



MS HYDRAULIC

AXIAL PISTON MOTORS AND PUMPS

In cooperation with  **HES**
HYDRAULIC ELEMENTS & SYSTEMS



NEW
PRODUCTS

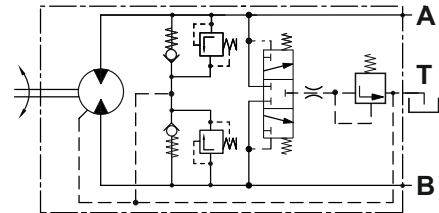
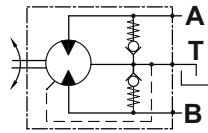
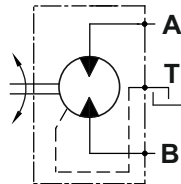


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Hydraulic Motors Type MAP50

Heavy Duty Axial Piston Motors Fixed Displacement



open drain line is always required

APPLICATION

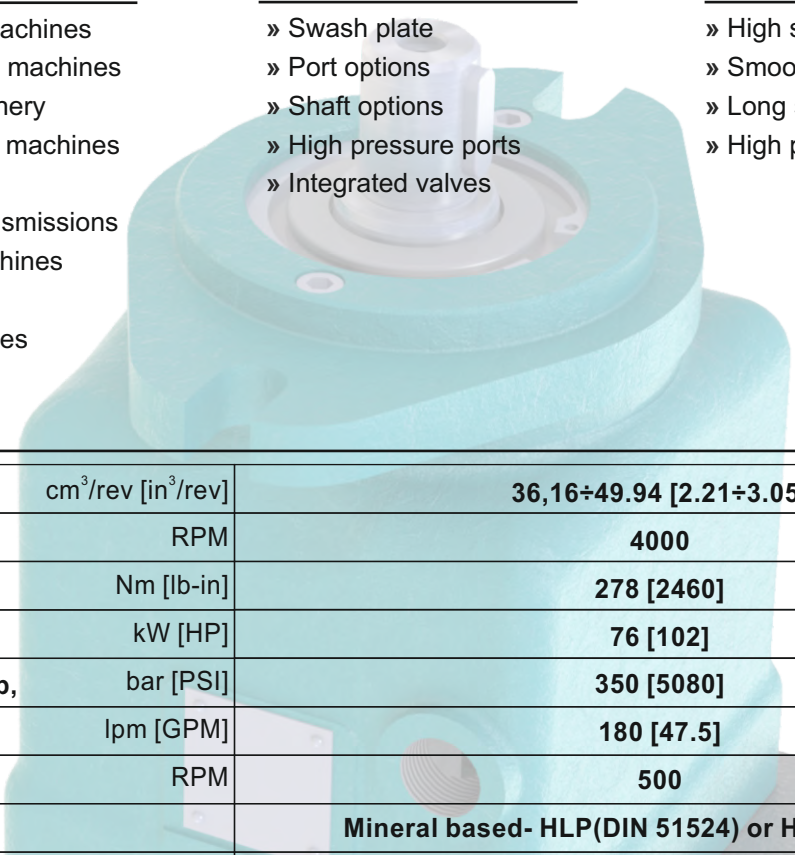
- » Agricultural machines
- » Road building machines
- » Mining machinery
- » Food industry machines
- » Swing drives
- » Hydraulic transmissions
- » Vibration machines
- » Fan drives
- » Special vehicles

OPTIONS

- » Swash plate
- » Port options
- » Shaft options
- » High pressure ports
- » Integrated valves

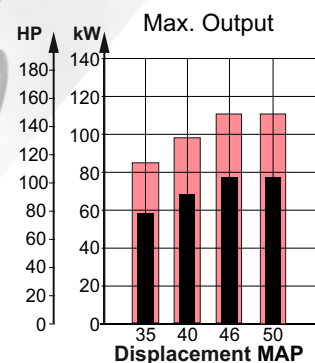
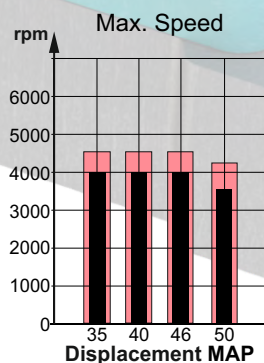
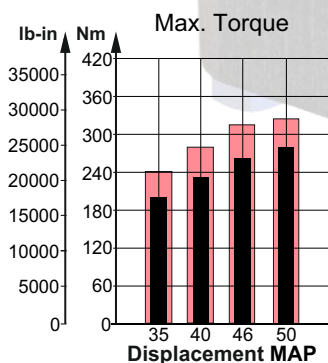
ADVANTAGES

- » High starting torque
- » Smooth operation
- » Long service life
- » High power density



GENERAL

Displacement,	cm ³ /rev [in ³ /rev]	36,16÷49.94 [2.21÷3.05]
Max. Speed,	RPM	4000
Max. Torque,	Nm [lb-in]	278 [2460]
Max. Output,	kW [HP]	76 [102]
Max. Pressure Drop,	bar [PSI]	350 [5080]
Max. Oil Flow,	lpm [GPM]	180 [47.5]
Min. Speed,	RPM	500
Fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)	
Temperature Range,	°C [°F]	-40÷82 [-40÷180]
Optimal Viscosity Range,	mm ² /s [SUS]	12÷68 [66÷311]
Filtration	ISO code 18/16/13 (Min. recommended fluid filtration of 10 micron)	

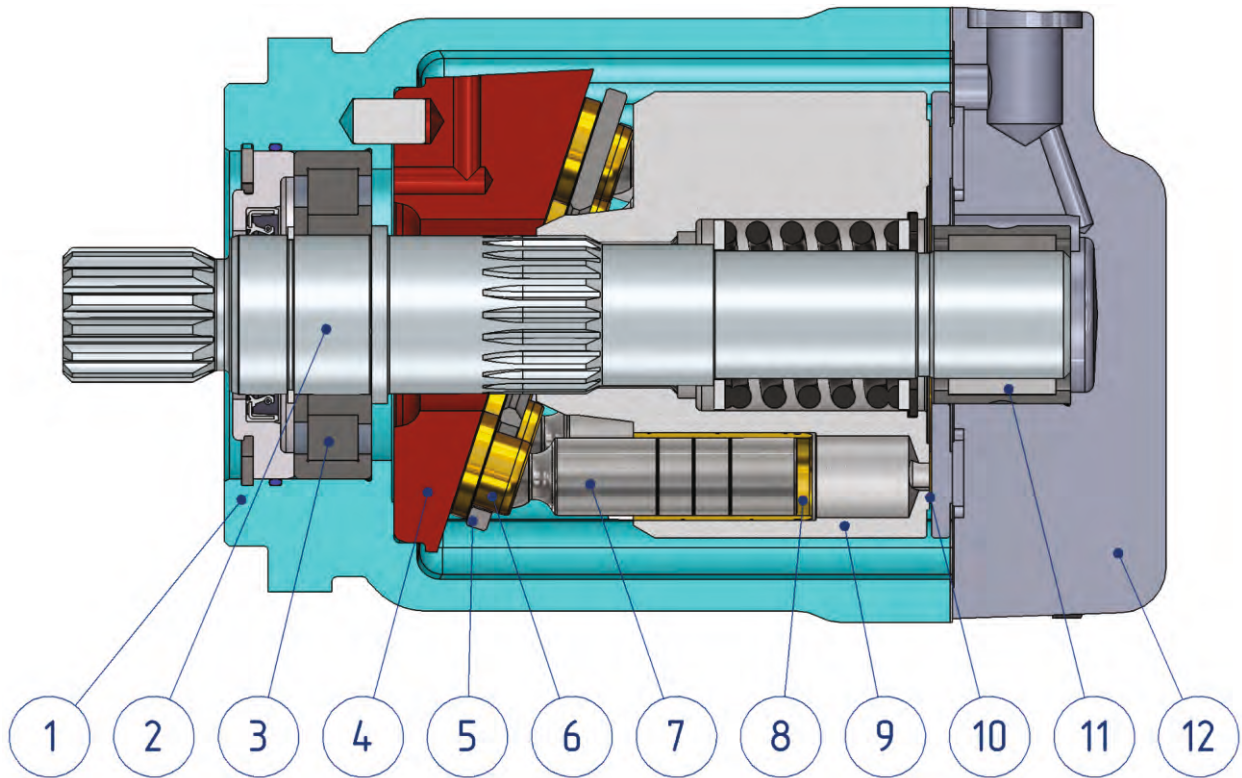


Intermittent values

Continuous values



SECTION VIEW



1. Cast iron body
2. Hardened shaft
3. Robust radial - axial roller bearing
4. Solid swash plate
5. Retainer plate
6. Improved piston shoes
7. Improved pistons
8. Brass bushings
9. Hardened steel cylinder block
10. Bimetal distributor
11. Needle bearing
12. Solid end cover

The heavy duty design of MAP motor gains big advantage over the typical swash plate motors. The starting torque is close to the starting torque of the bent axis motors and the total efficiency of our design in normal working modes is similar to the bent axis motors. The main advantage of our design over the bent axis motors is that the pulsations and vibrations during the operation are much less. Another advantage is that the swash plate motors are more reliable than the bent axis motors.

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SPECIFICATION DATA

Type		MAP 35	MAP 40	MAP 46	MAP 50
Displacement, cm.³/rev. [in.³/rev.]		36.16 [2.21]	41.59 [2.54]	47.13 [2.88]	49.94 [3.05]
Max. Speed, [RPM]	Cont.	4000	4000	4000	3600
	Int.*	4500	4500	4500	4200
Max. Torque,*** Nm [lb-in]	Cont.	202 [1789]	232 [2053]	263 [2328]	278 [2460]
	Int.**	242 [2142]	278 [2460]	315 [2788]	326 [2885]
Output, kW [HP]	Cont.	58 [78]	67 [90]	76 [102]	76 [102]
	Int.**	84 [113]	97 [130]	110 [148]	110 [148]
Max. Pressure, bar [PSI]	Cont.	350 [5080]	350 [5080]	350 [5080]	350 [5080]
	Int.**	420 [6100]	420 [6100]	420 [6100]	410 [5950]
Max. Oil Flow, lpm [GPM]	Cont.	145 [38.3]	167 [44.1]	189 [50]	180 [47.5]
	Int.*	163 [43.1]	187 [49.4]	212 [56]	210 [55.5]
Permissible Shaft Load max Axial**** N[lb]		Fa=2000 [450]			
	max Radial**** N[lb]				
Min. Speed, [RPM]		500			
Max. Pressure in Drain Line, bar [PSI]		5 [70] open drain line is always required			
Weight, kg [lb]		17.8 [39.2]			

* Intermittent speed (flow): for pressure up to 150[2200] bar[PSI];
 ** Intermittent load: the permissible values may occur for max. 10% of every minute;
 *** Theoretical torque;
 **** The calculated max values are based on the optimal direction of the forces Fr, Fa and optimal position of the shaft.

1. The recommended output power for continuous operations should not be exceeded.
2. Recommended filtration as per ISO 4406 cleanliness code 18/16/13 or better. This filtration corresponds to SAE AS 4059 8A/7B/7C. Nominal filtration - 10 micron or better.
3. Recommended a premium quality, anti-wear type mineral based hydraulic oil, HLP(DIN51524) or HM(ISO6743/4).
4. Recommended oil viscosity - 12...68 cSt or see page 61.
5. Recommended maximum system operating temperature - 82°C [180°F].
6. To ensure optimum life of the motor, fill it up with fluid prior to load it and run with moderate load and speed for about 10-15 minutes.

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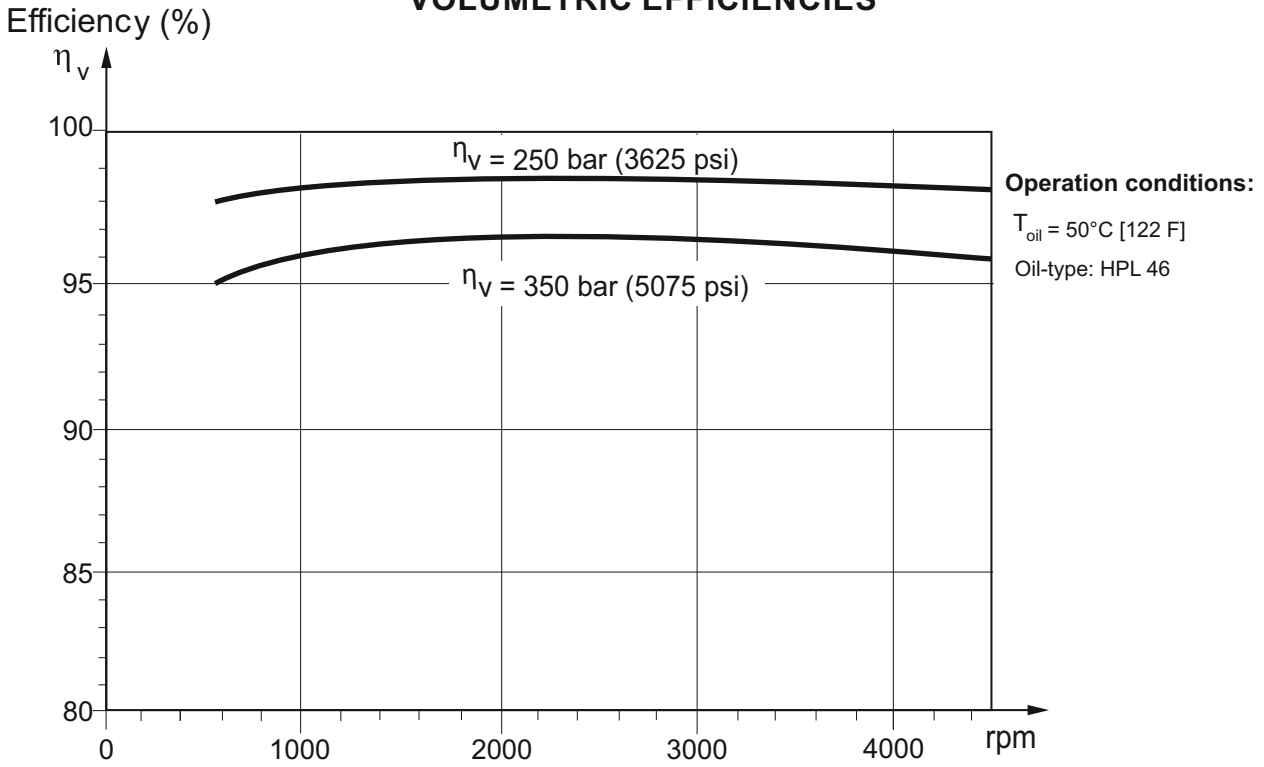
INFO



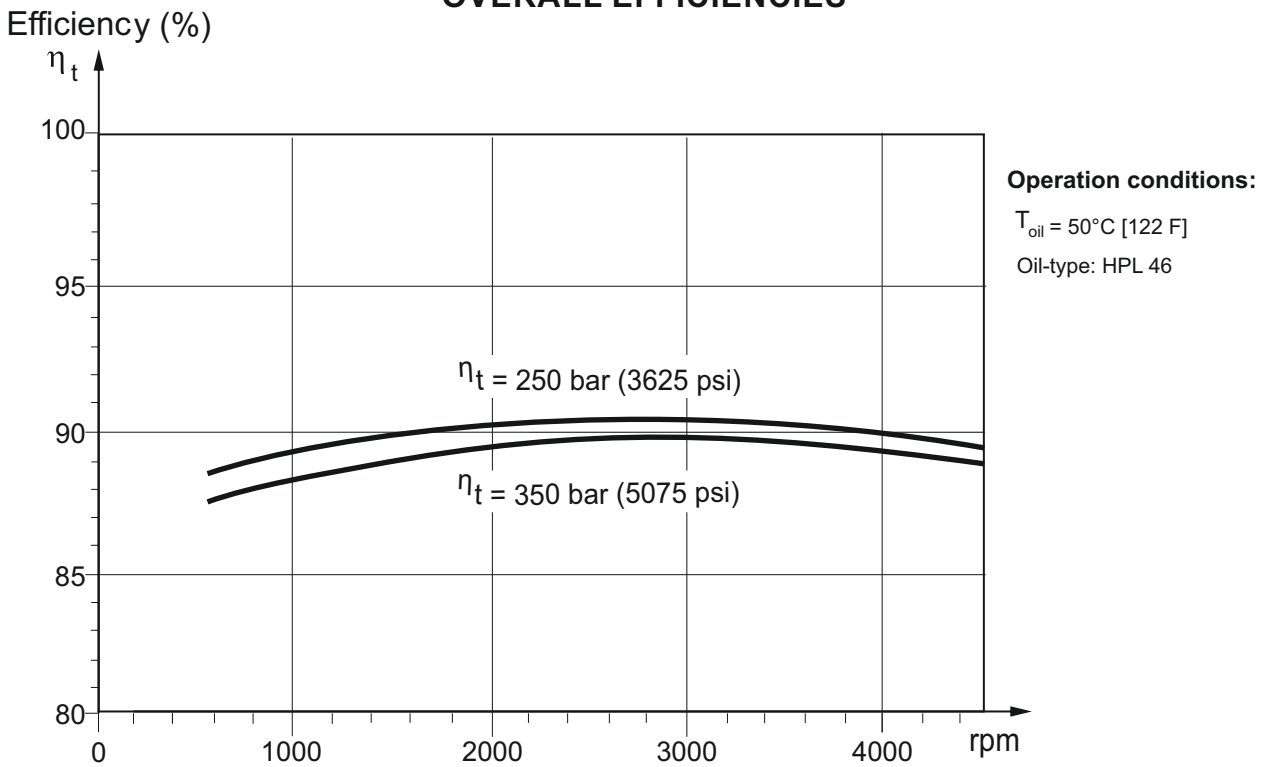
FUNCTION DIAGRAMS

The below efficiencies are applied for all displacements.

VOLUMETRIC EFFICIENCIES



OVERALL EFFICIENCIES



The motor size, pressure, torque, speed of rotation and flow rate required for a specific application can be calculated using the formulas on page 62

Efficiencies for a particular motor may vary from the shown in the diagram depending on the operating conditions.



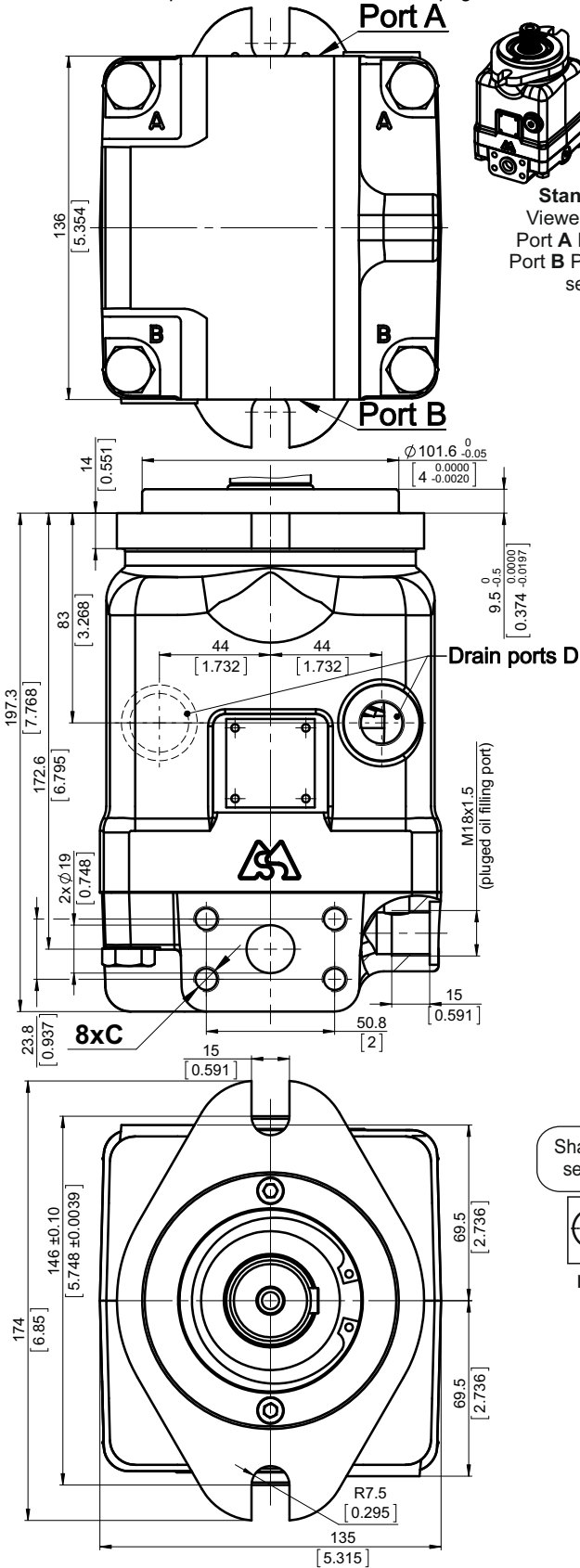
Overall Dimensions and Ports
Side Ports - Default

Side ports, port size default and 5

See the port sizes at the bottom of this page

Side ports, port size 2,3,4,6,7 and 8

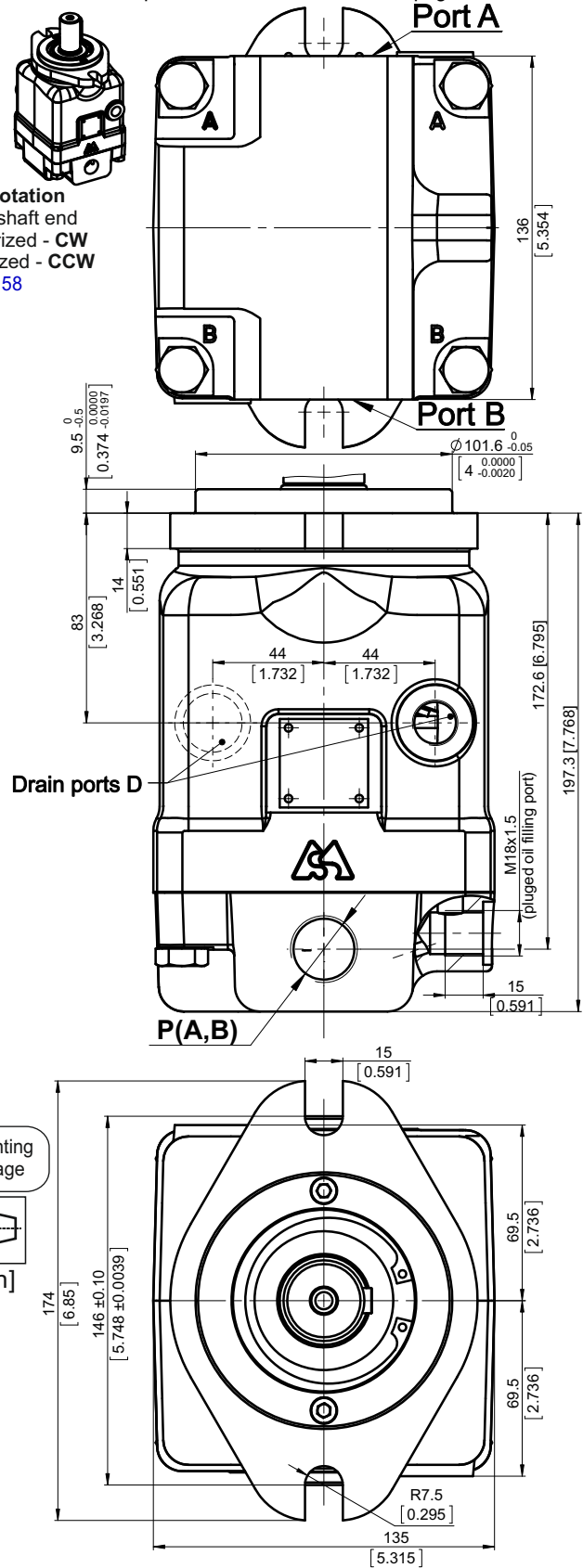
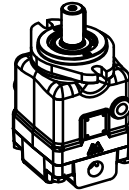
See the port sizes at the bottom of this page



	Port Size	
	default	5
P _(A,B)	2xISO 6162-2 DN19	2xSAE J518 3/4 PSI6000
D	M18x1,5	7/8-14 UNF-2B
C	M10-6H	3/8-16 UNC-2B



Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW
see page 58



	Port Size					
	2	3	4	6	7	8
P _(A,B)	2xG 3/4	2xM27x2	2x1 ¹ / ₁₆ -12UN	2xG 1/2	2xM22x1,5	2x ⁷ / ₈ -14UNF
D	G 1/2	M18x1,5	⁷ / ₈ -14UNF	G 1/2	M18x1,5	³ / ₄ -16UNF

Shaft Mounting
see 24 page

mm [in]



Overall Dimensions and Ports

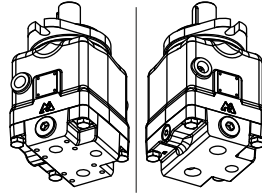
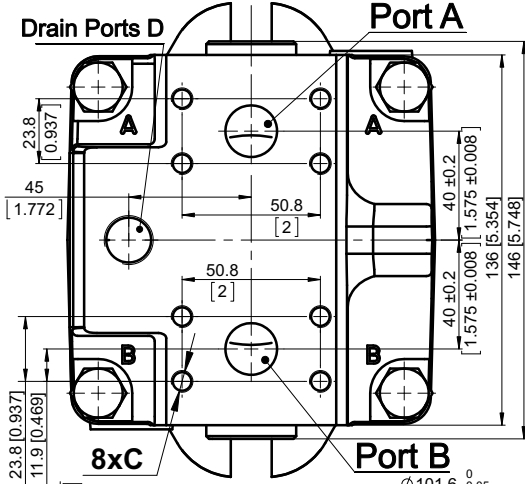
Rear Ports - Type E

Rear ports E, port size default and 5

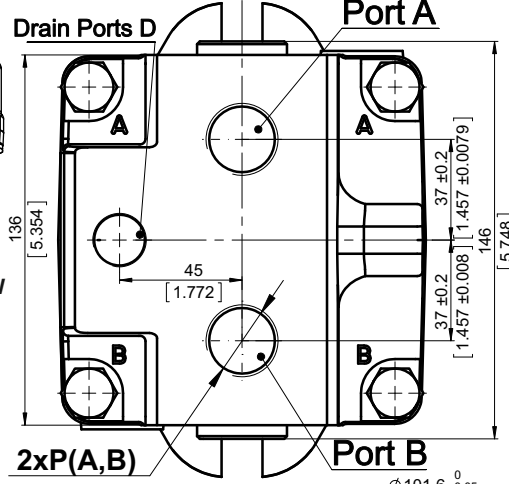
See the port sizes at the bottom of this page

Rear ports E, port size 2,3,4,6,7 and 8

See the port sizes at the bottom of this page



Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW
see page 58



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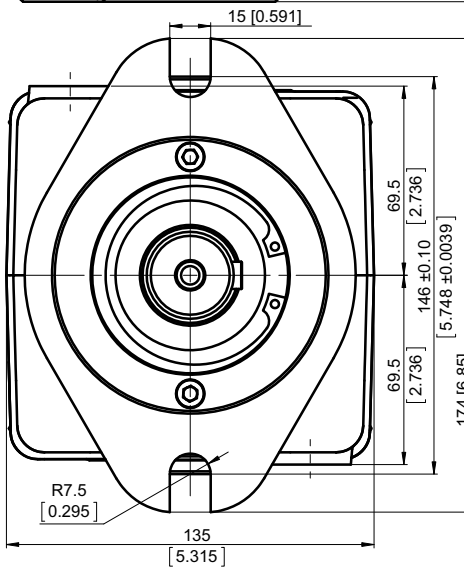
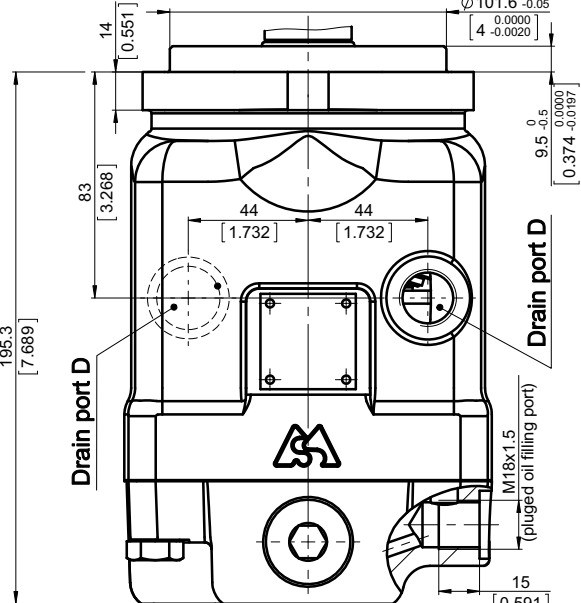
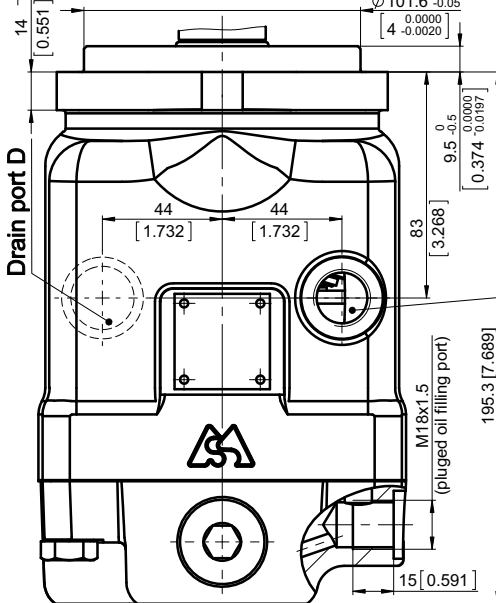
MAP50

MAP100

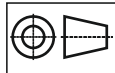
PAP50

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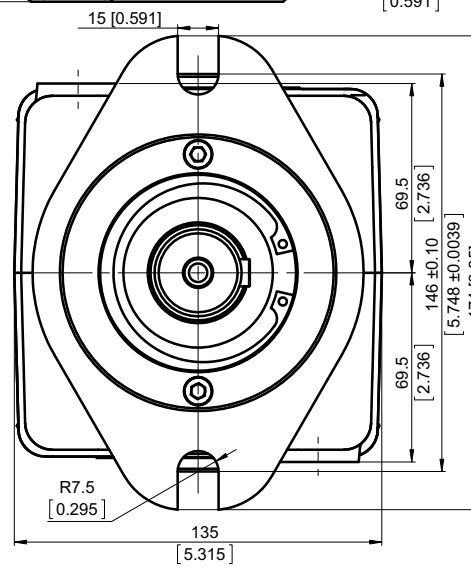
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Shaft Mounting
see the next page



mm [in]

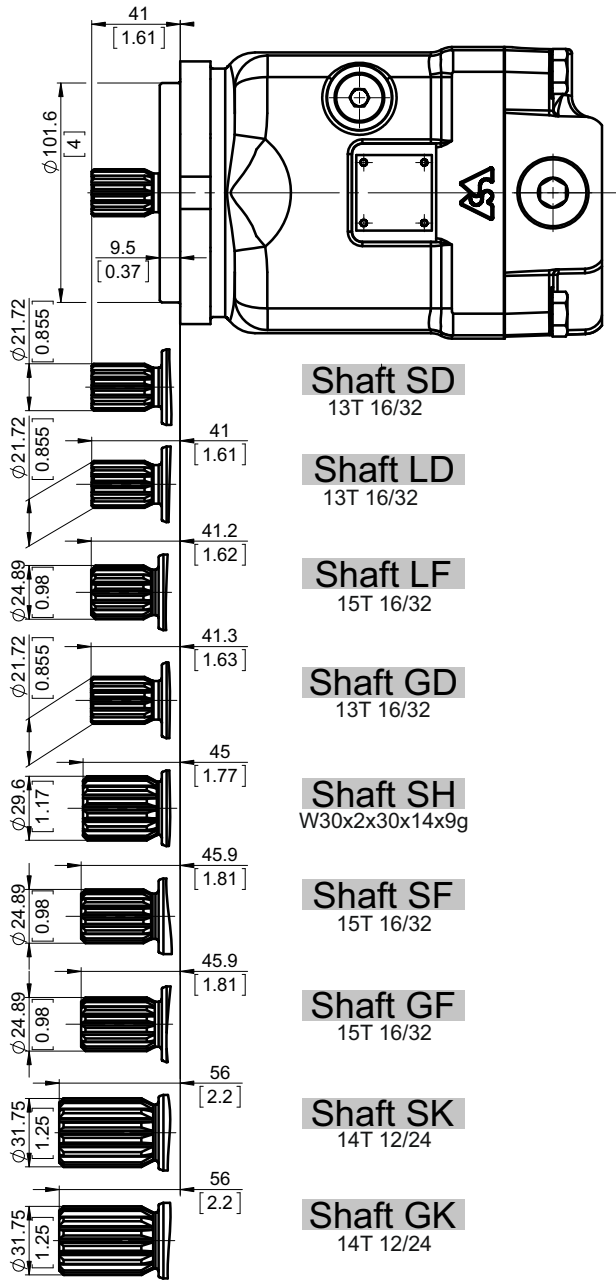


	Port Size	
	default	5
P _(A,B)	2xISO 6162-2 DN19	2xSAE J518 3/4 PSI6000
D	M18x1,5	7/8-14 UNF-2B
C	M10-6H	3/8-16 UNC-2B

	Port Size					
	2	3	4	6	7	8
P _(A,B)	2xG 3/4	2xM27x2	2x1 ¹ / ₁₆ -12UN	2xG 1/2	2xM22x1,5	2x ⁷ / ₈ -14UNF
D	G 1/2	M18x1,5	⁷ / ₈ -14UNF	G 1/2	M18x1,5	³ / ₄ -16UNF



Shafts Mounting
Ports - Type Default, Type E



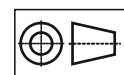
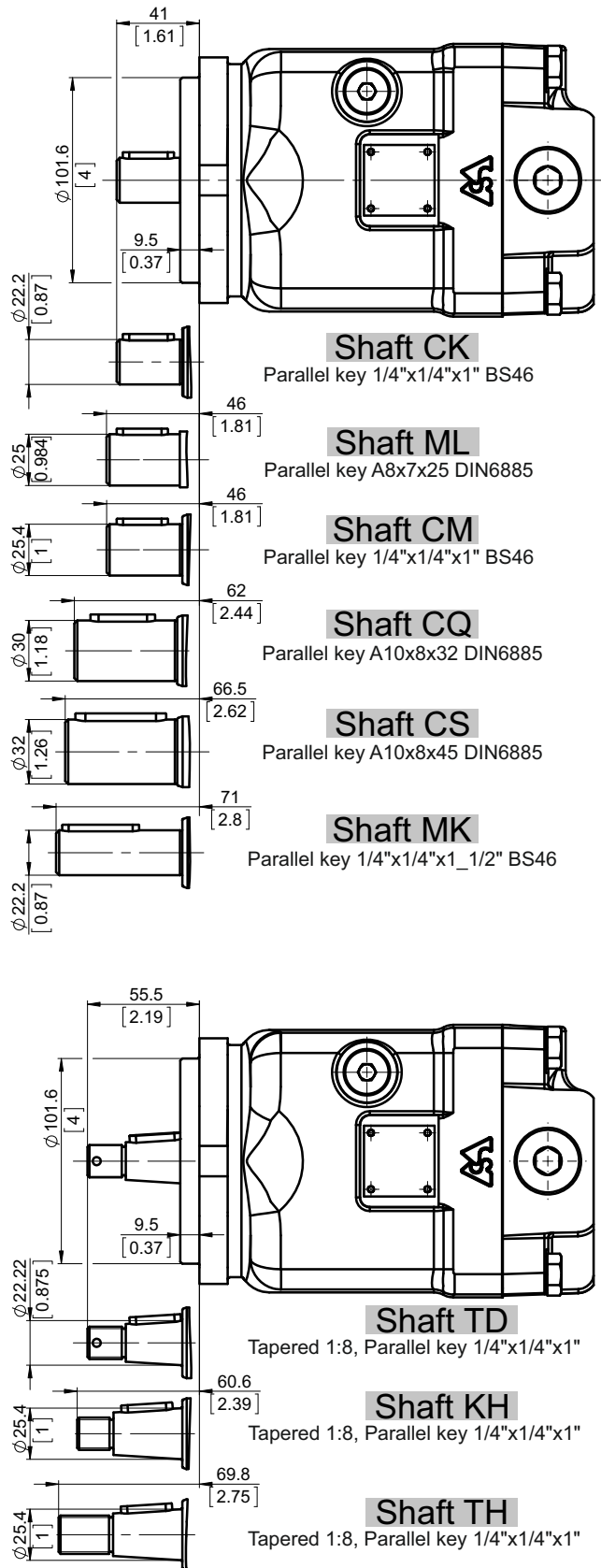
Shaft Dimensions
See Page 52+57

PERMISSIBLE SHAFT LOAD

Permissible shaft load		
max Axial	N[lb]	Fa=2000 [450]
max Radial	N[lb]	Fr=3600 [810]

The calculated max values are based on the optimal direction of the forces Fr, Fa and optimal position of the shaft (see page 58).

For more information, please, feel free to contact us.



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Overall Dimensions and Ports

Twin Side Ports - Type T

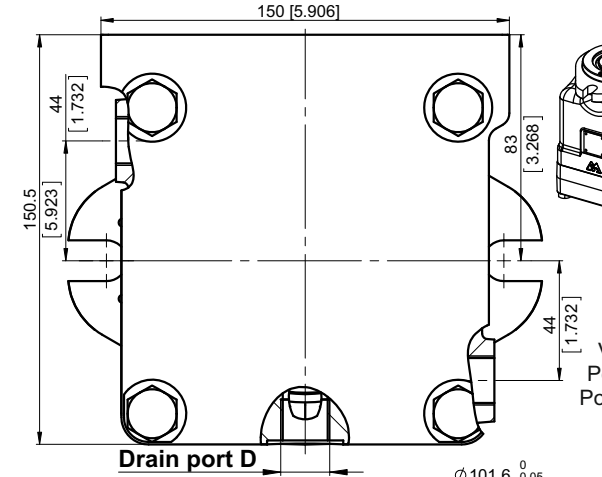
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Twin side ports, port size default and 5

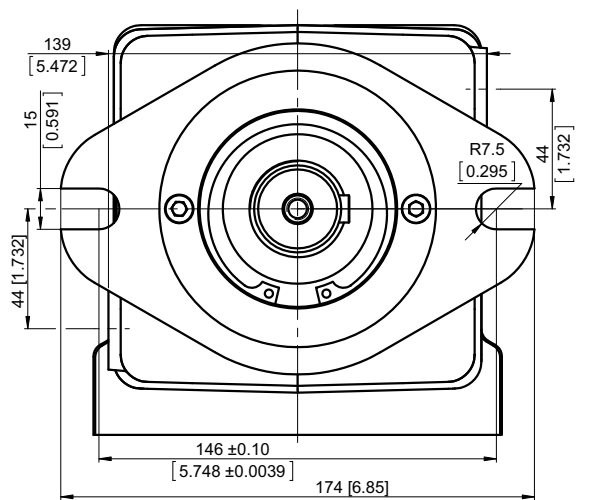
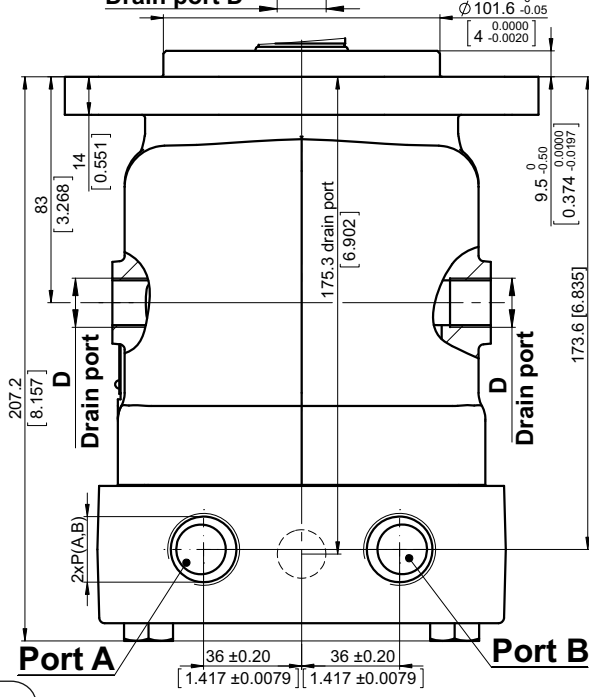
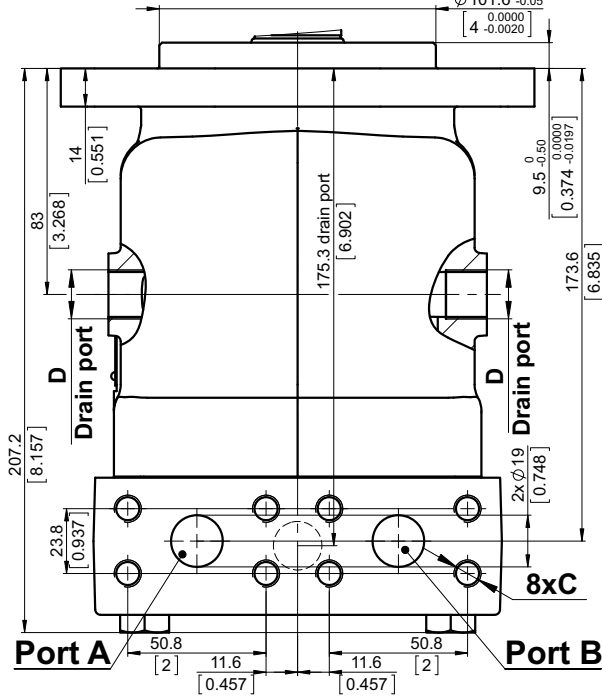
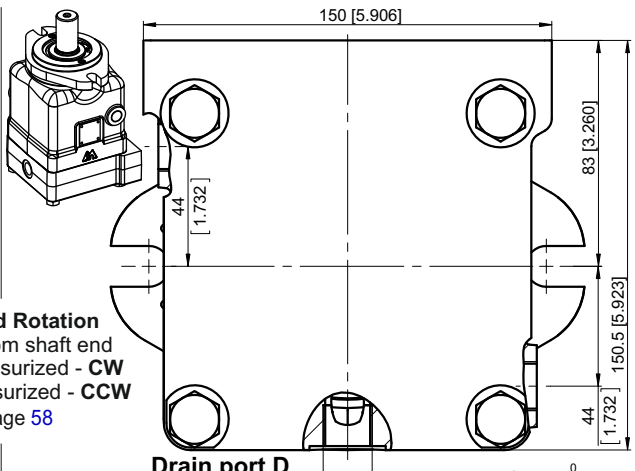
See the port sizes at the bottom of this page

Twin side ports, port size 2,3,4,6,7 and 8

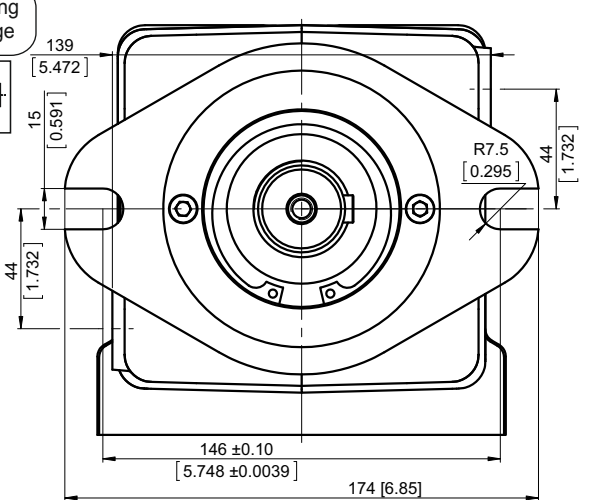
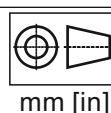
See the port sizes at the bottom of this page



Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW
see page 58



Shaft Mounting
see next page

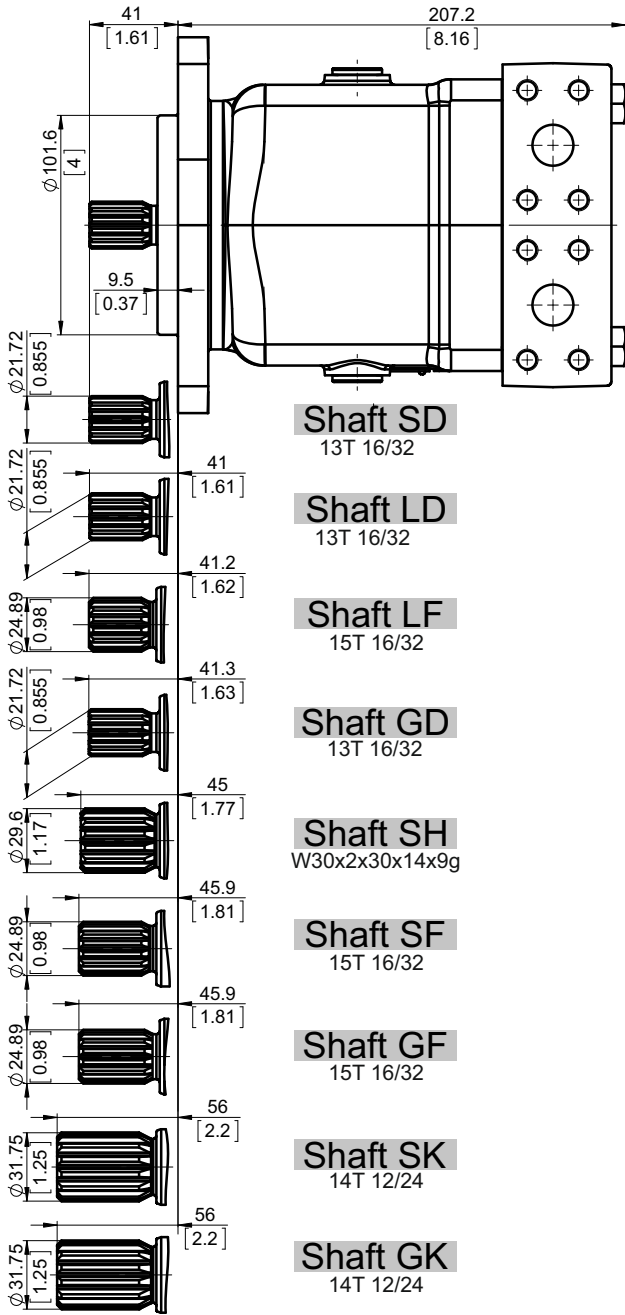


	Port Size	
	default	5
P _(A,B)	2xISO 6162-2 DN19	2xSAE J518 3/4 PSI6000
D	M18x1,5	7/8-14 UNF-2B
C	M10-6H	3/8-16 UNC-2B

	Port Size					
	2	3	4	6	7	8
P _(A,B)	2xG 3/4	2xM27x2	2x1 ¹ / ₁₆ -12UN	2xG 1/2	2xM22x1,5	2x ⁷ / ₈ -14UNF
D	G 1/2	M18x1,5	⁷ / ₈ -14UNF	G 1/2	M18x1,5	³ / ₄ -16UNF



Shafts Mounting
Twin Side Ports - Type T



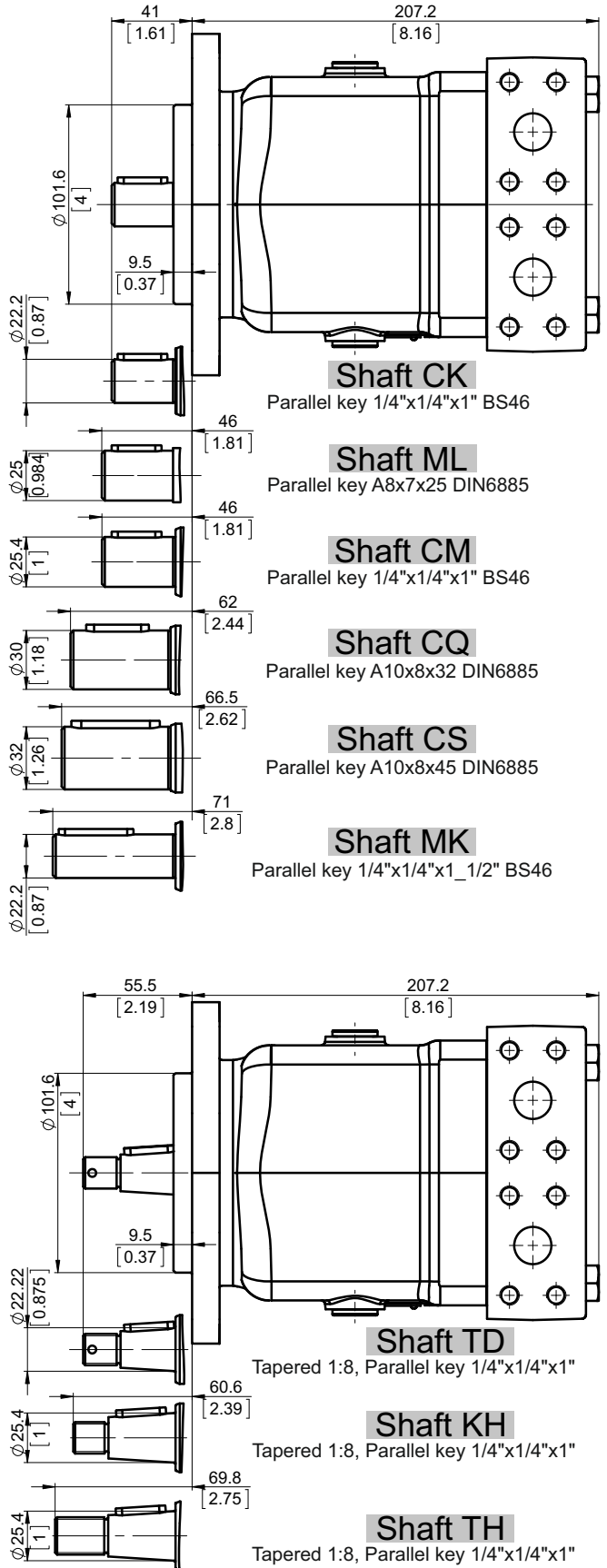
Shaft Dimensions
See Page 52+57

PERMISSIBLE SHAFT LOAD

Permissible shaft load		
max Axial	N[lb]	Fa=2000 [450]
max Radial	N[lb]	Fr=3600 [810]

The calculated max values are based on the optimal direction of the forces Fr, Fa and optimal position of the shaft (see page 58).

For more information, please, feel free to contact us.



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ORDERING CODE

	1	2	3	4	5	6	7	8	9	10	11	12	13	13
M A P												[]

Pos.1 - Mounting Flange

B - SAE B - 2-Bolt flange
spigot diam. 101,6 mm [4"] - BC 146 mm [5.75"]

Pos.2 - Port Type

omit - Side ports on opposite sides
T - Twin (Two) side ports on one side
E - Rear ports

Pos.3 - Displacement Code

35 - 36.16 cm.³/rev. [2.21 in.³/rev.]
40 - 41.59 cm.³/rev. [2.54 in.³/rev.]
46 - 47.13 cm.³/rev. [2.88 in.³/rev.]
50 - 49.94 cm.³/rev. [3.05 in.³/rev.]

Pos.4 - Shaft Extensions*

SD - $\varnothing 21,72$ [0.855"] Spline SAE 13T 16/32 DP, M8
GD - $\varnothing 21,72$ [0.855"] Spline SAE 13T 16/32 DP, 5/16-18 UNC-2B thread
LD - $\varnothing 21,72$ [0.855"] Spline SAE 13T 16/32 DP, 1/4-20 UNC-2B thread
SF - $\varnothing 24,9$ [0.98"] Spline SAE 15T 16/32, M8-6H
GF - $\varnothing 24,9$ [0.98"] Spline SAE 15T 16/32, 3/8-16UNC-2B
LF - $\varnothing 24,9$ [0.98"] Spline SAE 15T 16/32 DP, 1/4-20UNC-2B thread
SH - $\varnothing 29,6$ [1,165"] Spline W30x2x30x14x9g DIN, M10-6H thread
SK - $\varnothing 31,75$ [1,25"] Spline SAE 14T 12/24 DP, M10
GK - $\varnothing 31,75$ [1,25"] Spline SAE 14T 12/24 DP, 7/16-14UNC-2B thread
CK - $\varnothing 22,2$ [$\varnothing 7/8$ "] Straight, M8-6H thread Parallel key 1/4"x1/4"x1" BS46
MK - $\varnothing 22,2$ [$\varnothing 7/8$ "] Straight, M8-6H thread Parallel key 1/4"x1/4"x1 1/2" Bs46
ML - $\varnothing 25$ [$\varnothing 0.984$ "] Straight, M8-6H thread Parallel key A8x7x25 DIN6885
CM - $\varnothing 25,4$ [$\varnothing 1$ "] Straight, M8-6H thread Parallel key 1/4"x1/4"x1" BS46
CQ - $\varnothing 30$ [$\varnothing 1.181$ "] Straight, M8-6H thread Parallel key A8x7x32 DIN6885
CS - $\varnothing 32$ [$\varnothing 1.26$ "] Straight, M8-6H thread Parallel key A10x8x45 DIN6885
TD - $\varnothing 22,22$ [$7/8$ "] Tapered 1:8 [125:1000], Parallel key 1/4"x1/4"x1", 5/8-18 UNF-2A
TH - $\varnothing 25,4$ [1 "] Tapered 1:8 [125:1000], Parallel key 1/4"x1/4"x1", 3/4-16 UNF-2A
KH - $\varnothing 25,4$ [1 "] Tapered 1:8 [125:1000], Parallel key 1/4"x1/4"x1", M16x1.5

Pos.5 - Port Size

omit - 2xISO 6162-2 DN19, metric, drain M18x1,5
2 - 2xG3/4, drain ports G1/2
3 - 2xM27x2, drain ports M18x1,5-6H
4 - 2x1_1/16 -12 UN, drain ports 7/8-14 UNF
5 - 2xSAE 3/4" PSI6000, SAE, drain 7/8-14 UNF
6 - 2xG1/2, drain ports G1/2
7 - 2xM22x1.5, drain ports M18x1,5-6H
8 - 2x7/8-14 UNF Ports, drain ports 3/4-16 UNF

Pos.6 - Seal, Corrosion Resistant Seal Surface

omit - NBR seal type material
V - FKM seal type material

Pos.7 - Integrated Valves

See next page for information about valves
omit - None
HR - Single anti-cavitation valve
AR - Dual anti-cavitation valve
PU - Purge valve
FLU - Flush valve
SAR - Single anti-cavitation and relief valve
DAR - Dual anti-cavitation and relief valve
DARP - Dual anti-cavitation, relief and purge valve
DARF - Dual anti-cavitation, relief and flush valve

Option DAR,DARF,DARP,SAR, AR and HR are not available for Pos.2 option E

Pos.8 - Valve's Port for Single Valves

omit - None
A - Port A
B - Port B

Pos.9 - Pressure Setting of Integrated Valves

omit - None
x - For value - see next page

Pos.10 - Flow Setting of Integrated Valves

omit - None
Lx - For value - see next page

Pos.11 - Paint and Coating

omit - No paint or coating
P - Painted
PC - Corrosion protected paint
PS - Special painted **
PCS - Special corrosion protected paint**
If a painting option is required, the standard color is black-Alkyd-Styrenated Enamel, Black RAL 9005.
Other color by customer's request.

Pos.12 - Special Unit

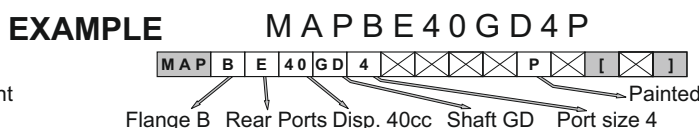
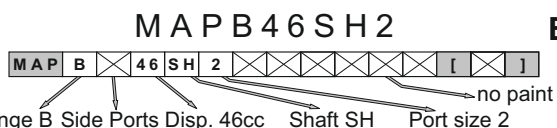
omit - None

Pos.13 - Design Series

omit - Factory specified

*The permissible output torque for shafts must not be exceeded!
**Non painted feeding surface

We remain open to meet your special requirements upon request.



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Valve Options

The overall dimensions of the motor with integrated valves could vary compared to the standard motors.

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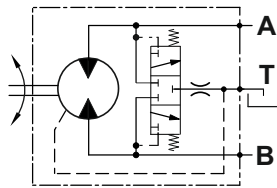
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Option PU
PURGE VALVE



- Mainly used in open loop circuit;
- Used for cooling purpose or oil cleanliness requirements;
- Flow rate by **default (omit)** - 4 ÷ 8 lit/min.
- For other options, please see Pos.10 of ordering code, considering the following possible values:

Pos.10

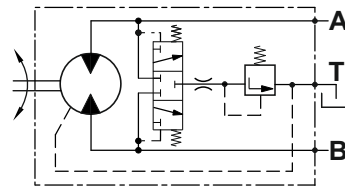
omit	L3.5	L5.5
------	------	------

 → flow rate

EXAMPLE

M A P B 4 6 S H 2 P U purge valve flow rate 6±2 lit/min
M A P B 4 6 S H 2 P U L 3 . 5 purge valve flow rate 3.5±1 lit/min
M A P B 4 6 S H 2 P U L 5 . 5 purge valve flow rate 5.5±1 lit/min

Option FLU
FLUSH VALVE



- Mainly used in close loop circuit;
- The valve is a combination between a purge valve and check valve;
- Flow rate by **default (omit)** - 4 ÷ 8 lit/min
- **and charge (opening) pressure 16 bar** with 20 bar feed pressure for close loop circuit;
- For other options, please see Pos.9 and Pos. 10 of ordering code, considering the following possible values:

Pos.9

omit	10
------	----

 → pressure

Pos.10

omit	L3.5	L5.5
------	------	------

 → flow rate

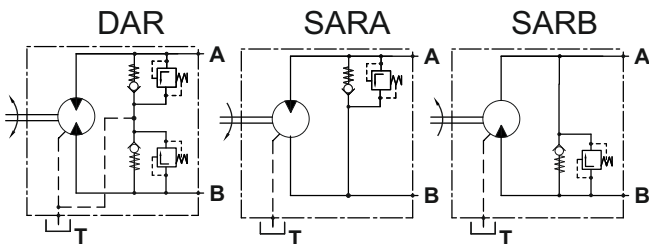
EXAMPLE

M A P B 4 6 S H 2 F L U flow rate 6±2 lit/min, charge pressure 16 bar
M A P B 4 6 S H 2 F L U 1 0 L 5 . 5 flow rate 5.5±1 lit/min, charge pressure 10 bar
M A P B 4 6 S H 2 F L U L 3 . 5 flow rate 3.5±1 lit/min, charge pressure 16 bar

Option DAR, SARA, SARB

Combined Anti-Cavitation and Relief Valve

- Anti-cavitation check valve is used for applications such as Fan drive control;
- Pressure relief valves prevent excessive pressures in the high pressure loop.



Please, consider the following possible values:

Pos.9

250	300	350
-----	-----	-----

 → pressure

EXAMPLE

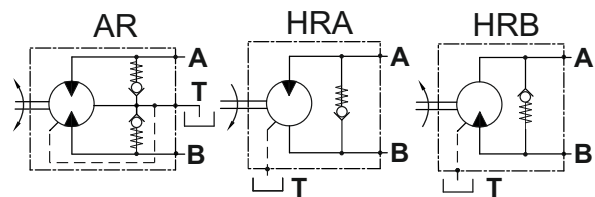
M A P B 4 6 S H 2 D A R 3 5 0
Double Anti-Cavitation and Relief Valve, relief valve setting 350 bar

M A P B 4 6 S H 2 S A R A 2 5 0
Single Anti-Cavitation and Relief Valve, relief valve setting 250 bar
The valve is placed on port A

M A P B 4 6 S H 2 S A R B 3 0 0
Single Anti-Cavitation and Relief Valve, relief valve setting 300 bar
The valve is placed on port B

Option AR, HRA, HRB
Anti-Cavitation Valve

- Anti-cavitation check valve is used for applications such as Fan drive control.



EXAMPLE

M A P B 4 6 S H 2 A R
Double Anti-Cavitation Valve

M A P B 4 6 S H 2 H R A
Single Anti-Cavitation Valve, the valve is placed on port A

M A P B 4 6 S H 2 H R B
Single Anti-Cavitation Valve, the valve is placed on port B

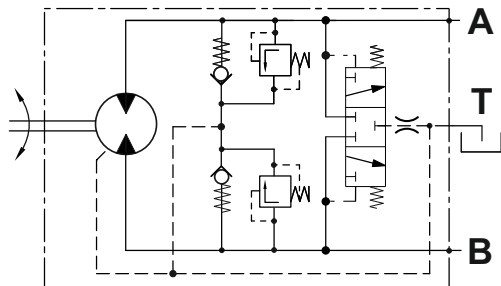


Valve Options

The overall dimensions of the motor with integrated valves could vary compared to the standard motors.

Option DARP

Dual Anti-Cavitation, Relief and Purge Valve



- Mainly used in open loop circuit;
- The valve is a combination between a dual anti-cavitation, relief and purge valve;
- Purge Valve is used for cooling purpose or cleanliness requirements;
- Anti-Cavitation Check Valve is used for applications such as Fan drive control;
- Pressure relief valves prevent excessive pressures in the high pressure loop;
- Please, consider the following possible values for pressure set of the relief valve:

Pos.9

250	300	350
-----	-----	-----

 → pressure

- Flow rate of purge valve by **default (omit) - 4 ÷ 8 lit/min**. The possible values are as follow:

Pos.10

omit	L3.5	L5.5
------	------	------

 → flow rate

EXAMPLE

M A P B 4 6 S H 2 D A R P 3 5 0

Double Anti-Cavitation, Relief and Purge Valve, relief valve setting 350 bar, purge valve flow rate 6±2 lit/min

M A P B 4 6 S H 2 D A R P 2 5 0 L 3 . 5

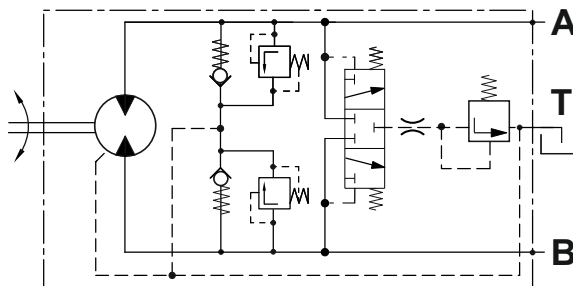
Double Anti-Cavitation, Relief and Purge Valve, relief valve setting is 250 bar, purge valve flow rate 3.5±1 lit/min

M A P B 4 6 S H 2 D A R P 3 0 0 L 5 . 5

Double Anti-Cavitation, Relief and Purge Valve, relief valve setting 300 bar, purge valve flow rate 5.5±1 lit/min

Option DARF

Dual Anti-Cavitation, Relief and Flush Valve



- Mainly used in close loop circuit;
- The valve is a combination between a dual anti-cavitation, relief and flush valve;
- Flush valve is used for cooling purpose or cleanliness requirements;
- Anti-Cavitation Check valve is used for applications such as Fan drive control;
- Pressure Relief Valves prevent excessive pressures in the high pressure loop;
- Please, consider the following possible values for pressure set of the relief valve:

Pos.9

250	300	350
-----	-----	-----

 → pressure

- Flow rate of flush valve by **default (omit) - 4 ÷ 8 lit/min and charge pressure 16 bar** with 20 bar feed pressure for close loop circuit. The possible values are as follow:

Pos.10

omit	L3.5	L5.5
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 → flow rate

- Other values for charge pressure are possible. Please see Pos.9.

Example: For charge pressure 10 bar the options are as follow:

Pos.9

250-10	300-10	350-10
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Relief valve opening pressure Flush valve opening pressure (charge pressure)

EXAMPLE

M A P B 4 6 S H 2 D A R F 3 5 0

Double Anti-Cavitation, Relief and Flush Valve, relief valve setting 350 bar flush valve charge pressure 16 bar, flush valve flow rate 6±2 lit/min

M A P B 4 6 S H 2 D A R F 3 5 0 - 1 0

Double Anti-Cavitation, Relief and Flush Valve, relief valve setting 350 bar flush valve charge pressure 10 bar, flush valve flow rate is 6±2 lit/min

M A P B 5 0 S H 2 D A R F 2 5 0 L 3 . 5

Double Anti-Cavitation, Relief and Flush Valve, relief valve setting 250 bar flush valve charge pressure 16 bar, flush valve flow rate is 3.5±1 lit/min

M A P B 4 6 S H 2 D A R F 3 0 0 - 1 0 L 5 . 5

Double Anti-Cavitation, Relief and Flush Valve, relief valve setting 300 bar flush valve charge pressure 10 bar, flush valve flow rate 5.5±1 lit/min