc/rev.

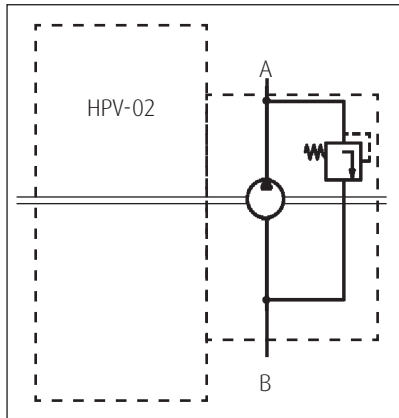
### Internal gear pump IGP with internal suction



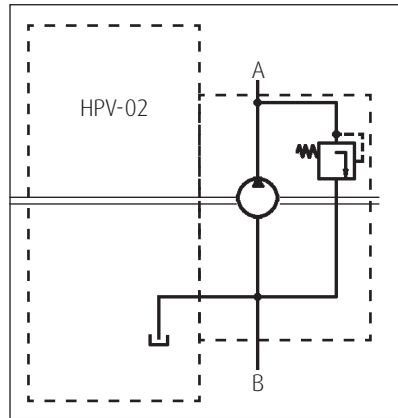
#### Internal suction



#### External suction



#### Combined suction



#### >> Internal suction

The charge pump supplies the main circuit with oil from the pump housing.  
External connection B is closed.

#### >> External suction

The charge pump supplies the main circuit with oil from the oil tank.  
The internal connection is closed.

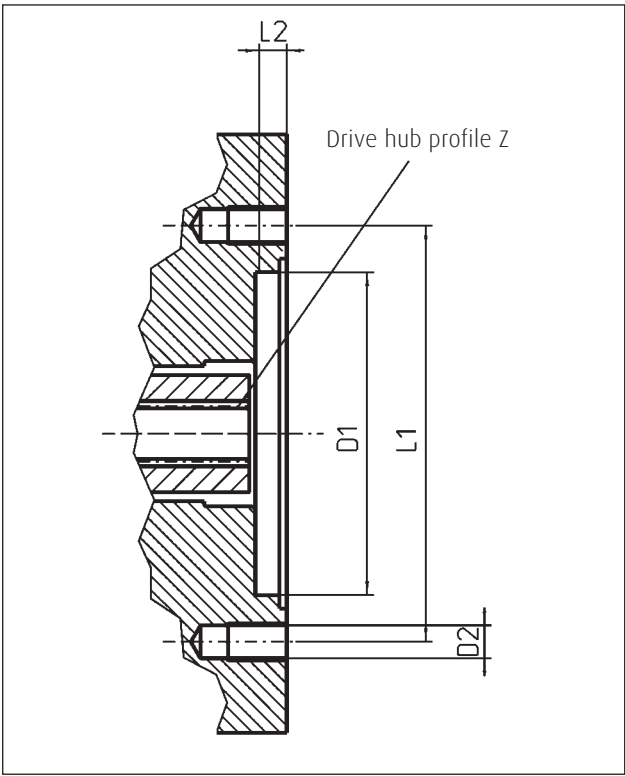
#### >> Combined suction

The charge pump supplies the main circuit with oil from the pump housing and oil tank.  
This type of suction is a combination of internal and external suction.

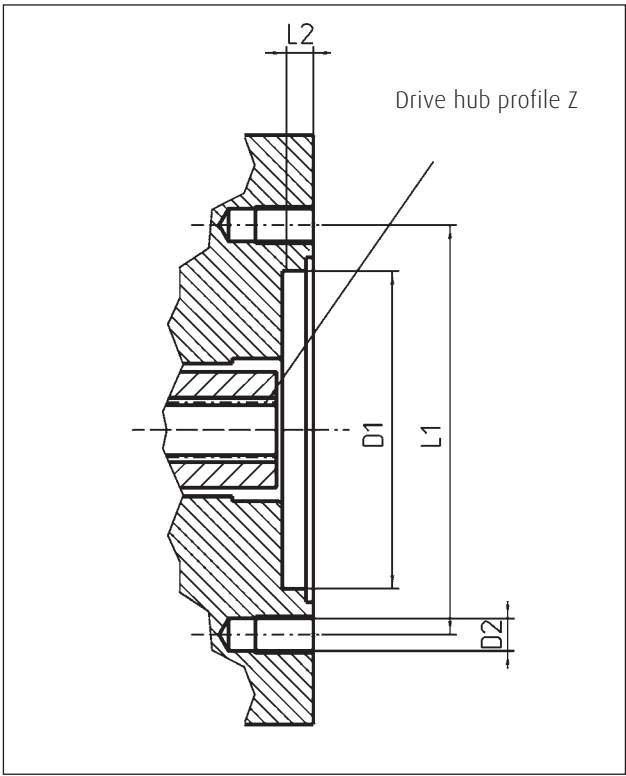
PTO flange with IGP

| Flange profile 2-hole                                         |    | SAE A      | SAE B       | SAE B-B     | SAE C       |
|---------------------------------------------------------------|----|------------|-------------|-------------|-------------|
| Z Internal drive hub profile<br>in accordance with ANSI B92.1 |    | 16/32, 9 t | 16/32, 13 t | 16/32, 15 t | 12/24, 14 t |
| D1 Spigot pilot diameter                                      | mm | 82.55      | 101.6       |             | 127         |
| D2 Thread size                                                | mm | M 10       | M 12        |             | M 16        |
| L1 Hole distance                                              | mm | 106.4      | 146         |             | 181         |
| L2 Adapter length                                             | mm | 7          | 11          |             | 13          |
| L3 Flange length                                              | mm | -          | 55          |             | 72          |
| Continuous transfer torque                                    | Nm | 75         | 175         |             |             |
| Maximum transfer torque                                       | Nm | 107        | 250         |             |             |

PTO SAE A with IGP



PTO SAE B, B-B and C with IGP



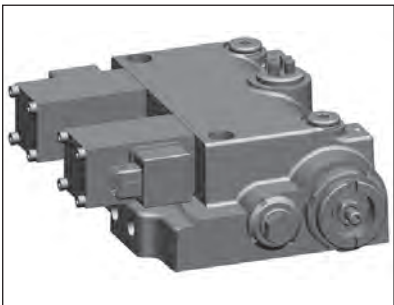
# Controls.

The modular control concept with standardised interface enables quick selection and adaptation for different customer and system requirements with mechanical, hydraulic or electronic control. All Series 02-controls feature an upstream signal circuit that is adapted to the respective control, and a standardised and load-independent servo control for simple and constantly available machine or vehicle control.

## Technical data

| Type of control | Additional option                | Name of control |
|-----------------|----------------------------------|-----------------|
| Mechanical      | proportional                     | M1R             |
| Hydraulic       | proportional                     | H1              |
|                 | with pressure cut-off regulation | H1P             |
|                 | speed dependent                  | CA              |
|                 | torque-/power controlled         | CA              |
| Electrical      | with additional safety function  | CA              |
|                 | proportional                     | E1              |
|                 | with pressure cut-off regulation | E1P             |
|                 | with additional safety function  | E2              |
|                 | 3 position                       | E5              |

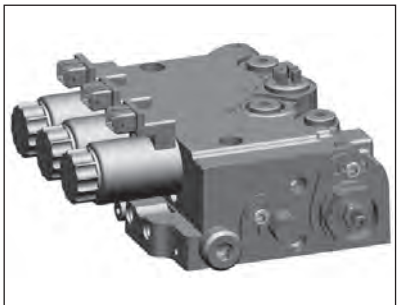
E1/E5-control



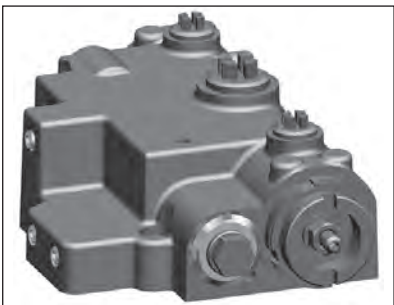
E1P-control



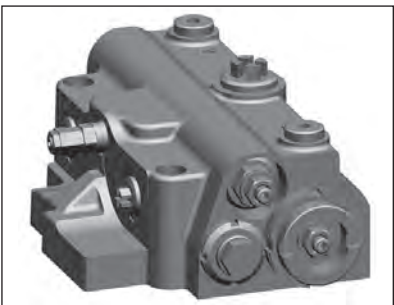
E2-control



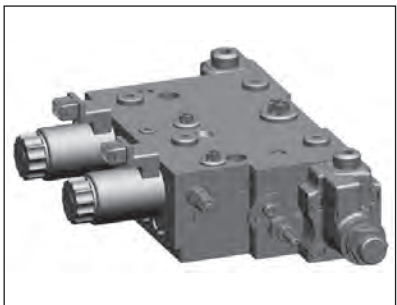
H1-control



H1P-control



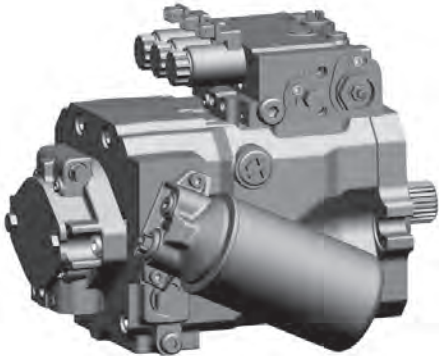
CA-control



M1R-control



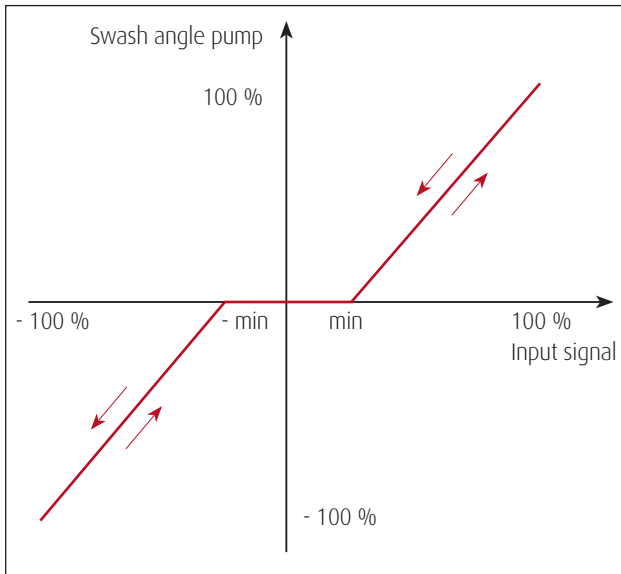
HPV-02 E2



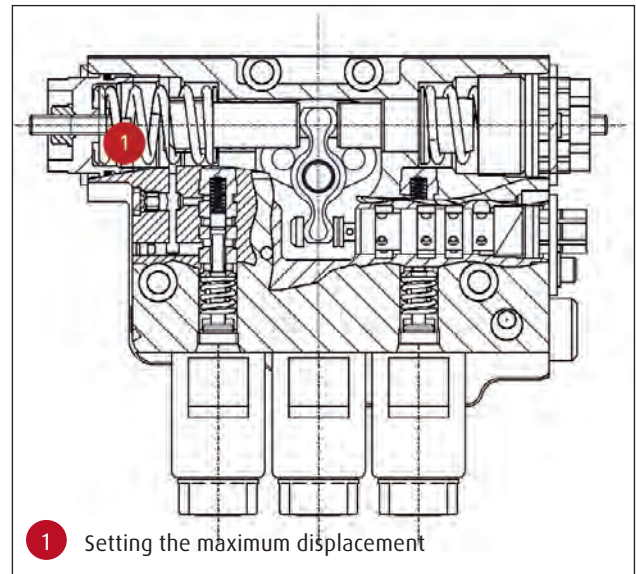
## Controls. Control accuracy

All Series 02-pump controls result in the same machine response for identical motion commands, irrespective of the control type. Corrective action by the operator is no longer required. The reliable control of the pump can easily be integrated into any kind of vehicle management control system.

### Control accuracy of a HPV-02 pump



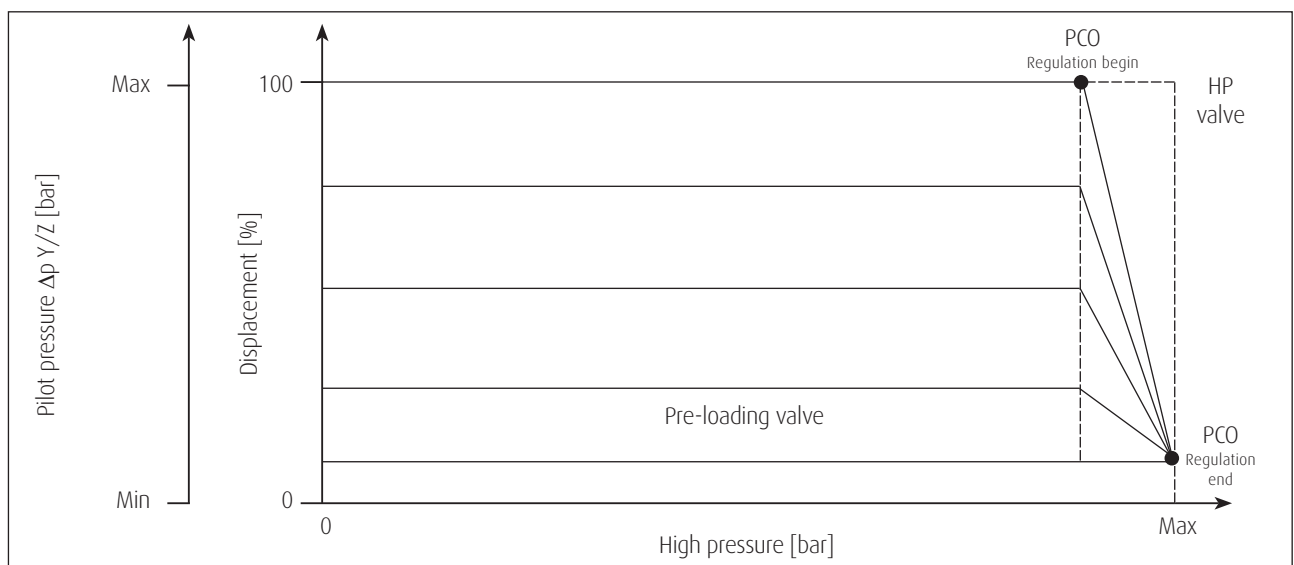
### E2-control



### Pressure cut-off regulation PCO

Special control elements deal with functions such as torque control or pressure cut-off regulation. Controls with pressure cut-off regulation (PCO) reduce pump flow when the cut-off pressure is reached. Because system pressure is maintained at low flow, the power consumption and thermal balance of the system are optimised.

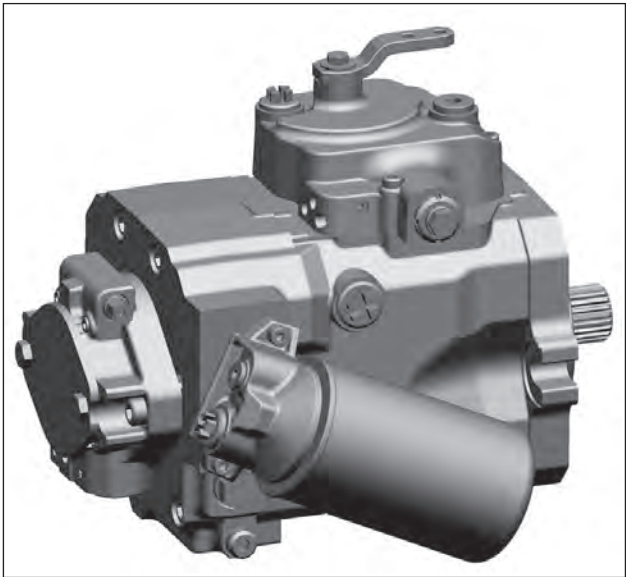
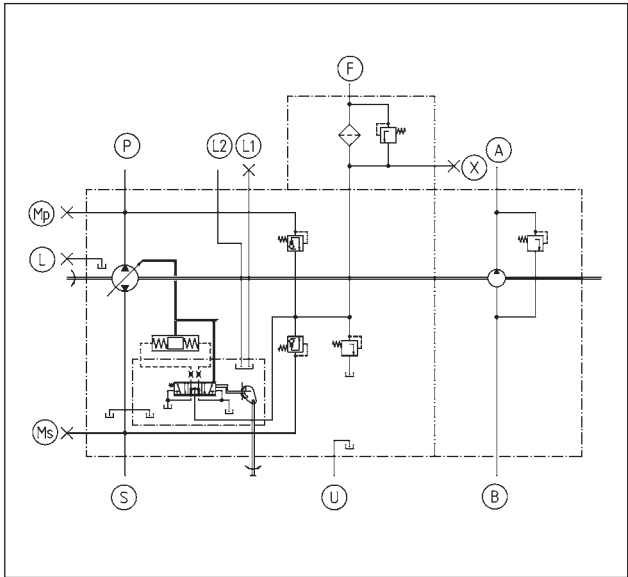
### Displacement relative to pilot pressure and pressure cut-off regulation for H- and E-controls



# Controls. Mechanical-hydraulic M

The M1R-pump control combines robustness with high precision for direct and reliable machine control. It is mechanically controlled and can be combined with a fixed, variable or regulating hydraulic motor. The control-specific data is independent of the nominal pump size.

## M1R Mechanical control

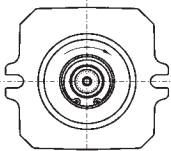
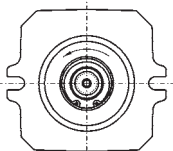
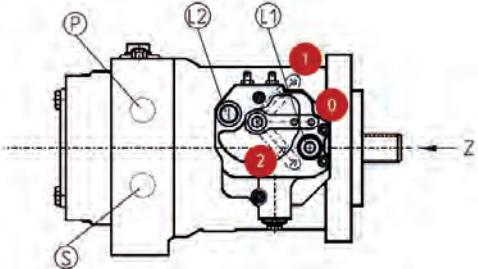


### Flow direction

By turning the control lever the pump flow rate and direction of flow are controlled via a cam plate. The flow direction of the fluid depends on

- >> the pump direction of rotation
- >> the over centre direction of the swash plate.

### High pressure outlet port

| Shaft rotation<br>(view on Z)                                                       |       |  |  |
|-------------------------------------------------------------------------------------|-------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
| Cam lever direction                                                                 |       | Right hand                                                                           | Left hand                                                                             |
|  | 0 → 1 | P                                                                                    | S                                                                                     |
|                                                                                     | 0 → 2 | S                                                                                    | P                                                                                     |

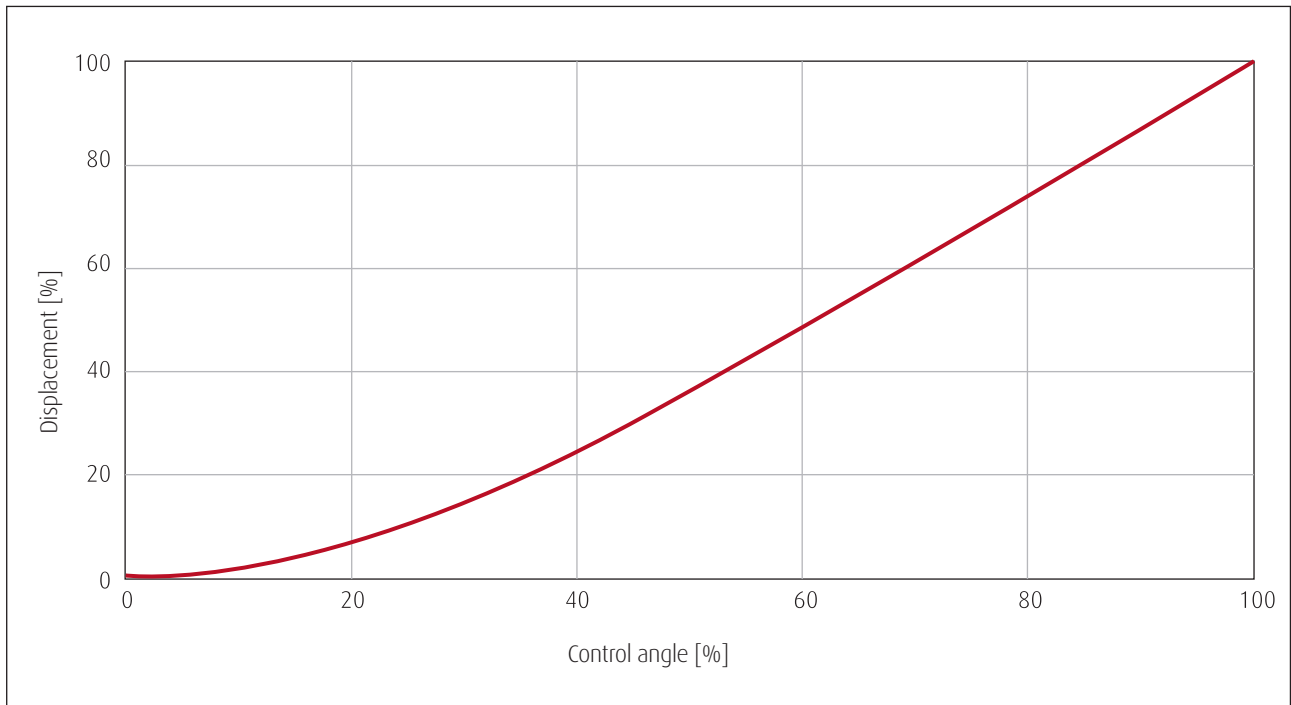
- P, S High pressure ports
- A Pressure port, charge pump
- B Suction port, charge pump
- F Feed port, charge and control
- X Test port, control pressure
- Ms, Mp Test ports, high pressure
- L, U Drain ports
- L1, L2 Vent ports

- Note for left hand rotation**
- A Suction port, charge pump
  - B Pressure port, charge pump

## Controls. Mechanical-hydraulic M

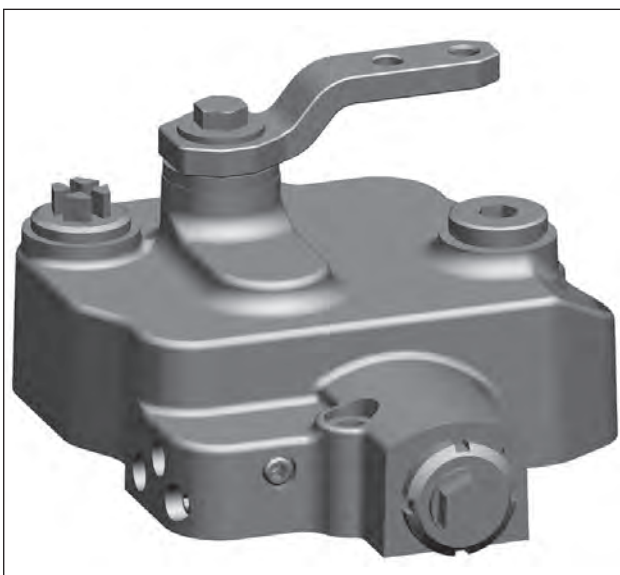
The cam plate offers a large control angle with progressive control characteristic and a wide neutral range. The resulting high resolution for movements from the neutral range (and vice versa) enables precise manoeuvring. Reliable and robust control of the displacement volume is achieved through position feedback.

### Displacement relative to control angle

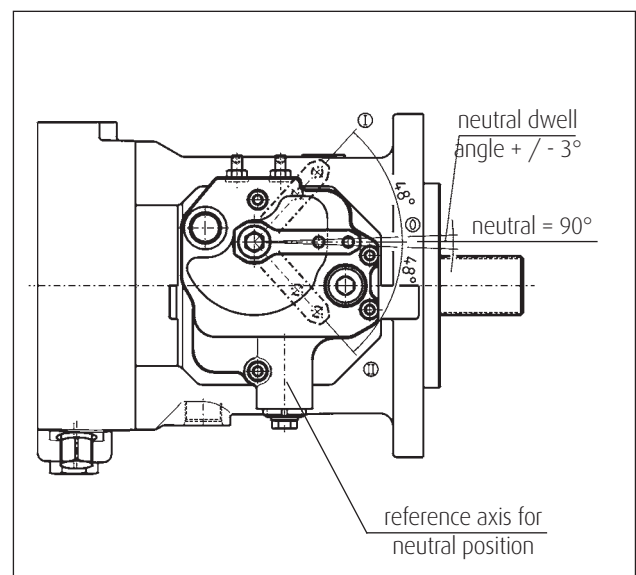


|                                                               |                                                   |
|---------------------------------------------------------------|---------------------------------------------------|
| Control force with max. long lever radius $r = 70 \text{ mm}$ | 17 N                                              |
| Max. permissible control force (intermittent)                 | 500 N                                             |
| Control torque                                                | < 1.0 Nm                                          |
| Control torque out of notch                                   | < 1.5 Nm                                          |
| Neutral position                                              | 24°, 90° (standard), 133°, 144°, 188°, 210°, 232° |
| Control angle neutral range ... to end position               | $\pm 3^\circ \dots \pm 48^\circ$                  |
| Minimum response time with standard restrictors               | 0.5 s                                             |

### M1R-cam plate



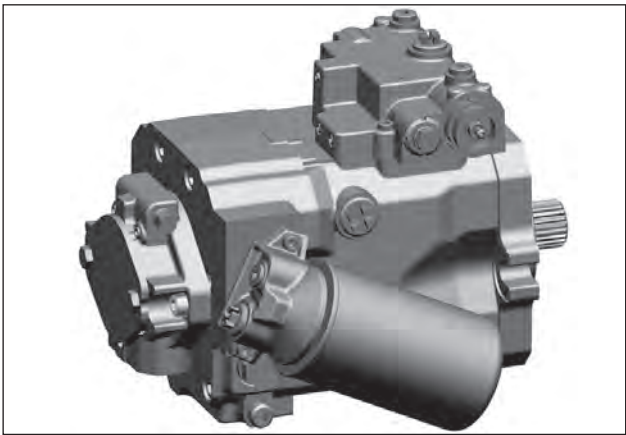
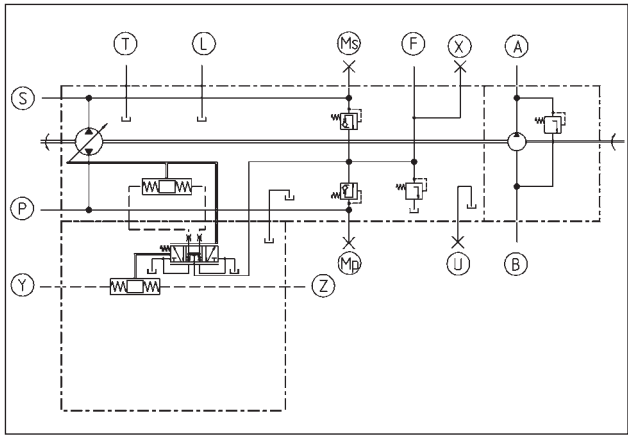
### Control range



# Controls. Hydraulic H

The HPV-02 H1 features hydraulic control with a wide pilot pressure range for improved machine control. It can be combined with a fixed, variable or regulating hydraulic motor. The data is specific for hydraulic controls, and independent of the nominal pump size and pressure cut-off regulation PCO, unless specified otherwise otherwise (see section Controls. Control accuracy).

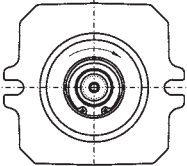
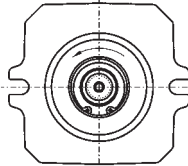
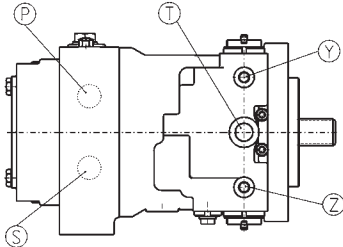
## H1. Hydraulic control



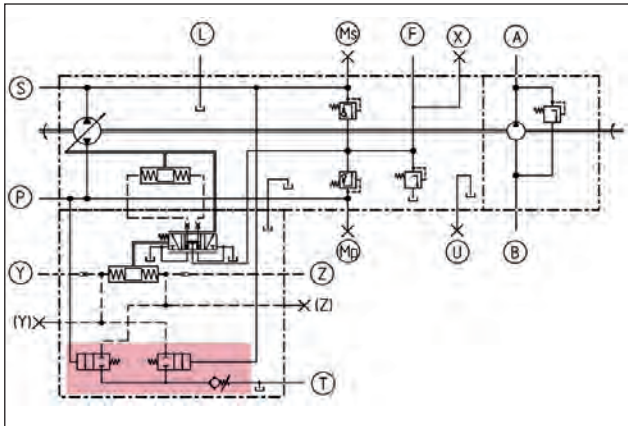
### Flow direction

By an external hydraulic signal input at the pilot pressure ports (Y, Z) the pump flow rate and direction of flow are controlled. The flow direction of the fluid depends on the pump direction of rotation and the over centre direction of the swash plate.

### High pressure outlet port

| Shaft rotation<br>(view on Z)                                                       |   |  |  |
|-------------------------------------------------------------------------------------|---|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  | Y | P                                                                                    | S                                                                                     |
|                                                                                     | Z | S                                                                                    | P                                                                                     |

## H1P. Hydraulic control with PCO



- P, S High pressure ports
- A Pressure port, charge pump
- B Suction port, charge pump
- F Feed port, charge and control
- X Test port, pilot pressure
- Ms, Mp Test ports, high pressure
- L, U Drain ports
- T Vent port
- Y, Z Pilot pressure ports

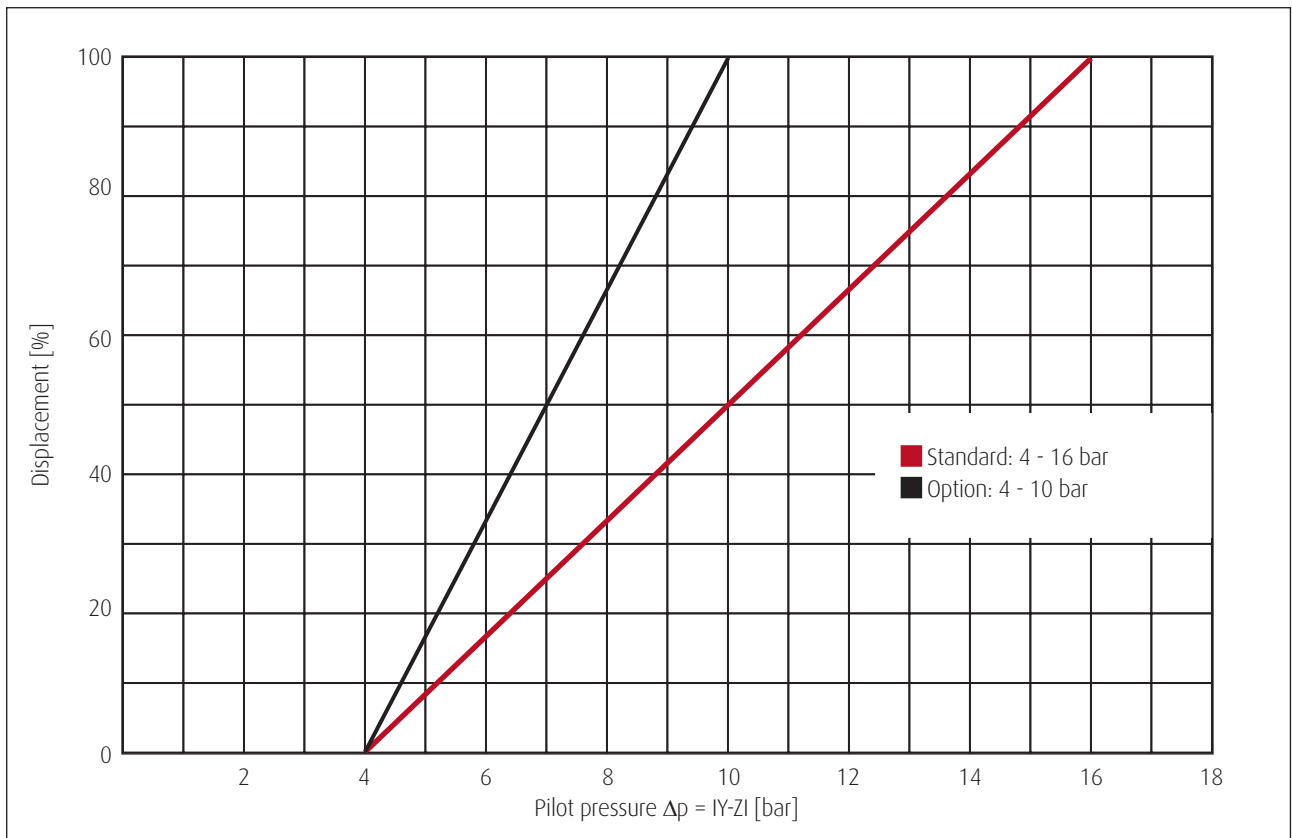
### Note for left hand rotation

- A Suction port, charge pump
- B Pressure port, charge pump

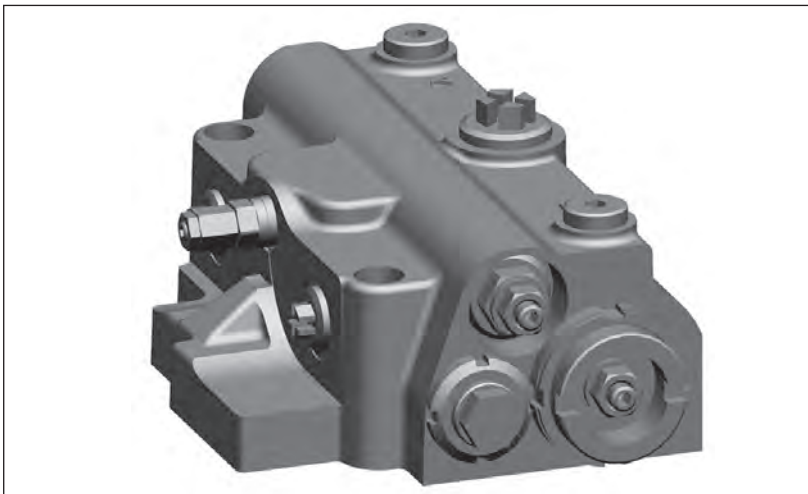
## Controls. Hydraulic H

|                                                                                        |                                                                  |
|----------------------------------------------------------------------------------------|------------------------------------------------------------------|
| Pilot pressure range                                                                   | standard: 4-16 bar, option: 4-10 bar differential pressure [Y-Z] |
| Maximum permissible pressure at Y or Z                                                 | 30 bar                                                           |
| Minimum response time with standard orifices<br>for one-way swashing between 0 and max | 0.5 s                                                            |

### Displacement relative to pilot pressure



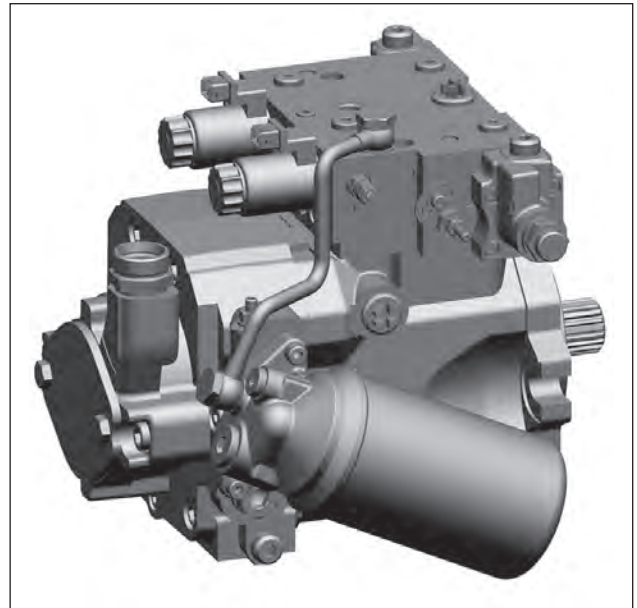
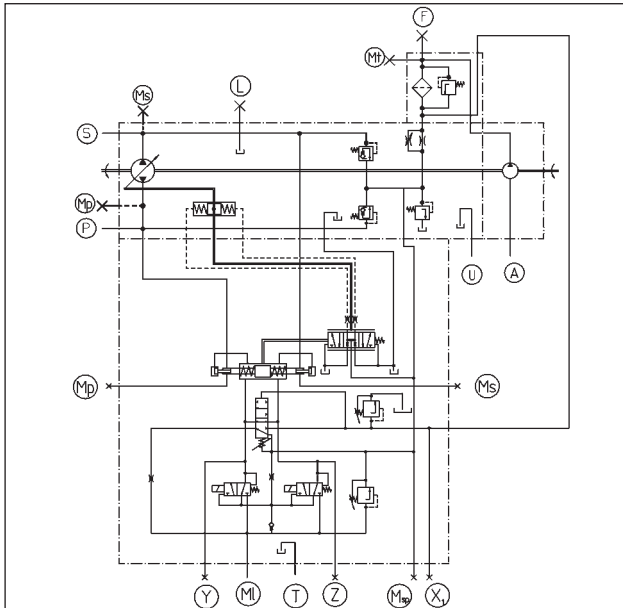
### H1P-control with PCO



## Controls. Hydraulic-mechanical CA

The HPV-02 CA is a speed-dependent pump control with torque/power regulation. It can be combined with a hydraulic motor as fixed, variable or regulating motor or a variable motor with pressure regulator. The modular design offers a high degree of versatility in terms of function and control.

### CA. Hydraulic-mechanical control



#### CA-control. Advantages

- >> pilot operated system
- >> controlled load response
- >> temperature independent
- >> dynamics
- >> precision
- >> low hysteresis
- >> high versatility (modular design)
- >> various motor control possible
- >> simple adjusting
- >> direct control of torque and tractive force
- >> speed optimized inching function
- >> high safety standard
- >> hydrostatic deceleration

- P, S High pressure ports
- A Suction port, charge pump
- F Feed port, charge and control

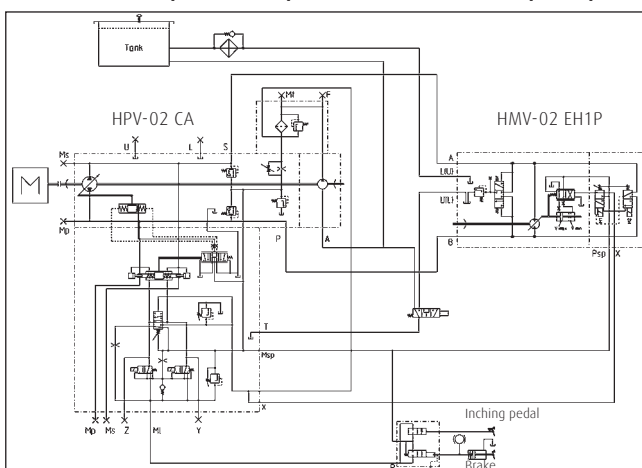
#### Test ports

- Mt Temperature
- Ms, Mp High pressure
- Y, Z Pilot pressure
- MI For power settings and inch pressure port
- Msp Charge pressure
- X Pilot pressure port HMV
- L, U Drain ports
- L1, L2 Vent ports
- T Drain and vent port

#### Note for left hand rotation

- A Suction port, charge pump

### Drive with speed-dependent variable pump and variable motor with pressure override

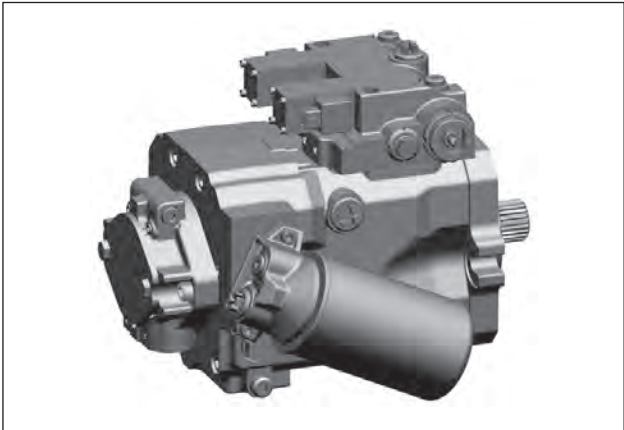
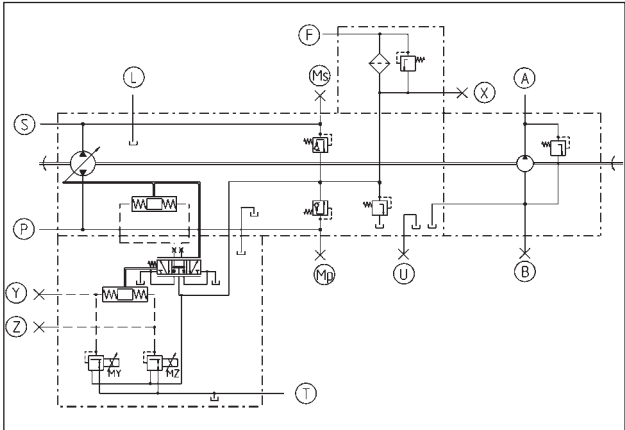


Not every component shown is part of the Linde product portfolio.

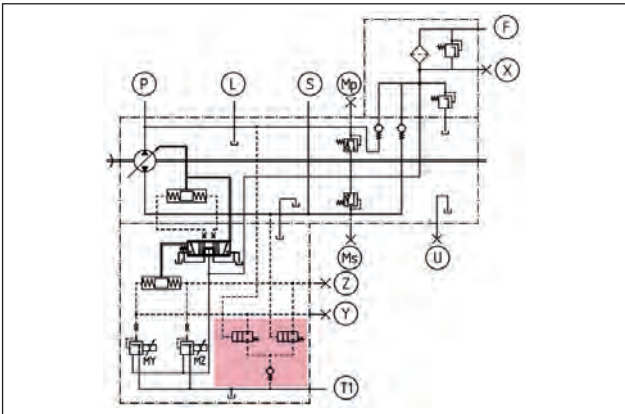
# Controls. Electro-hydraulic E1 and E5

The HPV-02 E1 has two proportional solenoids and through the upstream signal circuit it combines the flexibility of electronic vehicle management with the reliability of a pump control marked by its high operational availability. Precise and simple. Identical commands always call for the same response in the machine, so no corrective action is required by the operator or the electronic system. The HPV-02 E5 has two switching solenoids and thus sets the pump to either neutral or maximum swash angle of any direction.

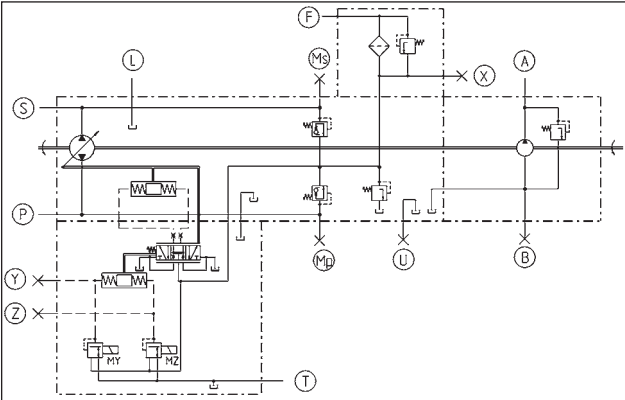
## E1. Electro-hydraulic control



## E1P. Electro-hydraulic control with PCO



## E5. Electro-hydraulic 3 position control



- P, S High pressure ports
- A Pressure port, charge pump
- B Suction port, charge pump
- F Feed port, charge and control
- X Test port, pilot pressure
- Ms, Mp Test ports, high pressure
- L, U Drain ports
- T Vent ports

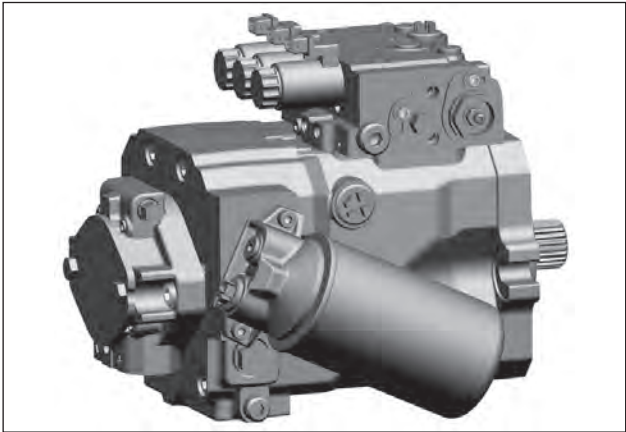
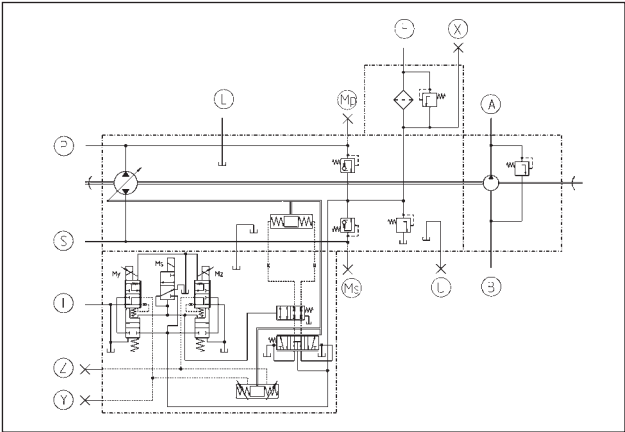
### Note for left hand rotation

- A Suction port, charge pump
- B Pressure port, charge pump

# Controls. Electro-hydraulic E2

The HPV-02 E2, with its additional release function, can easily be integrated in an electronic vehicle management control system like an E1-control. In addition it offers a safety standard that meets the stringent requirements for road traffic use. The E2-control features two proportional solenoids and a switching solenoid.

## E2. Electro-hydraulic control



### E2 with switch-off function

The E2 control offers an interface for switching off the whole system. In case of signal irregularity or perturbation like cable break or short-circuit in the switching solenoid circuit (co called 'watchdog'), the pump swashes back to neutral position in a defined manner.

The vehicle is decelerated until standstill and thus provides a safe condition of the machine as per EN ISO 13849.

In case of disfunction in the proportional magnets' circuits, a similar reaction can be induced by the intervention of the electronic control units.

Its use is recommended for mobile applications where specific safety criteria have to be met in terms of travel and coasting behaviour, e.g. road traffic use.

### Product advantages of E2

- >> fulfils the rigorous demands for road traffic use
- >> active drive enable
- >> minimized susceptibility to interference
- >> with HMF-02: defined swashing back of pump for controlled deceleration and stop in case of system fault
- >> with HMV-02: diesel overspeed protection by fast swashing back of pump

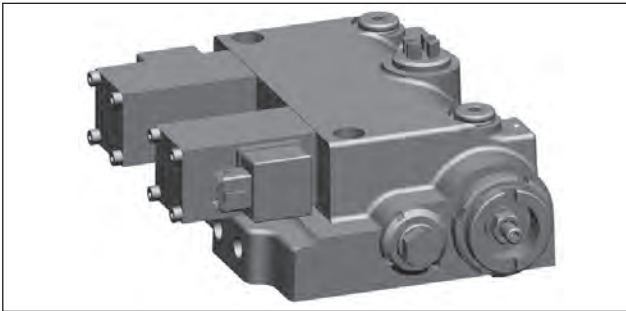
|        |                               |
|--------|-------------------------------|
| P, S   | High pressure ports           |
| A      | Pressure port, charge pump    |
| B      | Suction port, charge pump     |
| F      | Feed port, charge and control |
| X      | Test port, control pressure   |
| Ms, Mp | Test ports, high pressure     |
| Y, Z   | Test ports, control pressure  |
| L, U   | Drain ports                   |
| T      | Vent port                     |

### Note for left hand rotation

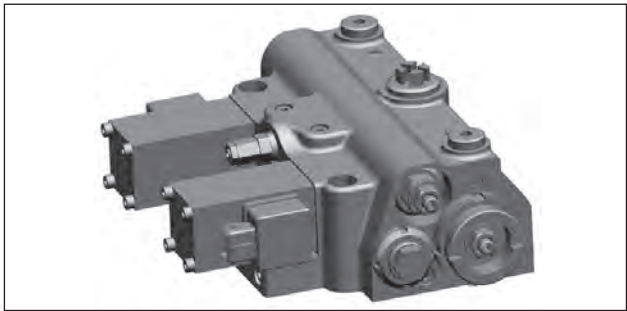
|   |                            |
|---|----------------------------|
| A | Suction port, charge pump  |
| B | Pressure port, charge pump |

Controls. Electro-hydraulic E

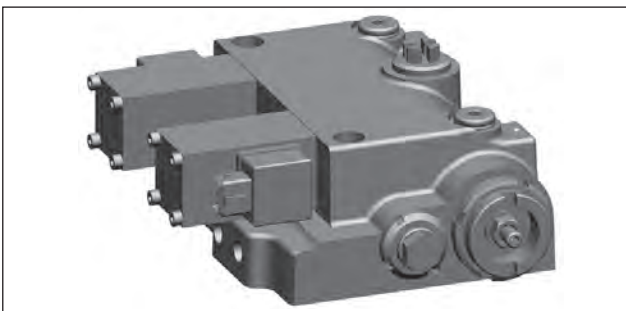
E1 control



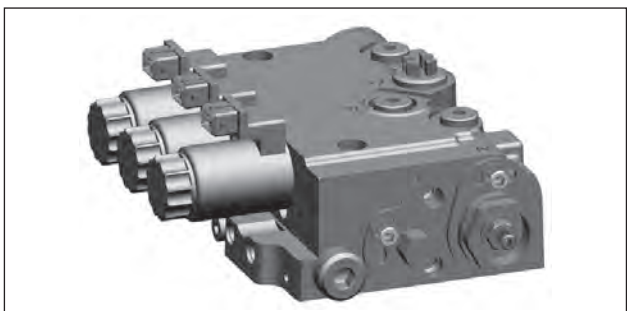
E1P control



E5 control



E2 control

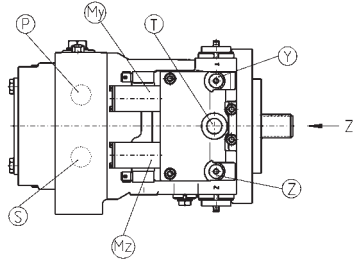
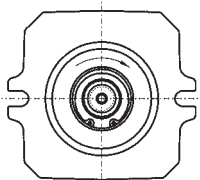
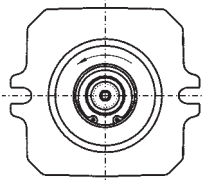
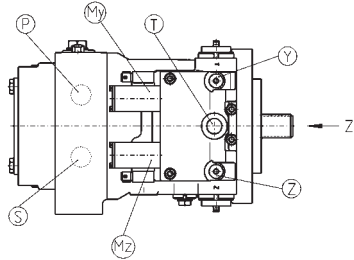


Flow direction

By an external electrical signal input at the solenoids (MY and MZ) the pump flow rate and direction of flow are controlled. The flow direction of the fluid depends on

- >> the pump direction of rotation
- >> the over centre direction of the swash plate.

High pressure outlet port

| Active solenoid                                                                     |    | Shaft rotation<br>(view on Z)                                                        |                                                                                       |
|-------------------------------------------------------------------------------------|----|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |    |  |  |
|                                                                                     |    | Right hand                                                                           | Left hand                                                                             |
|  | MY | P                                                                                    | S                                                                                     |
|                                                                                     | MZ | S                                                                                    | P                                                                                     |

# Controls. Electro-hydraulic E

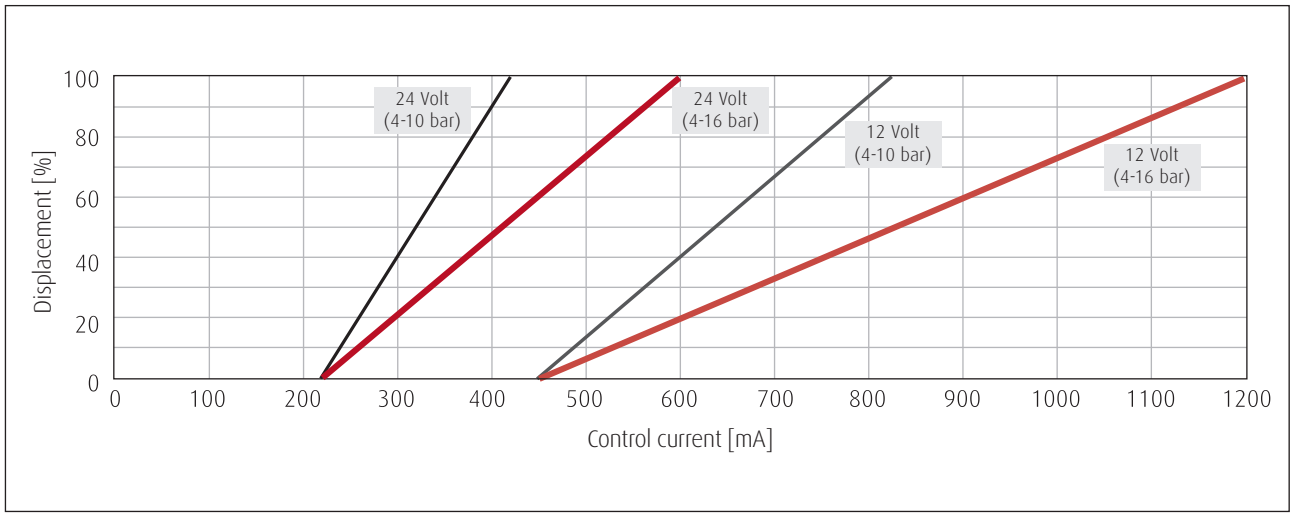
The data is specific for electrical controls, and independent of the nominal pump size and PCO pressure cut-off regulation, unless specified otherwise (see section Controls. Control accuracy). Figures HPV-02 E1 and HPV-02 E2 (page 22, 23) show the standard mounting position for the respective E-control.

## Control signal characteristics

|                                              |                                                |                                          |    |                                                                                                              |         |
|----------------------------------------------|------------------------------------------------|------------------------------------------|----|--------------------------------------------------------------------------------------------------------------|---------|
| Supply voltage = limiting voltage            |                                                |                                          | V  | 12                                                                                                           | 24      |
| Connector type                               |                                                |                                          |    | DIN EN 175301-803, Deutsch, AMP Junior Timer (2-pin*)                                                        |         |
| Voltage type                                 |                                                |                                          |    | Direct Current (D.C.)                                                                                        |         |
| Power consumption                            |                                                |                                          | W  | 15.6                                                                                                         |         |
| Rated current = limiting current             |                                                |                                          | mA | 1300                                                                                                         | 650     |
| Control current                              | swash begin                                    |                                          | mA | 450 ± 10                                                                                                     | 225 ± 5 |
|                                              | swash end on request                           | pilot pressure range 4-10 bar (option)   | mA | 810                                                                                                          | 410     |
|                                              |                                                | pilot pressure range 4-16 bar (standard) | mA | 1200                                                                                                         | 600     |
| Relative duty cycle                          |                                                |                                          | %  | 100                                                                                                          |         |
| Protection class                             |                                                |                                          |    | IP54 (DIN), IP67 (Deutsch), IP6K6K (AMP)                                                                     |         |
| Control types                                | digital control via Pulse Width Modulation PWM |                                          |    | 100 Hz rectangle, pulse duty ratio variable over control range                                               |         |
|                                              | analogue control                               |                                          |    | Direct current with dither overlay (dither frequency nom. 35 Hz, duty cycle 1:1). Further details on request |         |
| Minimum response time with standard orifices |                                                |                                          | s  | 0.5                                                                                                          |         |

\*) Coding 1 with proportional solenoids (E1, E1P), coding 2 with switching solenoids (E2, E5)

## Displacement relative to control current

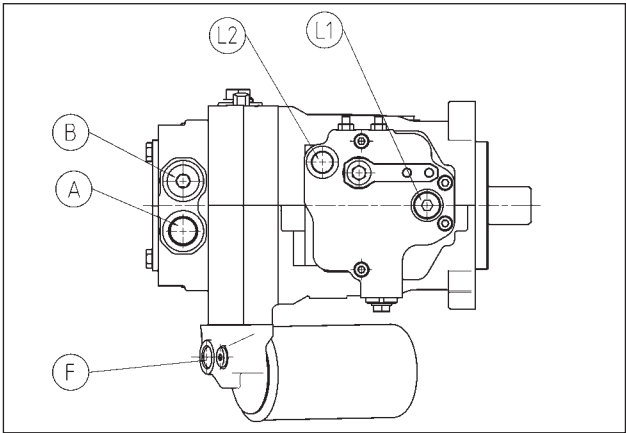
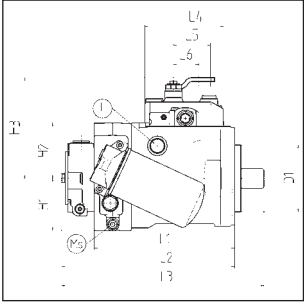
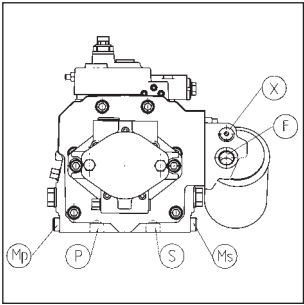
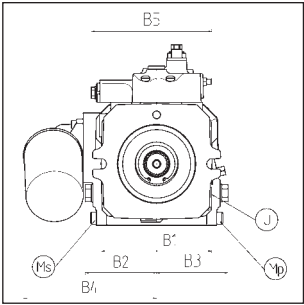


# Dimensions. M-controls

Control-specific dimensions for HPV-02 with mechanical-hydraulic controls.

## Port sizes and dimensions for M-controls

| Rated size  | 55      | 75     | 105 | 135      | 165      | 210      | 280   |
|-------------|---------|--------|-----|----------|----------|----------|-------|
| D1 [mm]     | 127     |        |     | 152.4    |          | 165.1    |       |
| B1 [mm]     | 181     |        |     | 228.6    |          | 224      | 225   |
| B2 [mm]     | 101     | 116    |     | 141      | 141      | 142      | 155   |
| B3 [mm]     | 101     | 116    |     | 141      | 138.5    | 135      | -     |
| B4 [mm]     | 192     | 216    |     | 219      | 233      | 240      | 246   |
| B5 [mm]     | 194     |        |     |          |          |          |       |
| L1 [mm]     | 225     | 242    | 267 | 288      | 319.5    | 346      | 392   |
| L2 [mm]     | 282     | 304    | 329 | 350      | 485.5    | 516      | 571   |
| L3 [mm]     | 335     | 359    | 385 | 425      | 560.4    | 591      | 646   |
| L4 [mm]     | 151     |        |     |          |          |          |       |
| L5 [mm]     | 70      |        |     |          |          |          |       |
| L6 [mm]     | 48      |        |     |          |          |          |       |
| H1 [mm]     | 88      | 93     | 99  | 106      | 119.5    | 134      | 152   |
| H2 [mm]     | 95      | 103    | 105 | 112      | 122.5    | 133      | 150   |
| H3 [mm]     | 184     | 188    | 193 | 198      | 214.5    | 226      | 238   |
| P           | SAE ¾"  | SAE 1" |     | SAE 1 ¼" |          | SAE 1 ½" |       |
| S           | SAE ¾"  | SAE 1" |     | SAE 1 ¼" |          | SAE 1 ½" |       |
| A gear pump | M27x2   |        |     |          | SAE 1"   | SAE ¾"   |       |
| B gear pump | M36x2   |        |     |          | SAE 1 ¼" | SAE 1 ¼" |       |
| L           | M22x1.5 |        |     | M27x2    |          | M27x2    | M33x2 |
| U           | M22x1.5 |        |     | M27x2    |          | M27x2    | M33x2 |
| F           | M22x1.5 |        |     |          | M27x2    |          |       |
| X           | M14x1.5 |        |     |          |          |          |       |
| Mp          | M14x1.5 |        |     |          |          |          |       |
| Ms          | M14x1.5 |        |     |          |          |          |       |
| L1          | M22x1.5 |        |     |          |          |          |       |
| L2          | M22x1.5 |        |     |          |          |          |       |



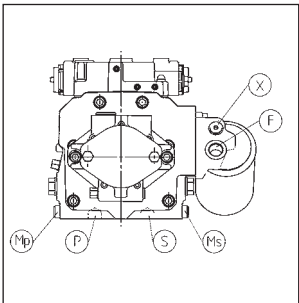
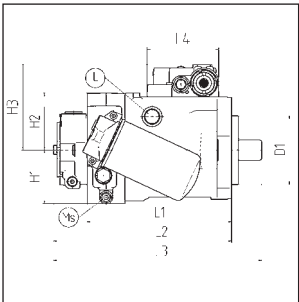
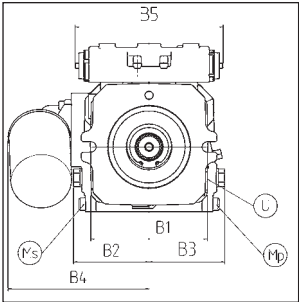
Threads metric in accordance with ISO 6149-1  
 Suction port at IGP in accordance with ISO 8434-1 L28  
 High pressure ports similar to ISO 6162-2  
 Socket cap screw in accordance with ISO 4762  
 Further threads on request

# Dimensions. H-controls

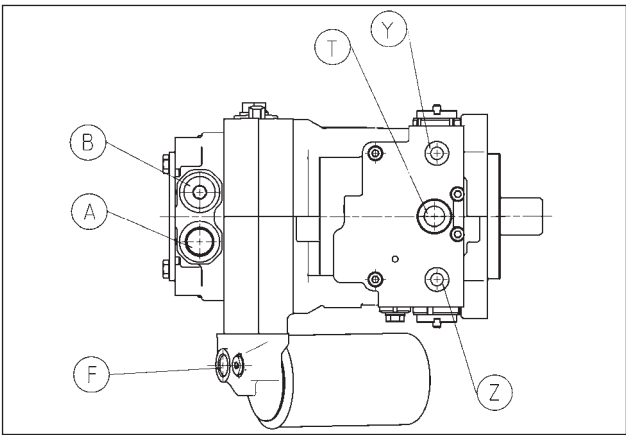
Control-specific dimensions for HPV-02 with hydraulic controls.

## Port sizes and dimensions for H-controls

| Rated size  |          | 55      | 75     | 105 | 135      | 165      | 210      | 280   |
|-------------|----------|---------|--------|-----|----------|----------|----------|-------|
| D1 [mm]     |          | 127     |        |     | 152.4    |          | 165.1    |       |
| B1 [mm]     |          | 181     |        |     | 228.6    |          | 224      | 225   |
| B2 [mm]     |          | 101     | 116    |     | 141      | 134.5    | 143      | 155   |
| B3 [mm]     |          | 101     | 116    |     | 141      | 134.5    | 135      | 139   |
| B4 [mm]     |          | 192     | 216    |     | 219      | 233      | 240      | 246   |
| B5 [mm]     |          | 231     |        |     |          |          |          |       |
| L1 [mm]     |          | 225     | 242    | 267 | 288      | 319.5    | 346      | 392   |
| L2 [mm]     |          | 282     | 304    | 329 | 350      | 485.5    | 516      | 571   |
| L3 [mm]     |          | 335     | 359    | 385 | 425      | 560.4    | 591      | 646   |
| L4 [mm]     |          | 133     |        |     |          |          |          |       |
| H1 [mm]     |          | 88      | 93     | 99  | 106      | 119.5    | 134      | 152   |
| H2 [mm]     |          | 95      | 103    | 105 | 112      | 122.5    | 133      | 150   |
| H3 [mm]     | w/o PCO  | 194     | 154    | 158 | 163      | 187      | 191      | 204   |
|             | with PCO | 185     | 190    | 194 | 199      | 223      | 201      | 214   |
| P           |          | SAE ¾"  | SAE 1" |     | SAE 1 ¼" |          | SAE 1 ½" |       |
| S           |          | SAE ¾"  | SAE 1" |     | SAE 1 ¼" |          | SAE 1 ½" |       |
| A gear pump |          | M27x2   |        |     |          | SAE 1"   | SAE ¾"   |       |
| B gear pump |          | M36x2   |        |     |          | SAE 1 ¼" | SAE 1 ¼" |       |
| L           |          | M22x1.5 |        |     | M27x2    |          |          | M33x2 |
| U           |          | M22x1.5 |        |     | M27x2    |          |          | M33x2 |
| F           |          | M22x1.5 |        |     |          | M27x2    |          | M27x2 |
| T           |          | M22x1.5 |        |     |          |          |          |       |
| X           |          | M14x1.5 |        |     |          |          |          |       |
| Mp          |          | M14x1.5 |        |     |          |          |          |       |
| Ms          |          | M14x1.5 |        |     |          |          |          |       |
| Y           |          | M14x1.5 |        |     |          |          |          |       |
| Z           |          | M14x1.5 |        |     |          |          |          |       |



Threads metric in accordance with ISO 6149-1  
Suction port at IGP in accordance with ISO 8434-1 L28  
High pressure ports similar to ISO 6162-2  
Socket cap screw in accordance with ISO 4762  
Further threads on request

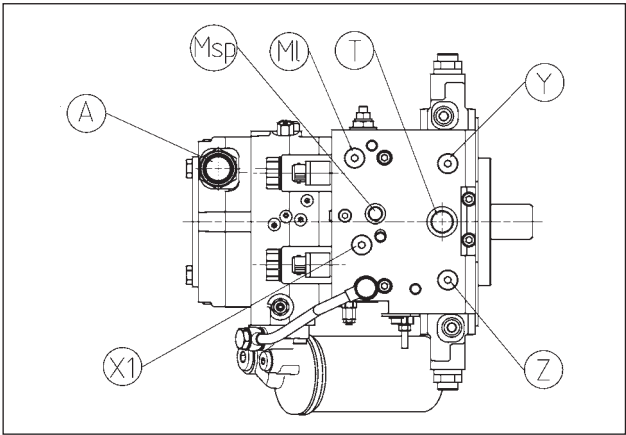
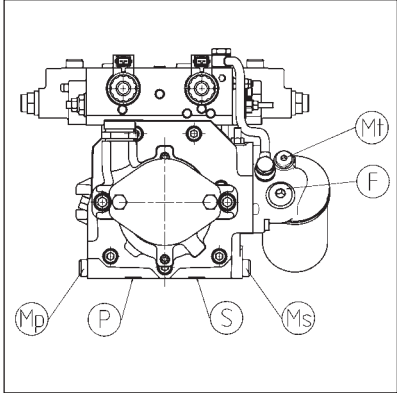
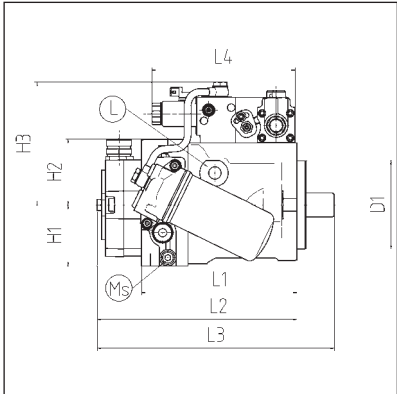
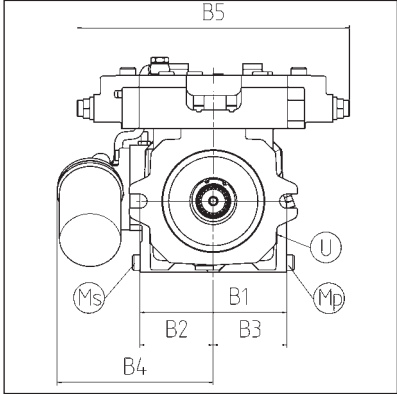


# Dimensions. CA-controls

Control-specific dimensions for HPV-02 with hydraulic-mechanical controls.

## Port sizes and dimensions for CA-controls

| Rated size  | 55      | 75  | 105   | 135   |
|-------------|---------|-----|-------|-------|
| D1 [mm]     | 127     |     |       | 152.4 |
| B1 [mm]     | 181     |     |       | 228.6 |
| B2 [mm]     | 101     | 116 |       | 141   |
| B3 [mm]     | 101     | 116 |       | 141   |
| B4 [mm]     | 193     | 212 | 214   | 217   |
| B5 [mm]     | 336     |     |       |       |
| L1 [mm]     | 225     | 242 | 267   | 288   |
| L2 [mm]     | 282     | 306 | 331   | 351.5 |
| L3 [mm]     | 343     | 361 | 386.3 | 426.1 |
| L4 [mm]     | 207     |     |       |       |
| H1 [mm]     | 88      | 93  | 99    | 105.5 |
| H2 [mm]     | 95      | 103 | 99    | 104   |
| H3 [mm]     | 178     | 184 | 187.8 | 191.1 |
| A gear pump | M36x2   |     |       |       |
| P           | SAE 1"  |     |       |       |
| S           | SAE 1"  |     |       |       |
| L           | M22x1.5 |     |       |       |
| U           | M22x1.5 |     |       |       |
| F           | M22x1.5 |     |       |       |
| T           | M22x1.5 |     |       |       |
| X1          | M14x1.5 |     |       |       |
| Mp          | M14x1.5 |     |       |       |
| MI          | M14x1.5 |     |       |       |
| Ms          | M14x1.5 |     |       |       |
| Msp         | M14x1.5 |     |       |       |
| Mt          | M14x1.5 |     |       |       |
| Y           | M14x1.5 |     |       |       |
| Z           | M14x1.5 |     |       |       |



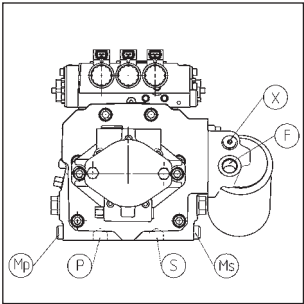
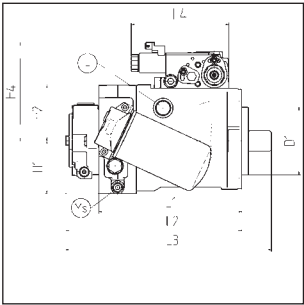
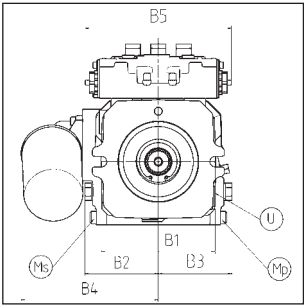
Threads metric in accordance with DIN 3852-1  
 Suction port at IGP in accordance with ISO 8434-1 L28  
 High pressure ports similar to ISO 6162-2  
 Socket cap screw in accordance with ISO 4762  
 Further threads on request

# Dimensions. E-controls

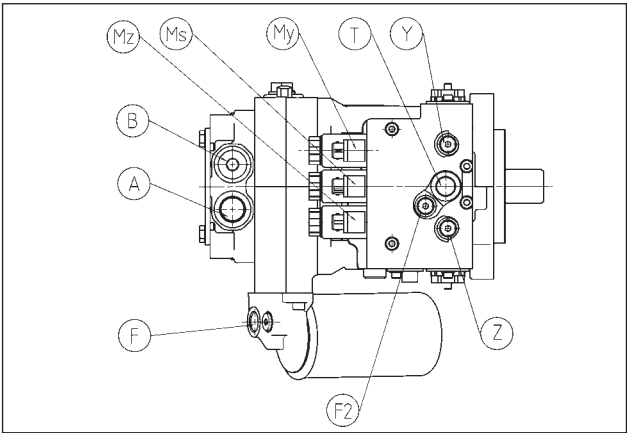
Control-specific dimensions for HPV-02 with electro-hydraulic controls.

## Port sizes and dimensions for E-controls

| Rated size                           | 55      | 75     | 105 | 135      | 165      | 210      | 280   |
|--------------------------------------|---------|--------|-----|----------|----------|----------|-------|
| D1 [mm]                              | 127     |        |     | 152.4    |          | 165.1    |       |
| B1 [mm]                              | 181     |        |     | 228.6    |          | 224      | 225   |
| B2 [mm]                              | 101     | 116    |     | 141      | 134.5    | 143      | 155   |
| B3 [mm]                              | 101     | 116    |     | 141      | 134.5    | 135      | 139   |
| B4 [mm]                              | 192     | 216    |     | 219      | 233      | 240      | 246   |
| B5 [mm] E1                           | 226     |        |     |          |          |          |       |
| B5 [mm] E2                           | 230     |        |     |          |          |          |       |
| L1 [mm]                              | 225     | 242    | 267 | 288      | 319.5    | 346      | 392   |
| L2 [mm]                              | 282     | 304    | 329 | 350      | 485.5    | 516      | 571   |
| L3 [mm]                              | 335     | 359    | 385 | 425      | 560.4    | 591      | 646   |
| L4 [mm]                              | 183     |        |     |          |          |          |       |
| H1 [mm]                              | 88      | 93     | 99  | 106      | 119.5    | 134      | 152   |
| H2 [mm]                              | 95      | 103    | 105 | 112      | 122.5    | 133      | 150   |
| H4 [mm] E1 / E2<br>AMP-JT connectors | 159     | 164    | 168 | 173      | 189.5    | 218      | 231   |
| H4 [mm] E1<br>DIN connectors         | 195     | 200    | 204 | 209      | 225.5    | 254      | (267) |
| P                                    | SAE ¾"  | SAE 1" |     | SAE 1 ¼" |          | SAE 1 ½" |       |
| S                                    | SAE ¾"  | SAE 1" |     | SAE 1 ¼" |          | SAE 1 ½" |       |
| Mp                                   | M14x1.5 |        |     |          |          |          |       |
| Ms                                   | M14x1.5 |        |     |          |          |          |       |
| A gear pump                          | M27x2   |        |     |          | SAE 1"   | SAE ¾"   |       |
| B gear pump                          | M36x2   |        |     |          | SAE 1 ¼" | SAE 1 ¼" |       |
| L                                    | M22x1.5 |        |     | M27x2    |          |          | M33x2 |
| U                                    | M22x1.5 |        |     | M27x2    |          |          | M33x2 |
| F                                    | M22x1.5 |        |     |          | M27x2    |          |       |
| T                                    | M22x1.5 |        |     |          |          |          |       |
| X                                    | M14x1.5 |        |     |          |          |          |       |
| Y                                    | M14x1.5 |        |     |          |          |          |       |
| Z                                    | M14x1.5 |        |     |          |          |          |       |
| F2                                   | M14x1.5 |        |     |          |          |          |       |

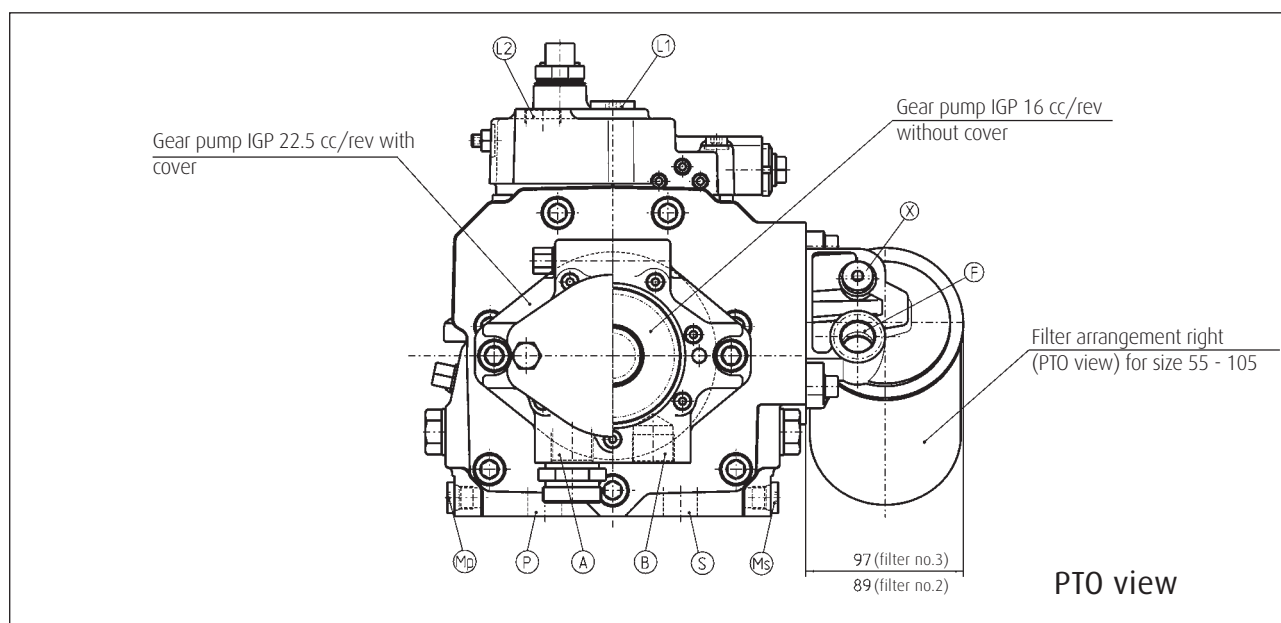


Threads metric in accordance with ISO 6149-1  
 Suction port at IGP in accordance with ISO 8434-1 L28  
 High pressure ports similar to ISO 6162-2  
 Socket cap screw in accordance with ISO 4762  
 Further threads on request



## Dimensions. Modular system

The following diagrams show the proportions of similar components.

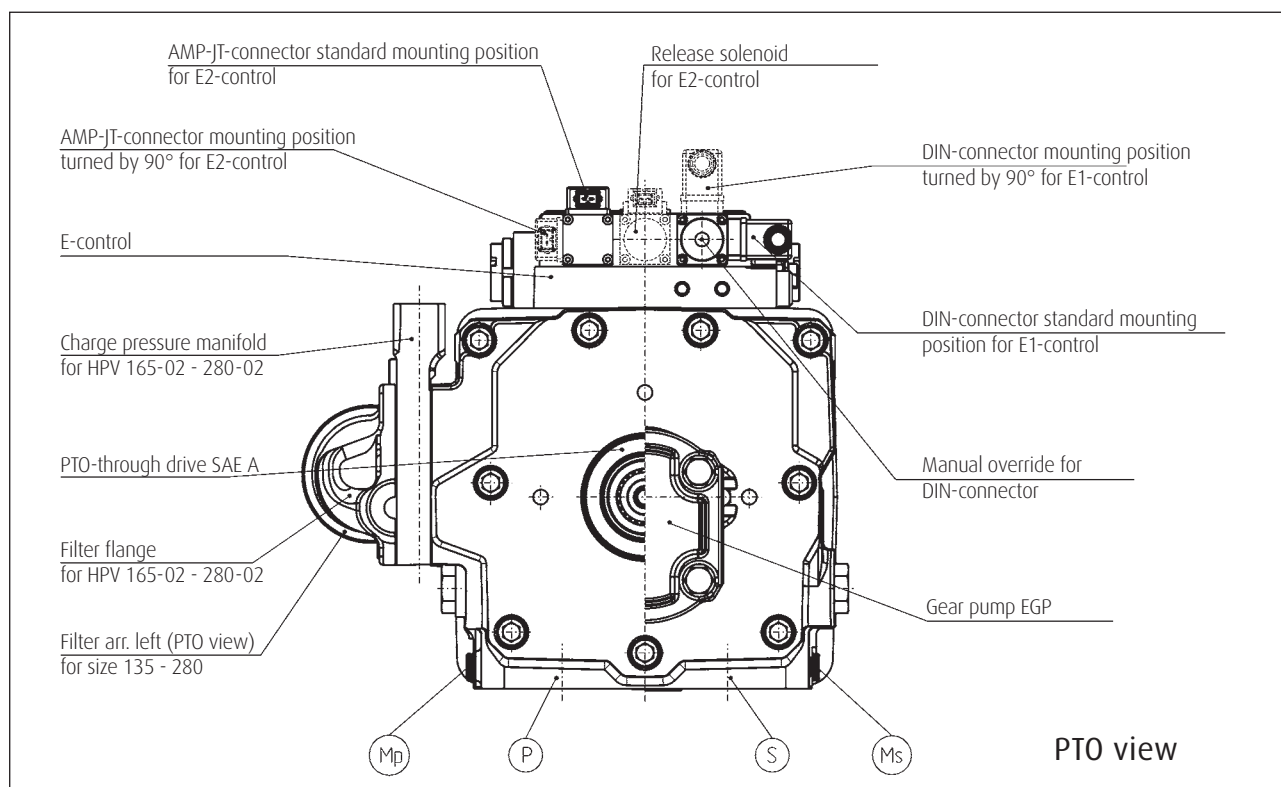


>> M1R-control

>> IGP 22.5 cc/rev with cover

>> IGP 16 cc/rev without cover

>> filter mounting side for rated sizes 55 - 105



>> E1-control with mounting position of solenoid connectors

>> E2-control with mounting position of solenoid connectors

>> manual override

>> DIN-connector

>> AMP-JT-connector

>> filter mounting side for rated size 135 - 280

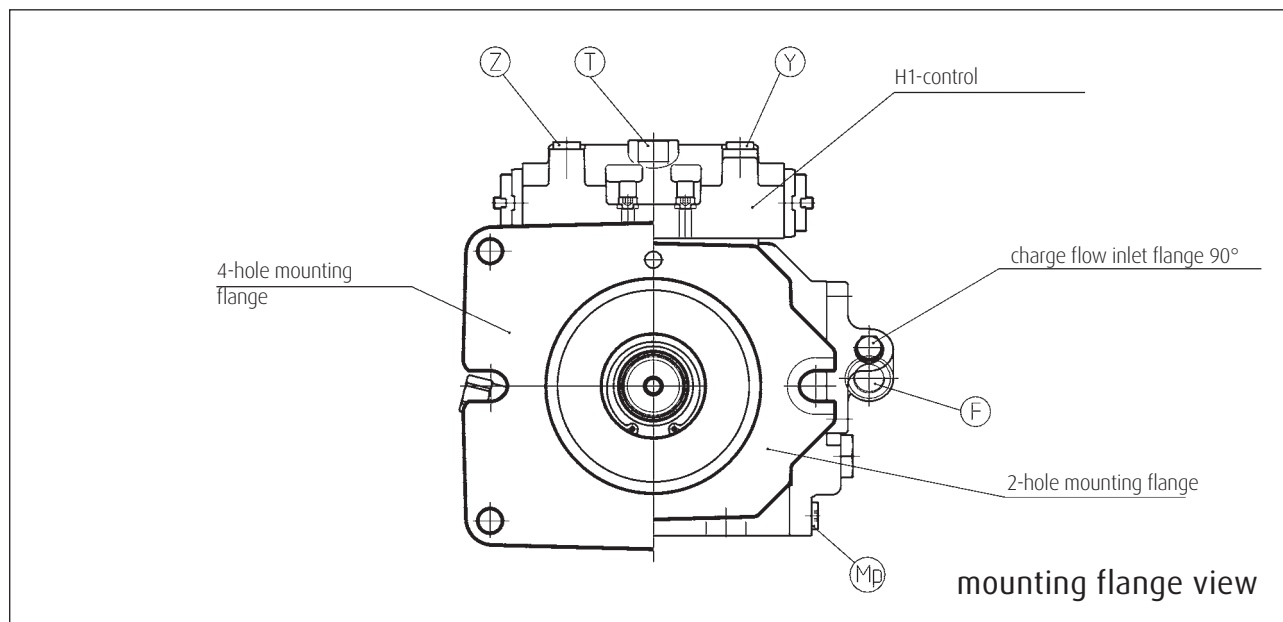
>> charge pressure manifold for rated size 210 and 280 without filter

>> SAE A PTO-mounting flange

>> EGP

## Dimensions. Modular system

The following diagrams show the proportions of similar components.

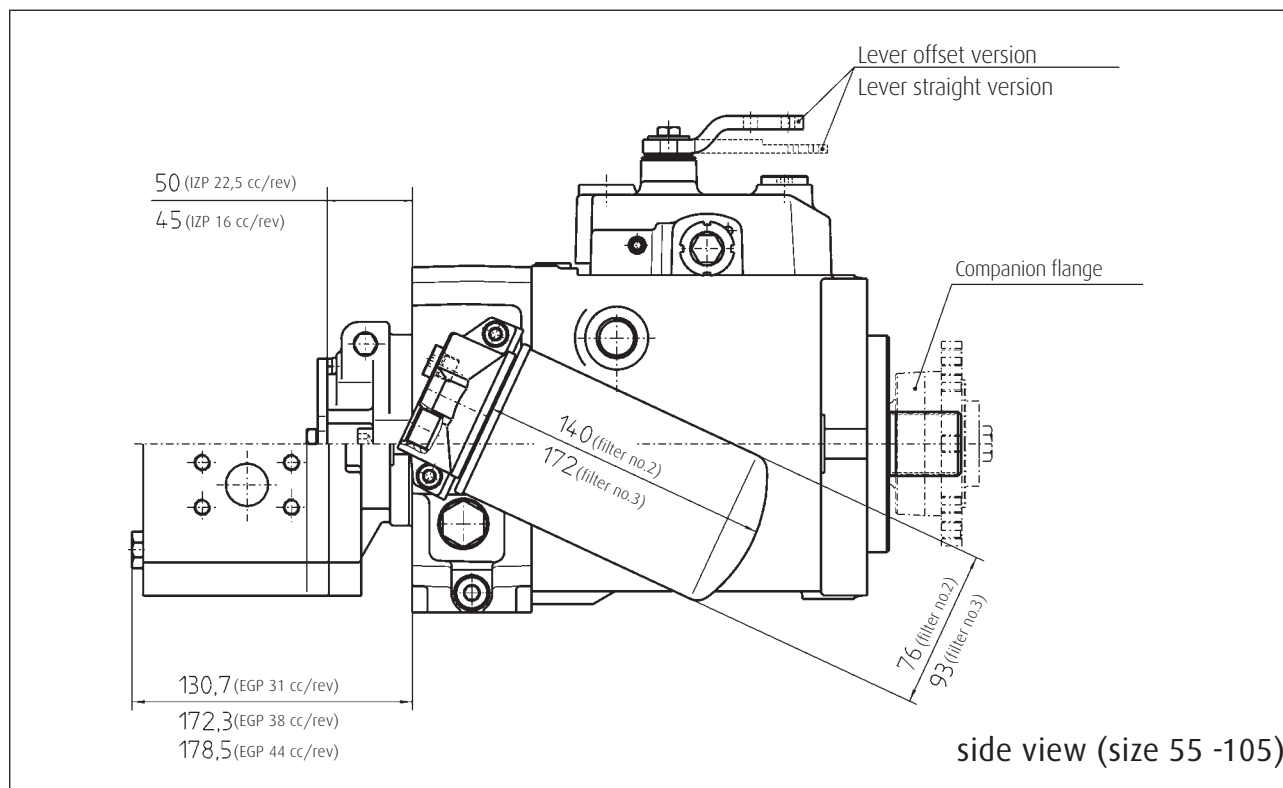


>> 4-hole mounting flange

>> H1-control

>> 2-hole mounting flange

>> filter flange 90° without filter



>> M1R-control lever geometry

>> IGP

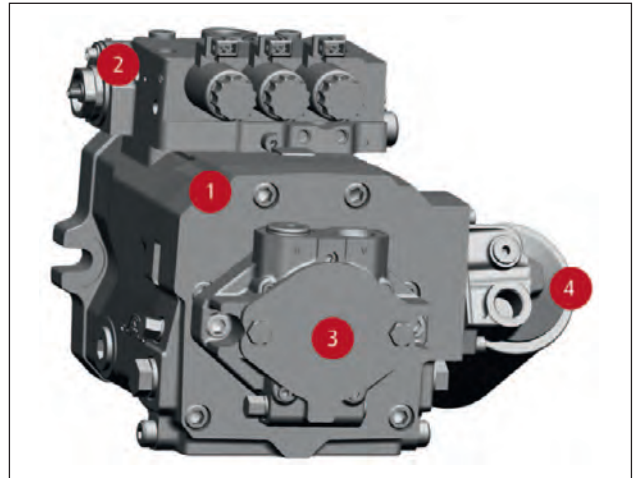
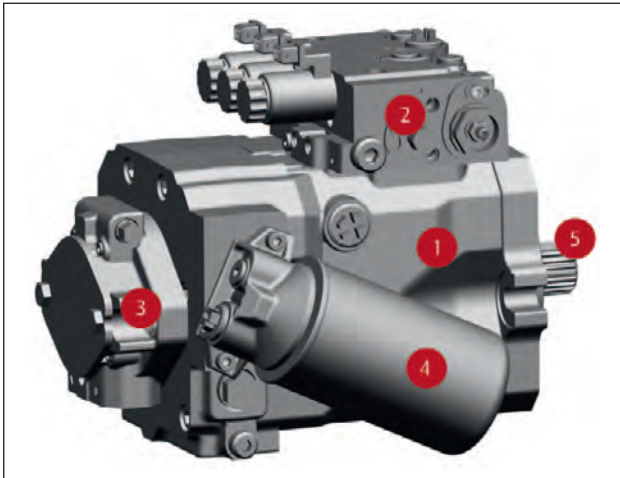
>> EGP

>> filter

>> companion flange

## Dimensions. Modular system

The following data enable quick calculation of the overall maximum external dimensions. In each case only the relevant dimensions are shown so that length, width and height can simply be determined through addition. The actual fitting dimensions of the respective units are shown on the installation drawing.



### External dimensions for addition

| Component                                                                 | Type                 | Length            | Width | Height |
|---------------------------------------------------------------------------|----------------------|-------------------|-------|--------|
| 1 Basic unit                                                              | 55                   | 230               | 210   | 185    |
|                                                                           | 75                   | 245               | 235   | 190    |
|                                                                           | 105                  | 270               | 235   | 210    |
|                                                                           | 135                  | 290               | 280   | 220    |
|                                                                           | 165                  | 320               | 270   | 245    |
|                                                                           | 210                  | 350               | 290   | 275    |
|                                                                           | 280                  | 395               | 315   | 305    |
| 2 Control                                                                 | M1R                  | -                 | 10    | 95     |
|                                                                           | H1                   | -                 | 5     | 55     |
|                                                                           | H1P                  | -                 | 10    | 75     |
|                                                                           | CA                   | -                 | 135   | 95     |
|                                                                           | E1/E5                | -                 | 5     | 110    |
|                                                                           | E1P                  | -                 | 10    | 110    |
|                                                                           | E2                   | -                 | 15    | 110    |
| 3 Gear pump                                                               | 16 cc                | 60                | -     | -      |
|                                                                           | 22,5 cc              | 65                | -     | -      |
|                                                                           | 31 cc                | 135               | -     | -      |
|                                                                           | 38 cc                | 175               | -     | -      |
|                                                                           | 44 cc                | 180               | -     | -      |
| 4 Filter                                                                  | Nr.2                 | 10                | 95    | -      |
|                                                                           | Nr.3                 | without gear pump | 105   | -      |
|                                                                           | F-port 90°           | 15                | 50    | -      |
| 5 Companion flange<br>not shown                                           |                      | 75                | -     | -      |
| 6 Intermediate flange<br>Shown in section<br><<Dimensions. Tandem pumps>> | 55 -> SAE C          | 47.5              |       |        |
|                                                                           | 75 -> SAE C          | 47.5              |       |        |
|                                                                           | 105 -> SAE C         | 37.5              |       |        |
|                                                                           | 135 -> SAE D / C     | 50 / 31           |       |        |
|                                                                           | 165 -> SAE D / C     | 61.5 / 26         |       |        |
|                                                                           | 210 -> SAE E / D / C | 55 / 68 / 32      |       |        |
|                                                                           | 280 -> SAE E / D / C | 39 / 39 / 45.5    |       |        |

Example:

HPV 135-02 H1 with IGP 22.5, filter no. 3 and companion flange

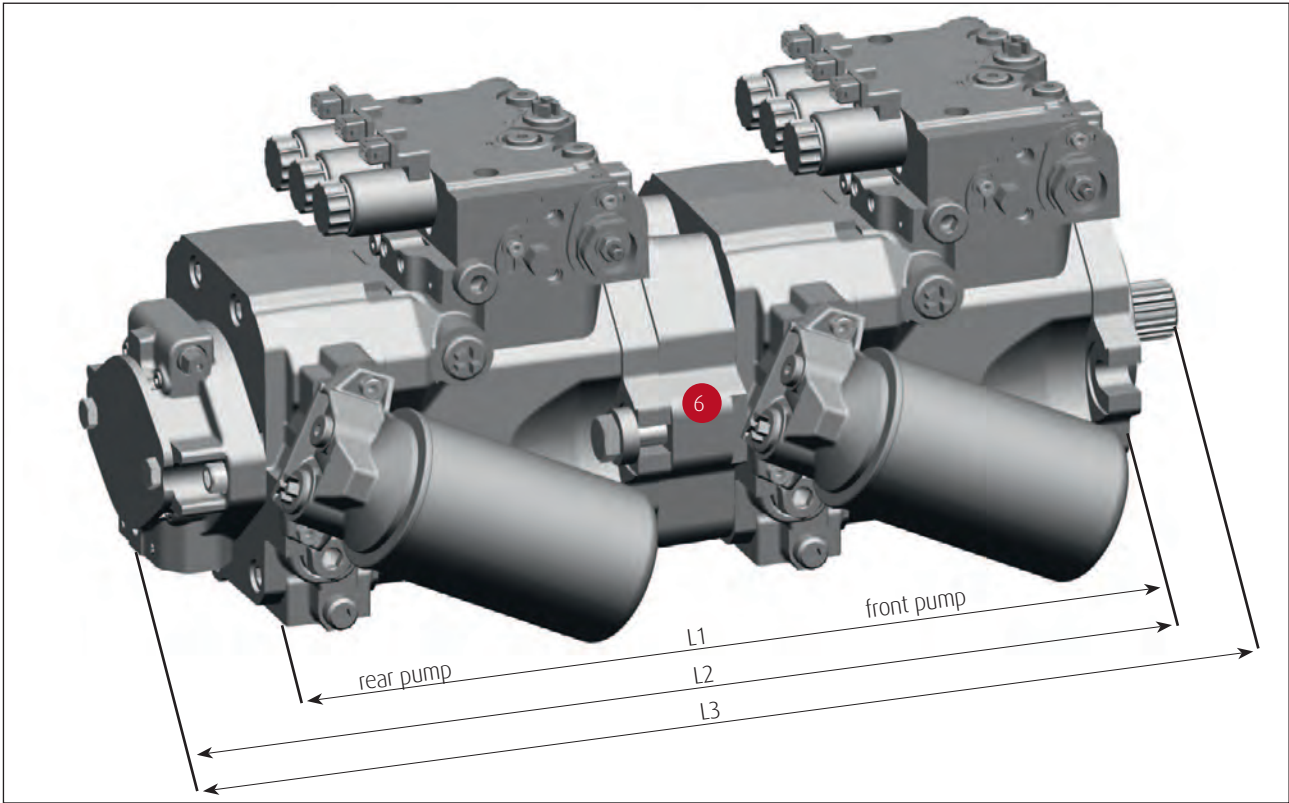
L. 440 mm

B. 390 mm

H. 275 mm

# Dimensions. HPV-02 tandem pumps

Tandem pumps are created by connecting individual HPV units in series, with the pumps arranged by capacity. Positioning the charge pump(s) at the end of the tandem ensures optimum space utilisation, output allocation and load distribution.

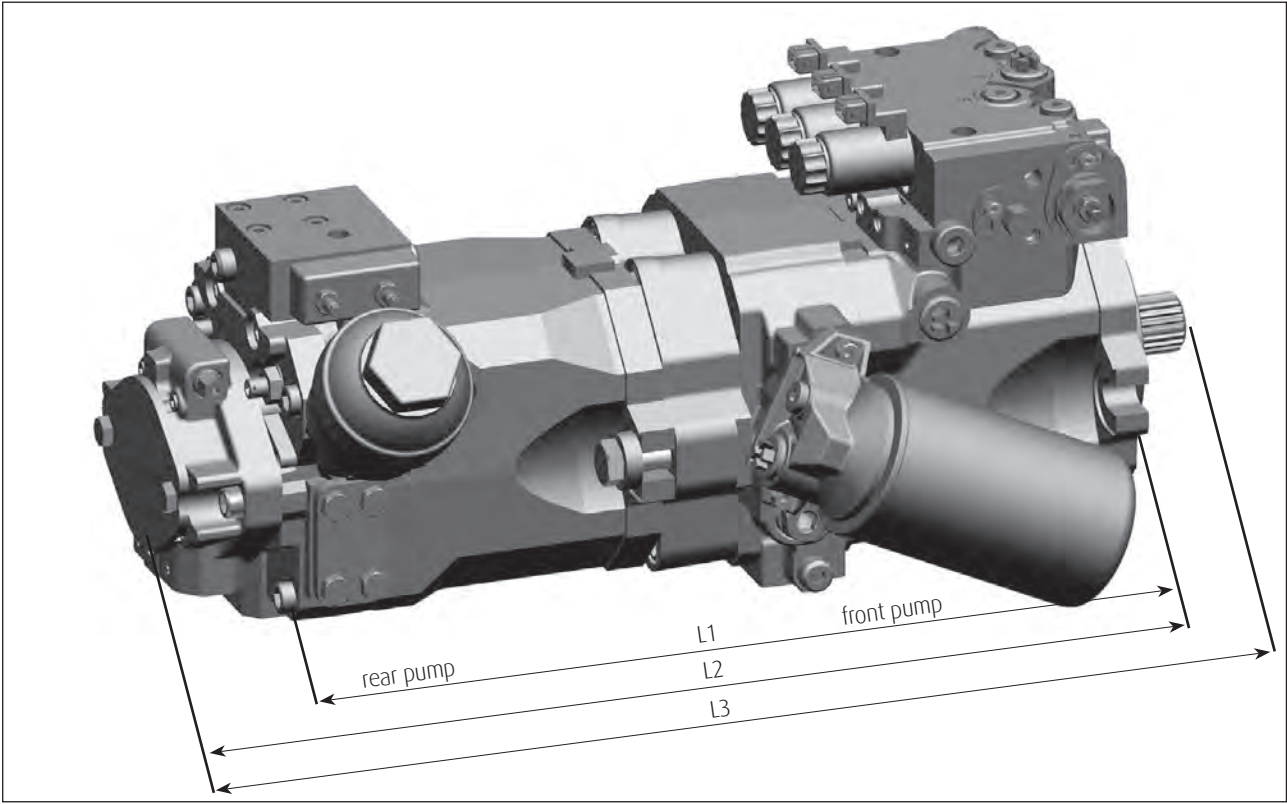


Overall length of tandem pump

| Rated size                                  | Rear pump    | HPV 55 | HPV 75 | HPV 105 | HPV 135 | HPV 165 | HPV 210 | HPV 280 |
|---------------------------------------------|--------------|--------|--------|---------|---------|---------|---------|---------|
| Front pump                                  | Lengths [mm] |        |        |         |         |         |         |         |
| HPV 55<br>with IGP 16 cc<br>at rear pump    | L1           | 496    | -      | -       | -       | -       | -       | -       |
|                                             | L2           | 553    | -      | -       | -       | -       | -       | -       |
|                                             | L3           | 607    | -      | -       | -       | -       | -       | -       |
| HPV 75<br>with IGP 22,5 cc<br>at rear pump  | L1           | 513    | 530    | -       | -       | -       | -       | -       |
|                                             | L2           | 575    | 592    | -       | -       | -       | -       | -       |
|                                             | L3           | 631    | 648    | -       | -       | -       | -       | -       |
| HPV 105<br>with IGP 22.5 cc<br>at rear pump | L1           | 529    | 546    | 572     | -       | -       | -       | -       |
|                                             | L2           | 591    | 608    | 634     | -       | -       | -       | -       |
|                                             | L3           | 647    | 663    | 586     | -       | -       | -       | -       |
| HPV 135<br>with IGP 22.5 cc<br>at rear pump | L1           | 543    | 560    | 586     | 640     | -       | -       | -       |
|                                             | L2           | 605    | 622    | 648     | 702     | -       | -       | -       |
|                                             | L3           | 680    | 696    | 722     | 777     | -       | -       | -       |
| HPV 165<br>with EGP 38 cc<br>at rear pump   | L1           | 571    | 588    | 613     | 670     | 684     | -       | -       |
|                                             | L2           | 746    | 763    | 788     | 844     | 859     | -       | -       |
|                                             | L3           | 820    | 837    | 865     | 919     | 934     | -       | -       |
| HPV 210<br>with EGP 38 cc<br>at rear pump   | L1           | 610    | 627    | 653     | 702     | 722     | 731     | -       |
|                                             | L2           | 782    | 799    | 825     | 874     | 897     | 903     | -       |
|                                             | L3           | 857    | 874    | 900     | 947     | 971     | 978     | -       |
| HPV 280<br>with EGP 44 cc<br>at rear pump   | L1           | 655    | 672    | 698     | 723     | 755     | 777     | 823     |
|                                             | L2           | 834    | 851    | 877     | 903     | 935     | 956     | 1002    |
|                                             | L3           | 909    | 925    | 951     | 978     | 1009    | 1030    | 1076    |

## Dimensions. HPV-HPR-02 multiple pumps

Multiple pumps are created by combining individual pump units in series, with the pumps arranged by capacity. Positioning the gear pump(s) at the end of the unit ensures optimum space utilization, output allocation and load distribution. The following table is based on the gear pump acting as charge pump for the HPV-02 variable pump.



Overall length of multiple pump

| Rated size                         | Rear pump    | HPR 55 | HPR 75 | HPR 105 | HPR 135 | HPR 165 | HPR 210 | HPR 280 |
|------------------------------------|--------------|--------|--------|---------|---------|---------|---------|---------|
| Front pump                         | Lengths [mm] |        |        |         |         |         |         |         |
| HPV 55<br>with IGP 16 cc at HPR    | L1           | 492    | -      | -       | -       | -       | -       | -       |
|                                    | L2           | 549    | -      | -       | -       | -       | -       | -       |
|                                    | L3           | 603    | -      | -       | -       | -       | -       | -       |
| HPV 75<br>with IGP 22.5 cc at HPR  | L1           | 509    | 521    | -       | -       | -       | -       | -       |
|                                    | L2           | 586    | 598    | -       | -       | -       | -       | -       |
|                                    | L3           | 642    | 653    | -       | -       | -       | -       | -       |
| HPV 105<br>with IGP 22.5 cc at HPR | L1           | 525    | 536    | 567     | -       | -       | -       | -       |
|                                    | L2           | 602    | 613    | 629     | -       | -       | -       | -       |
|                                    | L3           | 657    | 669    | 684     | -       | -       | -       | -       |
| HPV 135<br>with IGP 22.5 cc at HPR | L1           | 539    | 550    | 581     | 637     | -       | -       | -       |
|                                    | L2           | 616    | 627    | 643     | 699     | -       | -       | -       |
|                                    | L3           | 690    | 702    | 717     | 774     | -       | -       | -       |
| HPV 165<br>with EGP 38.5 cc at HPR | L1           | 565    | 578    | 608     | 667     | 715     | -       | -       |
|                                    | L2           | 741    | 753    | 783     | 842     | 882     | -       | -       |
|                                    | L3           | 815    | 827    | 857     | 916     | 956     | -       | -       |
| HPV 210<br>with EGP 38.5 cc at HPR | L1           | 606    | 618    | 648     | 699     | 722     | 733     | -       |
|                                    | L2           | 793    | 805    | 820     | 871     | 897     | 905     | -       |
|                                    | L3           | 868    | 879    | 895     | 945     | 972     | 980     | -       |
| HPV 280<br>with EGP 44 cc at HPR   | L1           | 651    | 663    | 693     | 720     | 768     | 779     | 834     |
|                                    | L2           | 845    | 856    | 872     | 900     | 948     | 958     | 1014    |
|                                    | L3           | 919    | 931    | 946     | 975     | 1023    | 1033    | 1089    |



### Product Catalogue

- >> Turning Power into Motion

### Brochures

- >> Drive systems for construction machines.
- >> Drive systems for agricultural machines.

### Datasheets

- >> Model Code. Configuration of the series 02
- >> HMF/A/V/R-02. Hydraulic motors for closed and open loop operation
- >> HPR-02. Self-regulating pumps for open loop operation
- >> HPV-02. Variable pumps for closed loop operation
- >> VT modular. Modular system for LSC manifold valve plate
- >> Linde pressure definitions. According to DIN 24312
- >> Mineral-oil-based hydraulic fluids

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