

# HPV-02



**Variable Pump  
for closed loop circuit**

## **We move the world.**

### **Hydraulic Components + Electronic Components from Linde this means total Vehicle Management through the complete Linde System.**

Linde – the pioneer in **mobile hydraulics** – discovered and perfected hydrostatics as the ideal drive system for mobile machinery. Since 1959, Linde has equipped more than two million vehicles in the fields of

- Construction Equipment
- Agricultural Machinery
- Forestry Equipment
- Municipal Vehicles
- Material Handling

with hydrostatic drives and working systems. The use of these systems in our own fork lift trucks has made Linde the world market leader! Electronics also play an important role in those applications.

Linde products have been leaders in the field of mobile hydraulics for many years. Our customers can rely on our systems expertise and our know-how.

Linde engineers are masters of their field – whether it involves better power utilization, the best possible interaction among the total-system components, ease of operation or safety.

Components and systems from Linde are also widely used in **stationary machines**. Many different uses and applications can be served: woodworking machines, mixers, agitators and centrifuges in process engineering, presses, drilling machines, cable winches, plastic-processing machines, theater engineering, ships' helms and other marine applications, rotary drums for the cement and sugar industries, material handling systems, amusement park rides, and many others.

Whether it's closed or open loop systems,

**Linde hydraulics is always the right choice.**



# HPV-02

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# 1. CHARACTERISTICS AND TECHNICAL DATA



## Features

- Compact design with high power density
- Reliable and durable
- Low noise
- High efficiency
- Superior quality

## Sizes

- 55, 75, 105, 135, 165 and 210 cm<sup>3</sup>/rev as well as tandem and multiple pumps

## Design Characteristics

- Axial piston pump, swash plate design
- Swash angle 21°
- Precise and robust control
- Integral boost pump (sizes 55-135 with cold start valve)
- Integrated high pressure relief and make-up valves
- Integrated low pressure valves for boost, servo and cooler circuits
- Integrated towing/short circuit valve (optional)
- Fitted replaceable cartridge filter
- SAE 2-bolt mounting flange with ANSI splined shaft (sizes 55-165)
- SAE 4-bolt mounting flange with ANSI splined shaft (size 210)
- SAE A, B, B-B and C rear flange (PTO)
- SAE A = Standard (built-in)
- Tandem and multiple pump options

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.

## Technical Data

|                        |  |               |           |            |            |                   |            |
|------------------------|--|---------------|-----------|------------|------------|-------------------|------------|
| <b>Rated Sizes</b>     | Nominal displacement [cm <sup>3</sup> /rev]                      | <b>55</b>     | <b>75</b> | <b>105</b> | <b>135</b> | under development | <b>210</b> |
|                        | Maximum displacement [cm <sup>3</sup> /rev]                      | 54.8          | 75.9      | 105.0      | 135.6      |                   | 210.0      |
| <b>Speed</b>           | Max. speed, continuous [rev/min]                                 | 3300          | 3100      | 2900       | 2700       |                   | 2300       |
|                        | Max. speed, intermittent *1 [rev/min]                            | 3700          | 3500      | 3200       | 2900       |                   | 2500       |
| <b>Pressure</b>        | Continuous pressure [bar]  | 250           |           |            |            |                   |            |
|                        | Max. operational pressure *2 [bar]                               | 420           |           |            |            |                   |            |
|                        | Max. intermittent pressure [bar]                                 | 500           |           |            |            |                   |            |
|                        | Permissible housing pressure (absolute) [bar]                    | 2,5           |           |            |            |                   |            |
| <b>Torque</b>          | Continuous input torque *3 [Nm]                                  | 220           | 305       | 420        | 540        |                   | 840        |
|                        | Max. input torque *4 [Nm]  | 350           | 485       | 670        | 870        |                   | 1340       |
| <b>Power</b>           | Continuous power *5 [kW]   | 75            | 98        | 127        | 153        |                   | 201        |
|                        | Max. power *6 [kW]   | 121           | 157       | 204        | 245        |                   | 322        |
| <b>Shaft Loads</b>     | Axial input force *7 [N]   | 2000          |           |            |            |                   |            |
|                        | Axial output force *7 [N]  | 2000          |           |            |            |                   |            |
|                        | Radial *7 [N]  | on request    |           |            |            |                   |            |
| <b>Temperature</b>     | *10 [°C]   | 90            |           |            |            |                   |            |
| <b>Weights</b>         | With mech-hydraulic servo *8 [kg]                                | 44            | 49        | 60         | 74         | 122               |            |
|                        | Max. moment of inertia *9 [kgm <sup>2</sup> x 10 <sup>-2</sup> ] | 0.54          | 0.84      | 1.49       | 2.20       | 4.75              |            |
| <b>Main dimensions</b> |  | see chapter 6 |           |            |            |                   |            |

\*1) Higher speeds on request  
 \*2) Corresponds to setting of pressure relief valve, other setting possible  
 \*3) At max. continuous pressure

\*4) At max. pressure and 19 bar boost pressure  
 \*5) At max. continuous speed and continuous pressure  
 \*6) At max. speed, max. pressure and 19 bar boost pressure  
 \*7) Definition: see chapter 6

\*8) automotive control: on request  
 \*9) includes boost pump  
 \*10) min. permissible viscosity > 10 cSt

## 2. CONTROLS

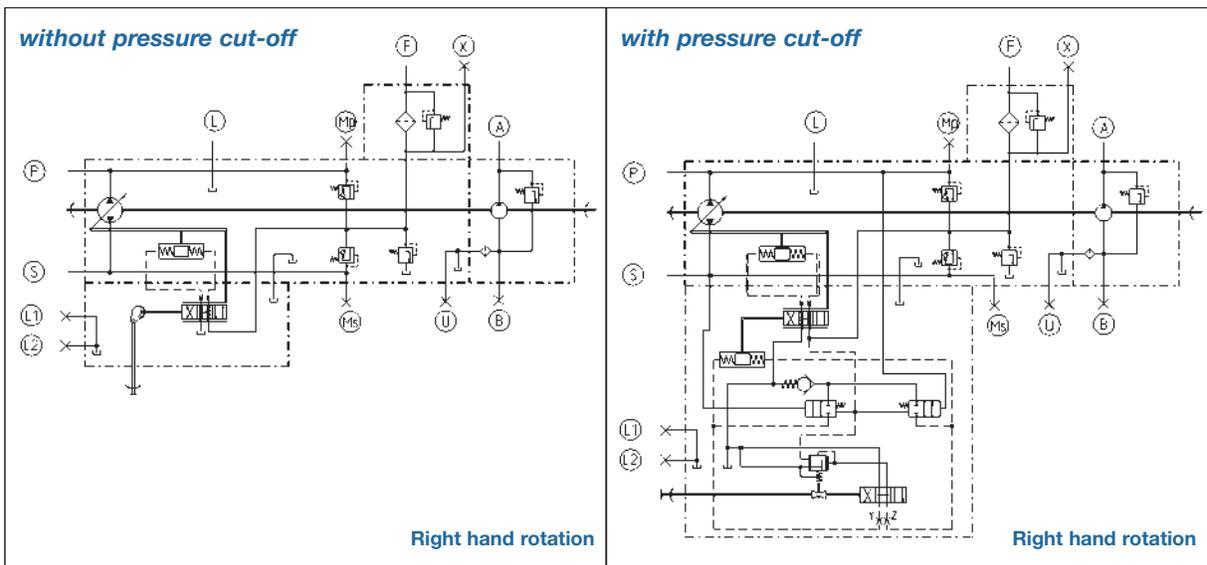
### 2.1 Mechanical-hydraulic Control M1



This control can be supplied with or without pressure cut-off

By turning the control lever the pump flow rate and direction of flow are controlled via a cam plate with progressive characteristic.

Controllers with pressure cut-off reduce pump flow when the cut-off pressure is reached. As system pressure is maintained, only a small quantity of residential fluid flows through the high pressure valve thus optimising power consumption and system thermal balance.



**PS** High pressure ports  
**A** Pressure port, boost pump  
**B** Suction port, boost pump  
**F** Feed port, boost & control

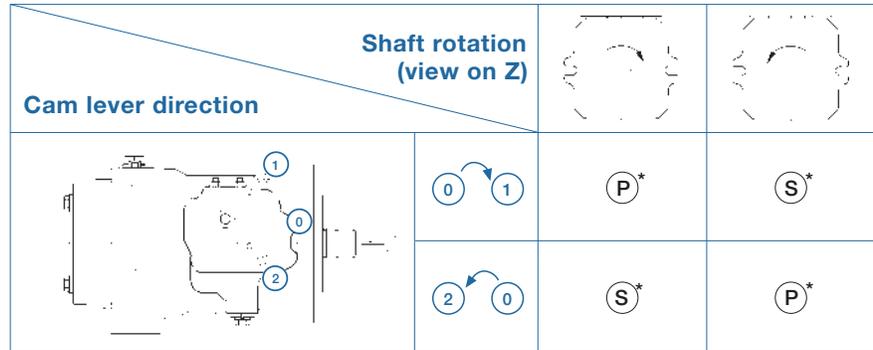
**X** Test port, control pressure  
**Ms, Mp** Test ports, high pressure  
**L, U** Drain ports  
**L1, L2** Vent ports

**Note for left hand rotation:**  
**A** Suction port, boost pump  
**B** Pressure port, boost pump

## Flow Direction

The flow direction of the fluid is dependant upon

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

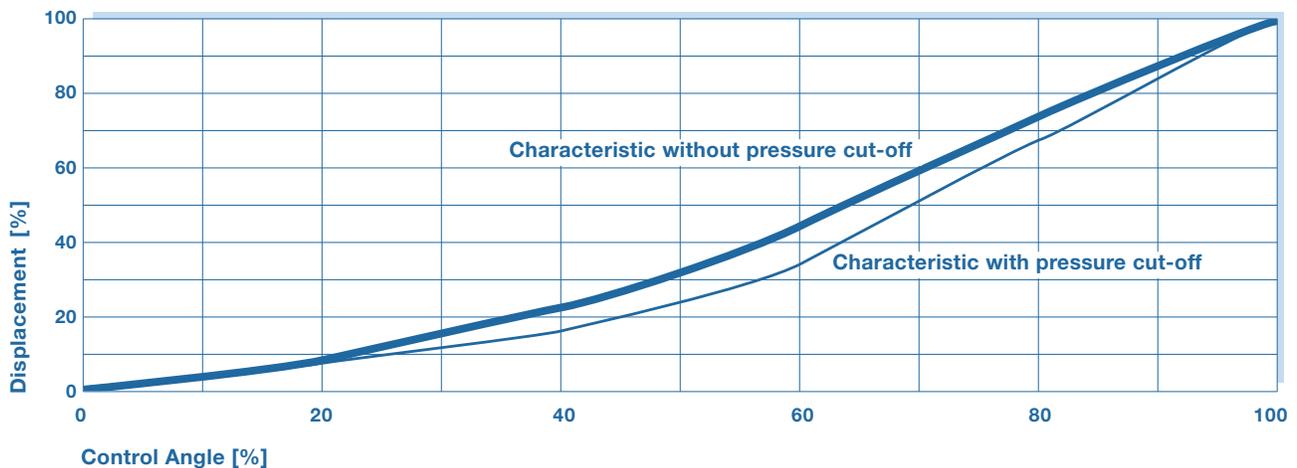


The table shows the flow correlation:

| Rated size     |                   |       | For all unit sizes without pressure cut-off | For all unit sizes with pressure cut-off |
|----------------|-------------------|-------|---|--|
| Control force  | *1                | [N]   | 17  | 13                                       |
|                | Max. intermittent | [N]   | 500   | 230                                      |
| Control torque |                   | [Nm]  | 1.2   | ≤1                                       |
| Control angle  | Neutral range     | ± [°] | ± 4   | ± 4                                      |
|                | To end position   | ± [°] | ± 48  | ± 30                                     |
| Response time  | *2 Minimum        | [sec] | 0.5   | 0.5                                      |
| Reset          | Principle         |       | Centred with external force                 | Self-centred without external force      |
|                | Torque            | [Nm]  | 1.2   | 0.7                                      |

\*1) With long lever (radius r without / with pressure cut-off = 70/75 mm)

\*2) Other response times possible with special restrictors



## 2.2 Electro-hydraulic Control E1/E2



This control can be supplied with 2 or 3 solenoids.  
The 2 solenoid version can also be fitted with pressure cut-off.

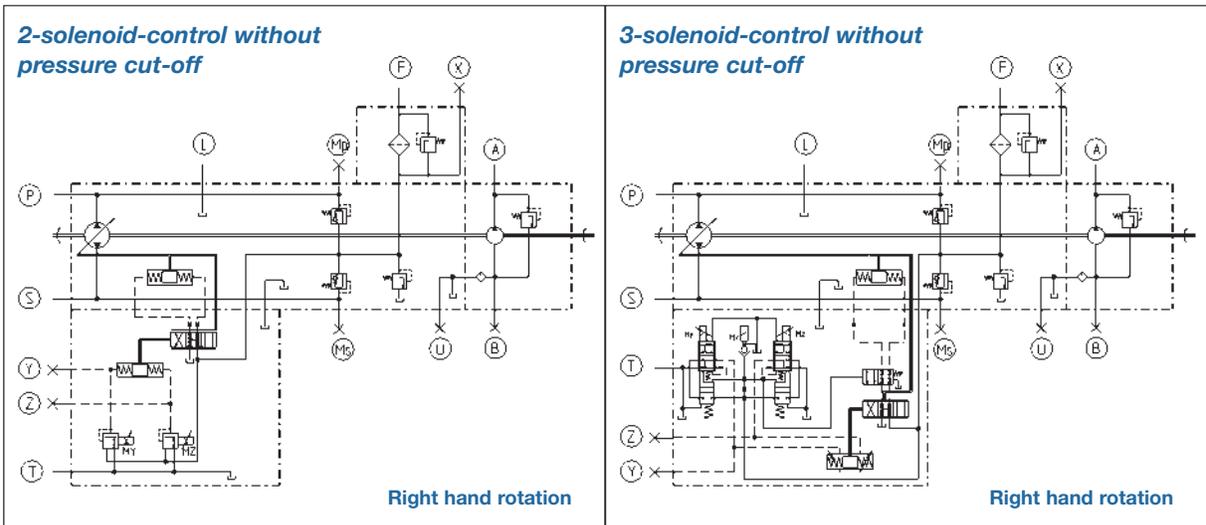
By means of a suitable controller (see Linde brochure "Controls Programme") the pump flow rate and flow direction are controlled via the energised proportional solenoid.

Controllers with pressure cut-off reduce pump flow when the cut-off pressure is reached. As system pressure is maintained only a small quantity of residual fluid flows through the high pressure valve thus optimising power consumption and system thermal balance

Electro-hydraulic control E1 has 2 proportional solenoids and is suitable for general application.

### Electro-hydraulic control E2 is fitted with an additional switching solenoid and complies to Linde Standards.

It's use is recommended for mobile applications where specific criteria have to be met in the event of electrical faults occurring. In these cases (e.g. cable break or false signals) the additional **third solenoid** ensures the pump swash is returned to neutral slowly and the vehicle is then brought to a stop in a smooth and jerk free manner.



**P, S** High pressure ports  
**A** Pressure port, boost pump  
**B** Suction port, boost pump

**F** Feed port, boost & control  
**X, Y, Z** Test port, control pressure  
**Ms, Mp** Test ports, high pressure

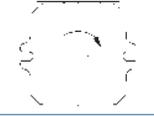
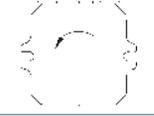
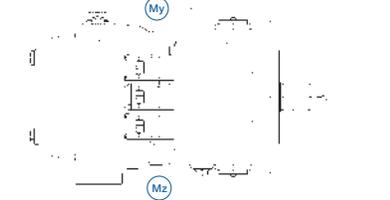
**L, U** Drain ports  
**T** Vent ports  
**My, Mz** Proportional solenoids connectors  
**Mx** Switching solenoid connector

**Note for left hand rotation:**  
**A** Suction port, boost pump  
**B** Pressure port, boost pump

## Flow Direction

The flow direction of the fluid is dependent upon

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

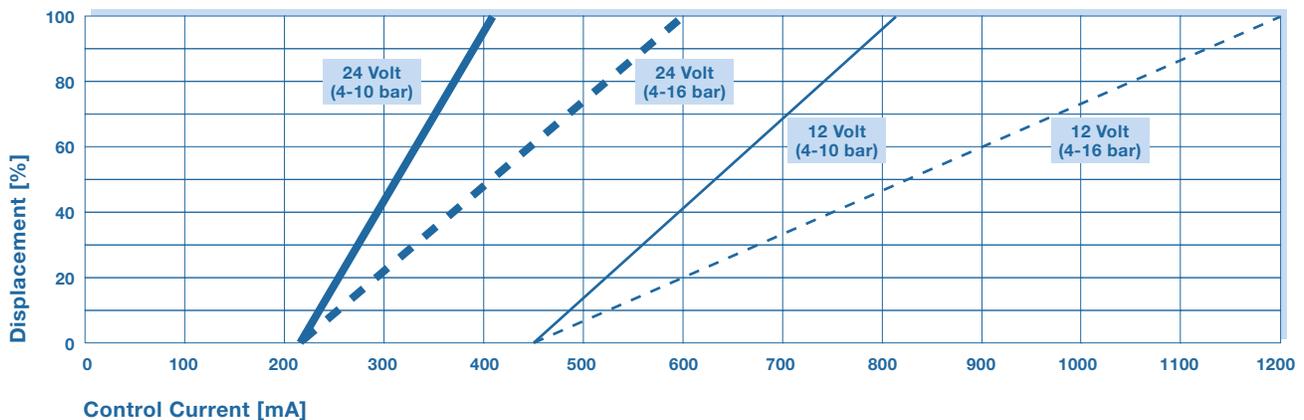
| Active solenoid   |    | Shaft rotation (view on Z)  |   |
|---|----|---|---|
|   |    |  |  |
|  | My | P*  | S*  |
|   | Mz | S*  | P*  |

The table shows the flow correlation:

| Rated size                       |  | For all unit sizes with and without pressure cut-off   |               |
|----------------------------------|--|--|---------------|
| Connector type                   | With E1-control  | Hirschmann/AMP-JT, 2-pin   |               |
|                                  | With E2-control  | AMP-JT, 2-pin  |               |
| Rated voltage = Limiting voltage | [V]  | 12   | 24            |
| Voltage type                     |  | Direct (D.C.)  |               |
| Power consumption                | [W]  | 15.6   |               |
| Rated current = Limiting current | [mA]   | 1.300  | 650           |
| Control current                  | Swash begin [mA]   | 450 ± 10   | 225 ± 10      |
|                                  | Swash end [mA]   | 820 (1200) *1)   | 410 (600) *1) |
| Relative duty cycle              | [%]  | 100  |               |
| Protection class                 |  | IP 6K 6K, Part 9   |               |
| Control types                    | With Linde transducers: digital via Pulse Width Modulation PWM | 100 Hz Rectangle, Pulse duty ratio variable over control range   |               |
|                                  | Alternative option: Analogue control                           | Direct current (with or without superimposed dither signal for stability and reducing hysteresis effects, dither ± 125 mA, 32-40 Hz, pulse duty ratio 1:1) |               |
| Response time *                  | Minimum *2) [s]  | 0.5  |               |

\*1) On request

\*2) Other response times possible with special orifices.



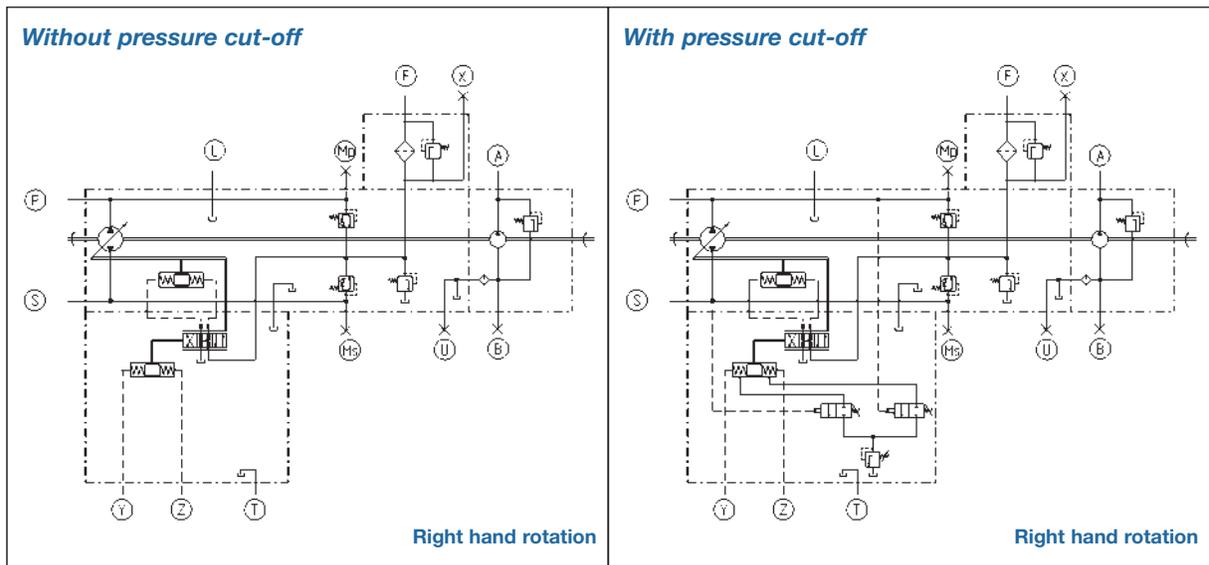
## 2.3 Hydraulic Control H1



This control can be supplied with or without pressure cut-off

By means of a suitable pilot pressure control valve (see Linde Brochure “Controls Programme”) the pump flow rate and flow direction are controlled.

Controllers with pressure cut-off reduce pump flow when the cut-off pressure is reached. As system pressure is maintained, only a small quantity of residual fluid flows through the high pressure valve thus optimising power consumption and system thermal balance.



**P, S** High pressure ports  
**A** Pressure port, boost pump  
**B** Suction port, boost pump

**F** Feed port, boost & control  
**X** Test port, control pressure  
**Ms, Mp** Test ports, high pressure

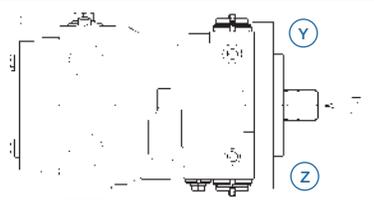
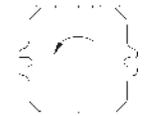
**L, U** Drain ports  
**T** Vent port  
**Y, Z** Pilot (control) pressure ports

**Note for left hand rotation:**  
**A** Suction port, boost pump  
**B** Pressure port, boost pump

## Flow Direction

The flow direction of the fluid is dependant upon

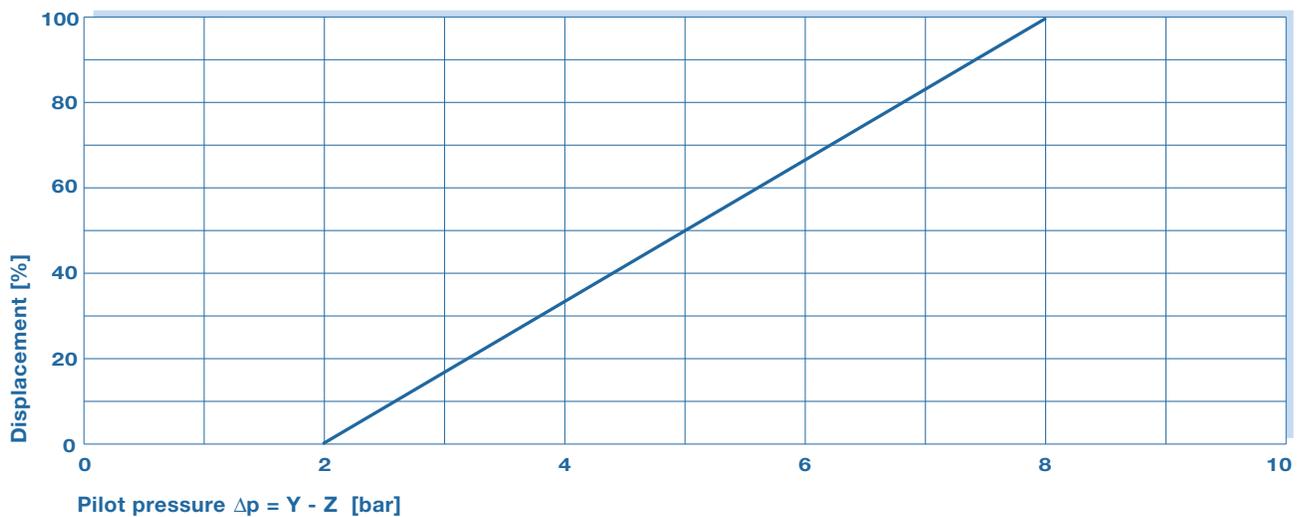
- the pump direction of rotation
- the over centre direction of the swash plate

|  |  | Shaft rotation<br>(view on Z)   |   |
|---|--|---|---|
|   |  |  |  |
| Pilot pressure port   |  | Y   | Z   |
|   |  | P*  | S*  |
|   |  | S*  | P*  |

The table shows the flow correlation:

| Rated size                     |                             |       | For all unit sizes with and without pressure cut-off |
|--------------------------------|-----------------------------|-------|--|
| Control pressure range         | Differential pressure [Y-Z] | [bar] | 2-8  |
| Permissible pressure at Y or Z | Maximum                     | [bar] | 30   |
| Response time *                | Minimum                     | [sec] | 0.5  |

\* Other response times possible with special restrictors.



### 3. BOOST PUMPS



HPV 105-02 with integrated boost pump and cold start valve



HPV 210-02 with boost pump added

The boost pump for the sizes 55-135 is an internal type gear pump, and for the sizes 165-210 an external type gear pump. The boost pump supplies

- Boost flow (make-up/feed)
- Control flow and
- Cooling flow.

All pump sizes include a charge valve, the sizes 55-135 have a cold start valve additionally.

Depending on the application, suction can either be

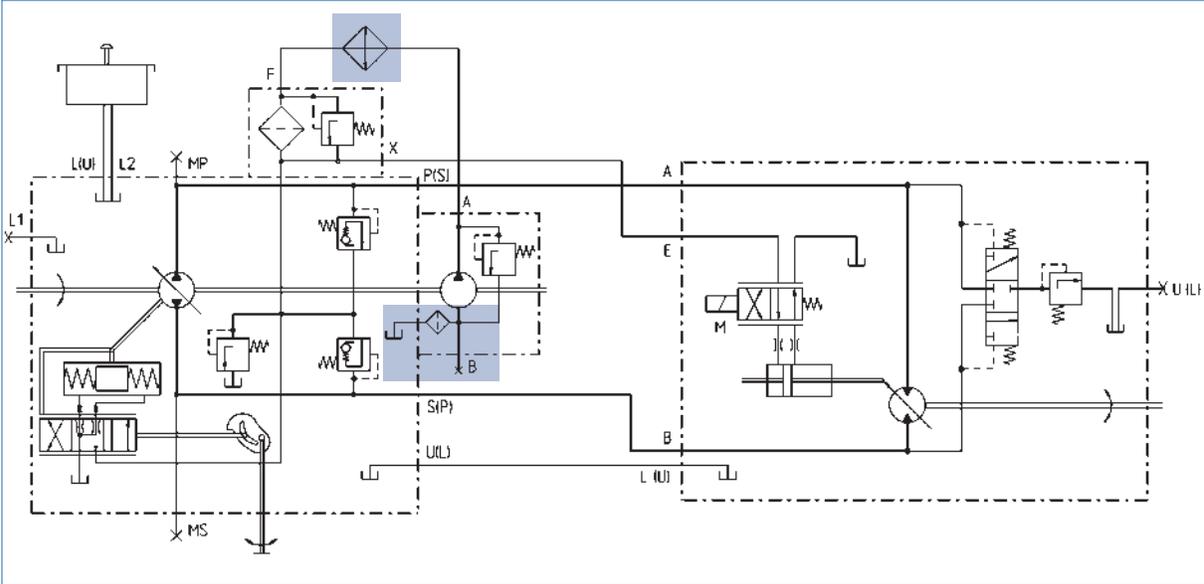
- internal, external or hybrid (simultaneous internal and external suction)
- for sizes 165-210 external only.

| Rated size     |                         | 55 | 75   | 105 | 135 | 165                       | 210 |  |
|----------------|-------------------------|----|------|-----|-----|---------------------------|-----|--|
| Displacement   | [ cm <sup>3</sup> /rev] | 16 | 22.5 |     | 38  |                           |     |  |
| Setting values | Boost pressure [bar]    | 19 |      |     |     |                           |     |  |
|                | Cold start valve [bar]  | 25 |      |     |     | not Linde-scope of supply |     |  |
| Pressure       | Maximum pressure* [bar] | 40 |      |     |     |                           |     |  |

\* Observe max. permissible rated pressures for filter and cooler.

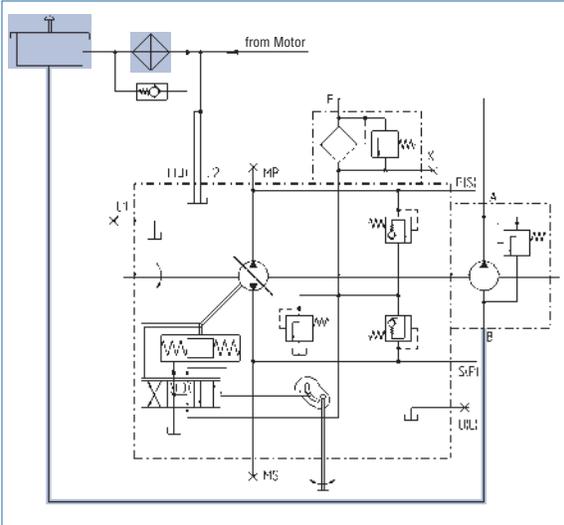
Boost pump with **internal** suction for sizes 55-135

- HPV-02 pump with mechanical - hydraulic control
- HMMV-02 motor with Electro-hydraulic Flip-Flop control
- Oil Cooler in low pressure circuit

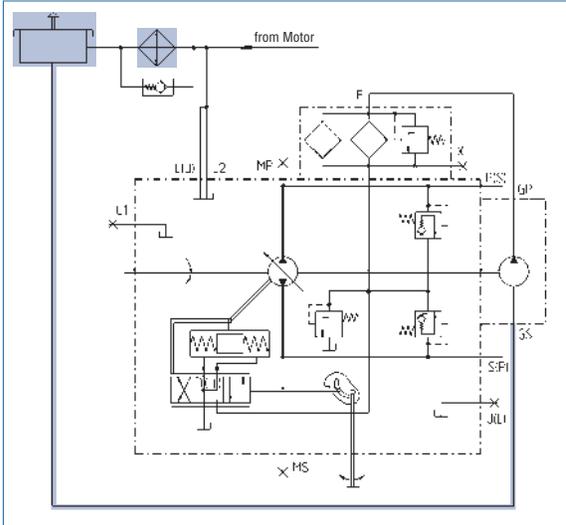


Boost pump with **external** suction for sizes 55-210

- HPV-02 pump with mechanical - hydraulic control
- Oil Cooler in return line



Sizes 55-135



Sizes 165-210

## 4. AUXILIARY PUMPS (PTO)



With sizes 55-135 additional drives, e.g. utility pumps can be driven from the splined thru-shaft.

With sizes 55-135 power can be taken off with or without boost pump mounted. In case of boost pump mounted the power take off options available are **SAE A-, B-, B-B-** or **C** mounting flanges.

Main pumps are supplied as standard with **SAE A** type PTO and require no additional intermediate flange or coupling. For optional SAE B, B-B and C type PTO's intermediate mounting flanges and muff couplings are available.

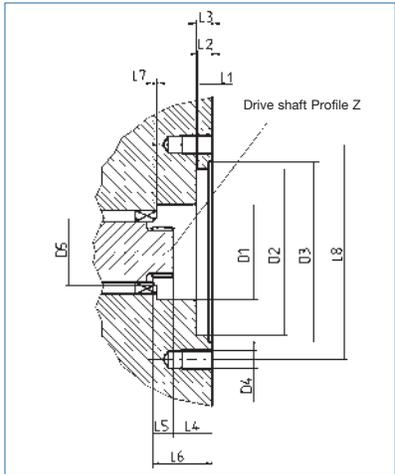
With sizes 165 and 210 power take off can only be realized without boost pump mounted.

Power take off with boost pump

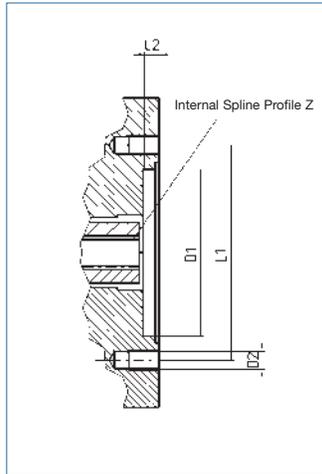
| Transfer Torque |                 | Rated size | 55 | 75  | 105 | 135 | 165 | 210 |
|-----------------|-----------------|------------|----|-----|-----|-----|-----|-----|
|                 |                 |            |    |     |     |     |     |     |
| SAE A           | Continuous [Nm] |            |    | 75  |     |     |     |     |
|                 | Max. [Nm]       |            |    | 107 |     |     |     |     |
| SAE B           | Continuous [Nm] |            |    | 175 |     |     |     |     |
|                 | Max. [Nm]       |            |    | 250 |     |     |     |     |
| SAE B-B         | Continuous [Nm] |            |    | 175 |     |     |     |     |
|                 | Max. [Nm]       |            |    | 250 |     |     |     |     |
| SAE C           | Continuous [Nm] |            |    | 175 |     |     |     |     |
|                 | Max. [Nm]       |            |    | 250 |     |     |     |     |

Power take off without boost pump

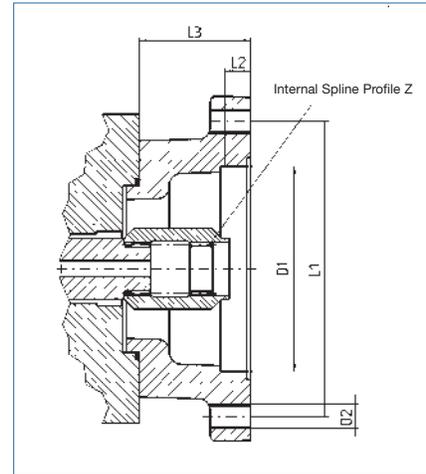
| Transfer Torque |      | Rated size | 55  | 75  | 105 | 135 | 165               | 210  |
|-----------------|------|------------|-----|-----|-----|-----|-------------------|------|
|                 |      |            |     |     |     |     | under development |      |
| Continuous      | [Nm] |            | 220 | 305 | 420 | 540 |                   | 840  |
| Max.            | [Nm] |            | 350 | 485 | 670 | 870 |                   | 1340 |



PTO without boost pump



PTO with boost pump  
SAE A



PTO with boost pump  
SAE B, B-B and C

Flange dimensions for PTO with boost pump

| Rated Size                    | For sizes 55-135   |          |          |                    |
|-------------------------------|--------------------|----------|----------|--------------------|
|                               | SAE A              | SAE B    | SAE B-B  | SAE C              |
| Flange Profile                | 2 hole             |          |          |                    |
| Internal spline profile Z     | ANSI B92.1,        |          |          |                    |
|                               | 16/32 spline pitch |          |          | 12/24 spline pitch |
|                               | 9 Teeth            | 13 Teeth | 15 Teeth | 14 Teeth           |
| 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                 |

Flange dimensions for PTO without boost pump

| Rated size                      | 55                 | 75       | 105      | 135      | 165               | 210        |
|---------------------------------|--------------------|----------|----------|----------|-------------------|------------|
| Drive shaft profile Z           | ANSI B92.1,        |          |          |          | under development | prototypes |
|                                 | 16/32 spline pitch |          |          |          |                   |            |
|                                 | 15 Teeth           | 18 Teeth | 19 Teeth | 21 Teeth |                   |            |
| D1 [mm]                         | 40                 | 42       | 48       | 52       |                   |            |
| D2 Spigot pilot diameter [mm]   | 82.55              |          |          |          |                   |            |
| D3 [mm]                         | 88                 |          |          |          |                   |            |
| D4 [mm]                         | M 10               |          |          |          |                   |            |
| D5 Bearing clearance, max. [mm] | 30                 | 35       | 38       | 43       |                   |            |
| L1 [mm]                         | 1.5                |          |          |          |                   |            |
| L2 Adapter length [mm]          | 7                  |          |          |          |                   |            |
| L3 [mm]                         | 9                  |          |          |          |                   |            |
| L4 Minimum distance [mm]        | 35                 | 39       | 33       | 35       |                   |            |
| L5 Usable spline length [mm]    | 14                 | 18       | 19       | 20       |                   |            |
| L6 Distance to bearing [mm]     | 51                 | 57.5     | 53       | 55.9     |                   |            |
| L7 Bearing clearance, min. [mm] | 3                  | 3        | 3        | 4        |                   |            |
| L8 Hole distance [mm]           | 106.4 (2 bolt)     |          |          |          |                   |            |

## 5. TANDEM AND MULTIPLE PUMPS



Tandem pumps are created by the “series adding on” of single HPV-02 units.  
Multiple pumps consist of an HPV-pump and an HPR-pump.

| Rated size back pump \ Rated size front pump | 55  | 75  | 105 | 135 | 165               | 210 |
|--|-----|-----|-----|-----|-------------------|-----|
| 55   | yes | yes | yes | yes | under development | yes |
| 75   | -   | yes | yes | yes |                   | yes |
| 105  | -   | -   | yes | yes |                   | yes |
| 135  | -   | -   | -   | yes |                   | yes |
| 165  | -   | -   | -   | -   |                   | -   |
| 210  | -   | -   | -   | -   |                   | yes |

| Max. transfer torque \ Rated size front pump               | 55                     | 75  | 105  | 135  | 165               | 210         |
|--|------------------------|-----|------|------|-------------------|-------------|
|  |                        |     |      |      |                   |             |
| <b>To Position (A)</b> [Nm]                                | 570                    | 790 | 1090 | 1410 | under development | 2180        |
| <b>To Position (B)</b> for rated size of back pump 55 [Nm] | 350                    | 485 | 570  | 570  |                   | 570         |
| for rated size of back pump 75 [Nm]                        | -                      | 485 | 670  | 790  |                   | 790         |
| for rated size of back pump 105 [Nm]                       | -                      | -   | 670  | 870  |                   | <b>1090</b> |
| for rated size of back pump 135 [Nm]                       |                        |     |      |      |                   |             |
| for rated size of back pump 165 [Nm]                       |                        |     |      |      |                   |             |
| for rated size of back pump 210 [Nm]                       |                        |     |      |      |                   |             |
| <b>To Position (C) (for PTO)</b> [Nm]                      | see table in chapter 4 |     |      |      |                   |             |

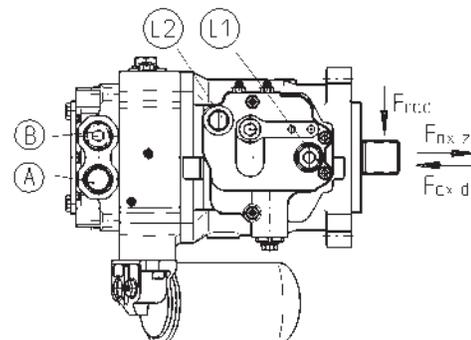
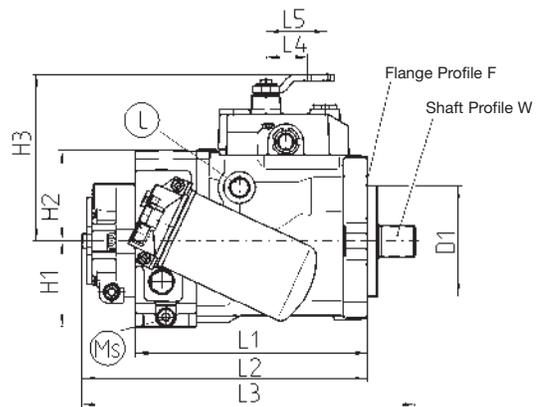
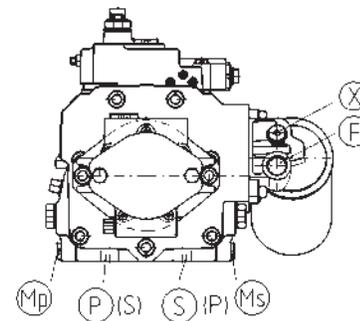
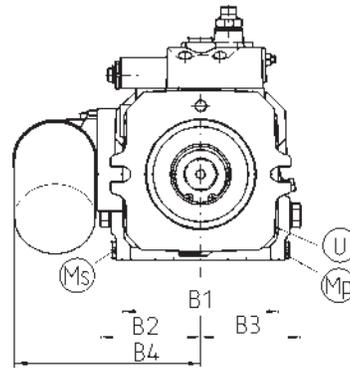
## 6. MAIN DIMENSIONS

### HPV-02 with Mechanical-hydraulic Control M1

| Size                    | 55                       | 75  | 105         | 135   | 165         | 210 |
|-------------------------|--------------------------|-----|-------------|-------|-------------|-----|
| <b>Flange Profile F</b> | Mounting flange: 2-hole  |     |             |       |             |     |
|                         | SAE C                    |     |             | SAE D |             |     |
| <b>Shaft Profile W</b>  | ANSI B92.1               |     |             |       |             |     |
|                         | 16/32 spline pitch       |     |             |       |             |     |
|                         | 21<br>Teeth              |     | 23<br>Teeth |       | 27<br>Teeth |     |
| <b>D1 [mm]</b>          | 127                      |     |             | 152.4 |             |     |
| <b>B1 [mm]</b>          | 181                      |     |             | 228.6 |             |     |
| <b>B2 [mm]</b>          | 101                      | 116 |             | 141   |             |     |
| <b>B3 [mm]</b>          | 101                      | 116 |             | 141   |             |     |
| <b>B4 [mm]</b>          | 192                      | 216 |             | 219   |             |     |
| <b>L1 [mm]</b>          | 225                      | 242 | 267         | 288   |             |     |
| <b>L2 [mm]</b>          | 282                      | 304 | 329         | 350   |             |     |
| <b>L3 [mm]</b>          | 335                      | 359 | 385         | 425   |             |     |
| <b>L4 [mm]</b>          | w/o PCO 48               |     |             |       |             |     |
|                         | with PCO 52              |     |             |       |             |     |
| <b>L5 [mm]</b>          | w/o PCO 70               |     |             |       |             |     |
|                         | with PCO 75              |     |             |       |             |     |
| <b>H1 [mm]</b>          | 88                       | 93  | 99          | 106   |             |     |
| <b>H2 [mm]</b>          | 95                       | 103 | 105         | 112   |             |     |
| <b>H3 [mm]</b>          | w/o PCO 184 188 193 198  |     |             |       |             |     |
|                         | with PCO 220 224 229 234 |     |             |       |             |     |
| <b>P</b>                | SAE 3/4"                 |     | SAE 1"      |       | SAE 1 1/4"  |     |
| <b>S</b>                | SAE 3/4"                 |     | SAE 1"      |       | SAE 1 1/4"  |     |
| <b>A</b>                | M26x1.5                  |     |             |       |             |     |
| <b>B</b>                | M26x1.5                  |     |             |       |             |     |
| <b>L</b>                | M22x1.5                  |     |             |       |             |     |
| <b>U</b>                | M22x1.5                  |     |             |       |             |     |
| <b>F</b>                | M22x1.5                  |     |             |       |             |     |
| <b>X</b>                | M14x1.5                  |     |             |       |             |     |
| <b>Mp</b>               | M14x1.5                  |     |             |       |             |     |
| <b>Ms</b>               | M14x1.5                  |     |             |       |             |     |
| <b>L1</b>               | M22x1.5                  |     |             |       |             |     |
| <b>L2</b>               | M22x1.5                  |     |             |       |             |     |
| <b>T</b>                | M22x1.5                  |     |             |       |             |     |
| <b>Y</b>                | M14x1.5                  |     |             |       |             |     |
| <b>Z</b>                | M14x1.5                  |     |             |       |             |     |

under development

prototypes

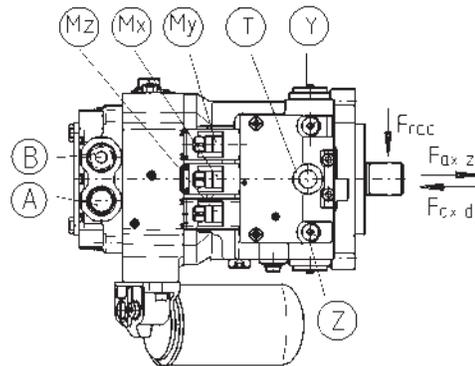
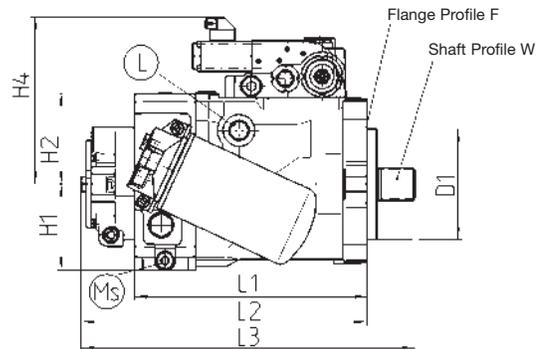
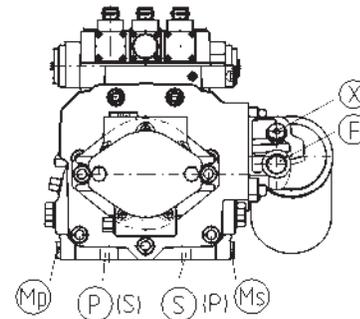
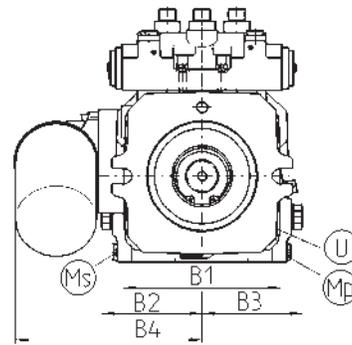


Threads metric as per ISO 6149  
 Threads for leakage ports metric as per DIN 3852 (with sizes 165-210 metric as per ISO 6149)  
 Threads for SAE-high pressure port metric as per DIN 3852  
 Threads as per UN/UNF on request

# HPV-02 with Electro-hydraulic Control E1/E2

| Size                    | 55                      | 75                 | 105         | 135        | 165 | 210               |            |  |
|-------------------------|-------------------------|--------------------|-------------|------------|-----|-------------------|------------|--|
| <b>Flange Profile F</b> | Mounting flange: 2-hole |                    |             |            |     | under development | prototypes |  |
|                         | SAE C                   |                    |             | SAE D      |     |                   |            |  |
| <b>Shaft Profile W</b>  | ANSI B92.1              |                    |             |            |     |                   |            |  |
|                         | 16/32 spline pitch      |                    |             |            |     |                   |            |  |
|                         | 21<br>Teeth             | 23<br>Teeth        | 27<br>Teeth |            |     |                   |            |  |
| <b>D1 [mm]</b>          | 127                     |                    |             | 152.4      |     |                   |            |  |
| <b>B1 [mm]</b>          | 181                     |                    |             | 228.6      |     |                   |            |  |
| <b>B2 [mm]</b>          | 101                     | 116                | 141         |            |     |                   |            |  |
| <b>B3 [mm]</b>          | 101                     | 116                | 141         |            |     |                   |            |  |
| <b>B4 [mm]</b>          | 192                     | 216                |             | 219        |     |                   |            |  |
| <b>L1 [mm]</b>          | 225                     | 242                | 267         | 288        |     |                   |            |  |
| <b>L2 [mm]</b>          | 282                     | 304                | 329         | 350        |     |                   |            |  |
| <b>L3 [mm]</b>          | 335                     | 359                | 385         | 425        |     |                   |            |  |
| <b>H1 [mm]</b>          | 88                      | 93                 | 99          | 106        |     |                   |            |  |
| <b>H2 [mm]</b>          | 95                      | 103                | 105         | 112        |     |                   |            |  |
| <b>H4 [mm]</b>          | w/o PCO                 | 159                | 164         | 168        | 173 |                   |            |  |
|                         | with PCO                | 195                | 200         | 204        | 209 |                   |            |  |
| <b>P</b>                | SAE 3/4"                | SAE 1"             |             | SAE 1 1/4" |     |                   |            |  |
| <b>S</b>                | SAE 3/4"                | SAE 1"             |             | SAE 1 1/4" |     |                   |            |  |
| <b>A</b>                | M26x1.5                 |                    |             |            |     |                   |            |  |
| <b>B</b>                | M26x1.5                 |                    |             |            |     |                   |            |  |
| <b>L</b>                | M22x1.5                 |                    |             |            |     |                   |            |  |
| <b>U</b>                | M22x1.5                 |                    |             |            |     |                   |            |  |
| <b>F</b>                | M22x1.5                 |                    |             |            |     |                   |            |  |
| <b>X</b>                | M14x1.5                 |                    |             |            |     |                   |            |  |
| <b>Mp</b>               | M14x1.5                 |                    |             |            |     |                   |            |  |
| <b>Ms</b>               | M14x1.5                 |                    |             |            |     |                   |            |  |
| <b>T</b>                | M22x1.5                 |                    |             |            |     |                   |            |  |
| <b>Y</b>                | M14x1.5                 |                    |             |            |     |                   |            |  |
| <b>Z</b>                | M14x1.5                 |                    |             |            |     |                   |            |  |
| <b>Mx</b>               | <b>E1 connector</b>     | -                  |             |            |     |                   |            |  |
|                         | <b>E2 connector</b>     | AMP-JT             |             |            |     |                   |            |  |
| <b>My</b>               | <b>E1 connector</b>     | Hirschmann, AMP-JT |             |            |     |                   |            |  |
|                         | <b>E2 connector</b>     | AMP-JT             |             |            |     |                   |            |  |
| <b>Mz</b>               | <b>E1 connector</b>     | Hirschmann, AMP-JT |             |            |     |                   |            |  |
|                         | <b>E2 connector</b>     | AMP-JT             |             |            |     |                   |            |  |

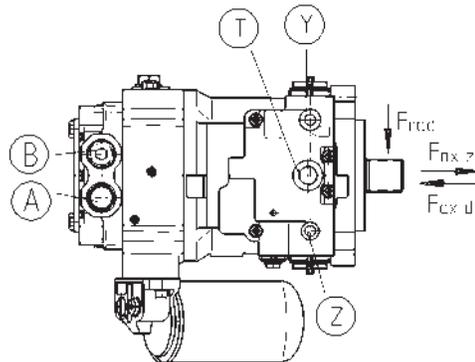
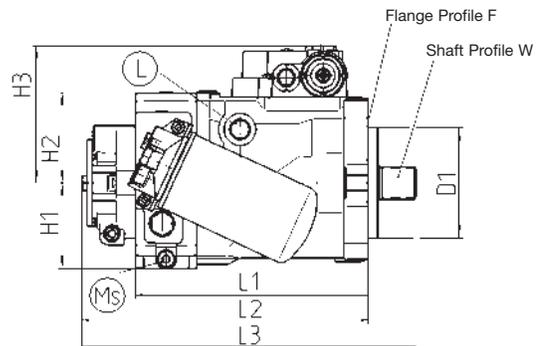
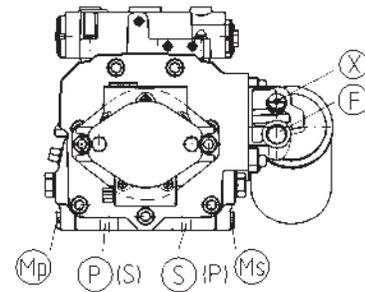
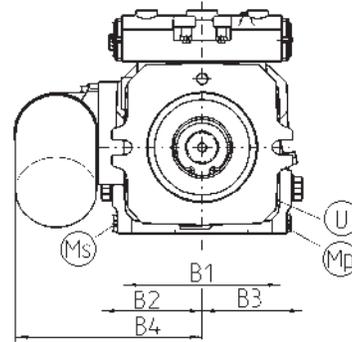
Threads metric as per ISO 6149  
 Threads for leakage ports metric as per DIN 3852 (with sizes 165-210 metric as per ISO 6149)  
 Threads for SAE-high pressure port metric as per DIN 3852  
 Threads as per UN/UNF on request



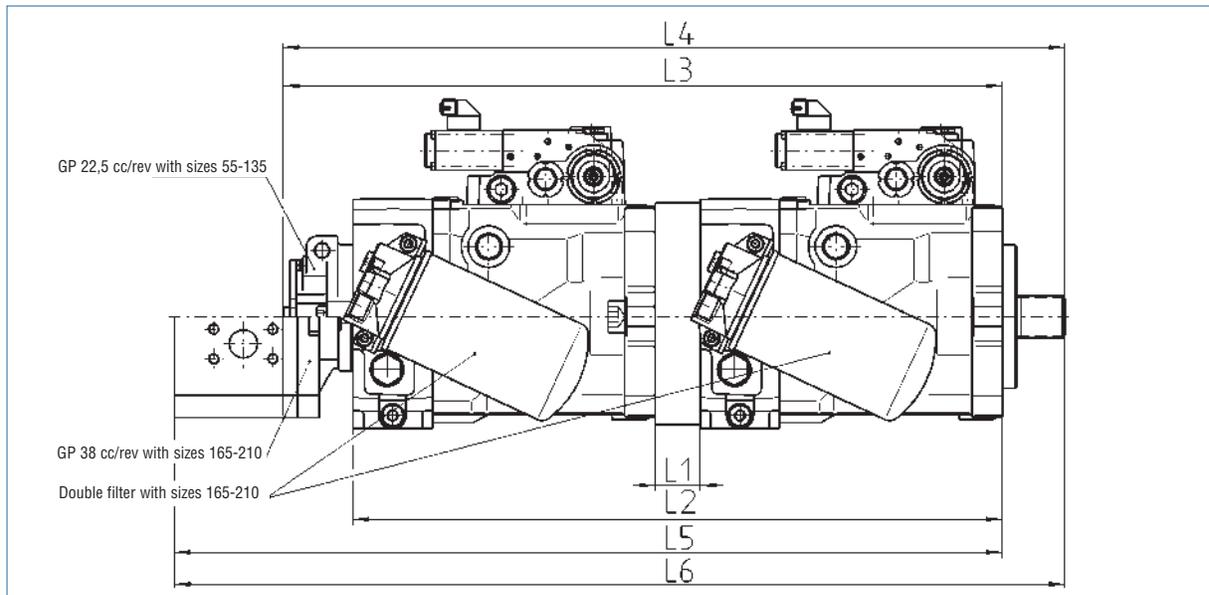
# HPV-02 with Hydraulic Control H1

| Size                    | 55                      | 75          | 105         | 135   | 165 | 210               |            |  |
|-------------------------|-------------------------|-------------|-------------|-------|-----|-------------------|------------|--|
| <b>Flange Profile F</b> | Mounting flange: 2-hole |             |             |       |     | under development | prototypes |  |
|                         | SAE C                   |             |             | SAE D |     |                   |            |  |
| <b>Shaft Profile W</b>  | ANSI B92.1              |             |             |       |     |                   |            |  |
|                         | 16/32 spline pitch      |             |             |       |     |                   |            |  |
|                         | 21<br>Teeth             | 23<br>Teeth | 27<br>Teeth |       |     |                   |            |  |
| <b>D1 [mm]</b>          | 127                     |             |             | 152.4 |     |                   |            |  |
| <b>B1 [mm]</b>          | 181                     |             |             | 228.6 |     |                   |            |  |
| <b>B2 [mm]</b>          | 101                     | 116         | 141         |       |     |                   |            |  |
| <b>B3 [mm]</b>          | 101                     | 116         | 141         |       |     |                   |            |  |
| <b>B4 [mm]</b>          | 192                     | 216         | 219         |       |     |                   |            |  |
| <b>L1 [mm]</b>          | 225                     | 242         | 267         | 288   |     |                   |            |  |
| <b>L2 [mm]</b>          | 282                     | 304         | 329         | 350   |     |                   |            |  |
| <b>L3 [mm]</b>          | 335                     | 359         | 385         | 425   |     |                   |            |  |
| <b>H1 [mm]</b>          | 88                      | 93          | 99          | 106   |     |                   |            |  |
| <b>H2 [mm]</b>          | 95                      | 103         | 105         | 112   |     |                   |            |  |
| <b>H3 [mm]</b>          | w/o PCO                 | 194         | 154         | 158   | 163 |                   |            |  |
|                         | with PCO                | 185         | 190         | 194   | 199 |                   |            |  |
| <b>P</b>                | SAE 3/4"                | SAE 1"      | SAE 1 1/4"  |       |     |                   |            |  |
| <b>S</b>                | SAE 3/4"                | SAE 1"      | SAE 1 1/4"  |       |     |                   |            |  |
| <b>A</b>                | M26x1.5                 |             |             |       |     |                   |            |  |
| <b>B</b>                | M26x1.5                 |             |             |       |     |                   |            |  |
| <b>L</b>                | M22x1.5                 |             |             |       |     |                   |            |  |
| <b>U</b>                | M22x1.5                 |             |             |       |     |                   |            |  |
| <b>F</b>                | M22x1.5                 |             |             |       |     |                   |            |  |
| <b>X</b>                | M14x1.5                 |             |             |       |     |                   |            |  |
| <b>Mp</b>               | M14x1.5                 |             |             |       |     |                   |            |  |
| <b>Ms</b>               | M14x1.5                 |             |             |       |     |                   |            |  |
| <b>T</b>                | M22x1.5                 |             |             |       |     |                   |            |  |
| <b>Y</b>                | M14x1.5                 |             |             |       |     |                   |            |  |
| <b>Z</b>                | M14x1.5                 |             |             |       |     |                   |            |  |

Threads metric as per ISO 6149  
 Threads for leakage ports metric as per DIN 3852 (with sizes 165-210 metric as per ISO 6149)  
 Threads for SAE-high pressure port metric as per DIN 3852  
 Threads as per UN/UNF on request



## HPV-02 Tandem and Multiple Pumps



In case of tandem pump configuration the required size of the boost pump depends on the actual application. Criteria e.g. are diesel engine speed, number of hydraulic motors fed, working cycles.

| Rated size front pump \ Rated size back pump |         | 55        | 75      | 105 | 135 | 165 | 210 |
|--|---------|-----------|---------|-----|-----|-----|-----|
|  |         | <b>55</b> | L1 [mm] | 48  | -   | -   | -   |
|  | L2 [mm] | 498       | -       | -   | -   |     | -   |
|  | L3 [mm] | 555       | -       | -   | -   |     | -   |
|  | L4 [mm] | 611       | -       | -   | -   |     | -   |
| <b>75</b>                                    | L1 [mm] | 43        | 43      | -   | -   |     | -   |
|  | L2 [mm] | 510       | 527     | -   | -   |     | -   |
|  | L3 [mm] | 567       | 589     | -   | -   |     | -   |
|  | L4 [mm] | 623       | 645     | -   | -   |     | -   |
| <b>105</b>                                   | L1 [mm] | 38        | 38      | 38  | -   |     | -   |
|  | L2 [mm] | 530       | 547     | 572 | -   |     | -   |
|  | L3 [mm] | 587       | 609     | 690 | -   |     | -   |
|  | L4 [mm] | 643       | 665     | 690 | -   |     | -   |
| <b>135</b>                                   | L1 [mm] | 31        | 31      | 31  | 31  |     | -   |
|  | L2 [mm] | 544       | 561     | 586 | 607 |     | -   |
|  | L3 [mm] | 601       | 623     | 648 | 669 |     | -   |
|  | L4 [mm] | 676       | 698     | 723 | 744 |     | -   |
| <b>165</b>                                   | L1 [mm] |           |         |     |     |     |     |
|  | L2 [mm] |           |         |     |     |     |     |
|  | L5 [mm] |           |         |     |     |     |     |
|  | L6 [mm] |           |         |     |     |     |     |
| <b>210</b>                                   | L1 [mm] | 40        | 40      | 40  | 55  |     | 39  |
|  | L2 [mm] | 610       | 627     | 653 | 689 |     | 731 |
|  | L5 [mm] | 780       | 797     | 823 | 859 |     | 901 |
|  | L6 [mm] | 855       | 872     | 898 | 933 |     | 976 |

## 7. PRESSURE FLUIDS AND FILTRATION

### Permitted Pressure Fluids

- Mineral oil HLP to DIN 51524
- Biodegradeable fluids upon request
- Other pressure fluids upon request

### Technical Data

|   |                              |          |
|---|------------------------------|----------|
| <b>Working Viscosity Range</b>              | [mm <sup>2</sup> /s] = [cSt] | 10 to 80 |
| <b>Optimum Working Viscosity</b>            | [mm <sup>2</sup> /s] = [cSt] | 15 to 30 |
| <b>Max. Viscosity (short time start up)</b> | [mm <sup>2</sup> /s] = [cSt] | 1000     |

The hydraulic components and parts are designed for a temperature range of -20 °C to max. +90 °C.

### Viscosity Recommendations

| <b>Working temperature [°C]</b> | <b>Viscosity class [mm<sup>2</sup>/s] = [cSt] at 40 °C</b> |
|---------------------------------|--|
| ca. 30 to 40                    | 22   |
| ca. 60 to 80                    | 46 or 68   |

Linde recommend using only pressure fluids which are confirmed by the producer as suitable for use in high pressure hydraulic installations. For the correct choice of suitable pressure fluid it is necessary to know the working temperature in the hydraulic circuit. The pressure fluid chosen must allow the working viscosity to be within the optimum viscosity range (refer to above table).

#### **Attention !**

Due to pressure and speed influences the leakage fluid temperature is always higher than the circuit temperature. The temperature must not exceed 90 °C in any part of the system. Under special circumstances, if the stated conditions cannot be observed then please consult Linde.

### Filtration

In order to guarantee proper functions and efficiency of the hydraulic pumps the purity of the pressure fluid over the entire operating period, must comply to at least class 18/13 according to ISO 4406. With modern filtration technology, however, much better values can be achieved which contributes significantly to extending the life and durability of the hydraulic pumps and complete system.

## 8. TYPICAL APPLICATIONS

We move the world.





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Telephone (330) 533-6801 • Fax (330) 533-6893

Email [info@lindeamerica.com](mailto:info@lindeamerica.com) • Internet <http://www.lindeamerica.com>