

# HYDROSTATIC STEERING UNITS AND ACCESSORIES

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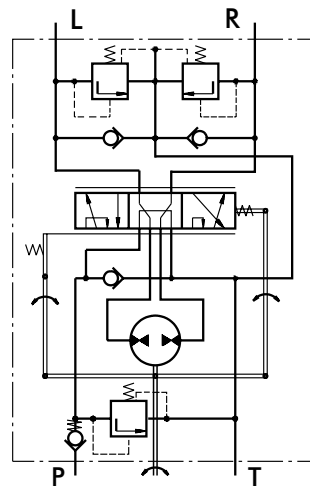
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# HYDROSTATIC STEERING UNITS TYPE XY.../1

The Hydrostatic Steering units are used in low-speed vehicles which driving speed does not exceed 60 km/h - such as: building machines, fork-lift trucks, harvesting machines, off-highway equipment and others. These hydraulic units amplify the torque to the steering wheels, with no need of hard mechanical connection.

The XY hydrostatic steering unit incorporates an axially displaced tracing valve and a metering pump in one housing. The working liquid is supplied by a separate pump and then is directed by the metering pump to the steering cylinders.

The XY steering unit is manufactured with built-in check valves, and there is an option for a built-in relief valve in the inlet.



"Open Center - Load Reaction"  
With Built-in Valves  
Version 1 - XY.../1

## SPECIFICATION DATA

| Parameters   | Type                        |                |                |     |
|--|-----------------------------|----------------|----------------|-----|
|  | XY<br>85.../1               | XY<br>120.../1 | XY<br>145.../1 |     |
| Displacement [cm <sup>3</sup> /rev]                | 84                          | 120            | 144            |     |
| Rated Flow* [l/min]                                | 9                           | 12             | 15             |     |
| Rated Pressure [bar]                               | 150                         |                |                |     |
| Relief Valve Pressure Settings** [bar]             | 80                          | 100            | 125            | 150 |
| Shock Valves Pressure Setting*** [bar]             | 200                         |                |                |     |
| Max.Cont.Pressure in Line T - P <sub>T</sub> [bar] | 20                          |                |                |     |
| Max.Torque at Servoamplifying [Nm]                 | 7,5 (by P <sub>T</sub> max) |                |                |     |
| Max.Torque w/o Servoamplifying [Nm]                | 125                         |                |                |     |
| Weight, avg. [kg]                                  | 6,4                         | 6,6            | 6,8            |     |
| Dimension A [mm]                                   | 136,3                       | 141,5          | 144,5          |     |

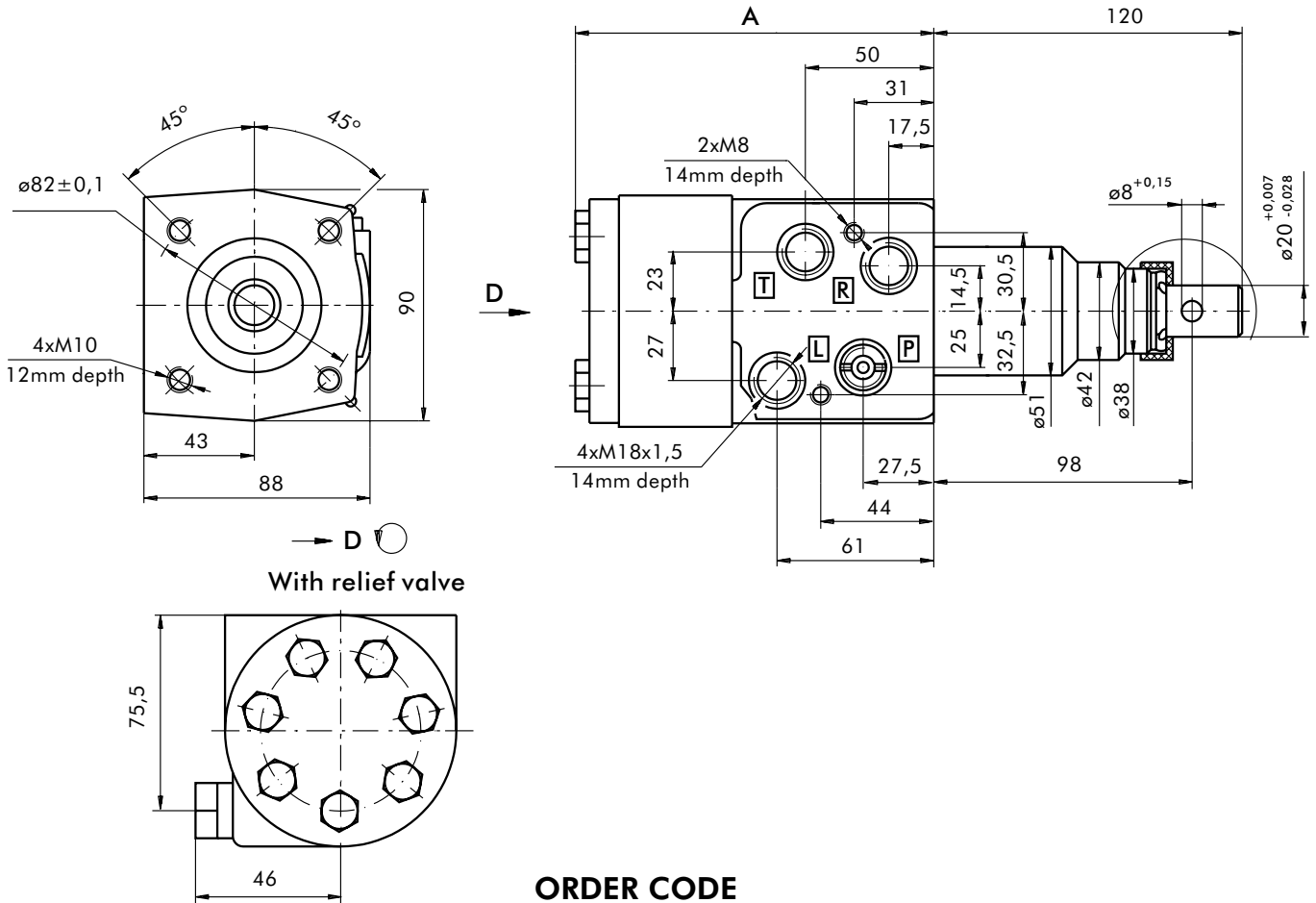
\* Rated Flow at 100 RPM.

\*\* Pressure Settings are at Rated Flow (as in the table) and viscosity 21 mm<sup>2</sup>/s (50° C).

\*\*\*Pressure Settings are at flow rate of 4 l/min and viscosity 21 mm<sup>2</sup>/s (50° C).

# HYDROSTATIC STEERING UNITS TYPE XY.../1

## DIMENSIONS AND MOUNTING DATA



## ORDER CODE

|           | 1 | 2 | 3 | 4        | 5 |
|-----------|---|---|---|----------|---|
| <b>XY</b> |   | - | / | <b>1</b> |   |

### Pos.1 - Displacement code

|            |                              |
|------------|------------------------------|
| <b>85</b>  | - 84 [cm <sup>3</sup> /rev]  |
| <b>120</b> | - 120 [cm <sup>3</sup> /rev] |
| <b>145</b> | - 144 [cm <sup>3</sup> /rev] |

### Pos.2 - Relief Valve Pressure Settings

|             |                        |
|-------------|------------------------|
| <b>8</b>    | - 80 bar               |
| <b>10</b>   | - 100 bar              |
| <b>12,5</b> | - 125 bar              |
| <b>15</b>   | - 150 bar              |
| <b>0</b>    | - without Relief Valve |

### Pos.3 - Versions

|          |   |
|----------|---|
| <b>1</b> | - Version 1 "Open Center - Load Reaction" |
|----------|---|

### Pos.4 - Option (Paint)\*

|           |                             |
|-----------|-----------------------------|
| omit      | - No Paint                  |
| <b>P</b>  | - Painted                   |
| <b>PC</b> | - Corrosion Protected Paint |

### Pos.5 - Design Series

|      |                     |
|------|---------------------|
| omit | - Factory specified |
|------|---------------------|

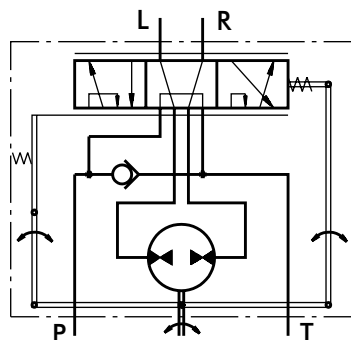
## NOTES:

\* Colour at customer's request.

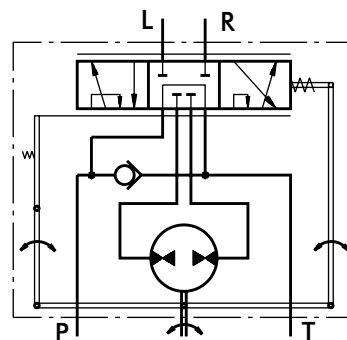
The steering units are mangano-phosphatized as standard.

# HYDROSTATIC STEERING UNITS TYPE HKU.../3, 4

The newly designed HKU steering units, with radial distribution, incorporate two rotary tracing valves in the housing, which turn on the metering pump.



"Open Center - Load Reaction"  
Version 3 - HKU.../3



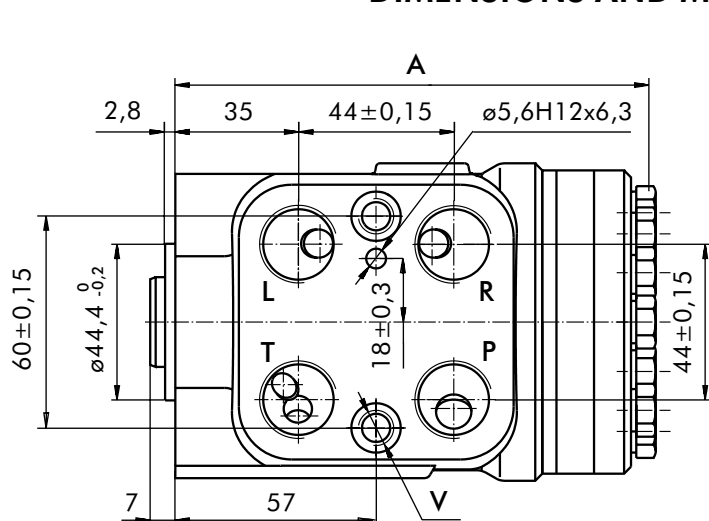
"Open Center - Non Load Reaction"  
Version 4 - HKU.../4

## SPECIFICATION DATA

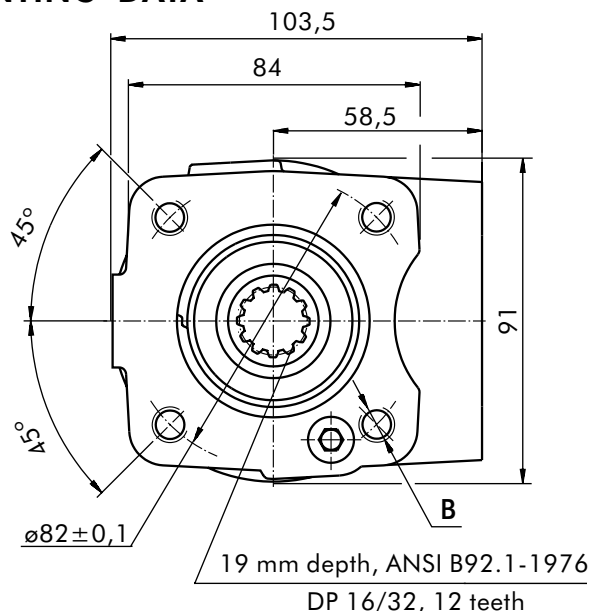
| Parameters   | Type                       |          |          |          |           |           |           |           |           |           |           |           |           |           |            |  |
|--|----------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|------------|--|
|  | HKU 40/3                   | HKU 50/3 | HKU 63/3 | HKU 80/3 | HKU 100/3 | HKU 125/3 | HKU 160/3 | HKU 200/3 | HKU 250/3 | HKU 320/3 | HKU 400/3 |           |           |           |            |  |
|  | HKU 40/4                   | HKU 50/4 | HKU 63/4 | HKU 80/4 | HKU 100/4 | HKU 125/4 | HKU 160/4 | HKU 200/4 | HKU 250/4 | HKU 320/4 | HKU 400/4 | HKU 500/4 | HKU 630/4 | HKU 800/4 | HKU 1000/4 |  |
| Displacement [cm <sup>3</sup> /rev]                  | 39,6                       | 49,5     | 65,6     | 79,2     | 99,0      | 123,8     | 158,4     | 198       | 247,5     | 316,8     | 396       | 495       | 618,7     | 793       | 990        |  |
| Rated Flow* [l/min]                                  | 4                          | 5        | 6        | 8        | 10        | 13        | 16        | 20        | 25        | 32        | 40        | 50        | 63        | 80        |            |  |
| Rated Pressure [bar]                                 | 160                        |          |          |          |           |           |           |           |           |           |           |           | 140       |           | 100        |  |
| Max. Cont. Pressure in Line T - P <sub>T</sub> [bar] | 25                         |          |          |          |           |           |           |           |           |           |           |           |           |           |            |  |
| Max. Torque at Servoamplifying [Nm]                  | 6 (by P <sub>T,max</sub> ) |          |          |          |           |           |           |           |           |           |           |           |           |           |            |  |
| Max. Torque w/o Servoamplifying [Nm]                 | 120                        |          |          |          |           |           |           |           |           |           |           |           |           |           |            |  |
| Weight, avg. [kg]                                    | 5,3                        | 5,4      | 5,5      | 5,6      | 5,7       | 5,8       | 6,0       | 6,3       | 6,5       | 7,0       | 7,4       | 8,0       | 8,7       | 9,6       | 10,6       |  |
| Dimension A [mm]                                     | 130,8                      | 132,2    | 133,9    | 136,2    | 138,8     | 142,2     | 146,8     | 152,2     | 158,8     | 168,2     | 178,8     | 192       | 209,3     | 232,2     | 258,6      |  |

\* Rated Flow at 100 RPM.

## DIMENSIONS AND MOUNTING DATA

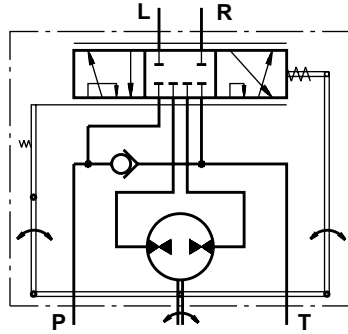


The ports are shown in the Table of page 7.



# HYDROSTATIC STEERING UNIT TYPE HKU.../7

The HKU.../7 is a "Closed Center - Non Load Reaction" hydrostatic steering unit, designed for integration into systems with built-in hydroaccumulator, achieving minimal energy losses.



"Closed Center - Non Load Reaction"  
Version 7 - HKU.../7

When connecting to a differential cylinder the L and R ports of the steering unit must be connected as follows: L to the greater piston area, and R - to the smaller one.

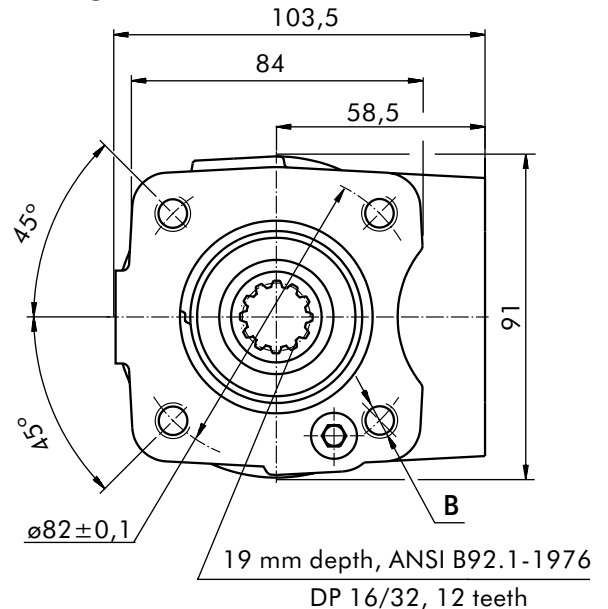
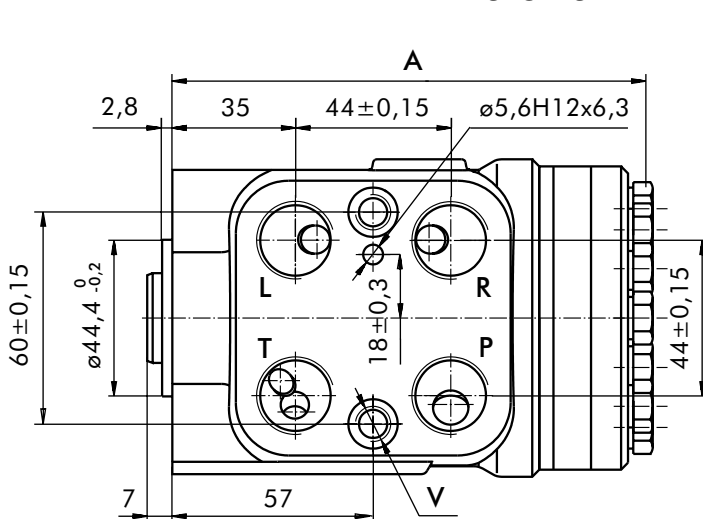
For the "Closed Center - Non Load Reaction" and "Closed Center - Non Reaction and Load Sensing" steering units it is possible to observe Thermal Shock - condition caused when the hydraulic system has operated for some time without turning the steering wheel, causing the fluid in the reservoir and the system to heat up while the steering unit is relatively cool (i.e. there is more than 50°F [10°C] difference in the temperature). If, under the condition of Thermal Shock, the steering wheel is turned very quickly, it is possible to experience temporary seizure and have the internal parts of the steering unit damaged. The temporary seizure may be followed by a total free wheeling.

## SPECIFICATION DATA

| Parameters                            | Type                      |          |          |          |           |           |           |           |         |           |           |         |         |           |         |
|---------------------------------------|---------------------------|----------|----------|----------|-----------|-----------|-----------|-----------|---------|-----------|-----------|---------|---------|-----------|---------|
|                                       | HKU 40/7                  | HKU 50/7 | HKU 63/7 | HKU 80/7 | HKU 100/7 | HKU 125/7 | HKU 158/7 | HKU 160/7 | HKU 198 | HKU 247,5 | HKU 316,8 | HKU 396 | HKU 495 | HKU 618,7 | HKU 793 |
| Displacement, [cm <sup>3</sup> /U]    | 39,6                      | 49,5     | 65,6     | 79,2     | 99,0      | 123,8     | 158,4     | 198       | 247,5   | 316,8     | 396       | 495     | 618,7   | 793       |         |
| Rated Flow*, [l/min]                  | 4                         | 5        | 6        | 8        | 10        | 13        | 16        | 20        | 25      | 32        | 40        | 50      | 63      | 80        |         |
| Rated Pressure, [bar]                 | 175                       |          |          |          |           |           |           |           |         |           |           |         |         |           |         |
| Max. Cont. Pressure in Line T, [bar]  | 20                        |          |          |          |           |           |           |           |         |           |           |         |         |           |         |
| Max. Torque at Servoamplifying, [Nm]  | 6 (by P <sub>T</sub> max) |          |          |          |           |           |           |           |         |           |           |         |         |           |         |
| Max. Torque w/o Servoamplifying, [Nm] | 120                       |          |          |          |           |           |           |           |         |           |           |         |         |           |         |
| Weight, [kg]                          | 5,3                       | 5,4      | 5,5      | 5,6      | 5,7       | 5,8       | 6,0       | 6,3       | 6,5     | 7,0       | 7,4       | 8,0     | 8,7     | 9,6       |         |
| Dimension A, [mm]                     | 130,8                     | 132,2    | 133,9    | 136,2    | 138,8     | 142,2     | 146,8     | 152,2     | 158,8   | 168,2     | 178,8     | 192     | 209,3   | 232,2     |         |

\* Rated Flow at 100 RPM.

## DIMENSIONS AND MOUNTING DATA



The ports are shown in the Table of page 7.

## THREADED PORTS

| Code | Ports - P, T, R, L<br>Thread       | Column Mounting<br>Thread - B    | Valve Mounting<br>Thread - V      |
|------|------------------------------------|----------------------------------|-----------------------------------|
| -    | G1/2<br>17 mm depth                | 4 x M10<br>18 mm depth           | 2 x M10x1<br>16 mm depth          |
| A    | 3/4 - 16 UNF<br>O-ring 17 mm depth | 4x 3/8 - 16 UNC<br>15,7 mm depth | 2 x 3/8 - 24 UNF<br>14,2 mm depth |
| M    | M22x1,5<br>17 mm depth             | 4 x M10<br>18 mm depth           | 2 x M10x1<br>16 mm depth          |

## ORDER CODE

|              |   |   |   |   |   |
|--------------|---|---|---|---|---|
|              | 1 | 2 | 3 | 4 | 5 |
| <b>H K U</b> |   | / | - |   |   |

**Pos.1 - Displacement code** (see Specification Data)

|             |                                |
|-------------|--------------------------------|
| <b>40</b>   | - 39,6 [cm <sup>3</sup> /rev]  |
| <b>50</b>   | - 49,5 [cm <sup>3</sup> /rev]  |
| <b>63</b>   | - 65,6 [cm <sup>3</sup> /rev]  |
| <b>80</b>   | - 79,2 [cm <sup>3</sup> /rev]  |
| <b>100</b>  | - 99,0 [cm <sup>3</sup> /rev]  |
| <b>125</b>  | - 123,8 [cm <sup>3</sup> /rev] |
| <b>160</b>  | - 158,4 [cm <sup>3</sup> /rev] |
| <b>200</b>  | - 198,0 [cm <sup>3</sup> /rev] |
| <b>250</b>  | - 247,5 [cm <sup>3</sup> /rev] |
| <b>320</b>  | - 316,8 [cm <sup>3</sup> /rev] |
| <b>400</b>  | - 396,0 [cm <sup>3</sup> /rev] |
| <b>500</b>  | - 495,0 [cm <sup>3</sup> /rev] |
| <b>630</b>  | - 618,7 [cm <sup>3</sup> /rev] |
| <b>800</b>  | - 792,0 [cm <sup>3</sup> /rev] |
| <b>1000</b> | - 990,0 [cm <sup>3</sup> /rev] |

**Pos.2 - Versions**

|          |   |
|----------|---|
| <b>3</b> | - Version 3 "Open Center - Load Reaction"       |
| <b>4</b> | - Version 4 "Open Center - Non Load Reaction"   |
| <b>7</b> | - Version 7 "Closed Center - Non Load Reaction" |

**Pos.3 - Ports**

|          |                           |
|----------|---------------------------|
| omit     | - BSPP (ISO 228)          |
| <b>A</b> | - SAE (ANSI B 1.1 - 1982) |
| <b>M</b> | - Metric (ISO 262)        |

**Pos.4 - Option (Paint)\***

|           |                             |
|-----------|-----------------------------|
| omit      | - No Paint                  |
| <b>P</b>  | - Painted                   |
| <b>PC</b> | - Corrosion Protected Paint |

**Pos.5 - Design Series**

|      |                     |
|------|---------------------|
| omit | - Factory specified |
|------|---------------------|

### NOTES:

\* Colour at customer's request.

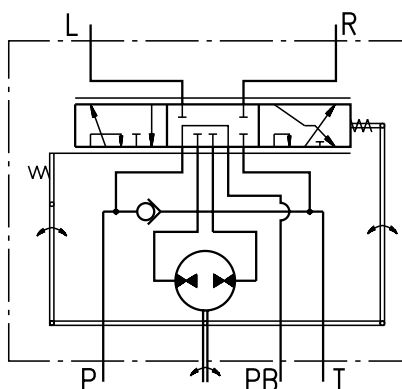
The steering units are mangano-phosphatized as standard.

# HYDROSTATIC STEERING UNIT TYPE HKU.../4PB

The hydrostatic steering unit is available for steering medium and large sized transport vehicles as building and agricultural machines.

HKU.../4PB works as standard steering unit with auxiliary port destined for flow providing additional vehicles functions. When the steering wheel is not turned, the flow will be delivered to port PB. After steering wheel has been turned a part of flow will be deviated to the steering unit and the flow trough port PB will be inconstant.

It is not recommended to use this unit in systems with auxiliary functions during the vehicle steering.

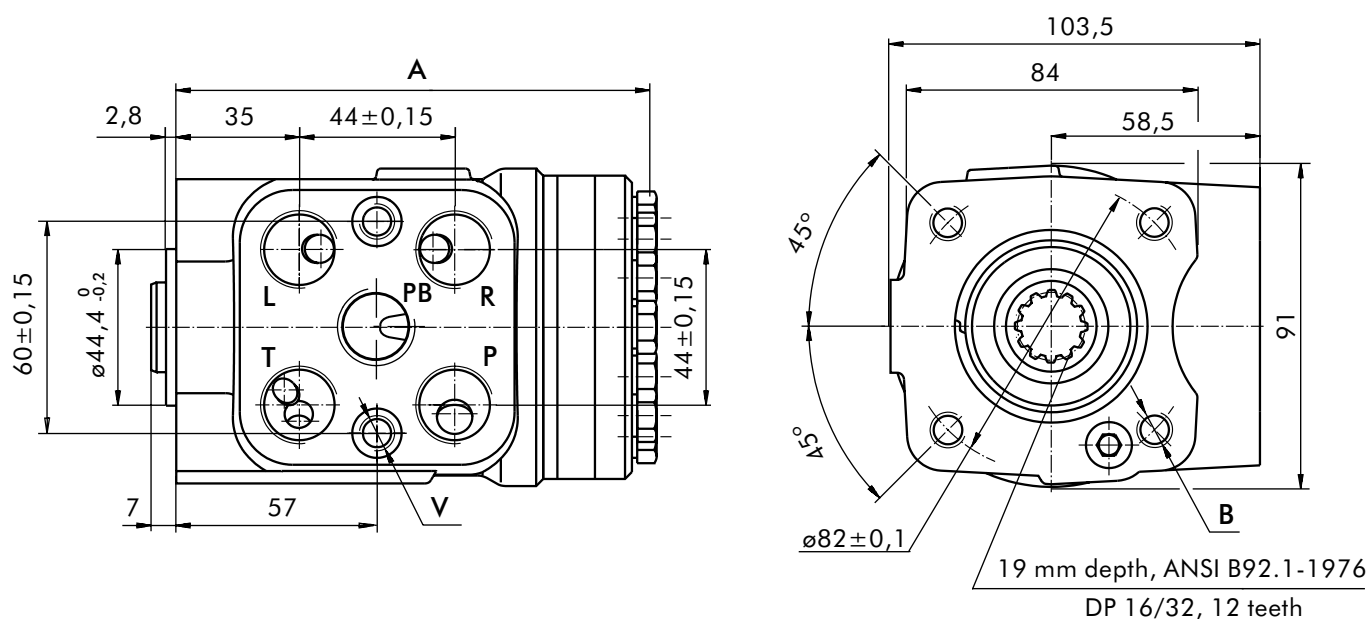


"Open Center - Non Load Reaction"  
HKU.../4PB - Power Beyond

## SPECIFICATION DATA

| Parameters  | Type                          |               |               |               |                |                |
|---|-------------------------------|---------------|---------------|---------------|----------------|----------------|
|   | HKU<br>40/4PB                 | HKU<br>50/4PB | HKU<br>63/4PB | HKU<br>80/4PB | HKU<br>100/4PB | HKU<br>125/4PB |
| Displacement, [cm <sup>3</sup> /rev]                      | 39,6                          | 49,5          | 65,6          | 79,2          | 99,0           | 123,8          |
| Rated Flow -5 Port<br>(Power Beyond) [l/min]              | 15                            |               |               |               |                |                |
| Rated Pressure, [bar]                                     | 125                           |               |               |               |                |                |
| Max. Pressure<br>in Line PB, [bar]                        | 125                           |               |               |               |                |                |
| Max. Cont. Pressure<br>in Line T - P <sub>T</sub> , [bar] | 10                            |               |               |               |                |                |
| Max. Torque at<br>Servoamplifying, [Nm]                   | 2,8 ( by P <sub>T,max</sub> ) |               |               |               |                |                |
| Max. Torque w/o<br>Servoamplifying, [Nm]                  | 135                           |               |               |               |                |                |
| Weight, [kg]  | 5,3                           | 5,4           | 5,5           | 5,6           | 5,7            | 5,8            |
| Dimension A, [mm]   | 130,8                         | 132,2         | 133,9         | 136,2         | 138,8          | 142,2          |

## DIMENSIONS AND MOUNTING DATA



### THREADED PORTS for HKU.../4PB

| Code     | Ports - P, T, R, L, PB<br>Thread    | Column Mounting<br>Thread - B    | Valve Mounting<br>Thread - V      |
|----------|-------------------------------------|----------------------------------|-----------------------------------|
| -        | G3/8<br>17 mm depth                 | 4 x M10<br>18 mm depth           | 2 x M10x1<br>16 mm depth          |
| <b>A</b> | 9/16 - 18 UNF<br>O-ring 17 mm depth | 4x 3/8 - 16 UNC<br>15,7 mm depth | 2 x 3/8 - 24 UNF<br>14,2 mm depth |

### ORDER CODE for HKU.../4PB

|            |   |              |   |   |   |
|------------|---|--------------|---|---|---|
|            | 1 | 2            | 3 | 4 | 5 |
| <b>HKU</b> |   | / <b>4PB</b> | - |   |   |

**Pos.1 - Displacement code** (see Specification Data)

|            |                                |
|------------|--------------------------------|
| <b>40</b>  | - 39,6 [cm <sup>3</sup> /rev]  |
| <b>50</b>  | - 49,5 [cm <sup>3</sup> /rev]  |
| <b>63</b>  | - 65,6 [cm <sup>3</sup> /rev]  |
| <b>80</b>  | - 79,2 [cm <sup>3</sup> /rev]  |
| <b>100</b> | - 99,0 [cm <sup>3</sup> /rev]  |
| <b>125</b> | - 123,8 [cm <sup>3</sup> /rev] |

**Pos.2 - Versions**

**4PB** - Version 4 "Open Center - Non Load Reaction"  
with 5 ports(Power Beyond)

**Pos.3 - Ports**

omit - BSPP (ISO 228)  
**A** - SAE (ANSI B 1.1 - 1982)

**Pos.4 - Option (Paint)\***

omit - No Paint  
**P** - Painted  
**PC** - Corrosion Protected Paint

**Pos.5 - Design Series**

omit - Factory specified

**NOTES:**

\* Colour at customer's request.

The steering units are mangano-phosphatized as standard.

# HYDROSTATIC STEERING UNIT TYPE HKUQ.../4



HKUQ.../4 is a new series of hydrostatic steering units with an additionally increased flow. The hydrostatic steering unit type HKUQ.../4 is available for steering medium and large sized vehicles, allowing easy control either in servo-amplified mode or in emergency operation.

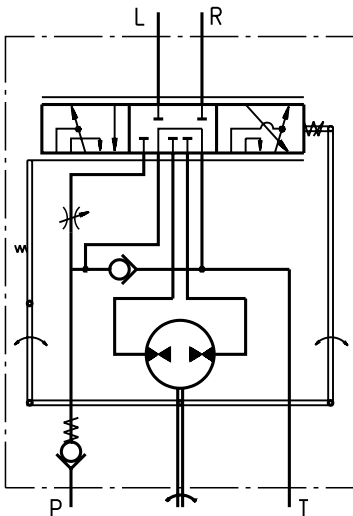
HKUQ.../4 is an "Open Center-Non Load Reaction" hydrostatic steering in which restrictor for amplifying factor from 1,3 to 2,5 is built-in.

In accordance with the size of the gear wheel set and amplifying factor, HKUQ...4 has the following working volume:

- from 80 cm<sup>3</sup> to 200 cm<sup>3</sup> for emergency operation mode (manual steering without servo-amplifying);

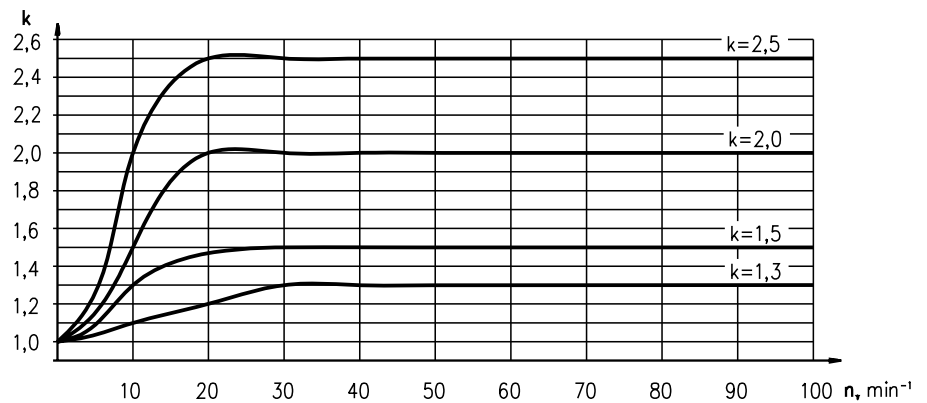
- from 100 cm<sup>3</sup> to 500 cm<sup>3</sup> for normal operation mode (with total flow amplifying).

There is no servo-amplifying of flow if low steering speed till 10 min<sup>-1</sup> is applied. In steering speed increase over 20 min<sup>-1</sup> there is total servo-amplifying of flow. In this mode gear wheel set flow and restrictor flow are added.



"Open Center - Non Load Reaction"  
HKUQ.../4

## VARIABLE AMPLIFYING FACTOR



## SPECIFICATION DATA

| Parameters  | Type                       |      |     |     |                |     |     |     |                |     |     |     |                |     |     |     |                |     |     |     |
|---|----------------------------|------|-----|-----|----------------|-----|-----|-----|----------------|-----|-----|-----|----------------|-----|-----|-----|----------------|-----|-----|-----|
|   | HKUQ 80/.../4              |      |     |     | HKUQ 100/.../4 |     |     |     | HKUQ 125/.../4 |     |     |     | HKUQ 160/.../4 |     |     |     | HKUQ 200/.../4 |     |     |     |
| Displacement<br>- without servo-amplifying<br>(in emergency mode)<br>- with servo-amplifying [cm <sup>3</sup> /rev] | 79,2                       |      |     |     | 99,0           |     |     |     | 123,8          |     |     |     | 158,4          |     |     |     | 198            |     |     |     |
| Rated Flow* [l/min]   | 10                         | 12,5 | 16  | 20  | 12,5           | 16  | 20  | 25  | 16             | 20  | 25  | 32  | 20             | 25  | 32  | 40  | 25             | 32  | 40  | 50  |
| Amplifying Factor<br>(at shaft revolution over 20 min <sup>-1</sup> )   | 1,3                        | 1,5  | 2,0 | 2,5 | 1,3            | 1,5 | 2,0 | 2,5 | 1,3            | 1,5 | 2,0 | 2,5 | 1,3            | 1,5 | 2,0 | 2,5 | 1,3            | 1,5 | 2,0 | 2,5 |
| Rated Pressure [bar]  | 160                        |      |     |     |                |     |     |     |                |     |     |     |                |     |     |     |                |     |     |     |
| Max. Cont. Pressure<br>in Line T - P <sub>T</sub> [bar]   | 25                         |      |     |     |                |     |     |     |                |     |     |     |                |     |     |     |                |     |     |     |
| Max. Torque at<br>Servoamplifying [Nm]  | 6 (by P <sub>T,max</sub> ) |      |     |     |                |     |     |     |                |     |     |     |                |     |     |     |                |     |     |     |
| Max. Torque w/o<br>Servoamplifying [Nm]   | 120                        |      |     |     |                |     |     |     |                |     |     |     |                |     |     |     |                |     |     |     |
| Weight, avg. [kg]   | 5,6                        |      |     |     | 5,7            |     |     |     | 5,8            |     |     |     | 6,0            |     |     |     | 6,3            |     |     |     |
| Dimension A [mm]  | 136,2                      |      |     |     | 138,8          |     |     |     | 142,2          |     |     |     | 146,8          |     |     |     | 152,2          |     |     |     |

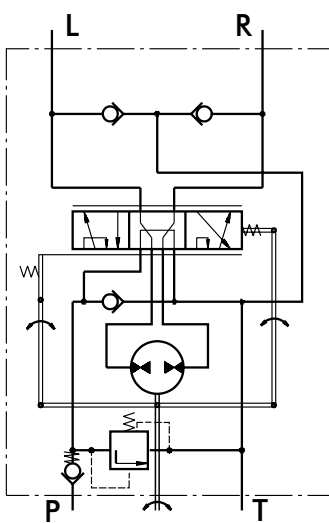
\* Rated Flow at 100 RPM.



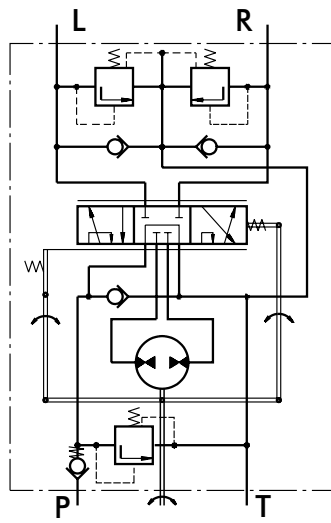
# HYDROSTATIC STEERING UNITS TYPE HKUS.../3, 4, 8



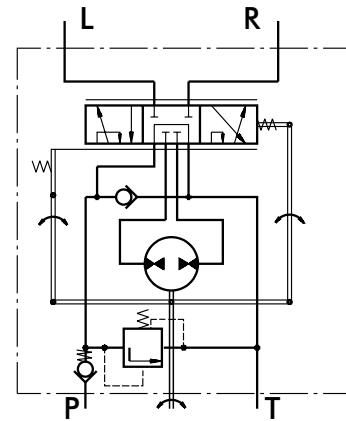
The HKUS Hydrostatic Steering unit is based on the HKU unit but has built-in relief and check valves. Thus M+S Hydraulic achieves one very compact steering unit which reduces the need for additional hydraulic components in the system.



"Open Center - Load Reaction"  
With Built-in Valves  
Version 3 - HKUS.../3



"Open Center - Non Load Reaction"  
With Built-in Valves  
Version 4 - HKUS.../4



"Open Center - Non Load Reaction"  
With Built-in Valve  
Version 8 - HKUS.../8

## SPECIFICATION DATA

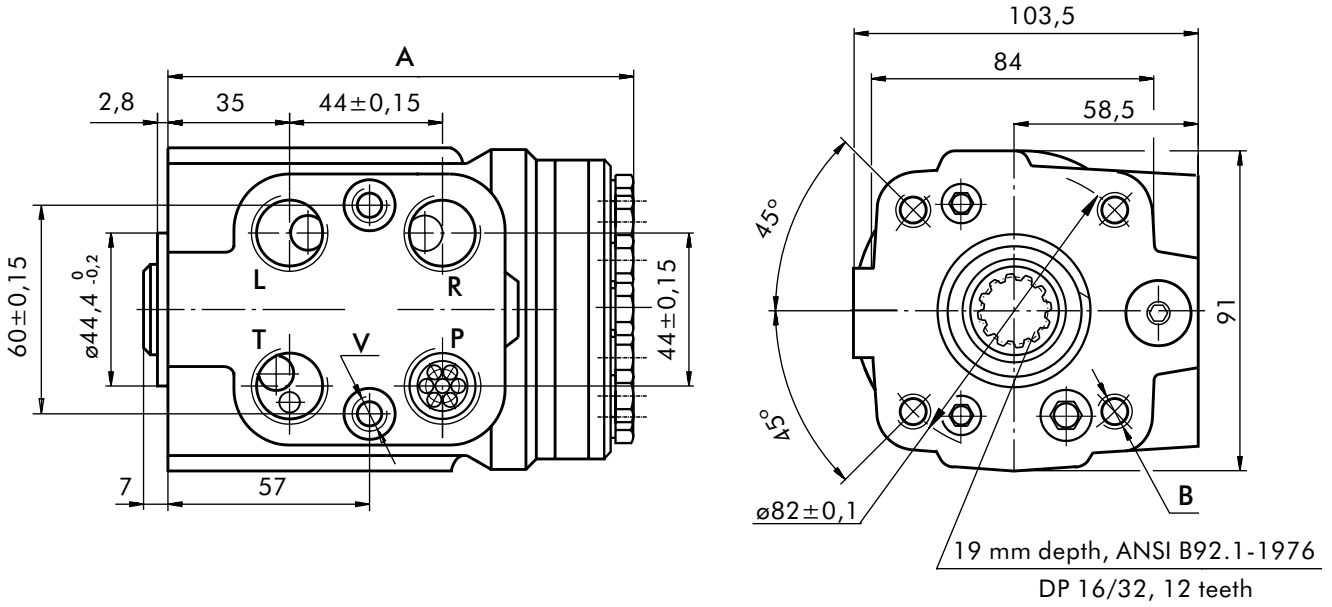
| Parameters  | Type                        |                  |                  |                  |                   |                   |                   |                   |                   |                   |                   |  |
|---|-----------------------------|------------------|------------------|------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|-------------------|--|
|   | HKUS<br>40/3,4,8            | HKUS<br>50/3,4,8 | HKUS<br>63/3,4,8 | HKUS<br>80/3,4,8 | HKUS<br>100/3,4,8 | HKUS<br>125/3,4,8 | HKUS<br>160/3,4,8 | HKUS<br>200/3,4,8 | HKUS<br>250/3,4,8 | HKUS<br>320/3,4,8 | HKUS<br>400/3,4,8 |  |
| Displacement [cm <sup>3</sup> /rev]                 | 39,6                        | 49,5             | 65,6             | 79,2             | 99,0              | 123,8             | 158,4             | 198               | 247,5             | 316,8             | 396               |  |
| Rated Flow* [l/min]                                 | 4                           | 5                | 6                | 8                | 10                | 13                | 16                | 20                | 25                | 32                | 40                |  |
| Rated Pressure [bar]                                | 160                         |                  |                  |                  |                   |                   |                   |                   |                   |                   |                   |  |
| Relief Valve Pressure Settings** [bar]              |                             |                  |                  | 80               | 100               | 125               | 150               |                   |                   |                   |                   |  |
| Shock Valves Pressure Settings*** [bar]             |                             |                  |                  | 140              | 160               | 180               | 200               |                   |                   |                   |                   |  |
| Max.Cont. Pressure in Line T - P <sub>T</sub> [bar] | 25 ( 50 - for HKUS.../8 )   |                  |                  |                  |                   |                   |                   |                   |                   |                   |                   |  |
| Max.Torque at Servoamplifying [Nm]                  | 6 ( by P <sub>T,max</sub> ) |                  |                  |                  |                   |                   |                   |                   |                   |                   |                   |  |
| Max.Torque w/o Servoamplifying [Nm]                 | 120                         |                  |                  |                  |                   |                   |                   |                   |                   |                   |                   |  |
| Weight, avg. [kg]                                   | 5,3                         | 5,5              | 5,6              | 5,7              | 5,8               | 5,9               | 6,2               | 6,5               | 6,6               | 7,2               | 7,8               |  |
| Dimension A [mm]                                    | 130,8                       | 132,2            | 133,9            | 136,2            | 138,8             | 142,2             | 146,8             | 152,2             | 158,8             | 168,2             | 178,8             |  |

\* Rated Flow at 100 RPM.

\*\* Pressure Settings are at Rated Flow ( as in the table ) and viscosity 21 mm<sup>2</sup>/s (50° C).

\*\*\*Pressure Settings are at flow rate of 2 l/min and viscosity 21 mm<sup>2</sup>/s (50° C).

## DIMENSIONS AND MOUNTING DATA



## THREADED PORTS

| c<br>o<br>d<br>e | Ports - P, T, R, L<br>Thread       | Column Mounting<br>Thread - B    | Valve Mounting<br>Thread - V      |
|------------------|------------------------------------|----------------------------------|-----------------------------------|
| -                | G1/2<br>17 mm depth                | 4 x M10<br>18 mm depth           | 2 x M10x1<br>16 mm depth          |
| <b>A</b>         | 3/4 - 16 UNF<br>O-ring 17 mm depth | 4x 3/8 - 16 UNC<br>15,7 mm depth | 2 x 3/8 - 24 UNF<br>14,2 mm depth |
| <b>M</b>         | M22x1,5<br>17 mm depth             | 4 x M10<br>18 mm depth           | 2 x M10x1<br>16 mm depth          |

\*Threaded Port **P** min 16 mm depth.

## ORDER CODE

|   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|
|   | 1 | 2 | 3 | 4 | 5 | 6 |
| H | K | U | S | / | - | - |

**Pos.1 - Displacement code** (see Specification Data)

|            |                                |
|------------|--------------------------------|
| <b>40</b>  | - 39,6 [cm <sup>3</sup> /rev]  |
| <b>50</b>  | - 49,5 [cm <sup>3</sup> /rev]  |
| <b>63</b>  | - 65,6 [cm <sup>3</sup> /rev]  |
| <b>80</b>  | - 79,2 [cm <sup>3</sup> /rev]  |
| <b>100</b> | - 99,0 [cm <sup>3</sup> /rev]  |
| <b>125</b> | - 123,8 [cm <sup>3</sup> /rev] |
| <b>160</b> | - 158,4 [cm <sup>3</sup> /rev] |
| <b>200</b> | - 198,0 [cm <sup>3</sup> /rev] |
| <b>250</b> | - 247,5 [cm <sup>3</sup> /rev] |
| <b>320</b> | - 316,8 [cm <sup>3</sup> /rev] |
| <b>400</b> | - 396,0 [cm <sup>3</sup> /rev] |

**Pos.2 - Versions**

|          |   |
|----------|---|
| <b>3</b> | - Version 3 "Open Center - Load Reaction"     |
| <b>4</b> | - Version 4 "Open Center - Non Load Reaction" |
| <b>8</b> | - Version 8 "Open Center - Non Load Reaction" |

**Pos.3 - Relief Valve Pressure Settings, bar**

|            |
|------------|
| <b>80</b>  |
| <b>100</b> |
| <b>125</b> |
| <b>150</b> |

**Pos.4 - Ports**

|          |                           |
|----------|---------------------------|
| omit     | - BSPP (ISO 228)          |
| <b>A</b> | - SAE (ANSI B 1.1 - 1982) |
| <b>M</b> | - Metric (ISO 262)        |

**Pos.5 - Option (Paint)\***

|           |                             |
|-----------|-----------------------------|
| omit      | - No Paint                  |
| <b>P</b>  | - Painted                   |
| <b>PC</b> | - Corrosion Protected Paint |

**Pos.6 - Design Series**

|      |                     |
|------|---------------------|
| omit | - Factory specified |
|------|---------------------|

| Version | Manual Steering Check Valve | Relief Valve | Inlet Check Valve | Cylinder Relief Valve | Anti-Cavitation Valve |
|---------|-----------------------------|--------------|-------------------|-----------------------|-----------------------|
| 3       | •                           | •            | •                 |                       | •                     |
| 4       | •                           | •            | •                 | •                     | •                     |
| 8       | •                           | •            | •                 |                       |                       |

### NOTES:

\* Colour at customer's request.

The steering units are mangano-phosphatized as standard.

# HYDROSTATIC STEERING UNITS TYPE HKU(S).../5(T)(E)(TE)



The HKU(S).../5(T)(E)(TE) range expands the steering units family with the "Closed Center - Non Reaction and Load Sensing Outlet" version (static hydraulic connection to the priority valve).

This range is manufactured in two versions; for modularly and pipe mounting and therefore were developed the two versions of priority (tracing) valves: PRD... and PRT...

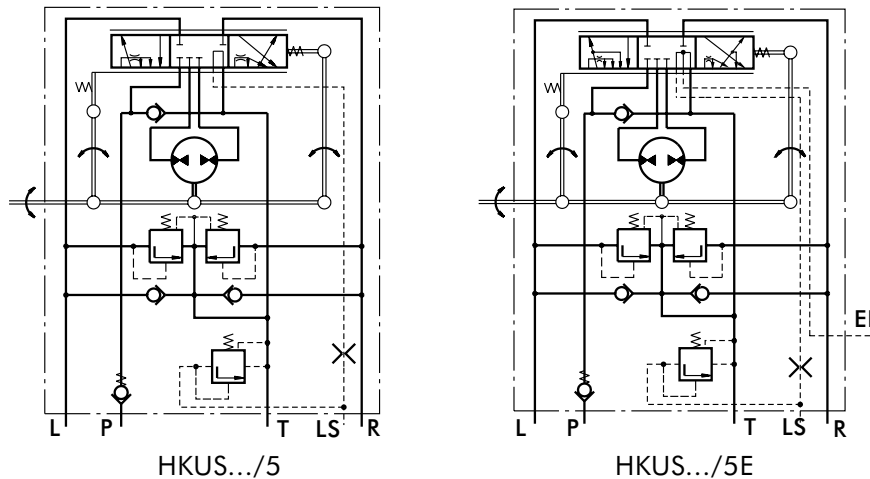
HKU.../5 is designed to be connected with priority valves with built-in relief valves for rated flow up to 160 l/min.

The control hydraulic circuits of the HKU(S).../5(T)(E)(TE) steering units were designed to ensure minimal energy consumption (energy losses) in various hydraulic systems such as those of: fork-lift trucks, agricultural and construction machines and others.

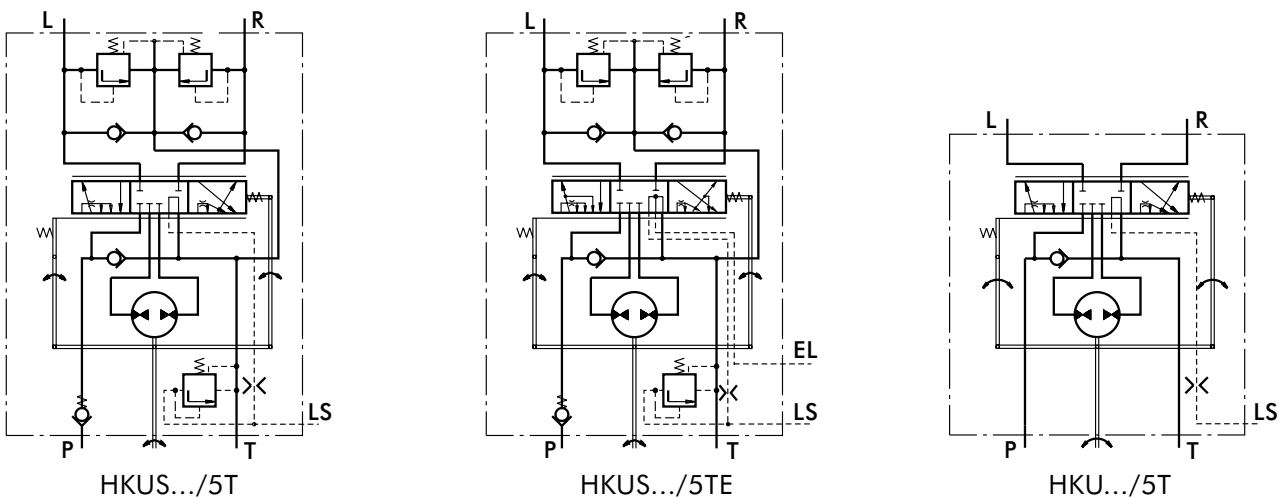
The HKUS.../5E and HKUS.../5TE are equipped with an electrohydraulic relay, mounted in the EL port, which supplies signal to the electric - control system. The relay can be pre-set to normally - open (N.O) or normally - closed (N.C) contacts, with control range from 0,1 to 50 bars. Upon customer's request the relay could be supplied with another type of fixing thread.

\*For operation in condition of Thermal Shock see the notes on page 6.

## Modulary Mounting



## Pipe Mounting



## SPECIFICATION DATA

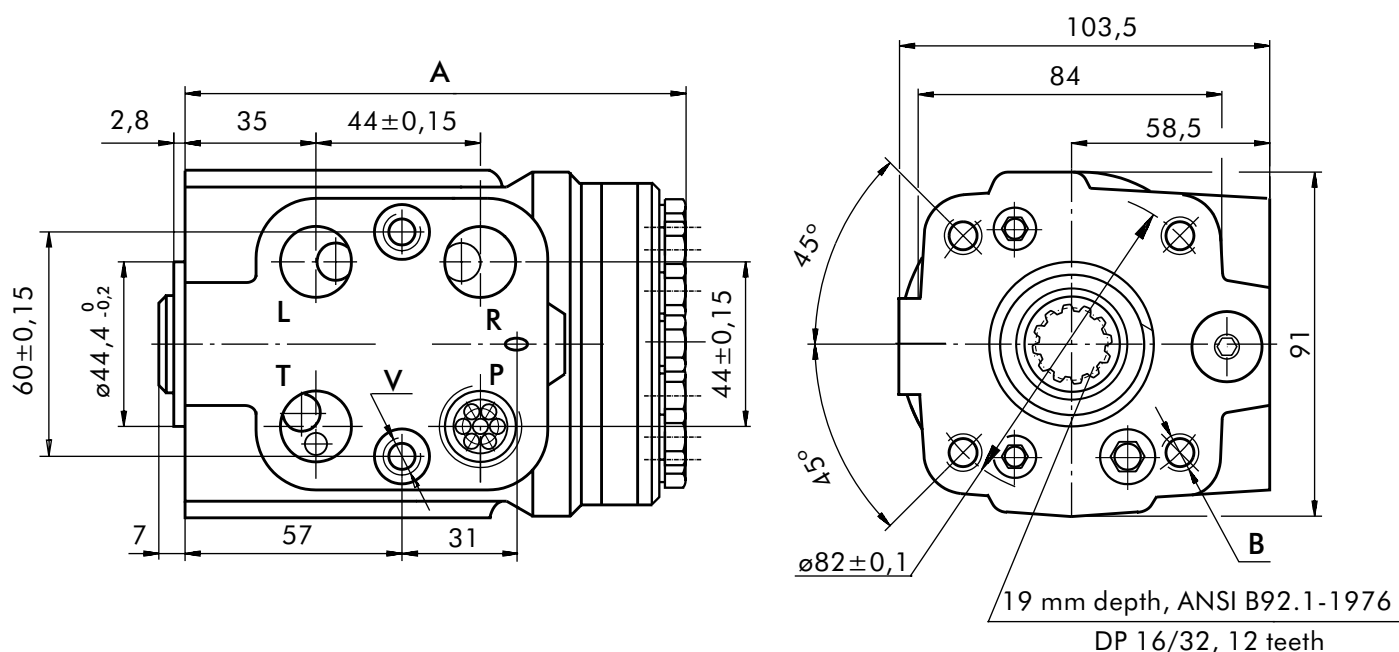
| Parameters  | Type                        |                 |                 |                 |                  |                  |                  |                  |                  |                  |                  |               |               |  |
|---|-----------------------------|-----------------|-----------------|-----------------|------------------|------------------|------------------|------------------|------------------|------------------|------------------|---------------|---------------|--|
|   | HKU<br>40/5T                | HKU<br>50/5T    | HKU<br>63/5T    | HKU<br>80/5T    | HKU<br>100/5T    | HKU<br>125/5T    | HKU<br>160/5T    | HKU<br>200/5T    | HKU<br>250/5T    | HKU<br>320/5T    | HKU<br>400/5T    | HKU<br>500/5T | HKU<br>630/5T |  |
|   | HKUS<br>40/5...             | HKUS<br>50/5... | HKUS<br>63/5... | HKUS<br>80/5... | HKUS<br>100/5... | HKUS<br>125/5... | HKUS<br>160/5... | HKUS<br>200/5... | HKUS<br>250/5... | HKUS<br>320/5... | HKUS<br>400/5... |               |               |  |
| Displacement [cm <sup>3</sup> /rev]                 | 39,6                        | 49,5            | 65,6            | 79,2            | 99,0             | 123,8            | 158,4            | 198              | 247,5            | 316,8            | 396              | 495           | 618,7         |  |
| Rated Flow* [l/min]                                 | 4                           | 5               | 6               | 8               | 10               | 13               | 16               | 20               | 25               | 32               | 40               | 50            | 63            |  |
| Rated Pressure [bar]                                | 125                         | 150             | 175             |                 |                  |                  |                  |                  |                  |                  |                  |               |               |  |
| LS - Valve Pressure Settings** [bar]                |                             |                 |                 |                 | 80               | 100              | 125              | 150              | 175              |                  |                  |               |               |  |
| Shock Valves Pressure Settings*** [bar]             |                             |                 |                 |                 | 140              | 160              | 180              | 200              | 240              |                  |                  |               |               |  |
| Max.Cont. Pressure in Line T - P <sub>T</sub> [bar] | 20                          |                 |                 |                 |                  |                  |                  |                  |                  |                  |                  |               |               |  |
| Max.Torque at Servoamplifying [Nm]                  | 6 ( by P <sub>T max</sub> ) |                 |                 |                 |                  |                  |                  |                  |                  |                  |                  |               |               |  |
| Max.Torque w/o Servoamplifying [Nm]                 | 120                         |                 |                 |                 |                  |                  |                  |                  |                  |                  |                  |               |               |  |
| Weight, avg. [kg]                                   | 5,4                         | 5,5             | 5,6             | 5,7             | 5,8              | 5,9              | 6,2              | 6,5              | 6,6              | 7,2              | 7,8              | 8             | 8,7           |  |
| Dimension A [mm]                                    | 130,8                       | 132,2           | 133,9           | 136,2           | 138,8            | 142,2            | 146,8            | 152,2            | 158,8            | 168,2            | 178,8            | 192           | 209,3         |  |

\* Rated Flow at 100 RPM.

\*\* Pressure Settings are at flow rate of 6 l/min and viscosity 21 mm<sup>2</sup>/s (50° C).

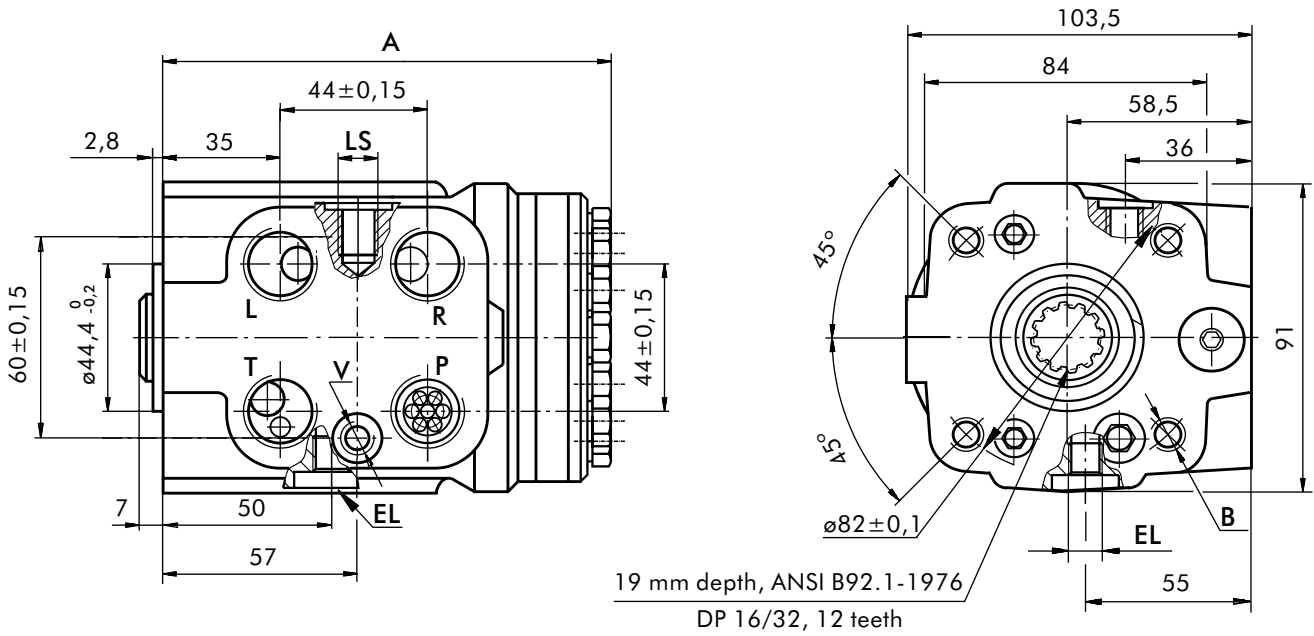
\*\*\*Pressure Settings are at flow rate of 2 l/min and viscosity 21 mm<sup>2</sup>/s (50° C).

## DIMENSIONS AND MOUNTING DATA - HKUS.../5

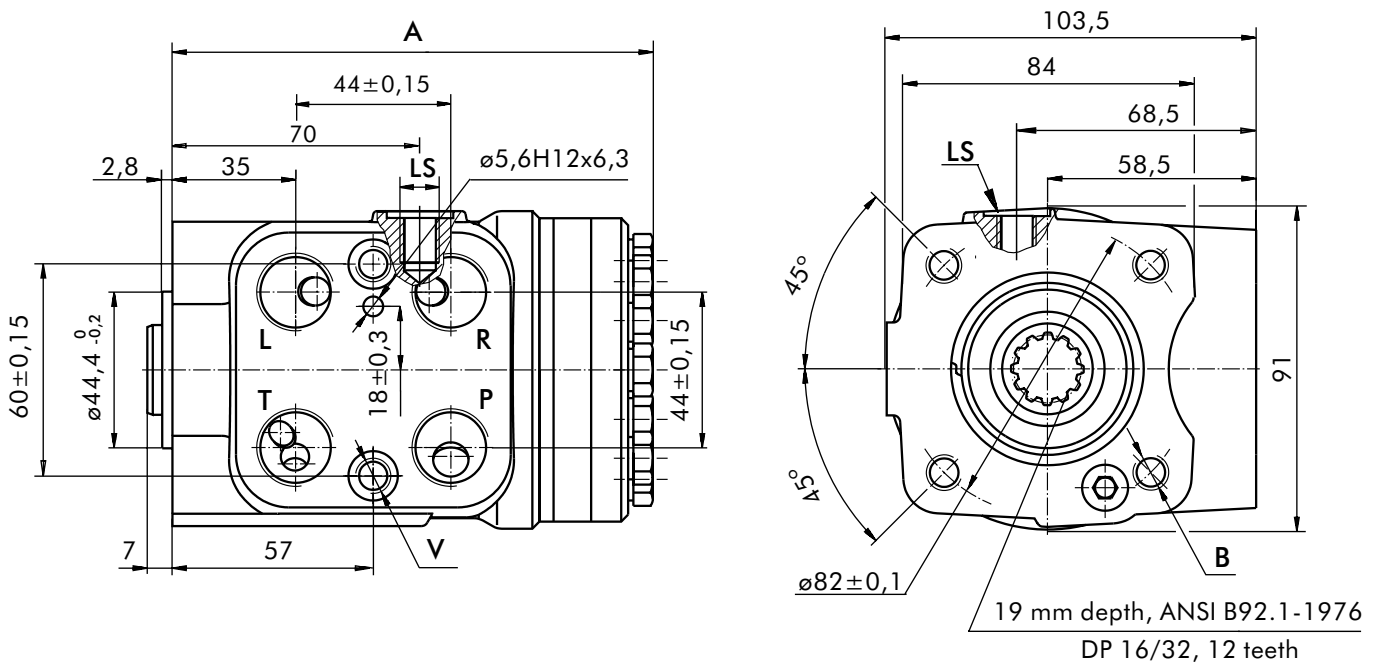




## DIMENSIONS AND MOUNTING DATA - HKUS.../5TE



## DIMENSIONS AND MOUNTING DATA - HKU.../5T



## THREADED PORTS

| c<br>a<br>o<br>e | Ports - *P, T, R, L<br>Thread      | Column Mounting<br>Thread - B     | Valve Mounting<br>Thread - V      | LS - Port                             | EL - Port                             |
|------------------|------------------------------------|-----------------------------------|-----------------------------------|---------------------------------------|---------------------------------------|
| -                | G1/2<br>17 mm depth                | 4 x M10<br>18 mm depth            | 2 x M10x1<br>16 mm depth          | G1/4<br>14 mm depth                   | M10x1<br>10 mm depth                  |
| <b>A</b>         | 3/4 - 16 UNF<br>O-ring 17 mm depth | 4 x 3/8 - 16 UNC<br>15,7 mm depth | 2 x 3/8 - 24 UNF<br>14,2 mm depth | 7/16 - 20 UNF<br>O-ring 12,7 mm depth | 7/16 - 20 UNF<br>O-ring 12,7 mm depth |
| <b>M</b>         | M22x1,5<br>17 mm depth             | 4 x M10<br>18 mm depth            | 2 x M10x1<br>16 mm depth          | G1/4<br>14 mm depth                   | M10x1<br>10 mm depth                  |

\*Threaded Port **P** min 16 mm.

## ORDER CODE for HKUS.../5...

|      |   |   |   |   |   |   |   |
|------|---|---|---|---|---|---|---|
| 1    | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| HKUS | / | 5 | - | - |   |   |   |

**Pos.1 - Displacement code** (see Specification Data)

|     |                                |
|-----|--------------------------------|
| 40  | - 39,6 [cm <sup>3</sup> /rev]  |
| 50  | - 49,5 [cm <sup>3</sup> /rev]  |
| 63  | - 65,6 [cm <sup>3</sup> /rev]  |
| 80  | - 79,2 [cm <sup>3</sup> /rev]  |
| 100 | - 99,0 [cm <sup>3</sup> /rev]  |
| 125 | - 123,8 [cm <sup>3</sup> /rev] |
| 160 | - 158,4 [cm <sup>3</sup> /rev] |
| 200 | - 198,0 [cm <sup>3</sup> /rev] |
| 250 | - 247,5 [cm <sup>3</sup> /rev] |
| 320 | - 316,8 [cm <sup>3</sup> /rev] |
| 400 | - 396,0 [cm <sup>3</sup> /rev] |

**Pos.2 - Versions**

|   |  |
|---|--|
| 5 | - Version 5 "Closed Center - Non Reaction and Load Sensing Outlet" |
|---|--|

**Pos.3 - Priority Valve Connection**

|      |                      |
|------|----------------------|
| omit | - Modularly Mounting |
| T    | - Pipe Mounting      |

**Pos.4 - Electric Signal Connection**

|      |                                      |
|------|--------------------------------------|
| omit | - without electric signal connection |
| E    | - with electric signal connection    |

**Pos.5 - LS - Valve Pressure Settings, bar**

|    |     |     |     |     |
|----|-----|-----|-----|-----|
| 80 | 100 | 125 | 150 | 175 |
|----|-----|-----|-----|-----|

**Pos.6 - Ports**

|      |                           |
|------|---------------------------|
| omit | - BSPP (ISO 228)          |
| A    | - SAE (ANSI B 1.1 - 1982) |
| M    | - Metric (ISO 262)        |

**Pos.7 - Option (Paint)\***

|      |                             |
|------|-----------------------------|
| omit | - No Paint                  |
| P    | - Painted                   |
| PC   | - Corrosion Protected Paint |

**Pos.8 - Design Series**

|      |                     |
|------|---------------------|
| omit | - Factory specified |
|------|---------------------|

**NOTES:**

\* Colour at customer's request.  
The steering units are mangano-phosphatized as standard.

## ORDER CODE for HKU.../5T...

|     |   |   |   |   |   |
|-----|---|---|---|---|---|
| 1   | 2 | 3 | 4 | 5 | 6 |
| HKU | / | 5 | T | - |   |

**Pos.1 - Displacement code** (see Specification Data)

|     |                                |
|-----|--------------------------------|
| 40  | - 39,6 [cm <sup>3</sup> /rev]  |
| 50  | - 49,5 [cm <sup>3</sup> /rev]  |
| 63  | - 65,6 [cm <sup>3</sup> /rev]  |
| 80  | - 79,2 [cm <sup>3</sup> /rev]  |
| 100 | - 99,0 [cm <sup>3</sup> /rev]  |
| 125 | - 123,8 [cm <sup>3</sup> /rev] |
| 160 | - 158,4 [cm <sup>3</sup> /rev] |
| 200 | - 198,0 [cm <sup>3</sup> /rev] |
| 250 | - 247,5 [cm <sup>3</sup> /rev] |
| 320 | - 316,8 [cm <sup>3</sup> /rev] |
| 400 | - 396,0 [cm <sup>3</sup> /rev] |
| 500 | - 495,0 [cm <sup>3</sup> /rev] |
| 630 | - 618,7 [cm <sup>3</sup> /rev] |

**Pos.2 - Versions**

|   |  |
|---|--|
| 5 | - Version 5 "Closed Center - Non Reaction and Load Sensing Outlet" |
|---|--|

**Pos.3 - Priority Valve Connection**

|   |                 |
|---|-----------------|
| T | - Pipe Mounting |
|---|-----------------|

**Pos.4 - Ports**

|      |                           |
|------|---------------------------|
| omit | - BSPP (ISO 228)          |
| A    | - SAE (ANSI B 1.1 - 1982) |
| M    | - Metric (ISO 262)        |

**Pos.5 - Option (Paint)\***

|      |                             |
|------|-----------------------------|
| omit | - No Paint                  |
| P    | - Painted                   |
| PC   | - Corrosion Protected Paint |

**Pos.6 - Design Series**

|      |                     |
|------|---------------------|
| omit | - Factory specified |
|------|---------------------|

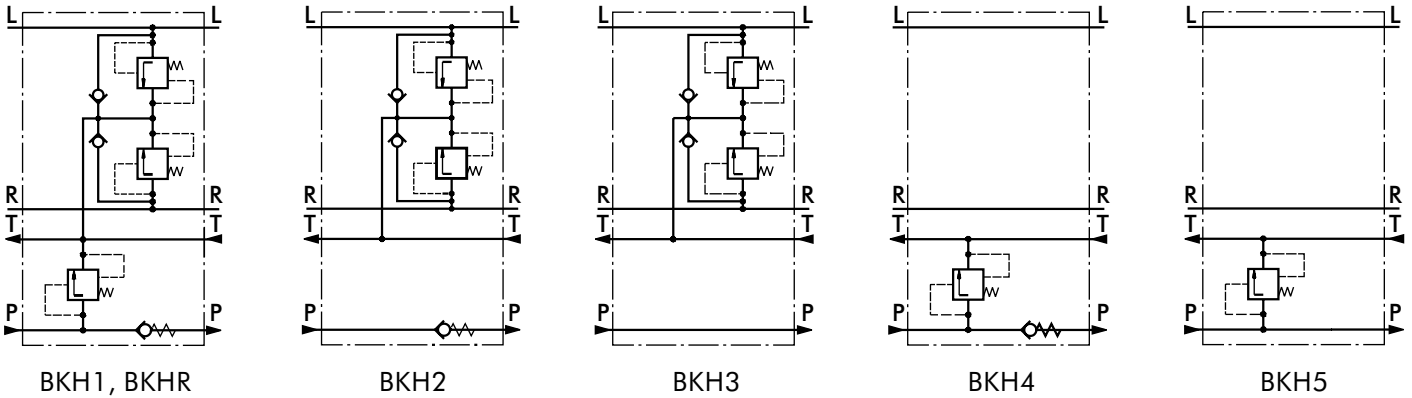
**NOTES:**

\* Colour at customer's request.  
The steering units are mangano-phosphatized as standard.

# VALVE BLOCKS FOR HKU AND XY TYPE BKH...



The BKH valves are developed to protect the components of the hydraulic circuit: pumps, steering units and cylinders - from overloads, impacts and cavitation. Some of their advantages are: easy integration into any hydraulic circuit, easy mounting to the steering unit, and quick and easy hose connections. Depending on the design and the built in valves the BKH valves can be divided into 6 types: BKH1 ... BKH5 and BKHR, with BKH5 designed for XY steering units only. The maximum flow rate is in compliance with the whole range of HKU and XY steering units but no more than 80 l/min. The pressure settings for the entry relief valves and the shock valves are given in the table.



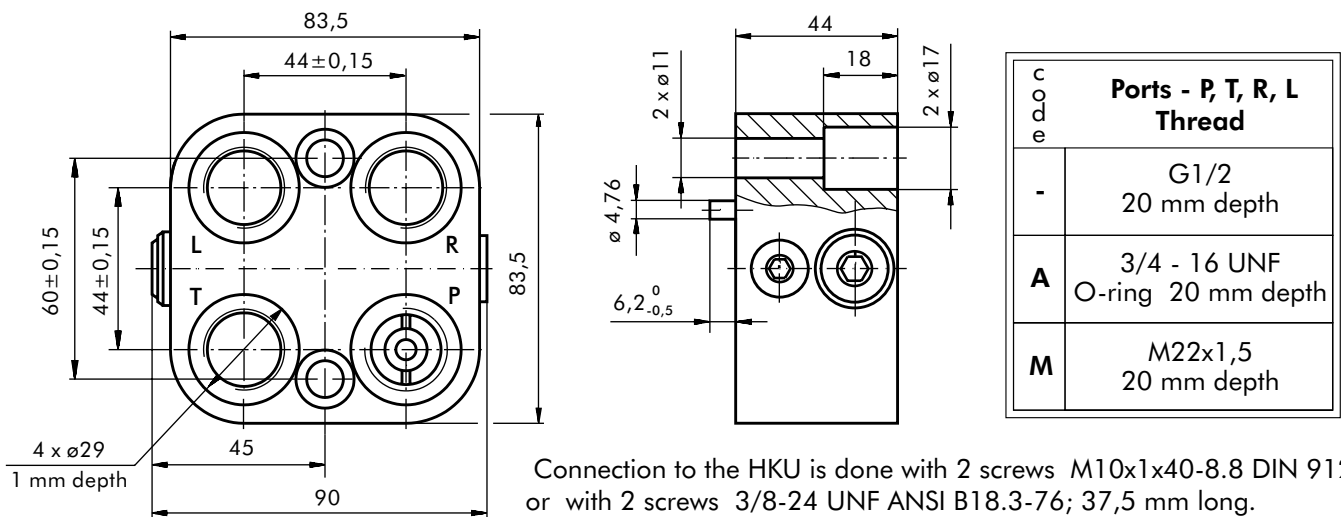
## SPECIFICATION DATA

| Parameters                             | Type       |     |     |     |      |      |            |     |     |     |
|--|------------|-----|-----|-----|------|------|------------|-----|-----|-----|
|  | BKH1, BKHR |     |     |     | BKH2 | BKH3 | BKH4, BKH5 |     |     |     |
| Rated Flow [l/min]                     | 80         |     |     |     |      |      |            |     |     |     |
| Rated Pressure [bar]                   | 160        |     |     |     |      |      |            |     |     |     |
| Relief Valve Pressure Settings* [bar]  | 80         | 100 | 125 | 150 | -    | -    | 80         | 100 | 125 | 150 |
| Shock Valves Pressure Settings** [bar] | 140        | 160 | 180 | 200 | 200  | 240  |            |     |     |     |
| Weight, avg. [kg]                      | 1,8 ; 2,3  |     |     |     | 1,8  |      | 1,8        |     |     |     |

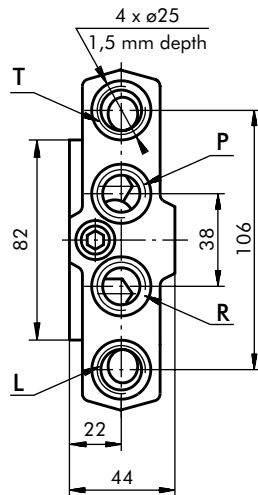
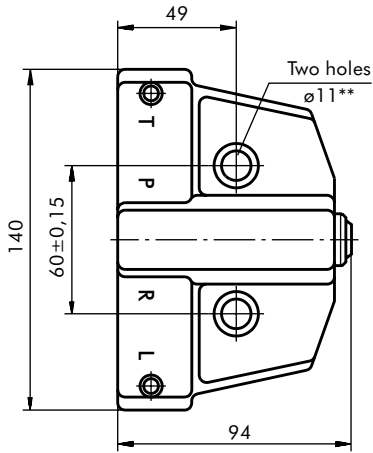
\* Pressure Settings are at flow rate of 30 l/min and viscosity 21 mm<sup>2</sup>/s (50° C).

\*\*Pressure Settings are at flow rate of 2 l/min and viscosity 21 mm<sup>2</sup>/s (50° C).

## DIMENSIONS AND MOUNTING DATA - BKH1, 2, 3, 4



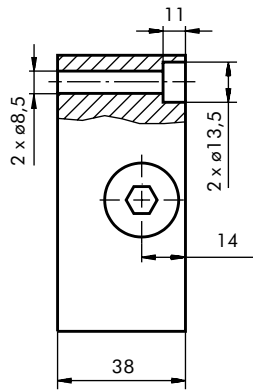
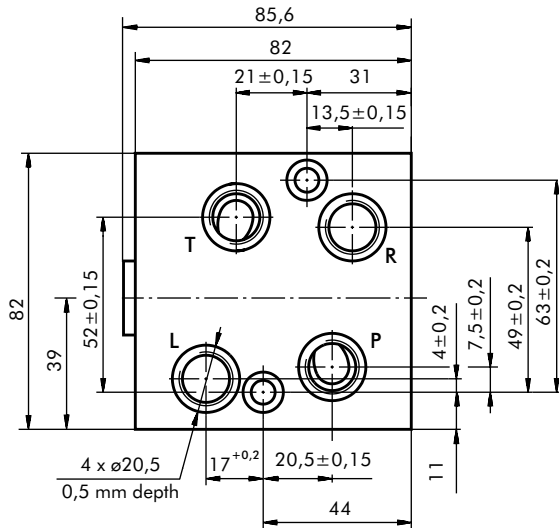
**DIMENSIONS AND MOUNTING DATA - BKHR**



| code     | Ports - P, T, R, L<br>Thread       |
|----------|------------------------------------|
| <b>A</b> | 3/4 - 16 UNF<br>O-ring 22 mm depth |
| <b>M</b> | M18x1,5<br>22 mm depth             |

\*\*Connection to the HKU is done with 2 screws M10x1x40-8.8 DIN 912 or with 2 screws 3/8-24 UNF ANSI B18.3-76; 37,5 mm long. Tightening torque: 2,5±0,5 daNm

**DIMENSIONS AND MOUNTING DATA - BKH5**



| code     | Ports - P, T, R, L<br>Thread |
|----------|------------------------------|
| <b>M</b> | M16x1,5<br>14 mm depth       |

Connection to the XY is done with 2 screws M8x40-8.8 DIN 912  
Tightening torque: 2,5±0,5 daNm

**ORDER CODE**

|              |   |   |   |   |   |
|--------------|---|---|---|---|---|
| <b>B K H</b> | 1 | 2 | 3 | 4 | 5 |
|              | - | - |   |   |   |

**Pos.1 - Versions\***

| R | 1 | 2 | 3 | 4 | 5 |   |
|---|---|---|---|---|---|---|
| • | • |   |   | • | • | with built-in valves:<br>-Input relief valve on line "P". |
| • | • | • |   | • |   | -Input check (non-return) valve on line "P".              |
| • | • | • | • |   |   | -Shock valves on lines "R" and "L".                       |
| • | • | • | • |   |   | -Anti-cavitation valves on lines "R" and "L".             |

**Pos.2 - Relief Valve Pressure Settings, bar\*\***

|           |            |            |            |
|-----------|------------|------------|------------|
| <b>80</b> | <b>100</b> | <b>125</b> | <b>150</b> |
|-----------|------------|------------|------------|

**Pos.3 - Ports \*\*\***

|          |                           |
|----------|---------------------------|
| omit     | - BSPP (ISO 228)          |
| <b>A</b> | - SAE (ANSI B 1.1 - 1982) |
| <b>M</b> | - Metric (ISO 262)        |

**Pos.4 - Option (Paint)\*\*\*\***

|           |                             |
|-----------|-----------------------------|
| omit      | - No Paint                  |
| <b>P</b>  | - Painted                   |
| <b>PC</b> | - Corrosion Protected Paint |

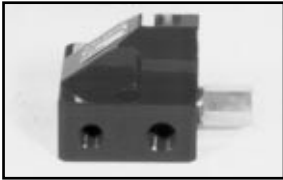
**Pos.5 - Design Series**

|      |                     |
|------|---------------------|
| omit | - Factory specified |
|------|---------------------|

**NOTES:** \* Versions **R, 1, 2, 3, 4**-for HKU; **5** - for XY  
\*\* That does not concern version **2** and **3**.  
\*\*\* For Port size see drawings on page 20 and 21.  
\*\*\*\* The colour is by customer's request.

The valve blocks are mangano-phosphatized as standard.

# PRIORITY VALVES FOR HKUS.../5... TYPE PR...

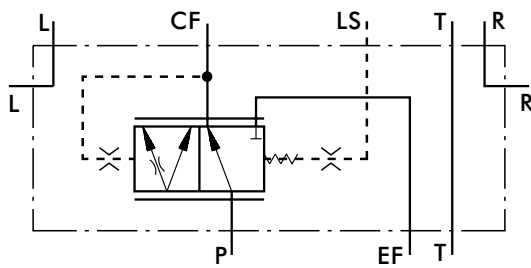


The Priority Valves distribute and trace the hydraulic flow from the supply pump of the hydraulic system to the hydraulic components which control and run the vehicle.

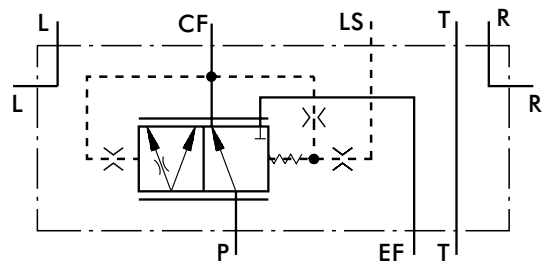
The Priority Valves are used only with the HKUS.../5(E)(T)(TE) hydrostatic steering units. When connected, the steering unit and the priority valve represent sophisticated hydraulic tracing system that controls the flow in both main pipelines of the hydraulic system (the working and control one) at any time of its operation.

As a static signal, the "LS" signal must be used in systems with circuit stability. The connection between the PRT, PRTA priority valves and the HKUS.../5T(TE) steering units has to be as short as possible, but should not exceed 1,5m (for iron pipe with  $\varnothing 4$  internal diameter). When a rubber hose is used this length have to be even shorter.

## Modulary Mounting

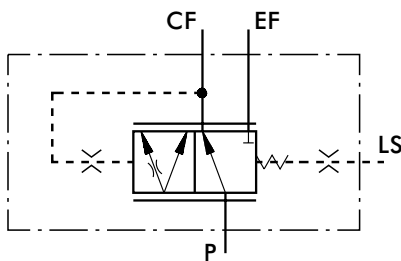


Static signal  
PRD...40,80/...

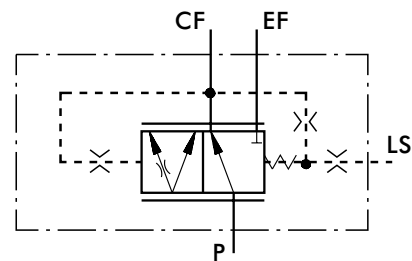


Dinamic signal  
PRDD...40,80/...

## Pipe Mounting

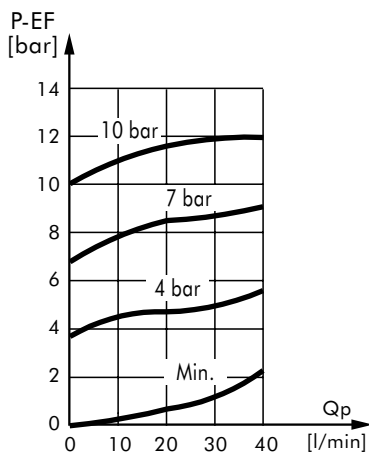


Static signal  
PRT...40,80/...; PRTA...40,80/...

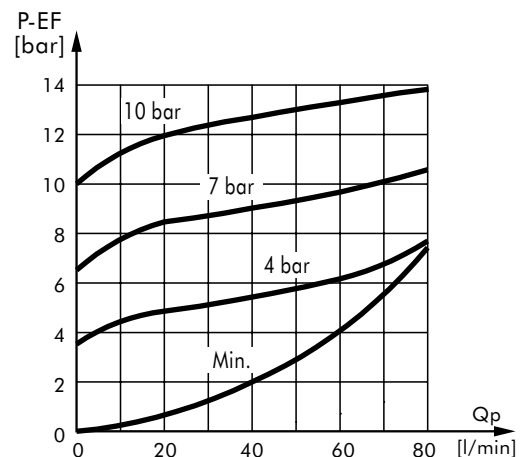


Dinamic signal  
PRTD...40,80/...; PRTAD...40,80/...

### PR...40



### PR...80

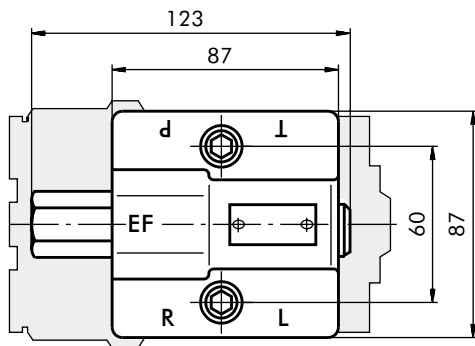
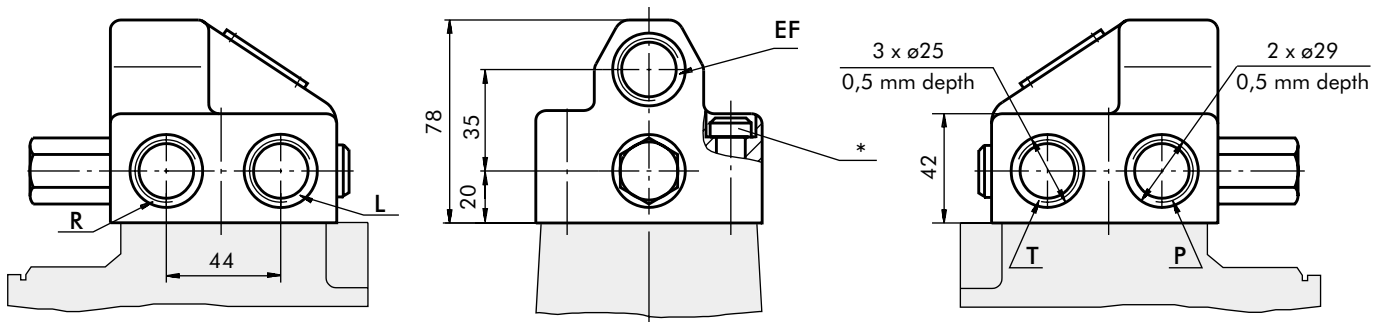


**SPECIFICATION DATA**

| Parameters                   | Type           |        |   |         |     |   |    |
|------------------------------|----------------|--------|---|---------|-----|---|----|
|                              | PRD(D), PRT(D) |        |   | PRTA(D) |     |   |    |
| Rated Flow                   | [l/min]        | 40; 80 |   |         |     |   |    |
| Control Spring Pressure      | [bar]          | 4      | 7 | 10      | 4   | 7 | 10 |
| Max. Pressures in Oil Ports: | P, EF, R, L    | 250    |   |         |     |   |    |
|                              | LS, CF         | 175    |   |         |     |   |    |
|                              | T              | 20     |   |         |     |   |    |
| Weight, avg.                 | [kg]           | 2,7    |   |         | 1,2 |   |    |

**P** - pump, **EF** - excess flow, **CF** - control flow (first priority oil flow),  
**L** - left, **R** - right, **LS** - load sensing, **T** - tank

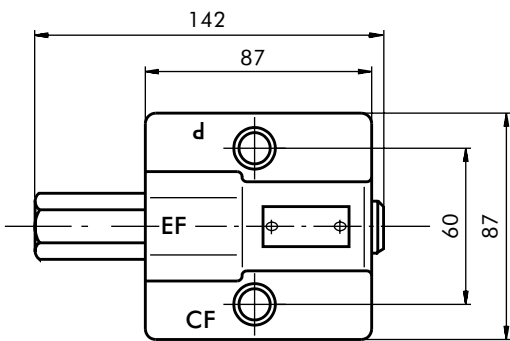
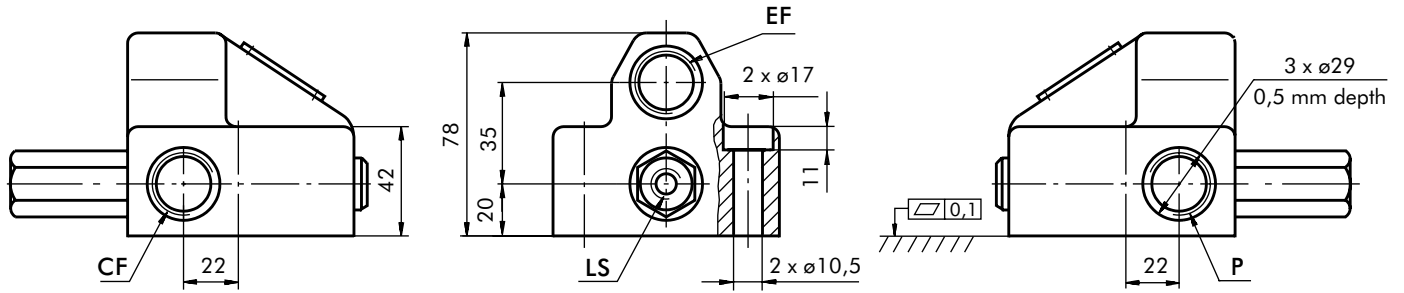
**DIMENSIONS AND MOUNTING DATA - PRD(D) 40,80/...**



| code     | Ports - P, EF<br>Thread            | Ports - T, R, L<br>Thread          |
|----------|------------------------------------|------------------------------------|
| -        | G1/2<br>18 mm depth                | G3/8<br>18 mm depth                |
| <b>M</b> | M22x1,5<br>18 mm depth             | M18x1,5<br>18 mm depth             |
| <b>A</b> | 7/8 - 14 UNF<br>O-ring 18 mm depth | 3/4 - 16 UNF<br>O-ring 18 mm depth |

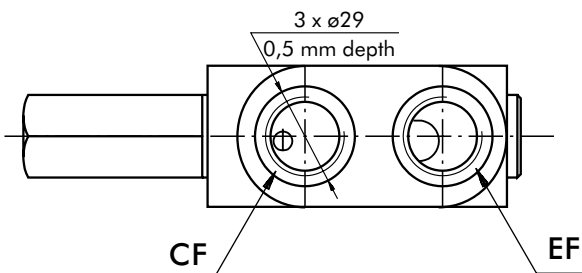
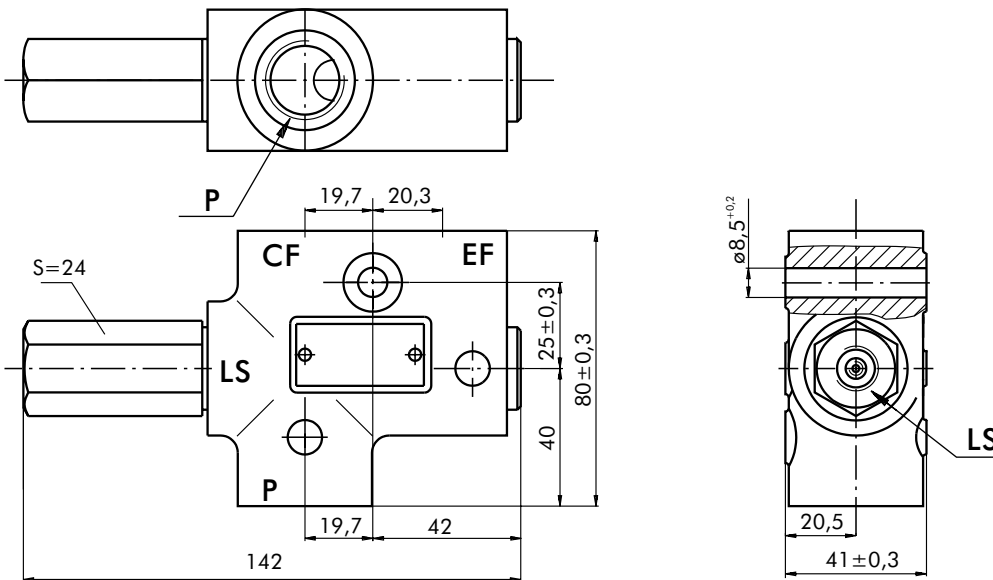
\* Connection to the HKUS.../5... is done with 2 screws M10x1x45-10.9 DIN 912 or with 2 screws 3/8-24 UNF ANSI B18.3-76; 44,5 mm long.  
Tightening torque: 4,5±0,5 daNm.

**DIMENSIONS AND MOUNTING DATA - PRT(D) 40,80/...**



| code | Ports - P, EF Thread               | Port - CF Thread                   | LS - Port                             |
|------|------------------------------------|------------------------------------|---------------------------------------|
| -    | G1/2<br>18 mm depth                | G1/2<br>18 mm depth                | G1/4<br>14 mm depth                   |
| M    | M22x1,5<br>18 mm depth             | M22x1,5<br>18 mm depth             | G1/4<br>14 mm depth                   |
| A    | 7/8 - 14 UNF<br>O-ring 18 mm depth | 3/4 - 16 UNF<br>O-ring 18 mm depth | 7/16 - 20 UNF<br>O-ring 12,7 mm depth |

**DIMENSIONS AND MOUNTING DATA - PRTA(D) 40,80/...**

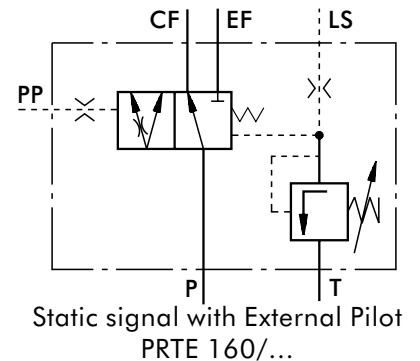
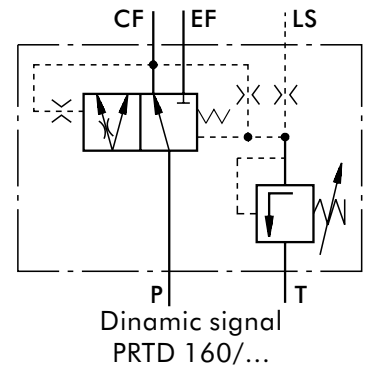
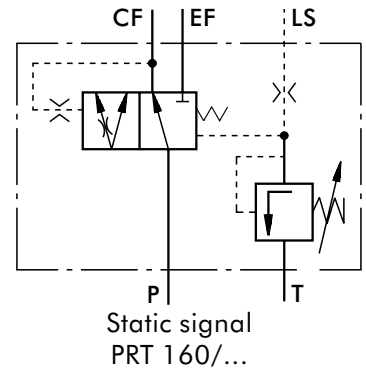


| code | Ports - P, EF Thread               | Port - CF Thread                   | LS - Port                             |
|------|------------------------------------|------------------------------------|---------------------------------------|
| -    | G1/2<br>18 mm depth                | G1/2<br>18 mm depth                | G1/4<br>14 mm depth                   |
| M    | M22x1,5<br>18 mm depth             | M22x1,5<br>18 mm depth             | G1/4<br>14 mm depth                   |
| A    | 7/8 - 14 UNF<br>O-ring 18 mm depth | 3/4 - 16 UNF<br>O-ring 18 mm depth | 7/16 - 20 UNF<br>O-ring 12,7 mm depth |

# PRIORITY VALVES FOR HKUS.../5... TYPE PRT...160/



The Priority Valves PRT.../160 have built-in a pilot pressure relief valve, who protects the steering unit against excess pressure. The pilot pressure relief valve operates with the Shuttle of the Priority valve to limit the maximum steering pressure P-T measured across the steering units ports.



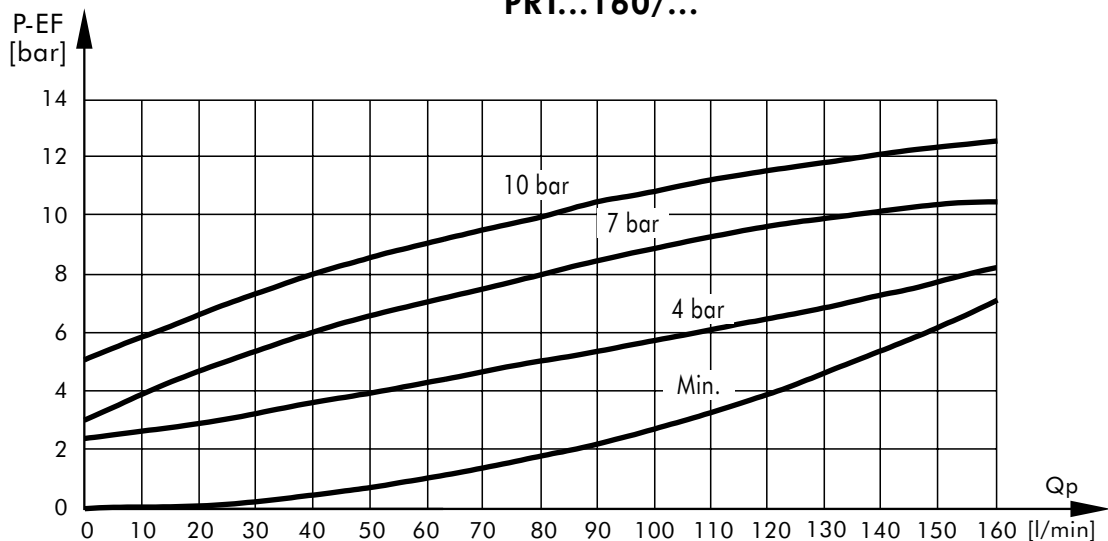
## SPECIFICATION DATA

| Parameters                                    | Type            |     |    |
|---|-----------------|-----|----|
|   | PRT(E), PRTD(E) |     |    |
| Rated Flow [l/min]                            | 160             |     |    |
| Control Spring Pressure [bar]                 | 4               | 7   | 10 |
| Max. Pressures in Oil Ports: [bar]            | P, EF           | 250 |    |
|   | LS, CF          | 210 |    |
|   | T               | 15  |    |
|   | PP              | 210 |    |
| Standart Relief Valve Pressure Settings [bar] | 175*            |     |    |
| Weight, avg. [kg]                             | 4,9             |     |    |

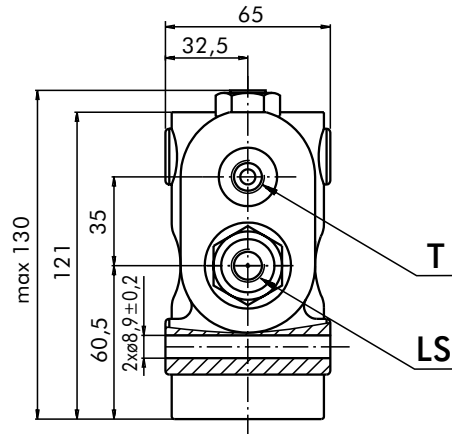
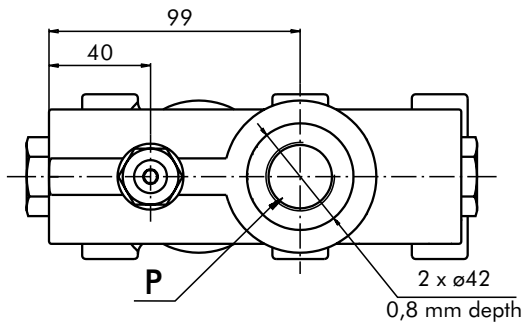
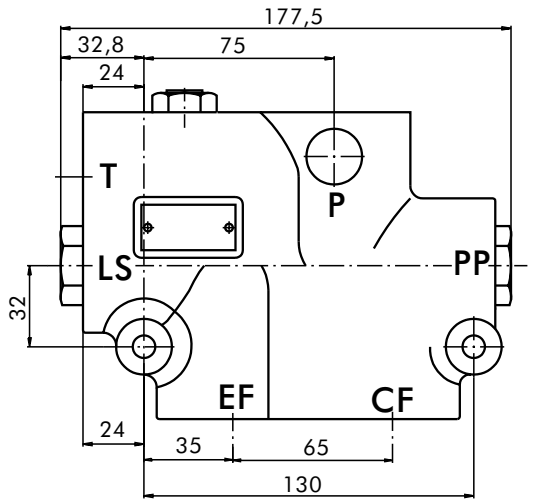
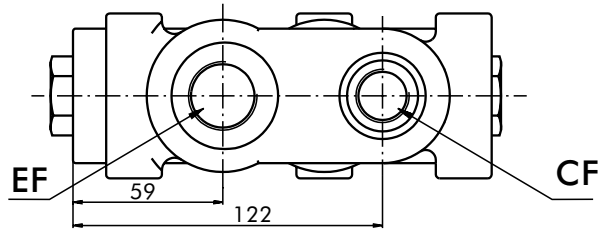
\* - Adjusted valve pressure from 80 till 210 bar upon customer request.

**P** - pump, **EF** - excess flow, **CF** - control flow (first priority oil flow), **LS** - load sensing, **T** - tank, **PP** - pilot pressure

## PRT...160/...



**DIMENSIONS AND MOUNTING DATA - PRT...160/...**



| code | Ports - P, EF<br>Thread                   | Port - CF<br>Thread                     | LS, PP, T - Ports                        |
|------|---|---|--|
| -    | G3/4<br>20,5 mm depth                     | G1/2<br>18,5 mm depth                   | G1/4<br>12,5 mm depth                    |
| A    | 1 1/16 - 12 UN<br>O-ring<br>20,5 mm depth | 3/4 - 16 UNF<br>O-ring<br>18,5 mm depth | 7/16 - 20 UNF<br>O-ring<br>12,5 mm depth |
| M    | M27x2<br>20,5 mm depth                    | M18x1,5<br>18,5 mm depth                | M12x1,5<br>12,5 mm depth                 |

**ORDER CODE**

|           |   |   |          |          |   |   |
|-----------|---|---|----------|----------|---|---|
| 1         | 2 | 3 | 4        | 5        | 6 | 7 |
| <b>PR</b> |   |   | <b>/</b> | <b>-</b> |   |   |

**Pos.1 - Mounting**

- D** - Modularly Mounting
- T** - Pipe Mounting (Model 1)
- TA** - Pipe Mounting (Model 2)

**Pos.2 - Signal Type**

- omit - with Static signal
- D** - with Dinamic signal
- E\*** - with Static signal w/ External Pilot

**Pos.3 - Rated Flow, l/min**

|           |           |              |
|-----------|-----------|--------------|
| <b>40</b> | <b>80</b> | <b>160**</b> |
|-----------|-----------|--------------|

**Pos.4 - Control Spring Pressure , bar**

|          |          |           |
|----------|----------|-----------|
| <b>4</b> | <b>7</b> | <b>10</b> |
|----------|----------|-----------|

**Pos.5 - Ports**

- omit - BSPP (ISO 228)
- A** - SAE (ANSI B 1.1 - 1982)
- M** - Metric (ISO 262)

**Pos.6 - Option (Paint)\*\*\***

- omit - No Paint
- P** - Painted
- PC** - Corrosion Protected Paint

**Pos.7 - Design Series**

- omit - Factory specified

**NOTES:\*** Only for PRT 160/...

**\*\*** Only for PRT

**\*\*\*** Colour at customer's request.

The priority valves are mangano-phosphatized as standard.

# TORQUE AMPLIFIERS TYPE UVM...

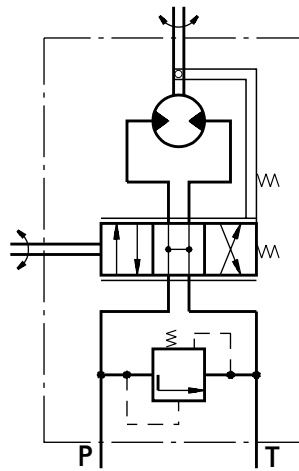
The UVM Torque Amplifiers amplify the applied torque to the control shaft and thus ease the running of various transport vehicles such as:

- agricultural and wood working machines;
- road rollers and road cleaning machines;
- fork-lift trucks and construction machinery;

The totally transferred power in terms of output torque is up to 1,1 kW.

The UVM torque amplifiers with their simple design, consisted of a pump and an amplifier, ensure 40 times higher output torque than the applied one. The amplifying is achieved as follows; by rotating the input shaft to the left or right the spool and the bushing are displaced, and the hydraulic flow enters the system turning the gerotor set, which transfers the already amplified torque to the output shaft.

One advantage of the UVM torque amplifier is that it allows manual steering in cases of engine (pump) failure.



UVM...

## SPECIFICATION DATA

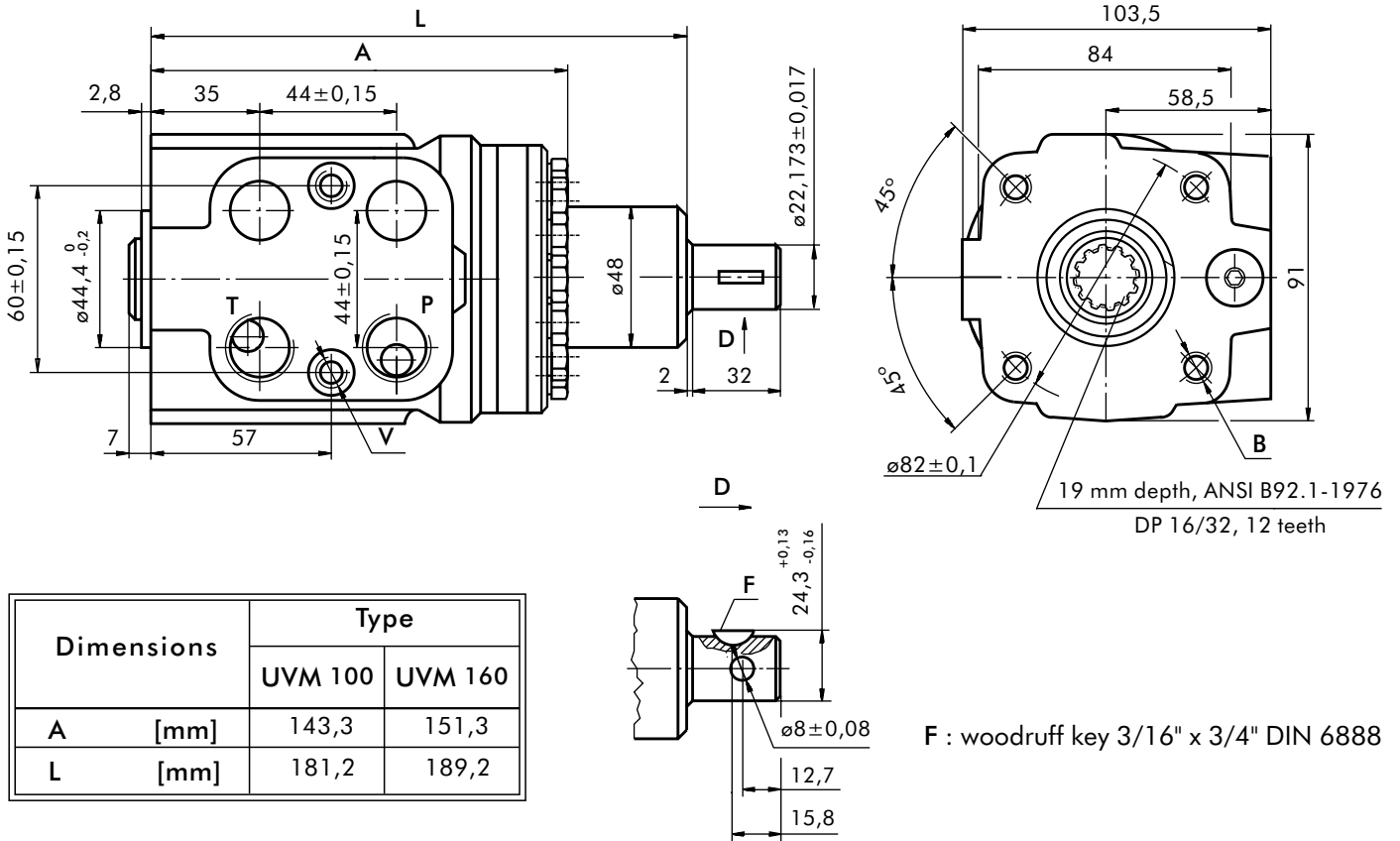
| Parameters  | Type                   |         |           |
|---|------------------------|---------|-----------|
|   | UVM 100                | UVM 160 |           |
| Displacement                                      | [cm <sup>3</sup> /rev] | 99,0    | 158,4     |
| Rated Flow*                                       | [l/min]                | 10      | 16        |
| Rated Pressure**                                  | [bar]                  | 70      | 70        |
| Input Torque                                      | [Nm]                   | 3,5...5 | 3,5...5   |
| Max. Input Torque                                 | [Nm]                   | 20      | 20        |
| Torque Output at 70 bar.                          | [Nm]                   | 80      | 120       |
| Pressure Drop between P and T at Rated Flow,      | [bar]                  | 1 ... 2 | 1,6...2,5 |
| Max. Speed of Rotation at Rated Flow and Pressure | [RPM]                  | 100     | 100       |
| Max. Continuous Pressure in Line T                | [bar]                  | 20      | 20        |
| Weight, avg.                                      | [kg]                   | 5,8     | 6,2       |

\* Rated Flow at 100 RPM.

\*\* Pressure Settings are at Rated Flow (as in the table ) and viscosity 21 mm<sup>2</sup>/s (50° C).



## DIMENSIONS AND MOUNTING DATA

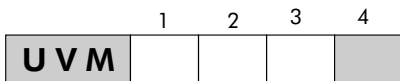


| Dimensions | Type    |         |
|------------|---------|---------|
|            | UVM 100 | UVM 160 |
| A [mm]     | 143,3   | 151,3   |
| L [mm]     | 181,2   | 189,2   |

F : woodruff key 3/16" x 3/4" DIN 6888

| code | Ports - P, T Thread                | Column Mounting Thread - B        | Port Mounting Thread - V          |
|------|------------------------------------|-----------------------------------|-----------------------------------|
| -    | G1/2<br>17 mm depth                | 4 x M10<br>18 mm depth            | 2 x M10x1<br>16 mm depth          |
| A    | 3/4 - 16 UNF<br>O-ring 17 mm depth | 4 x 3/8 - 16 UNC<br>15,7 mm depth | 2 x 3/8 - 24 UNF<br>14,2 mm depth |
| M    | M22x1,5<br>17 mm depth             | 4 x M10<br>18 mm depth            | 2 x M10x1<br>16 mm depth          |

## ORDER CODE



**Pos.1 - Displacement code**

**100** - 99,0 [cm<sup>3</sup>/rev]

**160** - 158,4 [cm<sup>3</sup>/rev]

**Pos.2 - Ports**

omit - BSPP (ISO 228)

**A** - SAE (ANSI B 1.1 - 1982)

**M** - Metric (ISO 262)

**Pos.3 - Option (Paint)\***

omit - No Paint

**P** - Painted

**PC** - Corrosion Protected Paint

**Pos.4 - Design Series**

omit - Factory specified

**NOTES:**

\* Colour at customer's request.

The steering units are mangano-phosphatized as standard.

# STEERING COLUMNS TYPE KK...



The KK Steering Columns transfer the torque from the steering wheel of the vehicle to the HKU, HKUS or other of the same class steering units. The KK steering columns are consisted of a pipe in which is centered the control shaft.

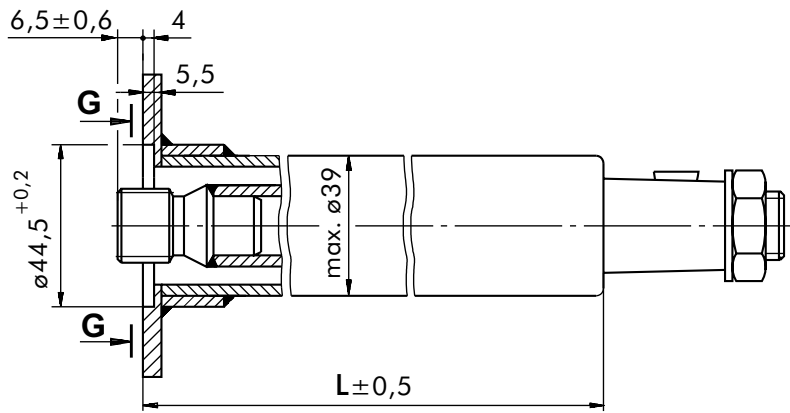
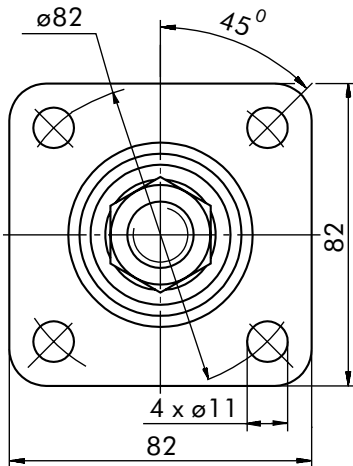
Permissible loads on the steering column are as follows:

|   |         |
|---|---------|
| Max. torque applied to the steering wheel | 24 daNm |
| Max. bending moment                       | 20 daNm |
| Max. axial load                           | 100 daN |

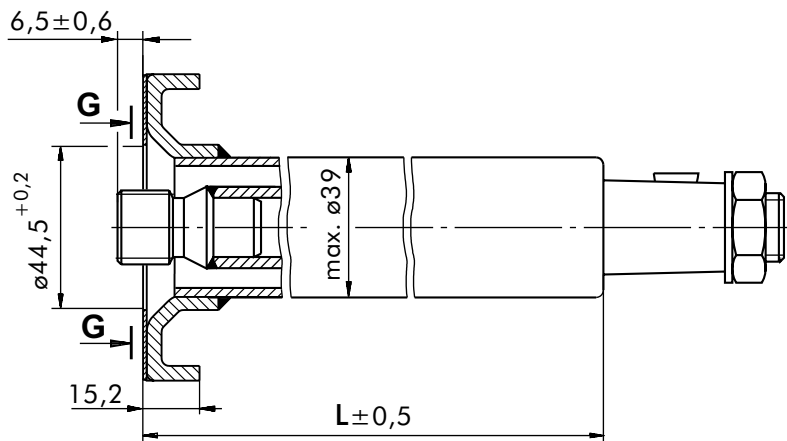
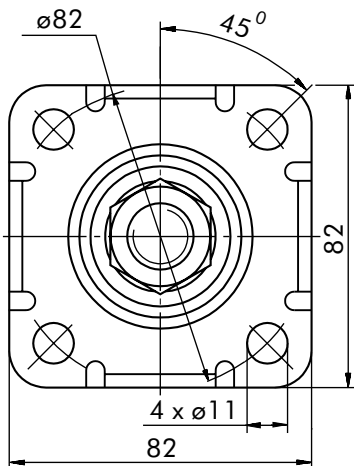
The steering column must be additionally supported when the length  $L$  exceeds 150 mm.

## DIMENSIONS AND MOUNTING DATA

### Type KK



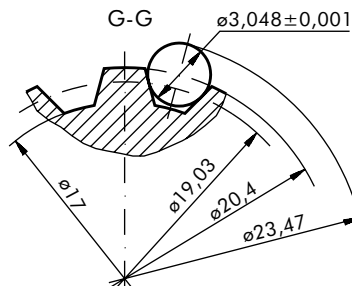
### Type KKF



## SPECIFICATION DATA

| Parameters   | Type  |        |        |        |
|--------------|-------|--------|--------|--------|
|              | KK 75 | KK 150 | KK 390 | KK 750 |
| L, [mm]      | 78    | 168,2  | 393    | 777,8  |
| Weight, [kg] | 0,75  | 1,1    | 1,9    | 3,3    |

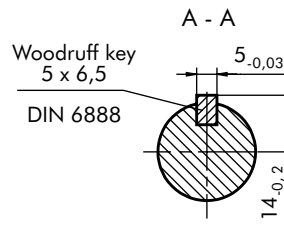
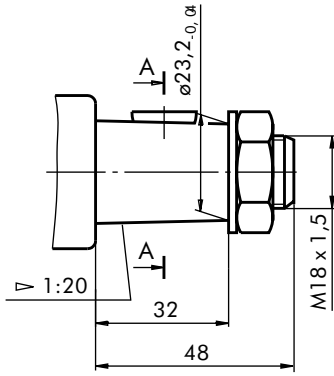
Please, contact factory or your regional manager regarding other lengths.



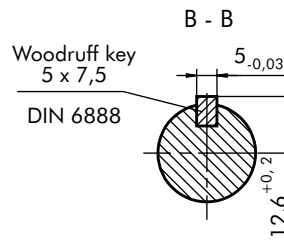
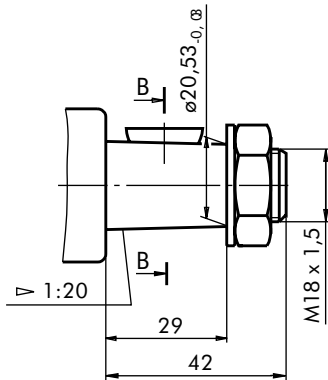
| Involute Spline Data |          |        |
|----------------------|----------|--------|
| Modul                | m        | 1,5875 |
| Number of Teeth      | z        | 12     |
| Pressure Angle       | $\alpha$ | 30°    |
| Pitch                | $p_t$    | 4,986  |

**SHAFT EXTENSIONS**

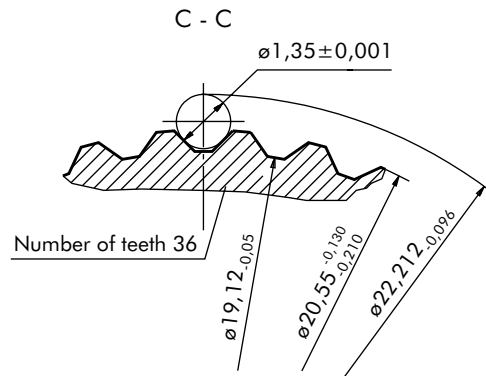
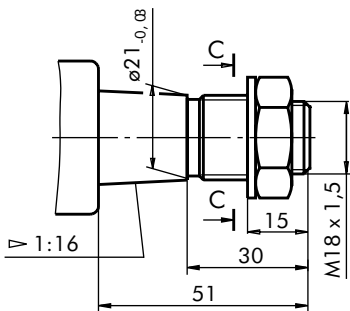
**TYPE I**



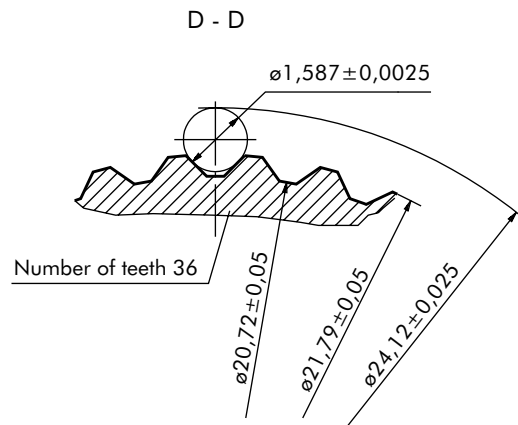
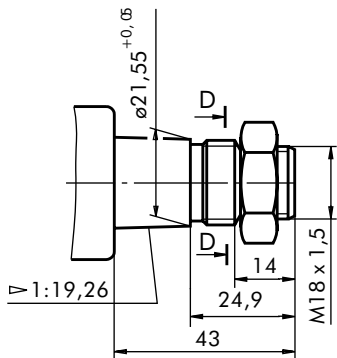
**TYPE II**



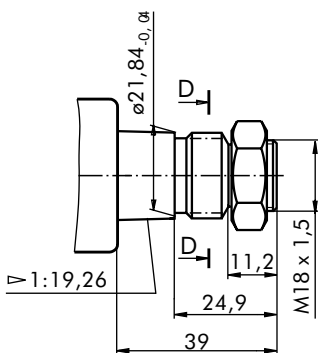
**TYPE III**



**TYPE IV**

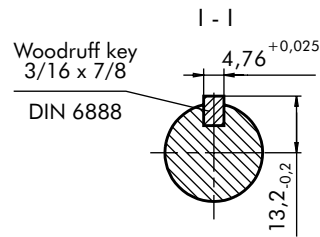
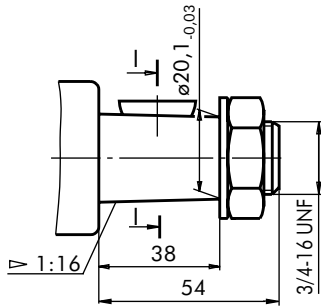


**TYPE V**

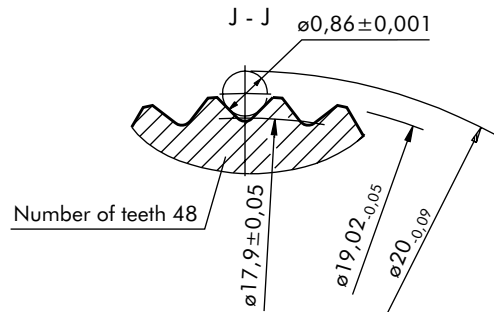
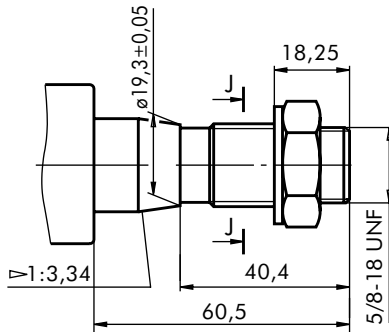


**SHAFT EXTENSIONS**

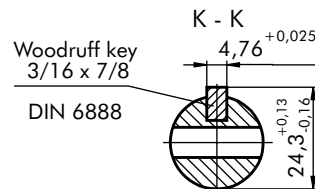
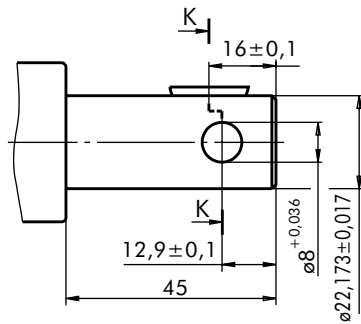
**TYPE VI**



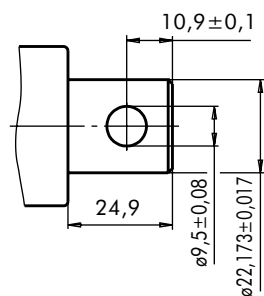
**TYPE VII**



**TYPE VIII**



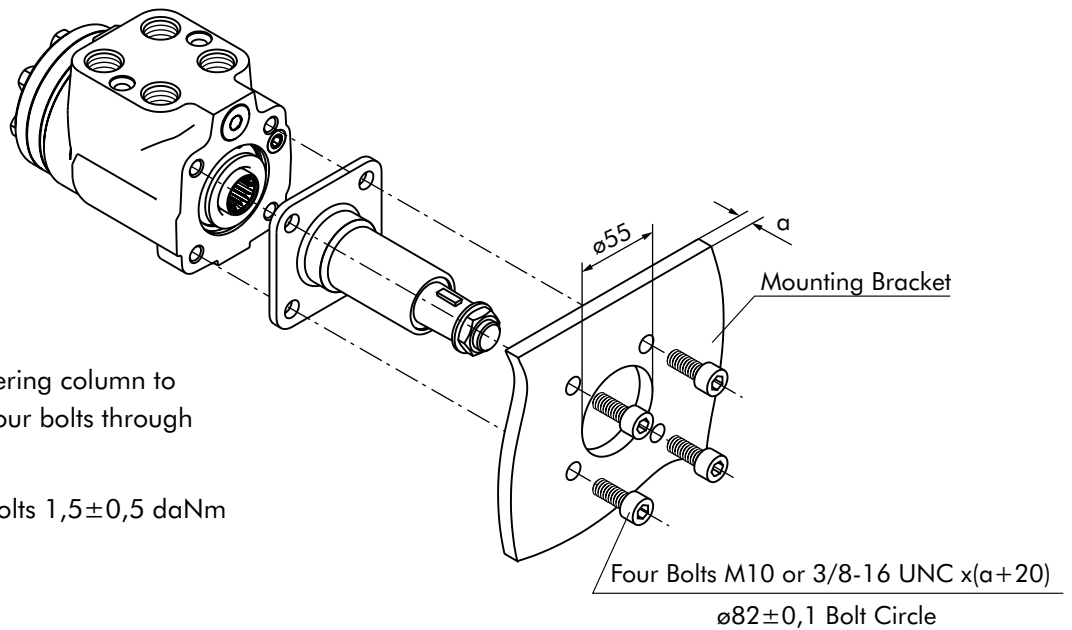
**TYPE IX**



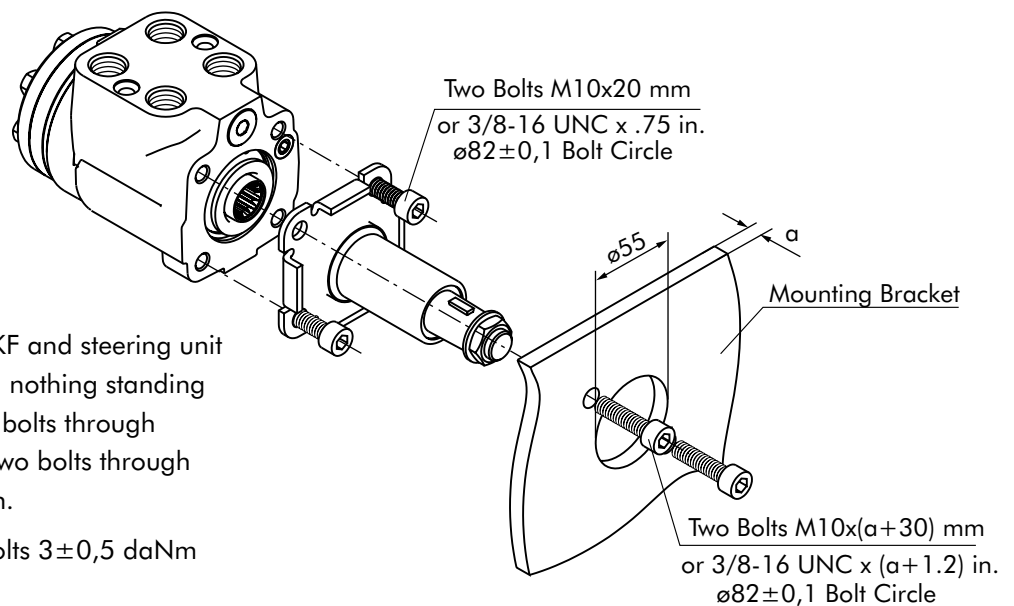


## INSTALLING

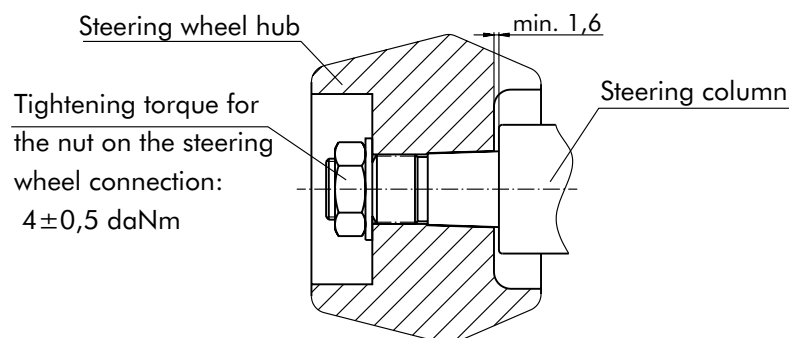
### For column type KK



### For column type KKF

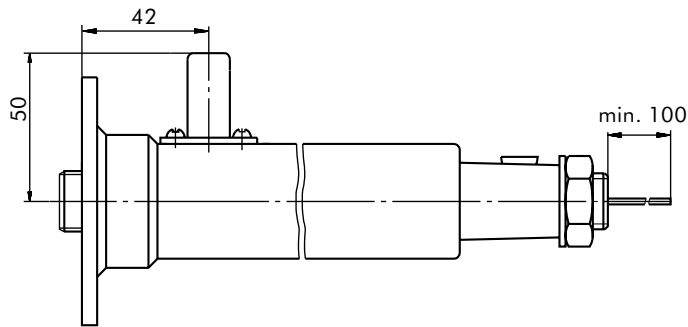


### Minimum Clearance at Assembly

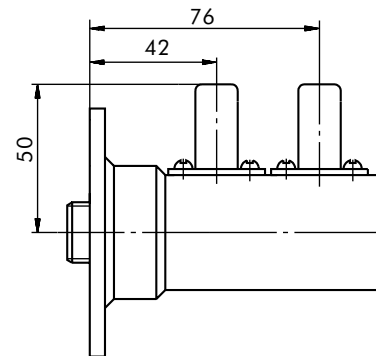


## SOUND SIGNAL CONNECTION

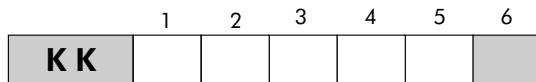
### E Option



### EE Option



## ORDER CODE



#### Pos.1 - Mounting Flange

omit - Flange without Tabs

**F** - Flange with Tabs

#### Pos.2 - Length, mm (acc. to table)

#### Pos.3 - Shaft Extensions

**I, II, III, IV, V, VI, VII, VIII, IX**

#### Pos.5 - Option (Paint)\*

omit - No Paint

**P** - Painted

**PC** - Corrosion Protected Paint

#### Pos.6 - Design Series

omit - Factory specified

#### Pos.4 - Signal Connection (Option)

omit - without electric signal connection

**E** - with one electric signal connection

**EE** - with two electric signal connection

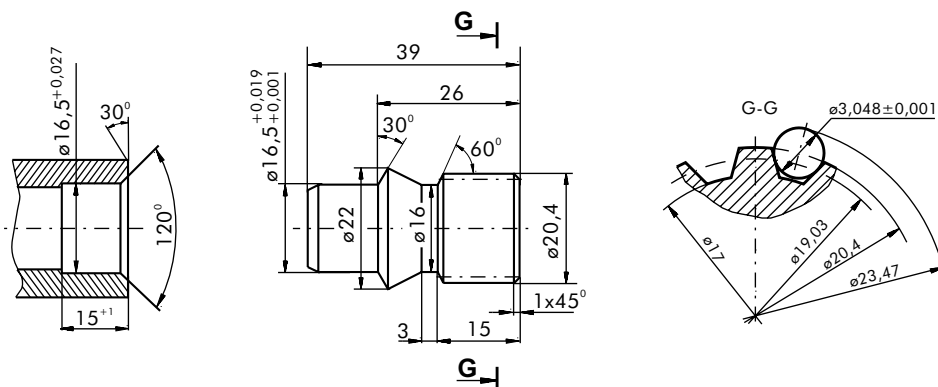
### NOTES:

\* Colour at customer's request.

The steering columns are yellow galvanized as standard.

## Shaft End Part

Order No:46415 001 00



| Involute Spline Data |          |        |
|----------------------|----------|--------|
| Modul                | m        | 1,5875 |
| Number of Teeth      | z        | 12     |
| Pressure Angle       | $\alpha$ | 30°    |
| Pitch                | $p_t$    | 4,986  |

# HYDROSTATIC STEERING UNITS

## GENERAL APPLICATION AND SPECIFICATION INFORMATION

### APPLICATION

(SIZING AND STEERING SYSTEM DESIGN PROCESS)

#### STEP ONE:

Calculate approximate kingpin torque ( $M_L$ ).

$$M_L = G \cdot \mu \sqrt{\frac{B^2}{8} + \ell^2}$$

**Note:** Double  $M_L$  if steered wheels are powered.

$M_L$  = Kingpin torque in [daNm].

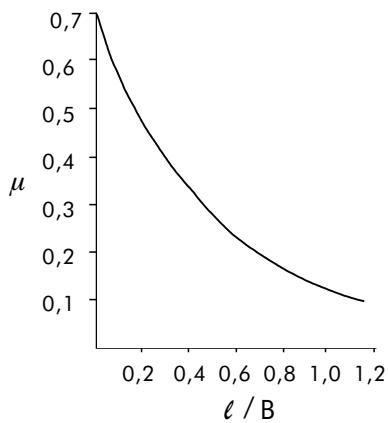
$G$  = Vehicle weight on steered axle in [daN] (use maximum estimated overload weight).

$\mu$  = Coefficient of friction (use Chart No 1, dimensionless) determined by  $\ell/B$  (see Diagram No 1).

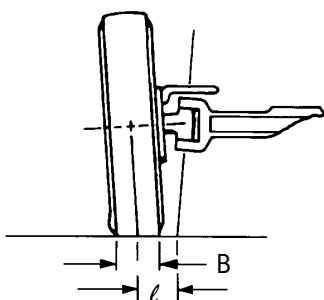
$B$  = Nominal width of tyre print [m] (see Diagram No 1).

$\ell$  = Kingpin offset. The distance between tyre centerline intersection at ground and kingpins centerline intersection at ground in [m] (see Diagram No 1).

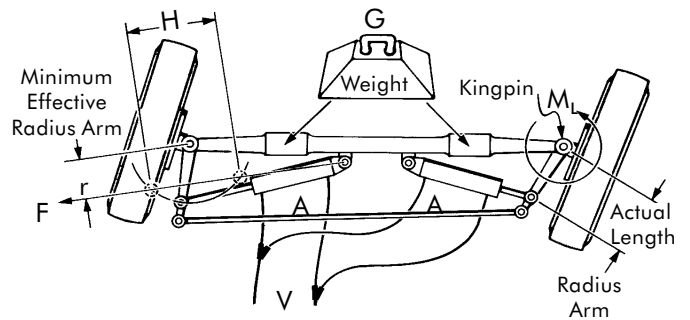
**Chart No 1**



**Diagram No 1**



**Diagram No 2**



#### STEP TWO:

Calculate approximate cylinder; force-area-stroke-volume.

**FORCE**

$$F = \frac{M_L}{r}$$

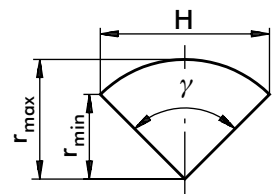
$F$  = Force required [daN] to steer axle.

$M_L$  = Kingpin torque in [daNm] from step one. Double  $M_L$  if steered wheels are powered.

$r$  = Effective radius Arm [mm] is the minimum distance from the centerline of the cylinders minimum and maximum stroke points parallel to the kingpin center pivot. This is not the physical length of the radius Arm (see Diagram No 2 and Chart No 2).

**Chart No 2**

$$r_{\min} = r_{\max} \cdot \cos \frac{\gamma}{2}$$



#### STROKE

$H$  = Stroke [cm].

Calculate stroke of cylinder using Diagram No 2 and Chart No 2 as shavt.

$$H = 2 r_{\max} \cdot \sin \frac{\gamma}{2}$$

**AREA**

$$A = \frac{F}{\Delta P}$$

$A$  = Cylinder area for axle cylinder set [cm<sup>2</sup>].

$F$  = Force required from step two force formula [daN].

$\Delta P$  = Hydraulic pressure [bar] use following percentage of relief valve setting by amount of load on steered axle. Severe load 25% - medium load 55% - no load 75%.

# STEERING UNIT

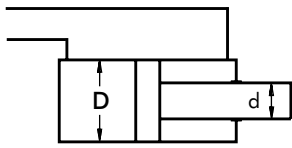
## DIAMETER

After the cylinder set area is determined, the cylinder diameter can be calculated.

D = Inside diameter of cylinder [cm].  
d = Road diameter of cylinder [cm].

Choose type of cylinder arrangement and formula shown for that type.

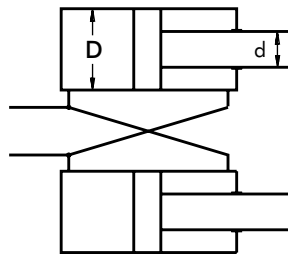
### Differential Cylinder



$$D = \sqrt{\frac{4A}{\pi} + d^2}$$

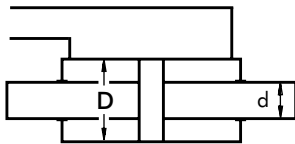
Note:  $\left(\frac{d}{D}\right)^2 \leq 0,15$

### Cross Connected Cylinders



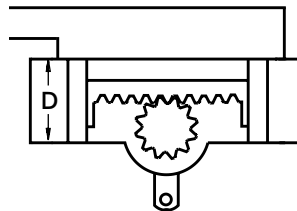
$$D = \sqrt{\frac{2A}{\pi} + \frac{d^2}{2}}$$

### Balanced Cylinder



$$D = \sqrt{\frac{4A}{\pi} + d^2}$$

### Opposed Cylinder



$$D = \sqrt{\frac{4A}{\pi}}$$

## VOLUME $V = H \cdot A$

V = Volume. The total amount of oil required to move the cylinder rod(s) through the entire stroke [cm<sup>3</sup>].

H = Stroke [cm].

A = Area [cm<sup>2</sup>].

**Note:** For differential cylinders it is important to calculate average cylinder volume for step three using below formula.

$$V_{avg} = H \cdot \frac{\pi}{4} (2D^2 - d^2)$$

## STEP THREE:

### Selecting displacement of hydrostatic steering unit.

At this point determine number of steering wheel revolutions desired for your application to steer the wheels from one side to the other (lock to lock). Depending on the type of vehicle and its use, this will vary from 3 to 5 turns.

## DISPLACEMENT $V_D = \frac{V}{n}$

$V_D$  = Displacement [cm<sup>3</sup>] per rev.

V = Volume of oil [cm<sup>3</sup>].

n = Steering wheel turns lock to lock.

After completing the above displacement calculation, choose the closest standard hydrostatic steering unit in displacement size that incorporates circuitry you require.

Recalculate the number of steering wheel turns using the displacement of selected standard hydrostatic steering unit outlined above. Use the formula shown below.

$$n = \frac{V}{V_D}$$

V = Volume of oil [cm<sup>3</sup>].

n = Steering wheel turns lock to lock.

**Note:** For differential cylinders applications the cylinder volume will be different for left and right turns - this means the value n (steering wheel turns lock to lock) will vary when turning to the left or right.

## STEP FOUR:

Calculate approximate minimum and maximum steering circuit flow requirements.

$$Q = \frac{V_D}{\text{Unit Conversion for Imperial or [1000] Metric}}$$

Q = Steering circuit flow [l/min].

$V_D$  = Unit displacement [cm<sup>2</sup>] per rev.

N = Steering wheel input speed [rpm] (min<sup>-1</sup>).

Recommended steering speed is 50 to 100 rpm.

Many variables are involved in sizing the pump. We suggest that the manufacturer test and evaluate for desired performance.

## GENERAL INFORMATION

### FLUID DATA:

To insure maximum performance and life of the Hydrostatic steering units, use premium quality hydraulic oils. Fluids with effective quantities of anti-wear agents or additives are highly recommended. If using synthetic fluids consult the factory for alternative seal materials.

### Viscosity

Viscosity at normal operating temperature should be approx. 20 mm<sup>2</sup>/s. Viscosity range 10 - 300 mm<sup>2</sup>/s.

### Temperature

Normal operating temperature range from +30°C to +60°C.

Minimum operating temperature -40°C.

Maximum operating temperature +80°C.

**Note:** Extended periods of operation at temperature of 60°C and above will greatly reduce life of oil due to oxidation and shorten life of product.



**Filtration**

The maximum degree of contamination per ISO 4406 or CETOP RP is:

- 20/17 open center units
- 19/16 closed center and load sensing
- 16/12 priority valves

Return line filtration of 25 μm nominal (40 - 50 μm absolute) or finer is recommended.

In extremely dusty conditions filtration of 10 μm absolute should be used.

**START UP**

All air must be purged from system before operating unit. It is extremely important that any external lines or units with load sensing or priority feature be completely bled. Lines going to and from cylinders as well as lines to and from pump be purged of all air. It is recommended that a 10 - 15 mm filter be used between pump and steering unit before start up.

**MOUNTING UNITS**

All hydrostatic steering units should be installed for ease of access. It is recommended that the steering unit be located outside the vehicle cabin.

It is important that no radial axial load be applied to the hydrostatic steering unit input shaft. Any or all radial and axial loads must be absorbed by the steering column or other operating device supplied by the vehicle manufacture.

Ports on the steering cylinder(s) should face upward to prevent damage.

During installation of the hydrostatic steering unit, cleanliness is of the utmost importance. Pipe plugs should be left in place during mounting and only removed when hydraulic lines are to be connected.

**TORQUE TIGHTENING VALUES**

**Fluid connections**

| Fluid connection | Max. tightening torque daNm |               |                 |          |
|------------------|-----------------------------|---------------|-----------------|----------|
|                  | metal edge                  | copper washer | aluminum washer | O - ring |
| 7/16 - 20 UNF    |                             |               |                 | 2        |
| 9/16 - 18 UNF    |                             |               |                 | 5        |
| 3/4 - 16 UNF     |                             |               |                 | 6        |
| 7/8 - 14 UNF     |                             |               |                 | 7        |
| G 1/4            | 4                           | 2             | 3               |          |
| G 3/8            | 6                           | 2             | 5               |          |
| G 1/2            | 10                          | 3             | 8               |          |
| G 3/4            | 16                          | 5             | 13              |          |
| M 10 x 1         | 4                           | 2             | 3               |          |
| M 18 x 1,5       | 7                           | 2             | 5               |          |
| M 22 x 1,5       | 10                          | 3             | 8               |          |

**Mounting bolts**

| Mounting bolts | Tightening torque daNm |
|----------------|------------------------|
| 3/8 - 16 UNC   | 3,0 ± 0,5              |
| M 10 x 1       | 6,5 ± 0,5              |
| M 10           | 3,0 ± 0,5              |

## WARRANTY

INTERMACHINEX warrants, that the listed above products are free of defects in material or workmanship. This warranty will apply only to defects appearing within 2 years after the date of delivery of the product. If customer notifies INTERMACHINEX within the above period about any such defects, INTERMACHINEX, at its sole option will replace or repair the defective products.

The foregoing limited warranty is available only if INTERMACHINEX is promptly notified in writing of the alleged defect and **does not cover:** failure to function caused by damage to the product, improper installation, unreasonable use or abuse of the product, failure to provide or use of improper maintenance or usual, degradation of the product due to physical environments of an usual nature. The foregoing remedies are the sole and exclusive remedies available to customer.