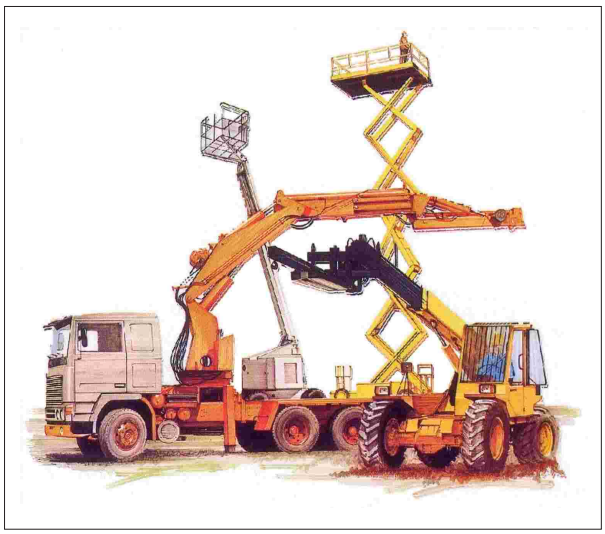
Steering units

Steering columns & Accessories



HYDROSTATIC STEERING UNITS AND ACCESSORIES

INDEX

- **STEERING UNITS**
  - STEERING UNIT TYPE OH/1-OH/8 .... OH/1-01 – OH/1-03
  - STEERING UNIT TYPE OH/3-OH/4 .... OH/3-01 – OH/3-05
  - STEERING UNIT TYPE OH .... OH-01 – OH-05
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  - STEERING UNIT TYPE OX .... OX-01 – OX-02

- **ACCESSORIES**
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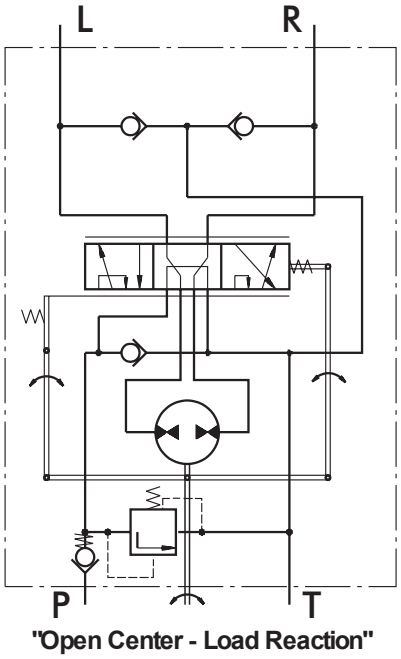
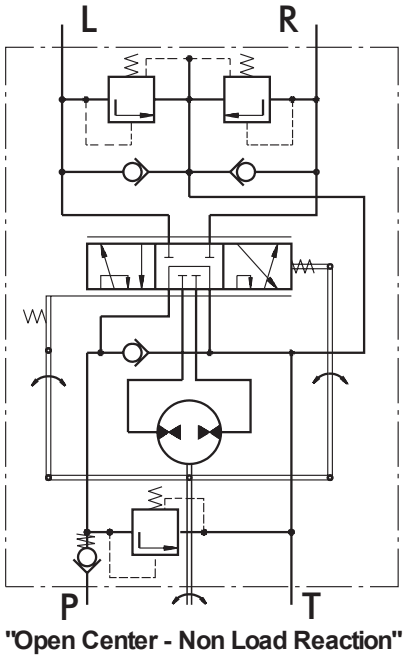
HYDROSTATIC STEERING UNITS TYPE OH/1...OR - OH/1 - OH/8

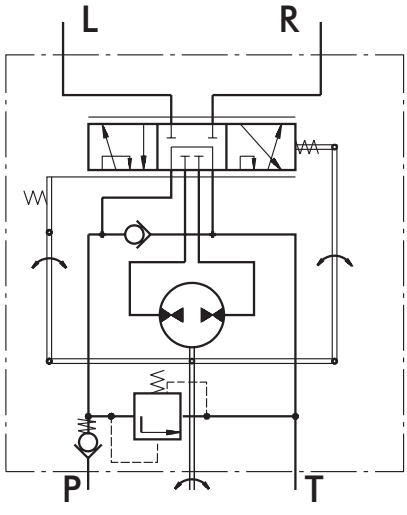
The OH/1 - OH/8 Hydrostatic Steering unit is based on the OH unit but has built-in relief and check valves. Thus Meta Hydraulic achieves one very compact steering unit which reduces the need for additional hydraulic components in the system.



"Open Center - Load Reaction"
With Built-inValves
Version OH/1...OR



"Open Center - Non Load Reaction"
With Built-in Valves
Version OH/1



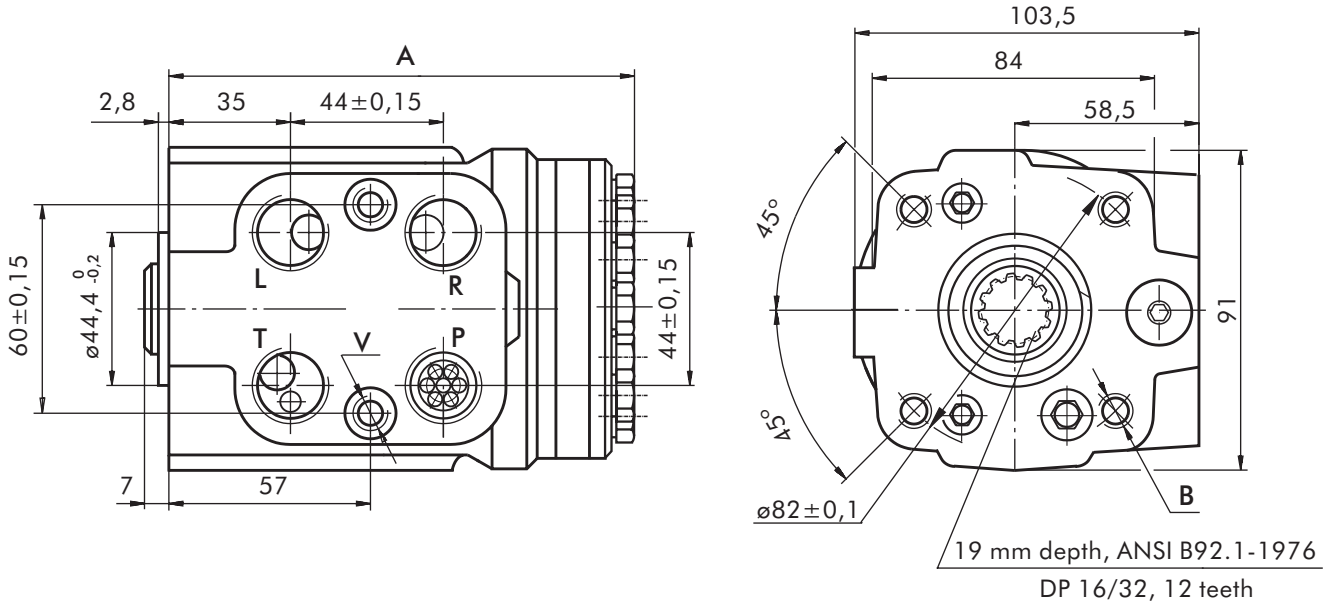
"Open Center - Non Load Reaction"
With Built-in Valve
Version OH/8

SPECIFICATION DATA

Parameters		Type										
		OH/1,8 40	OH/1,8 50	OH/1,8 63	OH/1,8 80	OH/1,8 100	OH/1,8 125	OH/1,8 160	OH/1,8 200	OH/1,8 250	OH/1,8 320	OH/1,8 400
Displacement	[cm³/rev]	39,6	49,5	65,6	79,2	99,0	123,8	158,4	198	247,5	316,8	396
Rated Flow	[l/min]	4	5	6	9		12		17	24	30	40
Rated Pressure	[bar]	160										
Relief Valve Pressure Settings*	[bar]	80 100 125 150										
Shock Valves Pressure Settings**	[bar]	140 160 180 200										
Max.Cont. Pressure in Line T - P_T	[bar]	25 (**50** - *for OH.../8)*										
Max.Torque at Servoamplifing	[Nm]	6 *(by P_T max)*										
Max.Torque w/o Servoamplifing	[Nm]	120										
Weight, avg.	[kg]	5,3	5,5	5,6	5,7	5,8	5,9	6,2	6,5	6,6	7,2	7,8
Dimension A	[mm]	130,8	132,2	133,9	136,2	138,8	142,2	146,8	152,2	158,8	168,2	178,8

*** Pressure Settings are at Rated Flow (as in the table) and viscosity 21 mm²/s (50° C).**
**** Pressure Settings are at flow rate of 2 l/min and viscosity 21 mm²/s (50° C).**

DIMENSIONS AND MOUNTING DATA



THREADED PORTS

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

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

ORDER CODE for OH1 - OH8

	1	2	3	4	5	6
O H		/		-		-			

Pos.1 - Versions

1	- **Version OR** *"Open Center - Load Reaction"*
1	- **Version 1** *"Open Center - Non Load Reaction"*
8	- **Version 8** *"Open Center - Non Load Reaction"*

Pos.2 - Displacement code (see Specification Data)

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

Pos.3 - Relief Valve Pressure Settings, bar

80
100
125
150
175

Pos.4 - Ports

omit - BSPP (ISO 228)

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

Pos.5 - Option (Paint)*

omit - No Paint

P	- **Painted**
PC	- **Corrosion Protected Paint**

Pos.6 - Version

OR	- **Version OR** *"Open Center - Laod Reaction"*

omit - *"Open Center - Non Load Reaction"*

Version	Manual Steering Check Valve	Relief Valve	Inlet Check Valve	Cylinder Relief Valve	Anti-Cavitation Valve
1-.-..OR	•	•	•		•
1	•	•	•	•	•
8	•	•	•		

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

The steering units are mangano-phosphatized as standard.

HYDROSTATIC STEERING UNITS TYPE OH/4 - OH/3 - OH/4E - OH/3E

The OH/4-OH/3-OH/4E-OH/3E **range expands the steering units family of Meta Hydraulic** with **the** *"Closed Center - Non Reaction and Load Sensing Outlet"* **version (static** hydraulic **connection to the priority valve)**

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

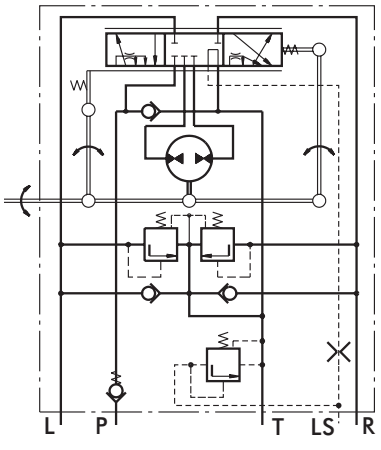
OH/4 **is designed to be connected with priority valves with built-in relief valves for rated flow up to 160 l/min.**

The control hydraulic circuits of the OH/4-OH/3-OH/4E-OH/3E **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.**

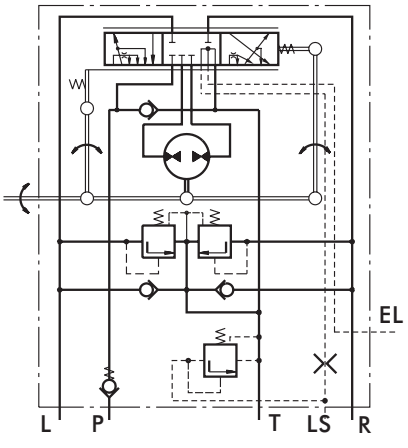
The OH/4E **and** OH/3E **are equipped with an electrohydraulic relay,** mounted **in the EL port, which supplies signal to the electric - control system. The relay can be pre-set to normally - open (N.O) or normally - closed (N.C) contacts, with control range from 0,1 to 50 bars. Upon customer's request the relay could be supplied with another type of fixing thread.**

***For operation in condition of Thermal Shock see the notes on page** OH - 02**.**

Modulary Mounting

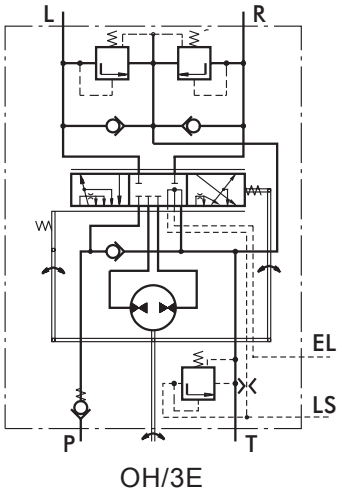


OH/4

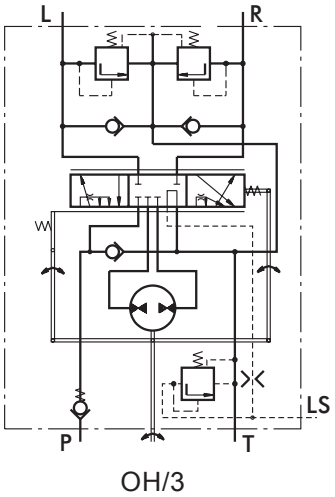


OH/4E

Pipe Mounting



OH/3E



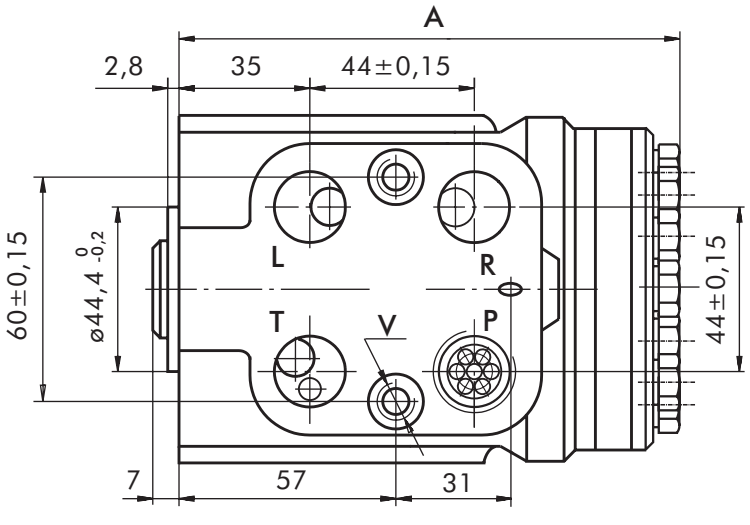
OH/3

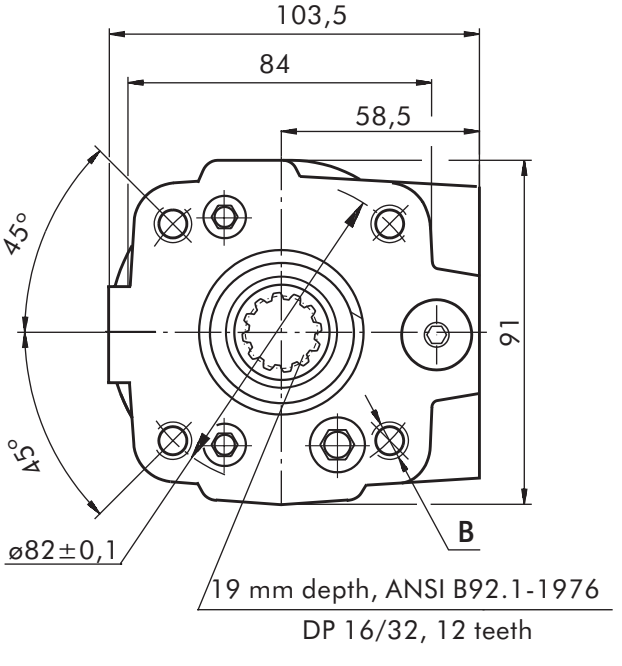
SPECIFICATION DATA

Parameters		Type									
		OH 40	OH 50	OH 63	OH 80	OH 100	OH 125	OH 160	OH 200	OH 250	OH 320
Displacement	[cm³/rev]	39,6	49,5	65,6	79,2	99,0	123,8	158,4	198	247,5	316,8
Rated Flow	[l/min]	4	5	6	9		12		17	24	30
Rated Pressure	[bar]	125	150	175							
LS - Valve Pressure Settings*	[bar]	80				100		125		150	175
Shock Valves Pressure Settings**	[bar]	140				160		180		200	240
Max.Cont. Pressure in LineT-P_T	[bar]	20									
Max.Torque at Servoamplifing	[Nm]	6 (by P_T max)									
Max.Torque w/o Servoamplifing	[Nm]	120									
Weight, avg.	[kg]	5,4	5,5	5,6	5,7	5,8	5,9	6,2	6,5	6,6	7,2
Dimension A	[mm]	130,8	132,2	133,9	136,2	138,8	142,2	146,8	152,2	158,8	168,2

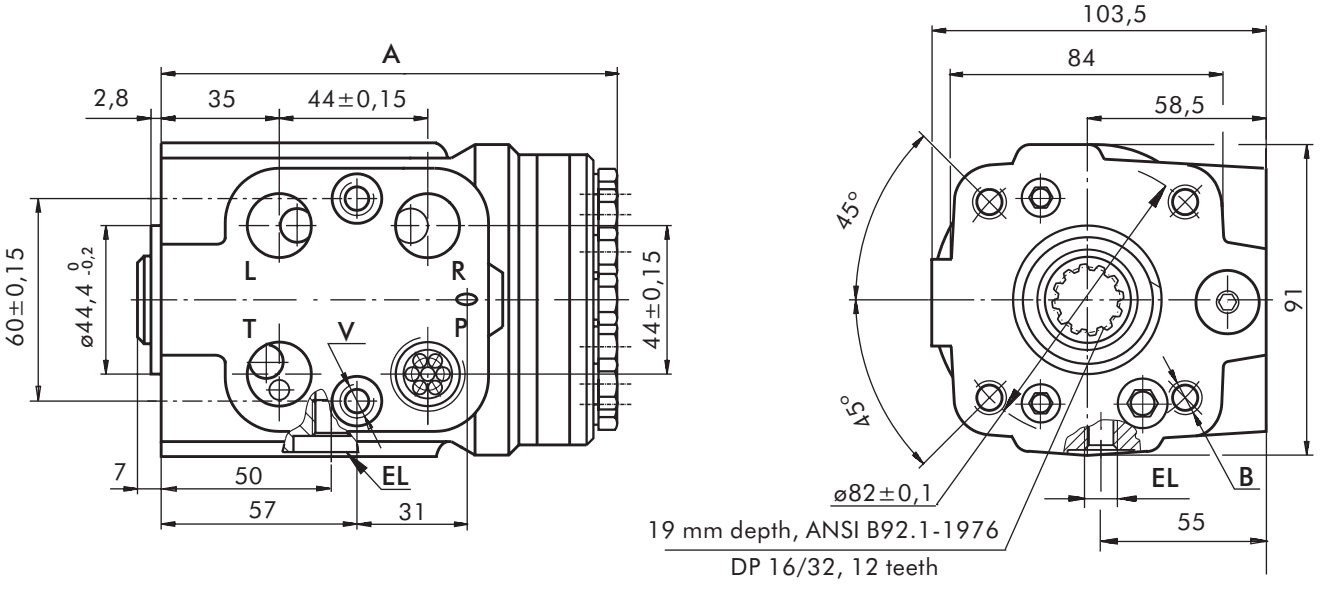
*** Pressure Settings are at flow rate of 6 l/min and viscosity 21 mm²/s (50°C).**
****Pressure Settings are at flow rate of 2 l/min and viscosity 21 mm²/s (50°C).**

DIMENSIONS AND MOUNTING DATA - OH/4

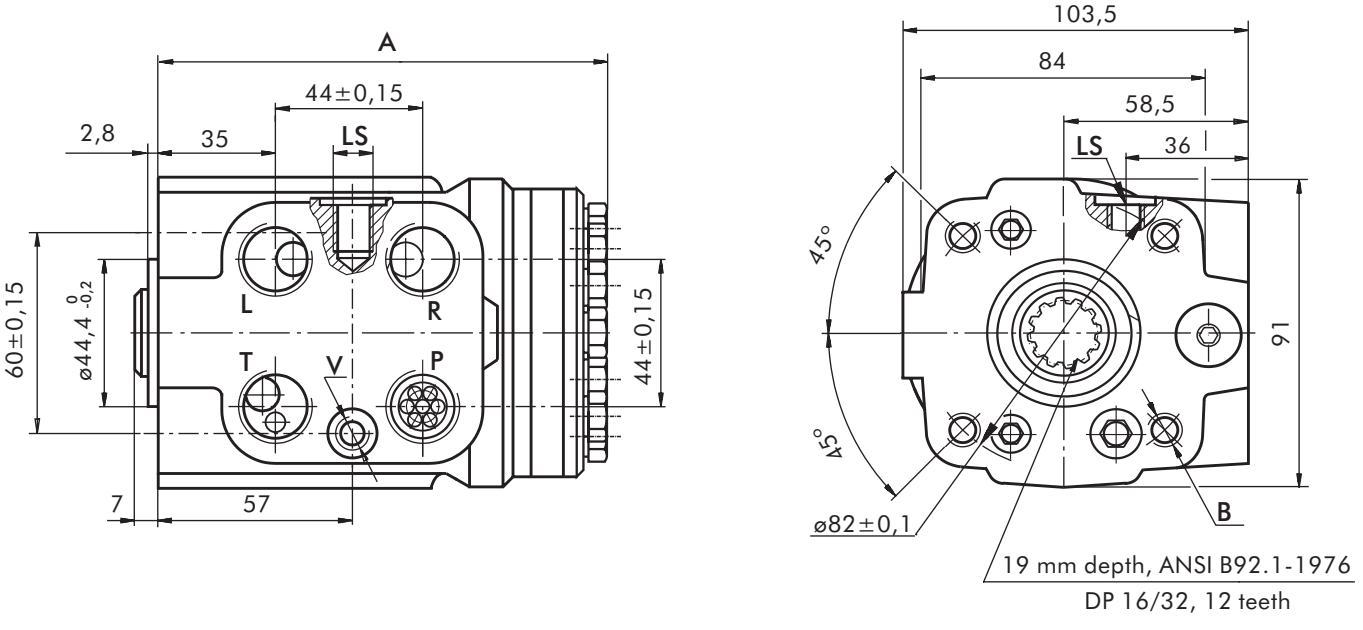




DIMENSIONS AND MOUNTING DATA - OH/4E

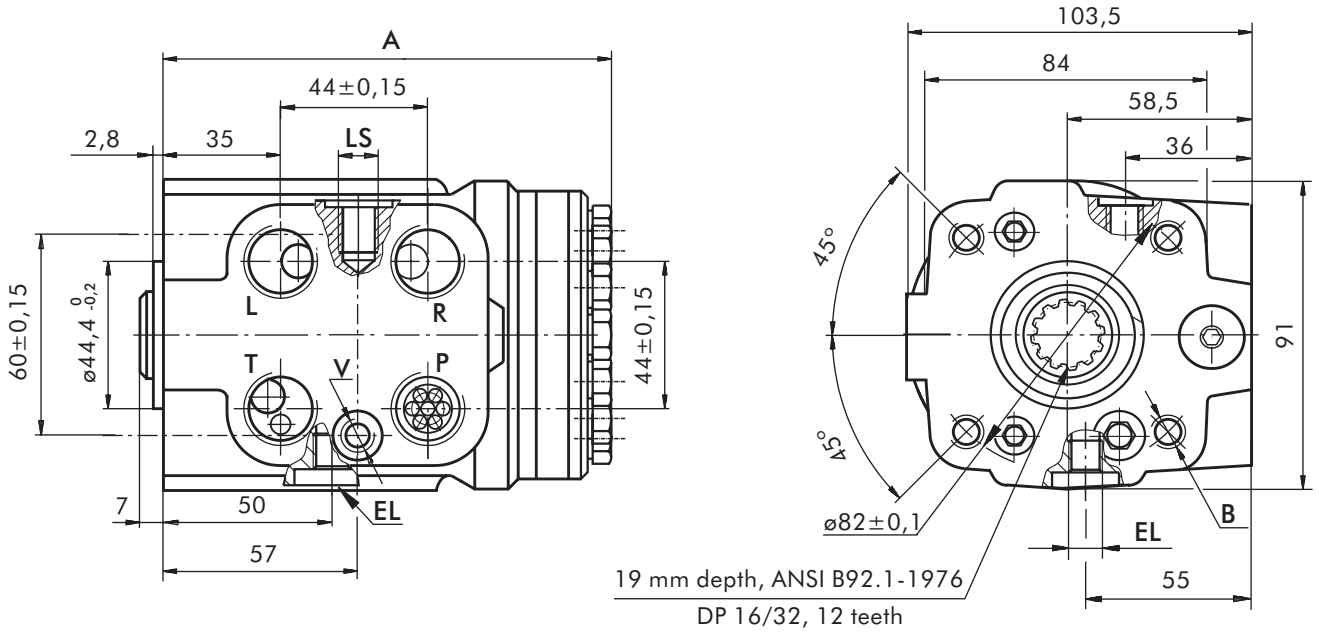


DIMENSIONS AND MOUNTING DATA - OH/3



*** The ports are shown in the Table of** the following **page**.

DIMENSIONS AND MOUNTING DATA - OH/3E



THREADED PORTS

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

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

ORDER CODE for OH/3 - OH/4

	1		2	3		4		5	6	7
OH		/			-		-			

Pos.1 - Versions and Priority Valve Connection

3 - **Version** 3 *"Closed Center - Non Reaction and Load Sensing Outlet"* - Pipe Mounting

4 - Version 4 *"Closed Center - Non Reaction and Load Sensing Outlet"* - Modulary **Mounting**

Pos.2 - Displacement code (see Specification Data)

40	- 39,6 [cm³/rev]
50	- 49,5 [cm³/rev]
63	- 65,6 [cm³/rev]
80	- 79,2 [cm³/rev]
100	- 99,0 [cm³/rev]
125	- 123,8 [cm³/rev]
160	- 158,4 [cm³/rev]
200	- 198,0 [cm³/rev]
250	- 247,5 [cm³/rev]
320	- 316,8 [cm³/rev]
400	- 396,0 [cm³/rev]

Pos.3 - Electric Signal Connection

omit - without electric signal connection

E - with electric signal connection

Pos.4 - Relief Valve Pressure Settings, bar

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

Pos.5 - Ports

omit - **BSPP (ISO 228)**

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

M - **Metric (ISO 262)**

Pos.6 - Option (Paint)*

omit - No Paint

P - Painted

PC - Corrosion Protected Paint

Pos.7 - Design Series

omit - Factory specified

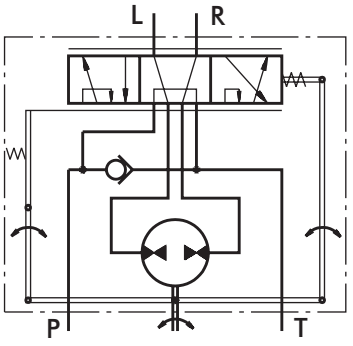
NOTES:

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

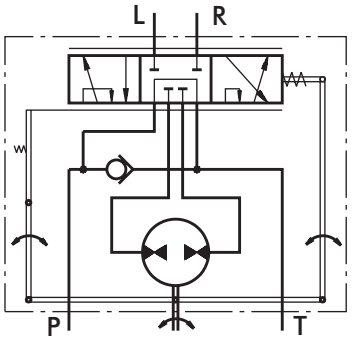
The steering units are mangano-phosphatized as standard.

HYDROSTATIC STEERING UNITS TYPE OH.../OR - OH...

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



"Open Center - Load Reaction"
Version OR - OH .../OR

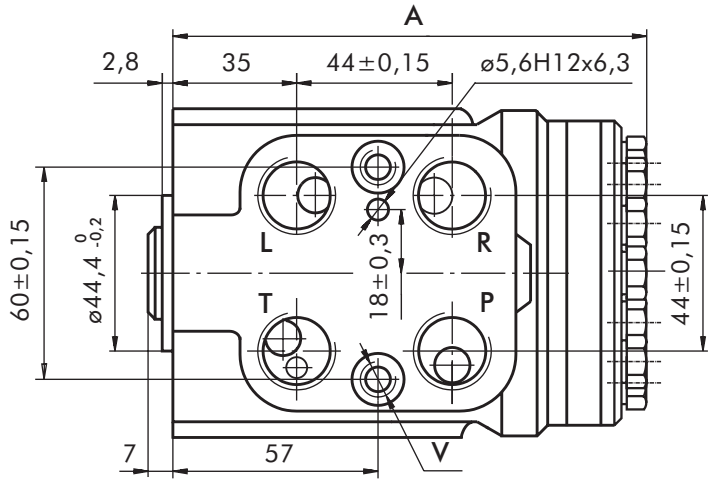


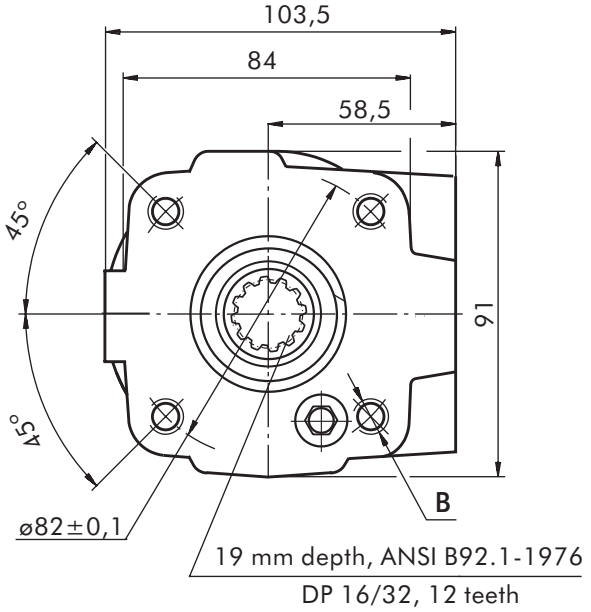
"Open Center - Non Load Reaction"
Version OH ...

SPECIFICATION DATA

Parameters	Type														
	OH 40/OR	OH 50/OR	OH 63/OR	OH 80/OR	OH 100/OR	OH 125/OR	OH 160/OR	OH 200/OR	OH 250/OR	OH 320/OR	OH 400/OR				
	OH 40	OH 50	OH 63	OH 80	OH 100	OH 125	OH 160	OH 200	OH 250	OH 320	OH 400	OH 500	OH 630	OH 800	OH 1000
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	618,7	793	990
Rated Flow [l/min]		6		9		12		17	24	30	40	50	63	80	
Rated Pressure [bar]	160												140		100
Max. Cont. Pressure in Line T_T - P_T [bar]	25														
Max. Torque at Servoamplifing [Nm]	6 (by P_T max)														
Max. Torque w/o Servoamplifing [Nm]	120														
Weight, avg. [kg]	5,3	5,4	5,5	5,6	5,7	5,8	6,0	6,3	6,5	7,0	7,4	8,0	8,7	9,6	10,6
Dimension A [mm]	130,8	132,2	133,9	136,2	138,8	142,2	146,8	152,2	158,8	168,2	178,8	192	209,3	232,2	258,6

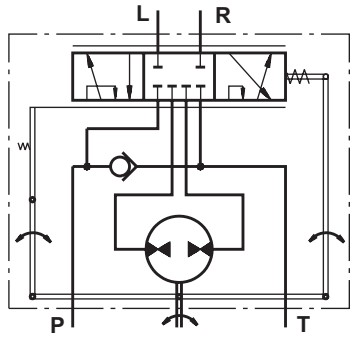
DIMENSIONS AND MOUNTING DATA





*** The ports are shown in the Table of page** Steering Units OH - 03.

HYDROSTATIC STEERING UNIT TYPE OH.../NC



"Closed Center - Non Load Reaction"
Version NC - OH.../NC

The OH.../NC is a *"Closed Center - Non Load Reaction".*

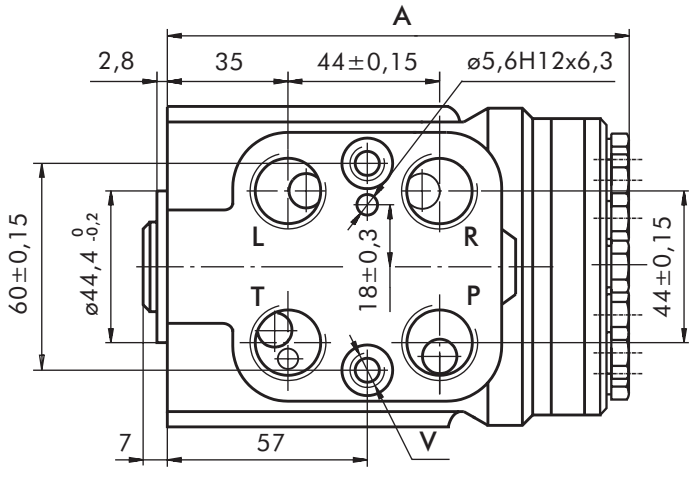
When connecting to a differential cylinder the L and R ports of the steering unit must be connected as follows: L to the greater piston area, and R - to the smaller one.

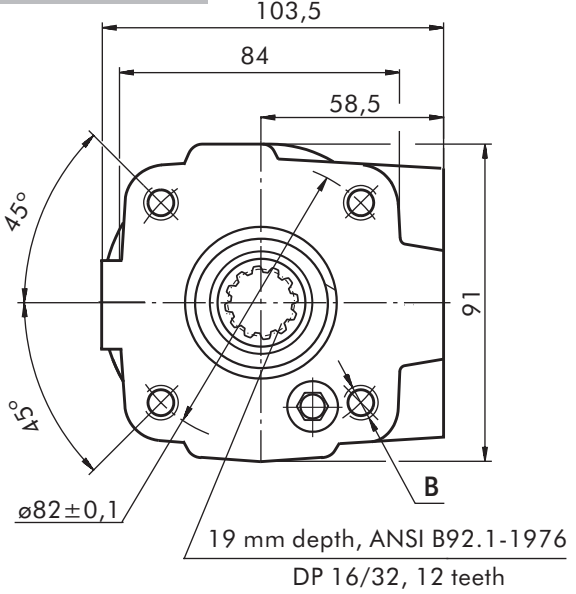
For the *"Closed Center - Non Load Reaction"* and *"Closed* **Center -** *Non Reaction and Load Sensing"* steering units is **possible to observe Thermal Shock - condition caused when the hydraulic system has operated for some time without turning the steering wheel, causing the fluid in the reservoir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

SPECIFICATION DATA

Parameters	Type													
	OH 40/NC	OH 50/NC	OH 63/NC	OH 80/NC	OH 100/NC	OH 125/NC	OH 160/NC	OH 200/NC	OH 250/NC	OH 320/NC	OH 400/NC	OH 500/NC	OH 630/NC	OH 800/NC
Displacement, [cm^3/U]	39,6	49,5	65,6	79,2	99,0	123,8	158,4	198	247,5	316,8	396	495	618,7	793
Rated Flow, [l/min]	4	5	6	9		12		17	24	30	40	50	63	80
Rated Pressure, [bar]	175													
Max. Cont. Pressure in Line T , [bar]	20													
Max. Torque at Servoamplifing, [Nm]	6 (by P_T max)													
Max. Torque w/o Servoamplifing, [Nm]	120													
Weight , [kg]	5,3	5,4	5,5	5,6	5,7	5,8	6,0	6,3	6,5	7,0	7,4	8,0	8,7	9,6
Dimension A, [mm]	130,8	132,2	133,9	136,2	138,8	142,2	146,8	152,2	158,8	168,2	178,8	192	209,3	232,2

DIMENSIONS AND MOUNTING DATA





*** The ports are shown in the Table of page** Steering Units OH - 03.

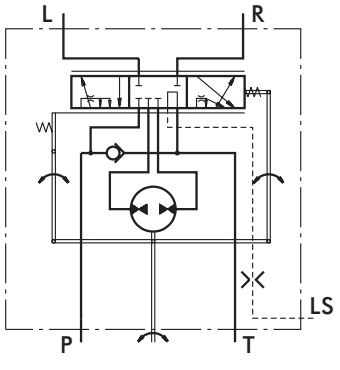
HYDROSTATIC STEERING UNITS TYPE OH.../NC...-LS

The OH/NC-LS **range expands the steering units family of Meta Hydraulic** with the *"Closed Center - Non Reaction and Load Sensing Outlet"* **version (static** hydraulic **connection to the priority valve)**
This range is manufactured in pipe mounting v**ersion** only.

SPECIFICATION DATA

Parameters		Type												
		OH 40 LS	OH 50 LS	OH 63 LS	OH 80 LS	OH 100 LS	OH 125 LS	OH 160 LS	OH 200 LS	OH 250 LS	OH 320 LS	OH 400 LS	OH 500 LS	OH 630 LS
Displacement	[cm³/rev]	39,6	49,5	65,6	79,2	99,0	123,8	158,4	198	247,5	316,8	396	495	618,7
Rated Flow	[l/min]	4	5	6	9		12		17	24	30	40	50	63
Rated Pressure	[bar]	125	150	175										
LS - Valve Pressure Settings*	[bar]	80	100	125	150	175								
Shock Valves Pressure Settings**	[bar]	140	160	180	200	240								
Max.Cont. Pressure in LineT-P_T	[bar]	20												
Max.Torque at Servoamplifing	[Nm]	6 *(by P_T max)*												
Max.Torque w/o Servoamplifing	[Nm]	120												
Weight, avg.	[kg]	5,4	5,5	5,6	5,7	5,8	5,9	6,2	6,5	6,6	7,2	7,8	8	8,7
Dimension A	[mm]	130,8	132,2	133,9	136,2	138,8	142,2	146,8	152,2	158,8	168,2	178,8	192	209,3

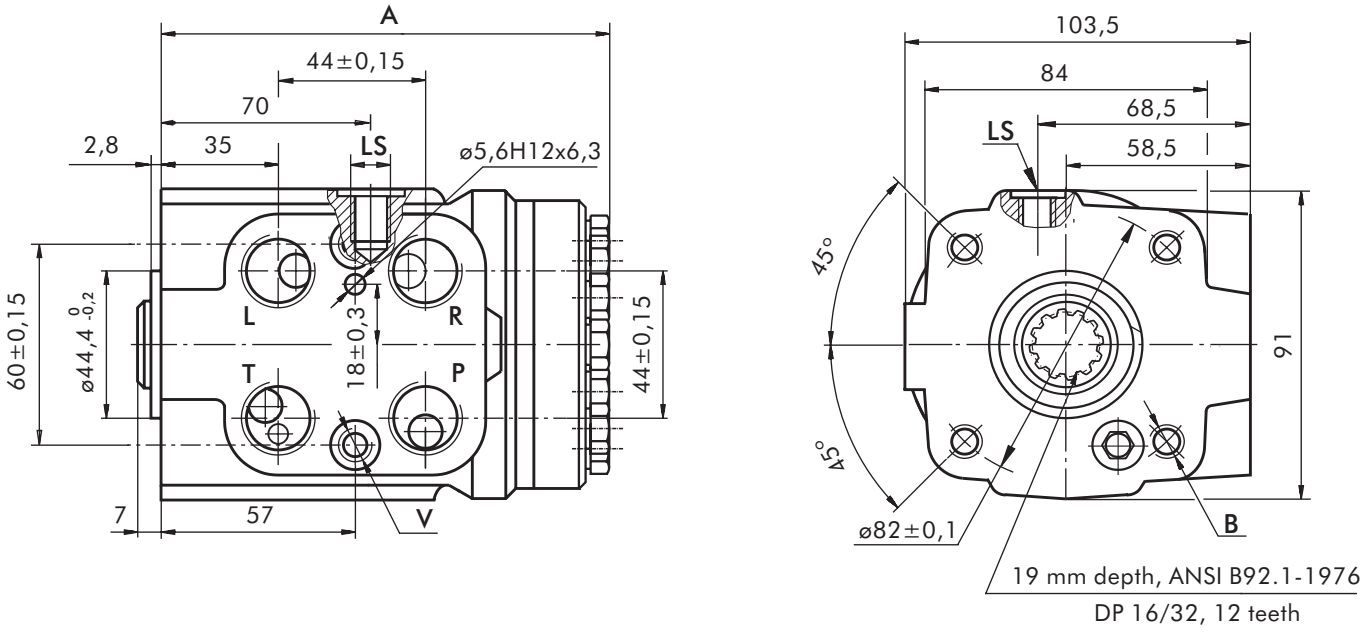
*** Pressure Settings are at flow rate of 6 l/min and viscosity 21 mm²/s (50°C).**
****Pressure Settings are at flow rate of 2 l/min and viscosity 21 mm²/s (50°C).**



"Closed Center - Non Load Reaction"
Version LS - OH.../NC-...-LS

Pipe Mounting

DIMENSIONS AND MOUNTING DATA - OH.../NC-LS



THREADED PORTS

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

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

THREADED PORTS FOR OH.../NC

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

ORDER CODE

	1		2		3	4	5
OH		/		-			

Pos.1 - Displacement code (see Specification Data)

40	- 39,6 [cm³/rev]
50	- 49,5 [cm³/rev]
63	- 65,6 [cm³/rev]
80	- 79,2 [cm³/rev]
100	- 99,0 [cm³/rev]
125	- 123,8 [cm³/rev]
160	- 158,4 [cm³/rev]
200	- 198,0 [cm³/rev]
250	- 247,5 [cm³/rev]
320	- 316,8 [cm³/rev]
400	- 396,0 [cm³/rev]
500	- 495,0 [cm³/rev]
630	- 618,7 [cm³/rev]
800	- 792,0 [cm³/rev]
1000	- 990,0 [cm³/rev]

Pos.2 - Versions

OR - **Version OR** *"Open Center - Load Reaction"*

omit - **Version** *"Open Center - Non Load Reaction"*

NC - **Version** NC *"Closed Center - Non Load Reaction"* Up to 800 cc only

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**

PC - **Corrosion Protected Paint**

Pos.5 - Load Sensing Option (for NC Version only)

LS - *"Closed Center - Non Load Reaction Load Sensing Outlet"* Up to 630 cc only

NOTES:

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

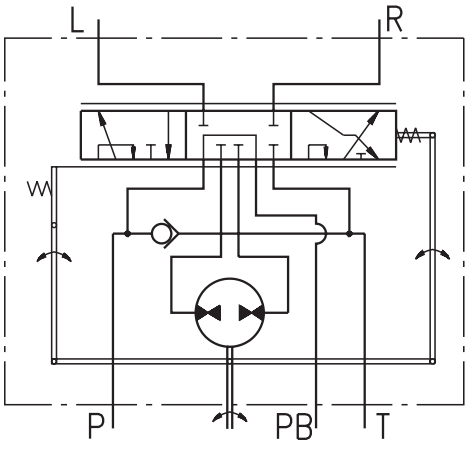
The steering units are mangano-phosphatized as standard.

HYDROSTATIC STEERING UNIT TYPE OH.../PB

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

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

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

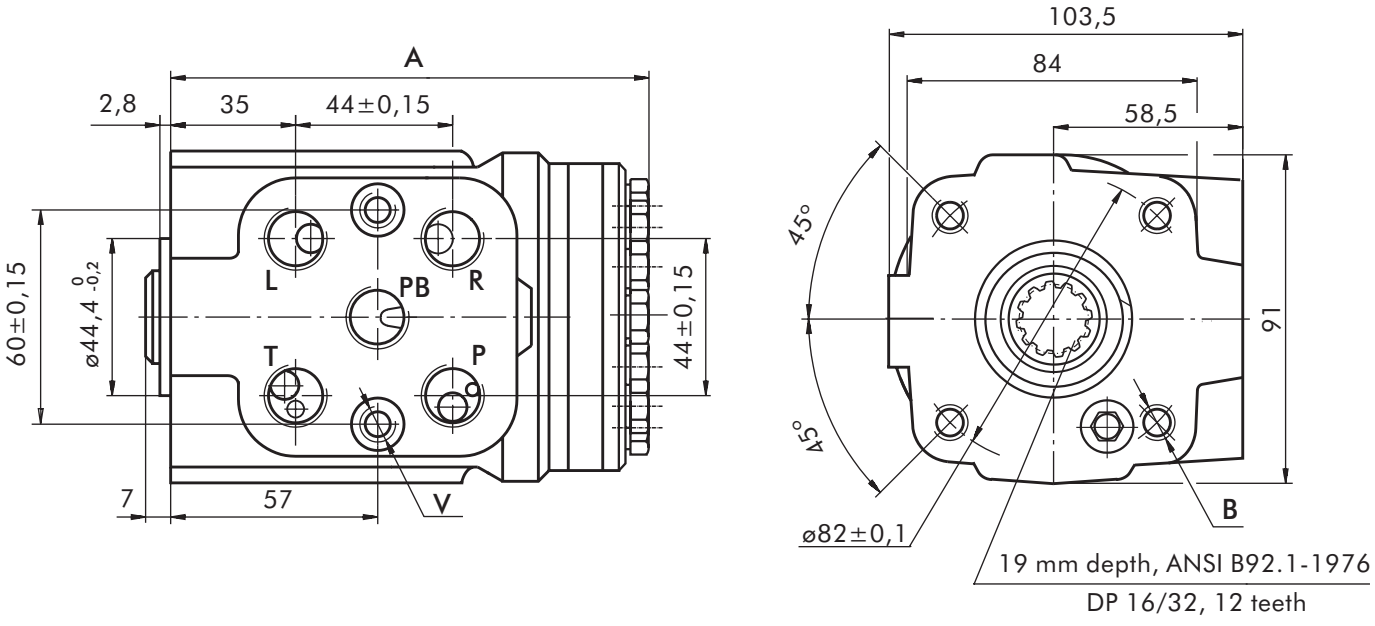


"Open Center - Non Load Reaction"
OH.../PB - Power Beyond

SPECIFICATION DATA

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

DIMENSIONS AND MOUNTING DATA



THREADED PORTS for OH.../PB

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

ORDER CODE for OH.../PB

	1		2		3	4	5
OH		**/**	**PB**	**-**			

Pos.1 - Displacement code (see Specification Data)

40	- 39,6 [cm ^{3}/rev]
50	- 49,5 [cm ^{3}/rev]
63	- 65,6 [cm ^{3}/rev]
80	- 79,2 [cm ^{3}/rev]
100	- 99,0 [cm ^{3}/rev]
125	- 123,8 [cm^3/rev]

Pos.2 - Versions

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

Pos.3 - Ports

omit - BSPP (ISO 228)

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

Pos.4 - Option (Paint)*

omit - No Paint

P - **Painted**

PC - **Corrosion Protected Paint**

Pos.5 - Design Series

omit - Factory specified

NOTES:

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

The steering units are mangano-phosphatized as standard.

HYDROSTATIC STEERING UNIT TYPE OHK

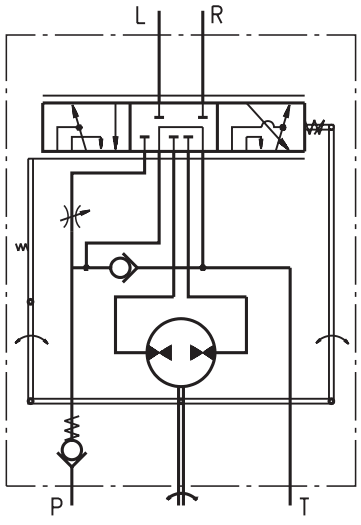
OHK is a new series of hydrostatic steering units with an additionally increased flow. The hydrostatic steering unit type OHK is available for steering medium and large sized vehicles, allowing easy control either in servo-amplified mode or in emergency operation.

OHK 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, OHK has the following working volume:

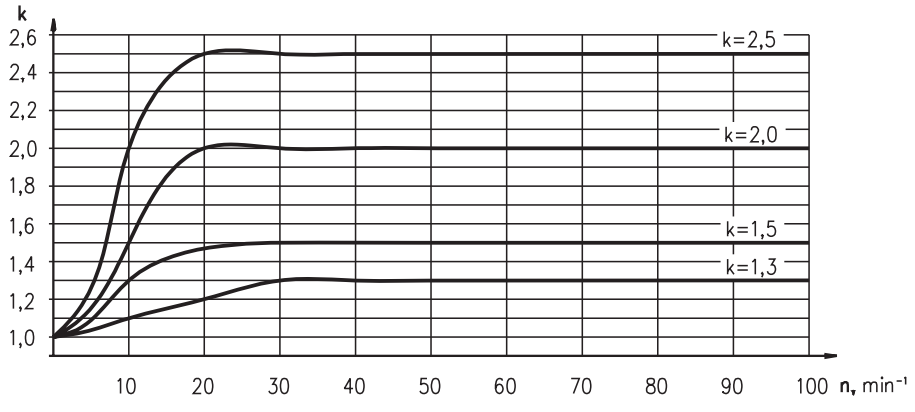
- from 80 cm^3 to 200 cm^3 for emergency operation mode (manual steering without servo-amplifying;
- from 100 cm^3 to 500 cm^3 for normal operation mode (with total flow amplifying).

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



"Open Center - Non Load Reaction" OHK

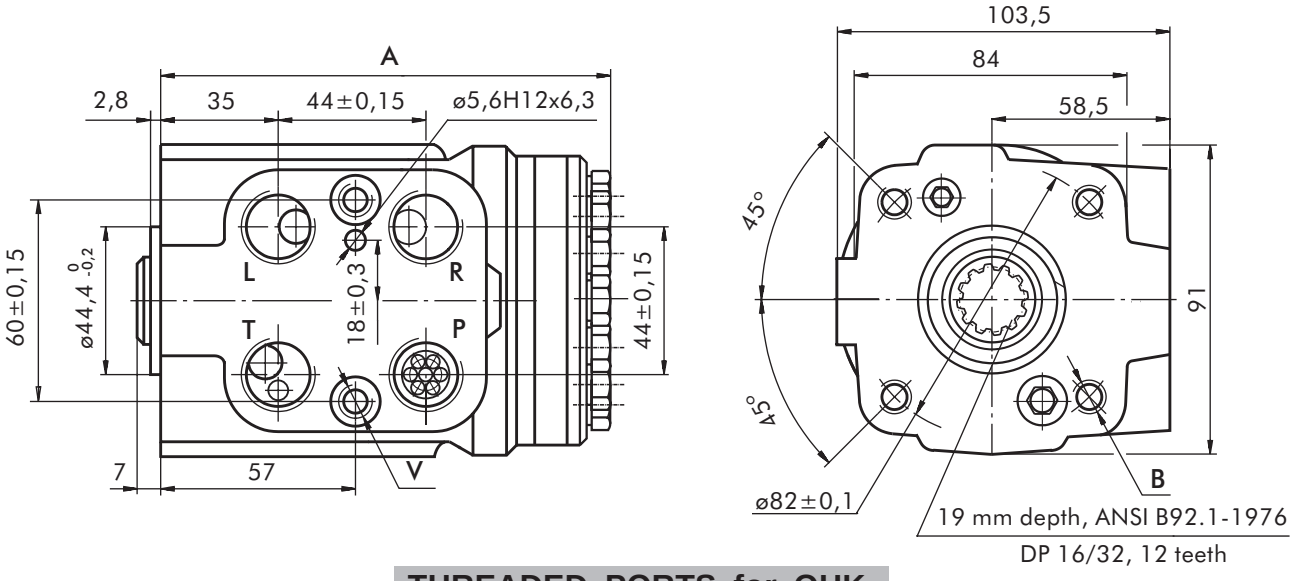
VARIABLE AMPLIFYING FACTOR



SPECIFICATION DATA

Parameters	Type																			
	OHK 80				OHK 100				OHK 125				OHK 160				OHK 200			
Displacement - without servo-amplifying (in emergency mode)	79,2				99,0				123,8				158,4				198			
- with servo-amplifing [cm^3/rev]	100	125	160	200	125	160	200	250	160	200	250	320	200	250	320	400	250	320	400	500
Rated Flow* [l/min]	10	12,5	16	20	12,5	16	20	25	16	20	25	32	20	25	32	40	25	32	40	50
Amplifying Factor (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]	160																			
Max. Cont. Pressure in Line T-P_T [bar]	25																			
Max. Torque at Servoamplifing [Nm]	*6 (by P_T max)*																			
Max. Torque w/o Servoamplifing [Nm]	120																			
Weight, avg. [kg]	5,6				5,7				5,8				6,0				6,3			
Dimension A [mm]	136,2				138,8				142,2				146,8				152,2			

DIMENSIONS AND MOUNTING DATA



THREADED PORTS for OHK

code	Ports - P*, T, R, L Thread	Column Mounting Thread - B	Valve Mounting Thread - V
-	G1/2 17 mm depth	4 x M10 18 mm depth	2 x M10x1 16 mm depth
A	3/4 - 16 UNF O-ring 17 mm depth	4x 3/8 - 16 UNC 15,7 mm depth	2 x 3/8 - 24 UNF 14,2 mm depth
M	M22x1,5 17 mm depth	4 x M10 18 mm depth	2 x M10x1 16 mm depth
MX	M20x1,5 17 mm depth	4 x M10 18 mm depth	2 x M10x1 16 mm depth

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

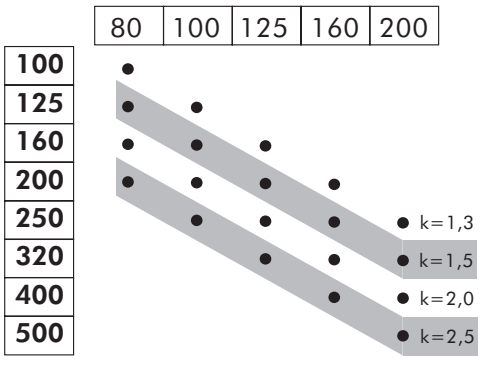
ORDER CODE for OHK

1	2	3	4	5	6
OHK	/	/	-		

Pos.1 - Displacement code (see Specification Data)

- **80** - 79,2 [cm³/rev]
- **100** - 99,0 [cm³/rev]
- **125** - 123,8 [cm³/rev]
- **160** - 158,4 [cm³/rev]
- **200** - 198,0 [cm³/rev]

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



Pos.3 - Versions

omit - **Version** *"Open Center - Non Load Reaction"*

Pos.4 - Ports

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

Pos.5 - Option(Paint)**

- **omit** - **No Paint**
- **P** - **Painted**
- **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 OHK 200/500**

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

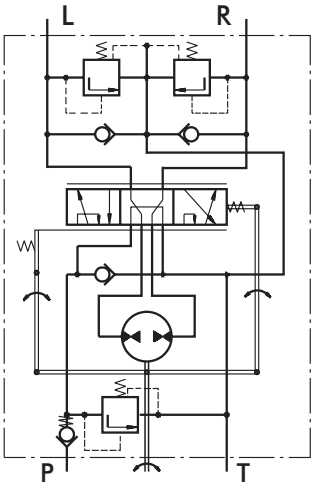
The steering units are mangano-phosphatized as standard.

HYDROSTATIC STEERING UNITS TYPE OX.../1 - OX.../2

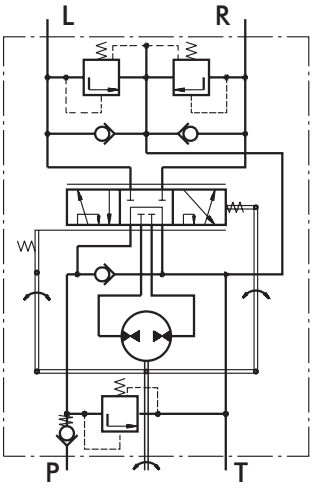
The Meta Hydraulic Hydrostatic Steering units are used in low-speed vehicles which driving speed does not exceed 60 km/h - such as: building machines, fork-lift trucks, harvesting machines, off-highway equipment and others. These hydraulic units amplify the torque to the steering wheels, with no need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

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



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



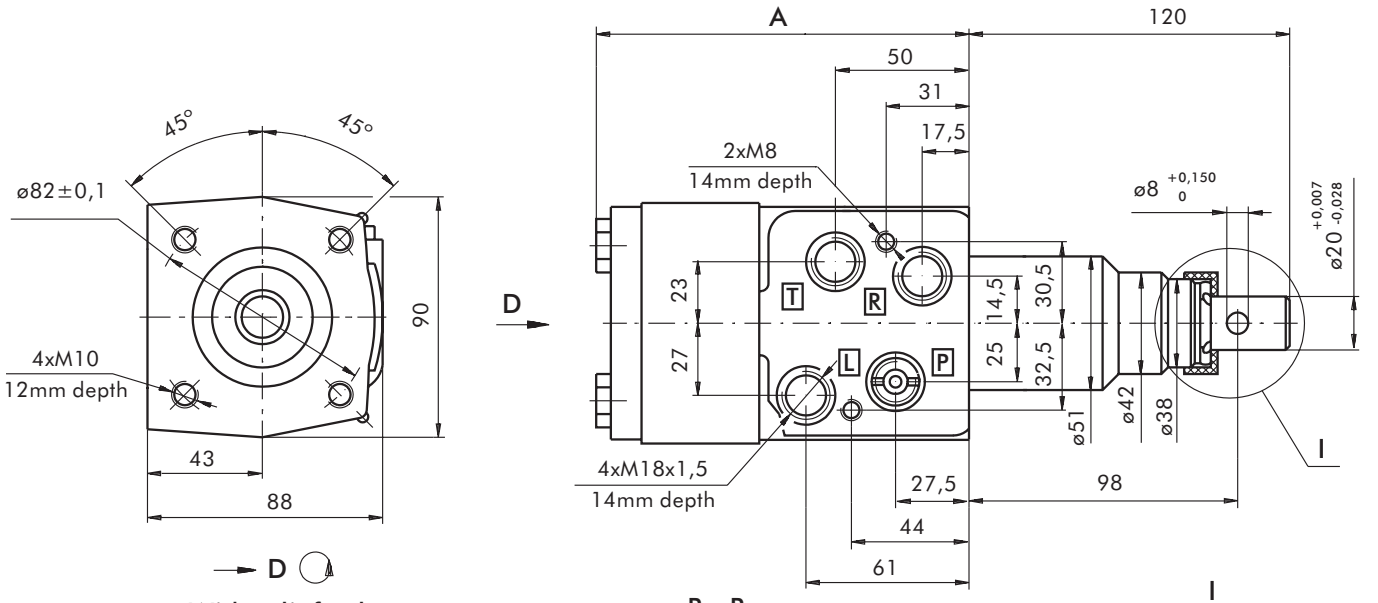
"Open Center - Non Load Reaction"
With Built-in Valves
Version 2 - OX.../2

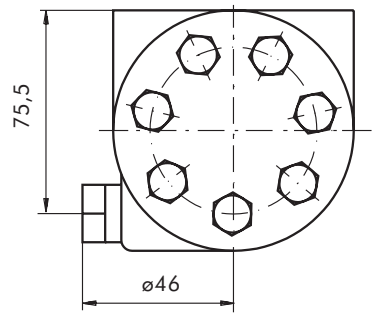
SPECIFICATION DATA

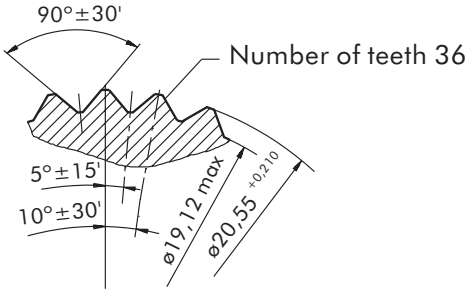
Parameters	Type											
	OX 65/1,2	OX 75/1,2	OX 85/1,2	OX 100/1,2	OX 120/1,2	OX 145/1,2	OX 170/1,2	OX 195/1,2	OX 245/1,2	OX 295/1,2	OX 340/1,2	OX 390/1,2
Displacement [cm^3/rev]	64	72	84	96	120	144	167	191	240	287	334	382
Rated Flow [l/min]	6		9		12		17		24		30	40
Rated Pressure [bar]	150											
Relief Valve Pressure Settings* [bar]	80		100		125		150					
Shock Valves Pressure Setting** [bar]	200											
Max.Cont.Pressure in Line T_T - P_T [bar]	20											
Max.Torque at Servoamplifing [Nm]	7,5 (by P_T max)											
Max.Torque w/o Servoamplifing [Nm]	125											
Weight, avg. [kg]	6,0	6,2	6,4	6,5	6,6	6,8	7,0	7,1	7,3	7,5	8,0	8,4
Dimension A [mm]	134	135	136,3	138,5	141,5	144,5	148	151	157,5	163,5	170	176,5

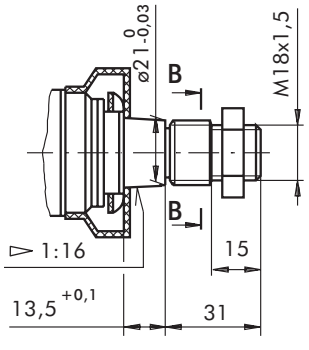
* Pressure Settings are at Rated Flow (as in the table) and viscosity 21 mm^2/s (50° C).
** Pressure Settings are at flow rate of 4 l/min and viscosity 21 mm^2/s (50° C).

DIMENSIONS AND MOUNTING DATA









ORDER CODE

1	2	3	4	5	6
O X		/	-	-			

Pos.1 - Displacement code

65	- 64 [cm³/rev]
75	- 72 [cm³/rev]
85	- 84 [cm³/rev]
100	- 96 [cm³/rev]
120	- 120 [cm³/rev]
145	- 144 [cm³/rev]
170	- 167 [cm³/rev]
195	- 191 [cm³/rev]
245	- 240 [cm³/rev]
295	- 287 [cm³/rev]
340	- 344 [cm³/rev]
390	- 382 [cm³/rev]

Pos.2 - Versions

1	**- Version 1** *"Open Center - Load Reaction"*
2	**- Version 2** *"Open Center - Non Load Reaction"*

Pos.3 - Relief Valve Pressure Settings, bar

80	
100	
125	
150	
0	**- without Relief Valve**

Pos.4 - Shaft Extension

omit - Standard driving shaft for connection to the steering column

A	**- Driving shaft for direct connection to the steering wheel**

Pos.5 - Option (Paint)*

omit - No Paint

P	**- Painted**
PC	**- Corrosion Protected Paint**

Pos. 6 - Design Series

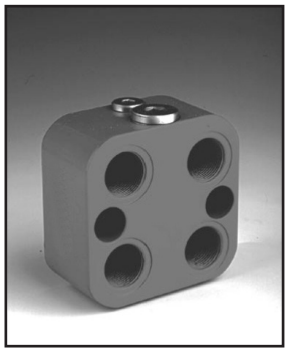
omit - Factory specified

NOTES:

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

The steering units are mangano-phosphatized as standard.

VALVE BLOCKS FOR OH TYPE BH...

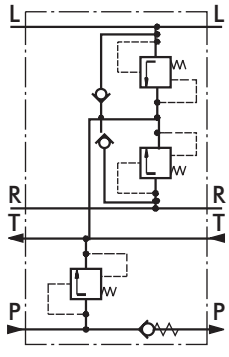


BH1

The Meta Hydraulic BH 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 BH valves can be divided into 2 **types: BH1 and BHR**. The maximum flow rate is in **in compliance with** the whole range of OH and OX steering units but no **more than 80**l/min. The pressure settings for the entry relief valves **and the shock** valves are given in the table.

BHR

SPECIFICATION DATA

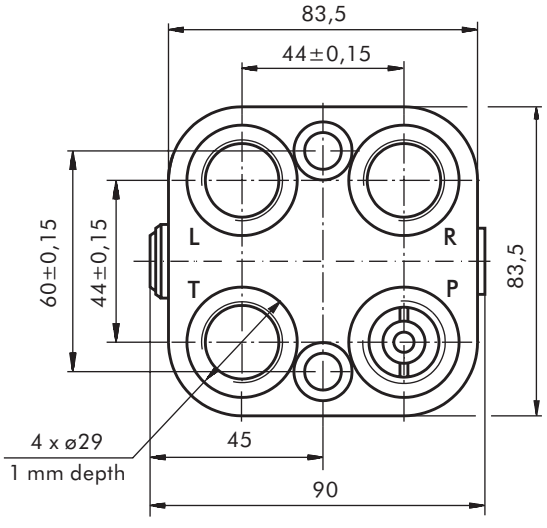


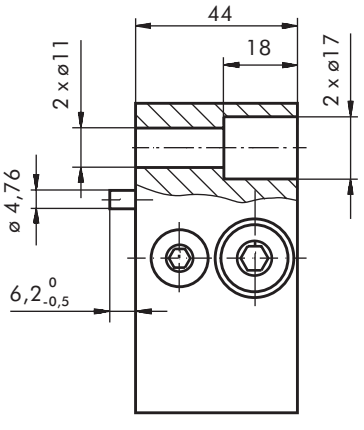
BH1, BHR

Parameters		Type			
		BH1, BHR			
Rated Flow	[l/min]	80			
Rated Pressure	[bar]	160			
Relief Valve Pressure Settings*	[bar]	80	100	125	150
Shock Valves Pressure Settings**	[bar]	140	160	180	200
Weight, avg.	[kg]	1,8 ; 2,3			

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

DIMENSIONS AND MOUNTING DATA - BH1





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

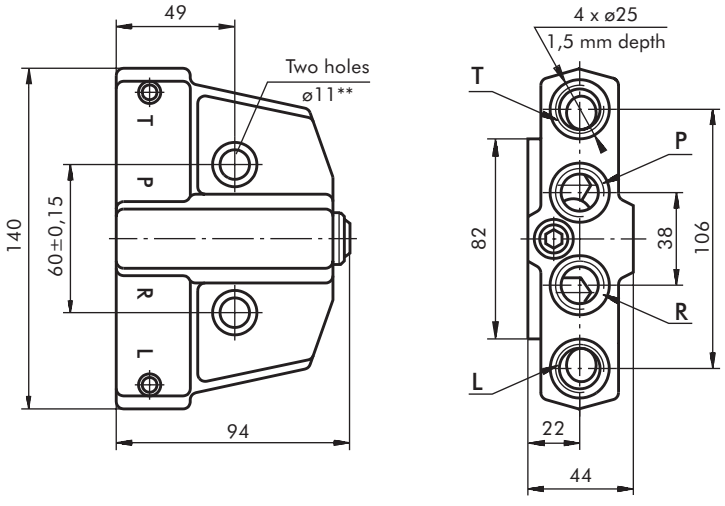
Connection to the OH **is done with 2 screws M10x1x40-8.8 DIN 912 or with 2 screws 3/8-24** ANSI B18.3-76; **UNF 37,5 mm long.**
Tightening torque: 2,5±0,5 daNm

DIMENSIONS AND MOUNTING DATA - BHR

**** Connection to the OH is done with 2 screws M10x1x40-**8.8 DIN 912 or
with 2 screws 3/8-24 UNF ANSI B18.3-76; 37,5 mm long.

Tightening torque: 2,5±0,5 daNm

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



ORDER CODE

1	2	3	4	5
B H		-		-			

Pos.1 - Versions*

R 1	**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**
PC	**- Corrosion Protected Paint**

Pos.5 - Design Series

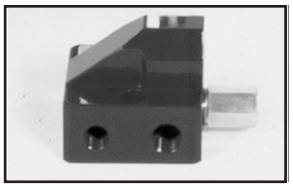
omit - Factory specified

NOTES: * Versions R,1- for OH.
** The colour is by customer's request.

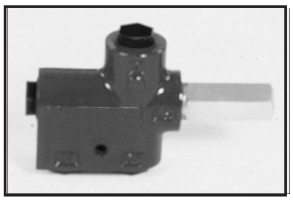
The valve blocks are mangano-phosphatized as standard.

PRIORITY VALVES FOR OH/4 AND OH/3 TYPE LS...

LSA



LS

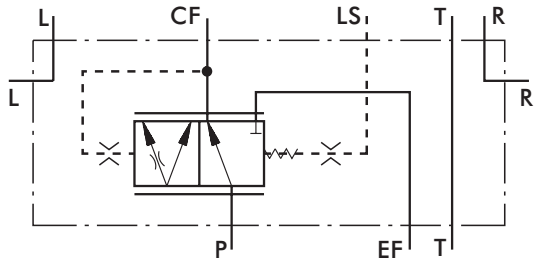


The Priority Valves distribute and trace the hydraulic flow from the supply pump of the hydraulic system to the hydraulic components which control and run the vehicle.

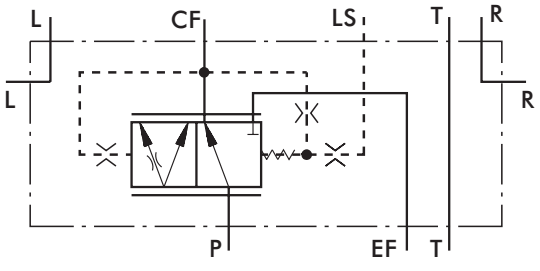
The Priority Valves are used only with the OH/4-OH/4E-OH/3-OH/3E **hydrostatic steering units. When connected, the steering unit and the priority valve represent sophisticated hydraulic tracing system that controls the flow in both main pipelines of the hydraulic system (the working and control one) 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** LS **priority valves and the** OH/3-OH/3E **steering units has to be as short as possible, but should not exceed 1,5m (for iron pipe with ø4 internal diameter). When a rubber hose is used this length have to be even shorter.**

Modulary Mounting

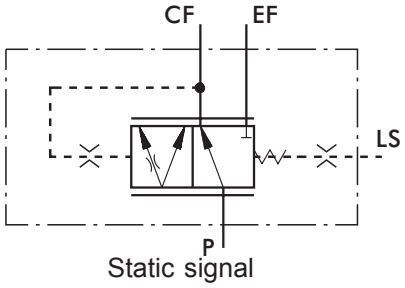


Static signal
LSSA.../40,80...

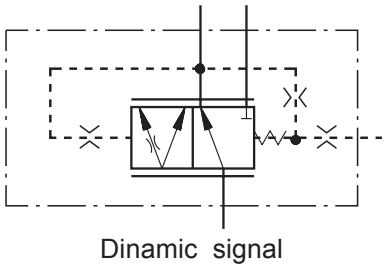


Dinamic signal
LSA.../40,80...

Pipe Mounting

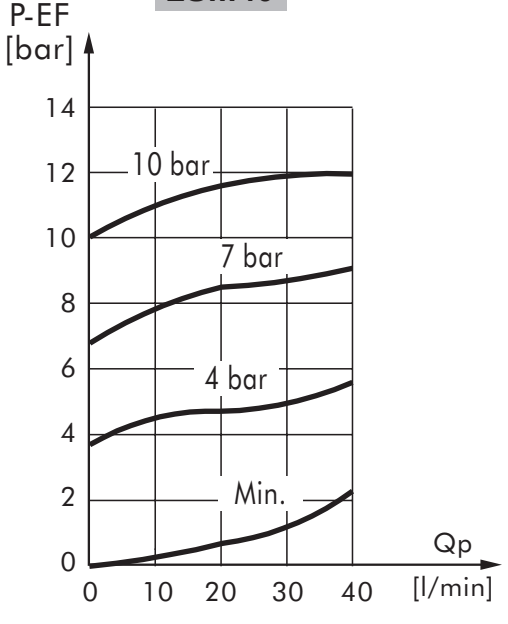


Static signal
LSS.../40,80...

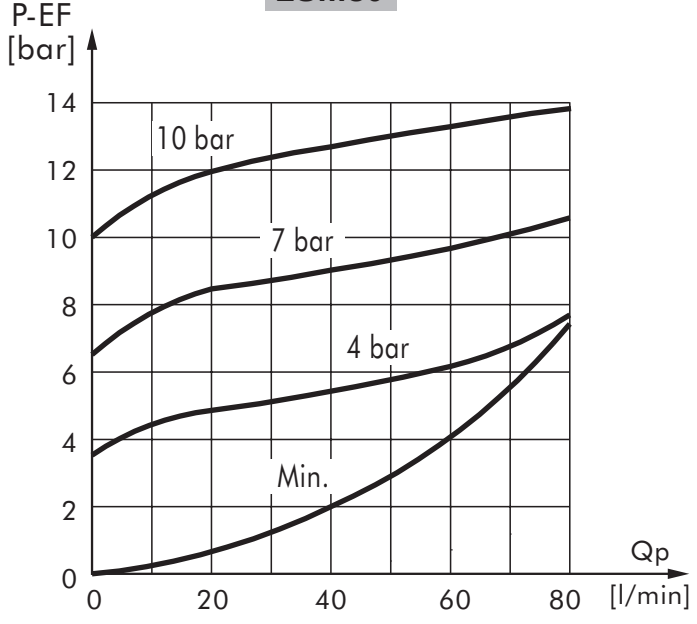


Dinamic signal
LS.../40,80...

LS...40



LS...80

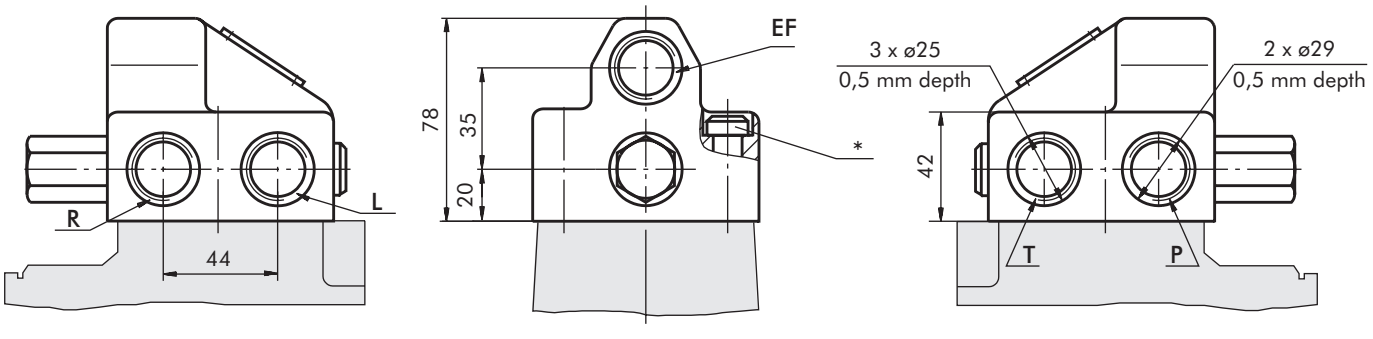


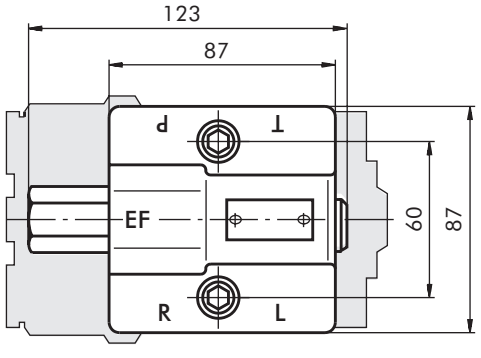
SPECIFICATION DATA

Parameters		Type					
		LS(S)A			LS(S)		
Rated Flow	[l/min]	40; 80					
Control Spring Pressure	[bar]	4	7	10	4	7	10
Max. Pressures in Oil Ports: P,EF,R,L		250					
[bar]	CF	175					
	T	15					
Weight, avg.	[kg]	2,7			1,2		

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

DIMENSIONS AND MOUNTING DATA - LS(S)A/40,80

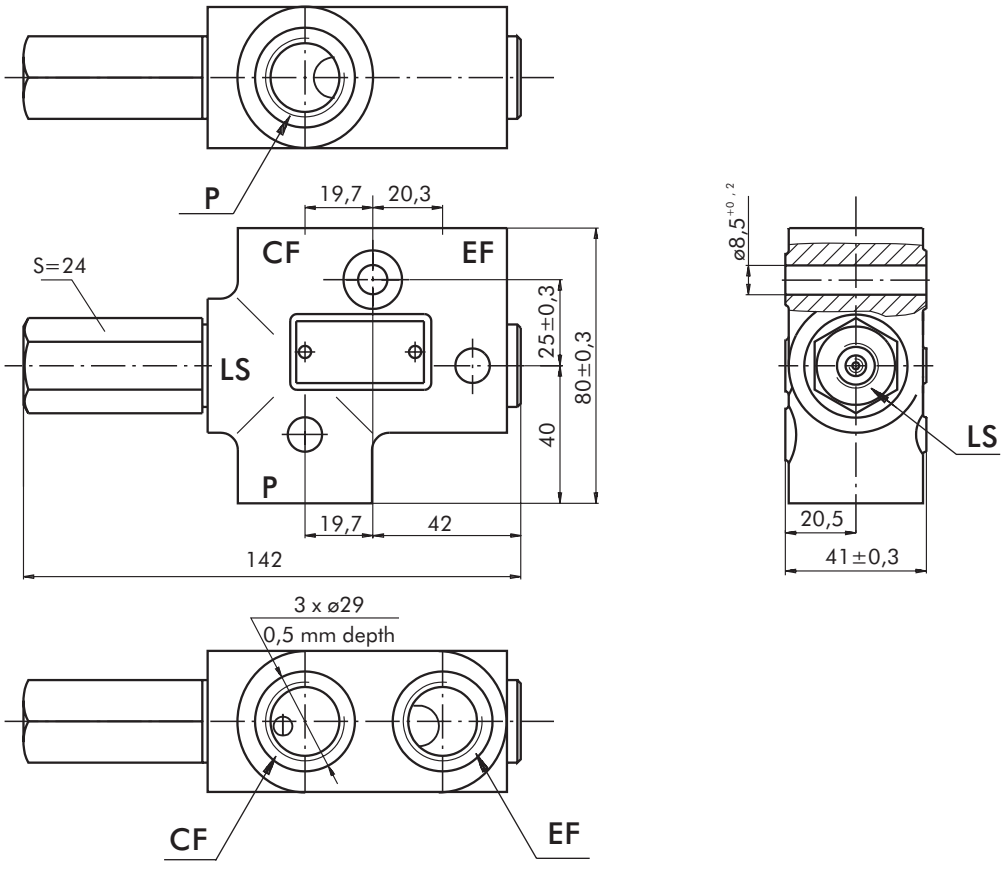




code	Ports-P,EF Thread	Ports-T,R,L Thread
A	7/8 - 14 UNF O-ring 18 mm depth	3/4 - 16 UNF O-ring 18 mm depth
-	G1/2 18 mm depth	G3/8 18 mm depth
M	M22x1,5 18 mm depth	M18x1,5 18 mm depth

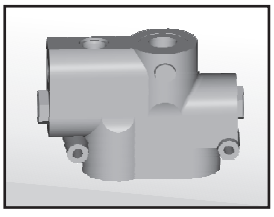
*** Connection to the OH/4... is done with 2 screws M10x1x45-10.9 DIN 912 or with 2 screws 3/8-24 UNF ANSI B18.3-76; 44,5 mm long. Tightening torque: 4,5±0,5 daNm.**

DIMENSIONS AND MOUNTING DATA - LS(S)/40,80

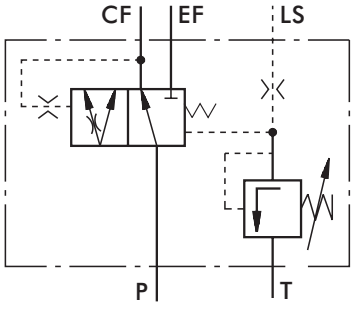


code	Ports-P,EF Thread	Port-CF Thread	LS-Port
-	G1/2 18 mm depth	G1/2 18 mm depth	G1/4 14 mm depth
A	7/8 - 14 UNF O-ring 18 mm depth	3/4 - 16 UNF O-ring 18 mm depth	7/16 - 20 UNF O-ring 12,7 mm depth
M	M22x1,5 18 mm depth	M22x1,5 18 mm depth	G1/4 14 mm depth

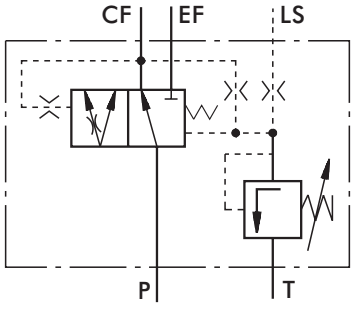
PRIORITY VALVES FOR OH/3... TYPE LS.../160



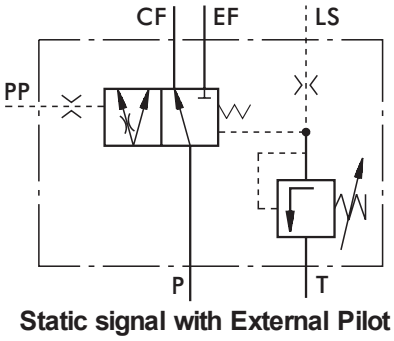
The Priority Valves LS.../160 have a built-in pilot pressure relief valve, who protects the steering unit against excess pressure. The pilot pressure relief valve operates with the Shuttle of the Priority valve to limit the maximum steering pressure P-T measured across the steering units ports.



Static signal
LSS.../**160...**



Dinamic signal
LS.../160...



Static signal with External Pilot
LSSE.../160...

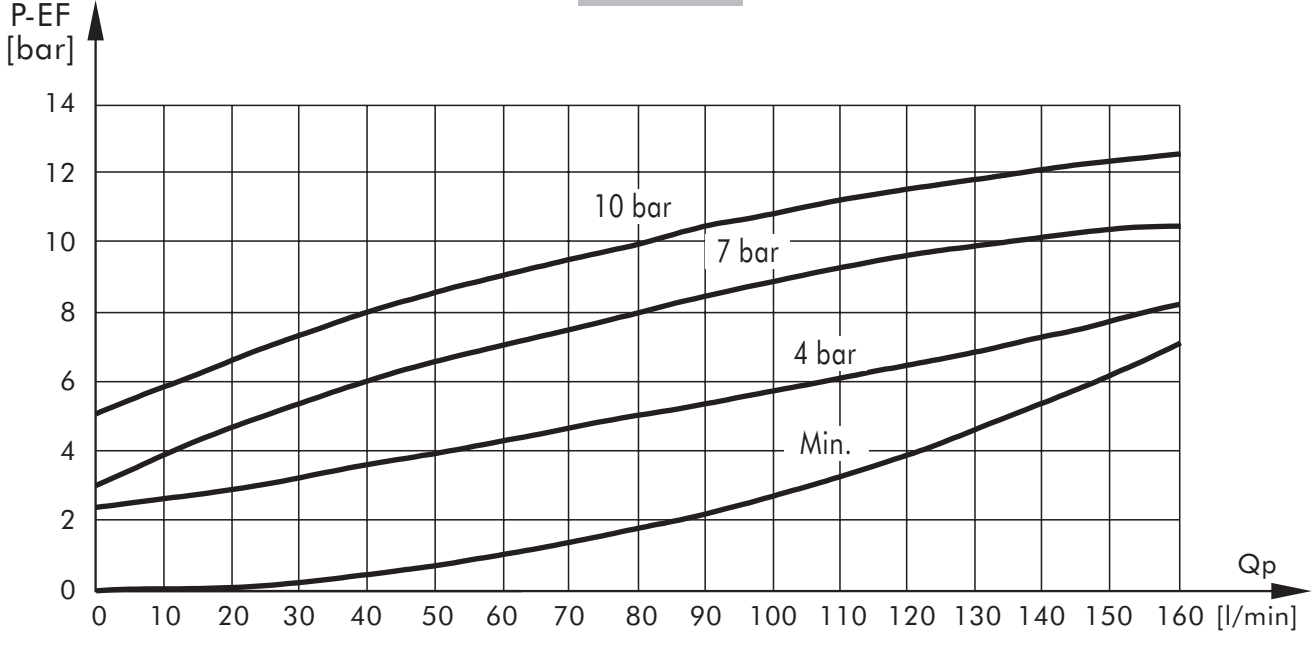
SPECIFICATION DATA

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

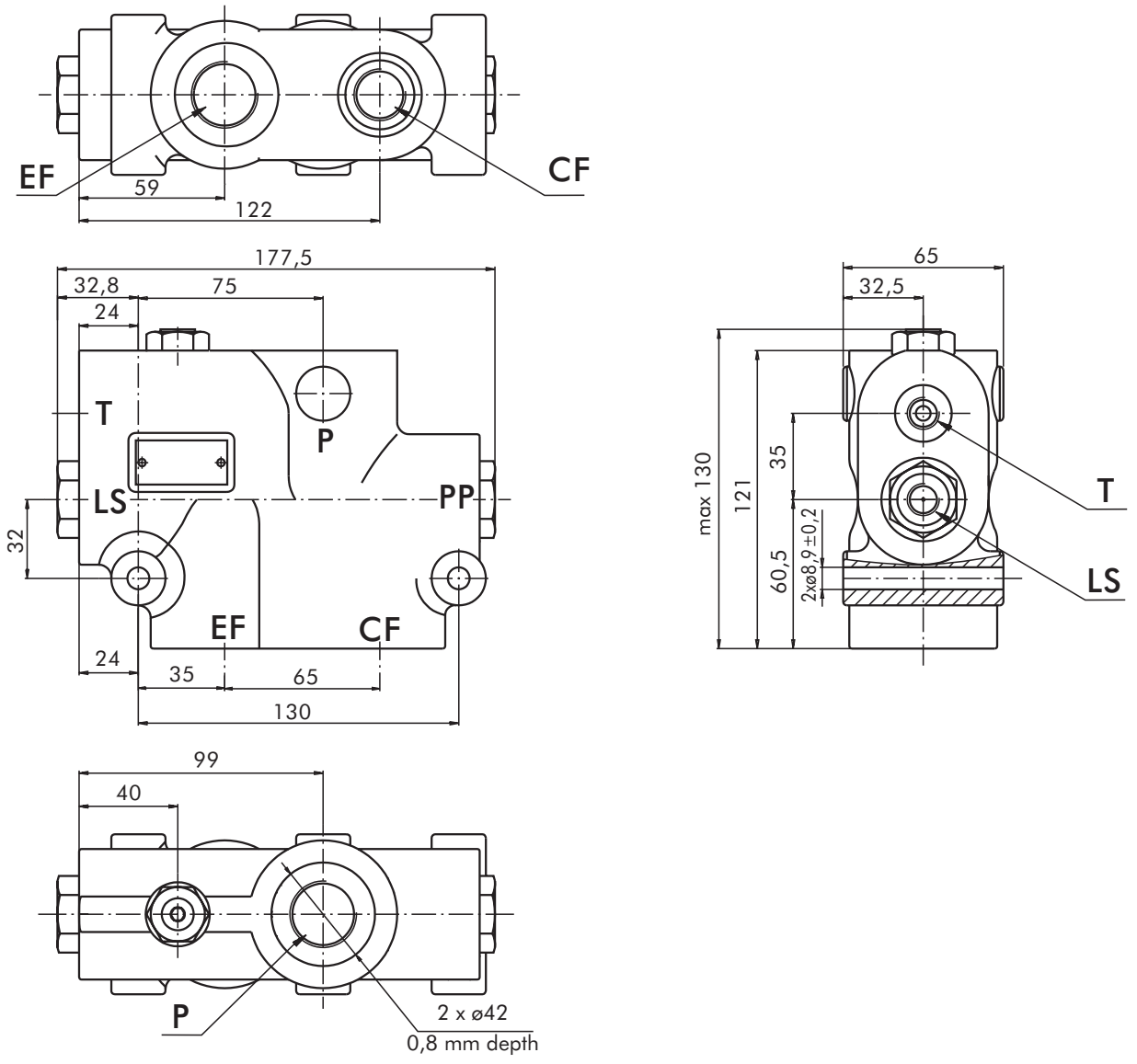
*** - Adjusted valve pressure from 80 till 210 bar upon customer request.**

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

LS...160



DIMENSIONS AND MOUNTING DATA - LS(S)(E)/160



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

ORDER CODE

	1	2	3		4		5	6	7
LS				/		-			

Pos.1 - Signal Type

S - **with Static signal**

omit - with Dinamic signal

Pos.2 - Mounting

omit - Pipe Mounting for OH/3

A - Modularly Mounting for OH/4

Pos.3 - Rated Flow, l/min

40 **80**

Pos.4 - Control Spring Pressure , bar

4 **7** **10**

Pos.5 - Ports

omit - BSPP (ISO 228)

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

M - **Metric (ISO 262)**

Pos.6 - Option (Paint)*

omit - No Paint

P - **Painted**

PC - **Corrosion Protected Paint**

Pos.7 - Design Series

omit - Factory specified

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

ORDER CODE

	1		2	3		4	5	6
LS		/			-			

Pos.1 - Signal Type

omit - with Dinamic **signal**

S - **with** Static **signal**

E - **with Static signal with External Pilot**

Pos.2 - Rated Flow, l/min

160

Pos.3 - Control Spring Pressure , bar

4 **7** **10**

Pos.4 - Ports

omit - BSPP (ISO 228)

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

M - **Metric (ISO 262)**

Pos.5 - Option (Paint)*

omit - No Paint

P - **Painted**

PC - **Corrosion Protected Paint**

Pos.6 - Design Series

omit - Factory specified

NOTES: * Colour at customer's request.

The priority valves are mangano-phosphatized as standard.

TORQUE AMPLIFIERS TYPE UVM... - Series 2

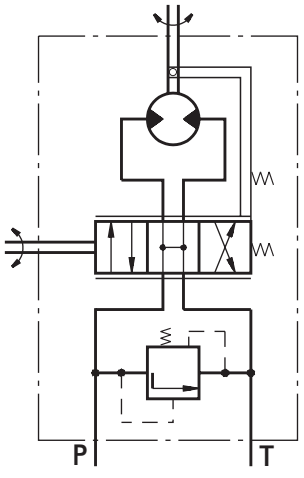
The Meta Hydraulic UVM Torque Amplifiers amplify the applied torque to the control shaft and thus ease the running of various transport vehicles such as:

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

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

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

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



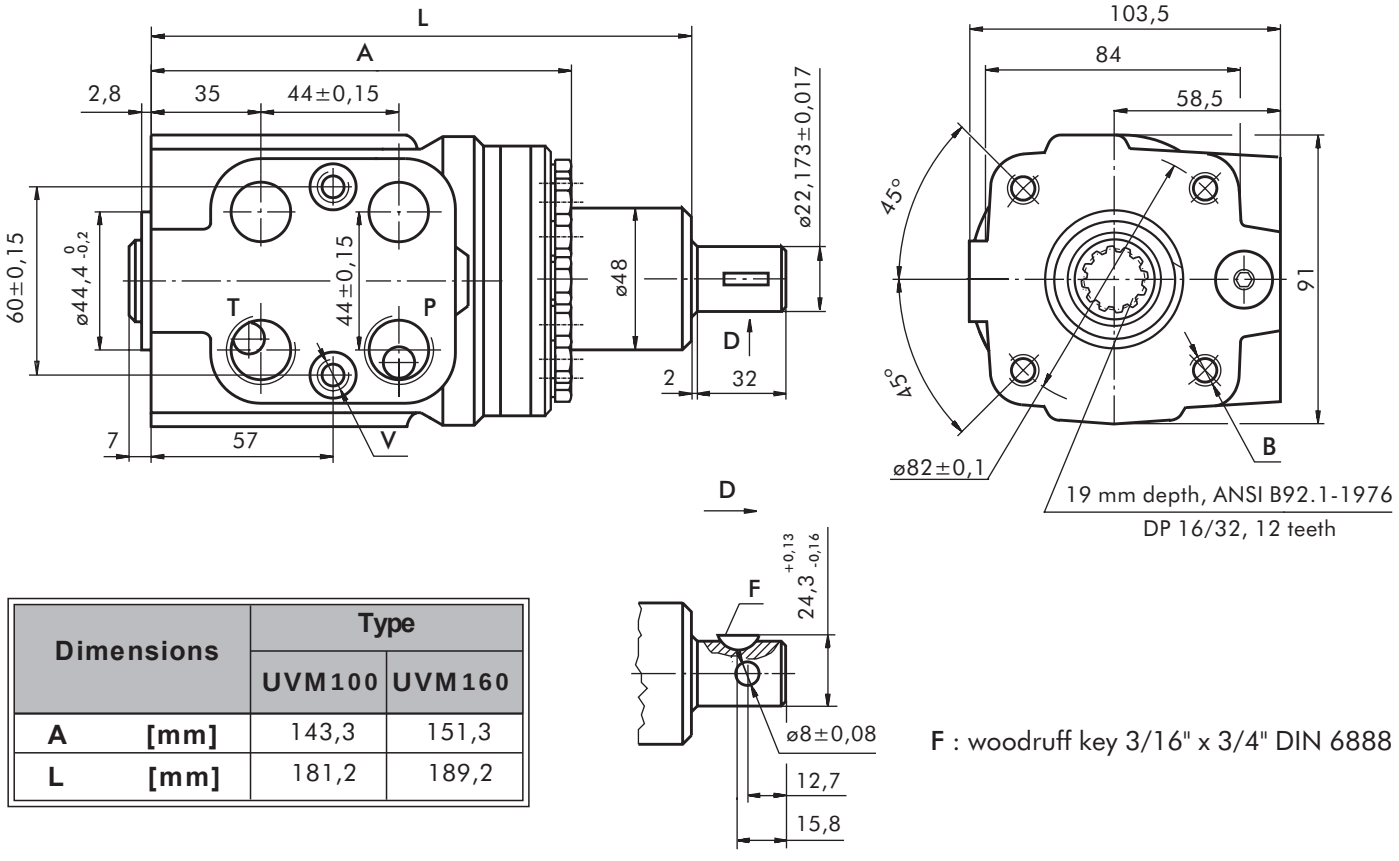
UVM...

SPECIFICATION DATA

Parameters		Type	
		UVM 100	UVM 160
Displacement	[cm³/rev]	99,0	158,4
Rated Flow	[l/min]	10	16
Rated Pressure*	[bar]	70	70
Input Torque	[Nm]	3,5...5	3,5...5
Max. Input Torque	[Nm]	20	20
Torque Output at 70 bar.	[Nm]	80	120
Pressure Drop between P and T at Rated Flow,	[bar]	1 ... 2	1,6...2,5
Max. Speed of Rotation at Rated Flow and Pressure	[r/min]	100	100
Max. Continuous Pressure in Line T	[bar]	20	20
Weight, avg.	[kg]	5,8	6,2

* Pressure Settings are at Rated Flow (as in the table) and viscosity 21 mm²/s (50°C).

DIMENSIONS AND MOUNTING DATA



Dimensions		Type	
		UVM100	UVM160
A	[mm]	143,3	151,3
L	[mm]	181,2	189,2

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

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

ORDER CODE

	1	2	3	4
U V M				

Pos.1 - Displacement code

100 - 99,0 [cm³/rev]

160 - 158,4 [cm³/rev]

Pos.2 - Ports

omit - BSPP (ISO 228)

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

M - **Metric (ISO 262)**

Pos.3 - Option (Paint)*

omit - No Paint

P - **Painted**

PC - **Corrosion Protected Paint**

Pos.4 - Design Series

omit - Factory specified

NOTES:

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

The steering units are mangano-phosphatized as standard.

STEERING COLUMNS TYPE CSF... - CSC...

The Meta Hydraulic CSF-CSC **Steering Columns transfer the torque from the steering wheel of** the **vehicle to the** OH,OH/1 **or other of the same class steering units. The** CSF-CSC **steering** columns are **consisted of a pipe in which is centred the control shaft.**

MOUNTING

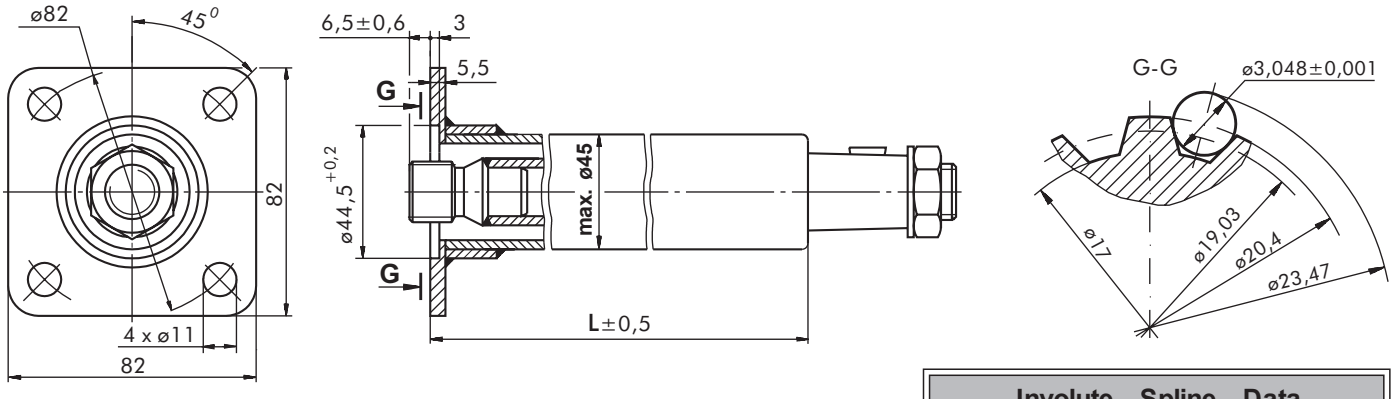
The CSF-CSC **steering column is hard-mounted to the steering unit by its welded flange using** four **screws M10 at minimal depth 10 mm fitted in the steering unit with tightening torque** of 2 **daNm.**

Permissible loads on the steering column are as follows:

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

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

DIMENSIONS AND MOUNTING DATA TYPE CSF



Involute Spline Data		
Modul	m	1,5875
Number of Teeth	z	12
Pressure Angle	α	30°
Pitch	p_t	4,986

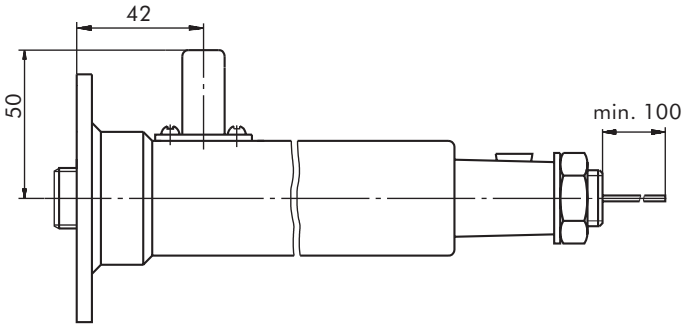
SPECIFICATION DATA

Parameters	Type				
	CSF 75	**CSF 150**	**CSF 400**	**CSF 715**	**CSF 775**
L [mm]	**75**	**150**	**400**	**715**	**775**
Weight, avd [kg]	**0,7**	**1,0**	**1,5**	**2,3**	**2,5**

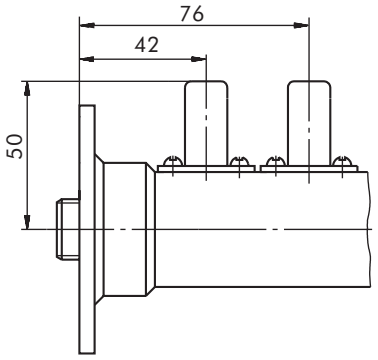
Please, contact factory or your regional manager regarding other lenghts

SOUND SIGNAL CONNECTION - TYPE CSC

1 Option

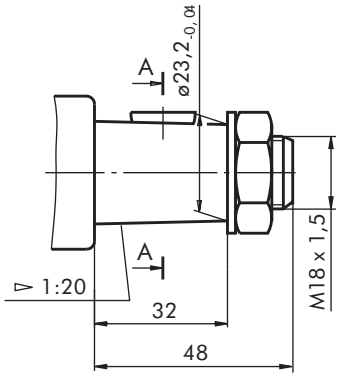


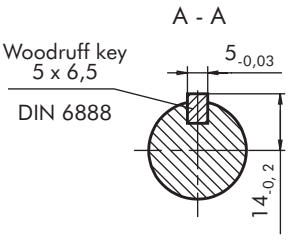
2 Option



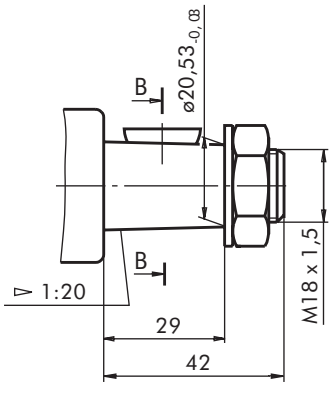
SHAFT EXTENSIONS

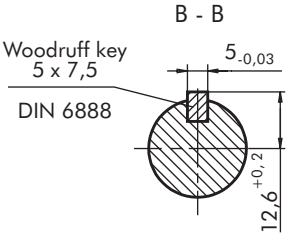
TYPE 1



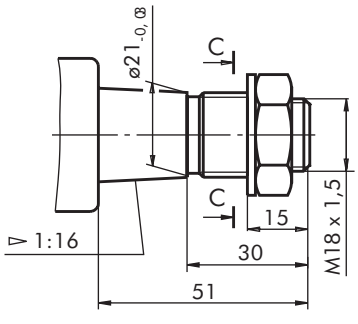


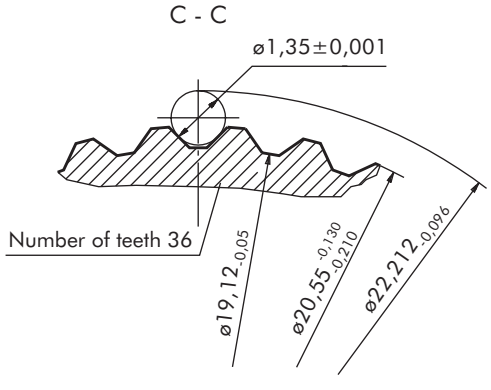
TYPE 2



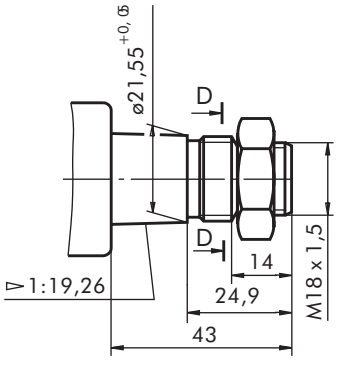


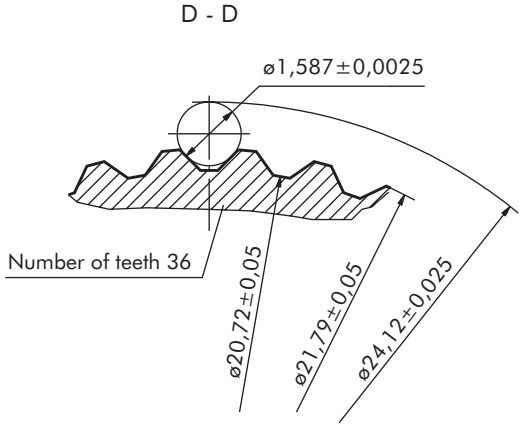
TYPE 3



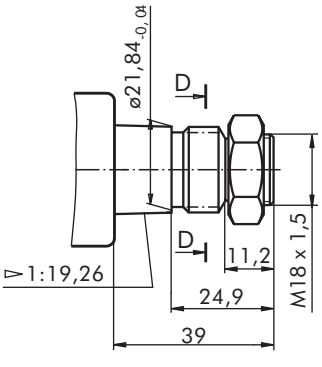


TYPE 4



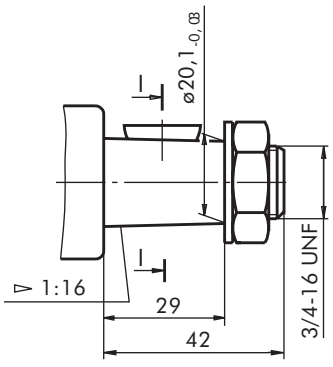


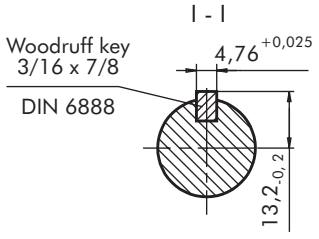
TYPE 5



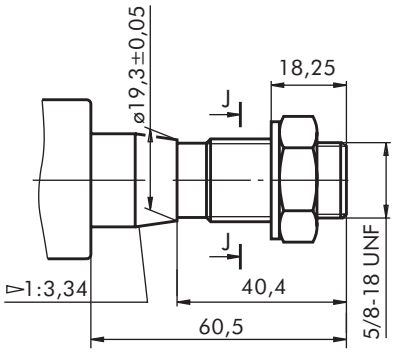
SHAFT EXTENSIONS

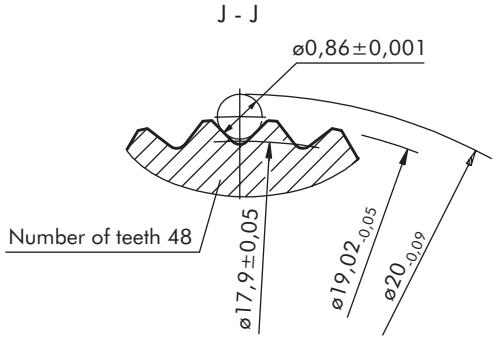
TYPE 6





TYPE 7





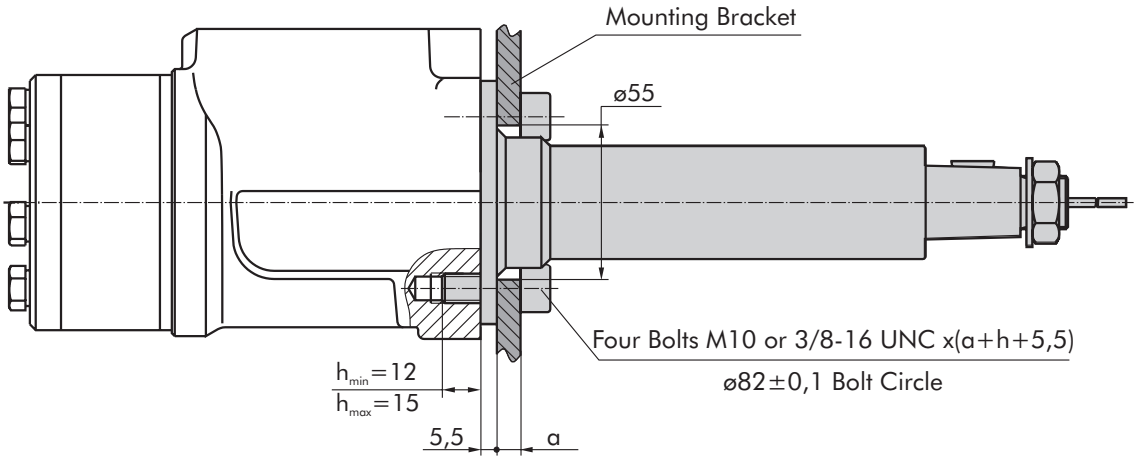
INSTALLING

For assembling the Steering column to the Steerin units must use:

For OH.../... **and** OH.../...M **- four bolts M10**

For OH.../...A **- four bolts 3/8-16 UNC**

Tightening torque for bolts 3±0,5 daNm



ORDER CODE

	1	2	3	4
CSF			1	

Pos.1 - External shaft dimension

0	- 38 mm□
1	- 45 mm□
2	- 40 mm

Pos.2 - Shaft Extensions

1, 2, 3, 4, 5, 6 and 7

Pos.3 - Design Series

1	**- Factory specified**

Pos.4 - Lenght, mm (according to table)

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

The steering columns are yelow galvanized as standard.

ORDER CODE

	1	2	3	4	5
CSC			1		

Pos.1 - External shaft dimension

0	- 38 mm□
1	- 45 mm□
2	- 40 mm

Pos.2 - Shaft Extensions

1, 2, 3, 4, 5, 6 and 7

Pos.3 - Design Series

1	**- Factory specified**

Pos.4 - Signal Connection (Option)

1	**- with one electric signal connection**
2	**- with two electric signal connection**

Pos.5 - Lenght, mm (according to table)

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

The steering columns are yelow galvanized as standard.

APPLICATION SPECIFICATION AND GENERAL 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 = Kingpintorque in [daNm].

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

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

B=Nominal width of tyre print [m] (seeDiagram No 1).

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

Chart No 1

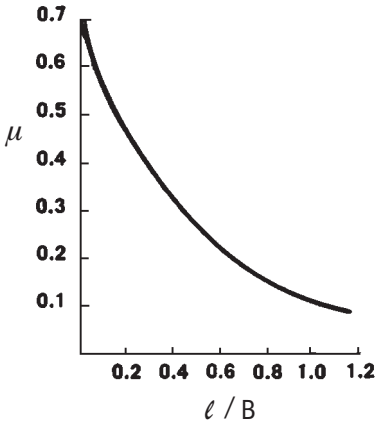


Diagram No 1

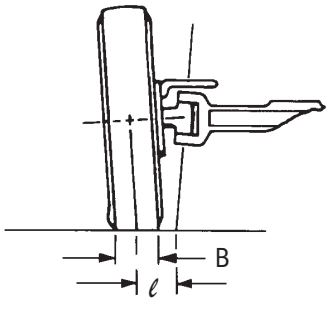
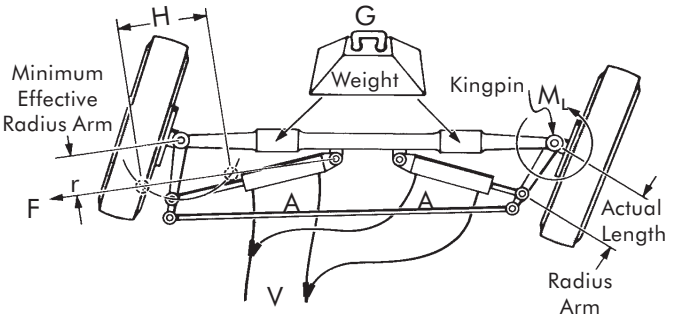


Diagram No 2



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

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

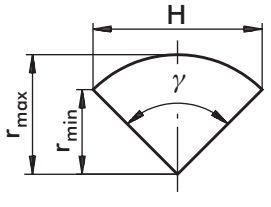
F = Force required [daN] to steer axle.

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

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

Chart No 2

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



STROKE
H = Stroke [cm].
Calculate stroke of cylinder using Diagram No 2 and Chart No 2 as shavt.

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

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

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

F = Force required from step twoforce formula [daN].

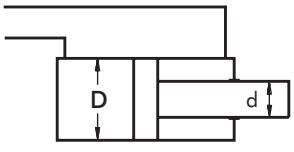
ΔP = Hydraulic pressure [bar] use following percentage of relief valve setting by amount of load on steered axle. Severe load 25% - medium load 55% - no load 75% .

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

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

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

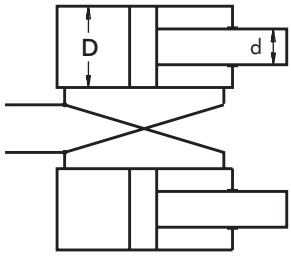
Differential Cylinder



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

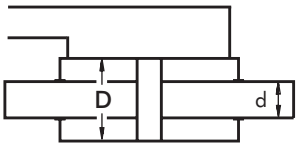
Note: $\left(\frac{d}{D}\right)^2 \leq 0,15$

Cross Connected Cylinders



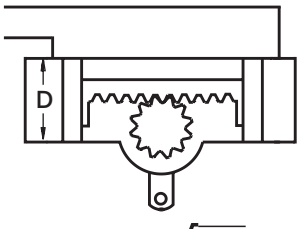
$$D = \sqrt{\frac{2A}{\pi} + \frac{d^2}{2}}$$

Balanced Cylinder



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

Opposed Cylinder



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

VOLUME $V = H \cdot A$

V = Volume. The total amount of oil required to move the cylinder rod(s) through the entire stroke [cm^3].
H = Stroke [cm].
A = Area [cm^2].
Note: For differential cylinders it is important to calculate average cylinder volume for step three using below formula.

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

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] per rev.
V = Volume of oil [cm^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 circuitry you require.
Recalculate the number of steering wheel turns using the displacement of selected standard hydrostatic steering unit outlined above. Use the formula shown below.

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

V = Volume of oil [cm^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 [l/min].
V_D= Unit displacement [cm^2] per rev.
N = Steering wheel input speed [rpm] (min^{-1}).
Recommended steering speed is 50 to 100 rpm.

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

GENERAL INFORMATION

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

- **Viscosity**

Viscosity at normal operating temperature should be approx. 20 mm²/s. Viscosity range 10 - 300 mm²/s.

- **Temperature**

Normal operating temperature range from +30 °C to+60 °C.
Minimum operating temperature -40°C.
Maximum operating temperature +80°C.
Note: Extended periods of operation at temperature of 60°C and above will greatly reduce life of oil due to oxidation and shorten life of product.

- **Filtration**

The maximum degree of contamination per ISO 4406 or CETOP RP is:
-20/17 open center units
-19/16 closed center and load sensing
-16/12 priority valves
Return line filtration of 25 μm nominal (40 - 50 μm absolute) **or finer is recommended.**
In extremely dusty conditions filtration of 10 μm absolute should be used.

START UP

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

MOUNTING UNITS

All hydrostatic steering units should be installed for ease of access. It is recommended that the steering unit be located outside the vehicle cabin.
It is important that no radial axial load be applied to the hydrostatic steering unit input shaft. Any or all radial and axial loads must be absorbed by the steering column or other operating device supplied by the vehicle manufacture.
Ports on the steering cylinder(s) should face upward to prevent damage.
During installation of the hydrostatic steering unit, cleanliness is of the utmost importance. Pipe plugs should be left in place during mounting and only removed when hydraulic lines are to be connected.

Many thanks to the production company M+S for the use of Technical Drawing

TORQUE TIGHTENING VALUES

Fluid connections

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

Mounting bolts

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

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