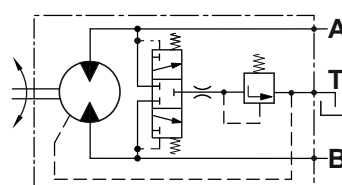
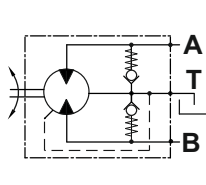
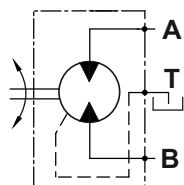


Hydraulic Motors Type MAP28

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

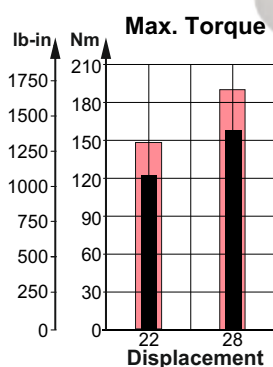
- » Flange options
- » Port options
- » Shaft options
- » High pressure ports
- » Integrated valves

ADVANTAGES

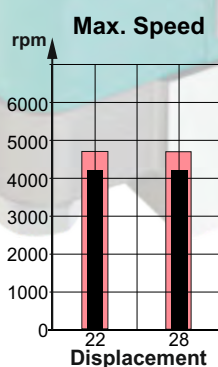
- » High starting torque
- » Smooth operation
- » Long service life
- » High power density

GENERAL

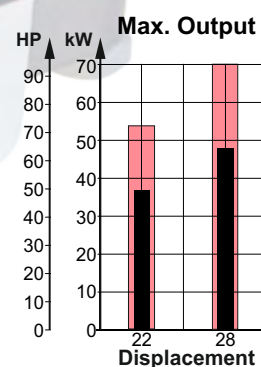
Displacement,	cm ³ /rev [in ³ /rev]	22.15÷28.47 [1.35÷1.74]
Max. Speed,	RPM	4200
Max. Torque,	Nm [lb-in]	159 [1407]
Max. Output,	kW [HP]	48 [64]
Max. Pressure Drop,	bar [PSI]	350 [5080]
Max. Oil Flow,	l/min [GPM]	120 [31.7]
Min. Speed,	RPM	500
Fluid	Mineral based- HLP(DIN 51524) or HM(ISO 6743/4)	
Temperature 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)	

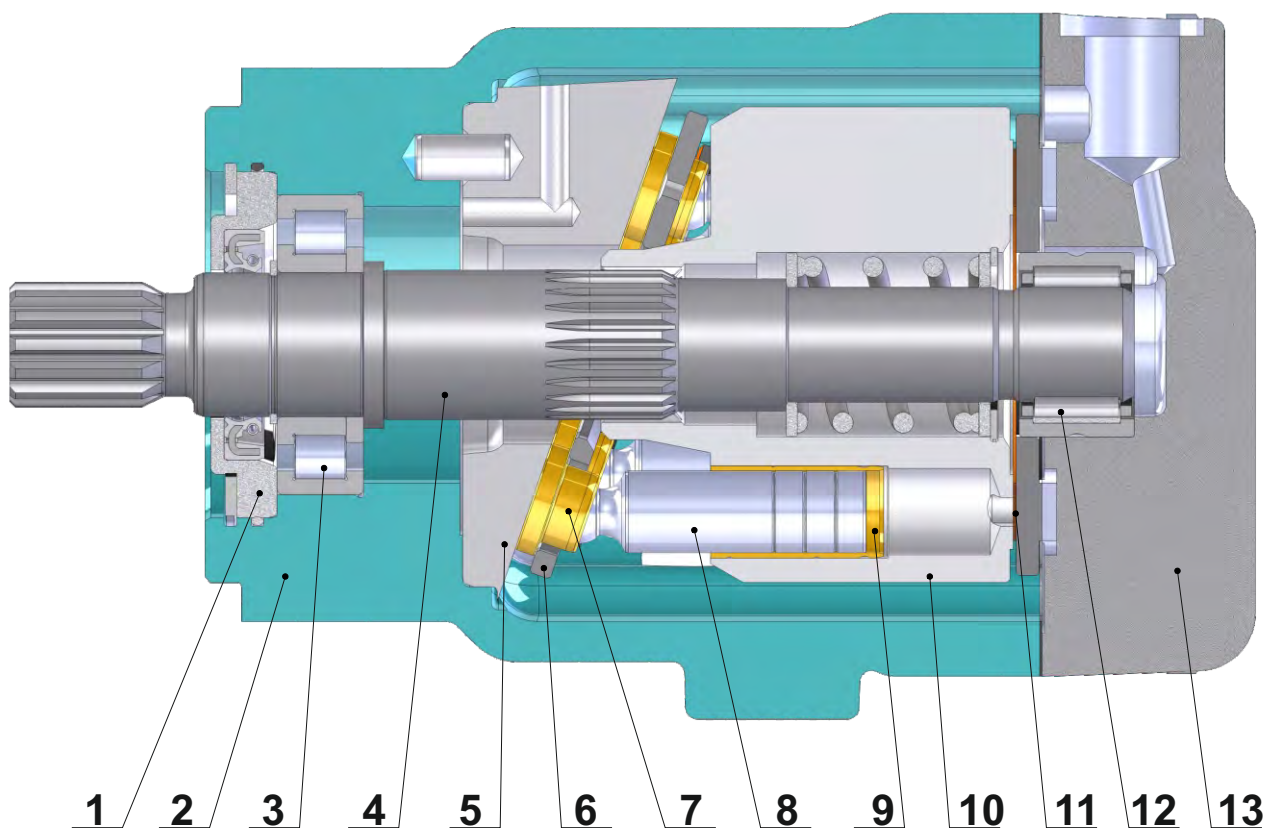


Intermittent values



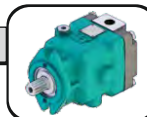
Continuous values




SECTION VIEW


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

The main advantages of the heavy duty design of the MAP motors over the typical swash plate motors are the higher starting torque and the higher total efficiency. In regards to these two parameters, under normal working mode, the MAP is comparable to the bent axis motors. The advantages of the MAP over the bent axis motors are the higher reliability and the lower degree of pulsation and vibration during operation.


SPECIFICATION DATA

Type		MAP 22	MAP 28
Displacement, cm ³ /rev [in ³ /rev]		22.15 [1.35]	28.47 [1.74]
Max. Speed, [RPM]	Cont.	4200	4200
	Int.*	4700	4700
Max. Torque,** Nm [lb-in]	Cont.	123 [1088]	159 [1407]
	Int.**	148 [1310]	190 [1682]
Output, kW [HP]	Cont.	37 [50]	48 [64]
	Int.**	54 [72]	70 [94]
Max. Pressure, bar [PSI]	Cont.	350 [5080]	350 [5080]
	Int.**	420 [6100]	420 [6100]
	Peak	450 [6527]	450 [6527]
Max. Oil Flow, l/min[GPM]	Cont.	93 [24.6]	120 [31.7]
	Int.*	104 [27.5]	134 [35.4]
Torque Constant ***** Nm/bar [lb-in/PSI]		0.32 [0.194]	0.41 [0.25]
Speed Constant ***** RPM/(l/min) [RPM/GPM]		42.9 [162.4]	33.4 [126.3]
Permissible Shaft Load max Axial**** N[lb]		Fa=1300 [292]	
	max Radial**** N[lb]	Fr=2200 [495]	
Min. Speed, [RPM]		500	
Max. Pressure in Drain Line, bar [PSI]		5 [70] open drain line is always required	
Weight, kg [lb]		10.79 [23.79] for SAE-A flange 11.50 [25.35] for SAE-B flange	

Peak pressure is the highest allowable pressure, may occur for max. 1% of every minute;

* Intermittent speed (flow): for pressure up to 150[2200] bar[PSI];

** Intermittent load: the permissible values may occur for max. 10% of motor lifetime;

*** Theoretical torque;

**** The calculated max values are based on the optimal direction of the forces Fr, Fa and optimal position of the shaft.

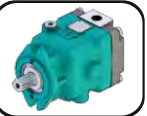
***** The constant values are used for calculation of torque and speed with motor efficiencies $\eta_v=0.95$ and $\eta_{mh}=0.9$.

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 84.
5. Recommended maximum system operating temperature - 82°[180°] C[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.

Hint: Motor Torque = Torque Constant * Pressure Drop

Rotation Speed = Speed Constant * Oil Flow

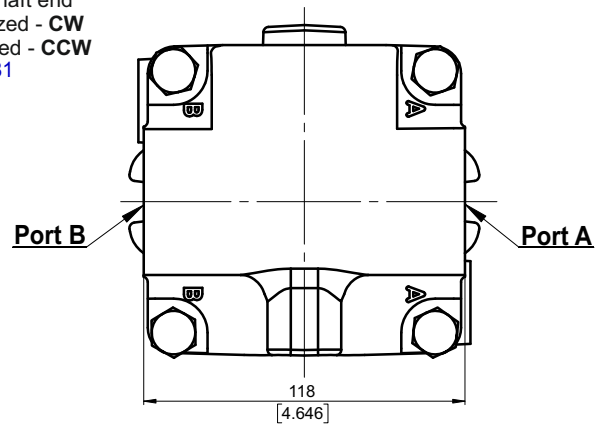
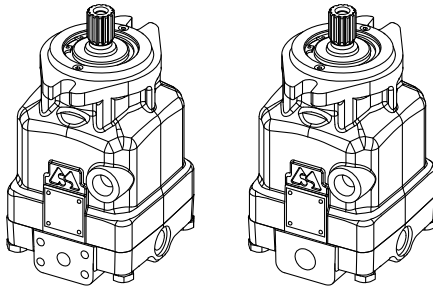
The constant values are approximate. Motor torque and rotation speed for a particular project are depending on the real operating conditions. For more detailed calculations please see efficiencies on page 74 and formulas on page 85.



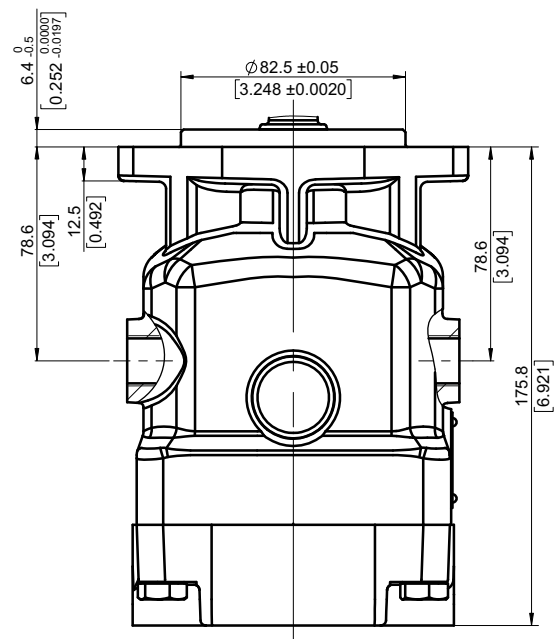
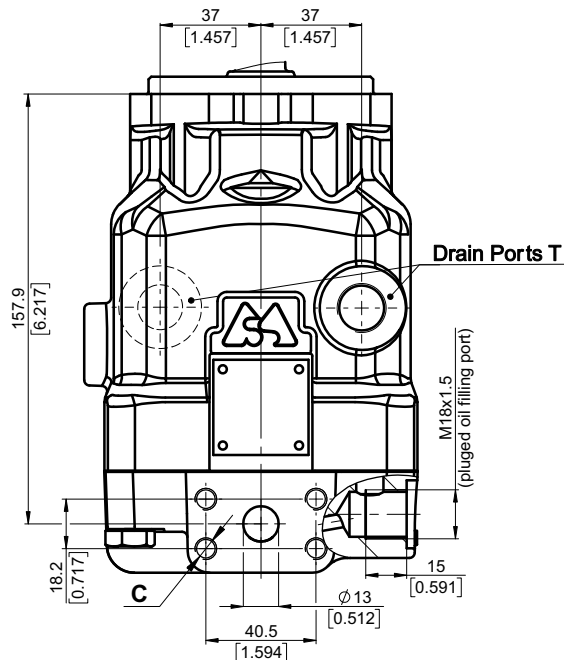
OVERALL DIMENSIONS AND PORTS

Side Ports - Default Mounting Flange - Type SAE-A

Standard Rotation
 Viewed from shaft end
 Port A Pressurized - CW
 Port B Pressurized - CCW
 see page 81

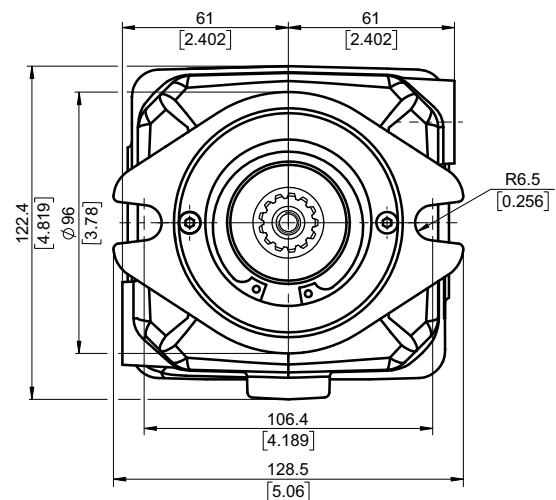
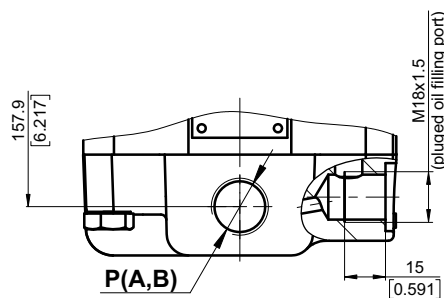


Side ports, port size default, 5 and 9



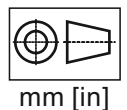
	Port Size		
	default	5	9
P _(A,B)	2xISO 6162-2 DN13	2xSAE J518 1/2" PSI6000	2xISO 6162-2 DN13
T	M18x1.5	3/4-16 UNF	G1/2
C	8xM8	8x5/16-18 UNC	8xM8

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



	Port Size			
	2	3	4	6
P _(A,B)	2xG 1/2	2xM22x1.5	2x7/8-14UNF	2xG 3/4
T	G 1/2	M18x1.5	3/4-16UNF	G 1/2

Shaft Mounting
 see page 14



mm [in]





OVERALL DIMENSIONS AND PORTS

Twin Side Ports - Type T Mounting Flange - Type SAE-A

Twin side ports T, port size 2,3,4 and 6

See the port sizes at the bottom of this page

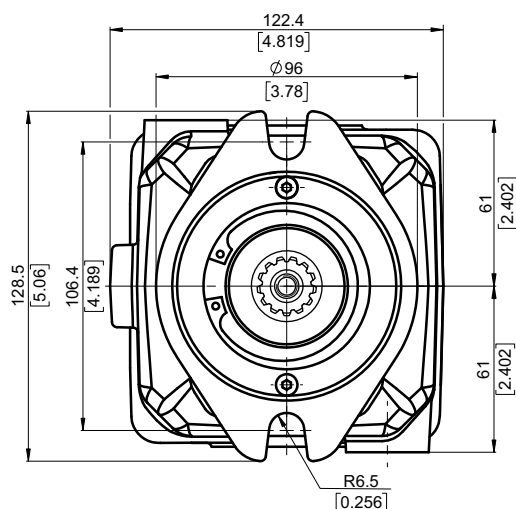
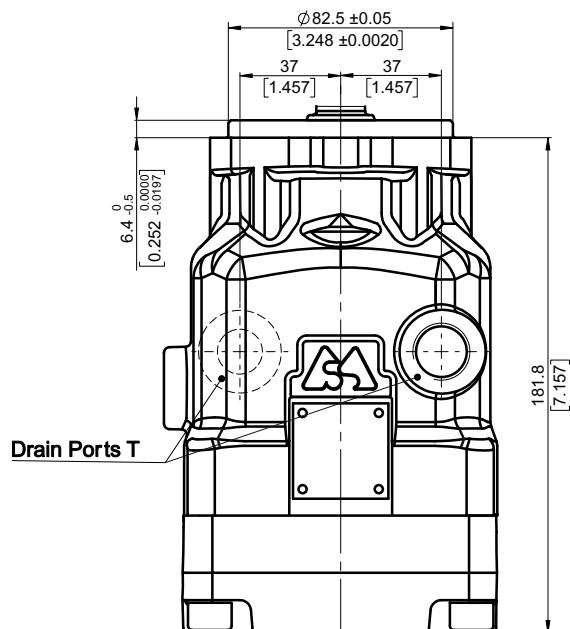
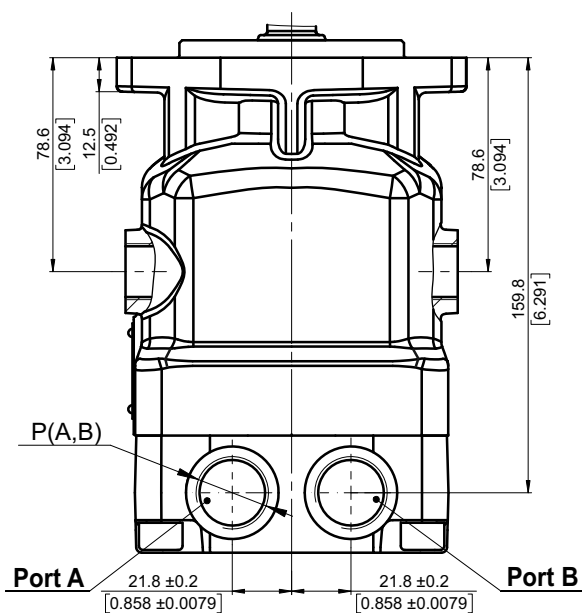
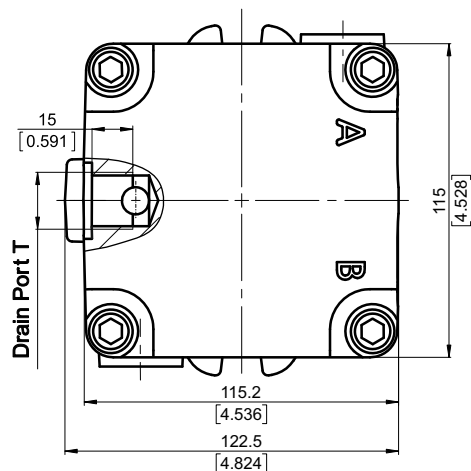
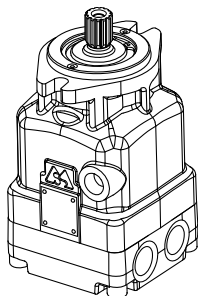
Standard Rotation

Viewed from shaft end

Port A Pressurized - CW

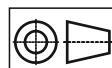
Port B Pressurized - CCW

see page 81



Port Size				
	2	3	4	6
P _(A,B)	2xG 1/2	2xM22x1.5	2x7/8-14UNF	2xG 3/4
T	G 1/2	M18x1.5	3/4-16UNF	G 1/2

Shaft Mounting
see the next page

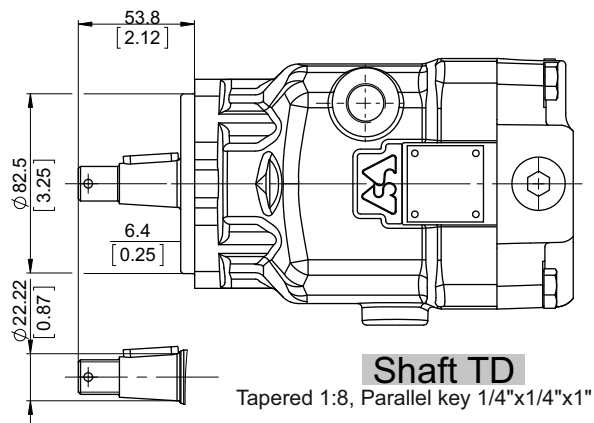
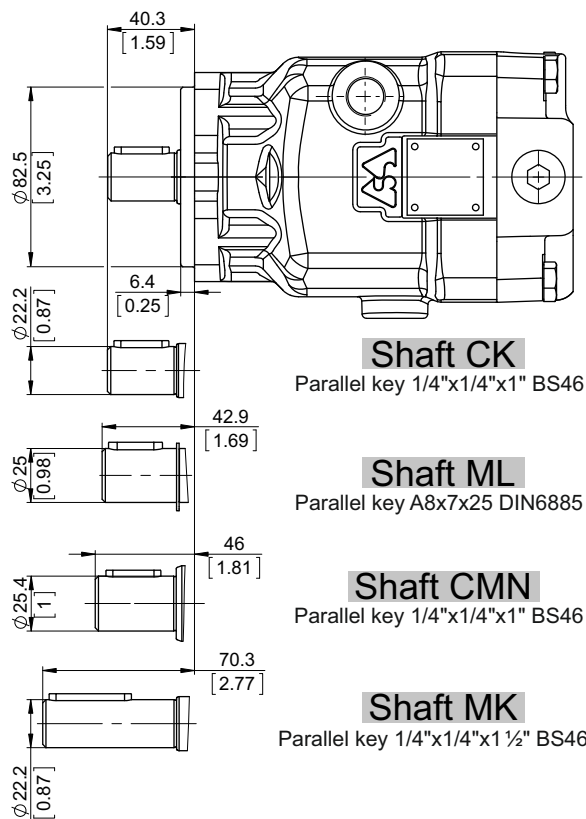
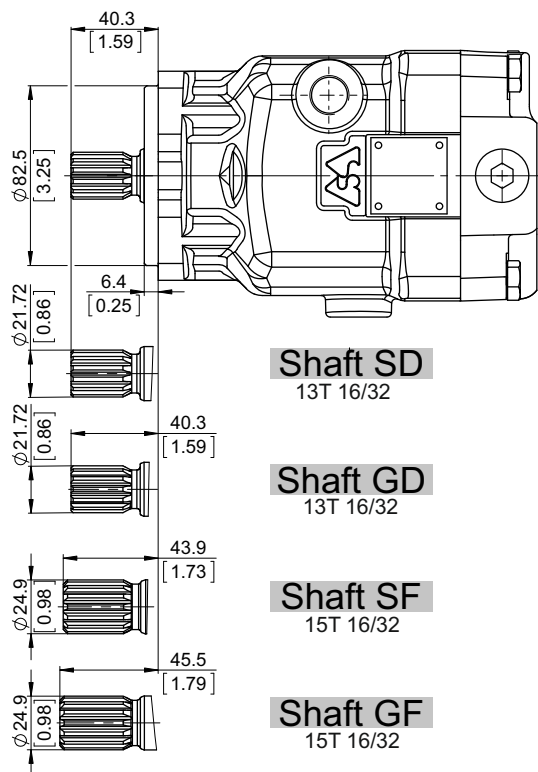


mm [in]



SHAFTS MOUNTING

Mounting Flange - Type SAE-A



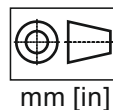
Shaft Dimensions
See Page 69+73

PERMISSIBLE SHAFT LOAD

Permissible shaft load		Standard bearing	CMN bearing
max Axial	N[lb]	Fa=1300 [292]	Fa=1600 [360]
max Radial	N[lb]	Fr=2200 [495]	Fr=3000 [674]

The calculated max values are based on the optimal direction of the forces Fr, Fa and optimal position of the shaft (see page 81).

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

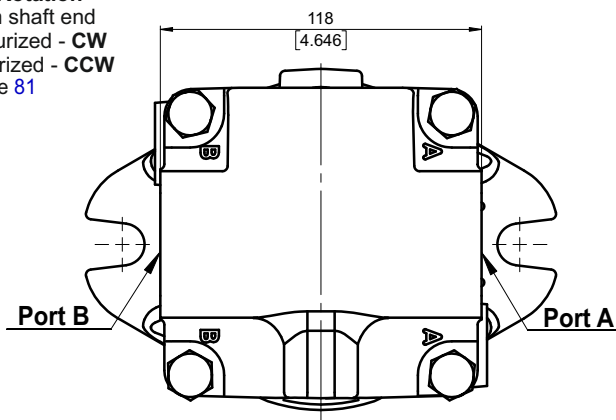
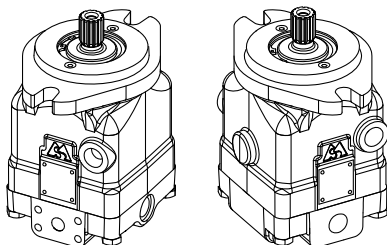




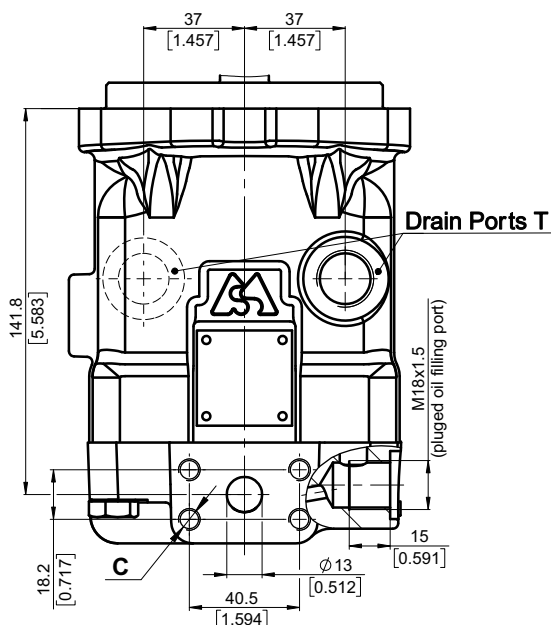
OVERALL DIMENSIONS AND PORTS

Side Ports - Default Mounting Flange - Type SAE-B

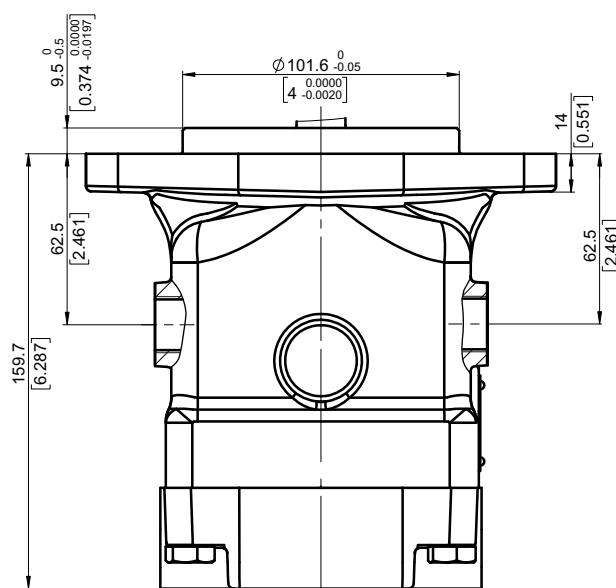
Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW
see page 81



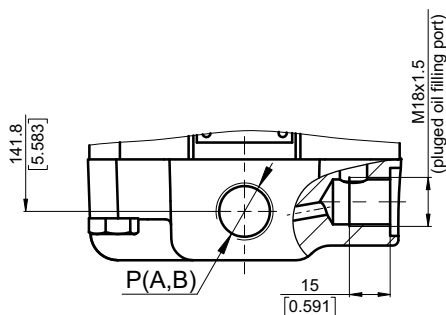
Side ports, port size default ,5 and 9



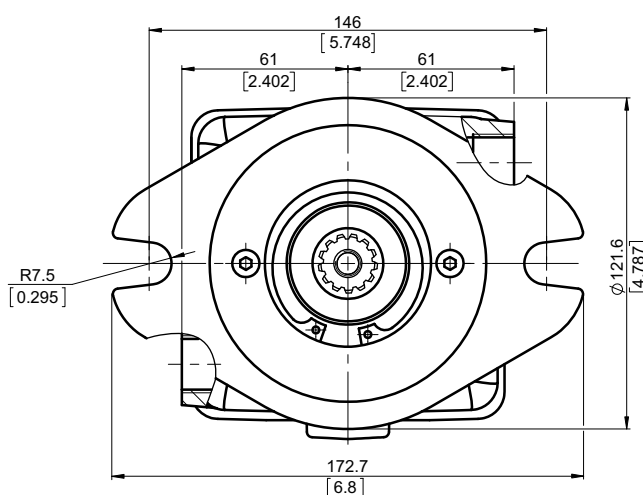
Port Size			
	default	5	9
P _(A,B)	2xISO 6162-2 DN13	2xSAE J518 1/2" PSI6000	2xISO 6162-2 DN13
T	M18x1.5	3/4-16 UNF	G1/2
C	8xM8	8x5/16-18 UNC	8xM8



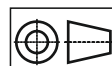
Side ports, port size 2, 3, 4 and 6



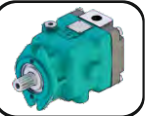
Port Size				
	2	3	4	6
P _(A,B)	2xG 1/2	2xM22x1.5	2x7/8-14 UNF	2xG 3/4
T	G 1/2	M18x1.5	3/4-16 UNF	G 1/2



Shaft Mounting
see page 18



mm [in]

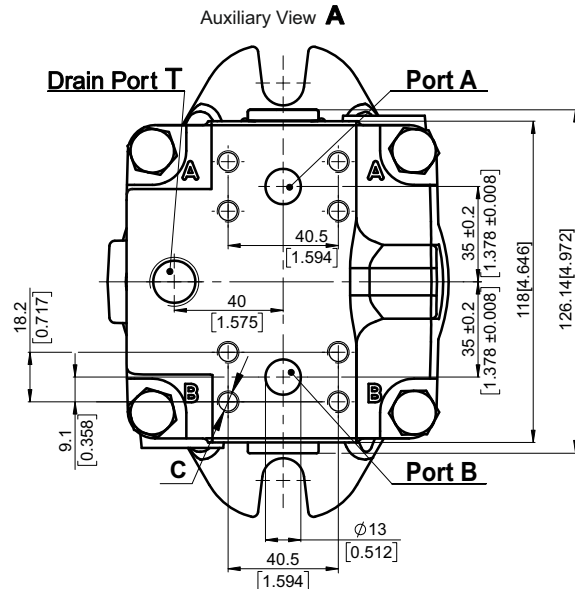


OVERALL DIMENSIONS AND PORTS

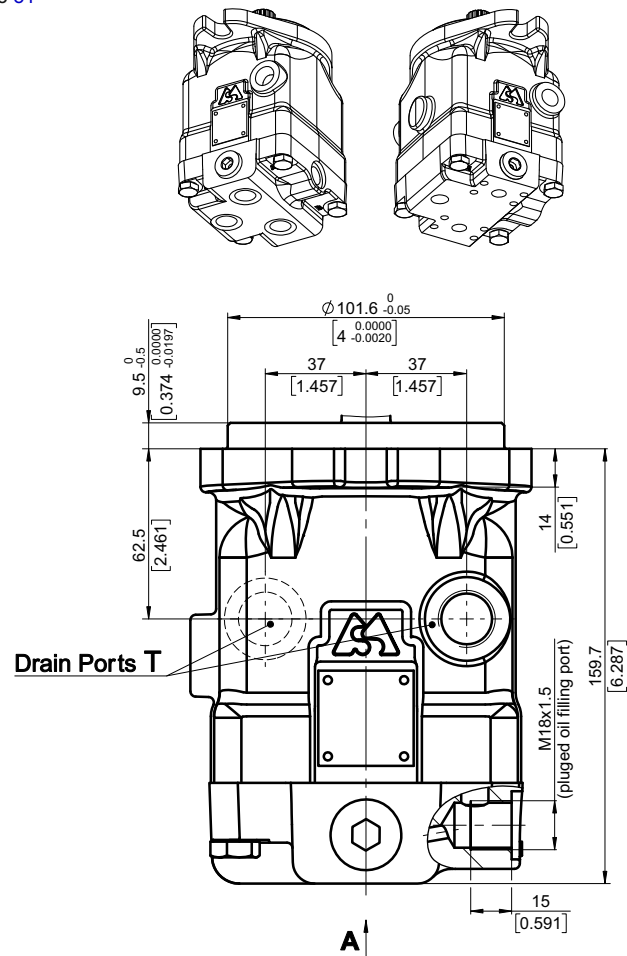
Rear Ports - Type E Mounting Flange - Type SAE-B

Standard Rotation
 Viewed from shaft end
 Port A Pressurized - CW
 Port B Pressurized - CCW
 see page 81

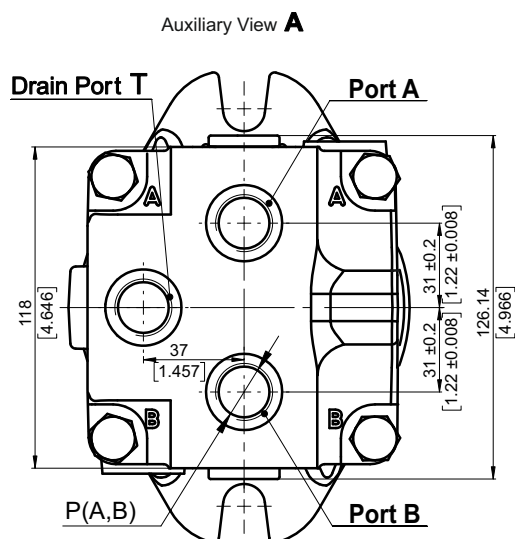
Rear ports E, port size default, 5 and 9



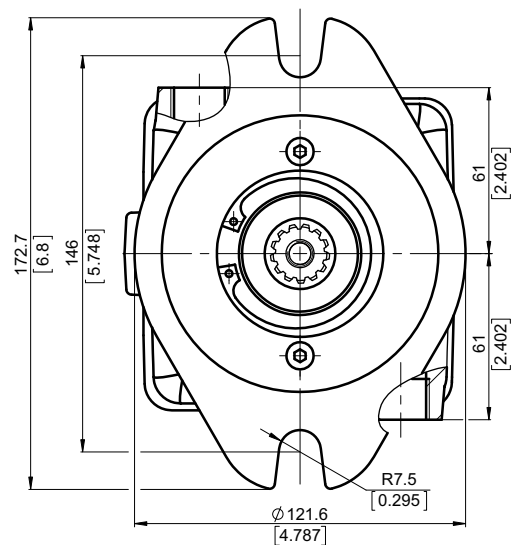
	Port Size		
	default	5	9
P _(A,B)	2xISO 6162-2 DN13	2xSAE J518 1/2" PSI6000	2xISO 6162-2 DN13
T	M18x1.5	3/4-16 UNF	G1/2
C	8xM8	8x5/16-18 UNC	8xM8



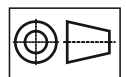
Rear ports E, port size 2, 3, 4 and 6



	Port Size			
	2	3	4	6
P _(A,B)	2xG 1/2	2xM22x1.5	2x7/8-14 UNF	2xG 3/4
T	G 1/2	M18x1.5	3/4-16 UNF	G 1/2



Shaft Mounting
 see page 18



mm [in]



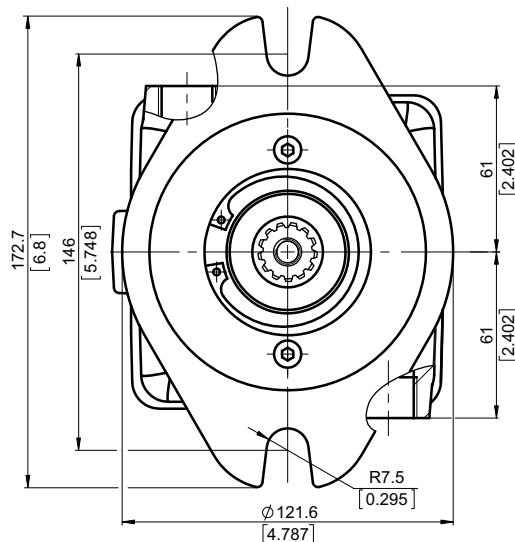
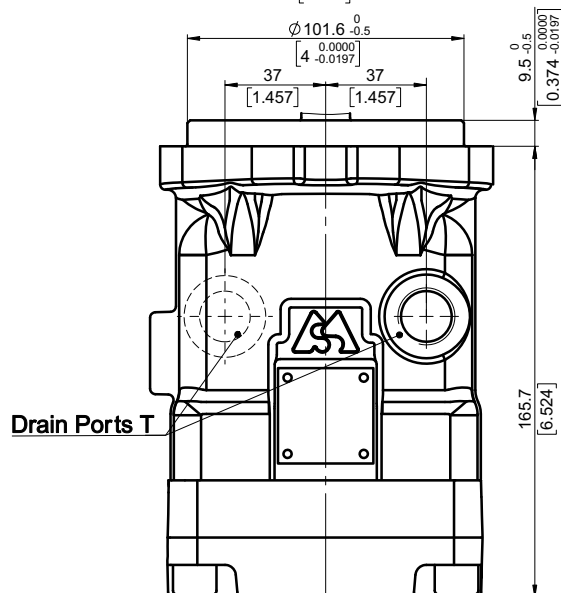
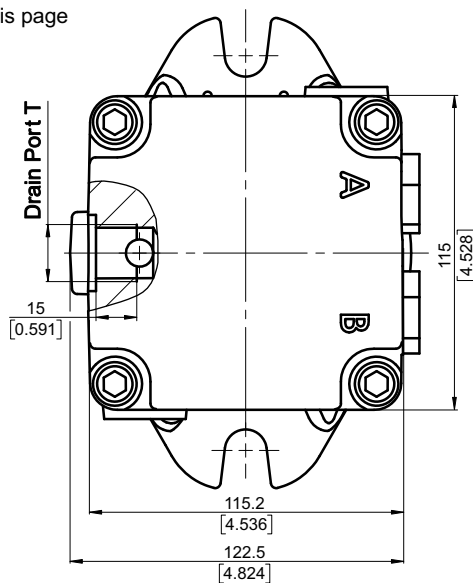
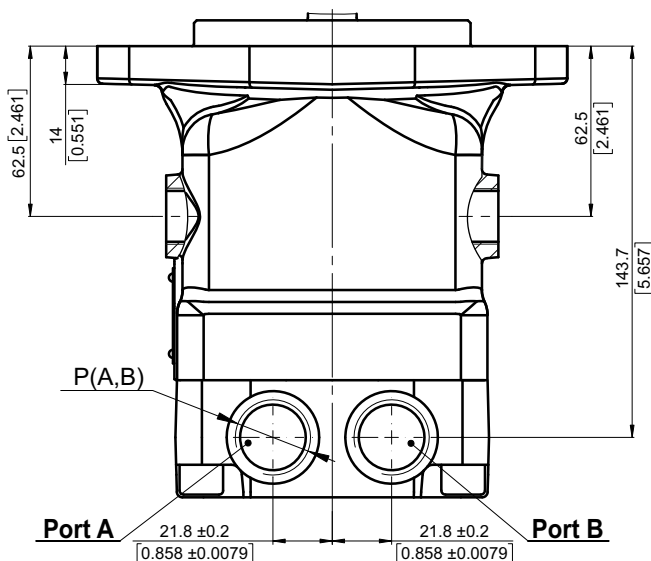
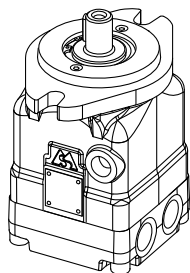
OVERALL DIMENSIONS AND PORTS

Twin Side Ports - Type T Mounting Flange - Type SAE-B

Twin side ports T, port size 2,3,4 and 6

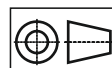
See the port sizes at the bottom of this page

Standard Rotation
Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW
see page 81

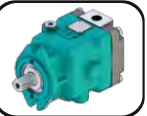


Port Size				
	2	3	4	6
P _(A,B)	2xG 1/2	2xM22x1.5	2x7/8-14UNF	2xG 3/4
T	G 1/2	M18x1.5	3/4-16UNF	G 1/2

Shaft Mounting
see the next page

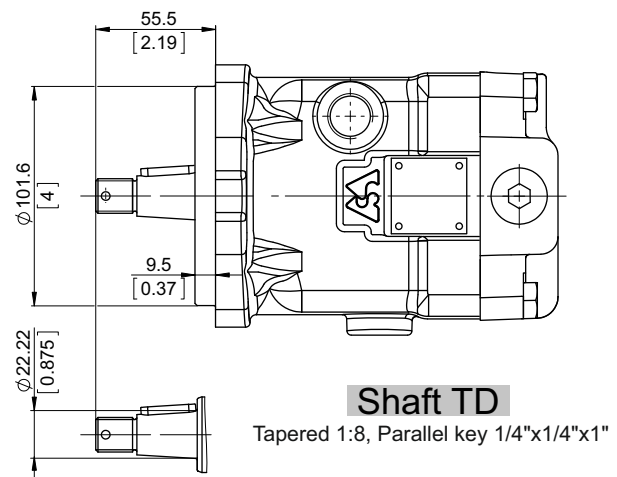
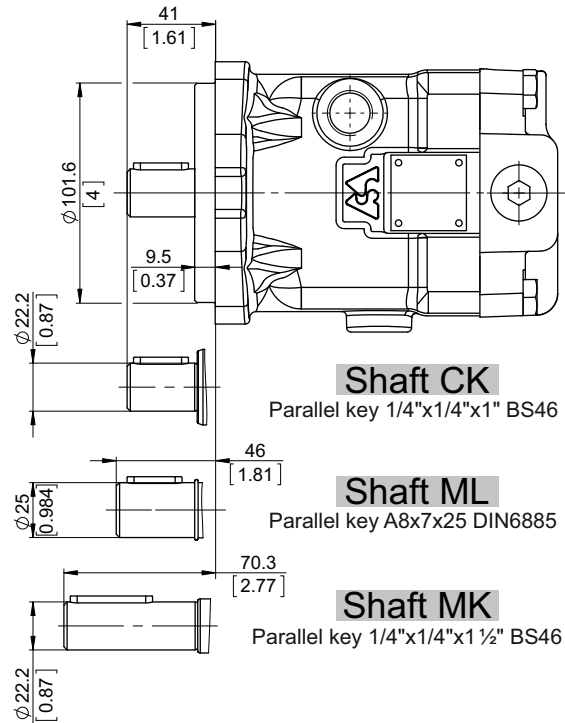
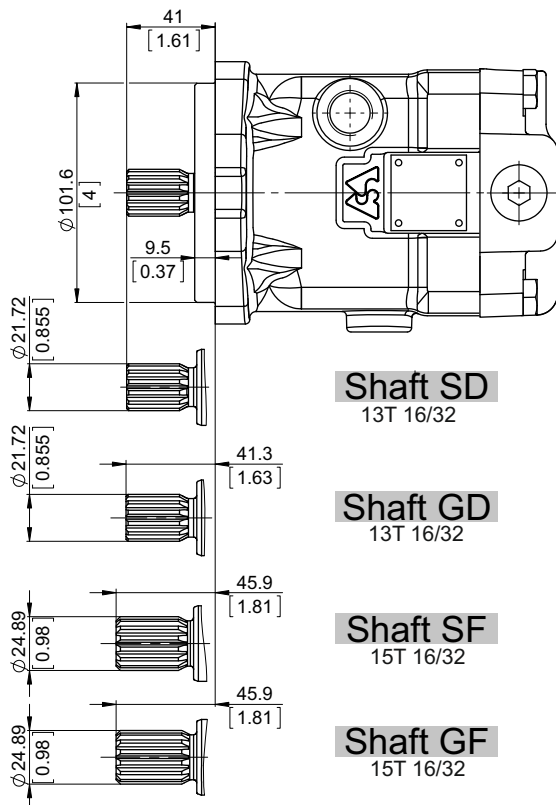


mm [in]



SHAFTS MOUNTING

Mounting Flange - Type SAE-B



Shaft Dimensions
See Page 69+73

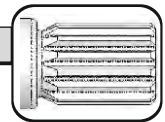
PERMISSIBLE SHAFT LOAD

Permissible shaft load		Standard bearing
max Axial	N[lb]	Fa=1300 [292]
max Radial	N[lb]	Fr=2200 [495]

The calculated max values are based on the optimal direction of the forces Fr, Fa and optimal position of the shaft (see page 81).

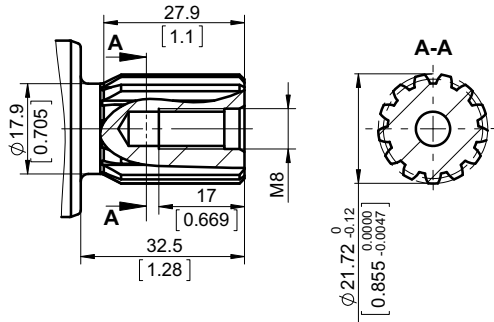
For more information, please, feel free to contact us.

SHAFT TYPES AND DIMENSIONS



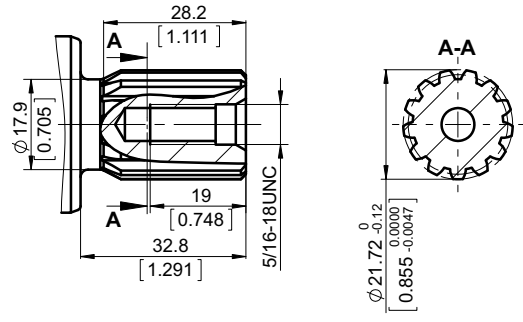
SD

$\phi 21.72$ [0.855], M8 thread
13T 16/32 DP splined ANSI B92.1-1970
 Max. torque 220 Nm [1950 lb-in]



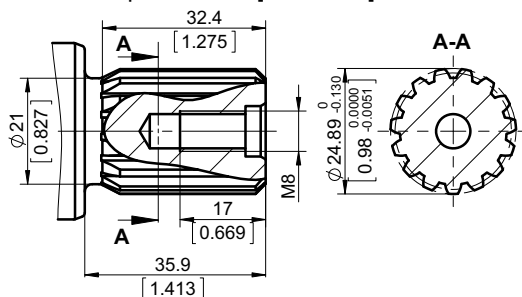
GD

$\phi 21.72$ [0.855], 5/16-18 UNC thread
13T 16/32 DP splined ANSI B92.1-1970
 Max. torque 220 Nm [1950 lb-in]



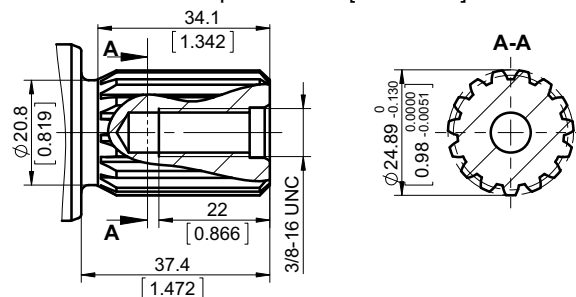
SF

$\phi 24.89$ [0.98], M8 thread
15T 16/32 DP splined ANSI B92.1-1970
 Max. torque 360 Nm [3180 lb-in]



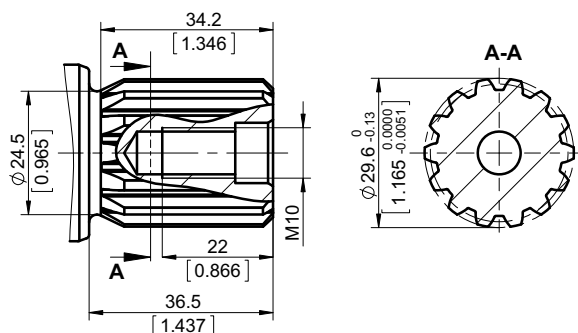
GF

$\phi 24.89$ [0.98], 3/8-16 UNC thread
15T 16/32 DP splined ANSI B92.1-1970
 Max. torque 360 Nm [3180 lb-in]



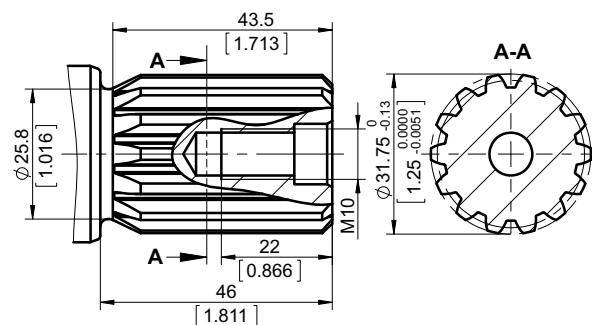
SH

$\phi 29.6$ [1.165], M10 thread
W30x2x30x14x9g splined DIN 5480
 Max. torque 600 Nm [5310 lb-in]

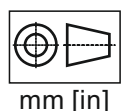


SK

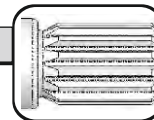
$\phi 31.75$ [1.25], M10 thread
14T 12/24 DP splined ANSI B92.1-1970
 Max. torque 600 Nm [5310 lb-in]



The required max. torque
 must not be exceeded

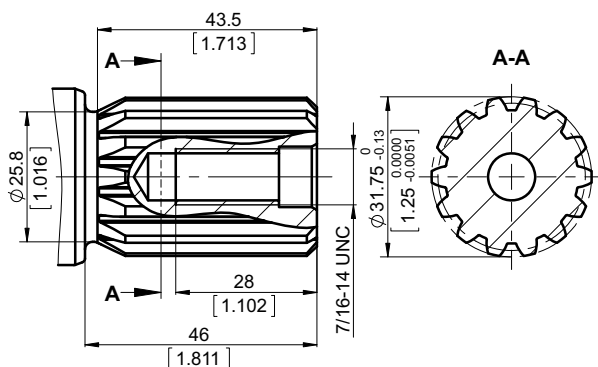


SHAFT TYPES AND DIMENSIONS



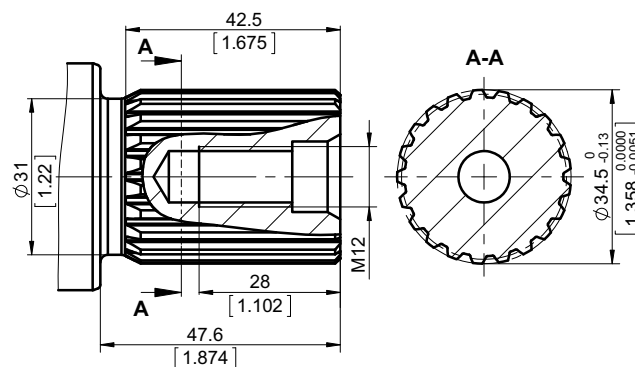
GK

$\phi 31.75$ [1.25], 7/16-14 UNC thread
 14T 12/24 DP splined ANSI B92.1-1970
 Max. torque 600 Nm [5310 lb-in]



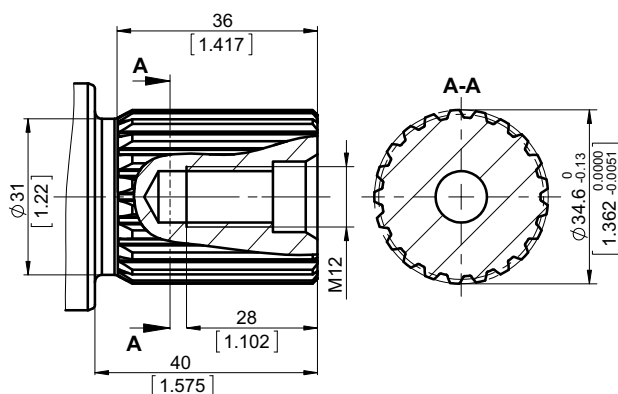
SP

$\phi 34.5$ [1.358], M12 thread
 21T 16/32 DP splined ANSI B92.1-1970
 Max. torque 1085 Nm [9600 lb-in]



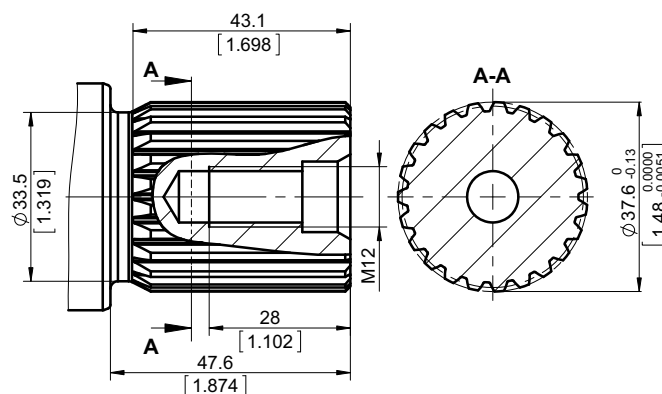
QH

$\phi 34.6$ [1.36], M12 thread
 W35x2x30x16x9g splined DIN 5480
 Max. torque 1085 Nm [9600 lb-in]



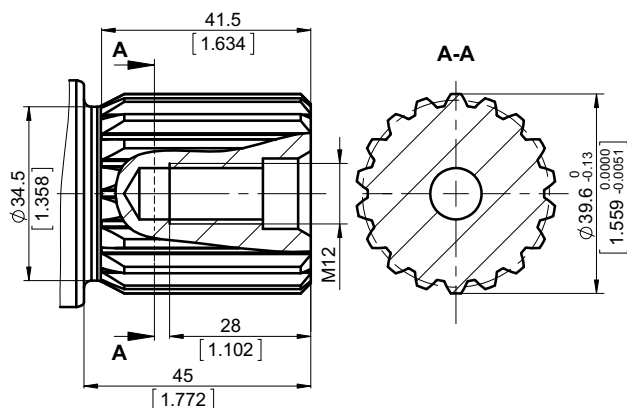
SR

$\phi 37.6$ [1½], M12 thread
 23T 16/32 DP splined ANSI B92.1-1970
 Max. torque 1300 Nm [11500 lb-in]



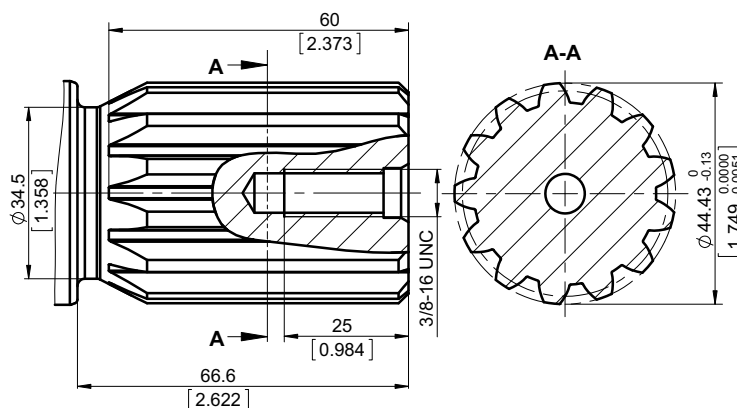
ST

$\phi 39.6$ [1.559], M12 thread
 W40x2x30x18x9g splined DIN 5480
 Max. torque 1400 Nm [12400 lb-in]

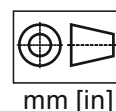


GU

$\phi 44.43$ [1¾], 3/8-16 UNC thread
 13T 8/16 DP splined ANSI B92.1-1970
 Max. torque 2000 Nm [17700 lb-in]



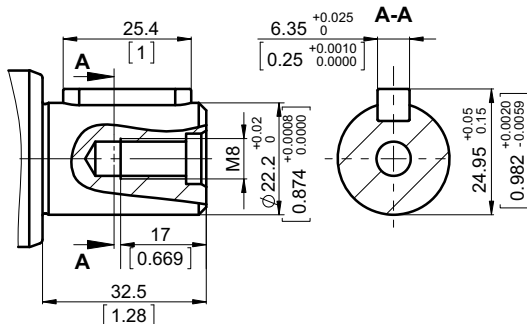
The required max. torque
 must not be exceeded



SHAFT TYPES AND DIMENSIONS

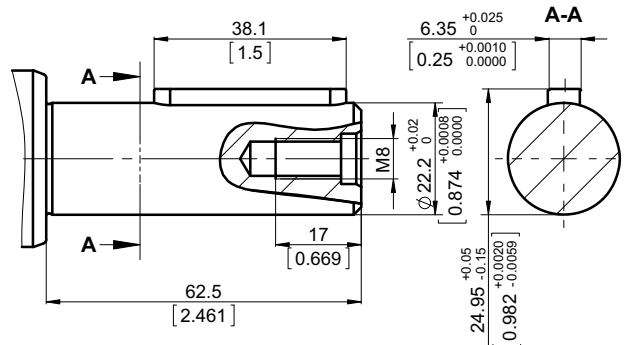
CK

ø22.2 [7/8] straight, M8 thread
Parallel key **1/4"x1/4"x1"** BS46
Max. torque 180 Nm [1600 lb-in]



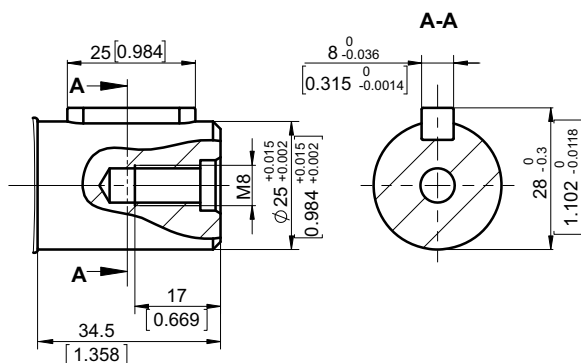
MK

ø22.2 [7/8] straight, M8 thread
Parallel key **1/4"x1/4"x1½"** BS46
Max. torque 180 Nm [1600 lb-in]



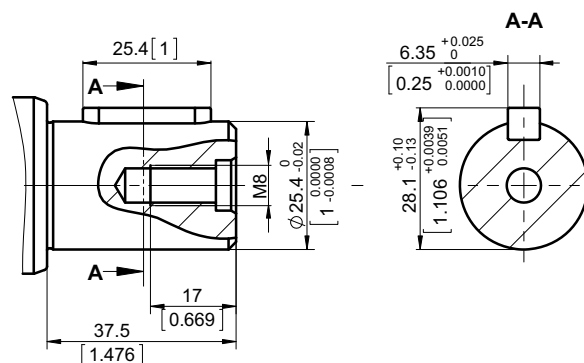
ML

ø25 [0.984] straight, M8 thread
Parallel key **A8x7x25** DIN6885
Max. torque 250 Nm [2210 lb-in]



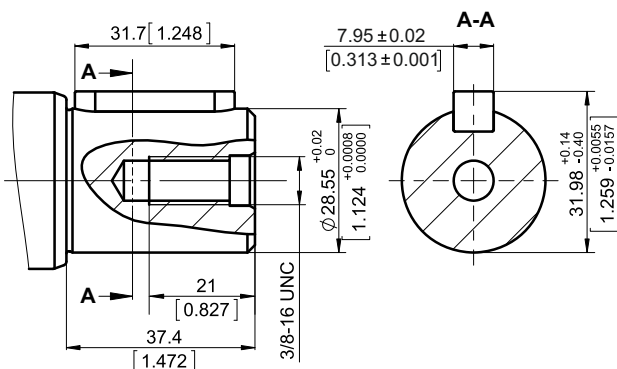
CM CMN

ø25.4 [1] straight, M8 thread
Parallel key **1/4"x1/4"x1"** BS46
Max. torque 250 Nm [2210 lb-in]



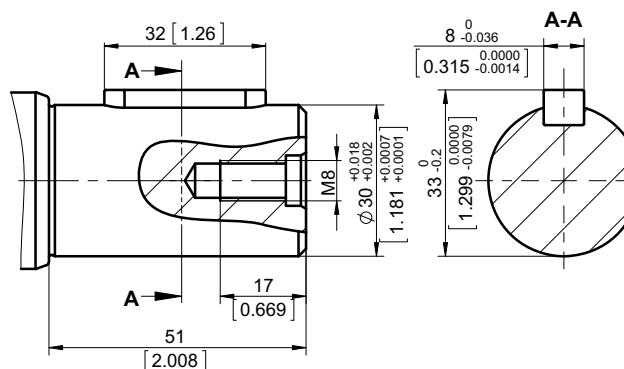
DO

ø28.55 [1.125] straight, 3/8-16 UNC thread
Parallel key **5/16"x5/16"x1¼"**
Max. torque 280 Nm [2480 lb-in]

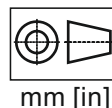


CQ

ø30 [1.181] straight, M8 thread
Parallel key **A8x7x32** DIN6885
Max. torque 300 Nm [2655 lb-in]



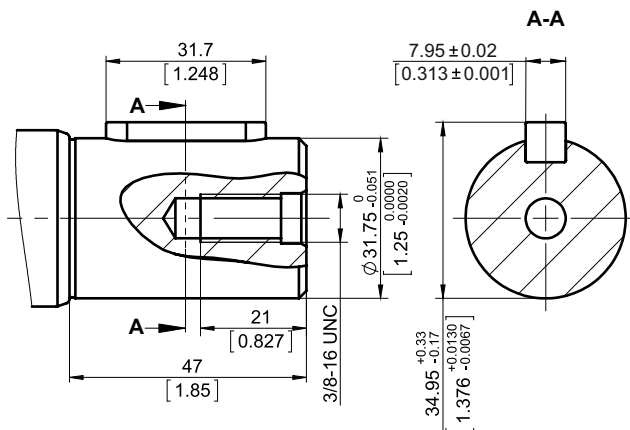
The required max. torque
must not be exceeded



SHAFT TYPES AND DIMENSIONS

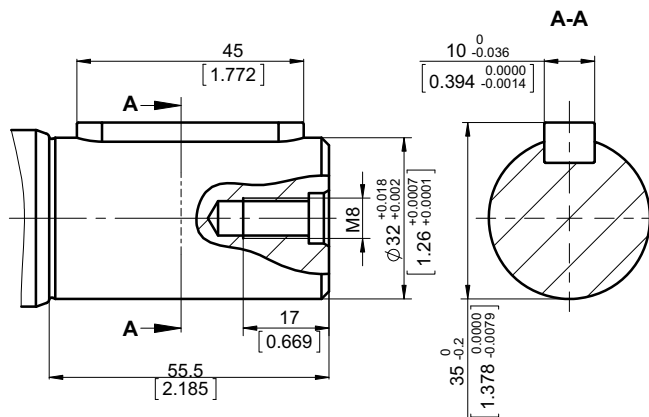
DR

ø31.75 [1.25] straight, 3/8-16 UNC thread
 Parallel key **5/16"x5/16"x1 1/4"**
 Max. torque 770 Nm [6815 lb-in]



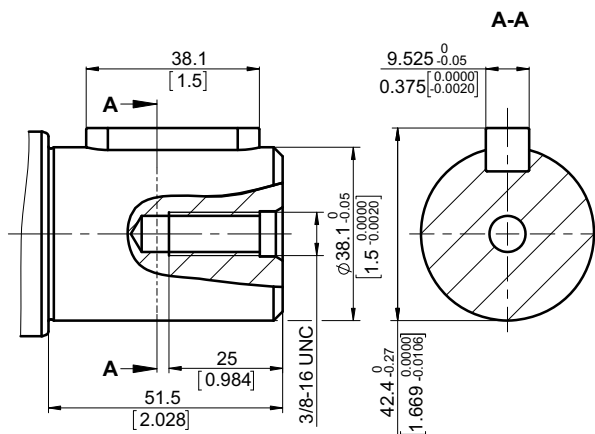
CS

ø32 [1.26] straight, M8 thread
 Parallel key **A10x8x45 DIN6885**
 Max. torque 565 Nm [5000 lb-in]



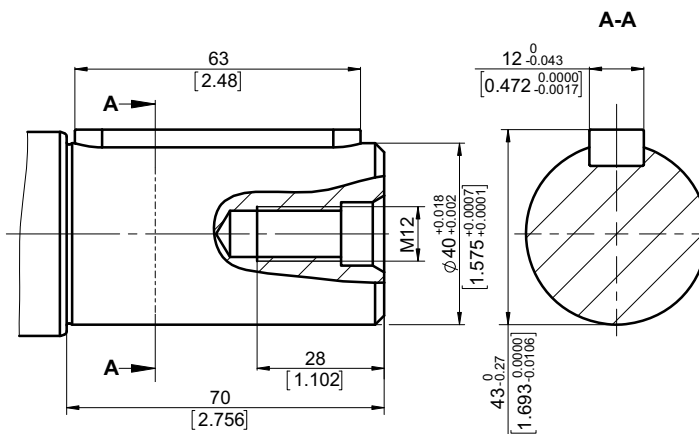
DU

ø38.1 [1 1/2] straight, 3/8-16 UNC thread
 Parallel key **3/4"x3/4"x1 1/2"** BS46
 Max. torque 1000 Nm [8850 lb-in]

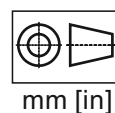


CV

ø40 [1.575] straight, M12 thread
 Parallel key **A12x8x63 DIN6885**
 Max. torque 1100 Nm [9735 lb-in]



The required max. torque
 must not be exceeded

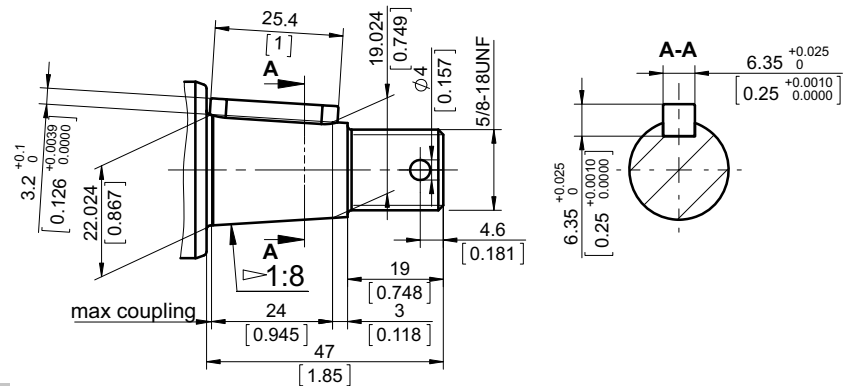




SHAFT TYPES AND DIMENSIONS

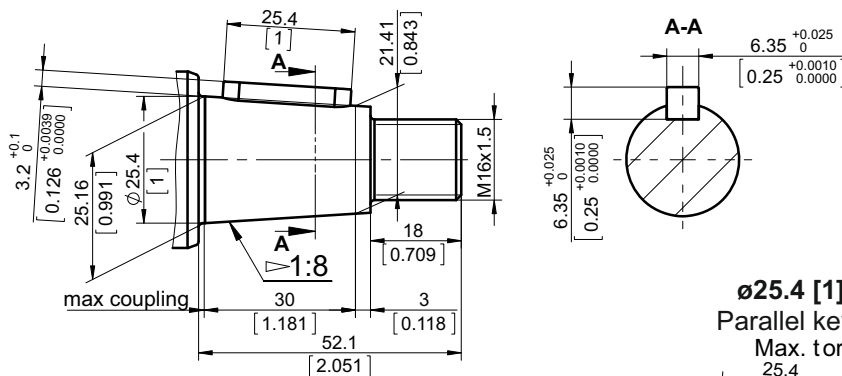
TD

ø22.22 [7/8] Tapered 1:8 [125:1000],
 Parallel key **1/4"x1/4"x1"**, 5/8-18 UNF
 Max. torque 220 Nm [1950 lb-in]



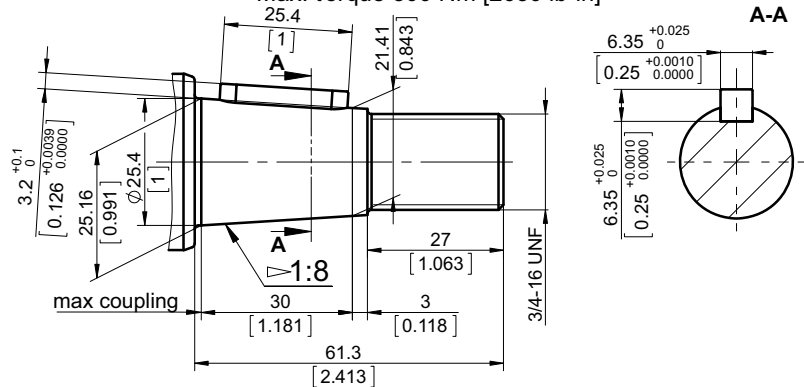
KH

ø25.4 [1] Tapered 1:8 [125:1000],
 Parallel key **1/4"x1/4"x1"**, M16x1.5
 Max. torque 300 Nm [2650 lb-in]



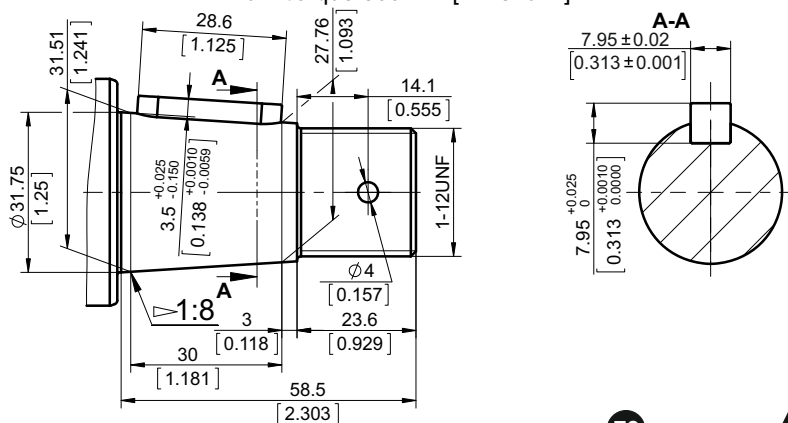
TH

ø25.4 [1] Tapered 1:8 [125:1000],
 Parallel key **1/4"x1/4"x1"**, 3/4-16 UNF
 Max. torque 300 Nm [2650 lb-in]

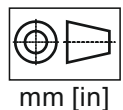


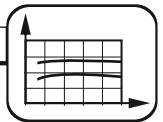
TN

ø31.75 [1 1/4] Tapered 1:8 [125:1000],
 Parallel key **5/16"x5/16"x1 1/8"**, 1-12 UNF
 Max. torque 500 Nm [4425 lb-in]



The required max. torque
 must not be exceeded

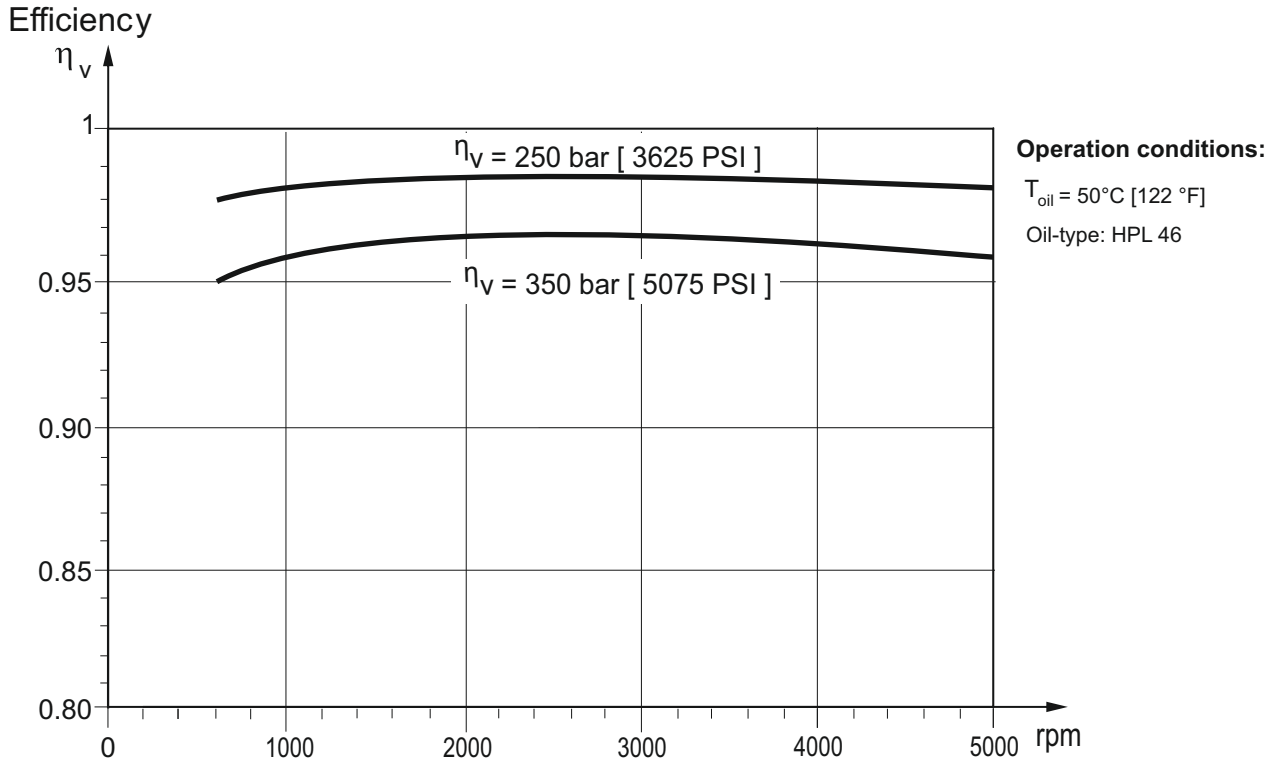




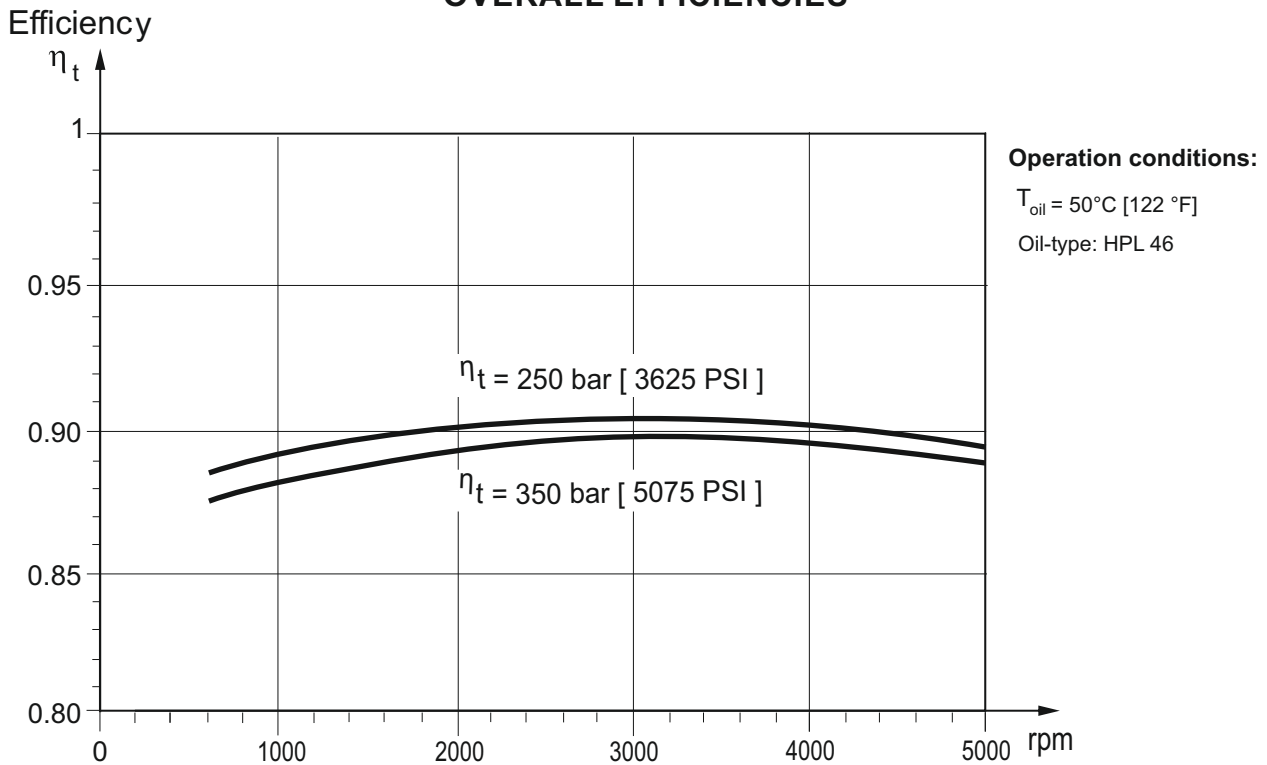
MOTOR FUNCTION DIAGRAMS

The below efficiencies are applied for all motor 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 [85](#)

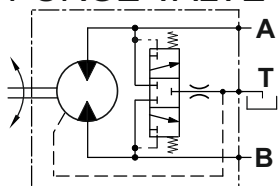
Efficiencies for a particular motor may vary from the shown in the diagram depending on the operating conditions.

VALVE OPTIONS



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

Option PU PURGE VALVE



- Mainly used in open loop circuit;
- Used for cooling purpose or oil cleanliness requirements;
- Flow rate by **default** :

Motors	MAP28	MAP62	MAP100	MAPW62
default	5±2 l/min	6±2 l/min	7±2 l/min	6±2 l/min

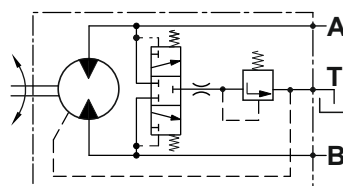
- For other options, please see Flow Setting of ordering code, considering the following possible values:

Flow setting → flow rate

EXAMPLE

MAPB50SH2PU purge valve flow rate 6±2 l/min
 MAPB50SH2PUL3.5 purge valve flow rate 3.5±1 l/min
 MAPB50SH2PUL5.5 purge valve flow rate 5.5±1 l/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**

Motors	MAP28	MAP62	MAP100	MAPW62
default	5±2 l/min	6±2 l/min	7±2 l/min	6±2 l/min

- and charge (opening) pressure 16 bar with 20 bar feed pressure for close loop circuit;

- For other options, please see Pressure Setting and Flow Setting of ordering code, considering the following possible values:

Pressure setting → pressure
 Flow setting → flow rate

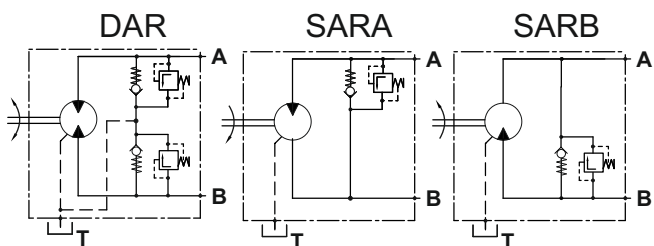
EXAMPLE

MAPB50SH2FLU flow rate 6±2 l/min, charge pressure 16 bar
 MAPB50SH2FLU10L5.5 flow rate 5.5±1 l/min, charge pressure 10 bar
 MAPB50SH2FLUL3.5 flow rate 3.5±1 l/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:

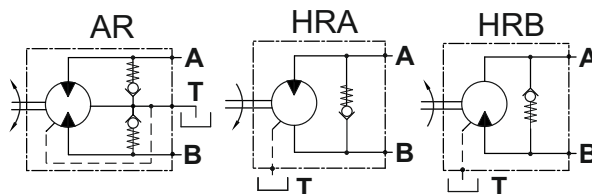
Pressure setting → pressure

EXAMPLE

MAPB50SH2DAR350
 Double Anti-Cavitation and Relief Valve, relief valve setting 350 bar
 MAPB50SH2SARA250
 Single Anti-Cavitation and Relief Valve, relief valve setting 250 bar
 The valve is placed on port A
 MAPB50SH2SARB300
 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

MAPB50SH2AR
 Double Anti-Cavitation Valve
 MAPB50SH2HRA
 Single Anti-Cavitation Valve, the valve is placed on port A
 MAPB50SH2HRB
 Single Anti-Cavitation Valve, the valve is placed on port B

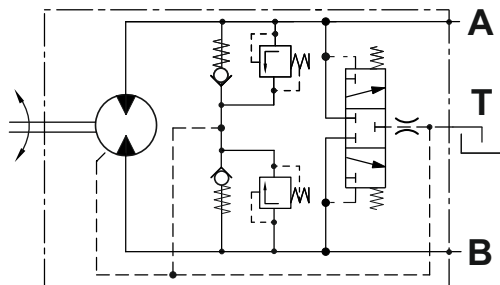
VALVE OPTIONS



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:

Pressure setting **250 300 350** → pressure

- Flow rate of purge valve by **default**

Motors	MAP28	MAP62	MAP100	MAPW62
default	5±2 l/min	6±2 l/min	7±2 l/min	6±2 l/min

The possible values are as follow:

Flow setting **omit L3.5 L5.5** → flow rate

EXAMPLE

MAPB50SH2DARP350

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

MAPB50SH2DARP250L3.5

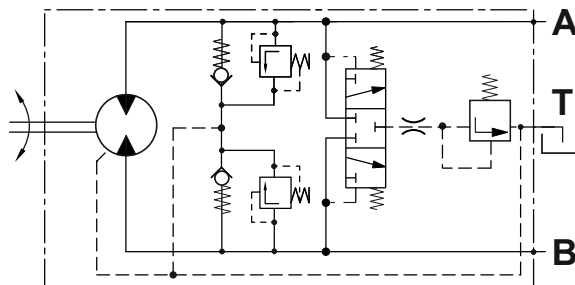
Double Anti-Cavitation, Relief and Purge Valve, relief valve setting is 250 bar, purge valve flow rate 3.5±1 l/min

MAPB50SH2DARP300L5.5

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

Pressure setting **250 300 350** → pressure

- Flow rate of flush valve by **default**

Motors	MAP28	MAP62	MAP100	MAPW62
default	5±2 l/min	6±2 l/min	7±2 l/min	6±2 l/min

and charge pressure 16 bar with 20 bar feed pressure for close loop circuit. The possible values are as follow:

Flow setting **omit L3.5 L5.5** → flow rate

- Other values for charge pressure are possible. Please see Pressure Setting. Example: For charge pressure 10 bar the options are as follow:

Pressure setting **250-10 300-10 350-10**

Relief valve opening pressure Flush valve opening pressure (charge pressure)

EXAMPLE

MAPB50SH2DARF350

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

MAPB50SH2DARF350-10

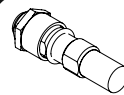
Double Anti-Cavitation, Relief and Flush Valve, relief valve setting 350 bar flush valve charge pressure 10 bar, flush valve flow rate is 6±2 l/min

MAPB50SH2DARF250L3.5

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 l/min

MAPB50SH2DARF300-10L5.5

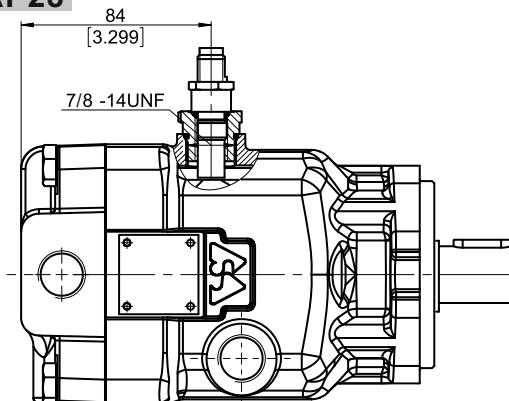
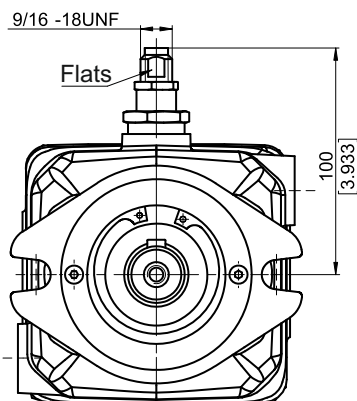
Double Anti-Cavitation, Relief and Flush Valve, relief valve setting 300 bar flush valve charge pressure 10 bar, flush valve flow rate 5.5±1 l/min



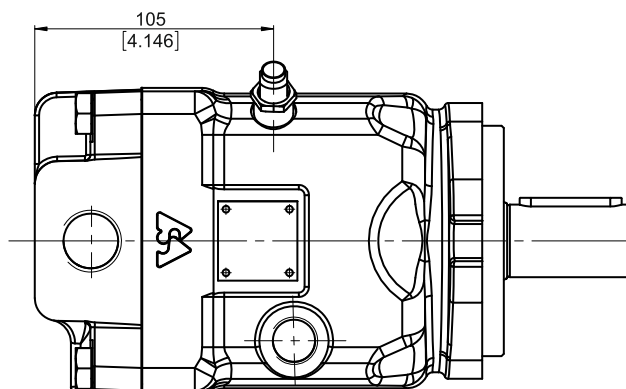
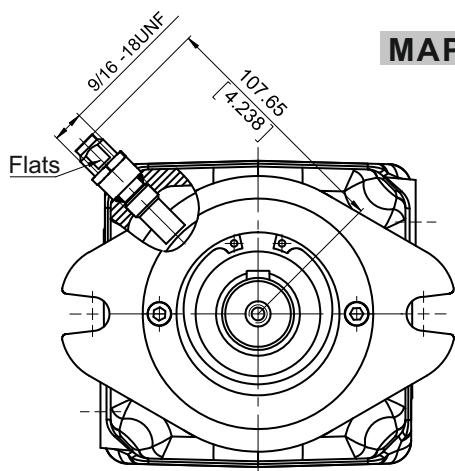
SPEED SENSORS

MOUNTING DIMENSIONS

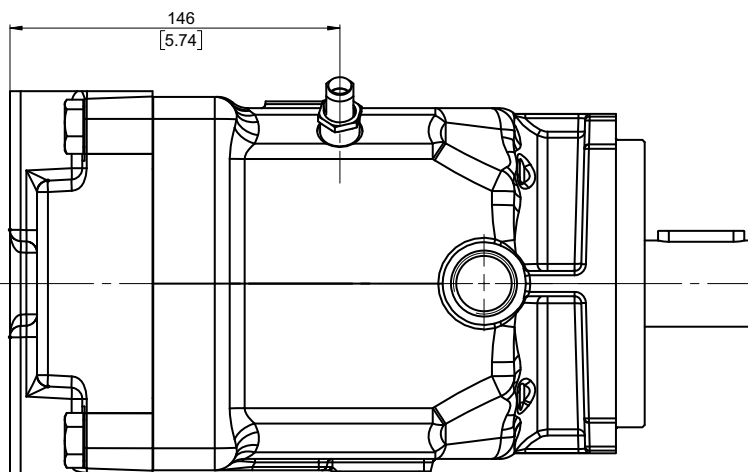
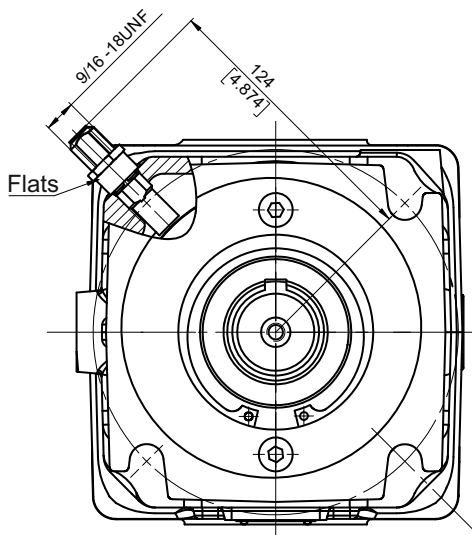
MAP28 and PAP28



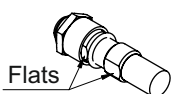
MAP62, MAPW62 and PAP62



MAP100

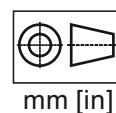


INSTALLATION



1. Remove the plug.
2. Screw in the (CW) sensor by hand until the bottom end gently touches the speed ring.
3. Unscrew (CCW) sensor 1/4 turn. Continue unscrewing until the flats are perpendicular to motor or pump shaft center line (tolerance 20° to 30° is acceptable). Do not unscrew the sensor more than 3/4 of a turn from the touching.
4. Using the 1/2 inch wrench to hold the sensor, tighten the lock nut to 10¹⁵ [115] Nm [lb-in]. with an 1 1/16 inch hew wrench.

NOTE: The speed sensor is not fitted at the factory, but is supplied in plastic bag with the motor.
For installation see enclosed instructions.



mm [in]

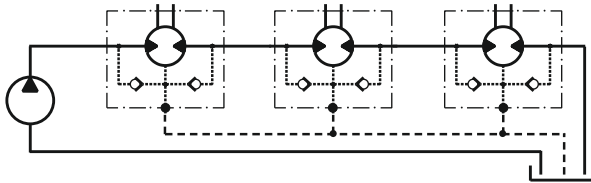


INSTALLATION

TYPE OF CONNECTION

Series connection

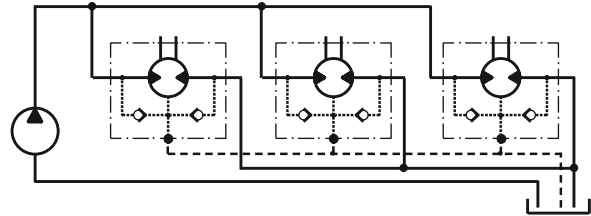
not recommended



open drain line is always required

Parallel connection

recommended

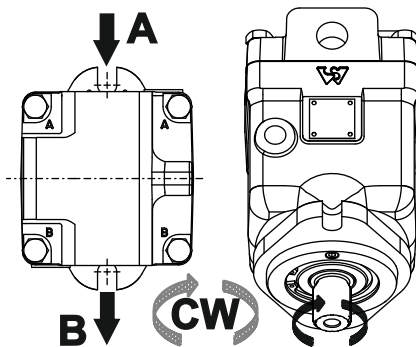


open drain line is always required

DIRECTION OF ROTATION

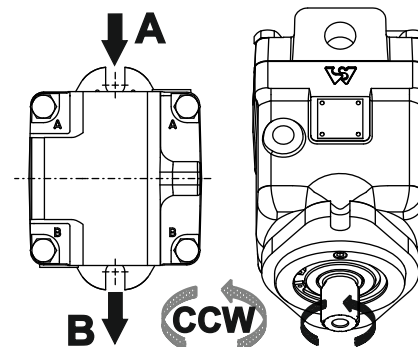
Standard Rotation

Viewed from shaft end
Port A Pressurized - CW
Port B Pressurized - CCW



Reverse Rotation

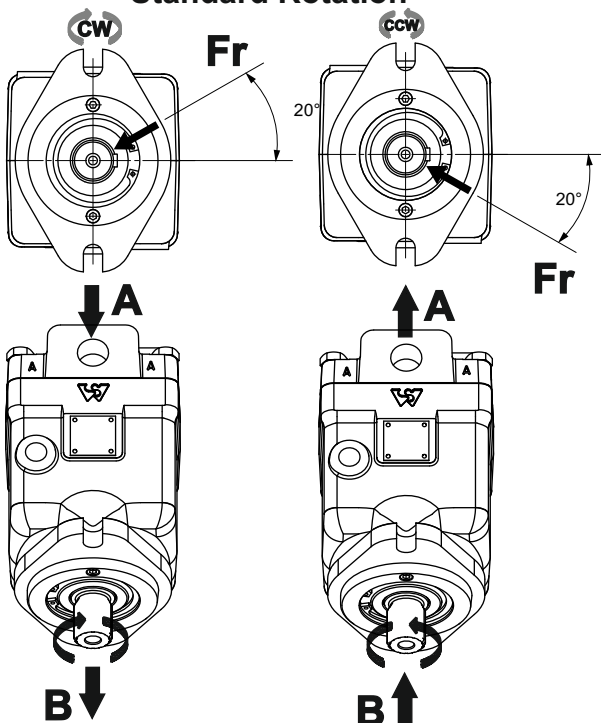
Viewed from shaft end
Port A Pressurized - CCW
Port B Pressurized - CW



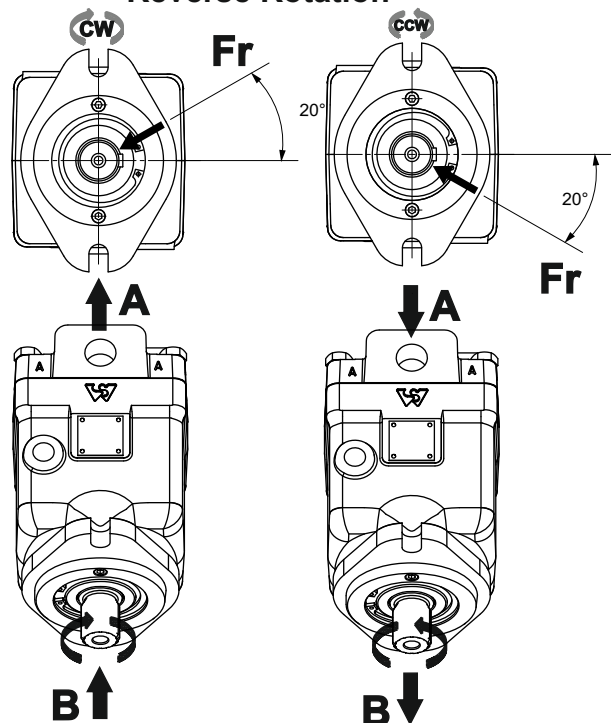
BEST POSITION FOR APPLYING RADIAL LOAD

Optimal position for applying radial load depending on the direction of rotation

Standard Rotation



Reverse Rotation

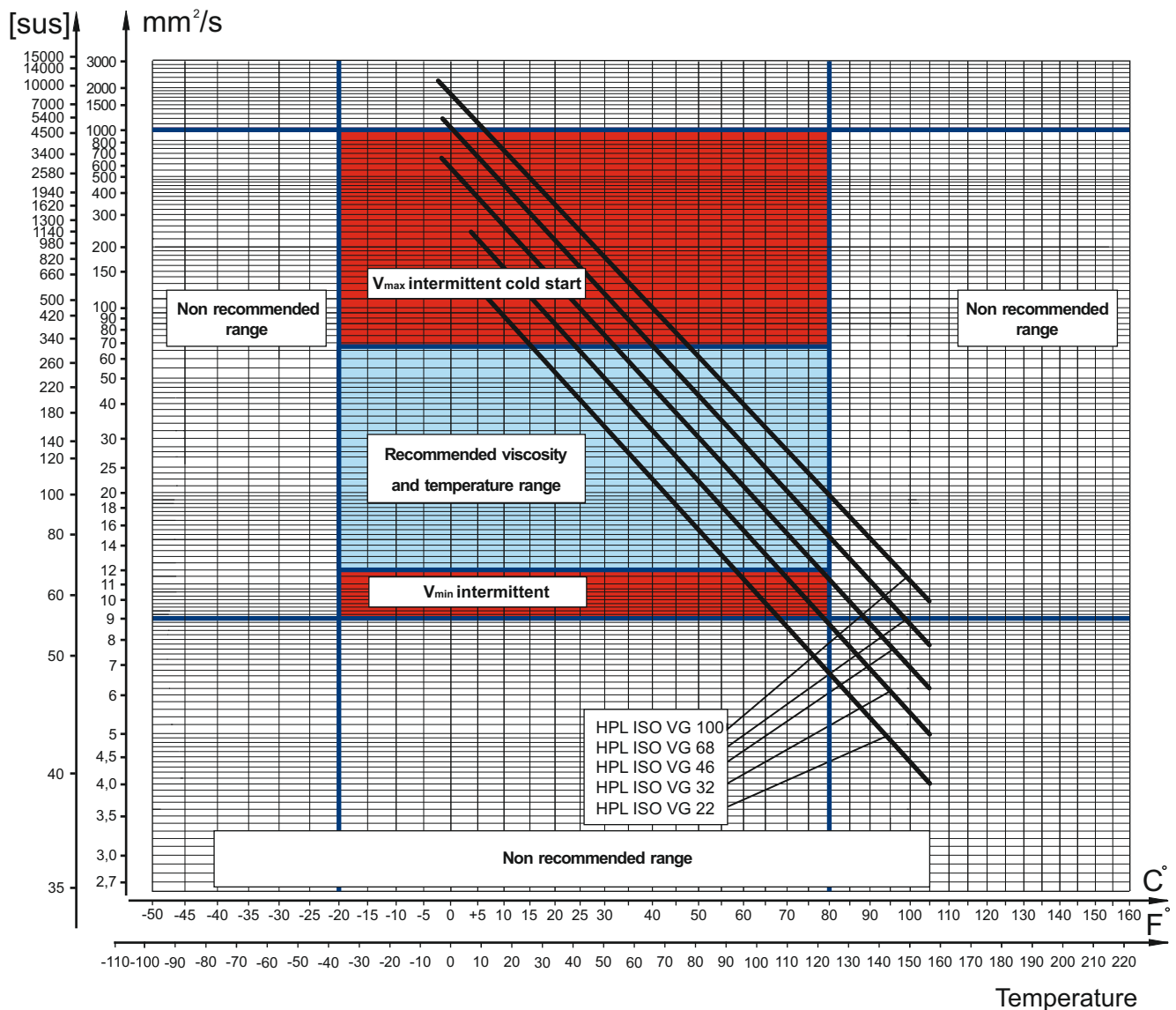




FLUID VISCOSITY LIMITS

In order to obtain optimum efficiency and service life, we recommend to select the operating viscosity (at operating temperature) within the range shown on diagram below.

Kinematic viscosity



The above - shown viscosity characteristics are for reference only. Please, check the actual viscosity with the manufacturer of the fluid.

BASIC FORMULAS

The motor(pump) size, pressure and flow required for a specific application can be calculated using the formulas below.

Metric System

$$\text{Efficiency} \quad \eta_t = \eta_{mh} \cdot \eta_v \quad \eta_{mh} = \frac{\eta_t}{\eta_v} \quad \eta_v = \frac{\eta_t}{\eta_{mh}}$$

$$\text{Input flow (for Motor)} \quad Q = \frac{Vg \cdot n}{1000 \cdot \eta_v} \quad [l/min]$$

$$\text{Output torque (for Motor)} \quad M = \frac{Vg \cdot \Delta p \cdot \eta_{mh}}{62,8} \quad \text{or} \quad M = \Delta p \cdot T_{con.} \quad [Nm]$$

$$\text{Output power (for Motor)} \quad P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p \cdot \eta_t}{600} \quad [kW]$$

$$\text{Speed (for Motor)} \quad n = \frac{Q \cdot 1000 \cdot \eta_v}{Vg} \quad \text{or} \quad n = Q \cdot N_{con.} \quad [min^{-1}]$$

$$\text{Output flow (for pump)} \quad Q = \frac{Vg \cdot n \cdot \eta_v}{1000} \quad [l/min]$$

$$\text{Driving torque (for pump)} \quad M = \frac{Vg \cdot \Delta p}{62,8 \cdot \eta_{mh}} \quad [Nm]$$

$$\text{Input power (for pump)} \quad P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t} \quad [kW]$$

$$Vg = \text{Displacement per rev.} \quad [cm^3]$$

$$\Delta p = p_{HP} - p_{LP} \quad [bar]$$

$$p_{HP} = \text{High pressure} \quad [bar]$$

$$p_{LP} = \text{Low pressure} \quad [bar]$$

$$n = \text{Rotation speed} \quad [RPM]$$

$$Q = \text{Oil flow} \quad [l/min]$$

$$T_{con.} = \text{Toque constant} \quad [Nm/bar]$$

$$N_{con.} = \text{Speed constant} \quad [RPM/(l/min)]$$

$$\eta_v = \text{Volumetric efficiency}$$

$$\eta_{mh} = \text{Mechanical-hydraulic efficiency}$$

$$\eta_t = \text{Overall efficiency}$$

Inch System

$$\text{Efficiency} \quad \eta_t = \eta_{mh} \cdot \eta_v \quad \eta_{mh} = \frac{\eta_t}{\eta_v} \quad \eta_v = \frac{\eta_t}{\eta_{mh}}$$

$$\text{Input flow (for Motor)} \quad Q = \frac{Vg \cdot n}{231 \cdot \eta_v} \quad [GPM]$$

$$\text{Output torque (for Motor)} \quad M = \frac{Vg \cdot \Delta p \cdot \eta_{mh}}{2 \cdot \pi} \quad \text{or} \quad M = \Delta p \cdot T_{con.} \quad [lb-in]$$

$$\text{Output power (for Motor)} \quad P = \frac{Vg \cdot n \cdot \Delta p \cdot \eta_t}{396000} \quad [hp]$$

$$\text{Speed (for Motor)} \quad n = \frac{Q \cdot 231 \cdot \eta_v}{Vg} \quad \text{or} \quad n = Q \cdot N_{con.} \quad [min^{-1}]$$

$$\text{Output flow (for pump)} \quad Q = \frac{Vg \cdot n \cdot \eta_v}{231} \quad [GPM]$$

$$\text{Driving torque (for pump)} \quad M = \frac{Vg \cdot \Delta p}{2 \cdot \pi \cdot \eta_{mh}} \quad [lb-in]$$

$$\text{Input power (for pump)} \quad P = \frac{Vg \cdot n \cdot \Delta p}{396000 \cdot \eta_t} \quad [hp]$$

$$Vg = \text{Displacement per rev.} \quad [in^3]$$

$$\Delta p = p_{HP} - p_{LP} \quad [PSI]$$

$$p_{HP} = \text{High pressure} \quad [PSI]$$

$$p_{LP} = \text{Low pressure} \quad [PSI]$$

$$n = \text{Rotation speed} \quad [RPM]$$

$$Q = \text{Oil flow} \quad [GPM]$$

$$T_{con.} = \text{Toque constant} \quad [lb-in/PSI]$$

$$N_{con.} = \text{Speed constant} \quad [RPM/GPM]$$

$$\eta_v = \text{Volumetric efficiency}$$

$$\eta_{mh} = \text{Mechanical-hydraulic efficiency}$$

$$\eta_t = \text{Overall efficiency}$$

Depending on the results of the load calculations, the most appropriate type of motor from the catalogue is selected.

Table 1

Rolling resistance coefficient In case of rubber tire rolling on different surfaces			
Surface	ρ	Surface	ρ
Concrete- faultless	0.010	Macadam- bad	0.037
Concrete- good	0.015	Snow- 5 cm	0.025
Concrete- bad	0.020	Snow- 10 cm	0.037
Asphalt- faultless	0.012	Polluted covering- smooth	0.025
Asphalt- good	0.017	Polluted covering- sandy	0.040
Asphalt- bad	0.022	Mud	0.037÷0.150
Macadam- faultless	0.015	Sand- Gravel	0.060÷0.150
Macadam- good	0.022	Sand- loose	0.160÷0.300