HYDROSTATIC STEERING UNITS & ACCESSORIES

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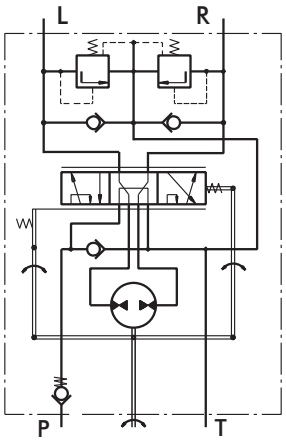
HYDROSTATIC STEERING UNITS TYPE XY.../1

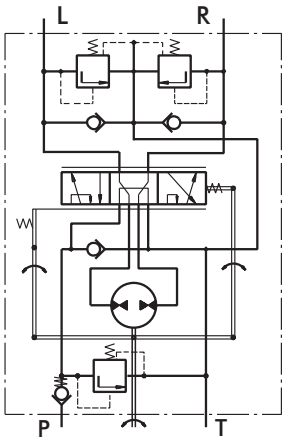
The M+S Hydraulic Hydrostatic Steering units are used in low-speed vehicles which driving speed does not exceed 60 km/h - such as: building machines, fork-lift trucks, harvesting machines, off-highway equipment and others. These hydraulic units amplify the torque to the steering wheels, with no need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



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

SPECIFICATION DATA

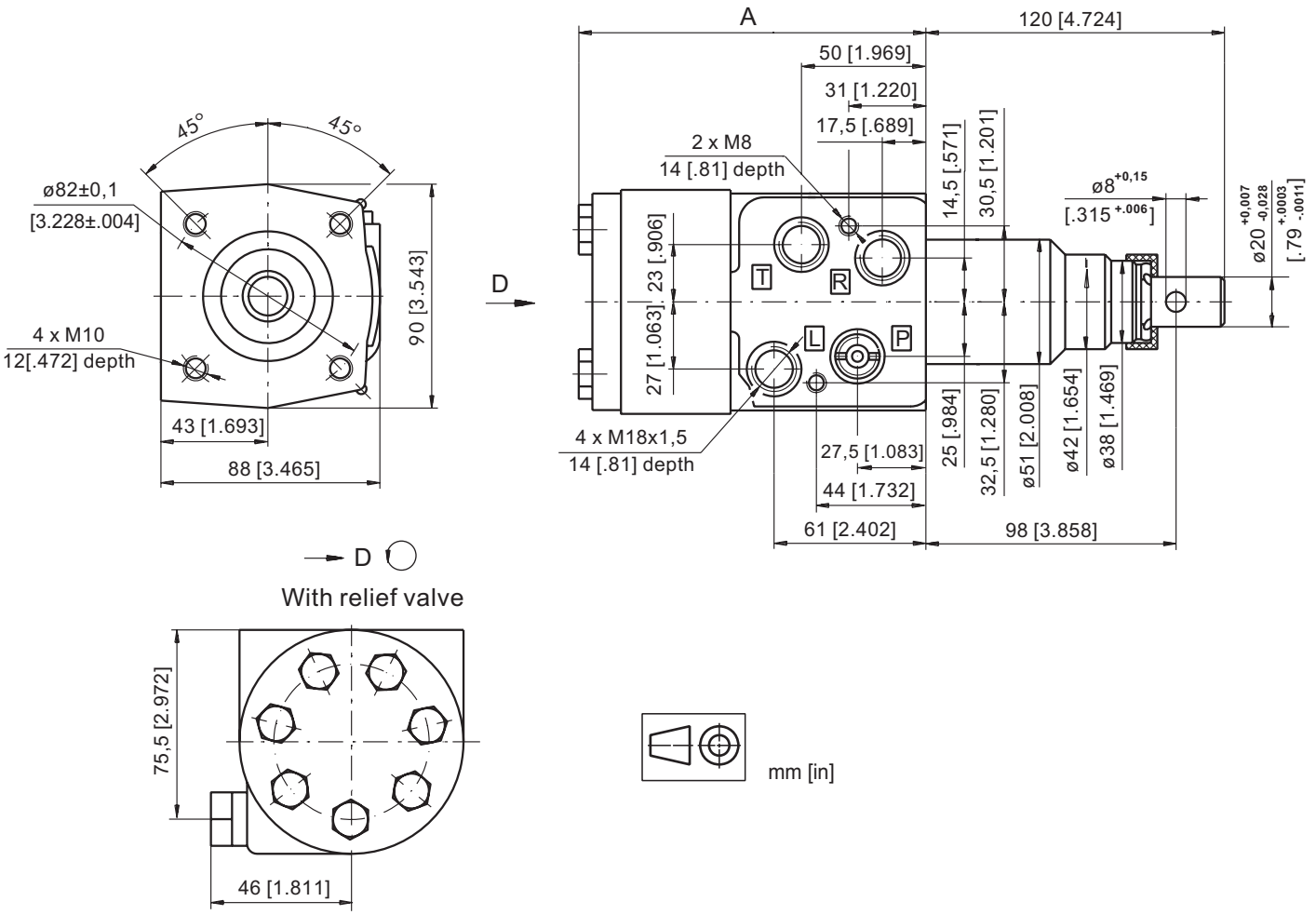
Parameters	Type			
	XY 85.../1	XY 120.../1	XY 145.../1	
Displacement cm^3/rev [in^3/rev]	84 [5.13]	120 [7.32]	144 [8.79]	
Rated Flow* lpm [GPM]	9 [2.4]	12 [3.2]	15 [4.0]	
Rated Pressure bar [PSI]	150 [2175]			
Relief Valve Pressure Settings** bar [PSI]	80 [1160]	100 [1450]	125 [1810]	150 [2175]
Shock 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
X Y		-	/	1		

Pos.1 - Displacement code

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

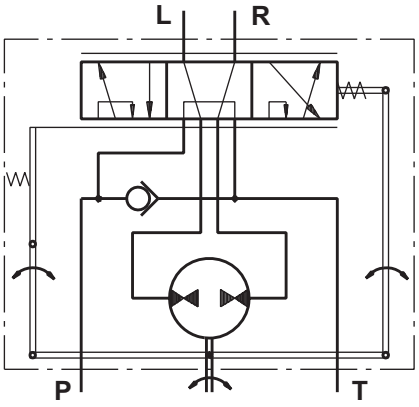
Pos.5 - Design Series

omit - Factory specified

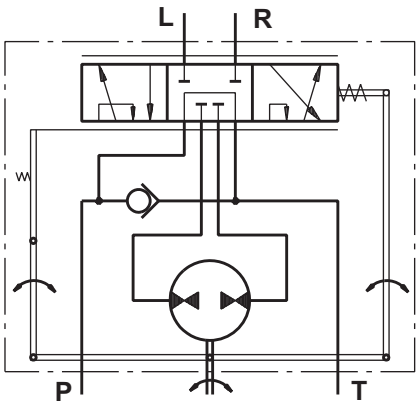
NOTES:
* Colour at customer's request.
The steering units are mangano-phosphatized as standard.

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

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



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



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

SPECIFICATION DATA

Parameters		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	7.56	9.67	198	247,5	316,8	396	495	623,6	793	990
	[in^3/rev]	[2.42]	[3.0]	[4.0]	[4.83]	[6.04]	[123,8]	[158,4]	[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]

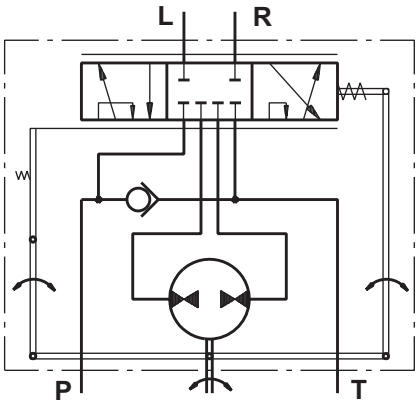
* Inlet flow providing maximum speed of rotation:
- 100 RPM - from HKU40 to HKU630;
- 87 RPM - for HKU800;
- 70 RPM - for HKU1000.

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 50^0F [10^0C] 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.



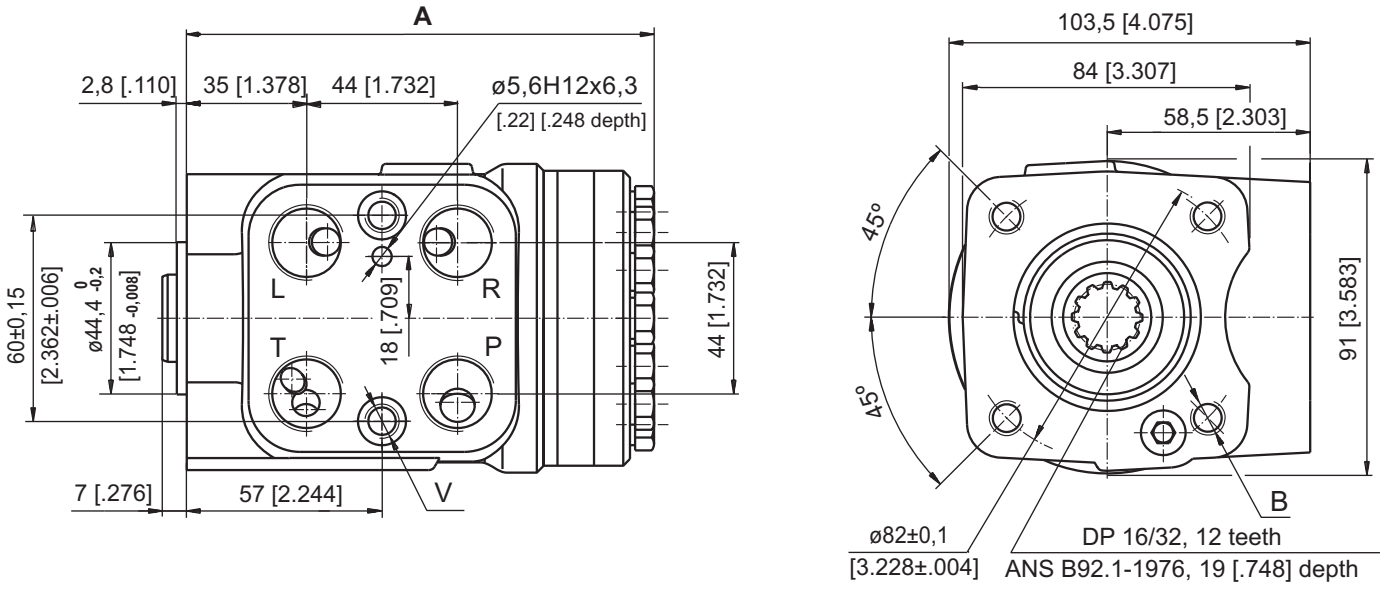
"Closed Center - Non Load Reaction"
Version 7 - HKU.../7

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



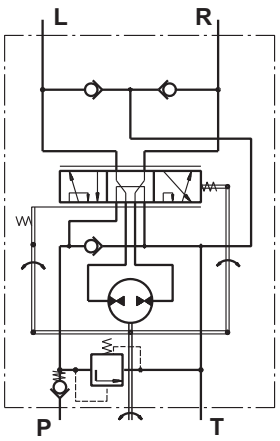
mm [in]

code	Ports - P, T, R, L Thread	Column Mounting Thread - B	Valve Mounting Thread - V
-	G1/2 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16[.63] depth
M	M22x1,5 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16 [.63] depth
A	3/4 - 16 UNF O-ring 17 [.67] depth	4 x 3/8 - 16 UNC 15,7 [.62] depth	2 x 3/8 - 24 UNF 14,2 [.56] depth
BA*	9/16 - 18 UNF O-ring 17 [.67] depth	4 x 3/8 - 16 UNC 15,7 [.62] depth	2 x 3/8 - 24 UNF 14,2 [.56] depth

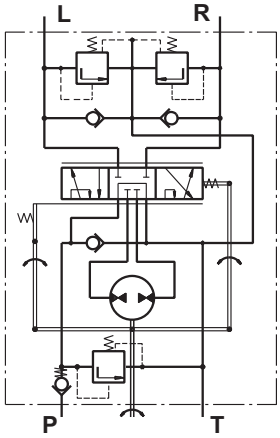
* These threads are for displacements from HKU40 to HKU200 only.

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

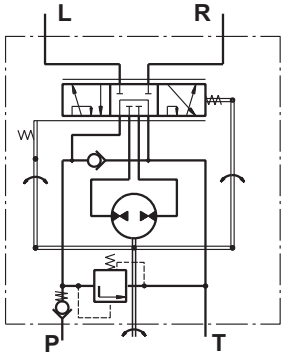
The HKUS Hydrostatic Steering unit is based on the HKU unit but has built-in relief and check valves. Thus M+S Hydraulic achieves one very compact steering unit which reduces the need for additional hydraulic components in the system.



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



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



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

SPECIFICATION DATA

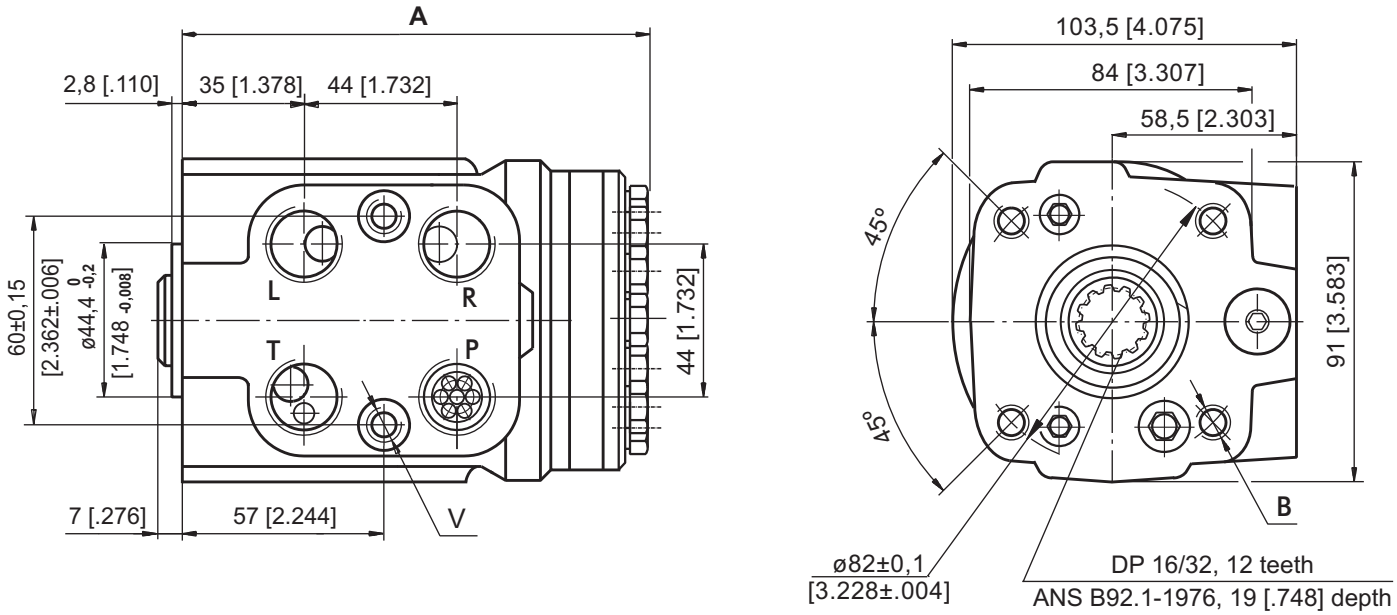
Parameters		Type											
		HKUS 40/3,4,8	HKUS 50/3,4,8	HKUS 63/3,4,8	HKUS 80/3,4,8	HKUS 100/3,4,8	HKUS 125/3,4,8	HKUS 160/3,4,8	HKUS 200/3,4,8	HKUS 250/3,4,8	HKUS 320/3,4,8	HKUS 400/3,4,8	HKUS 500/3,4,8
Displacement	cm^3/rev	39,6	49,5	65,6	79,2	99,0	123,8	158,4	198	247,5	316,8	396	495
	[in^3/rev]	[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 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16[.63] depth
M	M22x1,5 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16 [.63] depth
A	3/4 - 16 UNF O-ring 17 [.67] depth	4 x 3/8 - 16 UNC 15,7 [.62] depth	2 x 3/8 - 24 UNF 14,2 [.56] depth

*Threaded Ports P min 16 [.63] depth for pipe mounting.

ORDER CODE

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

Pos.1 - Displacement code (see Specification Data)

40	-	39,6	[2.42]	cm^3/rev [in^3/rev]
50	-	49,5	[3.00]	cm^3/rev [in^3/rev]
63	-	65,6	[4.00]	cm^3/rev [in^3/rev]
80	-	79,2	[4.83]	cm^3/rev [in^3/rev]
100	-	99,0	[6.04]	cm^3/rev [in^3/rev]
125	-	123,8	[7.56]	cm^3/rev [in^3/rev]
160	-	158,4	[9.67]	cm^3/rev [in^3/rev]
200	-	198,0	[12.10]	cm^3/rev [in^3/rev]
250	-	247,5	[15.10]	cm^3/rev [in^3/rev]
320	-	316,8	[19.30]	cm^3/rev [in^3/rev]
400	-	396,0	[24.20]	cm^3/rev [in^3/rev]
500	-	495,0	[30.20]	cm^3/rev [in^3/rev]
630	-	623,6	[38.05]	cm^3/rev [in^3/rev]
800	-	793,0	[48.40]	cm^3/rev [in^3/rev]
1000	-	990,0	[60.40]	cm^3/rev [in^3/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 Low Gloss Color
- **PC** - 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.

The steering units are mangano-phosphatized as standard.

ORDER CODE

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

Pos.1 - Displacement code (see Specification Data)

40	-	39,6	[2.42]	cm^3/rev [in^3/rev]
50	-	49,5	[3.00]	cm^3/rev [in^3/rev]
63	-	65,6	[4.00]	cm^3/rev [in^3/rev]
80	-	79,2	[4.83]	cm^3/rev [in^3/rev]
100	-	99,0	[6.04]	cm^3/rev [in^3/rev]
125	-	123,8	[7.56]	cm^3/rev [in^3/rev]
160	-	158,4	[9.67]	cm^3/rev [in^3/rev]
200	-	198,0	[12.10]	cm^3/rev [in^3/rev]
250	-	247,5	[15.10]	cm^3/rev [in^3/rev]
320	-	316,8	[19.30]	cm^3/rev [in^3/rev]
400	-	396,0	[24.20]	cm^3/rev [in^3/rev]
500	-	495,0	[30.20]	cm^3/rev [in^3/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 Low Gloss Color
- **PC** - 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.

The steering units are mangano-phosphatized as standard.

HYDROSTATIC STEERING UNIT TYPE HKU.../4PB

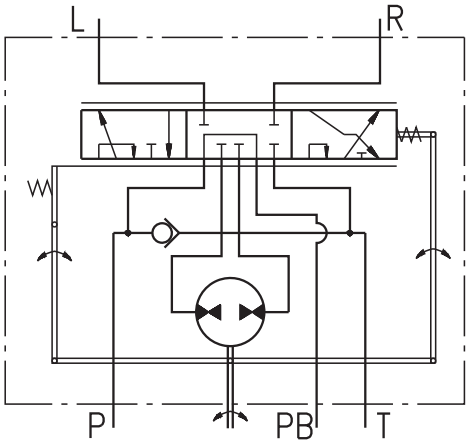
The hydrostatic steering unit is available for steering of medium and large sized transport vehicles such as building and agricultural machines.

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.

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 steering wheel has been turned a part of 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.

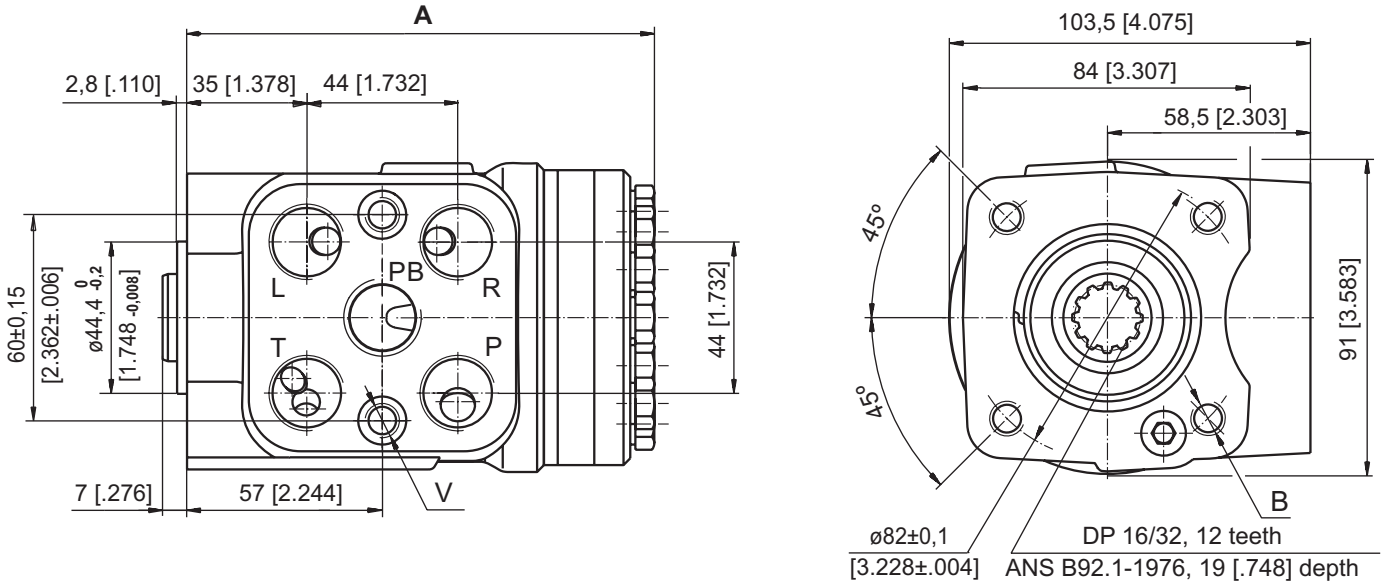


"Open Center - Non Load Reaction"
HKU.../4PB - Power Beyond

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 (Power Beyond) lpm [GPM]	15 [3.96]					
Rated Pressure bar [PSI]	125 [1813]					
Max. Pressure in line PB, bar [PSI]	125 [1813]					
Max. Cont. Pressure in Line T - P_T bar [PSI]	10 [145]					
Max. Torque at Servoamplifying Nm [lb-in]	2,8 (by PT max) [25]					
Max. Torque w/o Servoamplifying Nm [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



mm [in]

code	Ports - P, T, R, L, PB Thread	Column Mounting Thread - B	Valve Mounting Thread - V
-	G3/8 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16 [.63] depth
A	9/16 - 18 UNF O-ring 17 [.67] depth	4x 3/8 - 16 UNC 15,7 [.62] depth	2 x 3/8 - 24 UNF 14,2 [.56] depth

ORDER CODE for HKU.../4PB

	1		2		3	4	5
HKU		/	4PB	-			

Pos.1 - Displacement code (see Specification Data)

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

omit - No Paint

P - Painted Low Gloss Color

PC - Corrosion Protected Paint

Pos.5 - Design Series

omit - Factory specified

NOTES:

* Colour at customer's request.

The steering units are mangano-phosphatized as standard.

HYDROSTATIC STEERING UNIT TYPE HKUQ.../4

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

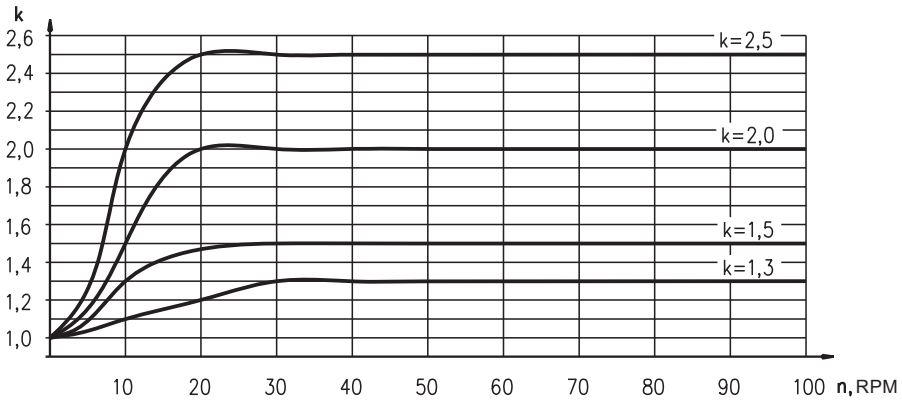
HKUQ…/4 is an "Open Center-Non Load Reaction" hydrostatic steering in which restrictor for amplifying factor from 1,3 to 2,5 is built-in.

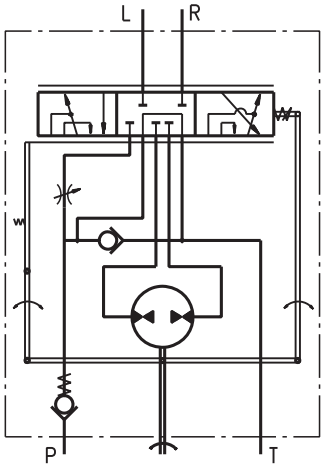
In accordance with the size of the gear wheel set and amplifying factor, HKUQ…4 has the following working volume:

- from 80 cm^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





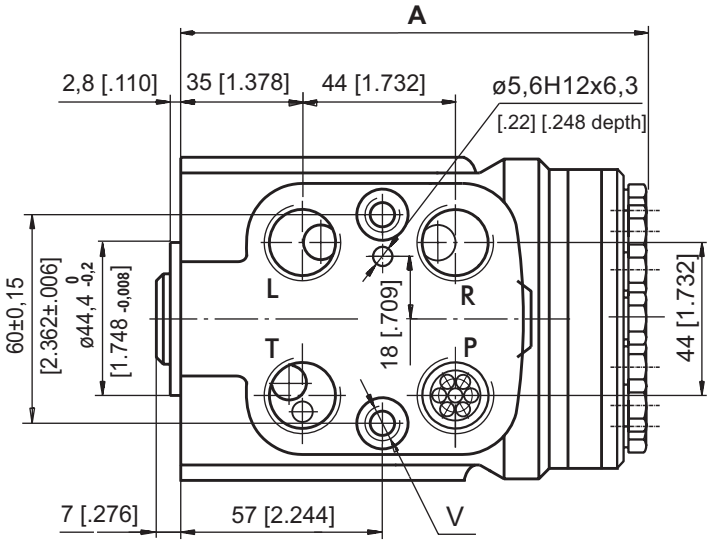
"Open Center - Non Load Reaction"
HKUQ.../4

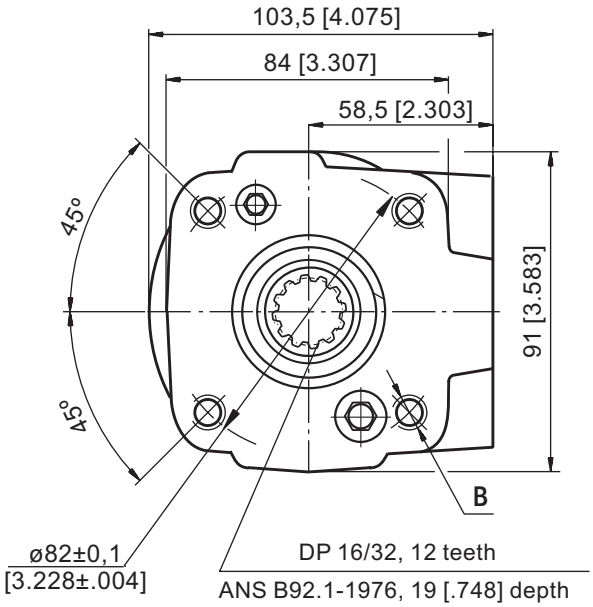
SPECIFICATION DATA

Parameters	Type																			
	HKUQ 80/.../4				HKUQ 100/.../4				HKUQ 125/.../4				HKUQ 160/.../4				HKUQ 200/.../4			
Displacement - without servo-amplifying (in emergency mode) cm^3/rev	79,2 [4.83]				99,0 [6.04]				123,8 [7.56]				158,4 [9.67]				198 [12.08]			
- with servo-amplifing [in^3/rev]	100 [6.10]	125 [7.62]	160 [9.76]	200 [12.2]	125 [7.62]	160 [9.76]	200 [12.2]	250 [15.25]	160 [9.76]	200 [12.2]	250 [15.25]	320 [19.52]	200 [12.2]	250 [15.25]	320 [19.52]	400 [24.4]	250 [15.25]	320 [19.52]	400 [24.4]	500 [30.5]
Rated Flow* l/min [GPM]	10 [2.64]	12,5 [3.30]	16 [4.22]	20 [5.28]	12,5 [3.30]	16 [4.22]	20 [5.28]	25 [6.60]	16 [4.22]	20 [5.28]	25 [6.60]	32 [8.45]	20 [5.28]	25 [6.60]	32 [8.45]	40 [10.57]	25 [6.60]	32 [8.45]	40 [10.57]	50 [13.21]
Amplifying Factor (at shaft revolution over 20 min^{-1})	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]			

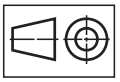
* Rated Flow at 100 RPM.

DIMENSIONS AND MOUNTING DATA





code	Ports - P*, T, R, L Thread	Column Mounting Thread - B	Valve Mounting Thread - V
-	G1/2 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16[.63] depth
M	M22x1,5 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16 [.63] depth
A	3/4 - 16 UNF O-ring 17 [.67] depth	4 x 3/8 - 16 UNC 15,7 [.62] depth	2 x 3/8 - 24 UNF 14,2 [.56] depth



mm [in]

*Threaded Ports P min 16 [.63] depth for pipe mounting.

ORDER CODE for HKUQ...

	1		2		3		4	5	6
HKUQ		/		/	4	-			

Pos.1 - Displacement code

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

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

	80	100	125	160	200
100	■				
125	■	■			
160	■	■	■		
200	■	■	■	■	
250		■	■	■	■ k=1,3
320			■	■	■ k=1,5
400				■	■ k=2,0
500					■ k=2,5

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 Low Gloss Color
PC	- 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.

The steering units are mangano-phosphatized as standard.

HYDROSTATIC STEERING UNITS TYPE HKU(S).../5(D)(T)(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.

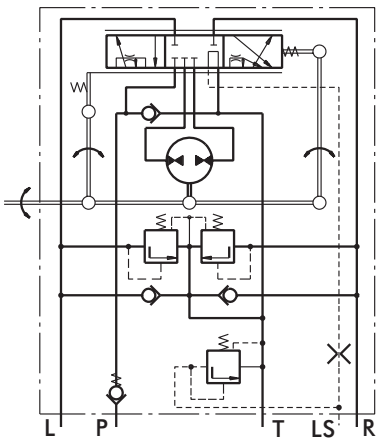
HKU.../5TU is a steering unit at which the ports R and L in neutral position are connected to the drain line T. This scheme contributes for the fast discharge of the residual pressure in lines L and R, that usually is “locked” when the steering wheel is jerky released at neutral position. These steering 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.

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.

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. For more information please refer to M+S Hydraulic.

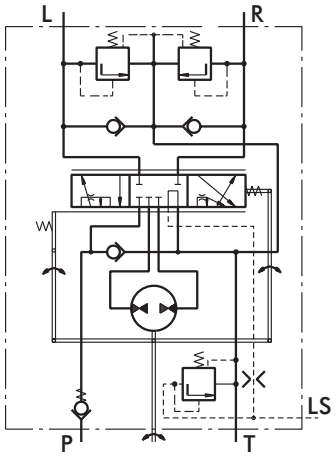
*For operation in condition of Thermal Shock see the notes on page 6.

Modulary Mounting

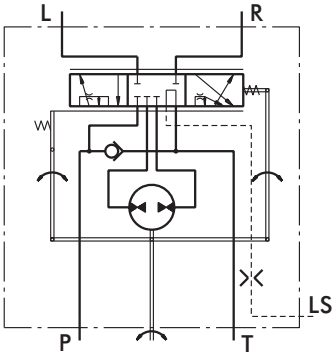


HKUS.../5

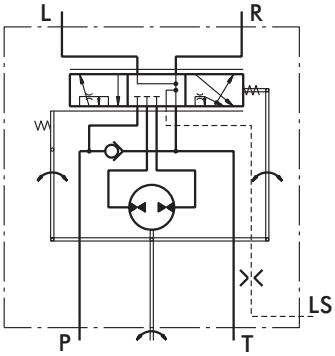
Pipe Mounting



HKUS.../5T



HKU.../5T



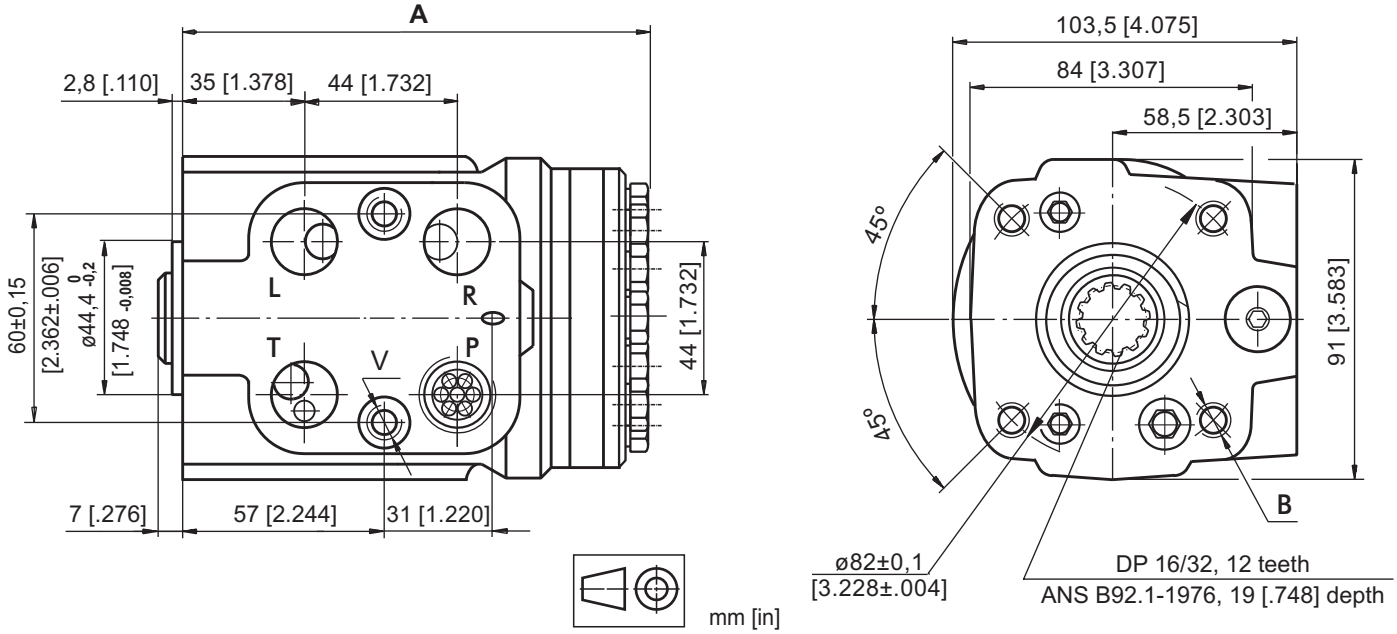
HKU.../5TU

SPECIFICATION DATA

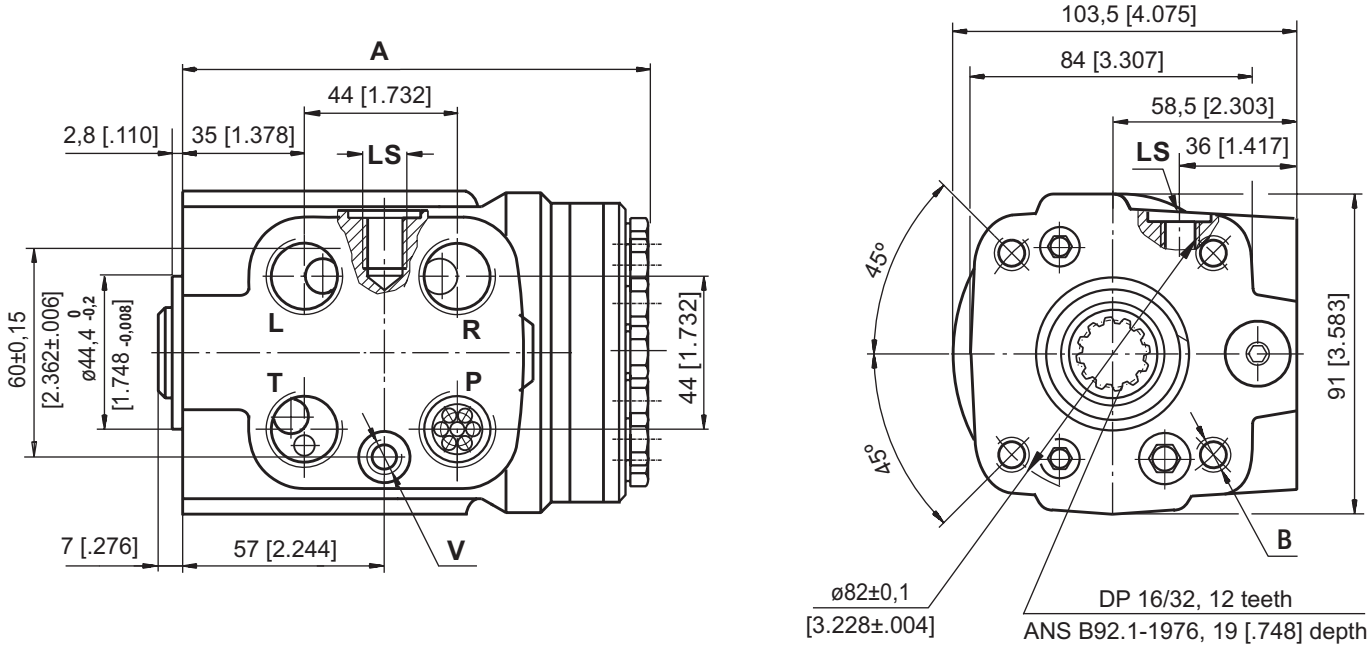
Parameters		Type												
		HKU 40/5T HKUS 40/5...	HKU 50/5T HKUS 50/5...	HKU 63/5T HKUS 63/5...	HKU 80/5T HKUS 80/5...	HKU 100/5T HKUS 100/5...	HKU 125/5T HKUS 125/5...	HKU 160/5T HKUS 160/5...	HKU 200/5T HKUS 200/5...	HKU 250/5T HKUS 250/5...	HKU 320/5T HKUS 320/5...	HKU 400/5T HKUS 400/5...	HKU 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 -with standard springs	Nm [lb-in]													
					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].

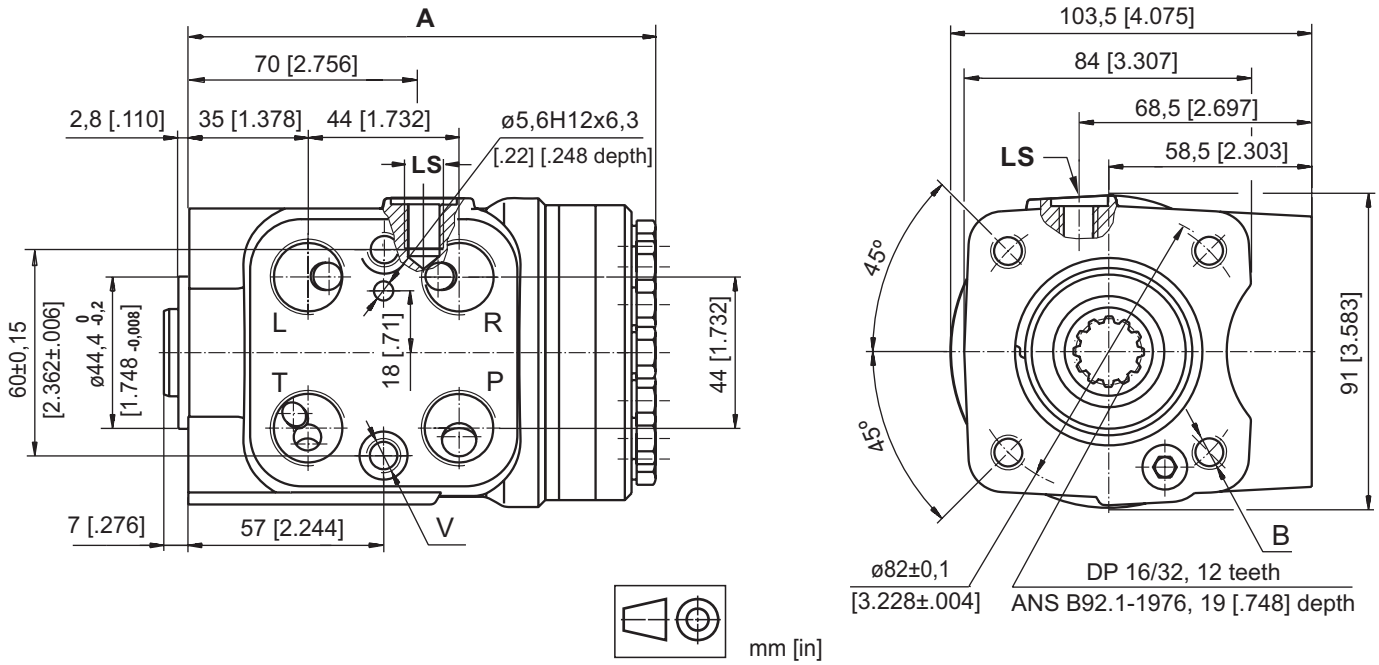
DIMENSIONS AND MOUNTING DATA - HKUS.../5(D)



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



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



mm [in]

code	Ports - P*, T, R, L Thread	Column Mounting Thread - B	Valve Mounting Thread- V	LS - Port
-	G1/2 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16[.63] depth	G1/4 14 [.55] depth
M	M22x1,5 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16 [.63] depth	G1/4 .14 [.55] depth
A	3/4 - 16 UNF O-ring 17 [.67] depth	4 x 3/8 - 16 UNC 15,7 [.62] depth	2 x 3/8 - 24 UNF 14,2 [.56] depth	7/16 - 20 UNF O-ring 12,7 [.50] depth

*Threaded Ports P min 16 [.63] depth for pipe mounting.

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

1	2	3	4	5	6	7	8	9	10
HKUS		/	5			-		-					

Pos.1 - Displacement code (see Specification Data)

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

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

Pos. 6 - Ports

omit - BSPP (ISO 228)
M - Metric (ISO 262)
A - SAE (ANSI B 1.1 - 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 Low Gloss Color
PC - Corrosion Protected Paint

Pos.10 - Design Series

omit - Factory specified

Notes:
* Available only for displacement from 40 to 200.
** 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
HKU		/	5	T	-					

Pos.1 - Displacement code (see Specification Data)

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

omit - No Paint
P - Painted Low Gloss Color
PC - Corrosion Protected Paint

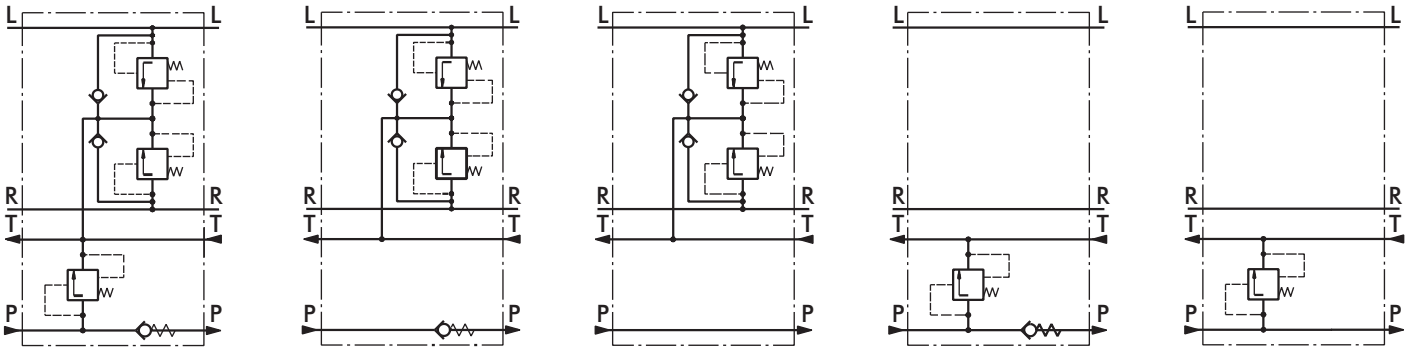
Pos.8 - Design Series

omit - Factory specified

Notes: * Available only for displacement from 40 to 200.
** 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.



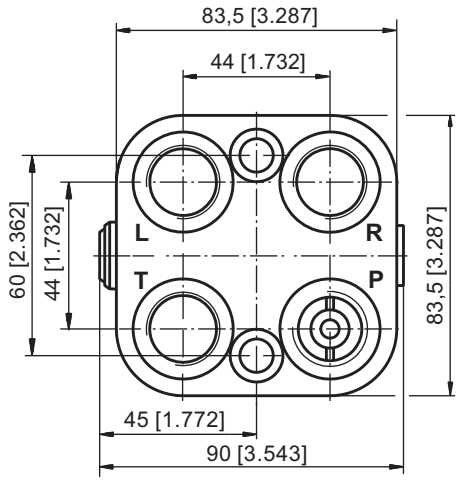
BKH1, BKHR BKH2 BKH3 BKH4 BKH5

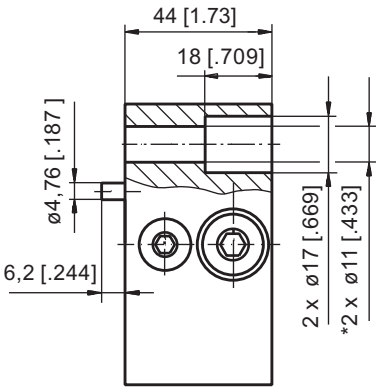
SPECIFICATION DATA

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

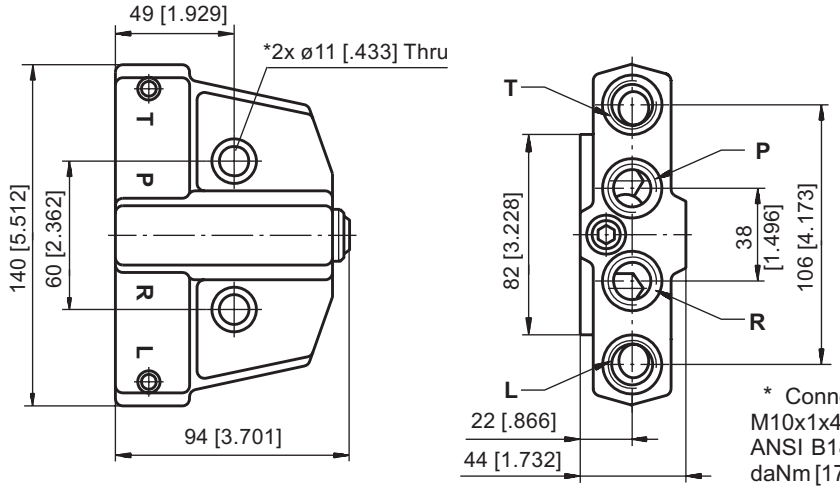




code	Ports - P, T, R, L Thread
-	G1/2 20 [.80] depth
M	M22x1,5 20 [.80] depth
A	3/4 - 16 UNF O-ring 20 [.80] depth

* 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].

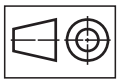
DIMENSIONS AND MOUNTING DATA - BKHR



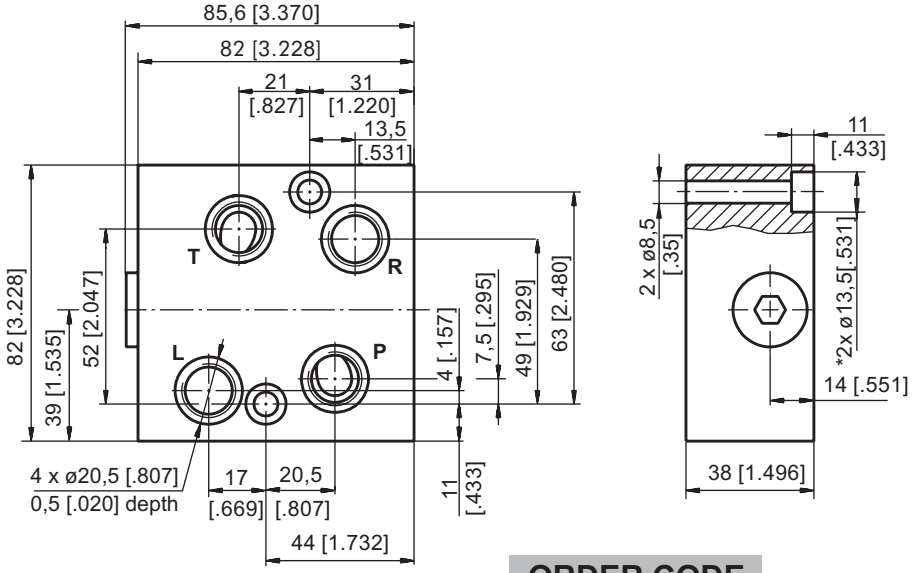
code	Ports - P, T, R, L Thread
M	M18x1,5 22 [.87] depth
A	3/4 - 16 UNF O-ring 22 [.87] depth

* 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 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
BKH	-	-		

Pos.1 - Versions*

R	1	2	3	4	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 - Option (Paint)****

omit - No Paint
P - Painted Low Gloss Color
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...

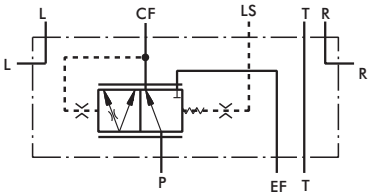
The Priority Valves distribute and trace the hydraulic flow from the supply pump of the hydraulic system to the hydraulic components which control and run the vehicle.

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.

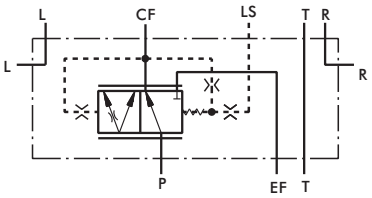
Priority valves with dynamic signal work in a system with dynamic hydrostatic steering units type HKUS.../5D (5DT).

Modulary Mounting



Static signal

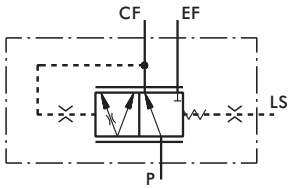
PRD 40,80/...



Dynamic signal

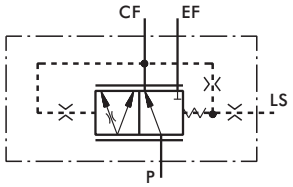
PRDD 40,80/...

Pipe Mounting



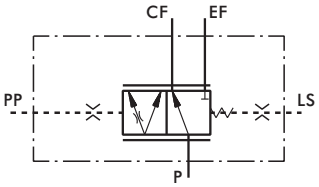
Static signal

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



Dynamic signal

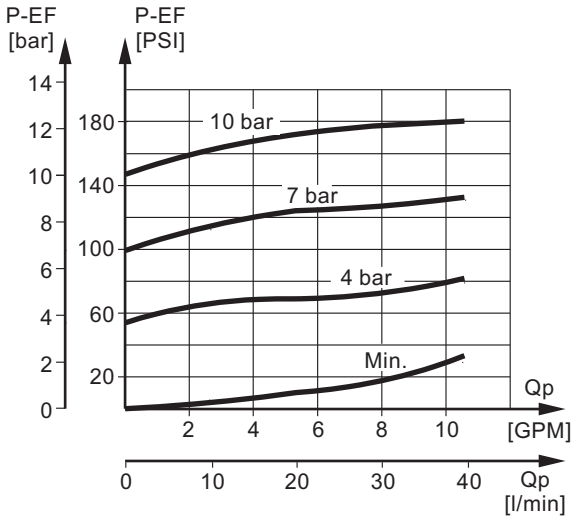
PRTD 40,80,120/...,PRTAD40,80/...



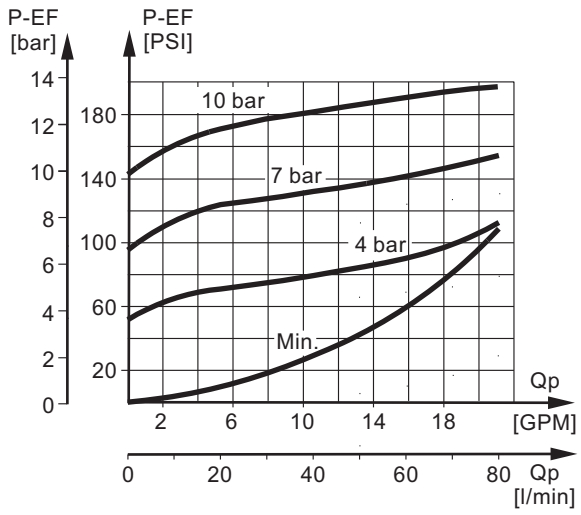
Static signal with External Port

PRTE120/...

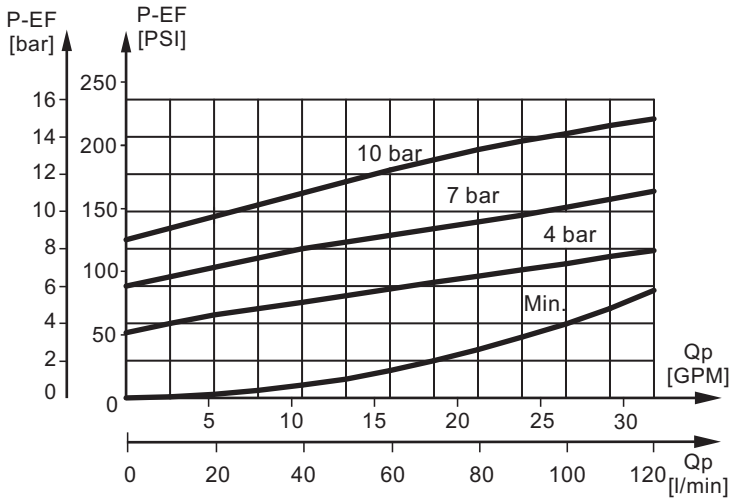
PR...40



PR...80



PRT...120

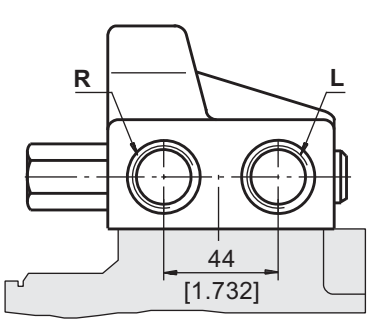


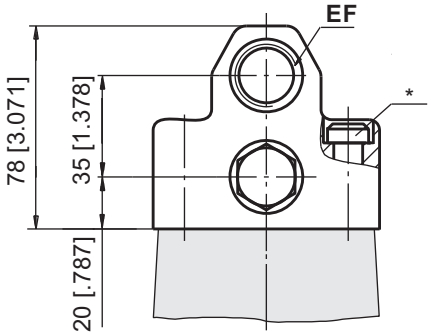
SPECIFICATION DATA

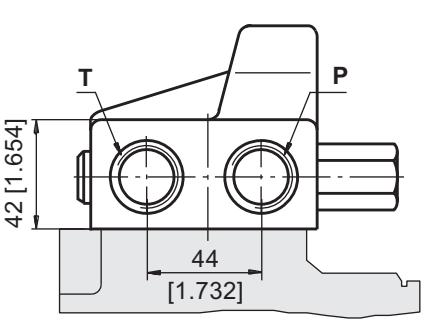
Parameters		Type								
		PRD(D), PRT(D)			PRTA(D)			PRT(D)(E)		
Rated Flow	lpm [GPM]	40 [10.6]			80 [21.1]			120 [31.7]		
Control Spring Pressure	bar [PSI]	4 [58]	7 [101.5]	10 [145]	4 [58]	7 [101.5]	10 [145]	4 [58]	7 [101.5]	10 [145]
Max. Pressures in Oil Ports:	P, EF	250 [3625]								
	CF	210 [3045]								
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]		

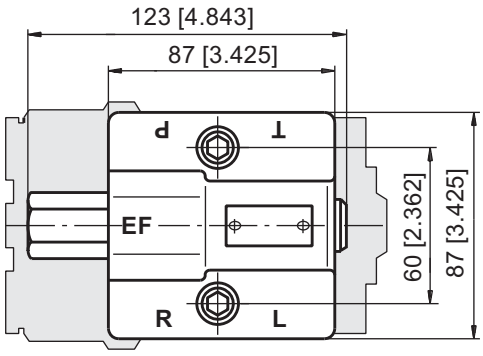
P - pump, **EF** - excess flow, **CF** - control flow (first priority oil flow),
L - left, **R** - right, **LS** - load sensing, **T** - tank, **PP** - pilot pressure (L,R and T - for PRD(D) only).

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







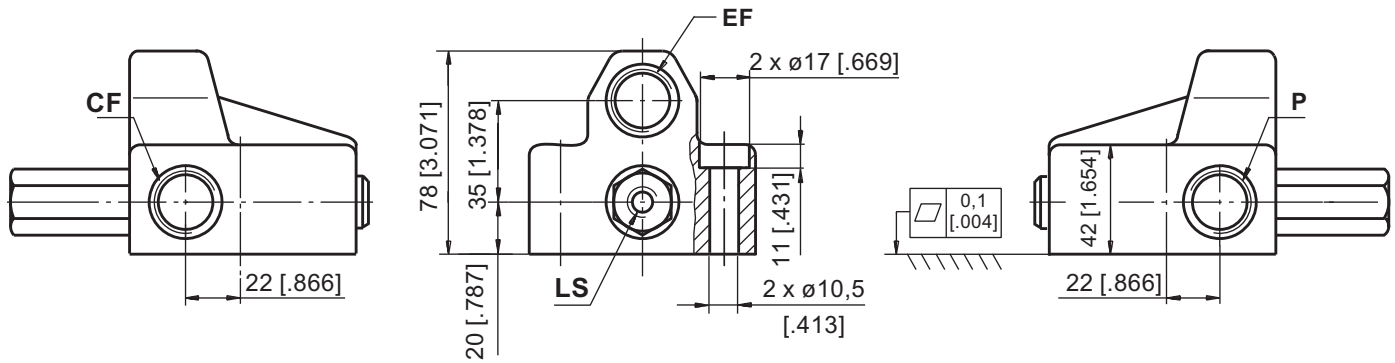


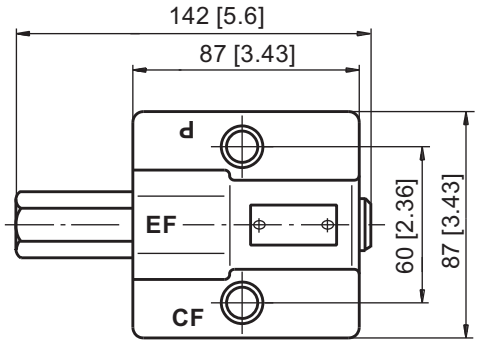
code	Ports - P, EF Thread	Ports - T, R, L Thread
-	G1/2 18 [.71] depth	G3/8 18 [.71] depth
M	M22x1,5 18 [.71] depth	M18x1,5 18 [.71] depth
A	7/8 - 14 UNF O-ring 18 [.71] depth	3/4 - 16 UNF O-ring 18 [.71] depth

* 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]

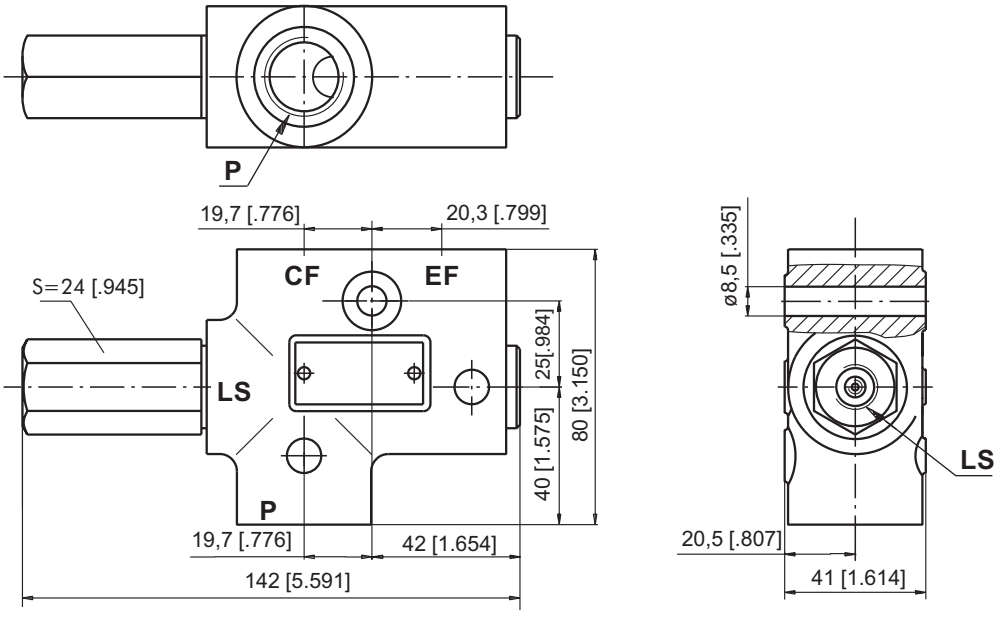
DIMENSIONS AND MOUNTING DATA - PRT(D) 40, 80/...

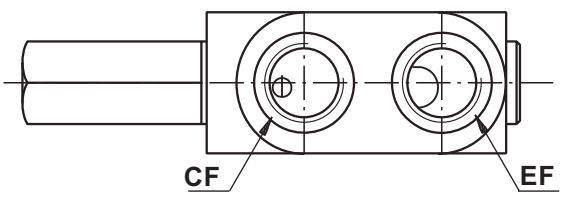




code	Ports - P, EF Thread	Port - CF Thread	LS - Port
-	G1/2 18 mm [.71] depth	G1/2 18 mm [.71] depth	G1/4 14 mm [.55] depth
M	M 22x1,5 18 mm [.71] depth	M 22x1,5 18 mm [.71] depth	G1/4 14 mm [.55] depth
A	7/8 - 14 UNF O-ring 18 [.71] depth	3/4 - 16 UNF O-ring 18 [.71] depth	7/16 - 20 UNF O-ring 12,7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

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

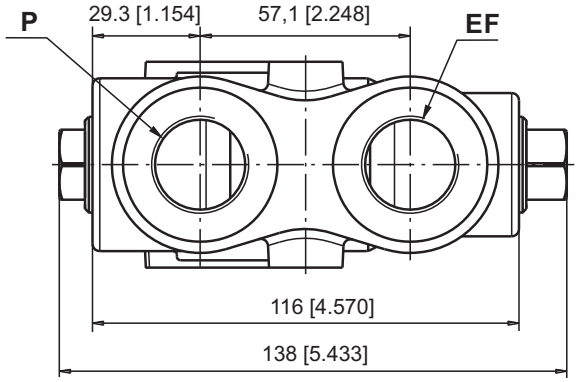


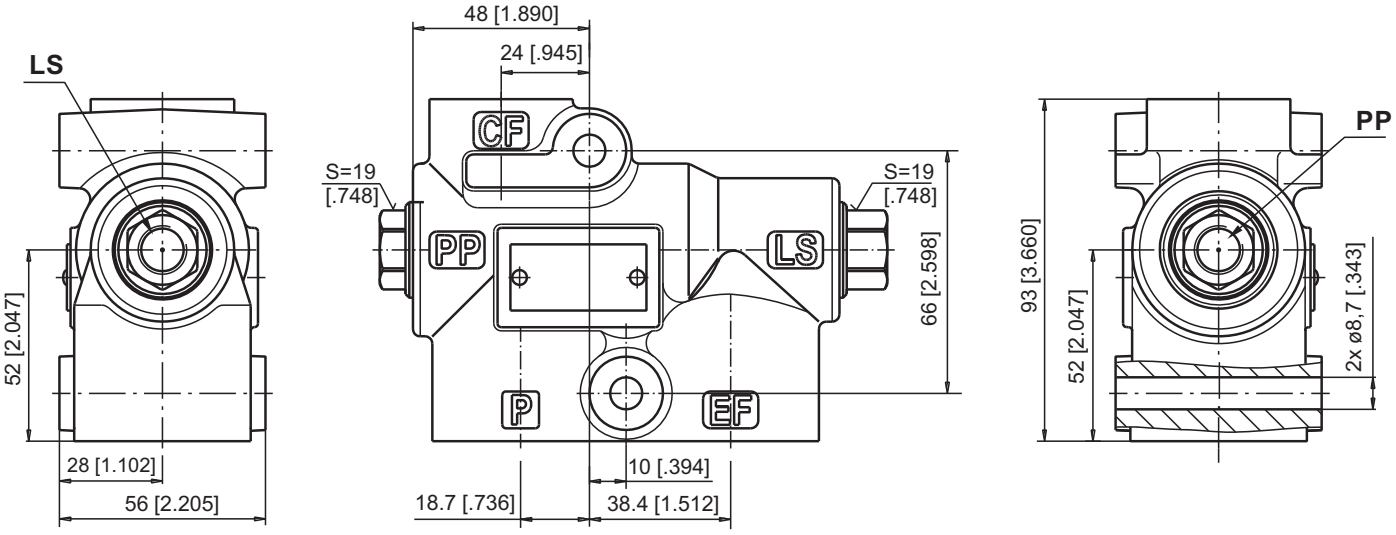


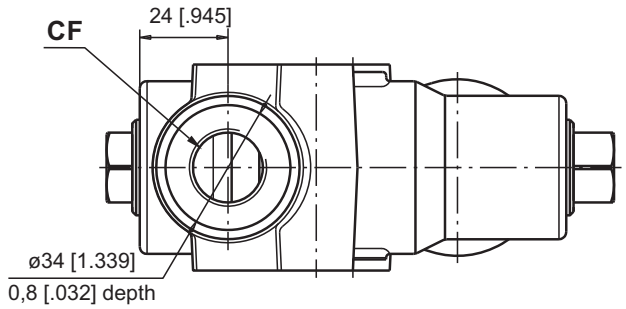
code	Ports - P, EF Thread	Port - CF Thread	LS - Port
-	G1/2 18 mm [.71] depth	G1/2 18 mm [.71] depth	G1/4 14 mm [.55] depth
M	M 22x1,5 18 mm [.71] depth	M 22x1,5 18 mm [.71] depth	G1/4 14 mm [.55] depth
A	7/8 - 14 UNF O-ring 18 [.71] depth	3/4 - 16 UNF O-ring 18 [.71] depth	7/16 - 20 UNF O-ring 12,7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

mm [in]

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





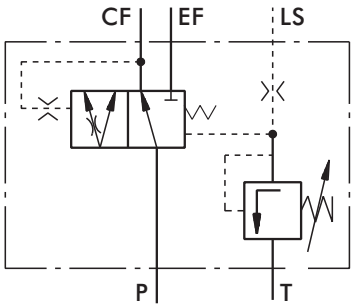


code	Ports - P, EF Thread	Port - CF Thread	LS, PP - Ports
-	G3/4 20,5 [.81] depth	G1/2 18,5 [.73] depth	G1/4 12,5 [.49] depth
M	M27x2 20,5 [.81] depth	M18x1,5 18,5 [.73] depth	M12x1,5 12,5 [.49] depth
A	1 1/16 - 12 UN O-ring 20,5 [.81] depth	3/4 - 16 UNF O-ring 18,5 [.73] depth	7/16 - 20 UNF O-ring 12,5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

mm [in]

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

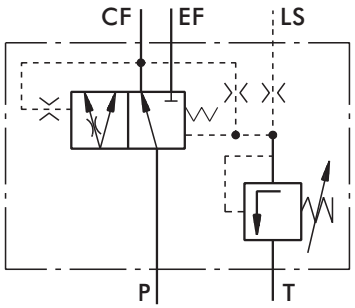
The Priority Valves PRT...160 have a built-in pilot pressure relief valve, which protects the steering unit against excessive pressure. The pilot pressure relief valve operates with the Shuttle of the Priority valve to limit the maximum steering pressure P-T measured across the ports of the steering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



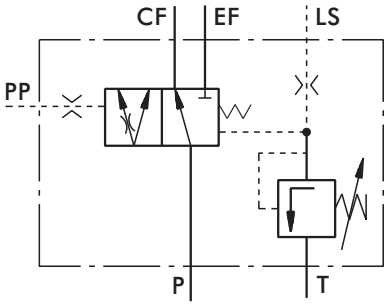
Static signal
PRT 160/...

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/...

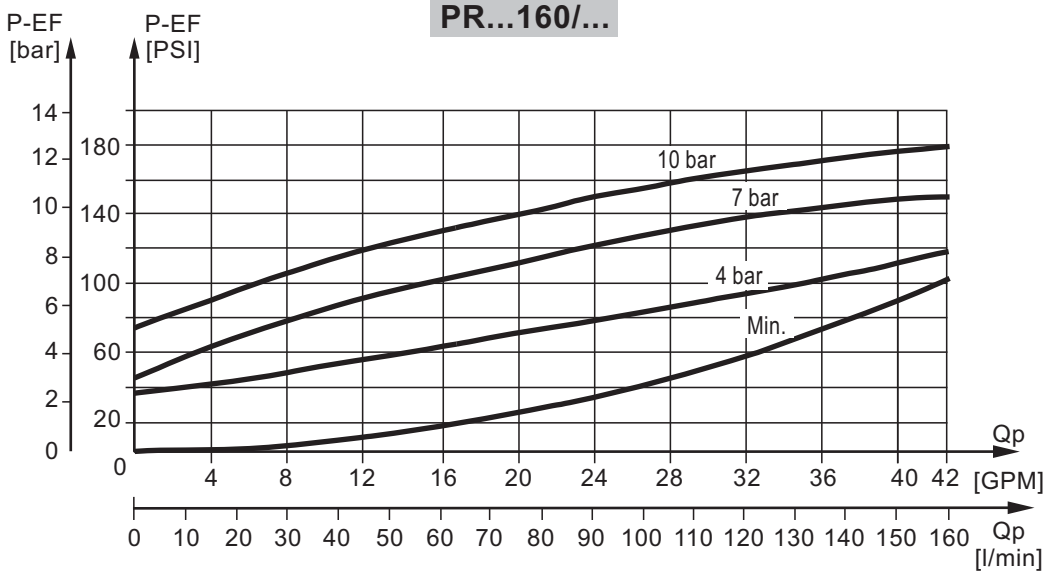


Static signal with External Pilot
PRTE 160/...

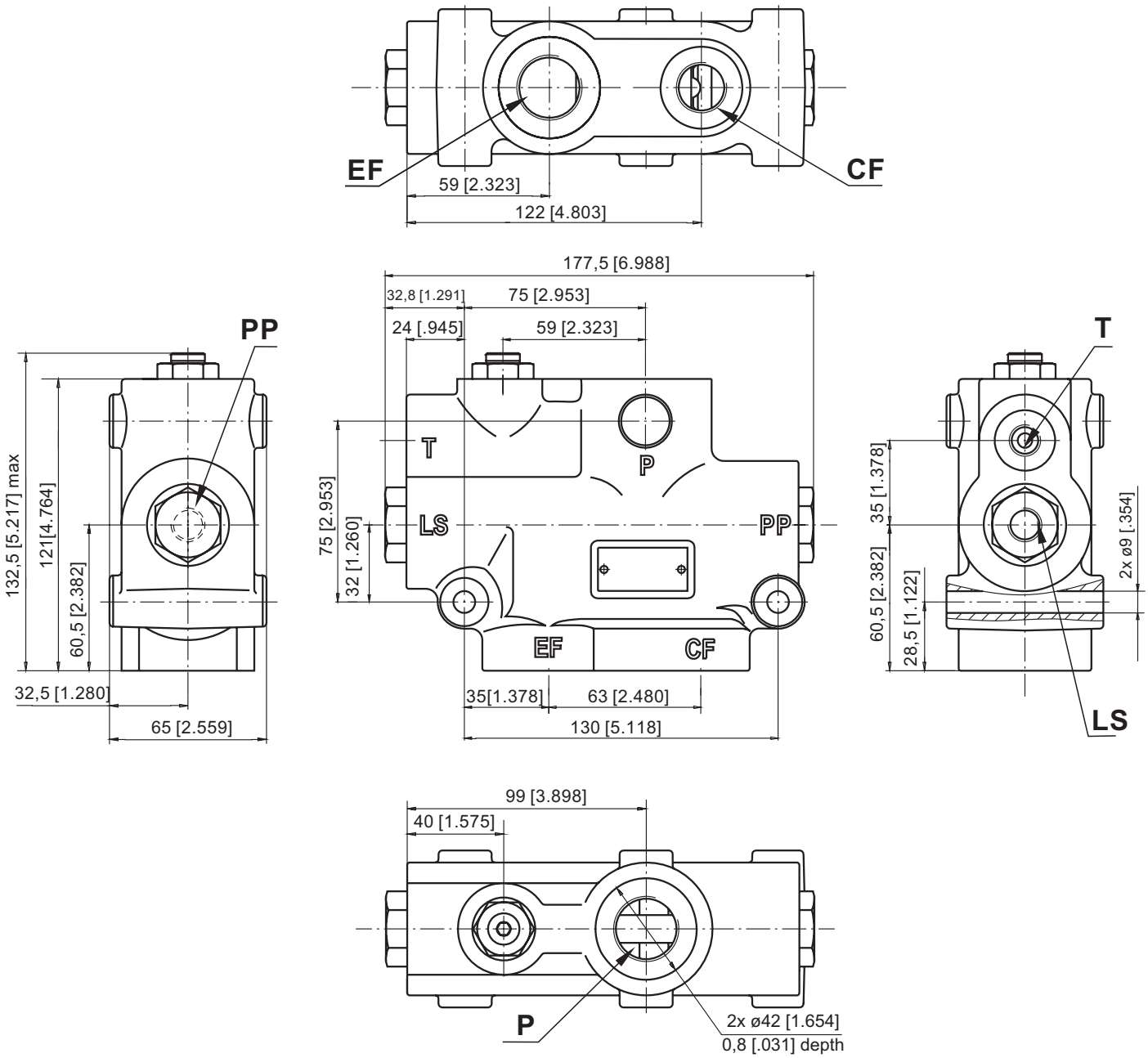
* - Adjusted valve pressure from 80 bar [1160 PSI] to 210 bar [3045 PSI] upon customer request.

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 20,5 [.81] depth	G1/2 18,5 [.73] depth	G1/4 12,5 [.49] depth
M	M27x2 20,5 [.81] depth	M18x1,5 18,5 [.73] depth	M12x1,5 12,5 [.49] depth
A	1 1/16 - 12 UN O-ring 20,5 [.81] depth	3/4 - 16 UNF O-ring 18,5 [.73] depth	7/16 - 20 UNF 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 Low Gloss Color
PC	- Corrosion Protected Paint

Pos.7 - Design Series

omit - Factory specified

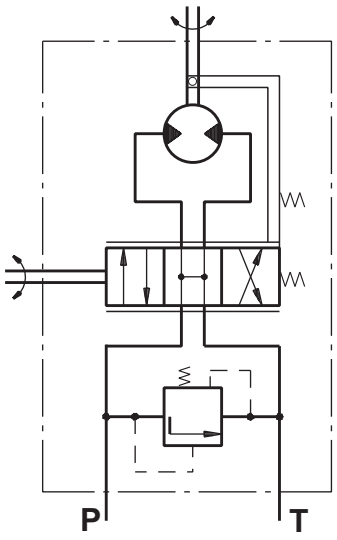
Notes: * For PRT 120/... and PRT 160/... only
** For PRT only
*** Colour at customer's request.

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.

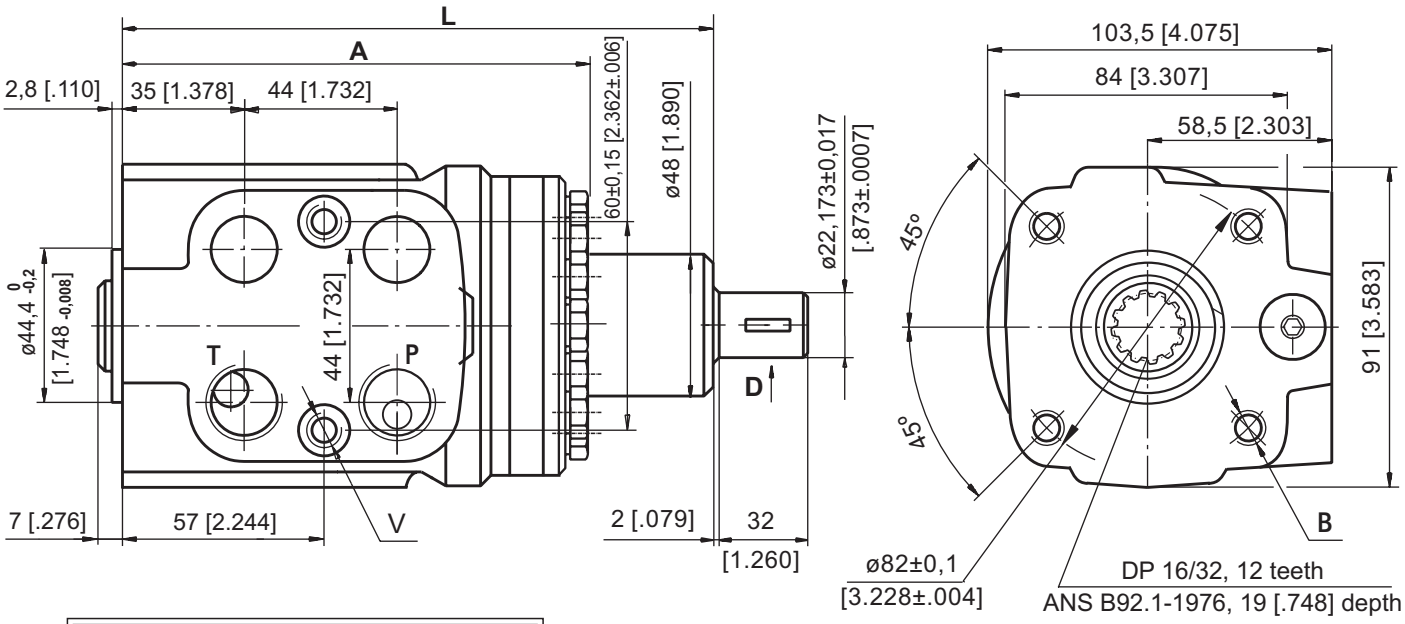
SPECIFICATION DATA

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]	daNm [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]

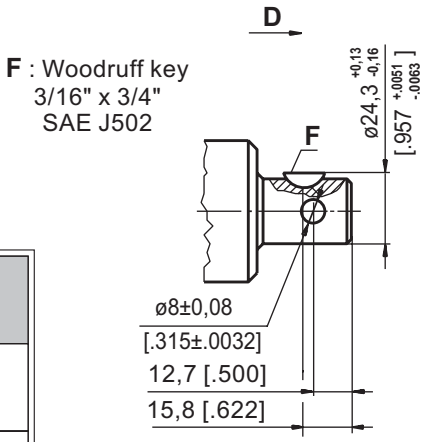
* Rated Flow at 100 RPM

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

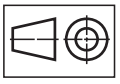
DIMENSIONS AND MOUNTING DATA



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



code	Ports - P, T Thread	Column Mounting Thread - B	Port Mounting Thread - V
-	G1/2 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16 [.63] depth
M	M22x1,5 17 [.67] depth	4 x M10 18 [.71] depth	2 x M10x1 16 [.63] depth
A	3/4 - 16 UNF O-ring 17 [.67] depth	4 x 3/8 - 16 UNC 15,7 [.62] depth	2 x 3/8 - 24 UNF 14,2 [.56] depth



mm [in]

ORDER CODE

	1	2	3	4
U V M				

Pos.1 - Displacement code

100 - 99,0 [6.04] cm^3/rev [in^3/rev]
160 - 158,4 [9.67] cm^3/rev [in^3/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 Low Gloss Color
PC - Corrosion Protected Paint

Pos.4 - Design Series

omit - Factory specified

Notes: * Colour at customer's request.

The steering units are mangano-phosphatized as standard.

STEERING COLUMNS TYPE KK...

The 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.

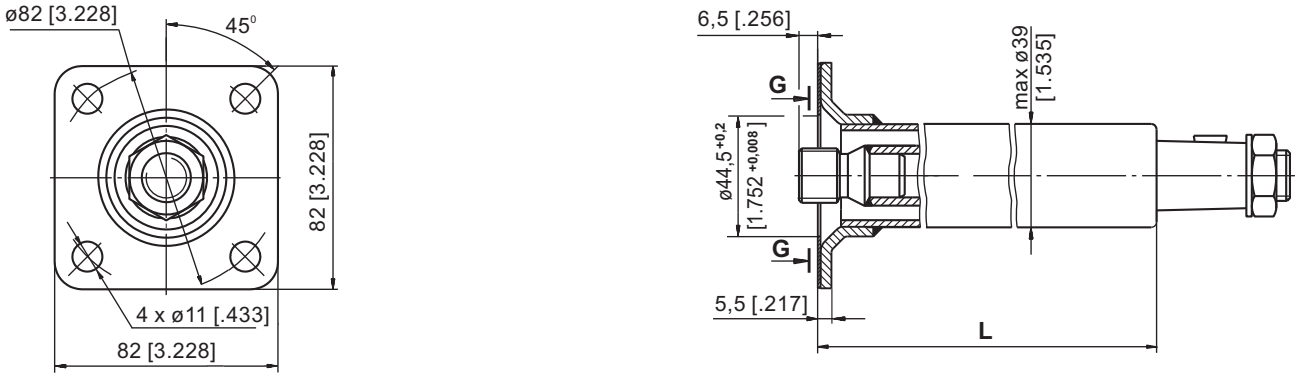
Permissible loads of the steering column are as follows:

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]

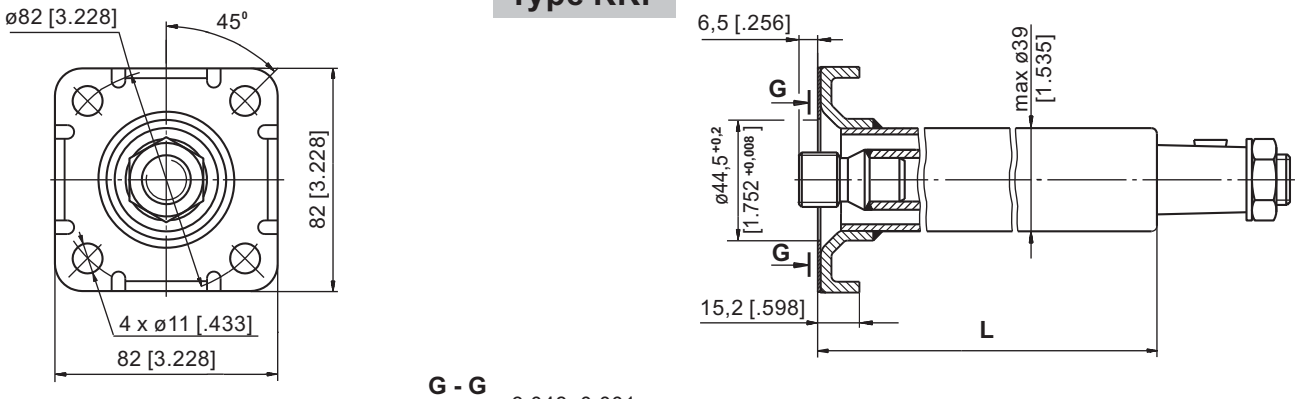
The steering column must be additionally supported when the length L exceeds 150 mm [5.91 in].

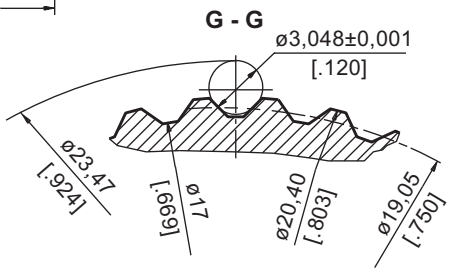
DIMENSIONS AND MOUNTING DATA

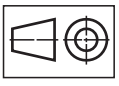
Type KK



Type KKF







mm [in]

SPECIFICATION DATA

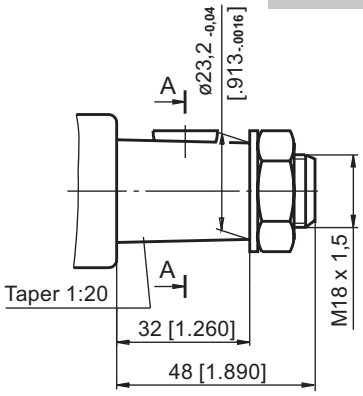
Involute Spline Data		
Modul	m	1.5875
Number of Teeth	z	12
Pressure Angle	α	30°
Diametral Pitch	DP	16/32

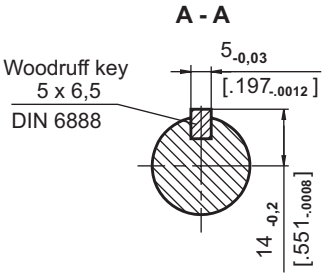
Parameters		Type				
		KK 75	KK 150	KK 390	KK 441	KK 750
L	mm [in]	78 [3.07]	168,2 [6.62]	393 [15.47]	441 [17.36]	777,8 [30.62]
Weight	kg [lb]	0,75 [1.65]	1,1 [2.43]	1,9 [4.19]	5,05 [11.13]	3,3 [7.28]

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.

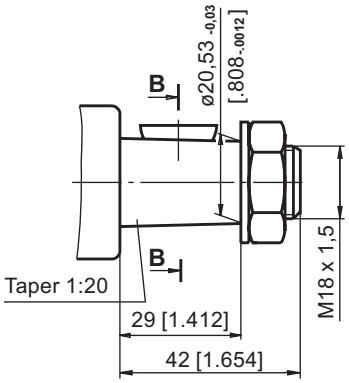
SHAFT VERSIONS

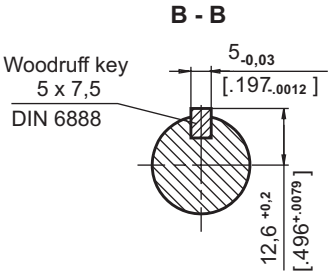
TYPE I



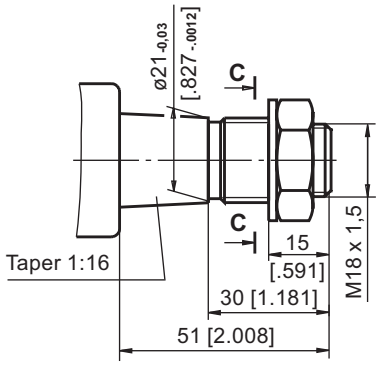


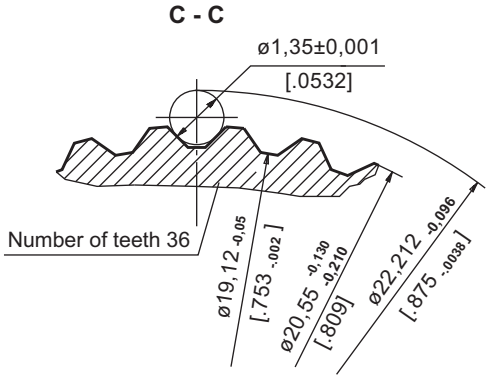
TYPE II



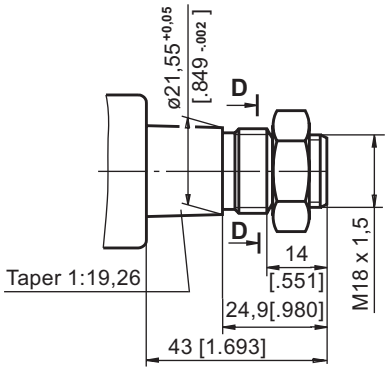


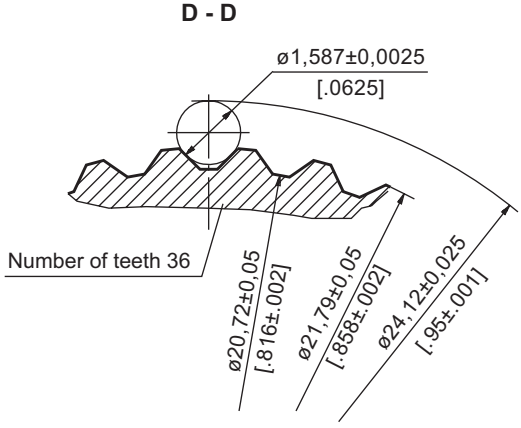
TYPE III



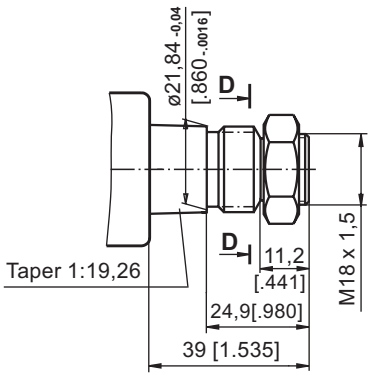


TYPE IV





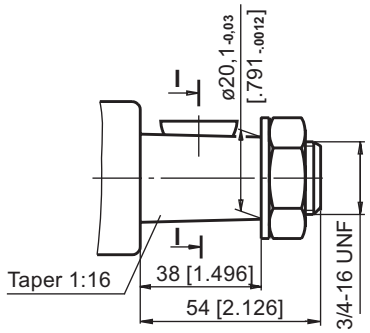
TYPE V

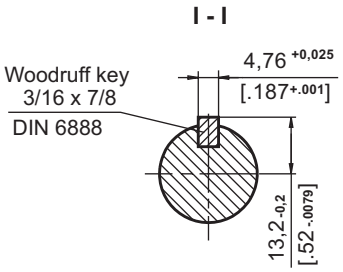


mm [in]

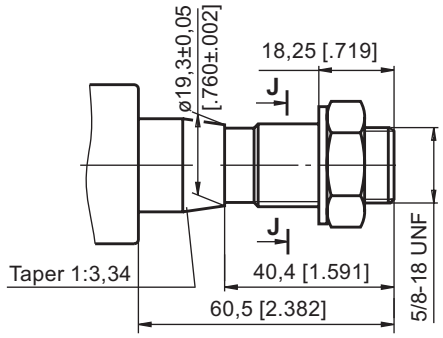
SHAFT EXTENSIONS

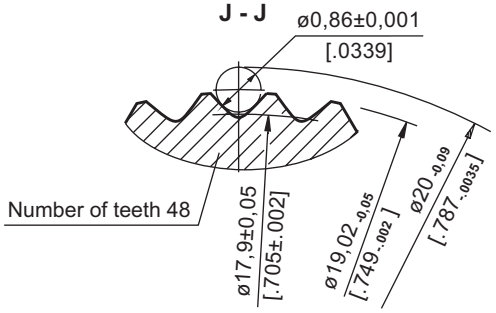
TYPE VI



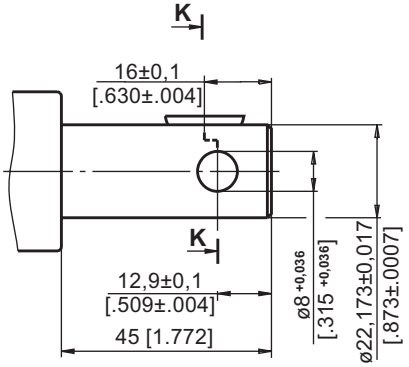


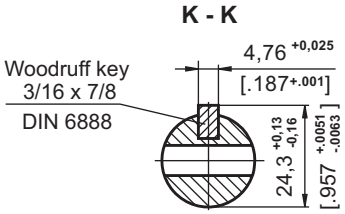
TYPE VII



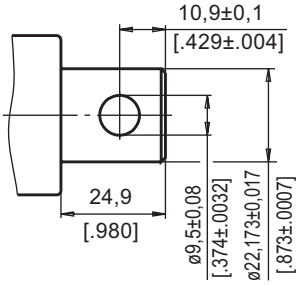


TYPE VIII





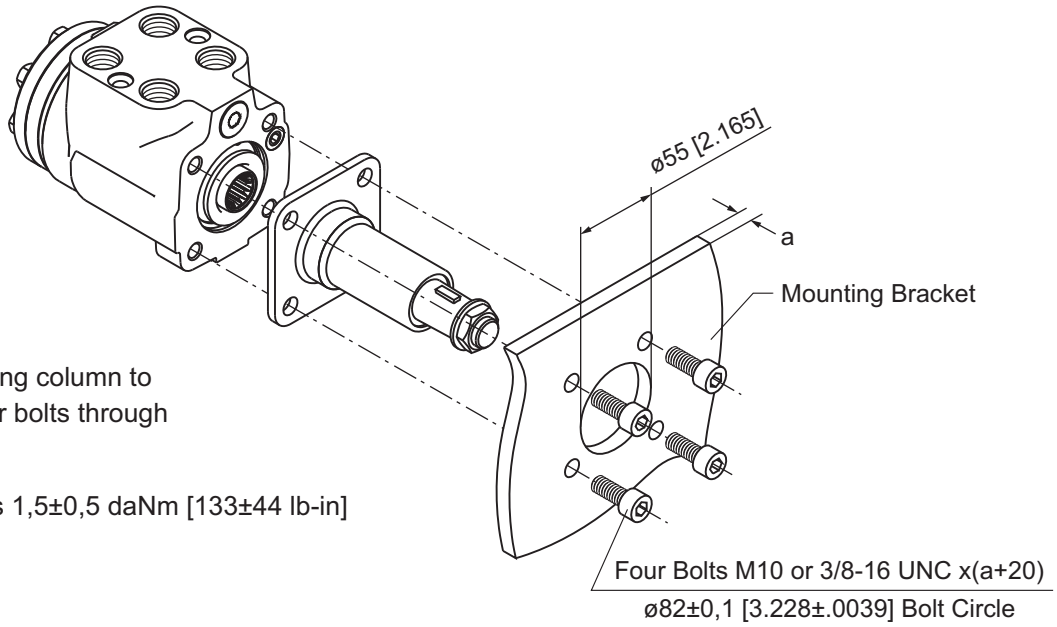
TYPE IX



mm [in]

INSTALLING

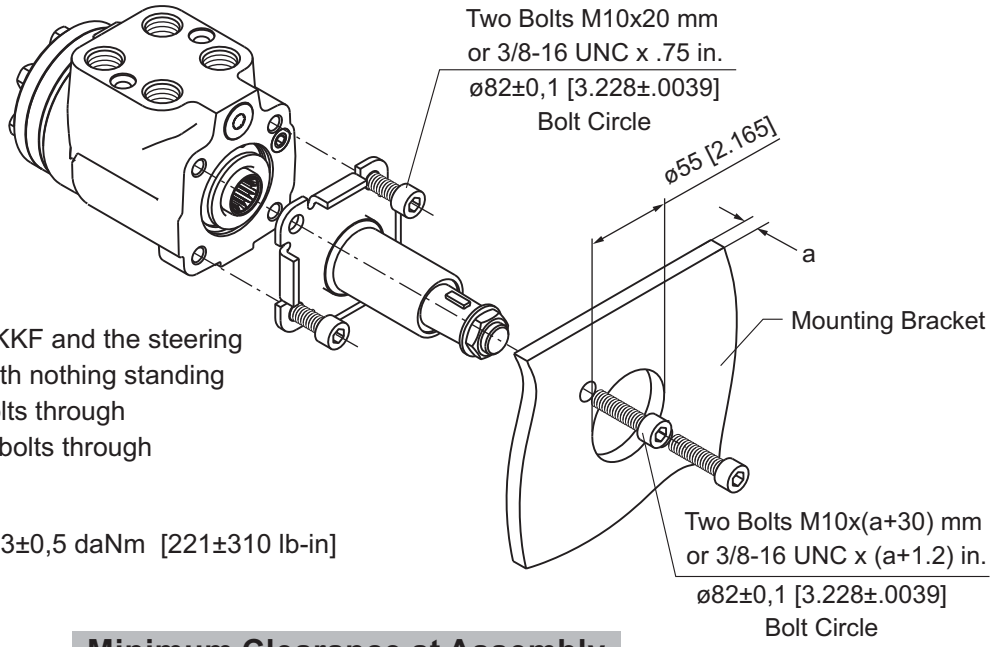
For column type KK



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

Tightening torque for bolts 1,5±0,5 daNm [133±44 lb-in]

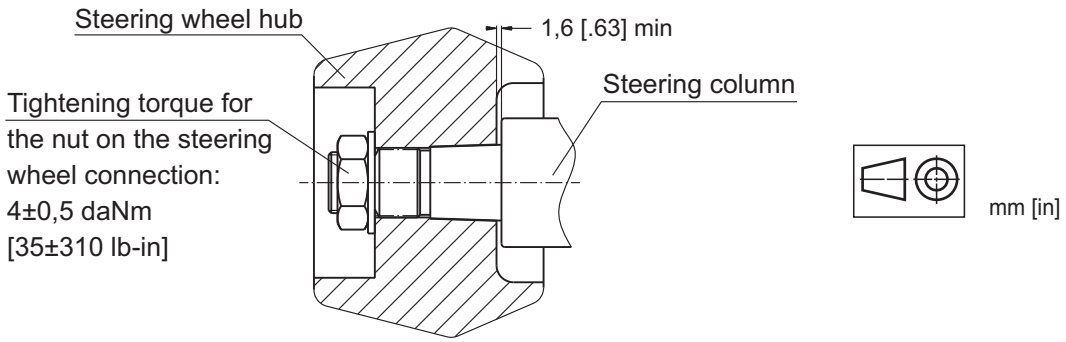
For column type KKF



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.

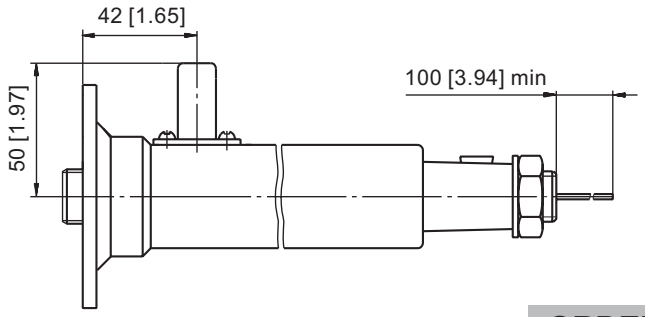
Tightening torque for bolts 3±0,5 daNm [221±310 lb-in]

Minimum Clearance at Assembly

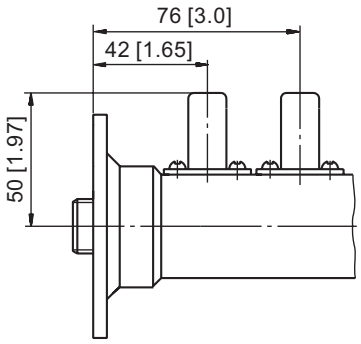


SOUND SIGNAL CONNECTION

E Option



EE Option



ORDER CODE

	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

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 Low Gloss Color
PC - Corrosion Protected Paint

Pos.6 - Design Series

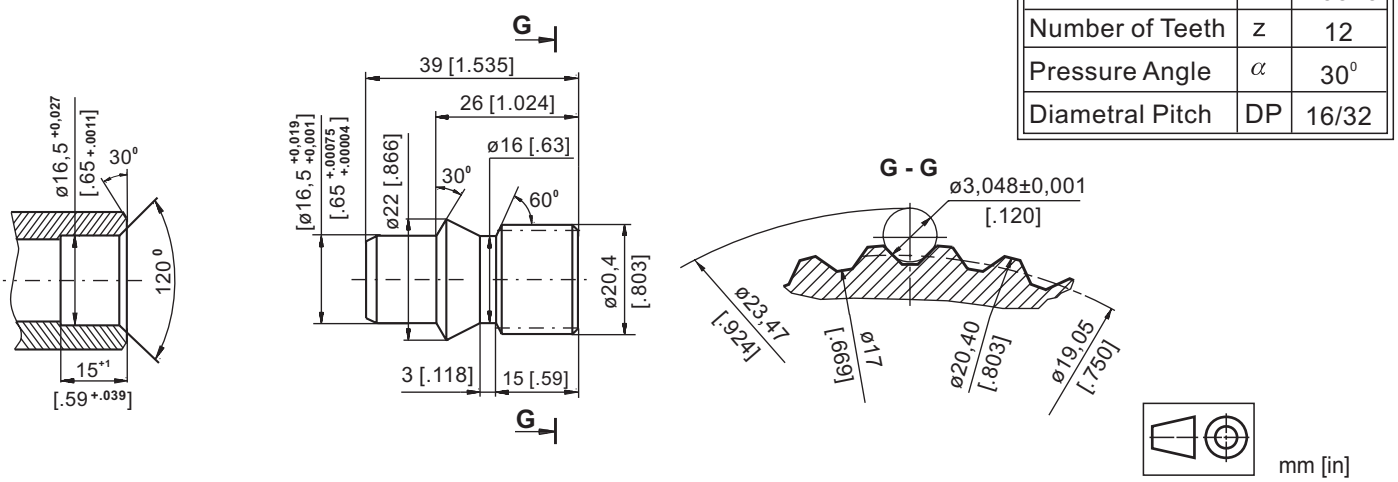
omit - Factory specified

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.

Shaft End Part

Order No: 46415 001 00

Involute Spline Data		
Modul	m	1.5875
Number of Teeth	z	12
Pressure Angle	α	30^0
Diametral Pitch	DP	16/32



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*].

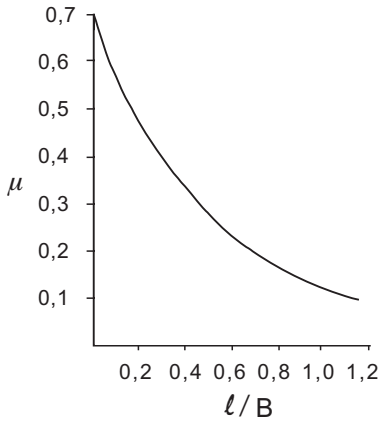
G = Vehicle weight on steered axle daN [*lbs*] (use maximum estimated overload weight).

μ = Coefficient of friction (use Chart № 1 , dimensionless) determined by ℓ/B (see Diagram № 1).

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

ℓ = 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

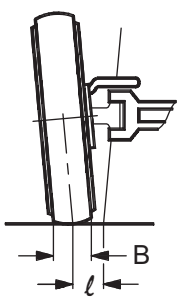
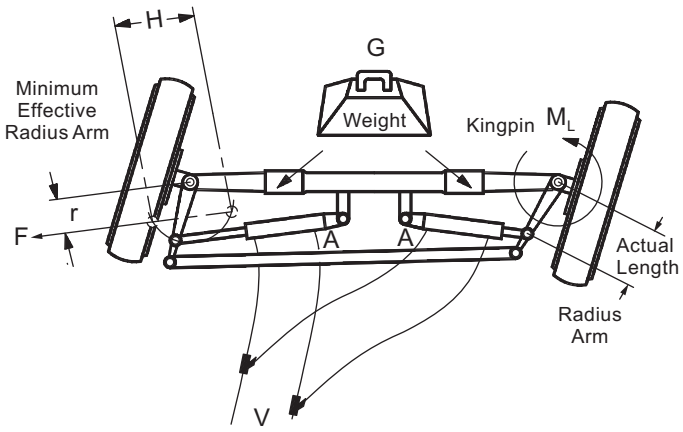


Diagram № 2



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

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

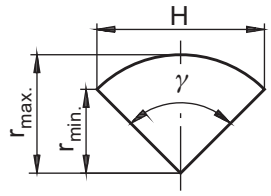
F = Force required daN [*lbs*] to steer axle.

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*].

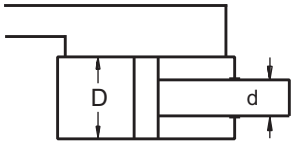
ΔP = Hydraulic pressure bar [*PSI*] use following percentage of relief valve setting by amount of load on steered axle. Severe load 25% - medium load 55% - no load 75% .

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.

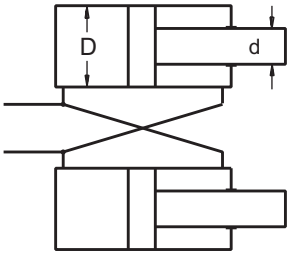
Differential Cylinder



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

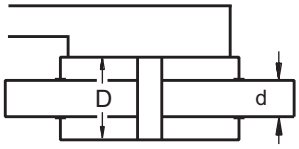
Note: $\left(\frac{d}{D}\right)^2 \leq 0{,}15$

Cross Connected Cylinders



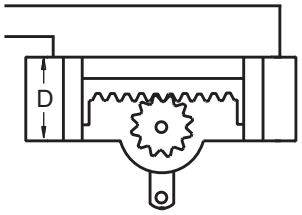
$$D = \sqrt{\frac{2A}{\pi} + \frac{d^2}{2}}$$

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 μm nominal (40 - 50 μm absolute) or finer is recommended.

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

START UP

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