TÜVRheinland® CERT ISO 9001

M+S HYDRAULIC

# HYDROSTATIC STEERING UNITS & ACCESSORIES



# HYDROSTATIC STEERING UNITS AND ACCESSORIES

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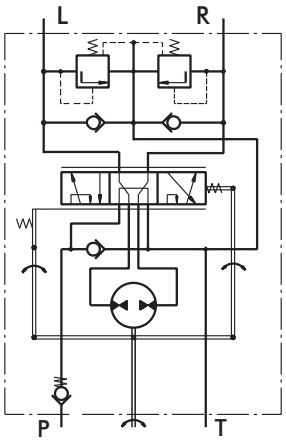


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# HYDROSTATIC STEERING UNITS TYPE XY.../1



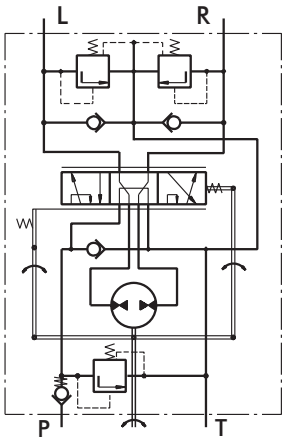
The M+S Hydraulic Hydrostatic Steering units are used in low-speed vehicles which driving speed does not exceed 60 km/h - such as: building machines, fork-lift trucks, harvesting machines, off-highway equipment and others. These hydraulic units amplify the torque to the steering wheels, with no need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




"Open Center - Load Reaction"
XY...-0/1

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 a built-in check valves, and there is an option for a built-in relief valve in the inlet.




"Open Center - Load Reaction"
XY...-.../1

## SPECIFICATION DATA

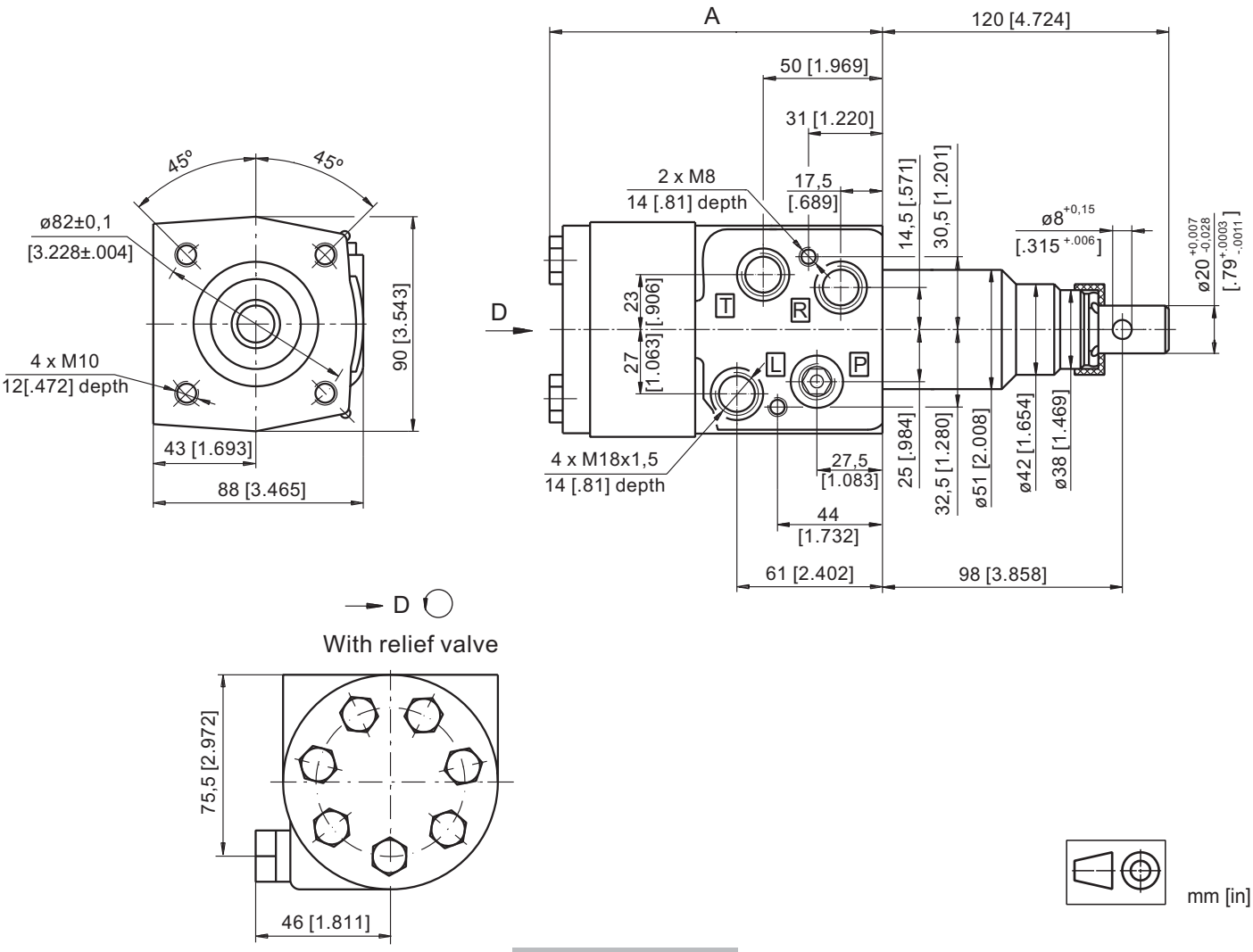
| Parameters | Type | | |
|---|---|---|---|
| | XY 85.../1 | XY 120.../1 | XY 145.../1 |
| Displacement $cm^3/rev$ [$in^3/rev$] | 84 [5.13] | 120 [7.32] | 144 [8.79] |
| Rated Flow* lpm [GPM] | 9 [2.4] | 12 [3.2] | 15 [4.0] |
| Rated Pressure bar [PSI] | 150 [2175] | | |
| Relief Valve Pressure Settings** bar [PSI] | 80 [1160] | 100 [1450] | 125 [1810] 150 [2175] |
| Shock Valves Pressure Settings*** bar [PSI] | 200 [2900] | | |
| Max. Cont. Pressure in Line T bar [PSI] | 20 [290] | | |
| Max. Torque at Servoamplifying Nm [lb - in] | 3,5 [31] | | |
| Max. Torque w/o Servoamplifying Nm [lb - in] | 120 [1065] | | |
| Weight kg [lb] | 6,4 [14.1] | 6,6 [14.6] | 6,8 [15.0] |
| Dimension A mm [in] | 136,3 [5.37] | 141.5 [5.57] | 144.5 [5.69] |

* Rated Flow at 100 RPM.

** Pressure Settings are at Rated Flow (as in the table ) and viscosity 21 $mm^2/s$ [105 SUS] at 50° C [122°F].

***Pressure Settings are at flow rate of 4 lpm [1.06 GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50° C [122°F].

## DIMENSIONS AND MOUNTING DATA




## ORDER CODE

| 1 | 2 | | 3 | 4 | 5 |
|---|---|---|---|---|---|
| XY | | - | / | 1 | | |

**Pos.1 - Displacement code**

| | |
|---|---|
| **85** | - 84,0 cm³/rev [5.13 in³/rev] |
| **120** | - 120,0 cm³/rev [7.32 in³/rev] |
| **145** | - 144,0 cm³/rev [8.79 in³/rev] |

**Pos.2 - Relief Valve Pressure Settings**

| | |
|---|---|
| **8** | - 80 bar [1160 PSI] |
| **10** | - 100 bar [1450 PSI] |
| **12,5** | - 125 bar [1810 PSI] |
| **15** | - 150 bar [2175 PSI] |
| **0** | - without Relief Valve |

**Pos.3 - Versions**

| | |
|---|---|
| **1** | - Version 1 *"Open Center - Load Reaction"* |

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

| | |
|---|---|
| omit | - No Paint |
| **P** | - Painted |
| **PC** | - Corrosion Protected Paint |
| **PS** | - Special Paint** |
| **PCS** | - Special Corrosion Protected Paint** |

**Pos.5 - Design Series**

omit - Factory specified

**NOTES:**

* Colour at customer's request.

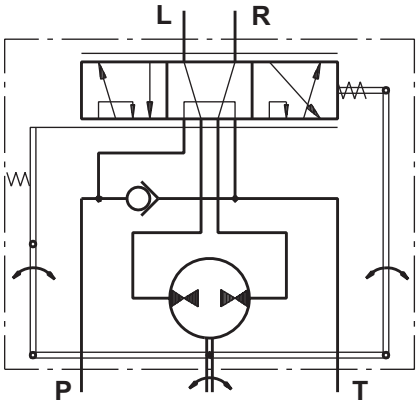
** Non painted feeding surfaces, colour at customer's request.

The steering units are mangano-phosphatized as standard.

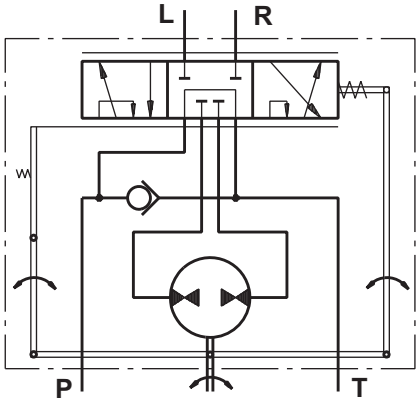
# HYDROSTATIC STEERING UNITS TYPE HKU.../3, 4



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"
HKU.../3




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

## SPECIFICATION DATA

| Parameters | Type | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HKU 40/3 HKU 40/4 | HKU 50/3 HKU 50/4 | HKU 63/3 HKU 63/4 | HKU 80/3 HKU 80/4 | HKU 100/3 HKU 100/4 | HKU 125/3 HKU 125/4 | HKU 160/3 HKU 160/4 | HKU 200/3 HKU 200/4 | HKU 250/3 HKU 250/4 | HKU 320/3 HKU 320/4 | HKU 400/3 HKU 400/4 | HKU 500/4 | HKU 630/4 | HKU 800/4 | HKU 1000/4 |
| Displacement $cm^3/rev$ | 39,6 | 49,5 | 65,6 | 79,2 | 99,0 | 123,8 | 158,4 | 198 | 247,5 | 316,8 | 396 | 495 | 623,6 | 793 | 990 |
| $[in^3/rev]$ | [2.42] | [3.0] | [4.0] | [4.83] | [6.04] | [7.56] | [9.67] | [12.1] | [15.1] | [19.3] | [24.2] | [30.2] | [38.05] | [48.4] | [60.4] |
| Rated Flow* lpm | 4 | 5 | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 32 | 40 | 50 | 63 | 70 | |
| [GPM] | [1.1] | [1.3] | [1.6] | [2.1] | [2.6] | [3.4] | [4.2] | [5.3] | [6.6] | [8.4] | [10.6] | [13.2] | [16.6] | [18.5] | |
| Rated Pressure bar | 140 | | | | 170 | | | | | | | | 140 | | 100 |
| [PSI] | [2030] | | | | [2465] | | | | | | | | [2030] | | [1450] |
| Max. Cont. Pressure in Line T bar [PSI] | | | | | | | | | | | | | | | |
| - standard | 25 [363] | | | | | | | | | | | | | | |
| - high pressure (H option) | 40 [580] | | | | | | | | | | | | | | |
| Max. Torque at Servoamplifying Nm [lb-in] | | | | | | | | | | | | | | | |
| - with standard springs | 3,0 [26] | | | | | | | | 3,0 [26] | | | | | | |
| - with soft springs (LT option) | 1,8 [16] | | | | | | | | - | | | | | | |
| Max. Torque w/o Servoamplifying Nm [lb-in] | 120 [1065] | | | | | | | | | | | | | | |
| 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 | 10,6 |
| [lb] | [11.7] | [11.9] | [12.2] | [12.4] | [12.6] | [12.8] | [13.2] | [13.9] | [14.3] | [15.4] | [16.3] | [17.6] | [19.2] | [21.2] | [23.4] |
| Dimension A mm | 130,85 | 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 |
| [in] | [5.1] | [5.20] | [5.27] | [5.36] | [5.47] | [5.60] | [5.78] | [5.99] | [6.25] | [6.62] | [7.04] | [7.56] | [8.24] | [9.14] | [10.18] |

* Inlet flow providing maximum speed of rotation:
- 100 RPM - from HKU40 to HKU630;
- 87 RPM - for HKU800;
- 70 RPM - for HKU1000.

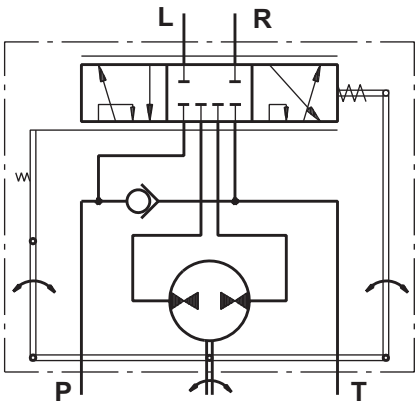
# HYDROSTATIC STEERING UNIT TYPE HKU.../7



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.

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 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 $50^0$F [$10^0$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.



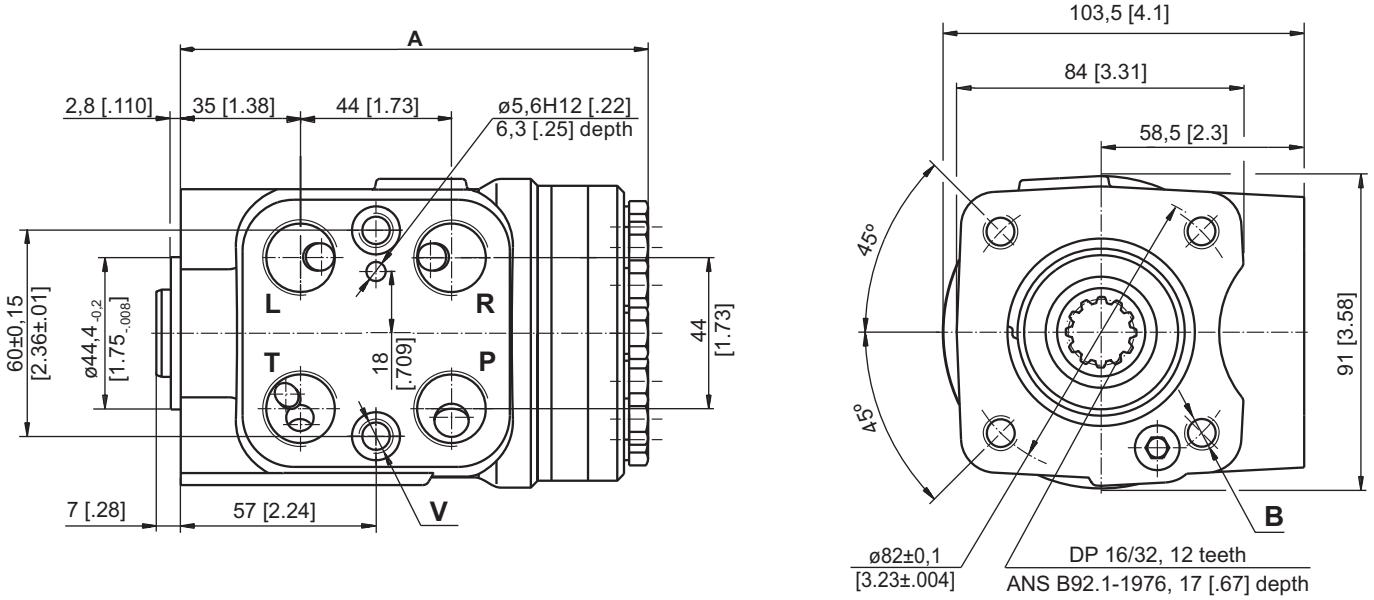

"Closed Center - Non Load Reaction"
Version 7 - HKU.../7

## SPECIFICATION DATA

| Parameters | | Type | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HKU 40/7 | HKU 50/7 | HKU 63/7 | HKU 80/7 | HKU 100/7 | HKU 125/7 | HKU 160/7 | HKU 200/7 | HKU 250/7 | HKU 320/7 | HKU 400/7 | HKU 500/7 | HKU 630/7 | HKU 800/7 |
| Displacement | $cm^3$/rev | 39,6 | 49,5 | 65,6 | 79,2 | 99,0 | 123,8 | 158,4 | 198 | 247,5 | 316,8 | 396 | 495 | 623,6 | 793 |
| | [$in^3$/rev] | [2.42] | [3.0] | [4.0] | [4.83] | [6.04] | [7.56] | [9.67] | [12.1] | [15.1] | [19.3] | [24.2] | [30.2] | [38.05] | [48.4] |
| Rated Flow* | lpm | 4 | 5 | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 32 | 40 | 50 | 63 | 80 |
| | [GPM] | [1.1] | [1.3] | [1.6] | [2.1] | [2.6] | [3.4] | [4.2] | [5.3] | [6.6] | [8.4] | [10.6] | [13.2] | [16.6] | [21.1] |
| Rated Pressure | bar | 125 | 140 | 175 | | | | | | | | | | | |
| | [PSI] | [1810] | [2030] | [2540] | | | | | | | | | | | |
| Max. Cont. Pressure in Line T bar [PSI] | | | | | | | | | | | | | | | |
| - standard | | 25 [363] | | | | | | | | | | | | | |
| - high pressure (H option) | | 40 [580] | | | | | | | | | | | | | |
| Max. Torque at Servoamplifying Nm [lb-in] | | | | | | | | | | | | | | | |
| - with standard springs | | 3,0 [26] | | | | | | | | 3,0 [26] | | | | | |
| - with soft springs (LT option) | | 1,8 [16] | | | | | | | | - | | | | | |
| Max. Torque w/o Servoamplifying Nm [lb-in] | | 120 [1065] | | | | | | | | | | | | | |
| 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 |
| | [lb] | [11.7] | [11.9] | [12.2] | [12.4] | [12.6] | [12.8] | [13.2] | [13.9] | [14.3] | [15.4] | [16.3] | [17.6] | [19.2] | [21.2] |
| 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 |
| | [in] | [5.15] | [5.20] | [5.27] | [5.36] | [5.47] | [5.60] | [5.78] | [5.99] | [6.25] | [6.62] | [7.04] | [7.56] | [8.24] | [9.14] |

* Inlet flow providing maximum speed of rotation:
- 100 RPM - from HKU40 to HKU630;
- 87 RPM - for HKU800.

## DIMENSIONS AND MOUNTING DATA - HKU.../3, 4, 7




mm [in]

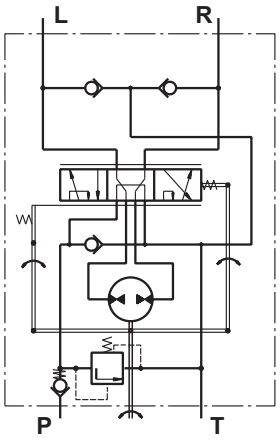
| code | Ports - P, T, R, L Thread | Column Mounting Thread - B | Valve Mounting Thread - V |
|---|---|---|---|
| - | G1/2<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| M | M22x1,5<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| A | 3/4 - 16 UNF<br>O-ring 15 mm [.59 in] depth | 4 x 3/8 - 16 UNC<br>15,7 mm [.62 in] depth | 2 x 3/8 - 24 UNF<br>14,2 mm [.56 in] depth |
| BA* | 9/16 - 18 UNF<br>O-ring 15 mm [.59 in] depth | 4 x 3/8 - 16 UNC<br>15,7 mm [.62 in] depth | 2 x 3/8 - 24 UNF<br>14,2 mm [.56 in] depth |

* These threads are for displacements from HKU40 to HKU200 only.

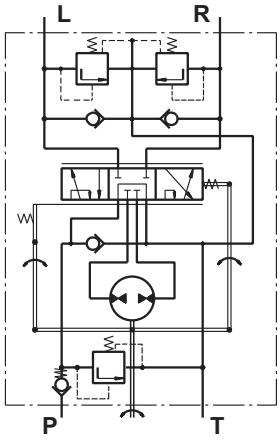
# HYDROSTATIC STEERING UNITS TYPE HKUS.../3, 4, 8



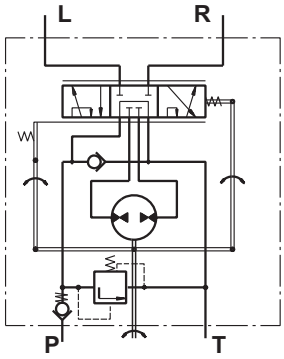
The HKUS Hydrostatic Steering unit is based on the HKU unit but has built-in relief and check valves. Thus M+S Hydraulic achieves one very compact steering unit which reduces the need for additional hydraulic components in the system.




"Open Center - Load Reaction"
HKUS.../3




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




"Open Center - Non Load Reaction"
HKUS.../8

## SPECIFICATION DATA

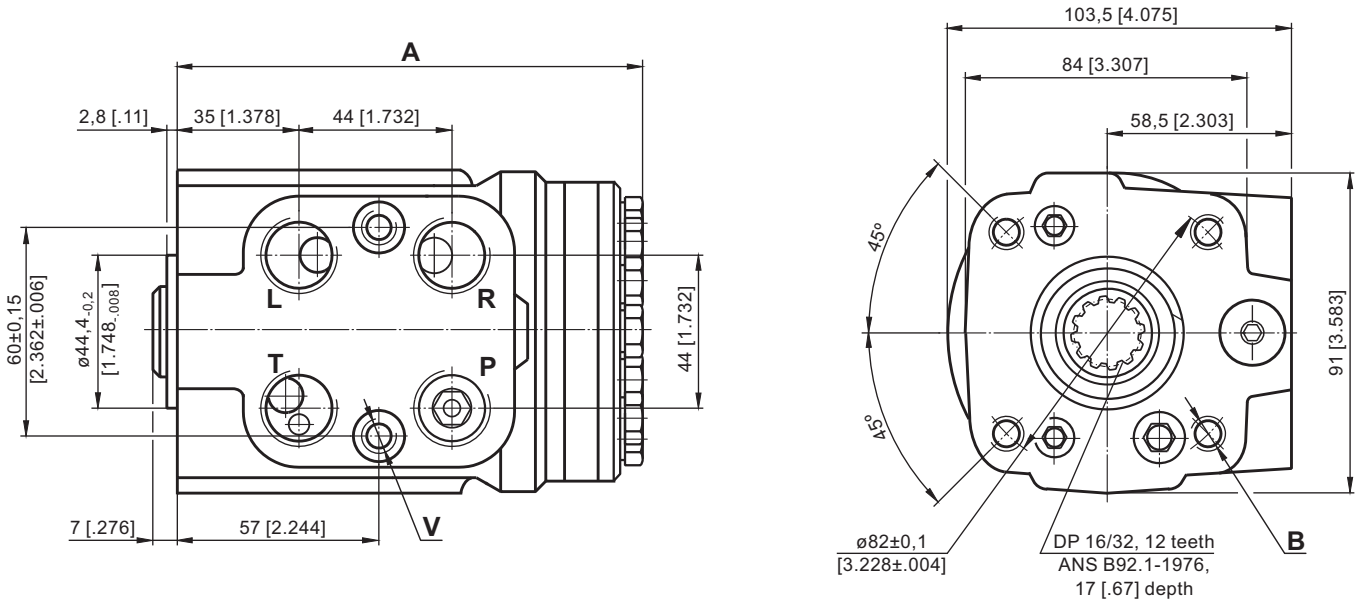
| Parameters | | Type | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HKUS 40/3,4,8 | HKUS 50/3,4,8 | HKUS 63/3,4,8 | HKUS 80/3,4,8 | HKUS 100/3,4,8 | HKUS 125/3,4,8 | HKUS 160/3,4,8 | HKUS 200/3,4,8 | HKUS 250/3,4,8 | HKUS 320/3,4,8 | HKUS 400/3,4,8 | HKUS 500/3,4,8 |
| Displacement | $cm^3$/rev | 39,6 | 49,5 | 65,6 | 79,2 | 99,0 | 123,8 | 158,4 | 198 | 247,5 | 316,8 | 396 | 495 |
| | [$in^3$/rev] | [2.42] | [3.0] | [4.0] | [4.83] | [6.04] | [7.56] | [9.67] | [12.1] | [15.1] | [19.3] | [24.2] | [30.2] |
| Rated Flow* | lpm | 4 | 5 | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 32 | 40 | 50 |
| | [GPM] | [1.1] | [1.3] | [1.6] | [2.1] | [2.6] | [3.4] | [4.2] | [5.3] | [6.6] | [8.4] | [10.6] | [13.2] |
| Rated Pressure | bar | 140 | | 170 | | | | | | | | | |
| | [PSI] | [2030] | | [2465] | | | | | | | | | |
| Relief Valve Pressure Settings** | bar [PSI] | | | 80 [1160] | | 100 [1450] | 125 [1810] | | 150 [2175] | 170 [2465] | | | |
| Shock Valves Pressure Settings*** | bar [PSI] | | | 140 [2030] | | 160 [2320] | 180 [2610] | | 200 [2900] | 220 [3190] | | | |
| Max. Cont. Pressure in Line T | bar [PSI] | | | | | | | | | | | | |
| - standard | | | | | | 25 [363] (50 [725] by HKUS.../8) | | | | | | | |
| - high pressure (H option) | | | | | | 40 [580] | | | | | | | |
| Max. Torque at Servoamplifying | Nm [lb-in] | | | | | | | | | | | | |
| - with standard springs | | | | 3,0 [26] | | | | | 3,0 [26] | | | | |
| - with soft springs (LT option) | | | | 1,8 [16] | | | | | - | | | | |
| Max. Torque w/o Servoamplifying | Nm [lb-in] | 120 [1065] | | | | | | | | | | | |
| 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 |
| | [lb] | [11.7] | [11.9] | [12.2] | [12.4] | [12.6] | [12.8] | [13.2] | [13.9] | [14.3] | [15.4] | [16.3] | [17.6] |
| 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 |
| | [in] | [5.15] | [5.20] | [5.27] | [5.36] | [5.47] | [5.60] | [5.78] | [5.99] | [6.25] | [6.62] | [7.04] | [7.56] |

* Rated Flow at 100 RPM.

** Pressure Settings are at Rated Flow (as in the table) and viscosity 21 $mm^2/s$ [105 SUS] at 50°C [122°F].

*** Pressure Settings are at flow rate of 2 lpm [.53 GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50°C [122°F].

## DIMENSIONS AND MOUNTING DATA - HKUS.../3, 4, 8




mm [in]

| code | Ports - P*, T, R, L Thread | Column Mounting Thread - B | Valve Mounting Thread - V |
|---|---|---|---|
| - | G1/2<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| M | M22x1,5<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| A | 3/4 - 16 UNF<br>O-ring 15 mm [.59 in] depth | 4 x 3/8 - 16 UNC<br>15,7 mm [.62 in] depth | 2 x 3/8 - 24 UNF<br>14,2 mm [.56 in] depth |

## ORDER CODE

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

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

| | |
|---|---|
| **40** | - 39,6 cm³/rev [2.42 in³/rev] |
| **50** | - 49,5 cm³/rev [3.00 in³/rev] |
| **63** | - 65,6 cm³/rev [4.00 in³/rev] |
| **80** | - 79,2 cm³/rev [4.83 in³/rev] |
| **100** | - 99,0 cm³/rev [6.04 in³/rev] |
| **125** | - 123,8 cm³/rev [7.56 in³/rev] |
| **160** | - 158,4 cm³/rev [9.67 in³/rev] |
| **200** | - 198,0 cm³/rev [12.10 in³/rev] |
| **250** | - 247,5 cm³/rev [15.10 in³/rev] |
| **320** | - 316,8 cm³/rev [19.30 in³/rev] |
| **400** | - 396,0 cm³/rev [24.20 in³/rev] |
| **500** | - 495,0 cm³/rev [30.20 in³/rev] |
| **630** | - 623,6 cm³/rev [38.05 in³/rev] |
| **800** | - 793,0 cm³/rev [48.40 in³/rev] |
| **1000** | - 990,0 cm³/rev [60.40 in³/rev] |

**Pos.2 - Versions**

| | |
|---|---|
| **3** | - Version 3 *"Open Center - Load Reaction"* |
| **4** | - Version 4 *"Open Center - Non Load Reaction"* |
| **7** | - Version 7 *"Closed Center - Non Load Reaction"* |

**Pos.3 - Ports**

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

**Pos.4 - Max. Cont. Pressure in line T**

| | |
|---|---|
| omit | - Standard |
| **H** | - High pressure |

**Pos.5 - Input torque**

| | |
|---|---|
| omit | - Standard |
| **LT*** | - Low |

**Pos.6 - Noise level**

| | |
|---|---|
| omit | - Standard |
| **LN*** | - Low |

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

| | |
|---|---|
| omit | - No Paint |
| **P** | - Painted |
| **PC** | - Corrosion Protected Paint |
| **PS** | - Special Paint**** |
| **PCS** | - Special Corrosion Protected Paint**** |

**Pos.8 - Design Series**

omit - Factory specified

**Notes:** * Available only for displacement from 40 to 200.
** Available only for versions 3 and 4 with displacement from 40 to 200.
*** Colour at customer's request.
**** Non painted feeding surfaces, colour at customer's request.

The steering units are mangano-phosphatized as standard.

## ORDER CODE

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|
| HKUS | | / | | - | | - | | | | | |

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

| | |
|---|---|
| **40** | - 39,6 cm³/rev [2.42 in³/rev] |
| **50** | - 49,5 cm³/rev [3.00 in³/rev] |
| **63** | - 65,6 cm³/rev [4.00 in³/rev] |
| **80** | - 79,2 cm³/rev [4.83 in³/rev] |
| **100** | - 99,0 cm³/rev [6.04 in³/rev] |
| **125** | - 123,8 cm³/rev [7.56 in³/rev] |
| **160** | - 158,4 cm³/rev [9.67 in³/rev] |
| **200** | - 198,0 cm³/rev [12.10 in³/rev] |
| **250** | - 247,5 cm³/rev [15.10 in³/rev] |
| **320** | - 316,8 cm³/rev [19.30 in³/rev] |
| **400** | - 396,0 cm³/rev [24.20 in³/rev] |
| **500** | - 495,0 cm³/rev [30.20 in³/rev] |

**Pos.2 - Versions**

| | |
|---|---|
| **3** | - Version 3 *"Open Center - Load Reaction"* |
| **4** | - Version 4 *"Open Center - Non Load Reaction"* |
| **8** | - Version 8 *"Open Center - Non Load Reaction"* |

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

**80, 100,125,150,170**

**Pos.4 - Ports**

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

**Pos.5 - Max. Cont. Pressure in line T**

| | |
|---|---|
| omit | - Standard |
| **H** | - High pressure |

**Pos.6 - Input torque**

| | |
|---|---|
| omit | - Standard |
| **LT*** | - Low |

**Pos.7 - Noise level**

| | |
|---|---|
| omit | - Standard |
| **LN*** | - Low |

**Pos.8 - Option (Paint)*****

| | |
|---|---|
| omit | - No Paint |
| **P** | - Painted |
| **PC** | - Corrosion Protected Paint |
| **PS** | - Special Paint**** |
| **PCS** | - Special Corrosion Protected Paint**** |

**Pos.9 - Design Series**

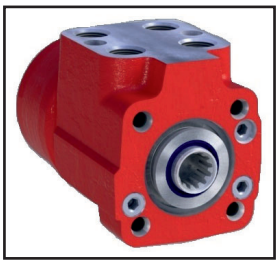
omit - Factory specified

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

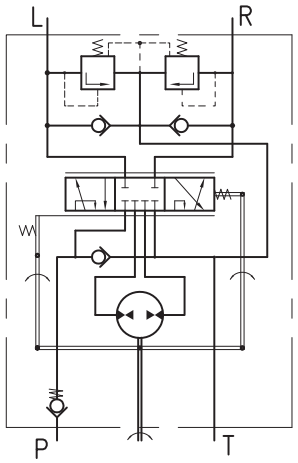
**Notes:** * Available only for displacement from 40 to 200.
** Colour at customer's request.
*** Non painted feeding surfaces, colour at customer's request.

The steering units are mangano-phosphatized as standard.

# HYDROSTATIC STEERING UNITS TYPE HKUS.../7



M + S Hydraulic complete its range of hydrostatic steering units .
These products are with built-in shock valves, while fully covering the parameters of the current HKU../7.
The application is for integration into systems with built-in hydroaccumulator, achieving minimal energy losses.



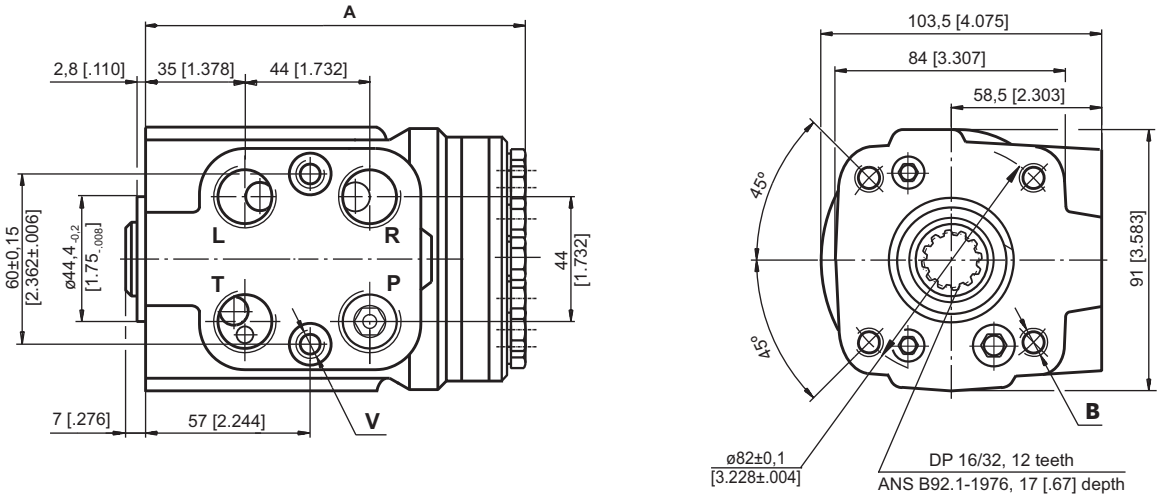

"Close Center - Non Load Reaction"
HKUS.../7 ser.3

## SPECIFICATION DATA

| Parameters | | Type | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HKUS 40/7 | HKUS 50/7 | HKUS 63/7 | HKUS 80/7 | HKUS 100/7 | HKUS 125/7 | HKUS 160/7 | HKUS 200/7 | HKUS 250/7 | HKUS 320/7 | HKUS 400/7 |
| Displacement | $cm^3/rev$ | 39,6 | 49,5 | 65,6 | 79,2 | 99,0 | 123,8 | 158,4 | 198 | 247,5 | 316,8 | 396 |
| | $[in^3/rev]$ | [2.42] | [3.0] | [4.0] | [4.83] | [6.04] | [7.56] | [9.67] | [12.1] | [15.1] | [19.3] | [24.2] |
| Rated Flow* | lpm | 4 | 5 | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 32 | 40 |
| | [GPM] | [1.1] | [1.3] | [1.6] | [2.1] | [2.6] | [3.4] | [4.2] | [5.3] | [6.6] | [8.4] | [10.6] |
| Rated Pressure | bar | 125 | 140 | 170 | | | | | | | | |
| | [PSI] | [1813] | [2030] | [2465] | | | | | | | | |
| Shock Valve Pressure** | bar | 220 | | | | | | | | | | |
| | [PSI] | [3190] | | | | | | | | | | |
| Max. Cont. Pressure in Line T | bar [PSI] | | | | | | | | | | | |
| - standard | | 25 [363] | | | | | | | | | | |
| - high pressure (H option) | | 40 [580] | | | | | | | | | | |
| Max. Torque at Servoamplifying | Nm [lb-in] | | | | | | | | | | | |
| - with standard springs | | 3,0 [26] | | | | | | | | 3,0 [26] | | |
| - with soft springs (LT option) | | 1,8 [16] | | | | | | | | - | | |
| Max. Torque w/o Servoamplifying | Nm [lb-in] | 120 [1065] | | | | | | | | | | |
| Weight | kg | 5,3 | 5,4 | 5,5 | 5,6 | 5,7 | 5,8 | 6,0 | 6,3 | 6,5 | 7,0 | 7,4 |
| | [lb] | [11.7] | [11.9] | [12.2] | [12.4] | [12.6] | [12.8] | [13.2] | [13.9] | [14.3] | [15.4] | [16.3] |
| Dimension A | mm | 130,8 | 132,2 | 134,2 | 136,2 | 138,8 | 142,2 | 146,8 | 152,2 | 158,8 | 168,2 | 178,8 |
| | [in] | [5.15] | [5.20] | [5.27] | [5.36] | [5.47] | [5.60] | [5.78] | [5.99] | [6.25] | [6.62] | [7.04] |

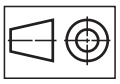
* Rated Flow at 100 RPM.
** Pressure Settings are at flow rate of 2 lpm [.53GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50°C [122°F].

## DIMENSIONS AND MOUNTING DATA - HKUS.../7




## THREADED PORTS

| code | Ports - *P, T, R, L Thread | Column Mounting Thread - B | Valve Mounting Thread- V |
|---|---|---|---|
| - | G1/2<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| M | M22x1,5<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| MBO | M18x1,5<br>O-ring 15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| A | 3/4 - 16 UNF<br>O-ring 15 mm [.59 in] depth | 4 x 3/8 - 16 UNC<br>15,7 mm [.62 in] depth | 2 x 3/8 - 24 UNC<br>14,2 mm [.56 in] depth |



mm [in]

## ORDER CODE

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

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

| | |
|---|---|
| **40** | - 39,6 cm³/rev [2.42 in³/rev] |
| **50** | - 49,5 cm³/rev [3.00 in³/rev] |
| **63** | - 65,6 cm³/rev [4.00 in³/rev] |
| **80** | - 79,2 cm³/rev [4.83 in³/rev] |
| **100** | - 99,0 cm³/rev [6.04 in³/rev] |
| **125** | - 123,8 cm³/rev [7.56 in³/rev] |
| **160** | - 158,4 cm³/rev [9.67 in³/rev] |
| **200** | - 198,0 cm³/rev [12.10 in³/rev] |
| **250** | - 247,5 cm³/rev [15.10 in³/rev] |
| **320** | - 316,8 cm³/rev [19.30 in³/rev] |
| **400** | - 396,0 cm³/rev [24.20 in³/rev] |

**Pos.2 - Versions**

| | |
|---|---|
| **7** | - Version 7 *"Closed Center - Non Load Reaction"* |

**Pos.3 - Ports**

| | |
|---|---|
| omit | - BSPP (ISO 228) |
| **A** | - SAE (ANSI B 1.1 - 1982) |
| **M** | - Metric (ISO 262) |
| **MBO** | - Metric (ISO 6149-1) |

If a painting option is required, the standard color is black Alkyd-styrenated enamel, Black RAL 9005.

**Pos.4 - Max. Cont. Pressure in line T**

| | |
|---|---|
| omit | - Standard |
| **H** | - High pressure |

**Pos.5 - Input torque**

| | |
|---|---|
| omit | - Standard |
| **LT*** | - Low |

**Pos.6 - Noise level**

| | |
|---|---|
| omit | - Standard |
| **LN*** | - Low |

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

| | |
|---|---|
| omit | - No Paint |
| **P** | - Painted |
| **PC** | - Corrosion Protected Paint |
| **PS** | - Special Paint**** |
| **PCS** | - Special Corrosion Protected Paint**** |

**Pos.8 - Design Series**

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

**Notes:** * Available only for displacement from 40 to 200.
** Colour at customer's request.
*** Non painted feeding surfaces.

The steering units are mangano-phosphatized as standard.

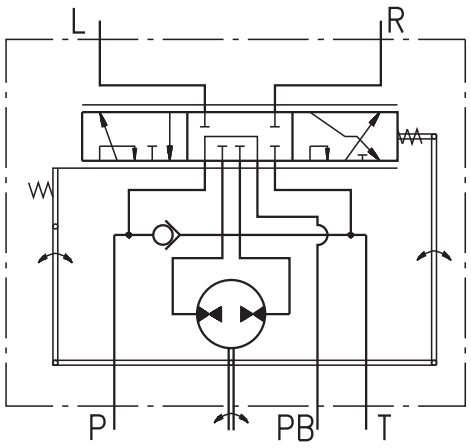
# HYDROSTATIC STEERING UNIT TYPE HKU.../4PB



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

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

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

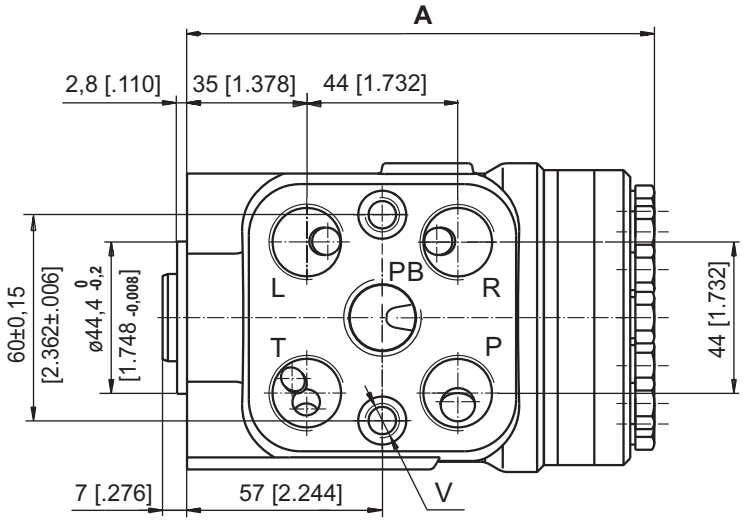


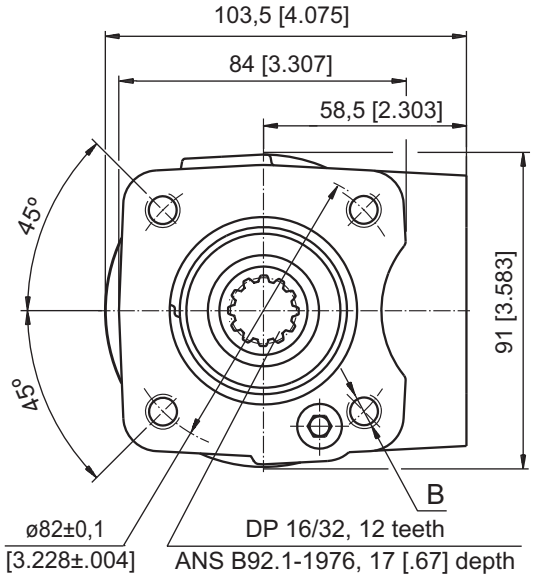

"Open Center - Non Load Reaction"
HKU.../4PB - Power Beyond

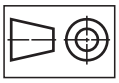
## SPECIFICATION DATA

| Parameters | Type | | | | | |
|---|---|---|---|---|---|---|
| | HKU 40/4PB | HKU 50/4PB | HKU 63/4PB | HKU 80/4PB | HKU 100/4PB | HKU 125/4PB |
| Displacement, $cm^3/rev$ [$in^3/rev$] | 39,6 [2.42] | 49,5 [3.0] | 65,6 [4.0] | 79,2 [4.83] | 99,0 [6.04] | 123,8 [7.56] |
| Rated Flow-5 Port, lpm (Power Beyond) [GPM] | 15 [3.96] | | | | | |
| Rated Pressure, bar [PSI] | 125 [1813] | | | | | |
| Max. Pressure, bar in line PB, [PSI] | 125 [1813] | | | | | |
| Max. Cont. Pressure bar in Line T, [PSI] | 10 [145] | | | | | |
| Max. Torque at Nm Servoamplifying, [lb-in] | 2,8 [25] | | | | | |
| Max. Torque w/o Nm Servoamplifying, [lb-in] | 135 [1195] | | | | | |
| Weight, kg [lb] | 5,3 [11.7] | 5,4 [11.9] | 5,5 [12.2] | 5,6 [12.4] | 5,7 [12.6] | 5,8 [12.8] |
| Dimension A, mm [in] | 130,8 [5.15] | 132,2 [5.20] | 133,9 [5.27] | 136,2 [5.36] | 138,8 [5.47] | 142,2 [5.60] |

## DIMENSIONS AND MOUNTING DATA





in [mm]

| code | Ports - *P, T, R, L, PB Thread | Column Mounting Thread - B | Valve Mounting Thread - V |
|---|---|---|---|
| - | G1/2<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| A | G3/8<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |

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

| 1 | | 2 | | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| HKU | | / | 4PB | - | | | |

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

- **40** - 39,6 cm³/rev [2.42 in³/rev]
- **50** - 49,5 cm³/rev [3.00 in³/rev]
- **63** - 65,6 cm³/rev [4.00 in³/rev]
- **80** - 79,2 cm³/rev [4.83 in³/rev]
- **100** - 99,0 cm³/rev [6.04 in³/rev]
- **125** - 123,8 cm³/rev [7.56 in³/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 - **Ports**

- omit - No Paint
- **P** - Painted
- **PC** - Corrosion Protected Paint
- **PS** - Special Paint**
- **PCS** - Special Corrosion Protected Paint**

Pos.5 - **Design Series**

- omit - Factory specified

**NOTES:**

* Colour at customer's request.

** Non painted feeding surfaces, 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.

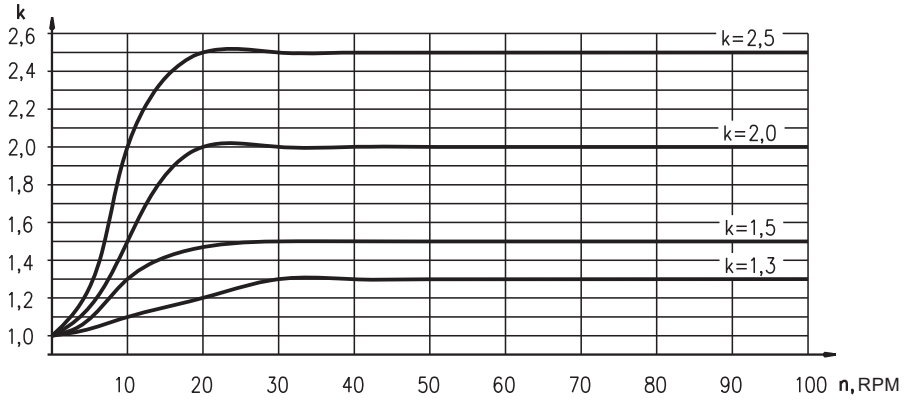
HKUQ…/4 is an “Open Center-Non Load Reaction” hydrostatic steering in which restrictor for amplifying factor from 1,3 to 2,5 is built-in.

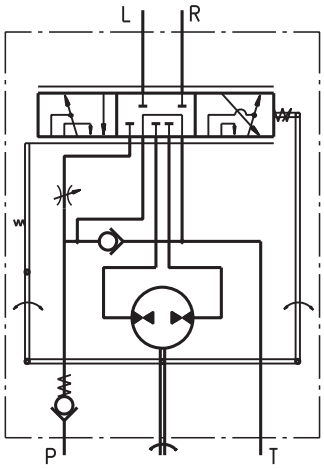
In accordance with the size of the gear wheel set and amplifying factor, HKUQ…4 has the following working volume:

- from 80 $cm^3$ to 200 $cm^3$ for emergency operation mode (manual steering without servo-amplifying;
- from 100 $cm^3$ to 500 $cm^3$ for normal operation mode (with total flow amplifying).

There is no servo-amplifying of flow if low steering speed up to 10 RPM is applied. In steering speed increase over 20 RPM there is total servo-amplifying of flow. In this mode gear wheel set flow and restrictor flow are added.

## VARIABLE AMPLIFYING FACTOR



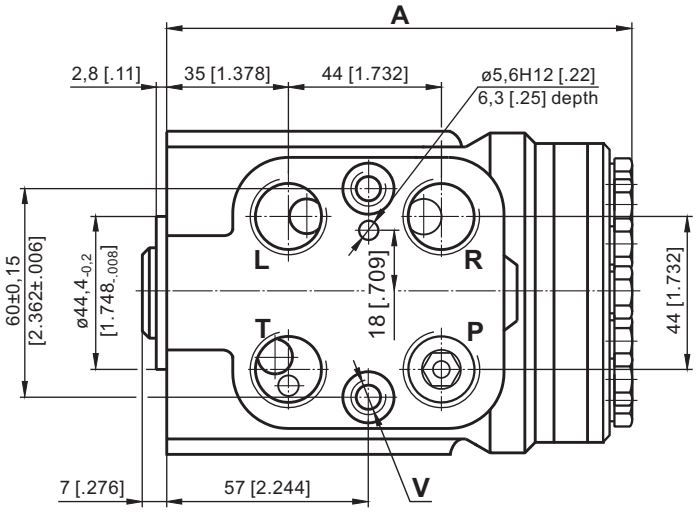

"Open Center - Non Load Reaction"
HKUQ.../4

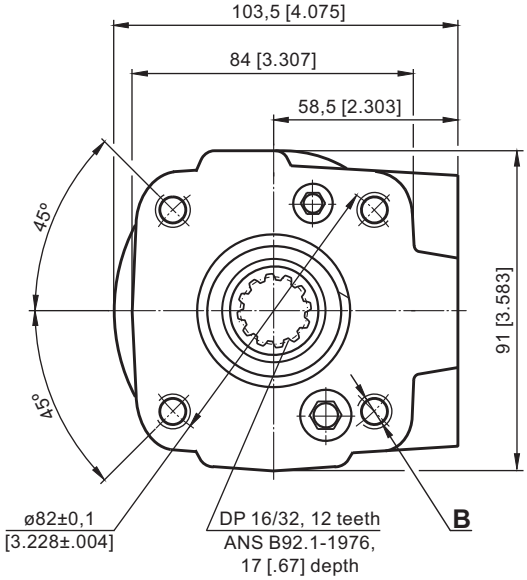
## SPECIFICATION DATA

| Parameters | | Type | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HKUQ 80/.../4 | | | | HKUQ 100/.../4 | | | | HKUQ 124/.../4 | | | | HKUQ 160/.../4 | | | | HKUQ 200/.../4 | | | |
| Displacement<br>- w/o servo-amplifying<br>(in emergency mode) | | 79,2<br>[4.83] | | | | 99,0<br>[6.04] | | | | 123,8<br>[7.56] | | | | 158,4<br>[9.67] | | | | 198<br>[12.08] | | | |
| - with servo-amplifying | $cm^3$/rev<br>[$in^3$/rev] | 100<br>[2.64] | 125<br>[7.62] | 160<br>[9.76] | 200<br>[12.2] | 125<br>[7.62] | 160<br>[9.76] | 200<br>[12.2] | 250<br>[15.25] | 160<br>[9.76] | 200<br>[12.2] | 250<br>[15.25] | 320<br>[19.52] | 200<br>[12.2] | 250<br>[15.25] | 320<br>[19.52] | 400<br>[24.4] | 250<br>[15.25] | 320<br>[19.52] | 400<br>[24.4] | 500<br>30.5] |
| Rated Flow* | lpm<br>[GPM] | 10<br>[2.64] | 12,5<br>[3.30] | 16<br>[4.22] | 20<br>[5.28] | 12,5<br>[3.30] | 16<br>[4.22] | 20<br>[5.28] | 25<br>[6.60] | 16<br>[4.22] | 20<br>[5.28] | 25<br>[6.60] | 32<br>[8.45] | 20<br>[5.28] | 25<br>[6.60] | 32<br>[8.45] | 40<br>[10.57] | 25<br>[6.60] | 32<br>[8.45] | 40<br>[10.57] | 50<br>[13.21] |
| Amplifying Factor<br>(at shaft revolution over 20 min) | | 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 [PSI] | 170 [2465] | | | | | | | | | | | | | | | | | | | |
| Max. Cont. Pressure in Line T | bar [PSI] | 25 [363] | | | | | | | | | | | | | | | | | | | |
| Max. Torque at Servoamplifying | Nm [lb-in] | 3 [26] | | | | | | | | | | | | | | | | | | | |
| Max. Torque w/o Servoamplifying | Nm [lb-in] | 120 [1065] | | | | | | | | | | | | | | | | | | | |
| Weight, avg. | kg [lb] | 5,6 [12.4] | | | | 5,7 [12.6] | | | | 5,8 [12.8] | | | | 6,0 [13.2] | | | | 6,3 [13.9] | | | |
| Dimension A | mm [in] | 136,2 [5.36] | | | | 138,8 [5.47] | | | | 142,2 [5.60] | | | | 146,8 [5.78] | | | | 152,2 [5.99] | | | |

* Rated Flow at 100 RPM.

## DIMENSIONS AND MOUNTING DATA




| code | Ports - *P, T, R, L Thread | Column Mounting Thread - B | Valve Mounting Thread - V |
|---|---|---|---|
| - | G1/2<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| M | M22x1,5<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| A | 3/4 - 16 UNF<br>O-ring 15 mm [.59 in] depth | 4 x 3/8 - 16 UNC<br>15,7 mm [.62 in] depth | 2 x 3/8 - 24 UNC<br>14,2 mm [.56 in] depth |

mm [in]

## ORDER CODE for HKUQ...

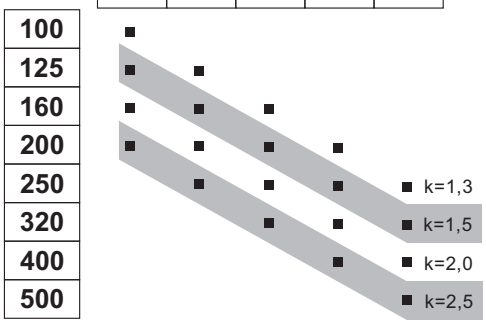
| 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|
| HKUQ | / | / | 4 | - | | | |

**Pos.1 - Displacement code**

| | |
|---|---|
| **80** | - 79,2 cm³/rev [ 4.83 in³/rev] |
| **100** | - 99,0 cm³/rev [ 6.04 in³/rev] |
| **125** | - 123,8 cm³/rev [ 7.56 in³/rev] |
| **160** | - 158,4 cm³/rev [ 9.67 in³/rev] |
| **200** | - 198,4 cm³/rev [12.10 in³/rev] |

**Pos.2 - Displacement with amplifying factor 1,3; 1,5; 2,0 or 2,5**

| 80 | 100 | 125 | 160 | 200 |
|---|---|---|---|---|




**Pos.3 - Versions**

| | |
|---|---|
| **4** | - Version 4 *"Open Center - Non Load Reaction»* |

**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 |
| **PS** | - Special Paint** |
| **PCS** | - Special Corrosion Protected Paint** |

**Pos.6 - Design Series**

omit - Factory specified

**NOTES:**

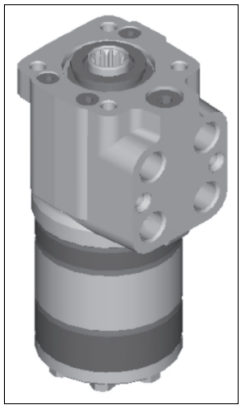
* Exemplary designation of steering unit with displacement 200 cm³ and amplifying factor 2,5: HKUQ 200/500/4

** Colour at customer's request.

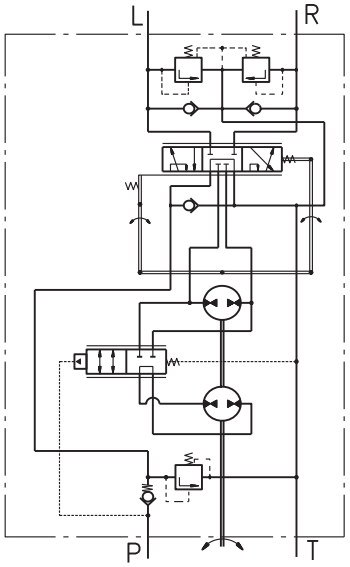
*** Non painted feeding surfaces, colour at customer's request.

The steering units are mangano-phosphatized as standard.

# HYDROSTATIC STEERING UNIT TYPE HKUSD.../.../4



The HKUSD…/4 is a new design of steering unit with two gerotor sets. They are mechanically connected. A switch valve, built between the two gerotor sets, switches between two displacements, one displacement for manual steering and the total of both displacements for powered operations. The switch valve is spring returned to the smaller manual displacement when inlet pressure falls below 4 bar. Above 4 bar the switch valve connects both gerotor sets to provide full powered displacement.
This function permits a higher pressure in the steering cylinder to be achieved and the vehicle steering at operation to be easier.



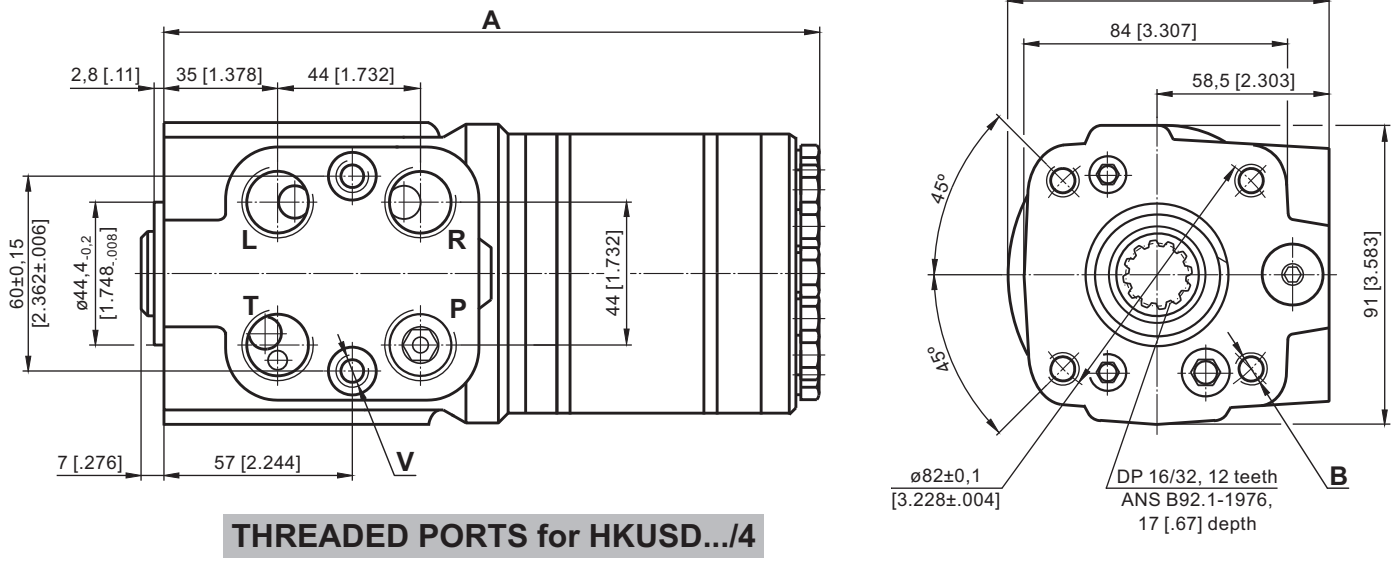

"Open Center - Non Load Reaction"
HKUSD.../4...

## SPECIFICATION DATA

| Parameters | | Type | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | HKUSD 63/.../4 | | | | HKUSD 80/.../4 | | | | HKUSD 100/.../4 | | | | HKUSD 125/.../4 | | |
| Displacement - without servo-amplifying (in emergency mode) | $cm^3/rev$ | 65,6 | | | | 79,2 | | | | 99,0 | | | | 123,8 | | |
| | | [4.0] | | | | [4.83] | | | | [6.04] | | | | [7.56] | | |
| - with servo-amplifying | [$in^3/rev$] | 140 | 160 | 190 | 220 | 160 | 180 | 200 | 240 | 200 | 225 | 260 | 300 | 250 | 285 | 325 |
| | | [8.54] | [9.67] | [11.59] | [13.42] | [9.67] | [10.98] | [12.1] | [14.64] | [12.1] | [13.73] | [15.86] | [18.3] | [15.1] | [17.39] | [19.83] |
| Rated Flow* | l/min | 14 | 16 | 19 | 22 | 16 | 18 | 20 | 24 | 20 | 22,5 | 26 | 30 | 25 | 28,5 | 32,5 |
| | [GPM] | [3.69] | [4.22] | [5.01] | [5.81] | [4.22] | [4.76] | [5.3] | [6.34] | [5.3] | [5.94] | [6.86] | [7.93] | [6.6] | [7.53] | [8.59] |
| Rated Pressure | bar | 170 | | | | | | | | | | | | | | |
| | [PSI] | [2320] | | | | | | | | | | | | | | |
| Relief Valve Pressure Settings** | bar | | | | | 80 | | 100 | | 125 | | 150 | | 170 | | |
| | [PSI] | | | | | [1160] | | [1450] | | [1810] | | [2175] | | [2465] | | |
| Shock Valve Pressure Settings*** | bar | | | | | 140 | | 160 | | 180 | | 200 | | 220 | | |
| | [PSI] | | | | | [2030] | | [2320] | | [2610] | | [2900] | | [3190] | | |
| Max. Cont. Pressure in Line T | bar | | | | | | | | | | | | | | | |
| | [PSI] | | | | | | | | | | | | | | | |
| - standard | | 25 [363] | | | | | | | | | | | | | | |
| - high pressure (H option) | | 40 [580] | | | | | | | | | | | | | | |
| Servoamplifing Max. Torque w/o | Nm | 3 | | | | | | | | | | | | | | |
| | [lb-in] | [26] | | | | | | | | | | | | | | |
| Servoamplifing | Nm | 120 | | | | | | | | | | | | | | |
| | [lb-in] | [1065] | | | | | | | | | | | | | | |
| Weight | kg | 7,75 | 7,85 | 7,95 | 8,10 | 7,85 | 7,95 | 8,10 | 8,20 | 7,95 | 8,10 | 8,20 | 8,40 | 8,15 | 8,30 | 8,50 |
| | [lb] | [17.1] | [17.3] | [17.5] | [17.9] | [17.3] | [17.5] | [17.9] | [18.1] | [17.5] | [17.9] | [18.1] | [18.5] | [18] | [18.3] | [18.8] |
| Dimension A | mm | 193,1 | 195,7 | 199,1 | 203,7 | 195,3 | 198 | 201,3 | 206 | 200,7 | 204 | 208,7 | 214 | 207,3 | 212 | 217,3 |
| | [in] | [7.6] | [7.71] | [7.84] | [8.02] | [7.69] | [7.8] | [7.93] | [8.11] | [7.9] | [8.03] | [8.22] | [8.43] | [8.16] | [8.35] | [8.56] |

* Rated Flow at 100 RPM.
** Pressure Settings are at Rated Flow (as in the table) and viscosity 21 $mm^2/s$ [105 SUS] at 50°C [122°F].
*** Pressure Settings are at flow rate of 2 lpm [.53 GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50°C [122°F].

## DIMENSIONS AND MOUNTING DATA




## THREADED PORTS for HKUSD.../4

| code | Ports - *P, T, R, L Thread | Column Mounting Thread - B | Valve Mounting Thread - V |
|---|---|---|---|
| - | G1/2<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| M | M22x1,5<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| A | 3/4 - 16 UNF<br>O-ring 15 mm [.59 in] depth | 4 x 3/8 - 16 UNC<br>15,7 mm [.62 in] depth | 2 x 3/8 - 24 UNC<br>14,2 mm [.56 in] depth |

mm [in]

## ORDER CODE for HKUSD...

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

**Pos.1 - Displacement code of I-st Gerotor set** (without servo-amplifying)

- **63** - 65,6 cm³/rev [4.00 in³/rev]
- **80** - 79,2 cm³/rev [4.83 in³/rev]
- **100** - 99,0 cm³/rev [6.04 in³/rev]
- **125** - 123,8 cm³/rev [7.56 in³/rev]

**Pos.2 - Displacement code of I-st + II-nd Gerotor set** (with servo-amplifying)

| | 63 | 80 | 100 | 125 |
|---|---|---|---|---|
| **140** | • | | | |
| **160** | • | • | | |
| **180** | | • | | |
| **190** | • | | | |
| **200** | | • | • | |
| **220** | • | | | |
| **225** | | | • | |
| **240** | | • | | |
| **250** | | | | • |
| **260** | | | • | |
| **285** | | | | • |
| **300** | | | • | |
| **325** | | | | • |

The steering units are mangano - phosphatized as standard.

**Pos.3 - Versions**

- **4** - Version 4 *"Open Center - Non Load Reaction»*

**Pos.4 - Relief Valve Pressure Settings, bar**

| 80 | 100 | 125 | 150 | 170 |
|---|---|---|---|---|

**Pos.5 - Ports**

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

**Pos.6 - Max. Cont. Pressure in Line T**

- omit - Standard
- **H** - High Pressure

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

- omit - No Paint
- **P** - Painted
- **PC** - Corrosion Protected Paint
- **PS** - Special Paint**
- **PCS** - Special Corrosion Protected Paint**

**Pos.8 - Design Series**

- omit - Factory specified

**NOTES:** * Colour at customer's request.
** Non painted feeding surfaces, colour at customer's request

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



The HKU(S).../5(D)(T)(TU) range expands the steering units family of M+S Hydraulic with the *"Closed Center - Non Reaction and Load Sensing Outlet" version* (static and dynamic 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 to priority valves with built-in relief valves for rated flow up to 160 lpm [42 GPM] - PRT.../160.

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

HKU.../5TU is a steering unit at which the ports R and L in neutral position are connected to the drain line T. This scheme contributes for the fast discharge of the residual pressure in lines L and R, that usually is “locked” when the steering wheel is jerky released at neutral position. These steering units do not drive directly the steering cylinders, but they are connected to hydraulic systems in which they drive the flow amplifiers or other devices.

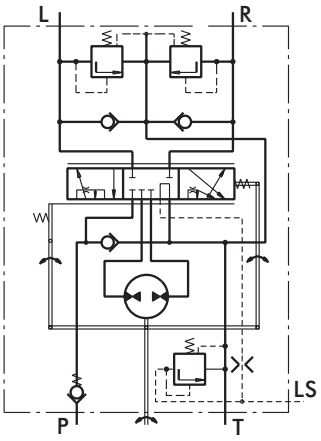
M+S Hydraulic produces steering units type HKUS.../5E(5TE) which have additional EL-port. An electro-hydraulic relay can be mounted on this port, providing control of the hydraulic system.The relay can be pre-set to normally - open (N.O) or normally - closed (N.C) contacts, with control range from 0,1 to 50 bars.

HKUS…/5D(DT)... is a new generation steering unit, where the dynamic flow to LS-line allows easy and smooth control when starting the steering. Main features are: Low torque of the steering wheel 0,5÷2,0 Nm [4.5÷18 lb-in] at normal operating conditions; High steering speed, limited only by the operating flow and the pressure of the supplying pump.

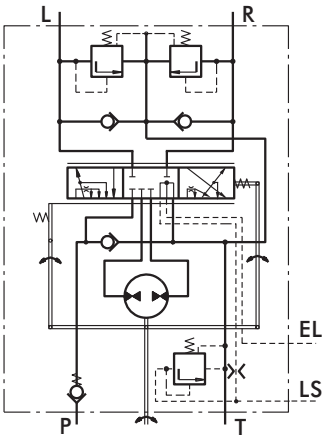
Constant oil flow to LS-line at neutral position within 0,45÷0,9 lpm [.12÷.24 GPM]. The unit works in a system with a dynamic priority valve and is appropriate for machines with increased energy saving requirements.

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

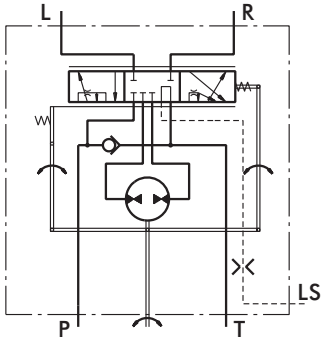
## Pipe Mounting



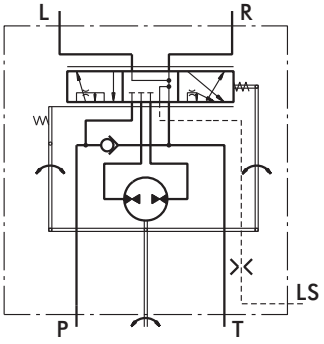

Closed Center - Non Reaction
Static Signal - HKUS.../5T
Dynamic Signal - HKUS.../5DT




Closed Center - Non Reaction
Static Signal - HKUS.../5TE

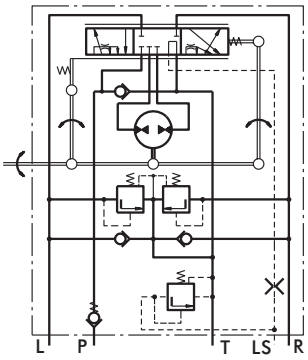



Closed Center - Non Reaction
Static Signal - HKU.../5T

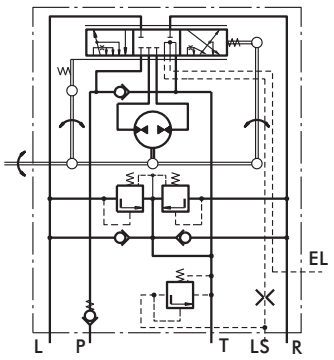



Closed Center - Non Reaction
Static Signal - HKU.../5TU

## Modulary Mounting




Closed Center - Non Reaction
Static Signal - HKUS.../5
Dynamic Signal - HKUS.../5D



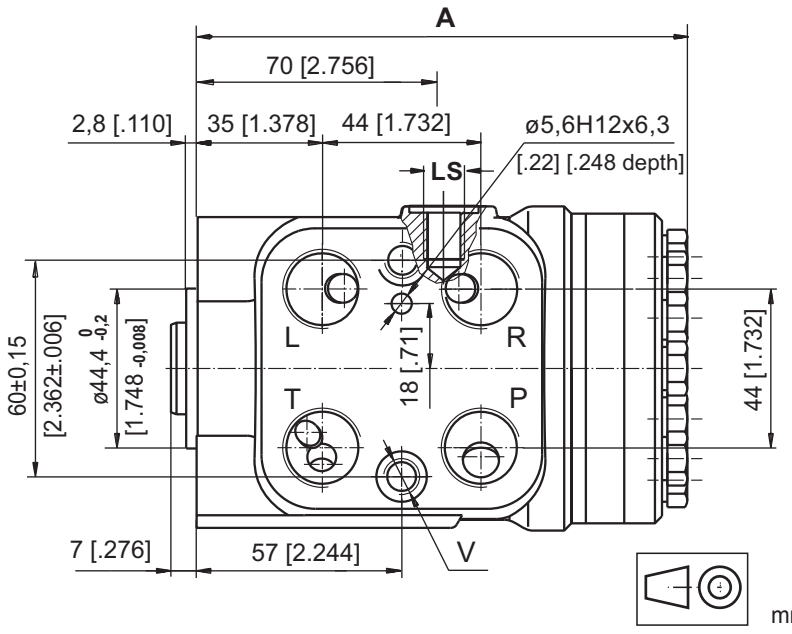

Closed Center - Non Reaction
Static Signal - HKUS.../5E

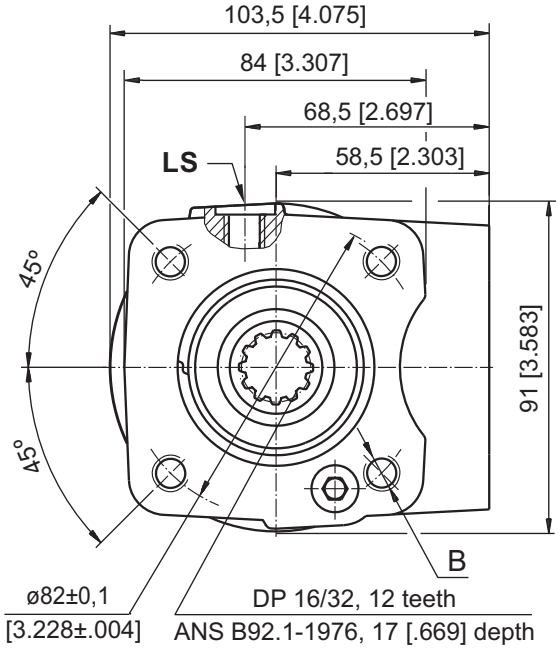
## SPECIFICATION DATA

| Parameters | Type | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | HKU 40/5T HKUS 40/5... | HKU 50/5T HKUS 50/5... | HKU 63/5T HKUS 63/5... | HKU 80/5T HKUS 80/5... | HKU 100/5T HKUS 100/5... | HKU 125/5T HKUS 125/5... | HKU 160/5T HKUS 160/5... | HKU 200/5T HKUS 200/5... | HKU 250/5T HKUS 250/5... | HKU 320/5T HKUS 320/5... | HKU 400/5T HKUS 400/5... | HKU 500/5T | HKU 630/5T |
| Displacement $cm^3/rev$ | 39,6 | 49,5 | 65,6 | 79,2 | 99,0 | 123,8 | 158,4 | 198 | 247,5 | 316,8 | 396 | 495 | 623,6 |
| $[in^3/rev]$ | [2.42] | [3.0] | [4.0] | [4.83] | [6.04] | [7.56] | [9.67] | [12.1] | [15.1] | [19.3] | [24.2] | [30.2] | [38.05] |
| Rated Flow* lpm | 4 | 5 | 6 | 8 | 10 | 13 | 16 | 20 | 25 | 32 | 40 | 50 | 63 |
| [GPM] | [1.1] | [1.3] | [1.6] | [2.1] | [2.6] | [3.4] | [4.2] | [5.3] | [6.6] | [8.4] | [10.6] | [13.2] | [16.6] |
| Rated Pressure bar | 125 | 150 | 175 | | | | | | | | | | |
| [PSI] | [1810] | [2175] | [2540] | | | | | | | | | | |
| LS-Valve Pressure Settings** bar [PSI] | | | | 80 [1160] | | 100 [1450] | 125 [1810] | | 150 [2175] | | 175 [2540] | | |
| Shock Valves Pressure Settings*** bar [PSI] | | | | 140 [2030] | | 160 [2320] | 180 [2610] | | 200 [2900] | | 240 [3480] | | |
| Max. Cont. Pressure in Line T bar [PSI] | | | | | | | | | | | | | |
| - standard | | | | | | | 20 [290] | | | | | | |
| - high pressure (H option) | | | | | | | 40 [580] | | | | | | |
| Max. Torque at Servoamplifying Nm [lb-in] | | | | | | | | | | | | | |
| -with standard springs | | | | | | | 3,0 [26] | | | | 3,0 [26] | | |
| -with soft springs (LT option) | | | | | | | 1,8 [16] | | | | - | | |
| Max. Torque w/o Servoamplifying Nm [lb-in] | | | | | | | 120 [1065] | | | | | | |
| 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 |
| [lb] | [11.7] | [11.9] | [12.2] | [12.4] | [12.6] | [12.8] | [13.2] | [13.9] | [14.3] | [15.4] | [16.3] | [17.6] | [19.2] |
| 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 |
| [in] | [5.15] | [5.20] | [5.27] | [5.36] | [5.47] | [5.60] | [5.78] | [5.99] | [6.25] | [6.62] | [7.04] | [7.56] | [8.24] |

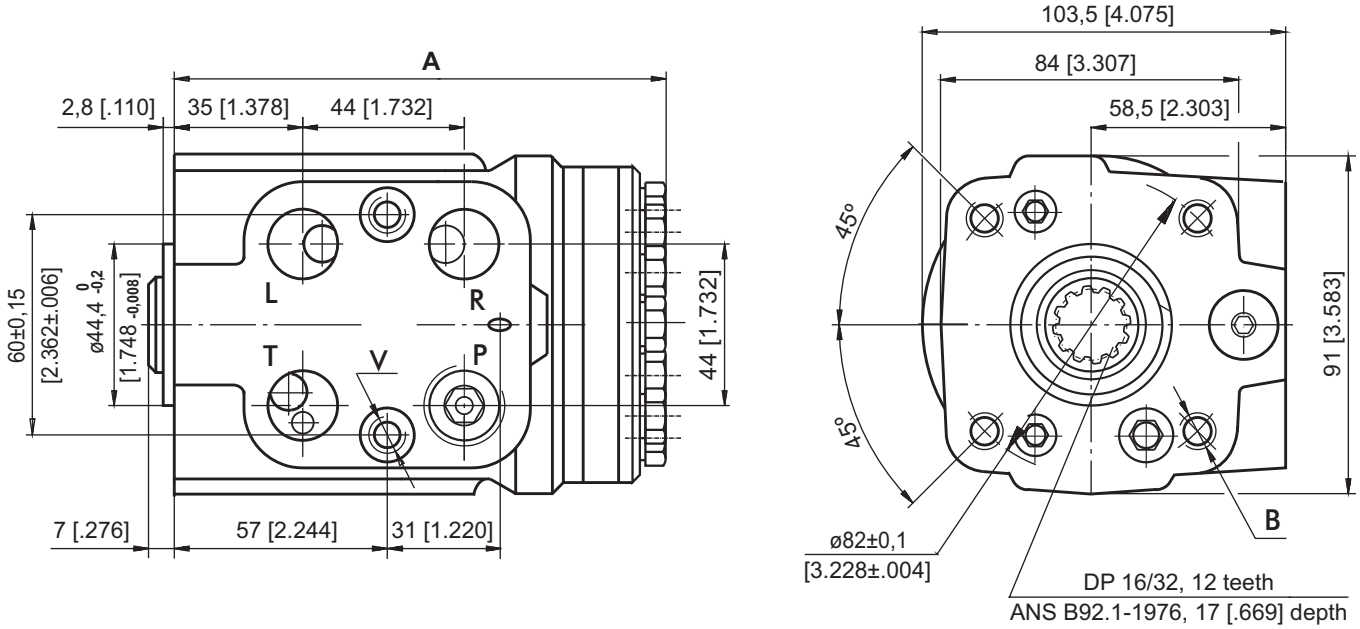
* Rated Flow at 100 RPM.
** Pressure Settings are at flow rate of 25 lpm [6.6 GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50° C [122°F], supplied through priority valve.
***Pressure Settings are at flow rate of 2 lpm [.53 GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50° C [122°F].

## DIMENSIONS AND MOUNTING DATA - HKU.../5T(TU)

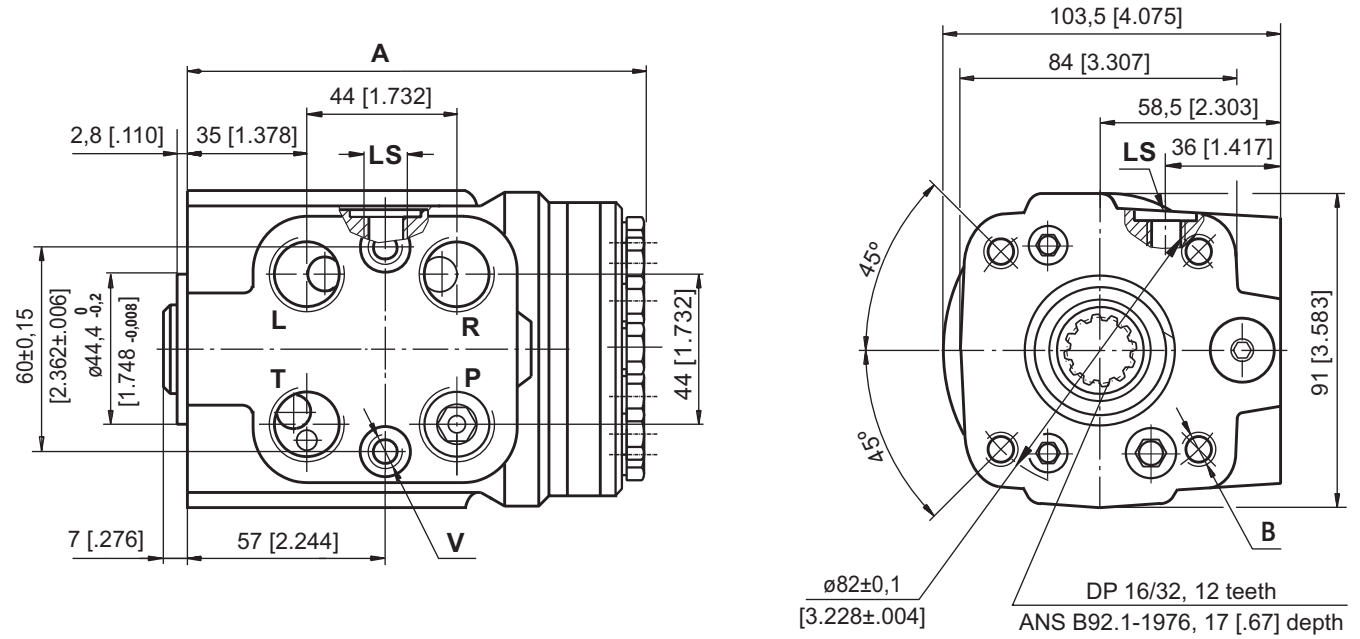


## DIMENSIONS AND MOUNTING DATA - HKUS.../5(D)



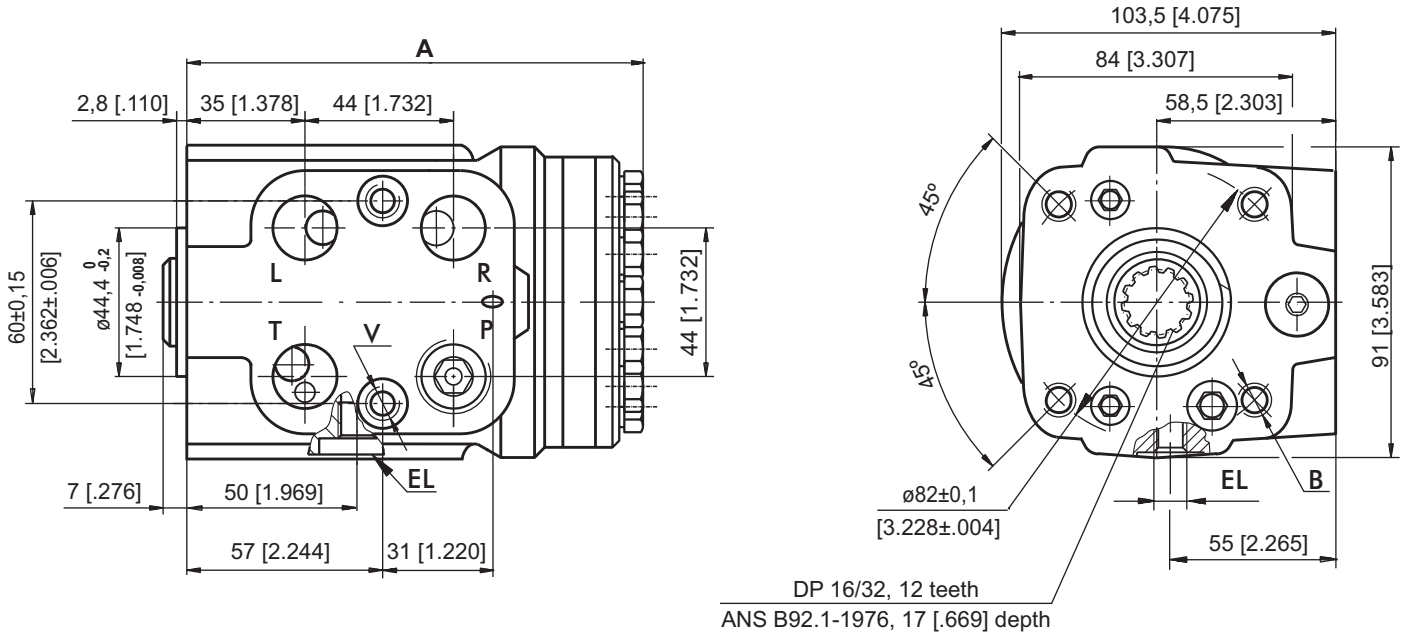

## DIMENSIONS AND MOUNTING DATA - HKUS.../5T(DT)



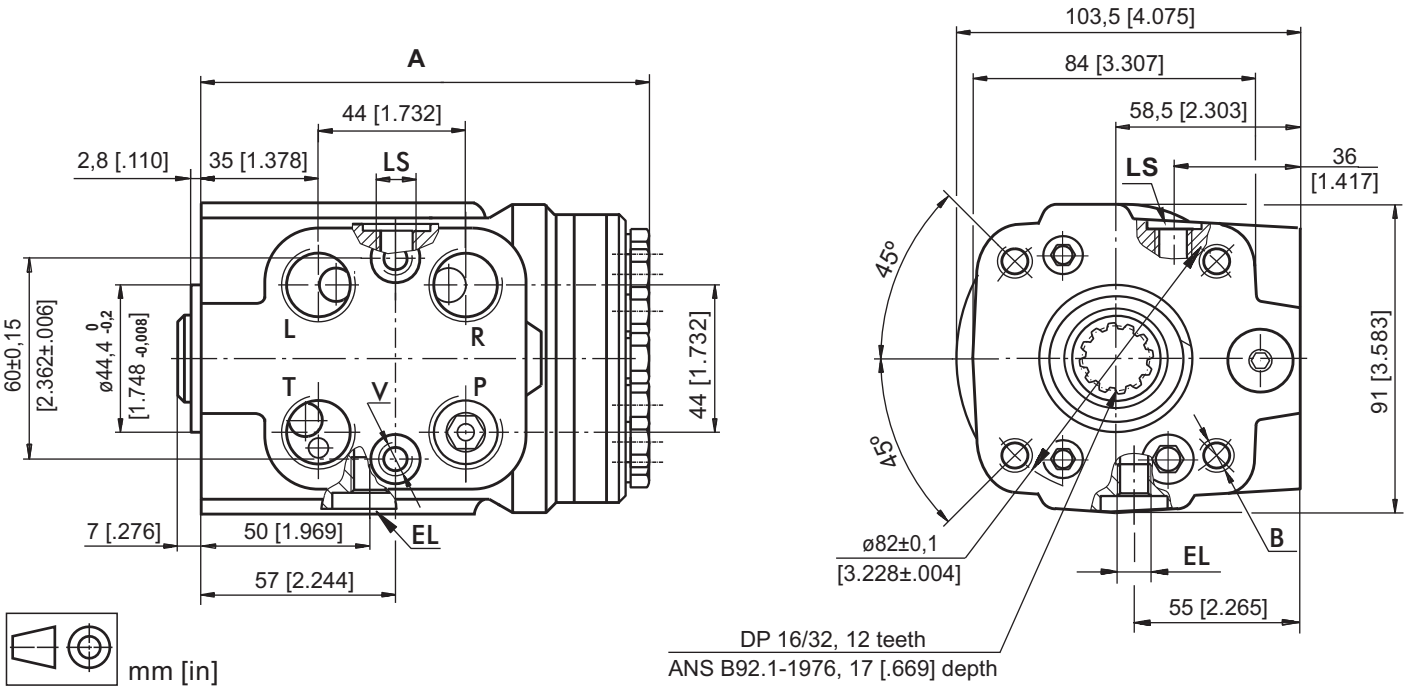

mm [in]

The ports are shown in the Table on page 22.

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




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




mm [in]

| code | Ports - *P, T, R, L Thread | Column Mounting Thread - B | Valve Mounting Thread - V | LS - Port | EL - Port |
|---|---|---|---|---|---|
| - | G1/2<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth | G1/4<br>14 mm [.55 in] depth | M10x1<br>10 mm [.39 in] depth |
| M | M22x1,5<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth | G1/4<br>14 mm [.55 in] depth | M10x1<br>10 mm [.39 in] depth |
| A | 3/4 - 16 UNF<br>O-ring<br>15 mm [.59 in] depth | 4 x 3/8 - 16 UNC<br>15,7 mm [.62 in] depth | 2 x 3/8 - 24 UNC<br>14,2 mm [.56 in] depth | 7/16 - 20 UNC<br>O-ring<br>12,7 mm [.50 in] depth | 7/16 - 20 UNC<br>O-ring<br>12,7 mm [.50 in] depth |

*Threaded Ports P min 15 [.59] depth for pipe mounting.

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

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|
| H K U S | | / | 5 | | | | - | | - | | | | | |

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

| | |
|---|---|
| **40** | - 39,6 cm³/rev [ 2.42 in³/rev] |
| **50** | - 49,5 cm³/rev [ 3.00 in³/rev] |
| **63** | - 65,6 cm³/rev [ 4.00 in³/rev] |
| **80** | - 79,2 cm³/rev [ 4.83 in³/rev] |
| **100** | - 99,0 cm³/rev [ 6.04 in³/rev] |
| **125** | - 123,8 cm³/rev [ 7.56 in³/rev] |
| **160** | - 158,4 cm³/rev [ 9.67 in³/rev] |
| **200** | - 198,0 cm³/rev [12.10 in³/rev] |
| **250** | - 247,5 cm³/rev [15.10 in³/rev] |
| **320** | - 316,8 cm³/rev [19.30 in³/rev] |
| **400** | - 396,0 cm³/rev [24.20 in³/rev] |

**Pos.2 - Versions**

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

**Pos.3 - Signal Type**

omit - Static Load Signal
**D** - Dynamic Load Signal

**Pos.4 - Priority Valve Connection**

omit - Modulary Mounting
**T** - Pipe Mounting

**Pos.5 - Electric Signal Connection**

omit - Without electric signal connection
**E** - With electric signal connection*

**Pos. 6 - LS - Valve Pressure Settings, bar**

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

**Pos. 7 - Ports**

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

**Pos. 8 - Max. Cont. Pressure in line T**

omit - Standard
**H** - High pressure

**Pos. 9 - Input torque**

omit - Standard
**LT**** - Low

**Pos.10 - Option (Paint)*****

omit - No Paint
**P** - Painted****
**PC** - Corrosion Protected Paint****
**PS** - Special Paint*****
**PCS** - Special Corrosion Protected Paint*****

**Pos.11 - Design Series**

omit - Factory specified

**Notes:**
* Available with Static Load Signal only.
** Available for displacement from 40 to 200 only.
*** Colour at customer's request.
**** Not for HKUS.../5 and HKUS.../5D.
***** Non painted feeding surfaces, colour at customer's request.
The steering units are mangano-phosphatized as standard.

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

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|
| H K U | | / | 5 | | - | | | | | |

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

| | |
|---|---|
| **40** | - 39,6 cm³/rev [ 2.42 in³/rev] |
| **50** | - 49,5 cm³/rev [ 3.00 in³/rev] |
| **63** | - 65,6 cm³/rev [ 4.00 in³/rev] |
| **80** | - 79,2 cm³/rev [ 4.83 in³/rev] |
| **100** | - 99,0 cm³/rev [ 6.04 in³/rev] |
| **125** | - 123,8 cm³/rev [ 7.56 in³/rev] |
| **160** | - 158,4 cm³/rev [ 9.67 in³/rev] |
| **200** | - 198,0 cm³/rev [12.10 in³/rev] |
| **250** | - 247,5 cm³/rev [15.10 in³/rev] |
| **320** | - 316,8 cm³/rev [19.30 in³/rev] |
| **400** | - 396,0 cm³/rev [24.20 in³/rev] |
| **500** | - 495,0 cm³/rev [30.20 in³/rev] |
| **630** | - 623,6 cm³/rev [38.05 in³/rev] |

**Pos.2 - Versions**

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

**Pos.3 - Priority Valve Connection**

**T** - Pipe Mounting (only)
**TU** - Pipe Mounting (ports R and L in neutral position are connected to the drain line T)

**Pos.4 - Ports**

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

**Pos.5 - Max. Cont. Pressure in line T**

omit - Standard
**H** - High pressure

**Pos.6 - Input torque**

omit - Standard
**LT*** - Low

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

omit - No Paint
**P** - Painted
**PC** - Corrosion Protected Paint
**PS** - Special Paint***
**PCS** - Special Corrosion Protected Paint***

**Pos.8 - Design Series**

omit - Factory specified

**Notes:**
* Available only for displacement from 40 to 200.
** Colour at customer's request.
*** Non painted feeding surfaces, colour at customer's request.
The steering units are mangano-phosphatized as standard.

# HYDROSTATIC STEERING UNITS TYPE HKUS.../5RDT



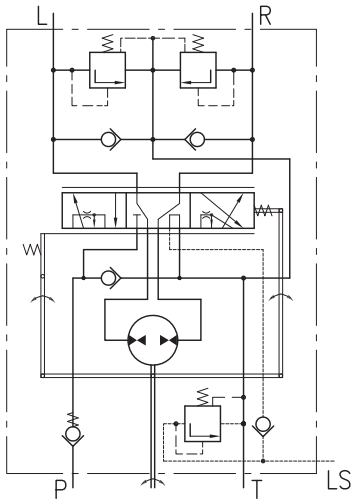
HKUS…/5RDT is a new generation steering unit with load sensing dynamic signal and integrated valve functions.

The hydraulic steering unit is applied on all types of agriculture and construction transportation vehicles which maximum speed does not exceed 60 km/h.

This sreering unit has low torque and low noise.

HKUS…/5RDT works in a system with a dynamic priority valve and it is appropriate for machines with increased energy saving requirements.

The dynamic flow to LS-line allows easy and smooth control when starting steering.



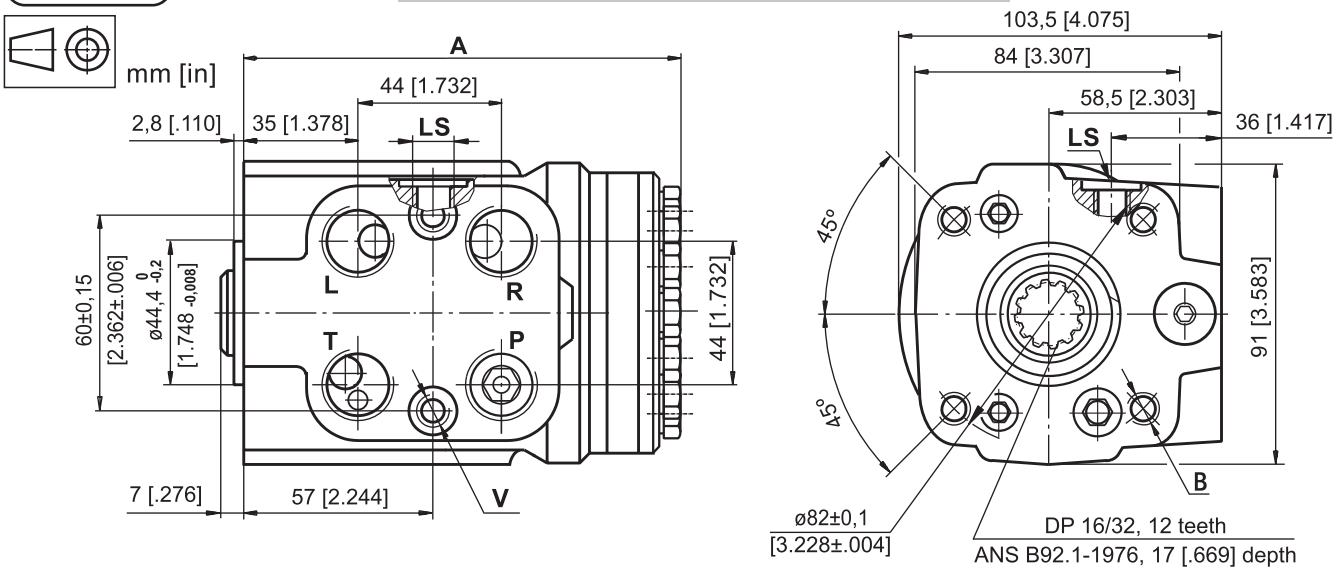

Closed Center - Load Reaction
HKUS.../5RDT

## SPECIFICATION DATA

| Parameters | Type | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | HKUS 40/5RDT | HKUS 50/5RDT | HKUS 63/5RDT | HKUS 80/5RDT | HKUS 100/5RDT | HKUS 125/5RDT | HKUS 160/5RDT | HKUS 200/5RDT |
| Displacement $cm^3/rev$ | 39,6 | 49,5 | 65,6 | 79,2 | 99,0 | 123,8 | 158,4 | 198 |
| $[in^3/rev]$ | [2.42] | [3.0] | [4.0] | [4.83] | [6.04] | [7.56] | [9.67] | [12.1] |
| Rated Flow* lpm | 4 | 5 | 6 | 8 | 10 | 13 | 16 | 20 |
| [GPM] | [1.1] | [1.3] | [1.6] | [2.1] | [2.6] | [3.4] | [4.2] | [5.3] |
| Rated Pressure bar | 125 | 150 | 175 | | | | | |
| [PSI] | [1810] | [2175] | [2540] | | | | | |
| LS-Valve Pressure Settings** bar [PSI] | | | 80 [1160] | 100 [1450] | 125 [1810] | 150 [2175] | 175 [2540] | |
| Shock Valves Pressure Settings*** bar [PSI] | | | 140 [2030] | 160 [2320] | 180 [2610] | 200 [2900] | 240 [3480] | |
| Max. Cont. Pressure in Line T bar [PSI] | | | | | | | | |
| - standard | | | | | 20 [290] | | | |
| - high pressure (H option) | | | | | 40 [580] | | | |
| Max. Torque at Servoamplifying Nm [lb-in] | | | | | | | | |
| -with standard springs | | | | | 3,0 [26] | | | |
| -with soft springs (LT option) | | | | | 1,8 [16] | | | |
| Max. Torque w/o Servoamplifying Nm [lb-in] | | | | | 120 [1065] | | | |
| Weight kg | 5,3 | 5,4 | 5,5 | 5,6 | 5,7 | 5,8 | 6,0 | 6,3 |
| [lb] | [11.7] | [11.9] | [12.2] | [12.4] | [12.6] | [12.8] | [13.2] | [13.9] |
| Dimension A mm | 130,8 | 132,2 | 133,9 | 136,2 | 138,8 | 142,2 | 146,8 | 152,2 |
| [in] | [5.15] | [5.20] | [5.27] | [5.36] | [5.47] | [5.60] | [5.78] | [5.99] |

* Rated Flow at 100 RPM.
** Pressure Settings are at flow rate of 25 lpm [6.6 GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50°C [122°F], supplied through priority valve.
*** Pressure Settings are at flow rate of 2 lpm [.53 GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50°C [122°F].

## DIMENSIONS AND MOUNTING DATA




| code | Ports - *P, T, R, L Thread | Column Mounting Thread - B | Valve Mounting Thread - V | LS - Port |
|---|---|---|---|---|
| - | G1/2<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth | G1/4<br>14 mm [.55 in] depth |
| M | M22x1,5<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth | G1/4<br>14 mm [.55 in] depth |
| MBO | M18x1,5<br>O-ring 15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth | M12x1,5<br>O-ring 11,5 mm [.45 in] depth |
| A | 3/4 - 16 UNF<br>O-ring 15 mm [.59 in] depth | 4 x 3/8 - 16 UNC<br>15,7 mm [.62 in] depth | 2 x 3/8 - 24 UNF<br>14,2 mm [.56 in] depth | 7/16 - 20 UNF<br>O-ring 12,7 mm [.50 in] depth |

* Threaded Ports $P_{min}$ 15 mm [.59 in] depth for pipe mounting.

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

| 1 | | 2 | 3 | 4 | | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| H K U S | | / | 5R | D | T | - | | | | | | |

**Pos.1 - Displacement code**

| | |
|---|---|
| **40** | - 39,6 cm³/rev [ 2.42 in³/rev] |
| **50** | - 49,5 cm³/rev [ 3.00 in³/rev] |
| **63** | - 65,6 cm³/rev [ 4.00 in³/rev] |
| **80** | - 79,2 cm³/rev [ 4.83 in³/rev] |
| **100** | - 99,0 cm³/rev [ 6.04 in³/rev] |
| **125** | - 123,8 cm³/rev [ 7.56 in³/rev] |
| **160** | - 158,4 cm³/rev [ 9.67 in³/rev] |
| **200** | - 198,0 cm³/rev [12.10 in³/rev] |

**Pos.2 - Version**

**5R** - Version 5R *"Closed Center - Reaction"*

**Pos.3 - Signal Type**

**D** - Dynamic Load Signal

**Pos.4 - Signal Type**

**T** - Piping Mount

**Pos.5 - Relief Valve Pressure Settings on LS-line, bar**

**80, 100, 125, 150, 175**

**Pos.6 - Ports**

omit - BSPP (ISO 228)
**M** - Metric (ISO 262)
**MBO** - Metric (ISO 6149-1)
**A** - SAE (ANSI B1.1-1982)

**Pos.7 - Max. Cont. Pressure in line T**

omit - Standard
**H** - High pressure

**Pos.8 - Input torque**

omit - Standard
**LT*** - Low

**Pos.9 - Option** (Paint)*

omit - No Paint
**P** - Painted
**PC** - Corrosion Protected Paint
**PS** - Special Paint**
**PCS** - Special Corrosion Protected Paint**

**Pos.10 - Design Series**

omit - Factory specified

**Notes:** * Colour at customer's request.
** Non painted feeding surfaces, colour at customer's request.
The steering units are mangano-phosphatized as standard.

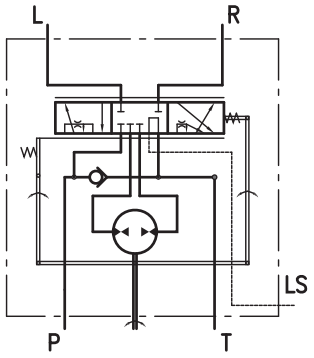
# HYDROSTATIC STEERING UNITS TYPE HKUL.../5DT



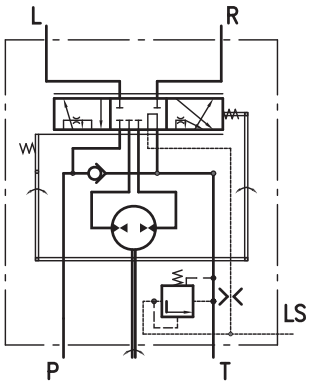
"M+S Hydraulic" introduce a new large size of steering unit HKUL *"Closed Center - Non Reaction and Load Sensing Outlet"* with Dynamic Load Signal.

HKUL is a load steering unit specially developed for large displacement in order to minimize flow loss. HKUL is extremely suitable for large vehicles, which maximum speed does not exceed 60 km/h and works together with dynamic priority valve.

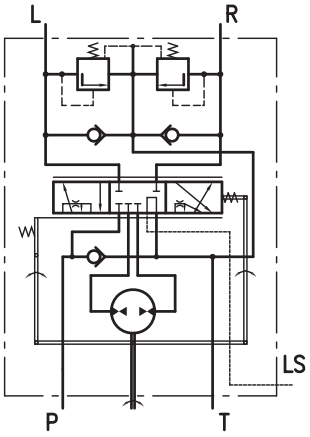
HKUL is available in versions with different valves that are required in hydraulic steering circuit for protection of the steering unit and steering cylinders.



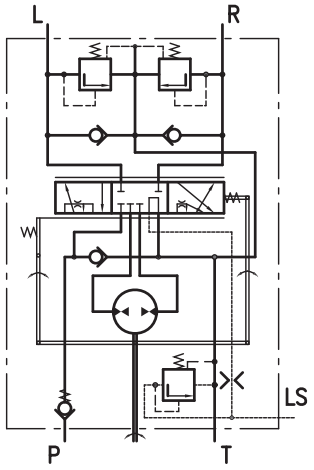

Closed Center - Non Reaction
HKUL.../5DT




Closed Center - Non Reaction
HKULR.../5DT




Closed Center - Non Reaction
HKULV.../5DT



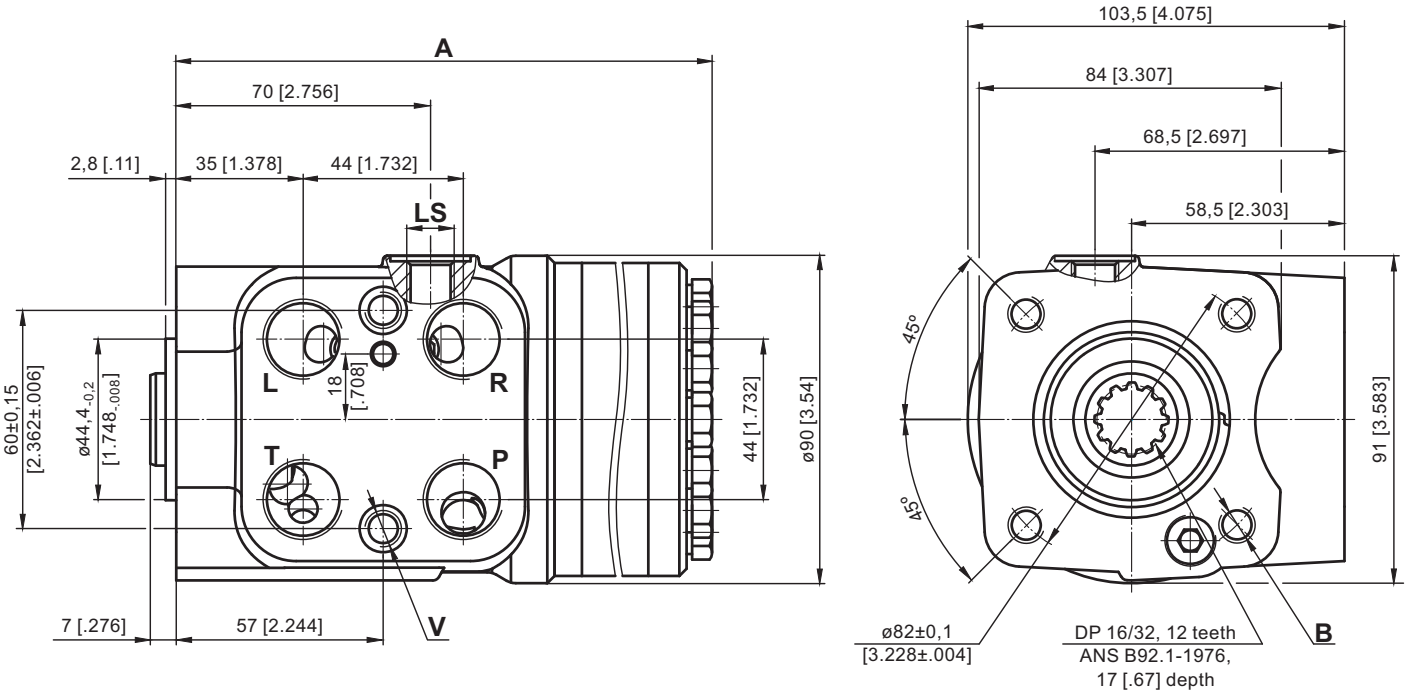

Closed Center - Non Reaction
HKULS.../5DT

## SPECIFICATION DATA

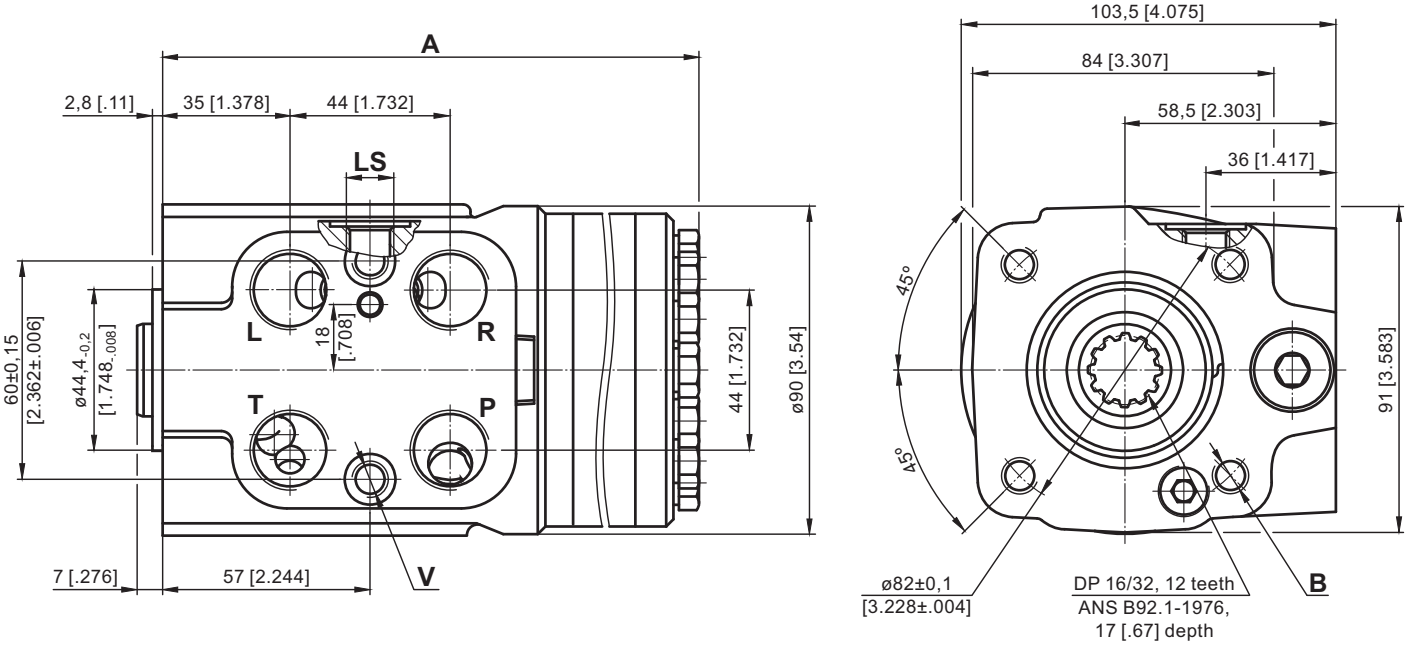
| Parameters | | Type | | | |
|---|---|---|---|---|---|
| | | HKUL... 500/5DT | HKUL... 630/5DT | HKUL... 800/5DT | HKUL... 1000/5DT |
| Displacement | $cm^3$/rev [$in^3$/rev] | 495 [30.2] | 623,6 [38.05] | 793 [48.4] | 990 [60.4] |
| Rated Flow | lpm [GPM] | 50 [13.2]* | 63 [16.6]* | 70 [18.5]** | 70 [18.5]*** |
| Rated Pressure | bar [PSI] | 175 [2540] | | | |
| LS-Valve Pressure Settings | bar [PSI] | 80 [1160] | 100 [1450] | 125 [1810] | 150 [2175] | 175 [2540] |
| Shock Valves Pressure Settings | bar [PSI] | 140 [2030] | 160 [2320] | 180 [2610] | 200 [2900] | 240 [3480] |
| Max. Cont. Pressure in Line T<br>- standard<br>- high pressure (H option) | bar [PSI] | 20 [290]<br>40 [580] | | | |
| Max. Torque at Servoamplifing | Nm [lb-in] | 3,0 [26] | | | |
| Max. Torque w/o Servoamplifing | Nm [lb-in] | 120 [1065] | | | |
| Weight | kg [lb] | 8,2 [18.1] | 8,9 [19.6] | 9,8 [21.6] | 10,8 [23.8] |
| Dimension A | mm [in] | 202 [7.95] | 219,3 [8.64] | 242,17 [9.54] | 268,64 [10.58] |

* Rated Flow at 100 RPM
** Max. Rated Flow at 87 RPM
*** Max. Rated Flow at 70 RPM

## DIMENSIONS AND MOUNTING DATA - HKUL.../5DT

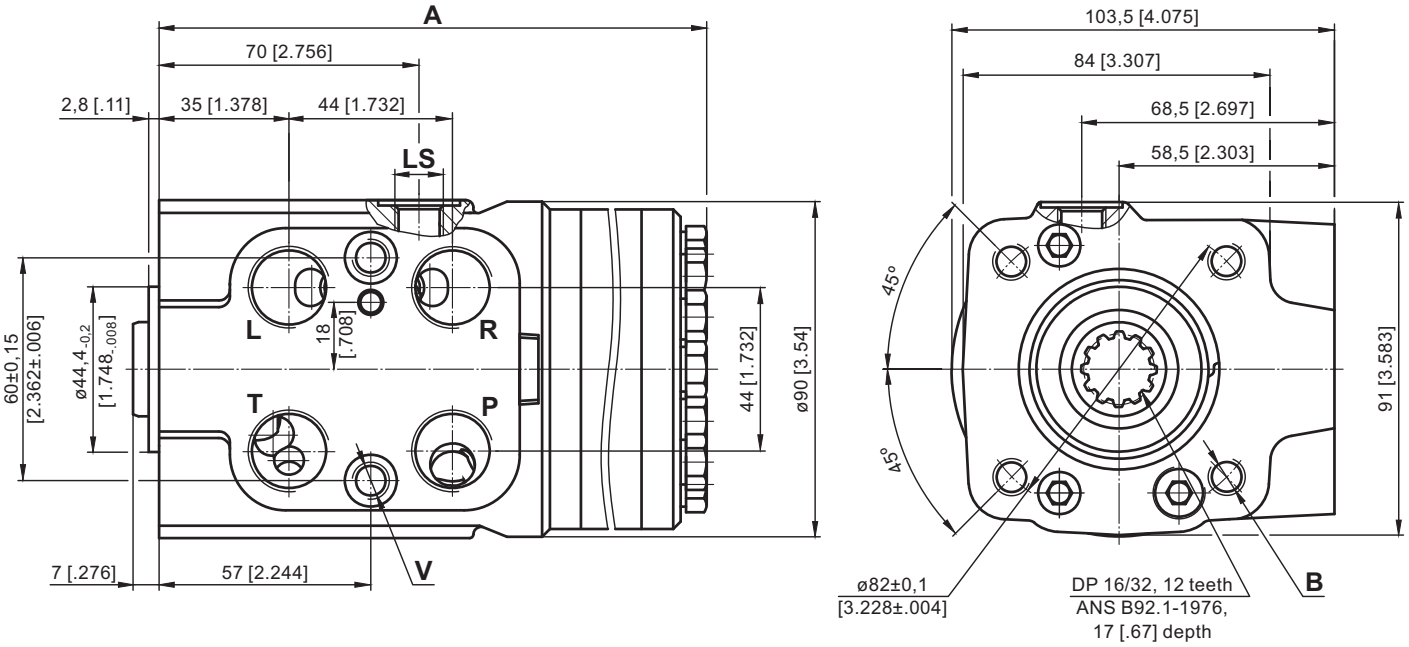



## DIMENSIONS AND MOUNTING DATA - HKULR.../5DT

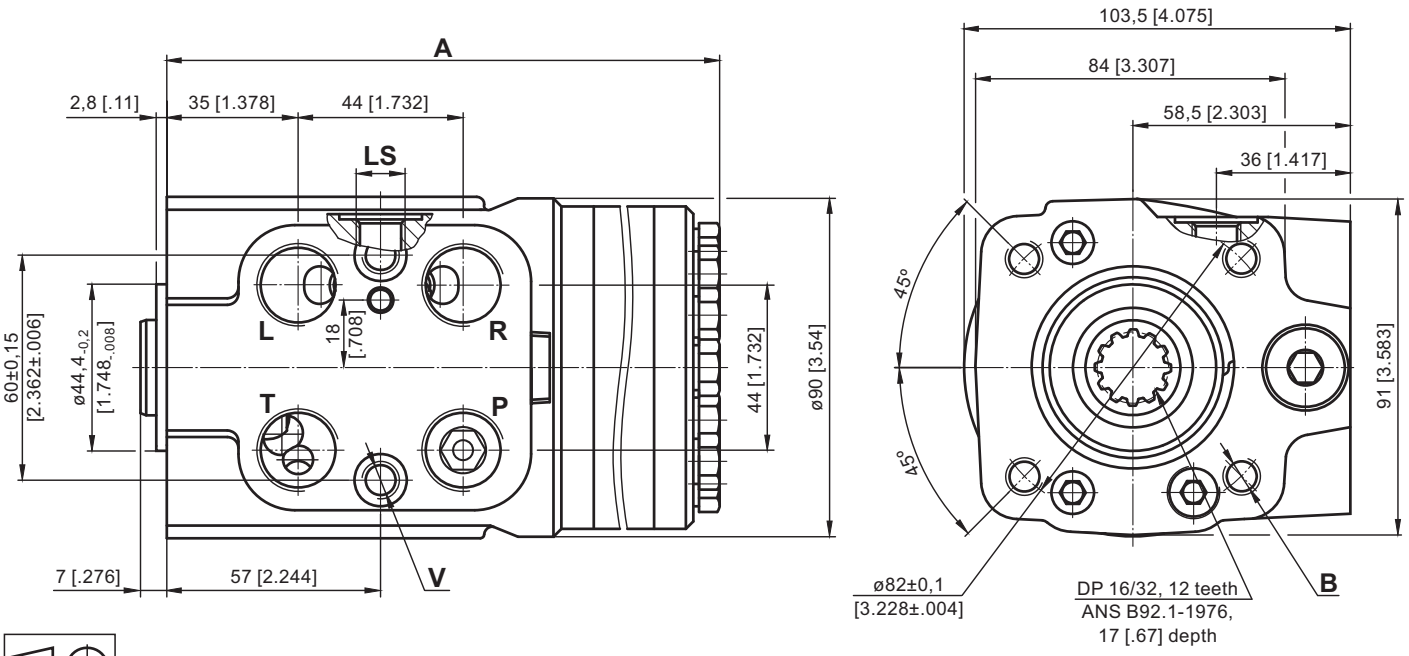



mm [in]

## DIMENSIONS AND MOUNTING DATA - HKULV.../5DT




## DIMENSIONS AND MOUNTING DATA - HKULS.../5DT




mm [in]

| code | Ports - *P, T, R, L Thread | Column Mounting Thread - B | Valve Mounting Thread - V | LS - Port |
|---|---|---|---|---|
| - | G1/2<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth | G1/4<br>14 mm [.55 in] depth |
| M | M22x1,5<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth | G1/4<br>14 mm [.55 in] depth |
| A | 3/4 - 16 UNF<br>O-ring<br>15 mm [.59 in] depth | 4 x 3/8 - 16 UNC<br>15,7 mm [.62 in] depth | 2 x 3/8 - 24 UNC<br>14,2 mm [.56 in] depth | 7/16 - 20 UNC<br>O-ring<br>12,7 mm [.50 in] depth |

## ORDER CODE for HKUL.../5DT...

| | 1 | 2 | | 3 | 4 | 5 | | 6 | 7 | | 8 | 9 | 10 | 11 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **HKUL** | | | **/** | **5** | **D** | **T** | **-** | | | **-** | | | | |

### Pos.1 - **Versions** (build-in valves)

| Version | Manual Steering Check Valve | Relief Valve | Inlet Check Valve | Cylinder Relief Valve | Anti-Cavitation Valve |
|---|---|---|---|---|---|
| omit | • | | | | |
| **R** | • | • | | | |
| **V** | • | | | • | • |
| **S** | • | • | • | • | • |

### Pos.2 - **Displacement code** (see Specification data)

**500** - 495,0 $cm^3$/rev [30.20 $in^3$/rev]
**630** - 623,6 $cm^3$/rev [38.05 $in^3$/rev]
**800** - 793,0 $cm^3$/rev [48.40 $in^3$/rev]
**1000** - 990,0 $cm^3$/rev [60.40 $in^3$/rev]

### Pos.3 - **Versions**

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

### Pos.4 - **Signal Type**

**D** - Dynamic Load Signal

### Pos.5 - **Priority Valve Connection**

**T** - Pipe Mounting

### Pos. 6 - **LS - Valve Pressure Settings, bar***

**80** | **100** | **125** | **150** | **175**

### Pos. 7 - **Shock Valves Pressure Settings, bar****

**140** | **160** | **180** | **200** | **240**

### Pos. 8 - **Ports**

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

### Pos. 9 - **Max. Cont. Pressure in line T**

omit - Standard
**H** - High pressure

### Pos.10 - **Option (Paint)*****

omit - No Paint
**P** - Painted
**PC** - Corrosion Protected Paint
**PS** - Special Paint****
**PCS** - Special Corrosion Protected Paint****

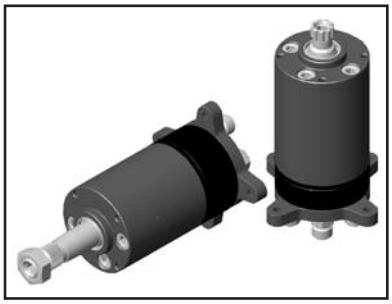
### Pos.11 - **Design Series**

omit - Factory specified

**NOTES**: * Only for HKULR and HKULS
** Only for HKULV
*** Colour at customer's request.
**** Non painted feeding surfaces, colour at customer's request.

The steering units are mangano-phosphatized as standard.

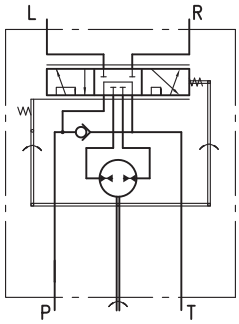
# HYDROSTATIC STEERING UNITS TYPE HKUM.../4(PB)



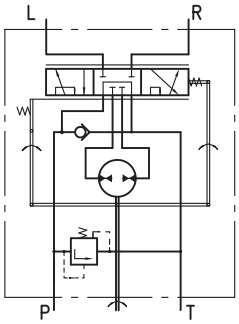
M+S Hydraulic expands its range of hydrostatic steering units with mini steering units, which are used in lawn and garden machines, minitracktors and municipal vehicles.

HKUM.../4 is open centre steering units in neutral position have open connection between pump and tank.

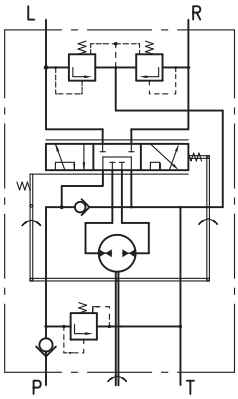
HKUM.../4PB works as standard steering unit with auxiliary port designed for flow providing additional vehicles functions.When the steering wheel is not turned, the flow will be delivered to port PB. After the steering wheel has been turned a part of the flow will be deviated to the steering unit and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



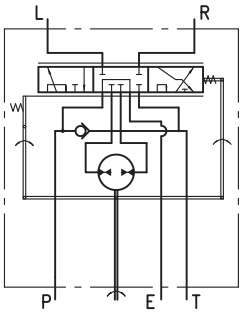

"Open Center - Non Load Reaction"
HKUM.../4



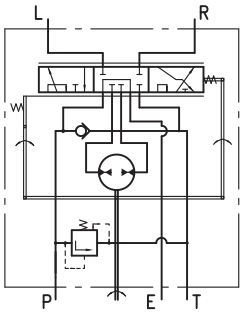

"Open Center - Non Load Reaction"
HKUMR.../4



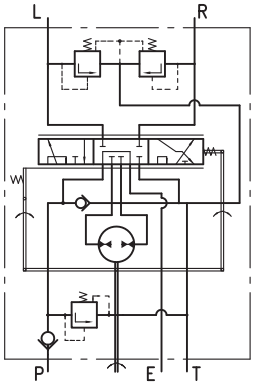

"Open Center - Non Load Reaction"
HKUMS.../4




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




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



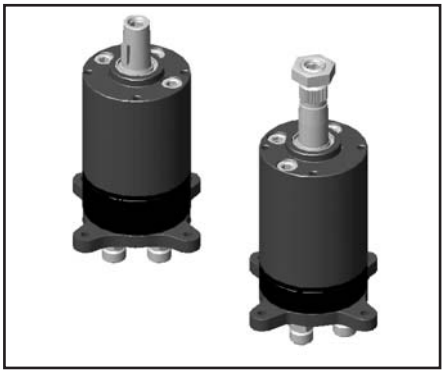

"Open Center - Non Load Reaction"
HKUMS.../4PB - Power Beyond

## SPECIFICATION DATA

| Parameters | | Type | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | HKUM... 32/4(PB) | HKUM... 40/4(PB) | HKUM... 50/4(PB) | HKUM... 63/4(PB) | HKUM... 70/4(PB) | HKUM... 80/4(PB) | HKUM... 100/4(PB) |
| Displacement | $cm^3$/rev [$in^3$/rev] | 31,8 [1.94] | 40 [2.44] | 50 [3.05] | 63 [3.84] | 70 [4.27] | 80 [4.88] | 100 [6.10] |
| Rated Flow* | lpm [GPM] | 3,2 [.85] | 4,0 [1.06] | 5,0 [1.32] | 6,0 [1.59] | 7,0 [1.85] | 8,0 [2.11] | 10,0 [2.64] |
| Max. recomended oil frow | lpm [GPM] | 20 [5.3] | | | | | | |
| Rated Pressure | bar [PSI] | 125 [1810] | | | | | | |
| Relief Valve Pressure Settings** | bar [PSI] | 60 [870] | 70 [1015] | 80 [1160] | 90 [1305] | 100 [1450] | 110 [1595] | 125 [1810] |
| Shock Valves Pressure Settings*** | bar [PSI] | 120 [1740] | 130 [1885] | 140 [2030] | 150 [2175] | 160 [2320] | 170 [2465] | 185 [2683] |
| Max. Cont. Pressure in Line T | bar [PSI] | 20 [290] | | | | | | |
| Max. Torque at Servoamplifing | Nm [lb-in] | 2,0 [17.7] | | | | | | |
| Max. Torque w/o Servoamplifing | Nm [lb-in] | 80 [708] | | | | | | |
| Weight, kg [lb] | for HKUM.../4... | 2,3 [5.1] | 2,4 [5.3] | 2,5 [5.5] | 2,6 [5.7] | 2,65 [5.84] | 2,7 [5.95] | 2,9 [6.39] |
| | for HKUM.../4(PB)... | 2,6 [5.7] | 2,7 [5.9] | 2,8 [6.2] | 2,9 [6.4] | 2,95 [6.5] | 3,0 [6.6] | 3,2 [7.1] |

* Rated Flow at 100 RPM.
** Pressure Settings are at flow rate of 12 l/min [3.17 GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50°C [120°F].
*** Pressure Settings are at flow rate of 1 l/min [.26 GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50°C [120°F].

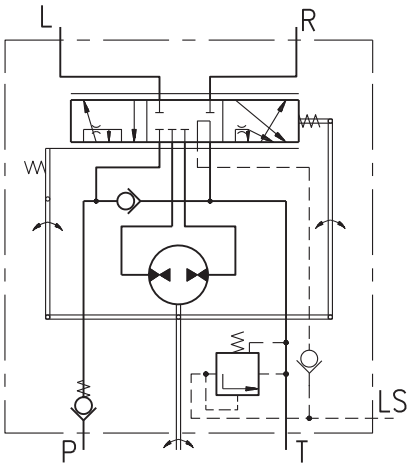
# HYDROSTATIC STEERING UNITS TYPE HKUM.../5DT



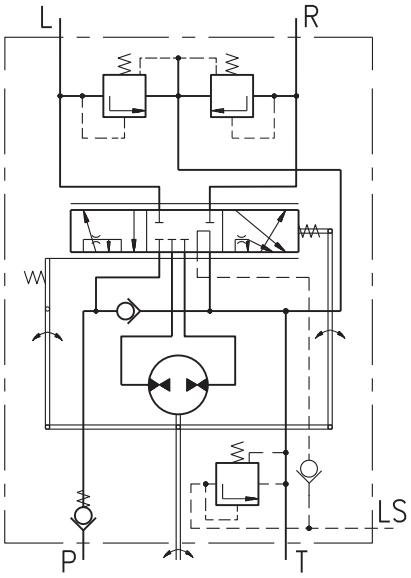
HKUM…/5DT is a steering unit with load sensing dynamic signal and integrated valve functions.

HKUM…/5DT works in a system with a dynamic priority valve and it is appropriate for machines with increased energy saving requirements.

The flow to LS-line allows easy and smooth control when starting steering.




"Closed Center - Non Reaction"
HKUMR.../5DT



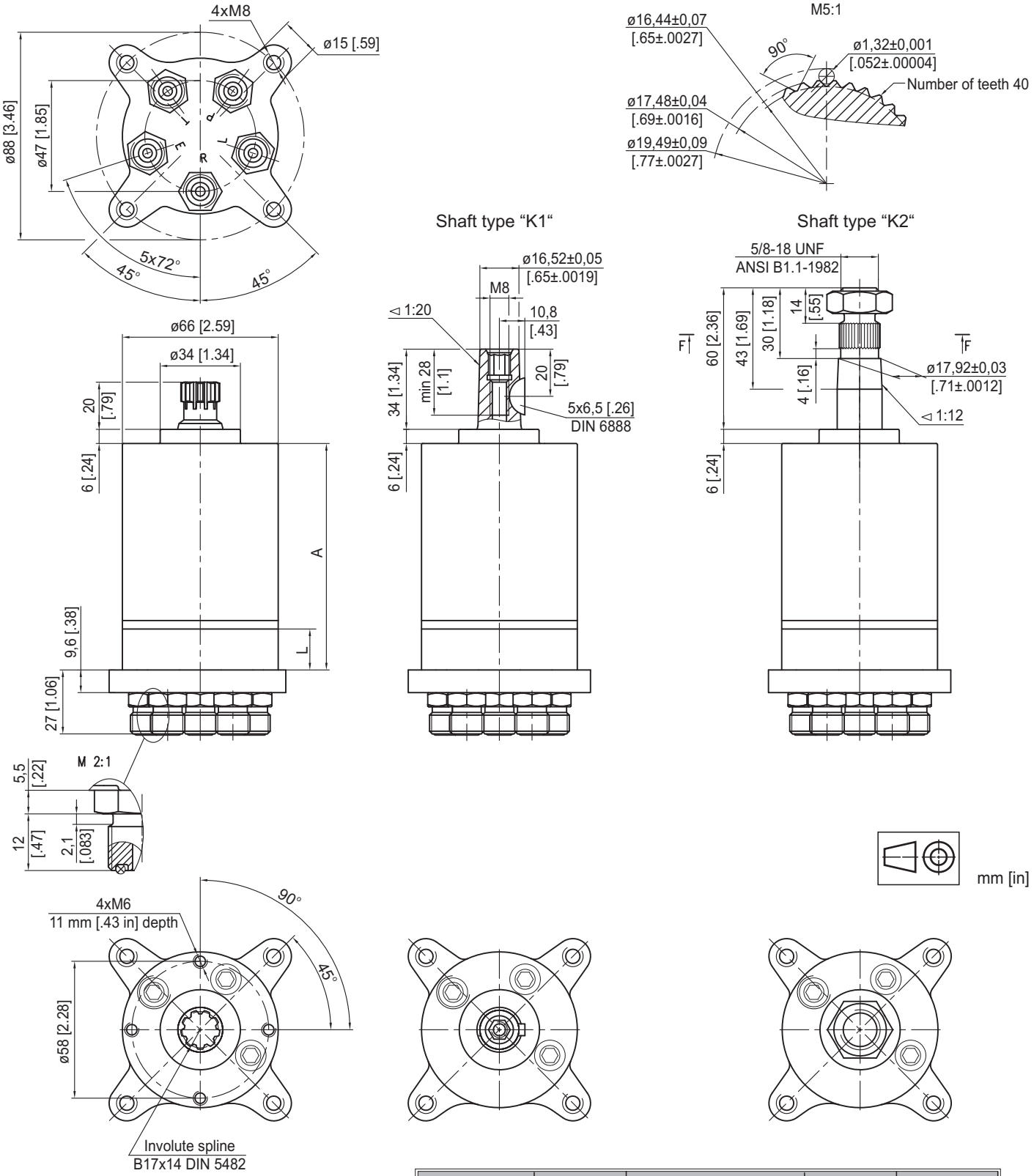

"Closed Center - Non Reaction"
HKUMS.../5DT

## SPECIFICATION DATA

| Parameters | Type | | | | | | |
|---|---|---|---|---|---|---|---|
| | HKUM... 32/5DT | HKUM... 40/5DT | HKUM... 50/5DT | HKUM... 63/5DT | HKUM... 70/5DT | HKUM... 80/5DT | HKUM... 100/5DT |
| Displacement $cm^3/rev$ [$in^3/rev$] | 31,8 [1.94] | 40 [2.44] | 50 [3.05] | 63 [3.84] | 70 [4.27] | 80 [4.88] | 100 [6.10] |
| Rated Flow* lpm [GPM] | 3,2 [.85] | 4,0 [1.06] | 5,0 [1.32] | 6,0 [1.59] | 7,0 [1.85] | 8,0 [2.11] | 10,0 [2.64] |
| Rated Pressure bar [PSI] | 125 [1810] | | | | | | |
| LS-Valve Pressure** Settings bar [PSI] | 60 [870] | 70 [1015] | 80 [1160] | 90 [1305] | 100 [1450] | 110 [1595] | 125 [1810] |
| Shock Valves Pressure*** Settings bar [PSI] | 120 [1740] | 130 [1885] | 140 [2030] | 150 [2175] | 160 [2320] | 170 [2465] | 185 [2683] |
| Max. Cont. Pressure in Line T bar [PSI] | 20 [290] | | | | | | |
| Max. Torque at Servoamplifing Nm [lb-in] | 2,0 [17.7] | | | | | | |
| Max. Torque w/o Servoamplifing Nm [lb-in] | 80 [708] | | | | | | |
| Weight kg [lb] | 2,6 [5.7] | 2,7 [5.95] | 2,8 [6.2] | 2,9 [6.39] | 2,95 [6.5] | 3 [6.6] | 3,2 [7.05] |

* Rated Flow at 100 RPM.
** The pilot pressure relief valve is set at an oil flow to the priority valve of 12 l/min [3.17GPM]
*** Pressure Settings are at flow rate of 1 l/min [.26 GPM] and viscosity 21 $mm^2/s$ [105 SUS] at 50°C [120°F].

# OUTLINE DIMENSIONS REFERENCE




| code | Ports - P, T, R, L, E Thread |
|---|---|
| **A** | 9/16-18 UNF (ORFS) |

| Type | A, mm [in] | Type | A, mm [in] | L, mm [in] |
|---|---|---|---|---|
| HKUM 32/4 | 90 [3.54] | HKUM 32/4PB(5DT) | 103 [4.06] | 11,0 [.43] |
| HKUM 40/4 | 93 [3.66] | HKUM 40/4PB(5DT) | 106 [4.17] | 13,7 [.54] |
| HKUM 50/4 | 96 [3.78] | HKUM 50/4PB(5DT) | 109 [4.29] | 17,1 [.67] |
| HKUM 63/4 | 100 [3.94] | HKUM 63/4PB(5DT) | 113 [4.45] | 21,6 [.85] |
| HKUM 70/4 | 103 [4.06] | HKUM 70/4PB(5DT) | 116 [4.57] | 24,0 [.94] |
| HKUM 80/4 | 106 [4.17] | HKUM 80/4PB(5DT) | 119 [4.69] | 27,4 [1.08] |
| HKUM 100/4 | 113 [4.45] | HKUM 100/4PB(5DT) | 126 [4.96] | 34,2 [1.35] |

## ORDER CODE for HKUM.../4(PB)...

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

**Pos.1 - Option**

| | Relief Valve | Check Valve in P-port | Shock Valve |
|---|---|---|---|
| omit | no build-in valves | | |
| **R** | • | | |
| **S** | • | • | • |

**Pos.2 - Displacement code**

| | |
|---|---|
| **32** | - 31,8 cm³/rev [1.94 in³/rev] |
| **40** | - 40,0 cm³/rev [2.44 in³/rev] |
| **50** | - 50,0 cm³/rev [3.05 in³/rev] |
| **63** | - 63,0 cm³/rev [3.84 in³/rev] |
| **70** | - 70,0 cm³/rev [4.27 in³/rev] |
| **80** | - 80,0 cm³/rev [4.88 in³/rev] |
| **100** | - 100,0 cm³/rev [6.10 in³/rev] |

**Pos.3 - Versions**

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

**Pos.4 - Relief Valve Pressure Settings* [bar]**

| | | | | | | |
|---|---|---|---|---|---|---|
| **60** | **70** | **80** | **90** | **100** | **110** | **125** |

**Pos.5 - Shaft Versions**

| | |
|---|---|
| omit | - Splined B17x14 DIN 5482 |
| **K1** | - Tapered 1:20, key 5x6,5 DIN 6888 |
| **K2** | - Tapered 1:12, with 11/16 in-40 serrations |

**Pos.6 - Ports**

| | |
|---|---|
| **A** | - ORFS main ports - ISO 8434-3 |

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

| | |
|---|---|
| omit | - no Paint |
| **P** | - Painted |
| **PC** | - Corrosion Protected Paint |

**Pos.8 - Design Series**

omit - Factory specified

**Notes:** * For HKUMR... and HKUMS... only.
** Colour at customer's request.
The steering units are mangano-phosphatized as standard.

## ORDER CODE for HKUM.../5DT

| | 1 | 2 | | 3 | 4 | | 5 | | 6 | | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| HKUM | | | / | 5D | T | - | | - | | - | | | |

**Pos.1 - Option**

| | Relief Valve | Check Valve in P-port | Shock Valve |
|---|---|---|---|
| **R** | • | • | |
| **S** | • | • | • |

**Pos.2 - Displacement code**

| | |
|---|---|
| **32** | - 31,8 cm³/rev [1.94 in³/rev] |
| **40** | - 40,0 cm³/rev [2.44 in³/rev] |
| **50** | - 50,0 cm³/rev [3.05 in³/rev] |
| **63** | - 63,0 cm³/rev [3.84 in³/rev] |
| **70** | - 70,0 cm³/rev [4.27 in³/rev] |
| **80** | - 80,0 cm³/rev [4.88 in³/rev] |
| **100** | - 100,0 cm³/rev [6.10 in³/rev] |

**Pos.3 - Versions**

| | |
|---|---|
| **5D** | - Version 5 "Close Center - Non Load Reaction and Dynamic Load Signal" |

**Pos.4 - Priority Valve Connection**

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

**Pos.5 - Relief Valve Pressure Settings [bar]**

| | | | | | | |
|---|---|---|---|---|---|---|
| **60** | **70** | **80** | **90** | **100** | **110** | **125** |

**Pos.6 - Shaft Versions**

| | |
|---|---|
| omit | - Splined B17x14 DIN 5482 |
| **K1** | - Tapered 1:20, key 5x6,5 DIN 6888 |
| **K2** | - Tapered 1:12, with 11/16 in-40 serrations |

**Pos.7 - Ports**

| | |
|---|---|
| **A** | - ORFS main ports - ISO 8434-3 |

**Pos.8 - Option** (Paint)*

| | |
|---|---|
| omit | - no Paint |
| **P** | - Painted |
| **PC** | - Corrosion Protected Paint |

**Pos.9 - Design Series**

omit - Factory specified

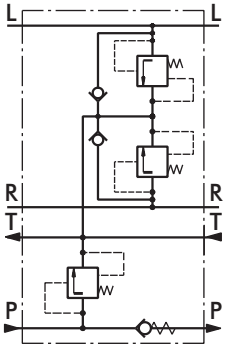
**Notes:** * Colour at customer's request.
The steering units are mangano-phosphatized as standard.

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

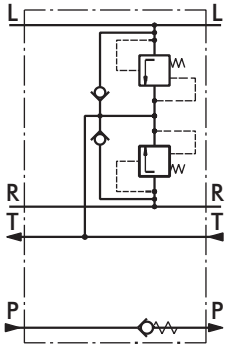


The M+S Hydraulic BKH valves are developed to protect the components of the hydraulic circuit: pumps, steering units and cylinders - from overloads, impacts and cavitation. Some of their advantages are: easy integration into any hydraulic circuit, easy mounting to the steering unit, and quick and easy 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 presented in the table.

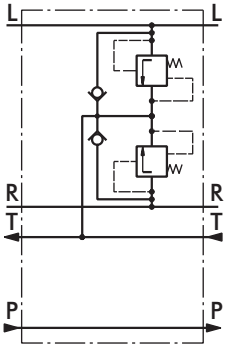




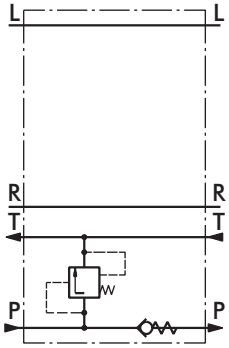
BKH1, BKHR



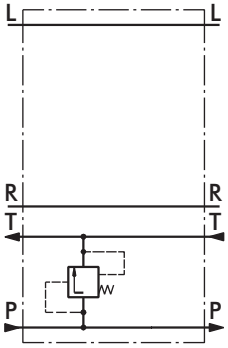
BKH2



BKH3



BKH4



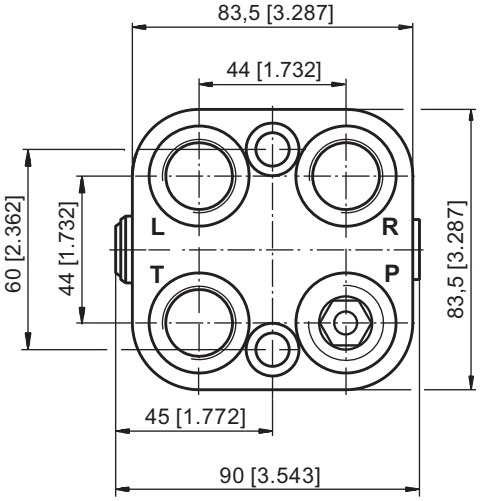
BKH5

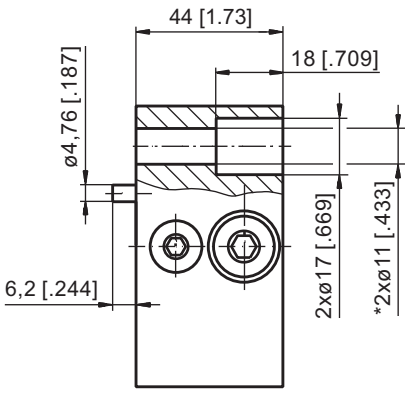
## SPECIFICATION DATA

| Parameters | | Type | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | BKH1, BKHR | | | | BKH2 | BKH3 | BKH4, BKH5 | | | |
| Rated Flow | lpm [GPM] | 80 [21.1] | | | | | | | | | |
| Rated Pressure | bar [PSI] | 160 [2320] | | | | | | | | | |
| Relief Valve Pressure Settings* | bar [PSI] | 80 [1160] | 100 [1450] | 125 [1810] | 150 [2175] | - | - | 80 [1160] | 100 [1450] | 125 [1810] | 150 [2175] |
| Shock Valves Pressure Settings** | bar [PSI] | 140 [2030] | 160 [2320] | 180 [2610] | 200 [2900] | 200 [2900] | 240 [3480] | - | - | - | - |
| Weight | kg [lb] | 1,8 , 2,3 [4.0] , [5.1] | | | | 1,8 [4.0] | | 1,8 [4.0] | | | |

* Pressure Settings are at flow rate of 30 lpm [7.92 GPM] and viscosity 21 mm²/s [105 SUS] at 50º C [122ºF].
** Pressure Settings are at flow rate of 2 lpm [ .53 GPM] and viscosity 21 mm²/s [105 SUS] at 50º C [122ºF].

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

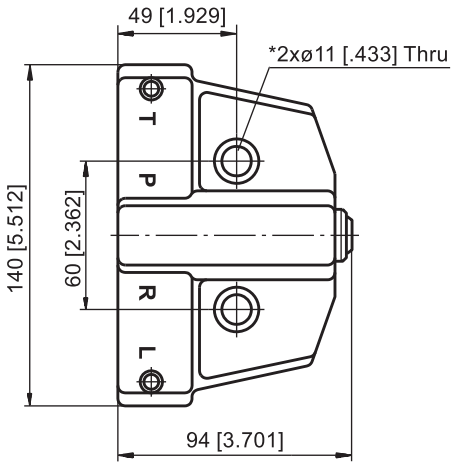


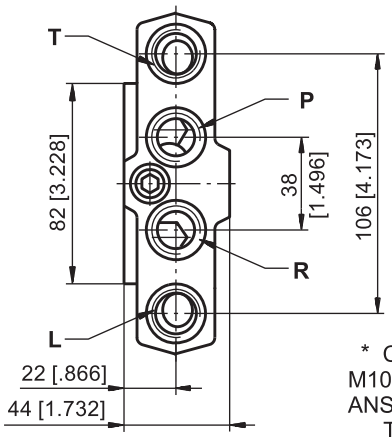




| code | Ports - P, T, R, L Thread |
|---|---|
| - | G1/2 20 [.80] depth |
| M | M22x1,5 20 [.80] depth |
| A | 3/4 - 16 UNF O-ring 20 [.80] depth |

* 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, long 1.5". Tightening torque: 2,5±0,5 daNm [177÷265 lb-in].

## DIMENSIONS AND MOUNTING DATA - BKHR



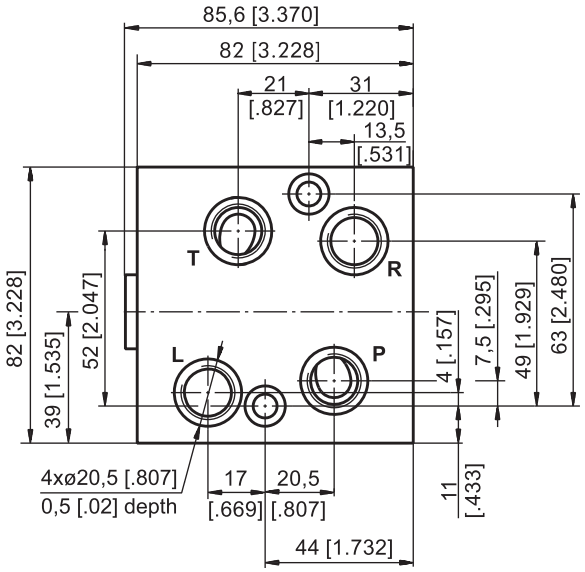



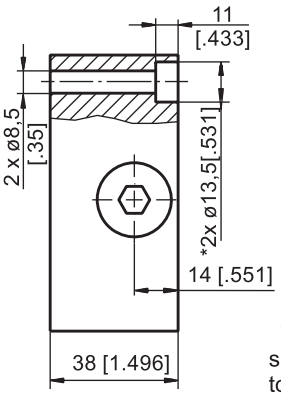

| code | Ports - P, T, R, L Thread |
|---|---|
| M | M18x1,5<br>22 [.87] depth |
| A | 3/4 - 16 UNF<br>O-ring 22 [.87] depth |

* 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, long 1.5".
Tightening torque: 2,5±0,5 daNm [177÷265 lb- in ].

## DIMENSIONS AND MOUNTING DATA - BKH5

mm [in]




| code | Ports - P, T, R, L Thread |
|---|---|
| M | M16x1,5<br>14 [.55] depth |

* Connection to the XY is done with 2 screws M8x1x40 -8.8 DIN 912 . Tightening torque: 2,5±0,5 daNm [177÷265 lb - in ].

## ORDER CODE

| | 1 | | 2 | | 3 | 4 | 5 |
|---|---|---|---|---|---|---|---|
| B K H | | - | | - | | | |

**Pos.1 - Versions***

| R | 1 | 2 | 3 | 4 | 5 | with built-in valves: |
|---|---|---|---|---|---|---|
| • | • | | | • | • | - 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****

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

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

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

**Pos.4 - Options (Paint)******

| | |
|---|---|
| omit | - No Paint |
| P | - Painted |
| PC | - 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 19 and 20.
**** Colour at customer's request.

The valve blocks are mangano-phosphatized as standard.

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





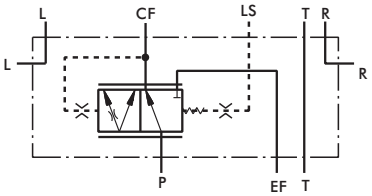
The Priority Valves distribute and trace the hydraulic flow from the supply pump of the hydraulic system to the hydraulic components which control and run the vehicle.

The Priority Valves are used only with the HKUS.../5(D)(T) 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 steering units has to be as short as possible, but should not exceed 1,5 m [4.92 ft] (for iron pipe with 4 mm [.157 in.] internal diameter). When a rubber hose is used this length has to be even shorter.

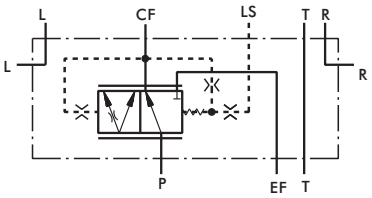
Priority valves with dynamic signal work in a system with dynamic hydrostatic steering units type HKUS.../5D (5DT).

## Modulary Mounting




Static signal

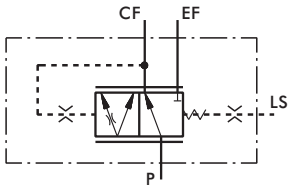
PRD 40,80/...




Dynamic signal

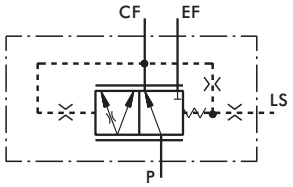
PRDD 40,80/...

## Pipe Mounting



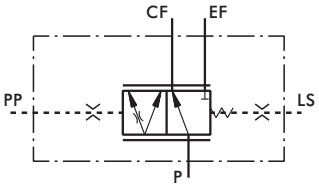

Static signal

PRT 40,80,120/..., PRTA 40,80/...




Dynamic signal

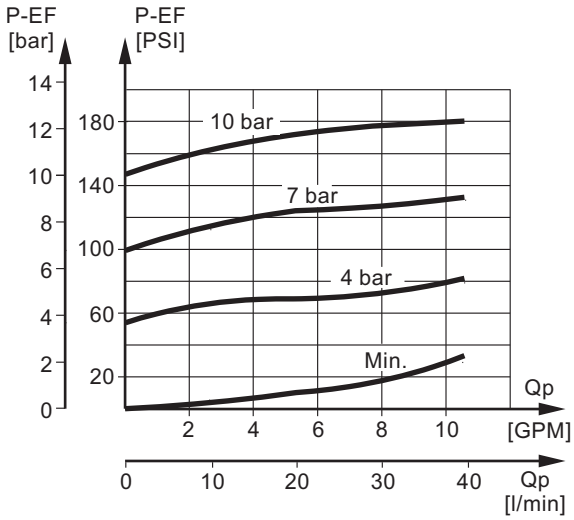
PRTD 40,80,120/...,PRTAD40,80/...



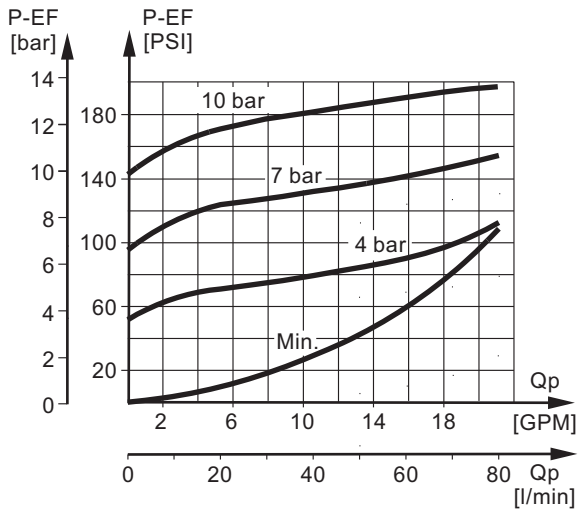

Static signal with External Port

PRTE120/...

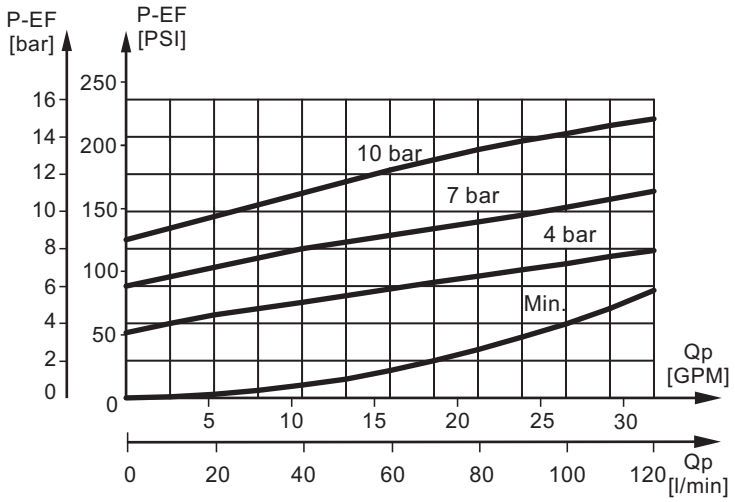
## PR...40




## PR...80




## PRT...120

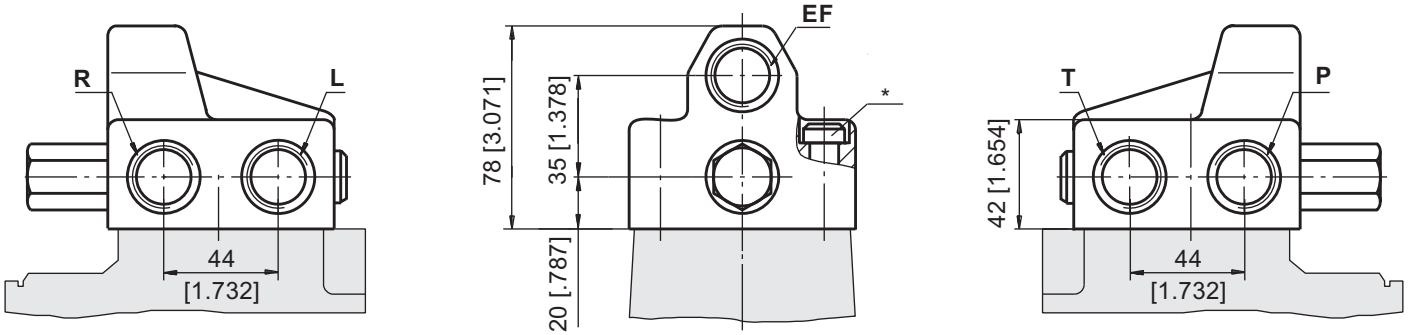


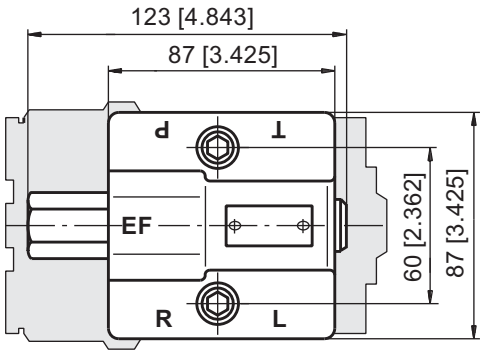
## SPECIFICATION DATA

| Parameters | | Type | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | PRD(D), PRT(D) | | | PRTA(D) | | | PRT(D)(E) | | |
| Rated Flow | lpm [GPM] | 40 [10.6] | | | 80 [21.1] | | | 120 [31.7] | | |
| Control Spring Pressure | bar [PSI] | 4 [58] | 7 [101.5] | 10 [145] | 4 [58] | 7 [101.5] | 10 [145] | 4 [58] | 7 [101.5] | 10 [145] |
| Max. Pressures in Oil Ports: | P, EF | 250 [3625] | | | | | | | | |
| | CF | 210 [3045] | | | | | | | | |
| bar [PSI] | R, L | 280 [4061] | | | - | | | | | |
| | LS | 210 [3045] | | | | | | | | |
| | PP | | | | | | | 210 [3045] | | |
| | T | 20 [290] | | | | | | | | |
| Weight | kg [lb] | 2,25 [4.96] | | | 1,3 [2.87] | | | 2,1 [4.6] | | |

**P** - pump, **EF** - excess flow, **CF** - control flow (first priority oil flow),
**L** - left, **R** - right, **LS** - load sensing, **T** - tank, **PP** - pilot pressure (L,R and T - for PRD(D) only).

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



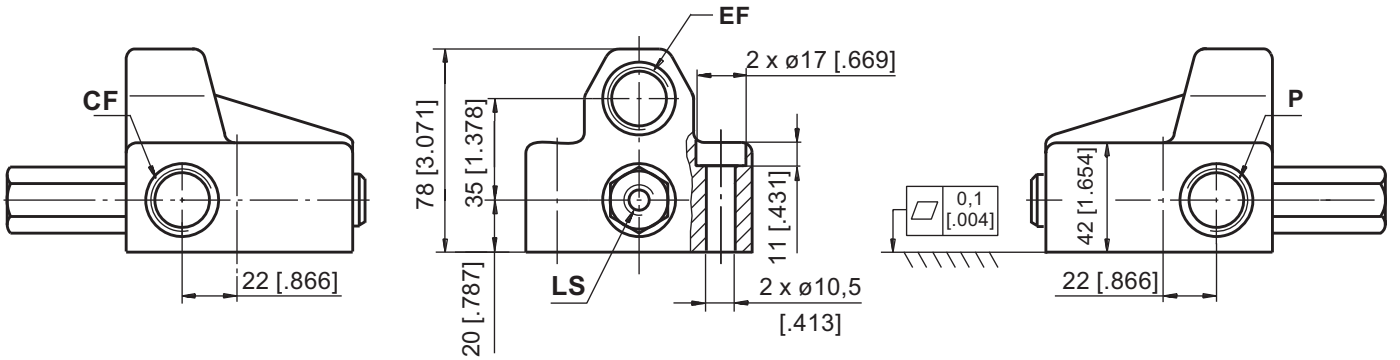



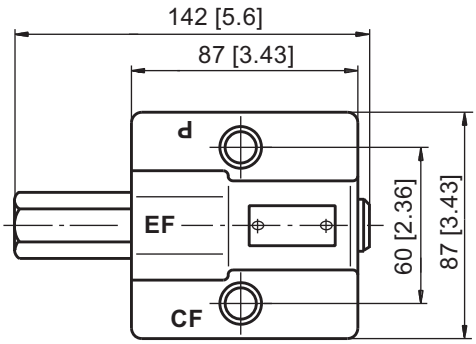

| code | Ports - P, EF Thread | Ports - T, R, L Thread |
|---|---|---|
| - | G1/2<br>18 [.71] depth | G3/8<br>18 [.71] depth |
| M | M22x1,5<br>18 [.71] depth | M18x1,5<br>18 [.71] depth |
| A | 7/8 - 14 UNF<br>O-ring 18 [.71] depth | 3/4 - 16 UNF<br>O-ring 18 [.71] depth |

* Connection to the HKUS.../5(D)... is done with 2 screws M10x1x45 -10.9 DIN 912 or with 2 screws 3/8-24 UNF ANSI B18.3-76, 1.75" long. Tightening torque: 4,5±0,5 daNm [360 ± 440 lb-in ].

mm [in]

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

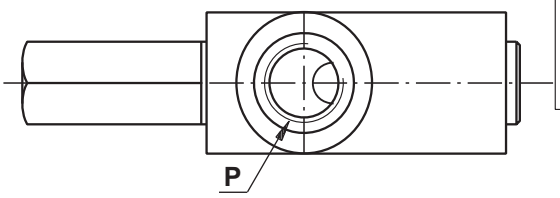


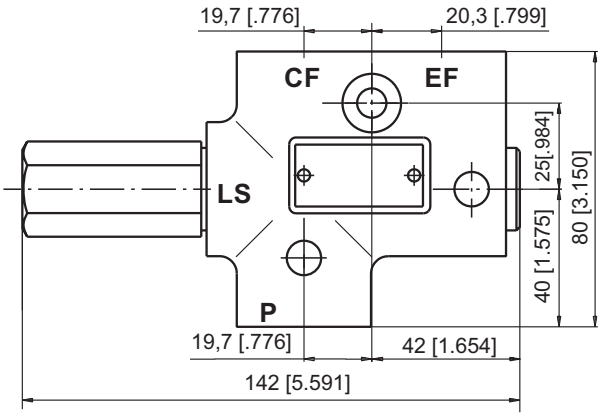



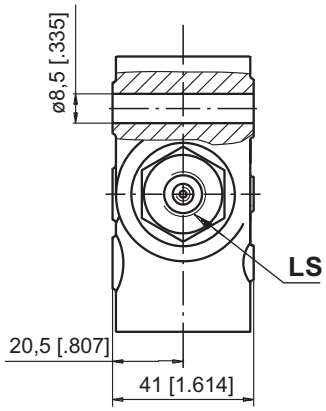

| code | Ports - P, EF Thread | Port - CF Thread | LS - Port |
|---|---|---|---|
| - | G1/2<br>18 mm [.71 in] depth | G1/2<br>18 mm [.71 in] depth | G1/4<br>14 mm [.55 in] depth |
| M | G1/2<br>18 mm [.71 in] depth | M 22x1,5<br>18 mm [.71 in] depth | G1/4<br>14 mm [.55 in] depth |
| A | 7/8 - 14 UNF<br>O-ring 18 [.71 in] depth | 3/4 - 16 UNF<br>O-ring 18 [.71 in] depth | 7/16 - 20 UNF<br>O-ring 12,7 [.50 in] depth |

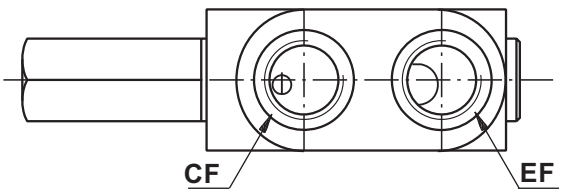
## DIMENSIONS AND MOUNTING DATA - PRTA(D) 40, 80/...

| code | Ports - P, EF Thread | Port - CF Thread | LS - Port |
|---|---|---|---|
| - | G1/2<br>18 mm [.71 in] depth | G1/2<br>18 mm [.71 in] depth | G1/4<br>14 mm [.55 in] depth |
| M | G1/2<br>18 mm [.71 in] depth | M 22x1,5<br>18 mm [.71 in] depth | G1/4<br>14 mm [.55 in] depth |
| A | 7/8 - 14 UNF<br>O-ring 18 [.71 in] depth | 3/4 - 16 UNF<br>O-ring 18 [.71 in] depth | 7/16 - 20 UNF<br>O-ring 12,7 [.50 in] depth |



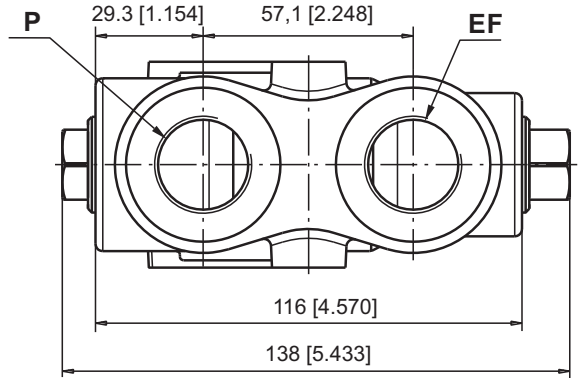



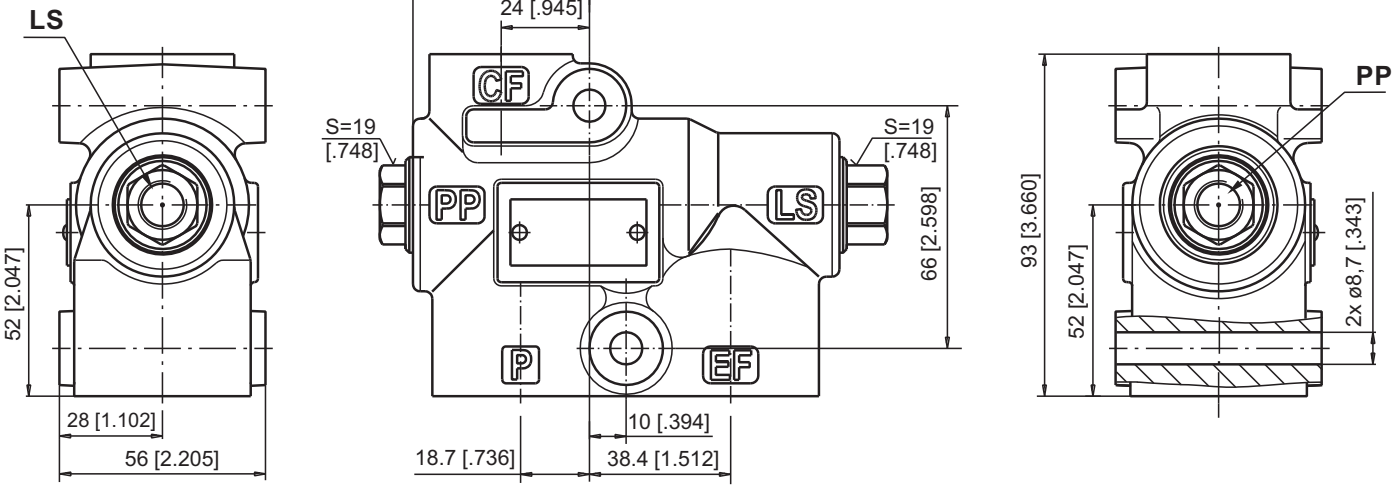



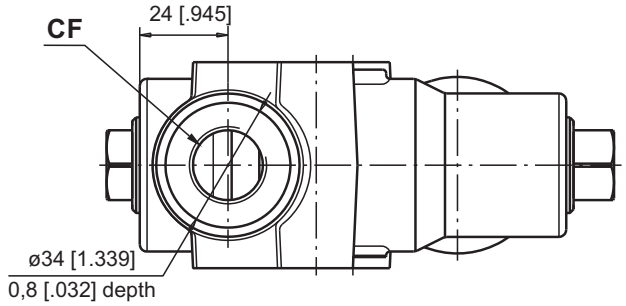




mm [in]

## DIMENSIONS AND MOUNTING DATA - PRT...120/...



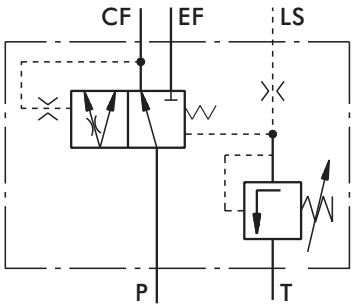

| code | Ports - P, EF Thread | Port - CF Thread | LS, PP - Ports |
|---|---|---|---|
| - | G3/4<br>20,5 [.81] depth | G1/2<br>18,5 [.73] depth | G1/4<br>12,5 [.49] depth |
| M | M27x2<br>20,5 [.81] depth | M18x1,5<br>18,5 [.73] depth | M12x1,5<br>12,5 [.49] depth |
| A | 1 1/16 - 12 UN<br>O-ring 20,5 [.81] depth | 3/4 - 16 UNF<br>O-ring 18,5 [.73] depth | 7/16 - 20 UNF<br>O-ring 12,5 [.49] depth |

mm [in]

# PRIORITY VALVES FOR HKU(S).../5T... TYPE PRT...160/...



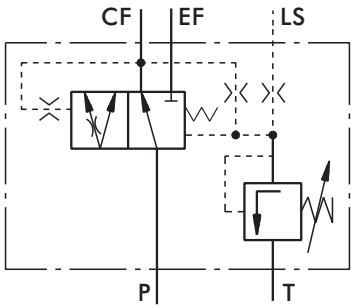
The Priority Valves PRT...160 have a built-in pilot pressure relief valve, which protects the steering unit against excessive pressure. The pilot pressure relief valve operates with the Shuttle of the Priority valve to limit the maximum steering pressure P-T measured across the ports of the steering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



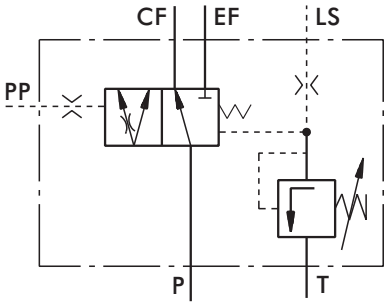

Static signal
PRT 160/...

## SPECIFICATION DATA

| Parameters | | Type PRT(D), PRTE | | |
|---|---|---|---|---|
| Rated Flow | lpm [GPM] | 160 [42.3] | | |
| Control Spring Pressure | bar [PSI] | 4 [58] | 7 [101.5] | 10 [145] |
| Max. Pressures in Oil Ports: | | | | |
| | P, EF | 350 [5076] | | |
| bar [PSI] | CF | 210 [3045] | | |
| | LS | 210 [3045] | | |
| | PP | 210 [3045] | | |
| | T | 15 [217] | | |
| Standard Relief Valve Pressure Settings | bar [PSI] * | 175 [2540] | | |
| Weight | kg [lb] | 4,4 [9.70] | | |




Dynamic signal
PRTD 160/...

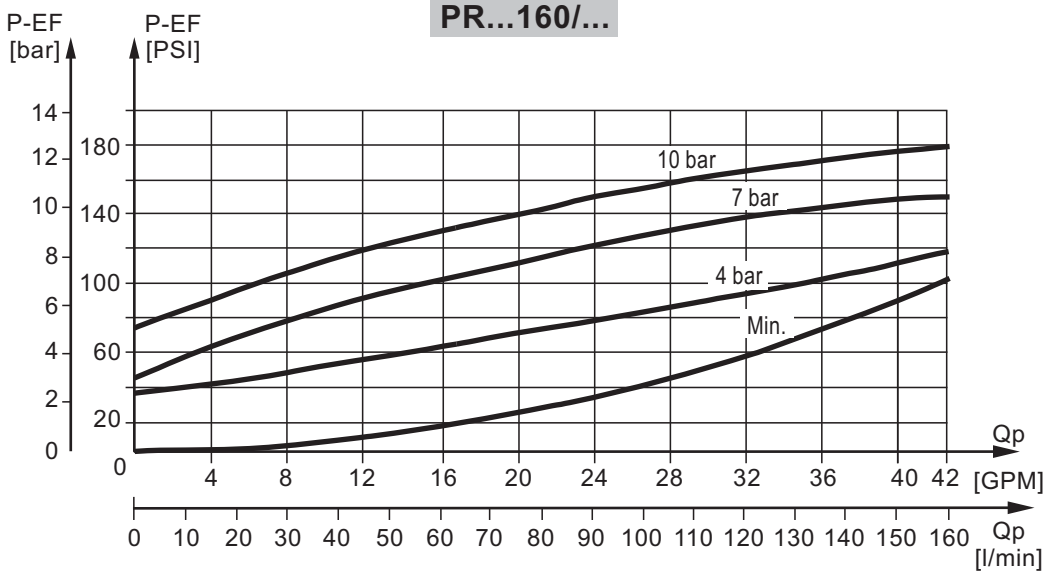



Static signal with External Pilot
PRTE 160/...

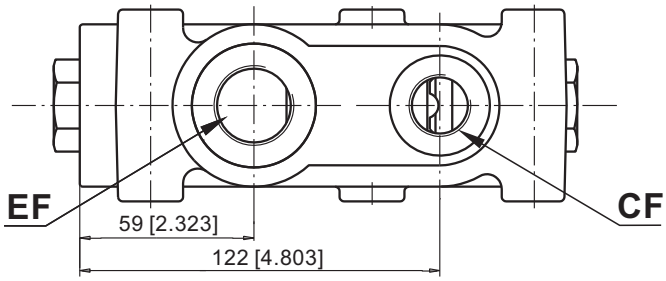
* - Adjusted valve pressure from 80 bar [1160 PSI] to 210 bar [3045 PSI] upon customer request.

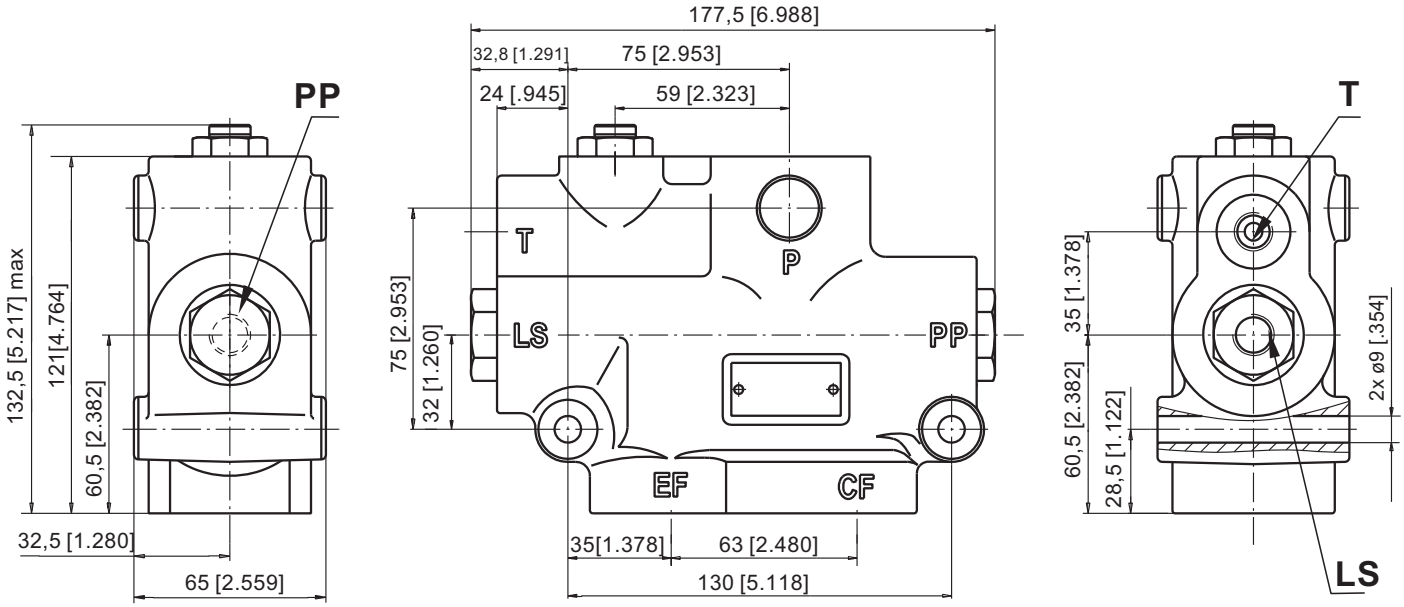
**P** - pump, **EF** - excess flow, **CF** - control flow (first priority oil flow),
**LS** - load sensing, **T** - tank, **PP** - pilot pressure

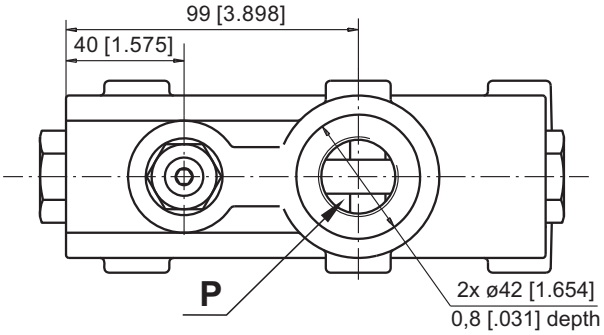
## PR...160/...



## DIMENSIONS AND MOUNTING DATA - PRT(D)(E)160/...




| code | Ports - P, EF Thread | Port - CF Thread | LS, PP, T - Ports |
|---|---|---|---|
| - | G3/4<br>20,5 [.81] depth | G1/2<br>18,5 [.73] depth | G1/4<br>12,5 [.49] depth |
| M | M27x2<br>20,5 [.81] depth | M18x1,5<br>18,5 [.73] depth | M12x1,5<br>12,5 [.49] depth |
| A | 1 1/16 - 12 UN<br>O-ring 20,5 [.81] depth | 3/4 - 16 UNF<br>O-ring 18,5 [.73] depth | 7/16 - 20 UNF<br>O-ring 12,5 [.49] depth |

mm [in]

## ORDER CODE

| | 1 | 2 | 3 | | 4 | | 5 | 6 | 7 |
|---|---|---|---|---|---|---|---|---|---|
| **P R** | | | | **/** | | **-** | | | |

**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 Dynamic signal |
| **E*** | - with Static signal and External Pilot |

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

| | | | |
|---|---|---|---|
| **40** | **80** | **120**** | **160**** |

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

| | | |
|---|---|---|
| **4** | **7** | **10** |

**Pos.5 - Ports**

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

**Pos.6 - Option** [Paint]***

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

**Pos.7 - Design Series**

omit - Factory specified

**Notes:** * For PRT 120/... and PRT 160/... only
** For PRT only
*** Colour at customer's request.

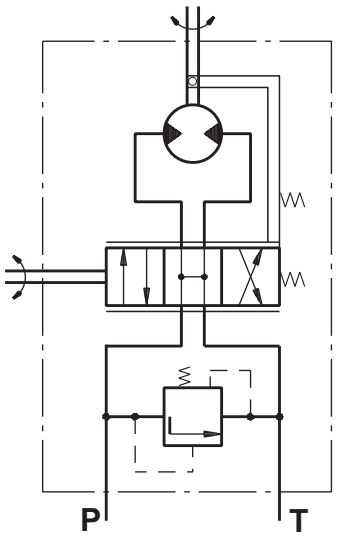
The priority valves are mangano-phosphatized as standard.

# TORQUE AMPLIFIERS TYPE UVM...



The M+S Hydraulic 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.



UVM...

The totally transferred power in terms of output torque is up to 1,1 kW [1.47 HP].

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 case of engine (pump) failure.

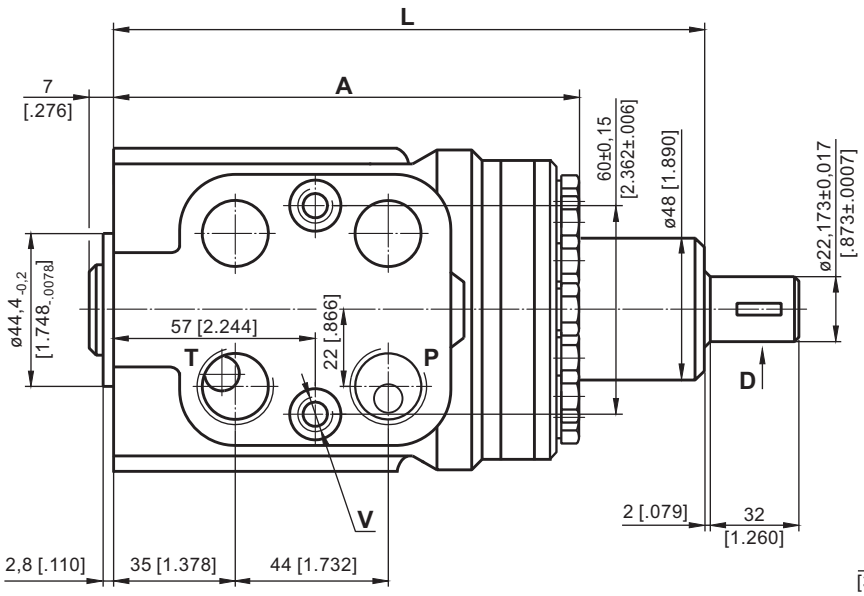
## SPECIFICATION DATA

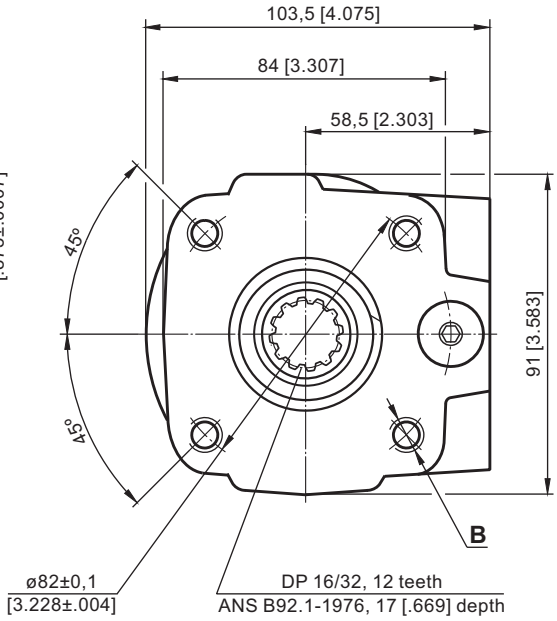
| Parameters | | Type | |
|---|---|---|---|
| | | **UVM 100** | **UVM 160** |
| Displacement | $cm^3/rev$ [$in^3/rev$] | 99,0 [6.04] | 158,4 [9.67] |
| Rated Flow* | lpm [GPM] | 10 [2.6] | 16 [4.2] |
| Rated Pressure** | bar [PSI] | 70 [1015] | 70 [1015] |
| Input Torque | daNm [lb-in] | 0,35...0,5 [31...44] | 0,35...0,5 [31...44] |
| Max. Input Torque | daNm [lb-in] | 20 [178] | 20 [178] |
| Torque Output at 70 bar [1015 PSI] | Nm [lb-in] | 80 [708] | 120 [1062] |
| Pressure Drop between P and T at Rated Flow | bar [PSI] | 1... 2 [14.5...29] | 1,6...2,5 [23.2...36.3] |
| Max. Speed of Rotation at Rated Flow and Pressure | RPM | 100 | 100 |
| Max. Continuous Pressure in Line T | bar [PSI] | 20 [290] | 20 [290] |
| Weight | kg [lb] | 5,8 [12.8] | 6,2 [13.7] |

* Rated Flow at 100 RPM

** Pressure Settings are at Rated Flow (as in the table ) and viscosity 21 $mm^2/s$ [105 SUS] at 50° C [122°F].

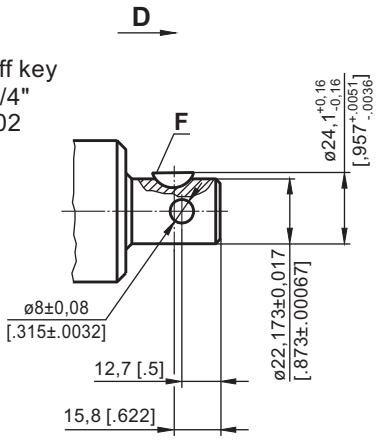
## DIMENSIONS and MOUNTING DATA




| Dimensions | | Type | |
|---|---|---|---|
| | | UVM 100 | UVM 160 |
| **A** | mm [in] | 143,3 [5.64] | 151,3 [5.96] |
| **L** | mm [in] | 181,2 [7.13] | 189,2 [7.45] |

**F** : Woodruff key
3/16" x 3/4"
SAE J502




| code | Ports - P, T Thread | Column Mounting Thread - B | Valve Mounting Thread - V |
|---|---|---|---|
| **-** | G1/2<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| **M** | M22x1,5<br>15 mm [.59 in] depth | 4 x M10<br>18 mm [.71 in] depth | 2 x M10x1<br>16 mm [.63 in] depth |
| **A** | 3/4 - 16 UNF<br>O-ring 15 mm [.59 in] depth | 4 x 3/8 - 16 UNC<br>15,7 mm [.62 in] depth | 2 x 3/8 - 24 UNC<br>14,2 mm [.56 in] depth |

mm [in]

## ORDER CODE

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **U V M** | | | | |

**Pos.1 - Displacement code**

| | |
|---|---|
| **100** | - 99,0 cm³/rev [6.04 in³/rev] |
| **160** | - 158,4 cm³/rev [9.67 in³/rev] |

**Pos.2 - Ports**

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

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

| | |
|---|---|
| omit | - No Paint |
| **P** | - Painted |
| **PC** | - Corrosion Protected Paint |
| **PS** | - Special Paint** |
| **PCS** | - Special Corrosion Protected Paint** |

**Pos.4 - Design Series**

omit - Factory specified

**NOTES:** * Colour at customer's request.
** Non painted feeding surfaces, colour at customer's request.

The steering units are mangano - phosphatized as standard.

# STEERING COLUMNS TYPE KK...



The M+S Hydraulic KK Steering Columns transfer the torque from the steering wheel of the vehicle to the HKU, HKUS or other steering units of the same class. The KK steering columns consist of a pipe in which the control shaft is centred.

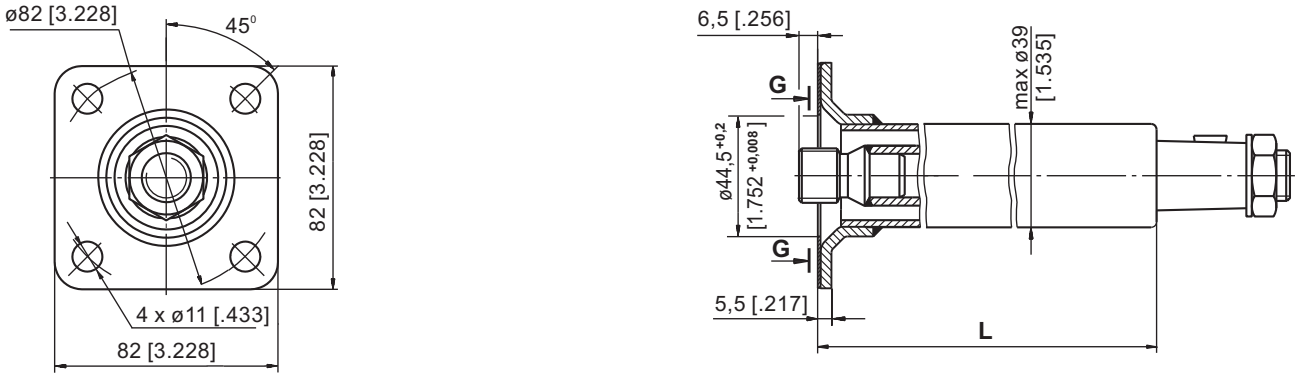
Permissible loads of the steering column are as follows:

| | | |
|---|---|---|
| Max. torque applied to the steering wheel | 24 daNm | [2124 lb-in ] |
| Max. bending moment | 20 daNm | [1770 lb-in] |
| Max. axial load | 100 daN | [225 lbs] |

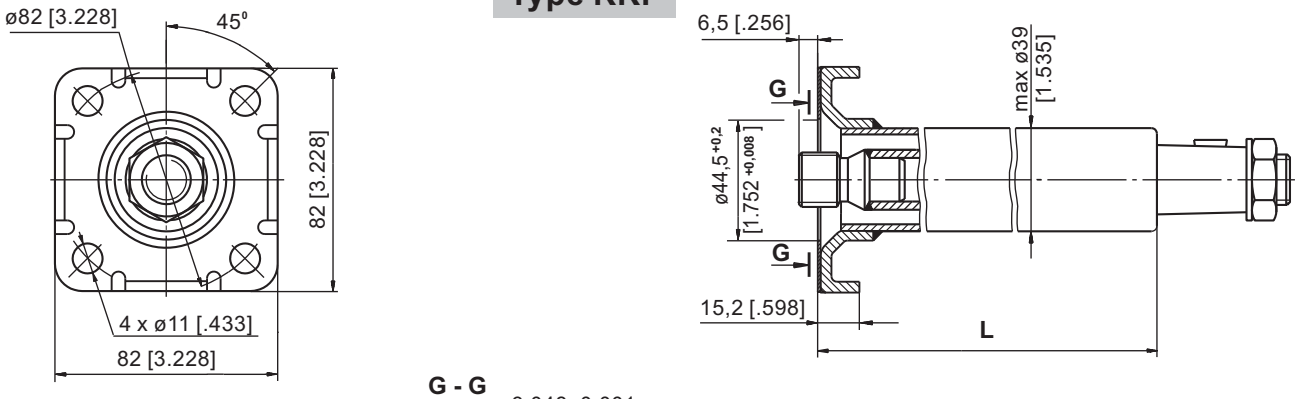
The steering column must be additionally supported when the length L exceeds 150 mm [5.91 in].

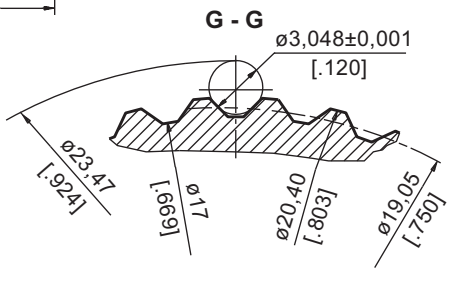
## DIMENSIONS AND MOUNTING DATA

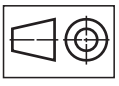
### Type KK




### Type KKF



mm [in]

## SPECIFICATION DATA

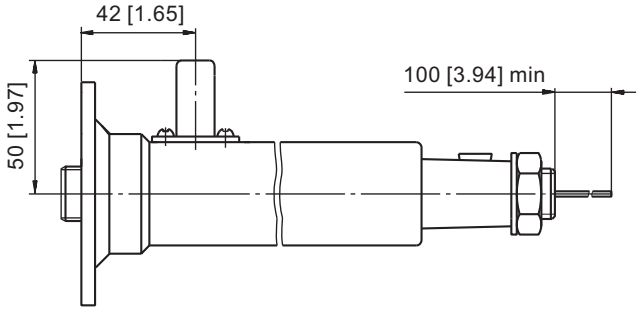
| Involute Spline Data | | |
|---|---|---|
| Modul | m | 1.5875 |
| Number of Teeth | z | 12 |
| Pressure Angle | $\alpha$ | 30° |
| Diametral Pitch | DP | 16/32 |

| Parameters | | Type | | | | |
|---|---|---|---|---|---|---|
| | | KK 75 | KK 150 | KK 390 | KK 441 | KK 750 |
| L | mm [in] | 78 [3.07] | 168,2 [6.62] | 393 [15.47] | 441 [17.36] | 777,8 [30.62] |
| Weight | kg [lb] | 0,75 [1.65] | 1,1 [2.43] | 1,9 [4.19] | 5,05 [11.13] | 3,3 [7.28] |

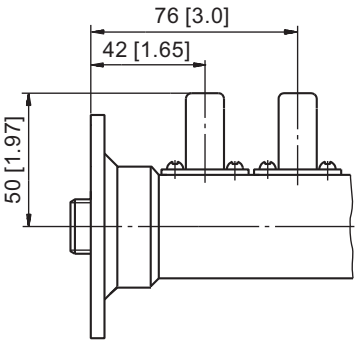
**Note:** The length L depends on the transport vehicle construction.
For more information regarding other lengths and shaft versions, please refer to M+S Hydraulic.

# SOUND SIGNAL CONNECTION

## E Option



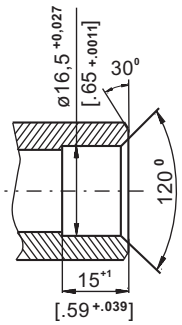

## EE Option

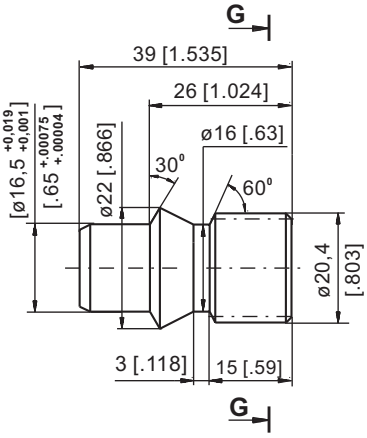


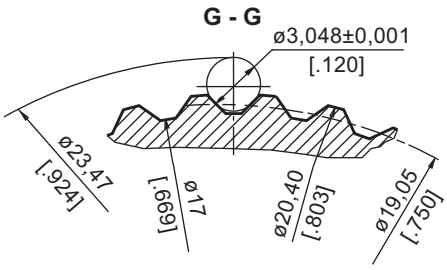

## Shaft End Part

Order No: 46415 001 00

| Involute Spline Data | | |
|---|---|---|
| Modul | m | 1.5875 |
| Number of Teeth | z | 12 |
| Pressure Angle | $\alpha$ | 30° |
| Diametral Pitch | DP | 16/32 |

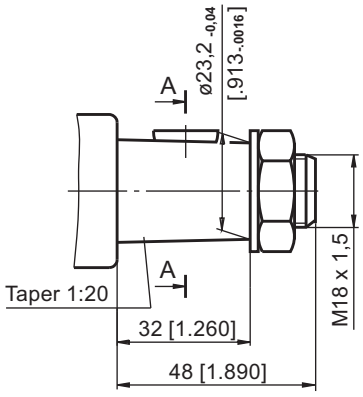


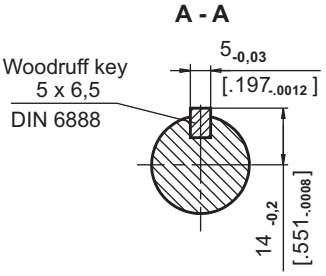



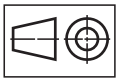




# SHAFT VERSIONS

## TYPE I

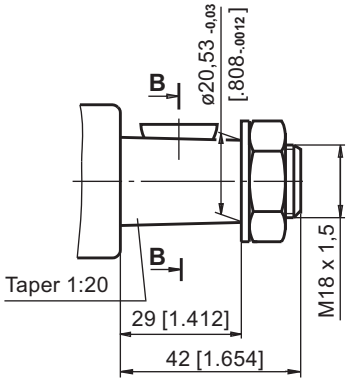


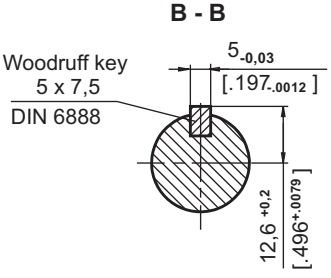



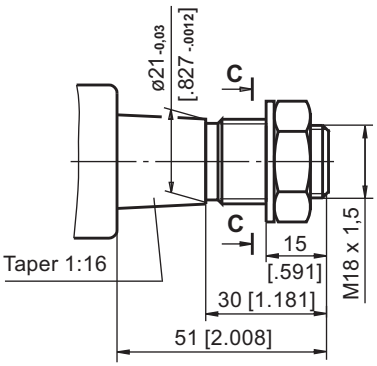
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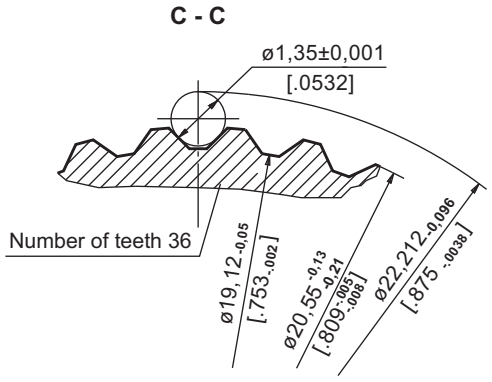
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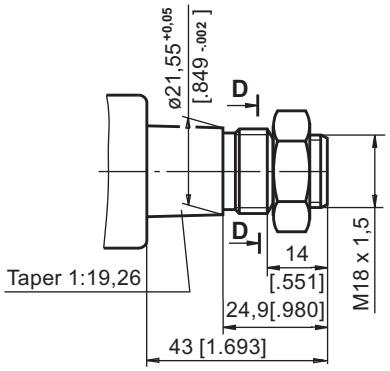



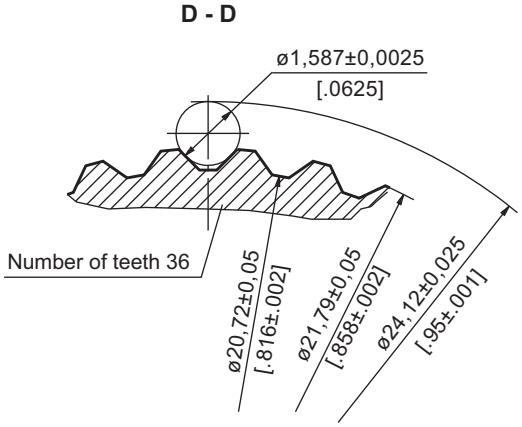
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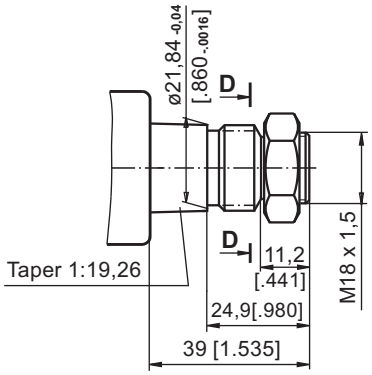



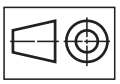

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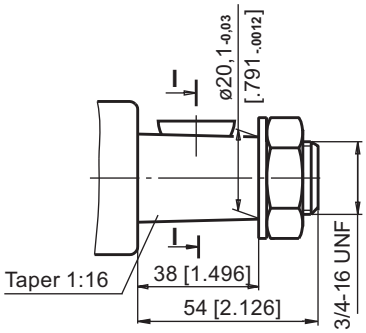

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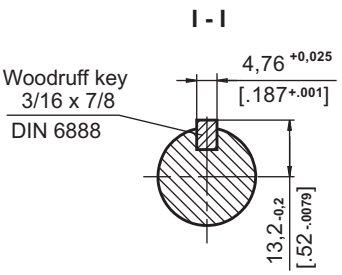


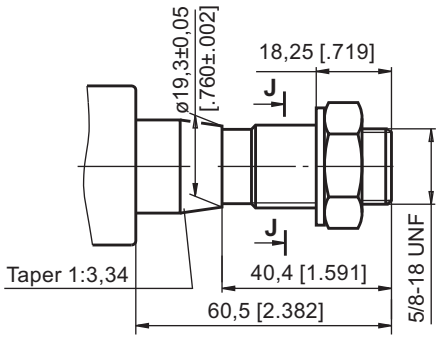
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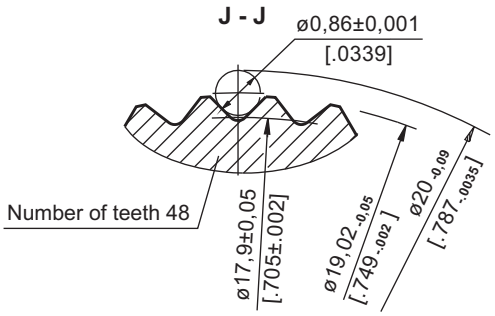
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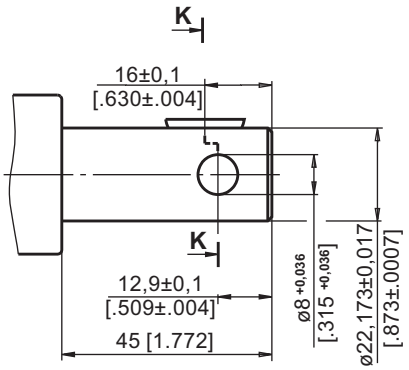



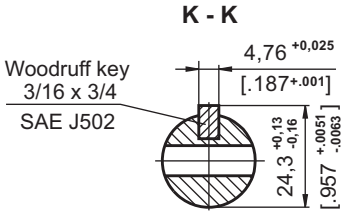
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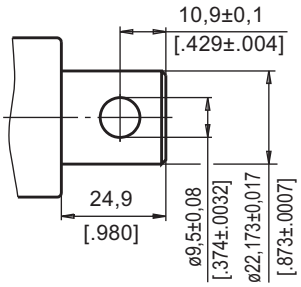




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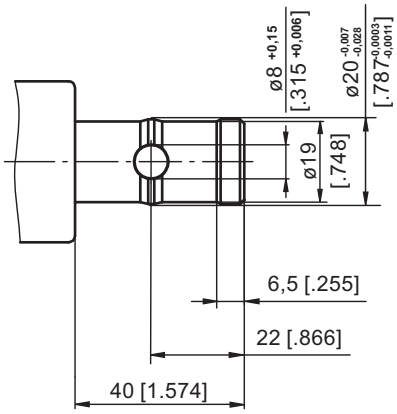


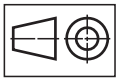




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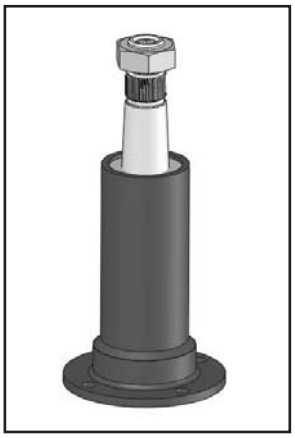

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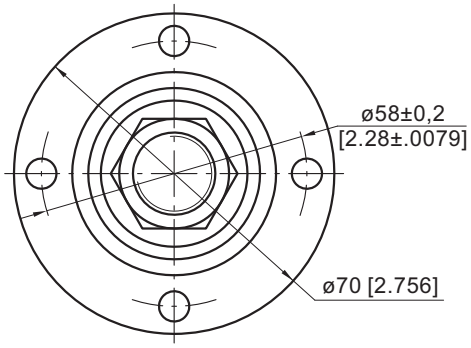
mm [in]

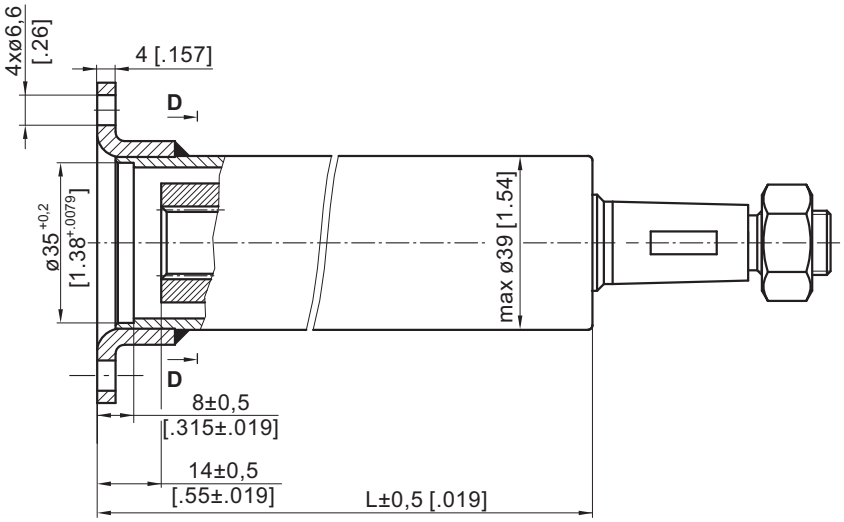
# STEERING COLUMNS TYPE KKM...



The M+S Hydraulic KKM Steering Columns transfer the torque from the steering wheel of the vehicle to the HKUM or other steering units of the same class. The KKM steering columns consist of a pipe in which the control shaft is centred.

## DIMENSIONS AND MOUNTING DATA

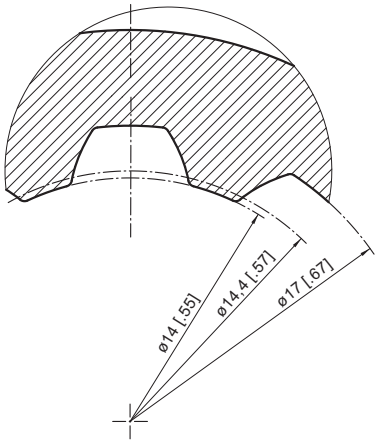



**D-D**

5:1

Involute spline data
A17x14 DIN5482



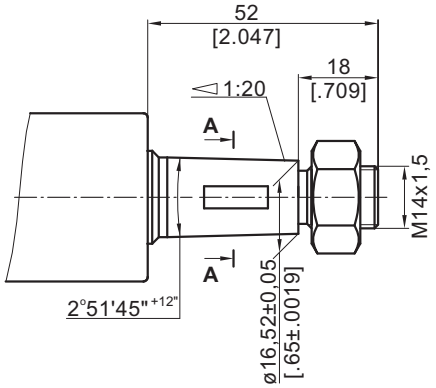

## SPECIFICATION DATA

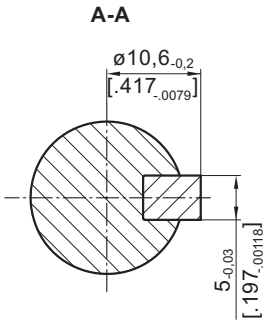
| Length | Type | |
|---|---|---|
| | KKM 165 | KKM 355 |
| L, mm [in] | 165 [6.496] | 355 [13.976] |

**Note:** The length L depends on the transport vehicle construction. For more information regarding other lengths and shaft versions, please refer to M+S Hydraulic.

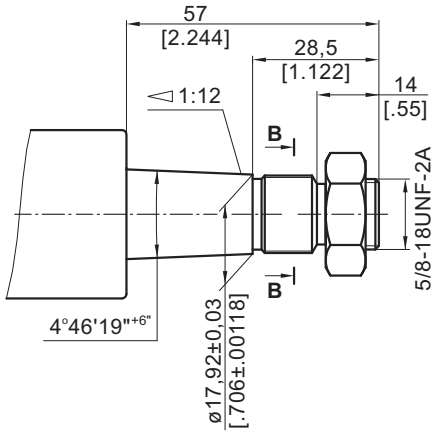
# SHAFT VERSIONS

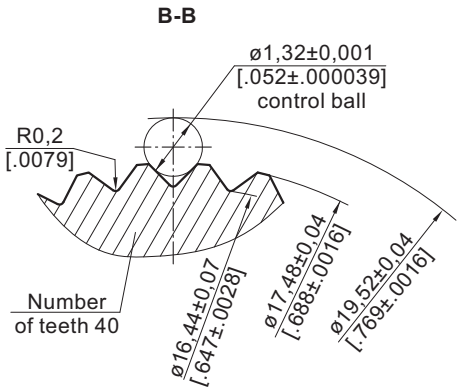
## TYPE S1



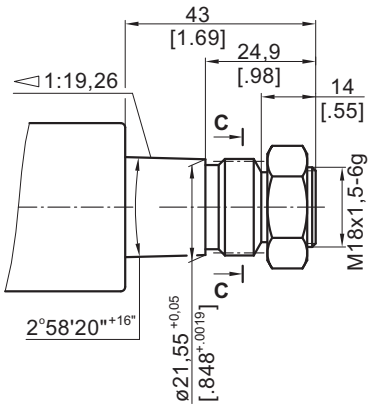



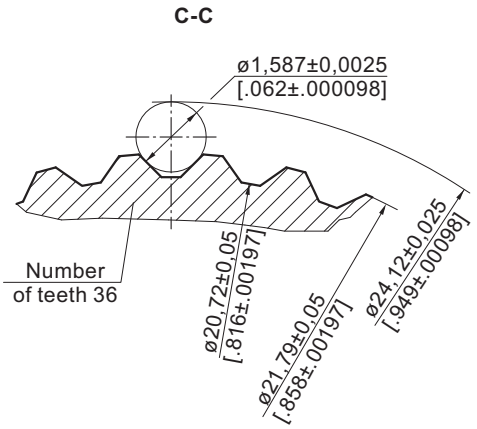

## TYPE S2

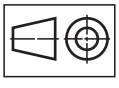



## TYPE S3



mm [in]

## ORDER CODE KK

| | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| **K K** | | | | | | |

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, XIII**

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

omit - without electric signal connection
**E** - with one electric signal connection
**EE*** - with two electric signal connection

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

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

Pos.6 - **Design Series**

omit - Factory specified

**Notes:** * For steering column's length L>150 mm [5.9 in] only.
** Colour at customer's request.

The steering columns are yelow galvanized as standard.

## ORDER CODE KKM

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| **K K M** | | | | |

Pos.1 - **Length, mm [in]** (acc. to table)

Pos.2 - **Shaft Extensions**

**S1, S2, S3**

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

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

Pos.4 - **Design Series**

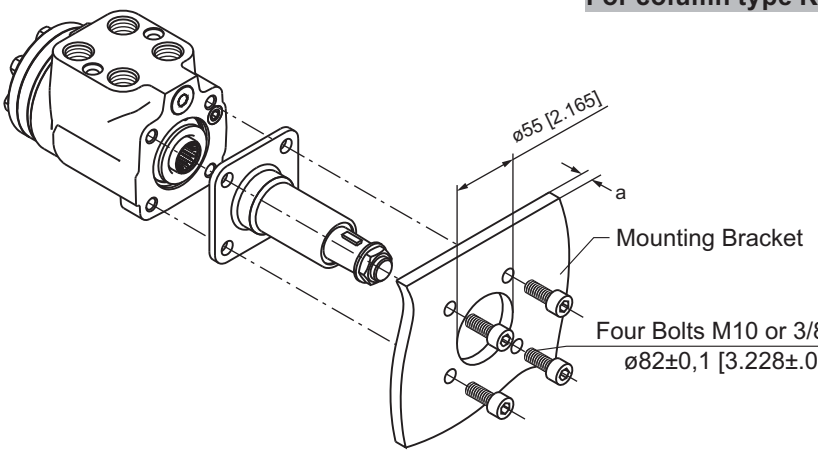
omit - Factory specified

**Notes:** * Colour at customer's request.

The steering columns are yelow galvanized as standard.
The main technical features correspond to the standard steering columns type KK.

# INSTALLING

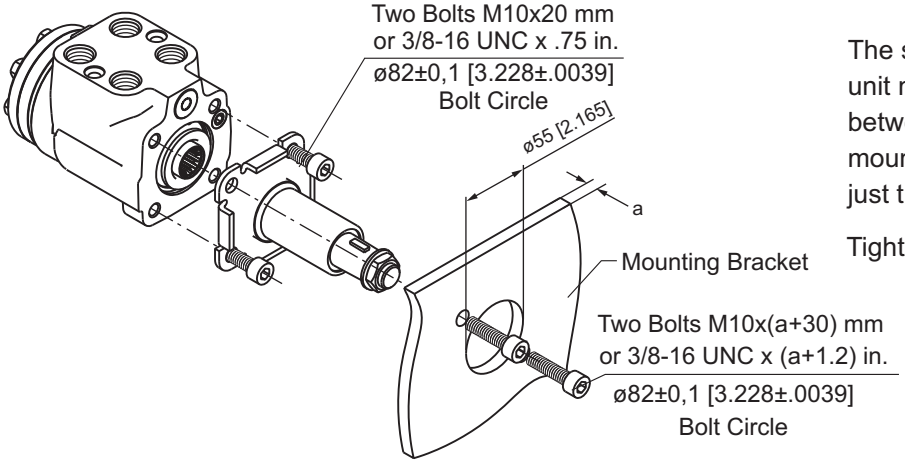
## For column type KK




For assembling the Steering column to the Steering units use four bolts through mounting bracket.

Tightening torque for bolts 3 daNm [266 lb-in]

## For column type KKF




The steering column type KKF and the steering unit must be assembled with nothing standing between them. Use two bolts through mounting bracket and two bolts through just the steering column.

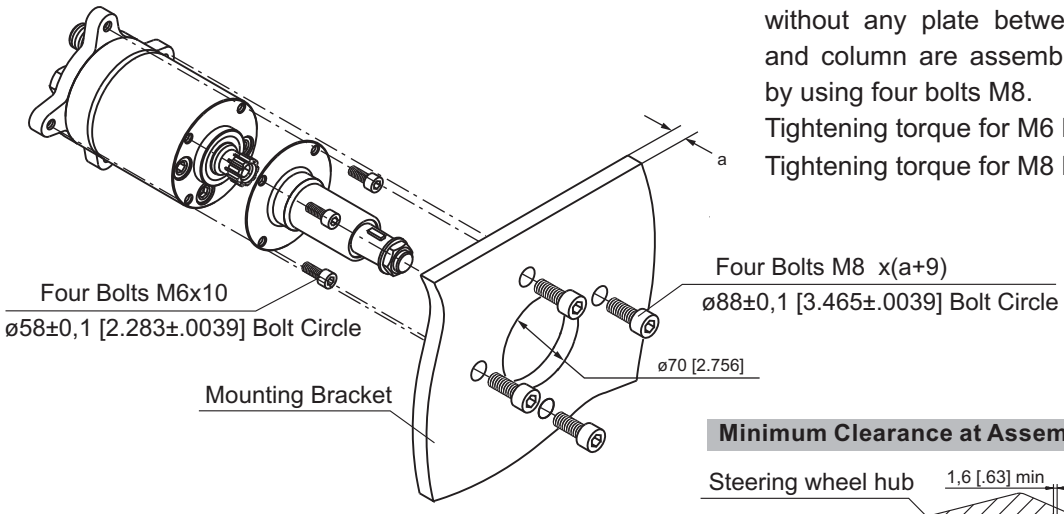
Tightening torque for bolts 3 daNm [266 lb-in]

## For column type KKM

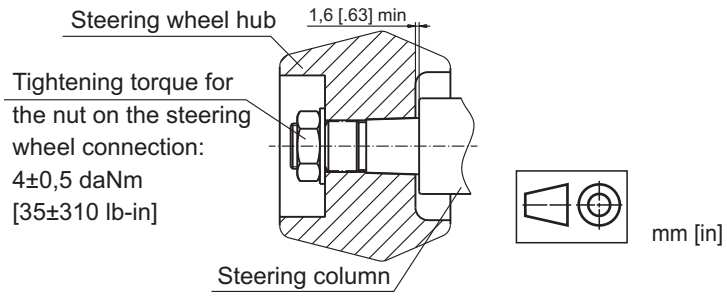
The steering column type KKM must be assembled directly to the steering unit by using four bolts M6 without any plate between them. The steering unit and column are assembled to the mounting bracket by using four bolts M8.

Tightening torque for M6 bolts 1,5 daNm [133 lb-in]

Tightening torque for M8 bolts 2,0 daNm [177 lb-in]




### Minimum Clearance at Assembly



# 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 [*lb-in*].

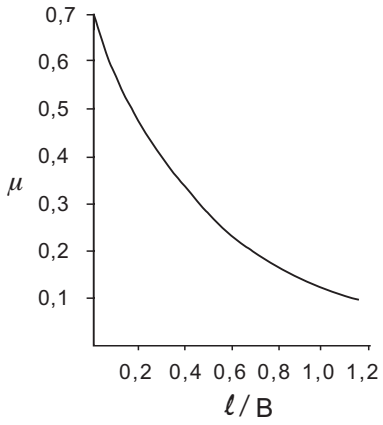
G = Vehicle weight on steered axle daN [*lbs*] (use maximum estimated overload weight).

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

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

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

**Chart № 1**




Rubber tyres on dry concrete.

**Diagram № 1**

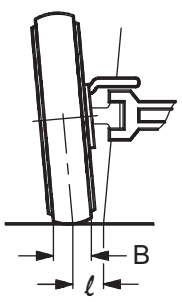
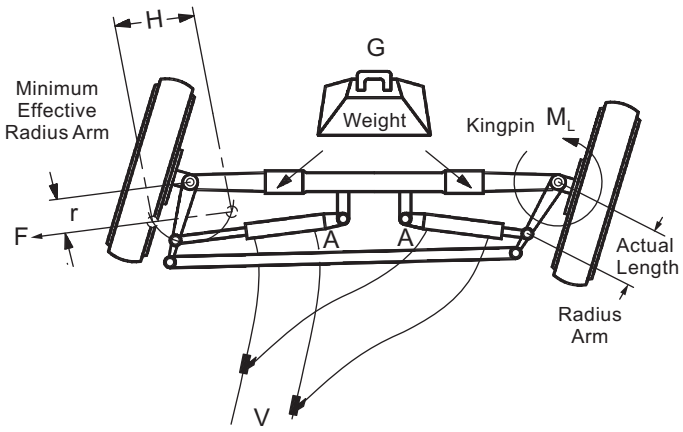



**Diagram № 2**




**STEP TWO:**
**Calculate approximate cylinder; force-area-stroke-volume.**

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

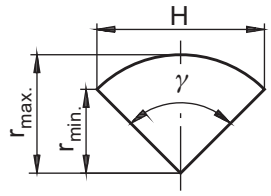
F = Force required daN [*lbs*] to steer axle.

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

r = Effective radius Arm mm [*in*] 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 № 2 and Chart № 2).

**Chart № 2**

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




**STROKE**
H = Stroke, cm [*in*].
Calculate stroke of cylinder using Diagram № 2 and Chart № 2 as shaft.

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

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

A = Cylinder area for axle cylinder set, $cm^2$ [$in^2$].

F = Force required from step two force formula, daN [*lbs*].

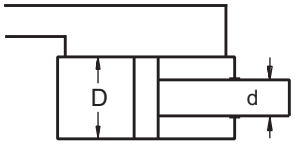
$\Delta$P = Hydraulic pressure bar [*PSI*] use following percentage of relief valve setting by amount of load on steered axle. Severe load 25% - medium load 55% - no load 75% .

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

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

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

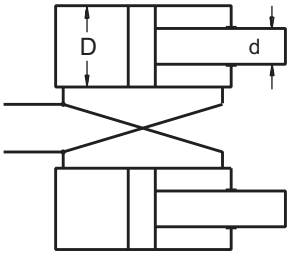
**Differential Cylinder**




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

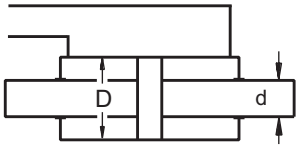
Note: $\left(\frac{d}{D}\right)^2 \leq 0{,}15$

**Cross Connected Cylinders**



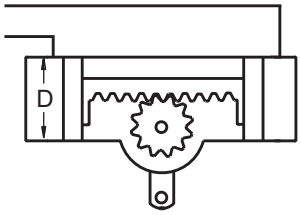

$$D = \sqrt{\frac{2A}{\pi} + \frac{d^2}{2}}$$

**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, $cm^3$ [$in^3$].
H = Stroke, cm [*in*].
A = Area, $cm^2$ [$in^2$].
**Note:** For differential cylinders it is important to calculate average cylinder volume for step three using below formula.

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

**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, $cm^3$/rev [$in^3$/*rev*].
V = Volume of oil, $cm^3$ [$in^3$].
*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 circuity 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, $cm^3$ [$in^3$].
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.**

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

Q = Steering circuit flow, lpm [*GPM*].
$V_D$ = Unit displacement, $cm^3$/rev [$in^3$/*rev*]
N = Steering wheel input speed, RPM.
Recommended steering speed is 50 to 100 *RPM*.

Many variables are involved in sizing the pump. We suggest that the manufacturer should test and evaluate for the 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 $mm^2$/s [100 SUS]. Viscosity range 10 - 300 $mm^2$/s [60 - 1500 SUS].

- **Temperature**

Normal operating temperature range from +30°C [+85°F] to +60°C [140°F].
Minimum operating temperature -40°C [-40°F].
Maximum operating temperature +80°C [+176°F].
**Note:** Extended periods of operation at temperature of 60°C and above will greatly reduce the life of the oil due to oxidation and will shorten the life of the 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 $\mu m$ nominal (40 - 50 $\mu m$ absolute) or finer is recommended.

In extremely dusty conditions filtration of 10 $\mu m$ 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 $\mu m$ 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. Some or all radial and axial loads must be absorbed by the steering column or other operating devices supplied by the vehicle manufacturer.

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.

## CONVERSIONS

### to convert inches and millimeters:

1 in = 25,4 mm
1 mm = .03973 in

### to convert gallons per minute and liters per minute:

1 GPM = 3,785 lpm
1 lpm = .2642 GPM

### to convert pounds per square inch and bar:

1 PSI = 0,0689 bar
1 bar =14.51 PSI

### to convert pounds-inch and newton-meters:

1 lb-in = 0,113 Nm
1 Nm = 8.85 lb-in

## TORQUE TIGHTENING VALUES

### Fluid connections

| Fluid connection | Max. tightening torque daNm [lb-in] | | | |
|---|---|---|---|---|
| | metal edge | copper washer | aluminum washer | O - ring |
| G 1/4 | 4,0 [350] | 3,5 [309] | 3,5 [309] | |
| G 3/8 | 7,0 [620] | 4,5 [398] | 5,0 [442] | |
| G 1/2 | 10,0 [885] | 5,5 [486] | 8,0 [708] | |
| G 3/4 | 18,0 [1593] | 9,0 [796] | 13,0 [1150] | |
| M 10 x 1 | 4,0 [350] | 2,0 [180] | 3,0 [265] | |
| M 18 x 1,5 | 8,0 [708] | 5,5 [486] | 7,0 [620] | |
| M 22 x 1,5 | 10,0 [885] | 6,5 [575] | 8,0 [708] | |
| 7/16 - 20 UNF | | | | 2,0 [180] |
| 9/16 - 18 UNF | | | | 5,0 [442] |
| 3/4 - 16 UNF | | | | 6,0 [531] |
| 7/8 - 14 UNF | | | | 9,0 [796] |
| 1 1/16 - 12 UN | | | | 12,0 [1062] |

### Mounting bolts

| Mounting bolts | Tightening torque daNm [lb - in] |
|---|---|
| 3/8 - 16 UNC | 3,0 ± 0,5 [230 ÷ 310] |
| M 10 x 1 | 6,5 ± 0,5 [540 ÷ 620] |
| M 10 | 3,0 ± 0,5 [230 ÷ 310] |

# WARRANTY

M+S Hydraulic warrants, that its products, supplied directly to original equipment manufacturer, authorized distributor or other customer, will be free of defects in material or workmanship at the time of shipment from M+S Hydraulic and will conform to the products technical documentation (drawings and specifications) under sale agreement with Buyer.

This warranty will apply only to defects appearing within applicable Warranty period, mentioned below. If Buyer notifies M+S Hydraulic within the Warranty period about any such defects, M+S, at its sole option will replace or repair the defective products or their parts found by M+S Hydraulic to be defective in material or workmanship.

THE FOREGOING LIMITED WARRANTY IS AVAILABLE ONLY IF “M+S HYDRAULIC” IS PROMPTLY NOTIFIED IN WRITTEN 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. To facilitate the inspection, M+S Hydraulic may require return of the product/part, which Buyer claims to be defective.

M+S Hydraulic shall not be liable for labor costs or any other expenses incurred during the disassembling or reinstalling of the product/part.

In case the claimed products are returned to M+S Hydraulic in bad condition: dirty, disassembled, with damaged or missing parts during transportation, the warranty will be considered as not applicable and the products will not be liable to repair.

**Warranty periods**

**New products:** The Warranty period is limited to 24 consecutive months (2 years) from the date of production of the product.

**Repaired products:** If the product is repaired in M+S Hydraulic during its warranty period, the warranty period of the repaired item shall continue for the balance of original Warranty period or for a period equal to 50% of the original new product Warranty period, whichever is later.

**Spare parts:** The Warranty period for Spare parts is 12 consecutive months (1 year) from the dispatch date of such parts from M+S Hydraulic.

LIMITATION OF LIABILITY M+S Hydraulic's liability for claim of any kind, for loss or damage arising out of, connected with or resulting from an order, or from the performance or branch thereof, or from the design, manufacture, sale delivery, operation or use of any of its products shall be limited to, at M+S 's sole option, replacement, repair of any defective product or the issuance of a credit to Customer against any future purchases. Cash refunds will not be made under any circumstances and Customer will not be entitled to recover any damages of any kind against M+S Hydraulic, including but not limited to incidental or consequential damages, whether direct or indirect, known or unknown, foreseen or unforeseen.



M+S HYDRAULIC

68, Kozloduy St., 6100 Kazanlak, Bulgaria
Tel.: ++359 431 65167
++359 431 64271
Fax: +359 431 64114
E-Mail: msh@ms-hydraulic.com
URL: http://www.ms-hydraulic.com