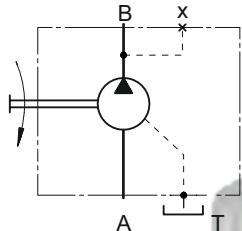




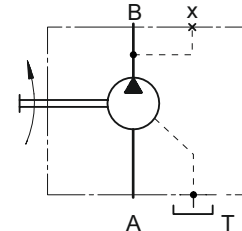
Hydraulic Pumps Type PAP28

Heavy Duty Axial Piston Pumps Fixed Displacement for open loop circuit



Symbols

- B Outlet port
- A Inlet port
- T Drain port



open drain line is always required

APPLICATION

- » Open loop circuit
- » Agricultural machines
- » Road building machines
- » Mining machinery
- » Food industry machines
- » Special vehicles

OPTIONS

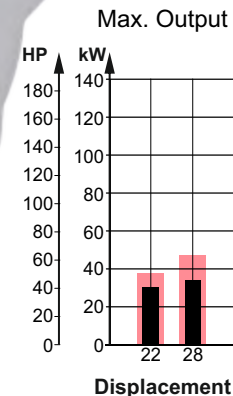
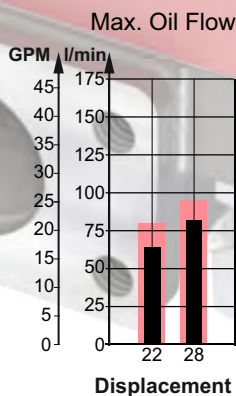
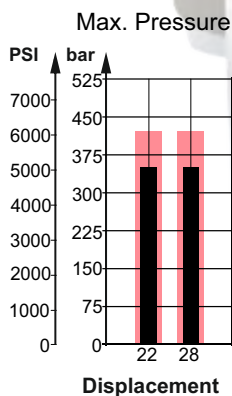
- » Port options
- » Shaft options
- » High pressure ports

ADVANTAGES

- » Low noise
- » Low pulsation
- » Long service life
- » High power density

GENERAL

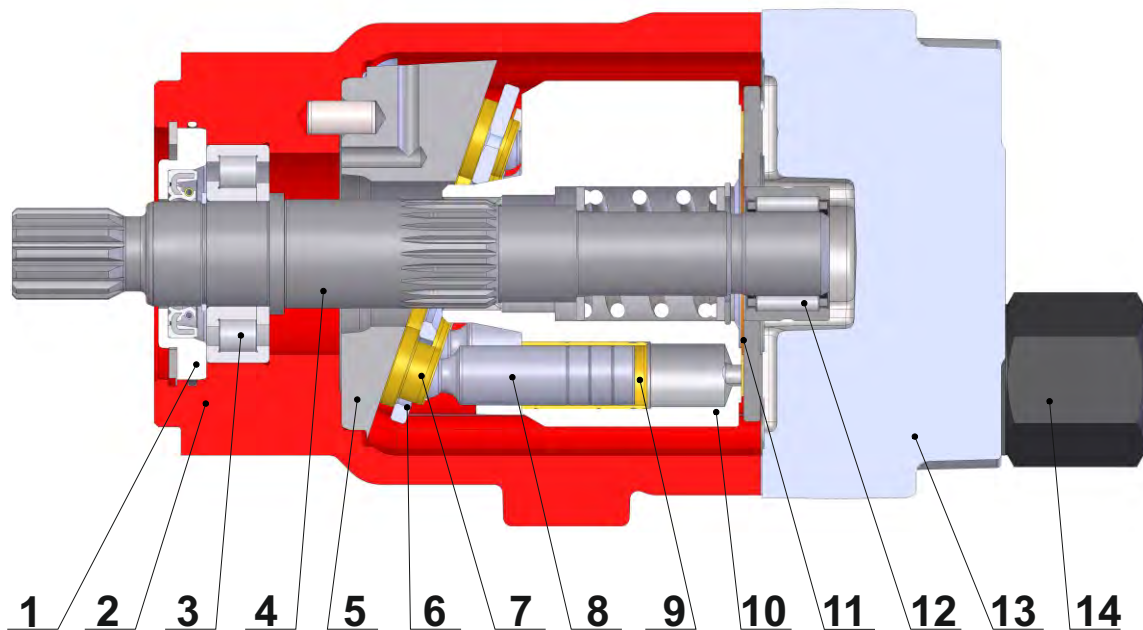
Displacement,	cm ³ /rev [in ³ /rev]	22.15÷28.47 [1.35÷1.74]
Max. Driving Speed,	RPM	3000
Max. Driving Torque,	Nm [lb-in]	158 [1400]
Max. Output,	kW [HP]	35 [47]
Max. Pressure,	bar [PSI]	350 [5080]
Max. Oil Flow,	l/min [GPM]	82 [21.7]
Min. Driving Speed,	RPM	500
Fluid		Mineral based- HLP(DIN 51524) or 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
14. Part of hydraulic system helps reduces pump noise and vibration

The main advantages of the heavy duty swash plate PAP pumps design over the typical pumps are:

- Special hydraulic system reducing the levels of noise and vibration created by the pump.
- Lower pulsations during operation.

In comparison with the bent axis and the gear pumps, the swash plate type is in general considered to have higher reliability.

SPECIFICATION DATA



Type		PAP 22	PAP 28
Displacement, cm ³ /rev[in ³ /rev]		22.15 [1.35]	28.47 [1.74]
Max. Driving Speed, Cont. [RPM]		3000	3000
	Int.*	3400	3400
Max. Driving Torque,*** Cont. Nm [lb-in]		123 [1090]	158 [1400]
	Int.**	148 [1310]	190 [1680]
Output, kW [HP]	Cont.	30 [40.2]	35 [47]
	Int.**	38 [51]	48 [64.4]
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.	64 [16.9]	82 [21.7]
	Int.*	70 [18.5]	90 [23.8]
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]		12.80 [28.22] for SAE-A flange	
		13.50 [29.76] 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 pump lifetime;

*** 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 84.
5. Recommended maximum system operating temperature - 82°[180°] C[F].
6. To ensure optimum life of the pump, fill it up with fluid prior to load it and run with moderate load and speed for about 10-15 minutes.

The constant values are approximate. Pump pressure and flow for a particular project are depending on the real operating conditions. For more detailed calculations please see efficiencies on page 75 and formulas on page 85.



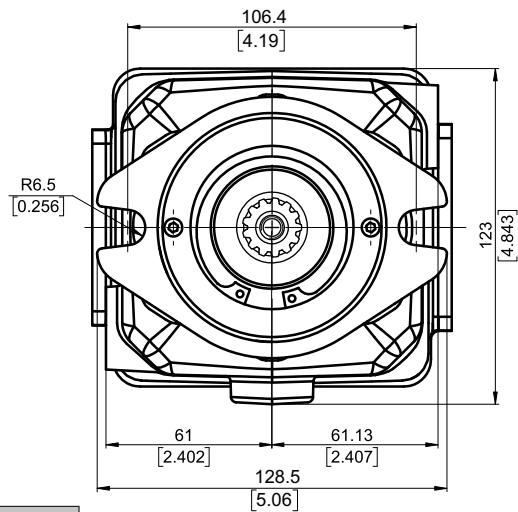
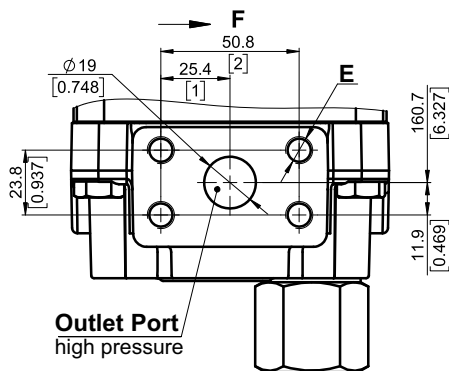
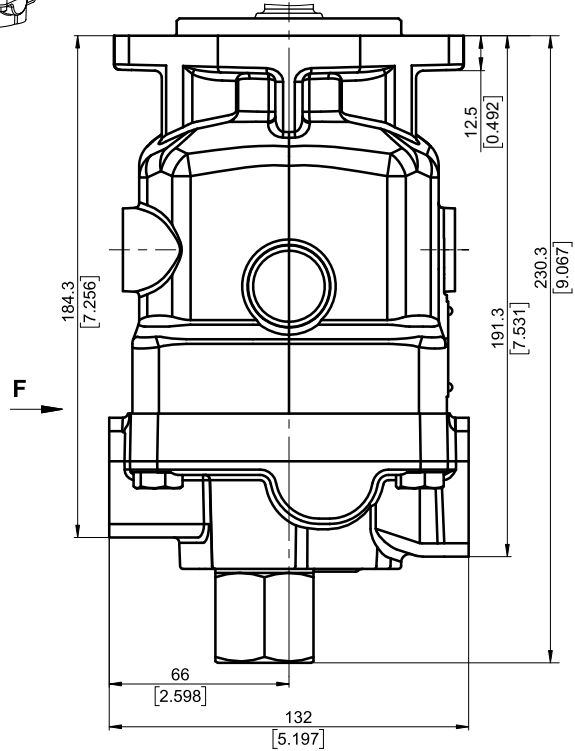
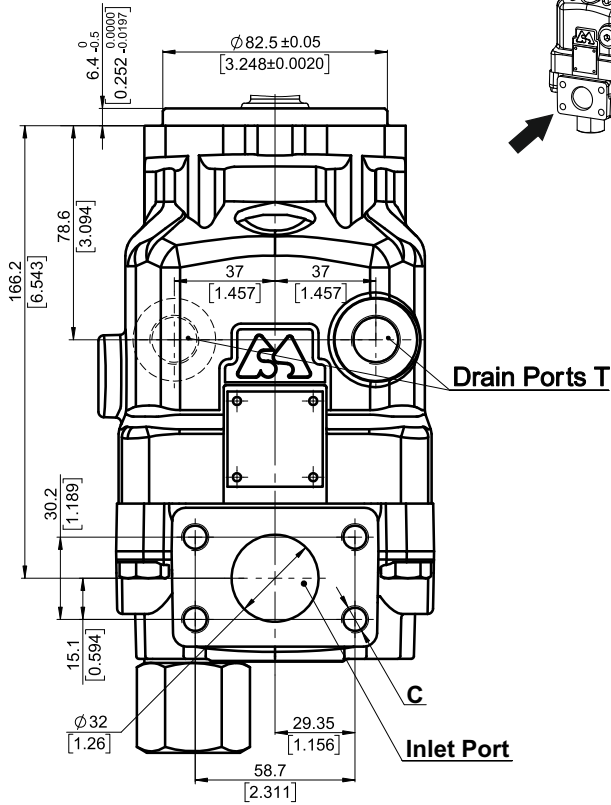
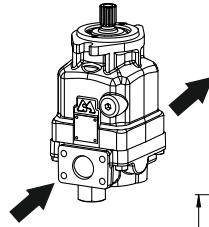
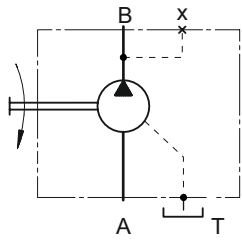
OVERALL DIMENSIONS AND PORTS

Mounting Flange - Type SAE-A

Direction of Rotation **CW**(Right)

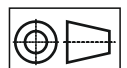
Port sizes **default, 5 and 9**

See the port sizes at the bottom of this page



	Port Size		
	default	5	9
Inlet	ISO 6162-1 DN32	SAE J518 1 1/4 PSI3000	ISO 6162-1 DN32
Outlet	ISO 6162-2 DN19	SAE J518 3/4 PSI6000	ISO 6162-2 DN19
T	M18x1,5	7/8-14 UNF	G1/2
C	4xM10	4x7/16-14 UNC	4xM10
E	4xM10	4x3/8-16 UNC	4xM10

Shaft Mounting
see page 57



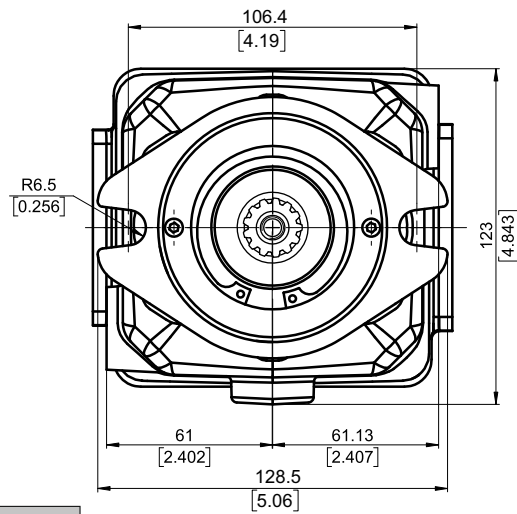
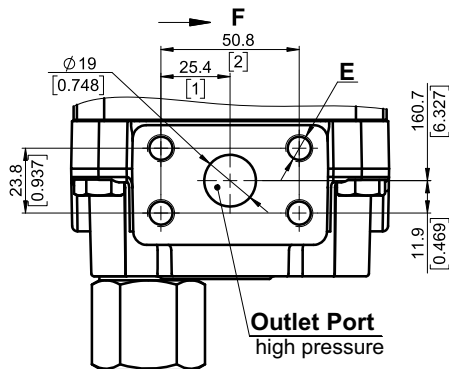
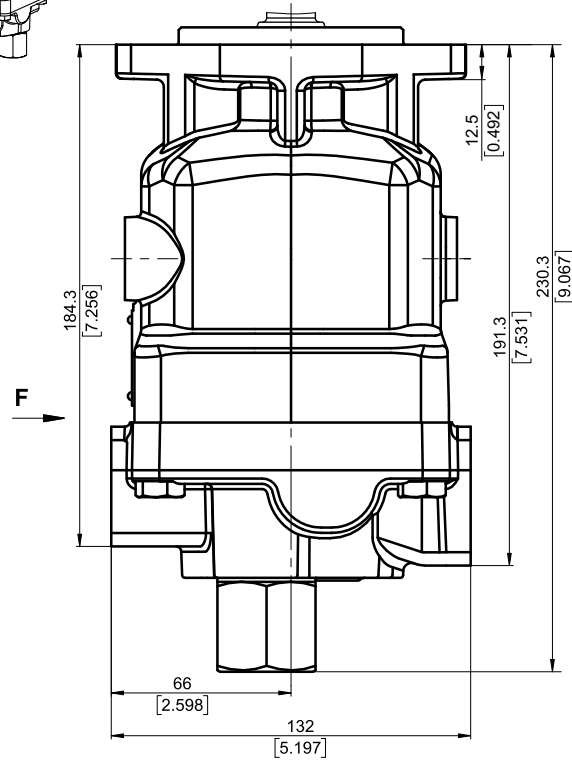
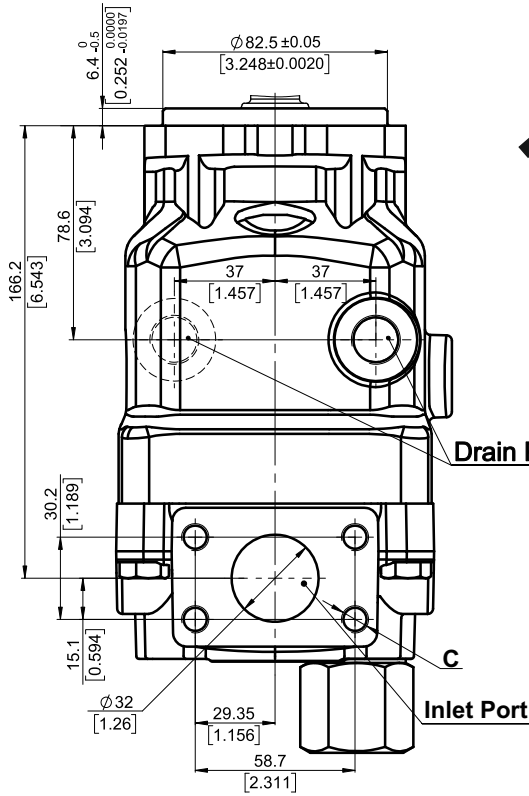
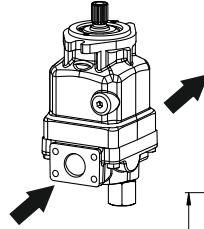
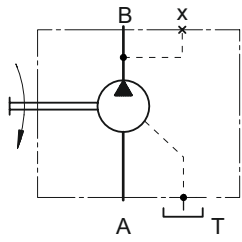
mm [in]



OVERALL DIMENSIONS AND PORTS

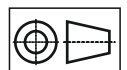
Mounting Flange - Type **SAE-A**
Direction of Rotation **CCW**(Left)

Port sizes **default, 5 and 9**
See the port sizes at the bottom of this page



	Port Size		
	default	5	9
Inlet	ISO 6162-1 DN32	SAE J518 1 1/4 PSI3000	ISO 6162-1 DN32
Outlet	ISO 6162-2 DN19	SAE J518 3/4 PSI6000	ISO 6162-2 DN19
T	M18x1,5	7/8-14 UNF	G1/2
C	4xM10	4x7/16-14 UNC	4xM10
E	4xM10	4x3/8-16 UNC	4xM10

Shaft Mounting
see page 57

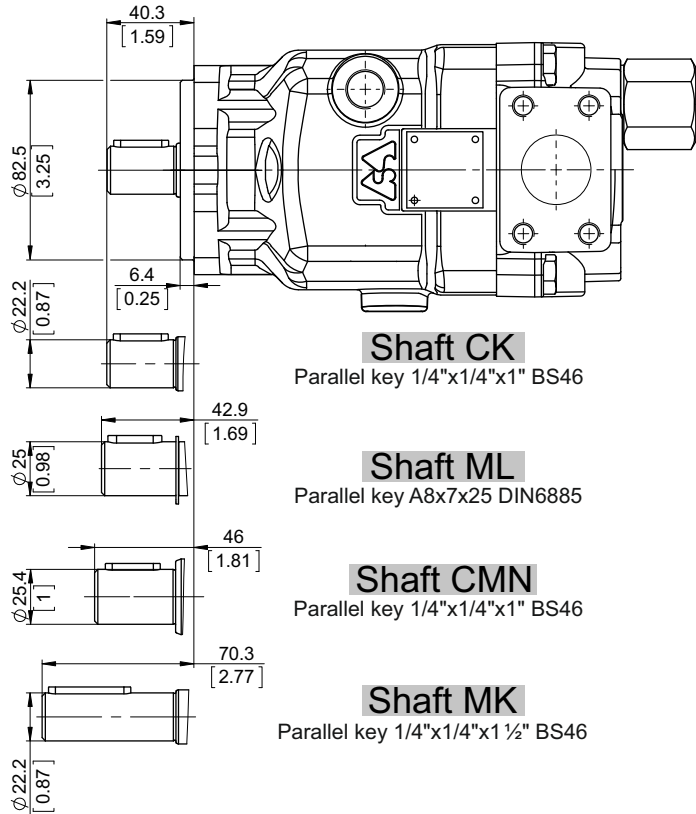
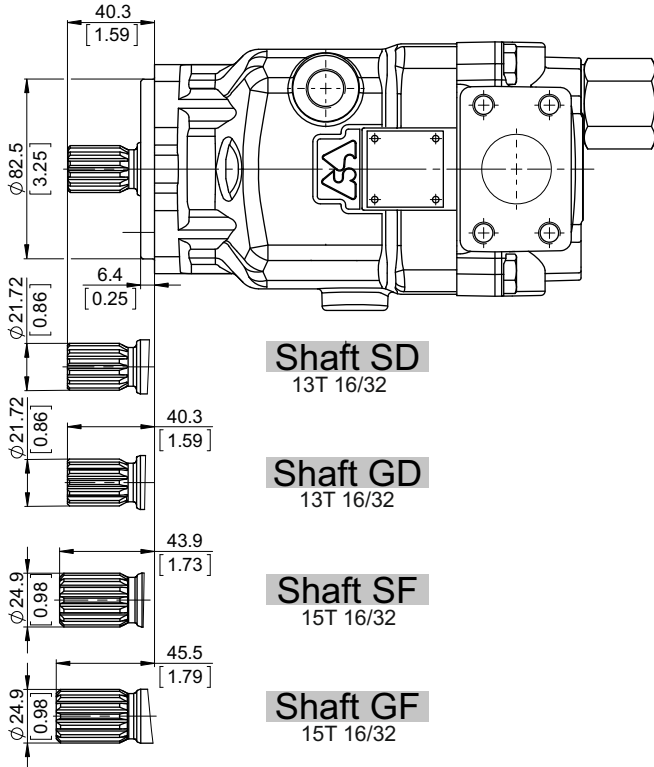


mm [in]



SHAFTS MOUNTING

Mounting Flange - Type **SAE-A**



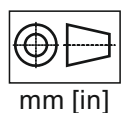
Shaft Dimensions
See Page 69+73

PERMISSIBLE SHAFT LOAD

Permissible shaft load		
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.





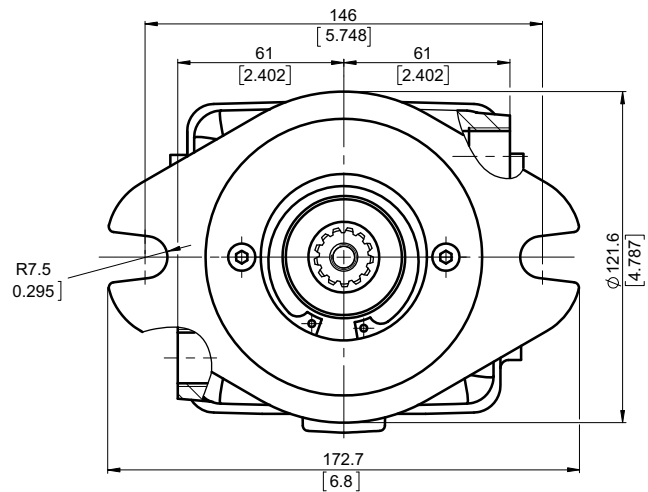
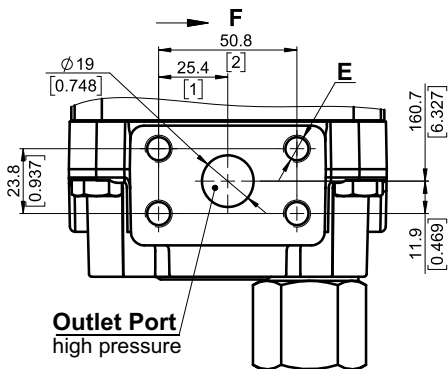
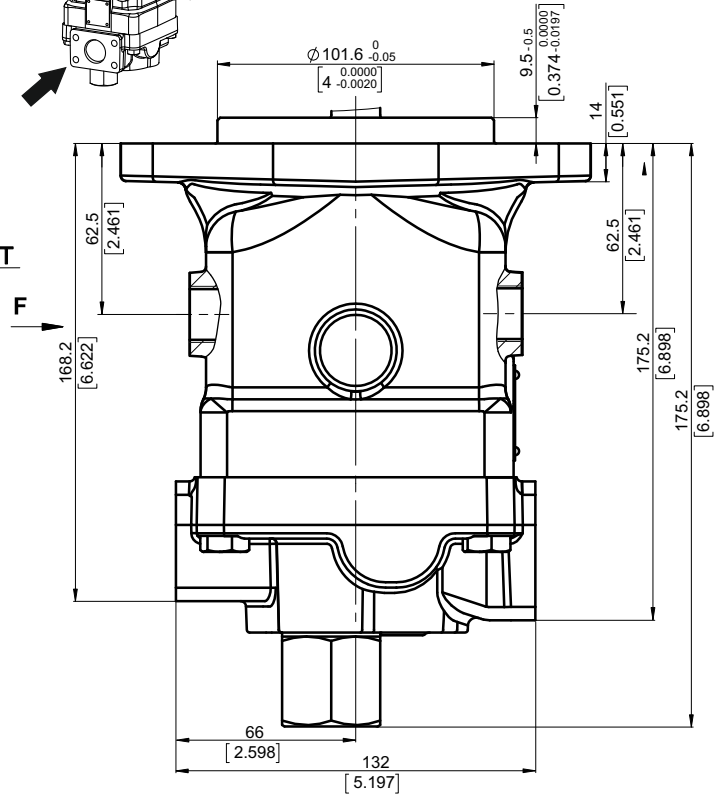
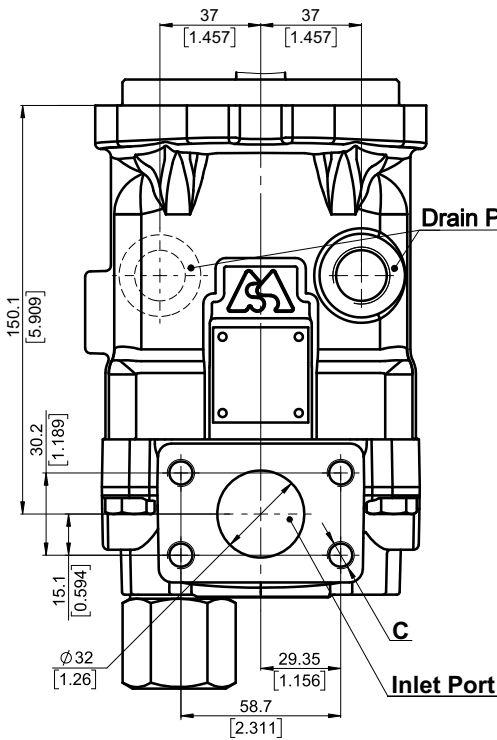
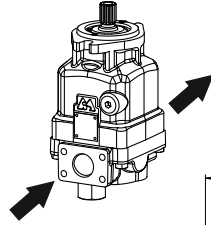
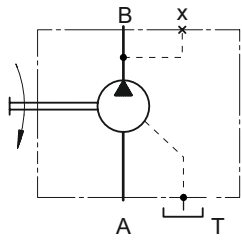
OVERALL DIMENSIONS AND PORTS

Mounting Flange - Type SAE-B

Direction of Rotation **CW**(Right)

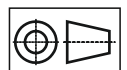
Port sizes **default, 5 and 9**

See the port sizes at the bottom of this page



	Port Size		
	default	5	9
Inlet	ISO 6162-1 DN32	SAE J518 1¼ PSI3000	ISO 6162-1 DN32
Outlet	ISO 6162-2 DN19	SAE J518 3/4 PSI6000	ISO 6162-2 DN19
T	M18x1,5	7/8-14 UNF	G1/2
C	4xM10	4x7/16-14 UNC	4xM10
E	4xM10	4x3/8-16 UNC	4xM10

Shaft Mounting see page 60

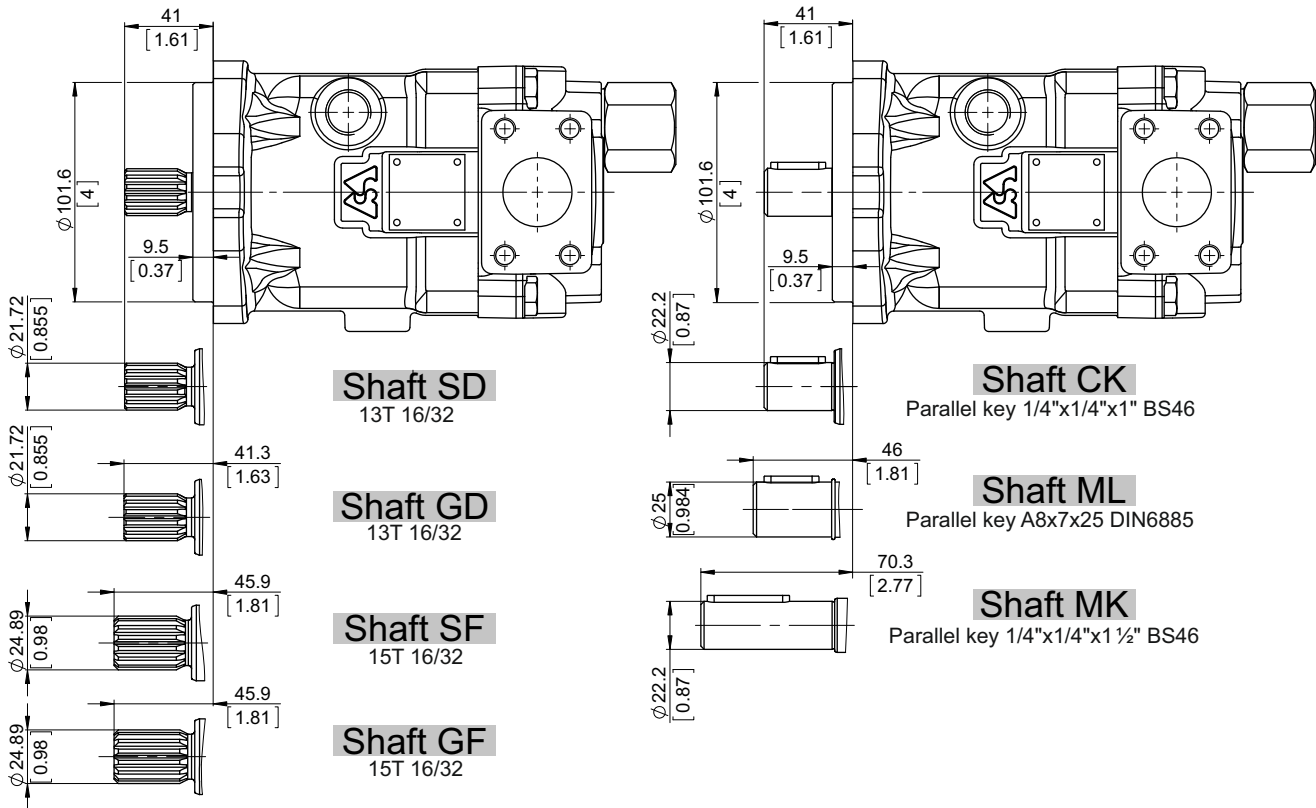


mm [in]



SHAFTS MOUNTING

Mounting Flange - Type **SAE-B**



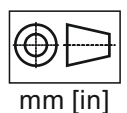
Shaft Dimensions
See Page 69+73

PERMISSIBLE SHAFT LOAD

Permissible shaft load		
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.





ORDERING CODE

	1	2	3	4	5	6	7	8	9	9	9
PAP									[]

Pos.1 - Mounting Flange

- A** - 2-Bolt flange, SAE A, spigot dia. 82.5 [3.25"], BC 106.35 [4.19"], Bolt Dia. 13.5 [0.53"]
- B** - 2-Bolt flange, SAE B, spigot dia. 101.6 [4"], BC 146 [5.748"], Bolt Dia. 14.3 [0.563"]

Pos.2 - Displacement Code

- 22** - 22.15 cm³/rev [1.35 in³/rev]
- 28** - 28.47 cm³/rev [1.74 in³/rev]

Pos.3 - Direction of Rotation

- R** - CW, Right direction
- L** - CCW, Left direction

Pos.4 - Shaft Extensions**

- SD** - ø21.72 [0.855"] Spline SAE 13T 16/32 DP, M8 thread
- GD** - ø21.72 [0.855"] Spline SAE 13T 16/32 DP, 5/16-18 UNC thread
- SF** - ø24.9 [0.98"] Spline SAE 15T 16/32, M8 thread
- GF** - ø24.9 [0.98"] Spline SAE 15T 16/32, 3/8-16UNC thread
- CK** - ø22.2 [7/8"] Straight, M8 thread
Parallel key 1/4"x1/4"x1" BS46
- MK** - ø22.2 [7/8"] Straight, M8 thread
Parallel key 1/4"x1/4"x1 1/2" BS46
- ML** - ø25 [0.984"] Straight, M8 thread
Parallel key A8x7x25 DIN6885
- CMN** - ø25.4 [1"] Straight, M8 thread
Parallel key 1/4"x1/4"x1" BS46

Pos.5 - Port Size

- omit - Inlet ISO 6162-1 DN32, Outlet ISO 6162-2 DN19, metric thread, drain ports M18x1.5
- 5** - Inlet SAE J518 1 1/4" PSI3000, Outlet SAEJ518 3/4" PSI6000, sae thread, drain 7/8-14 UNF
- 9** - Inlet ISO 6162-1 DN32, Outlet ISO 6162-2 DN19, metric thread, drain ports G1/2

Pos.6 - Seal, Corrosion Resistant Seal Surface

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

Pos.7 - Special Features* see page 77

- omit - None
- R2S** - Speed Sensor Two Directional

Pos.8 - Paint and Coating

- omit - No paint or coating
- P** - Painted
- PC** - Painted 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.

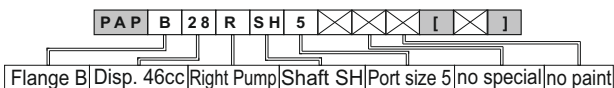
Pos.9 - Design Series

- omit - Factory specified

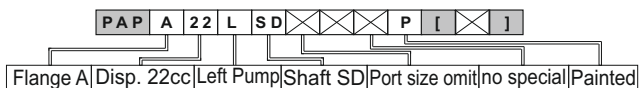
**The permissible output torque for shafts must not be exceeded!

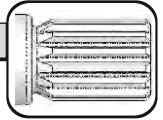
EXAMPLE

PAPB28RSH5



PAPA22LSDPS

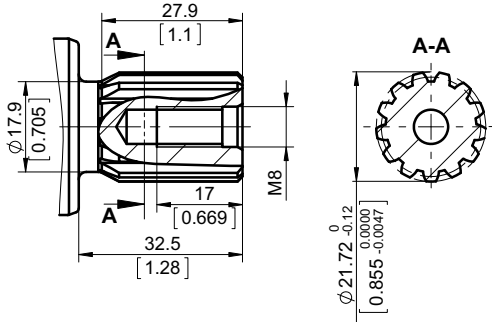




SHAFT TYPES AND DIMENSIONS

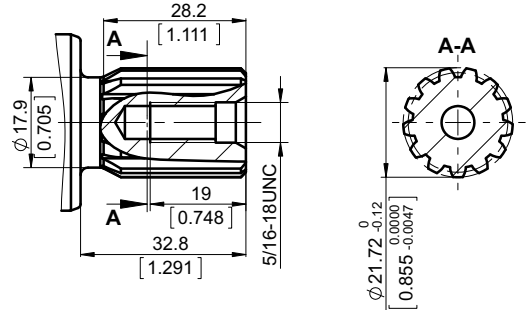
SD

ø21.72 [0.855], M8 thread
 13T 16/32 DP splined ANSI B92.1-1970
 Max. torque 220 Nm [1950 lb-in]



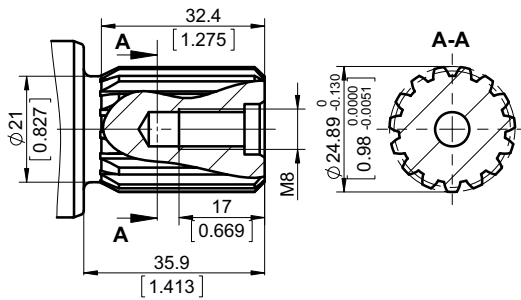
GD

ø21.72 [0.855], 5/16-18 UNC thread
 13T 16/32 DP splined ANSI B92.1-1970
 Max. torque 220 Nm [1950 lb-in]



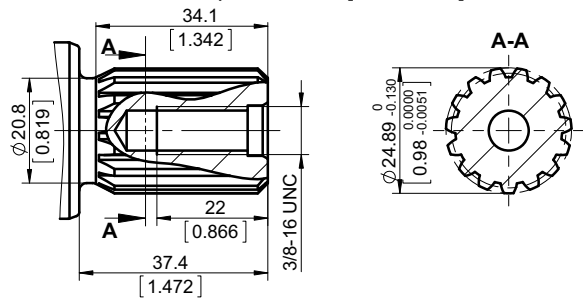
SF

ø24.89 [0.98], M8 thread
 15T 16/32 DP splined ANSI B92.1-1970
 Max. torque 360 Nm [3180 lb-in]



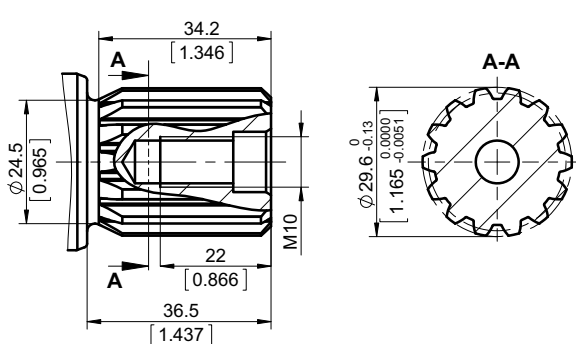
GF

ø24.89 [0.98], 3/8-16 UNC thread
 15T 16/32 DP splined ANSI B92.1-1970
 Max. torque 360 Nm [3180 lb-in]



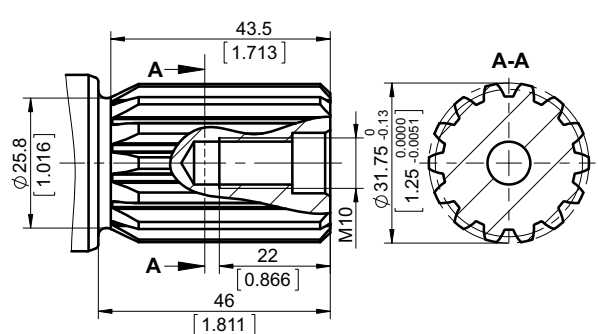
SH

ø29.6 [1.165], M10 thread
 W30x2x30x14x9g splined DIN 5480
 Max. torque 600 Nm [5310 lb-in]

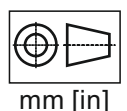


SK

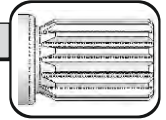
ø31.75 [1.25], M10 thread
 14T 12/24 DP splined ANSI B92.1-1970
 Max. torque 600 Nm [5310 lb-in]



The required max. torque must not be exceeded

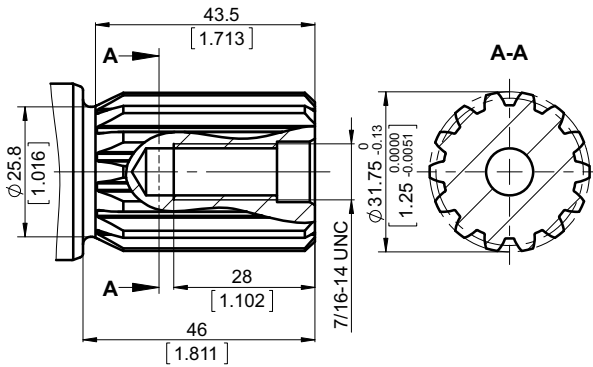


SHAFT TYPES AND DIMENSIONS



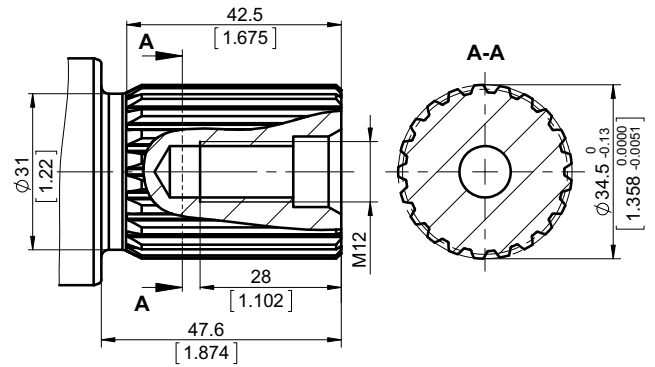
GK

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



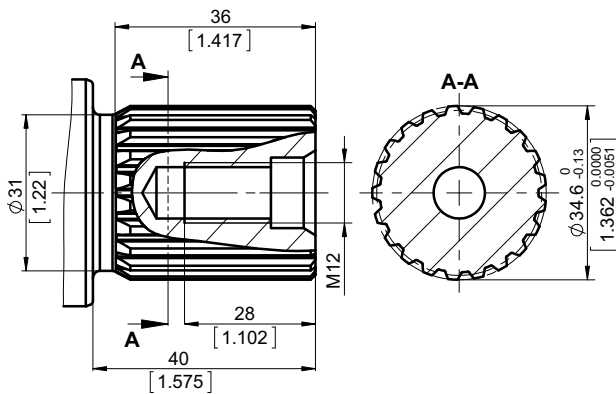
SP

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



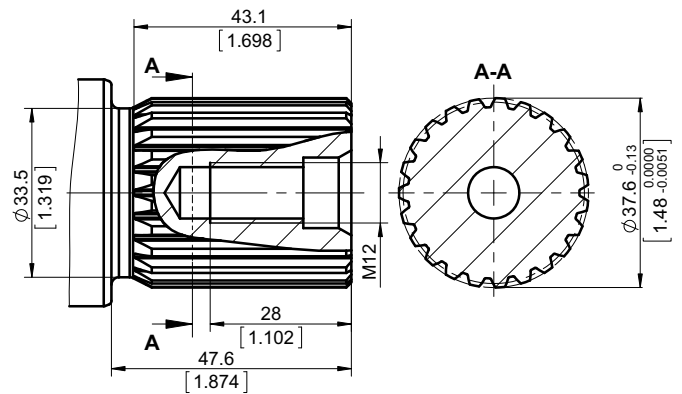
QH

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



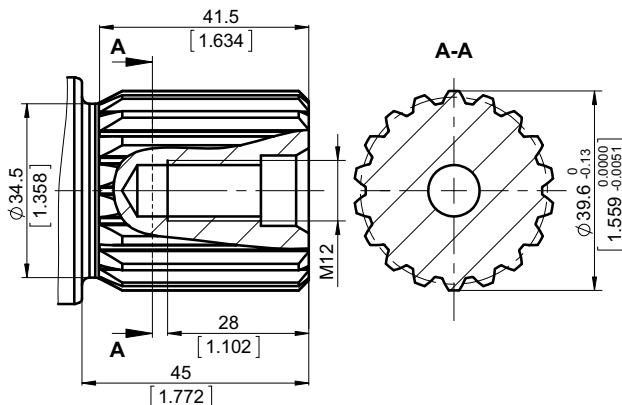
SR

$\phi 37.6$ [1.5], M12 thread
23T 16/32 DP splined ANSI B92.1-1970
Max. torque 1300 Nm [11500 lb-in]



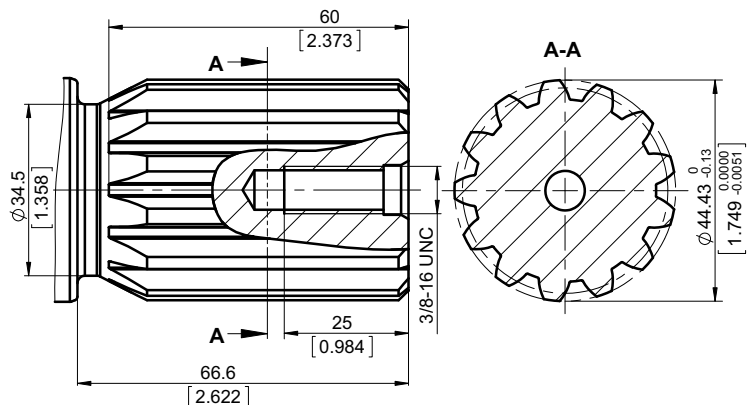
ST

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

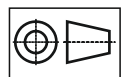


GU

$\phi 44.43$ [1.75], 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

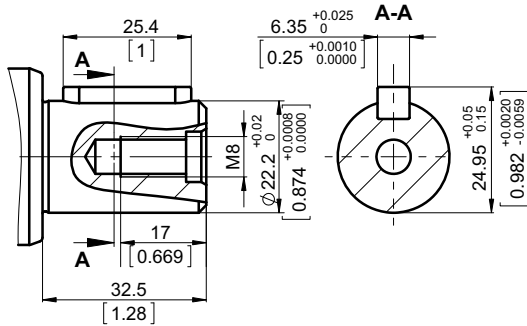


mm [in]

SHAFT TYPES AND DIMENSIONS

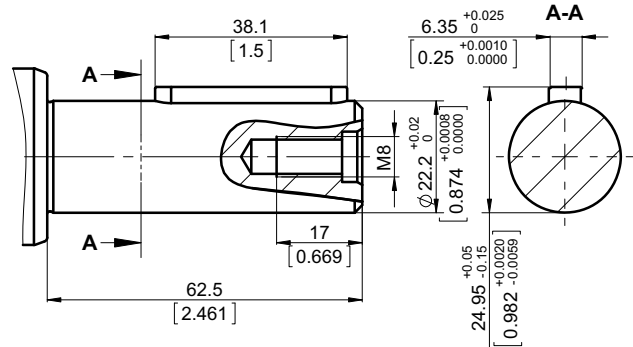
CK

$\varnothing 22.2$ [7/8] straight, M8 thread
Parallel key $1/4 \times 1/4 \times 1$ " BS46
Max. torque 180 Nm [1600 lb-in]



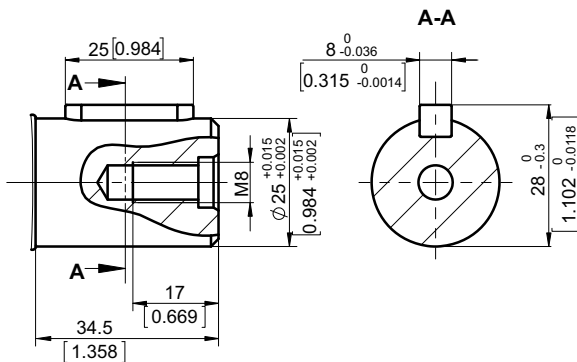
MK

$\varnothing 22.2$ [7/8] straight, M8 thread
Parallel key $1/4 \times 1/4 \times 1/2$ " BS46
Max. torque 180 Nm [1600 lb-in]



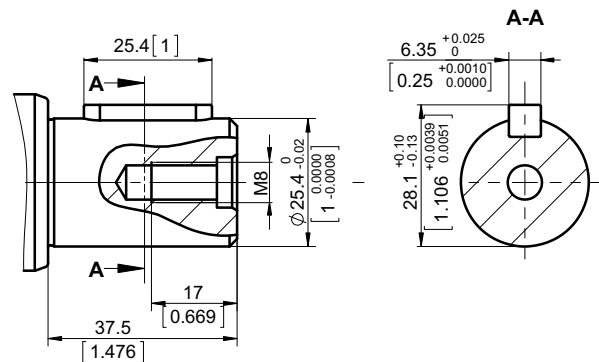
ML

$\varnothing 25$ [0.984] straight, M8 thread
Parallel key $A8 \times 7 \times 25$ DIN6885
Max. torque 250 Nm [2210 lb-in]



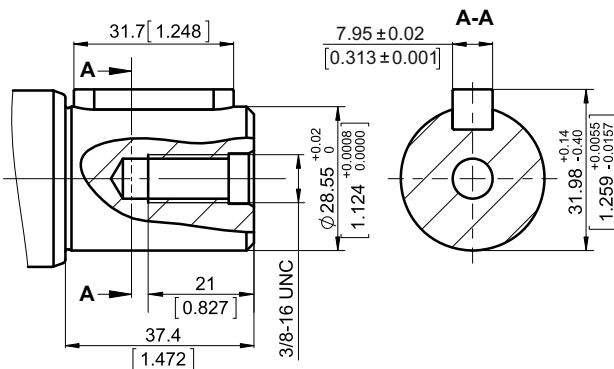
CM CMN

$\varnothing 25.4$ [1] straight, M8 thread
Parallel key $1/4 \times 1/4 \times 1$ " BS46
Max. torque 250 Nm [2210 lb-in]



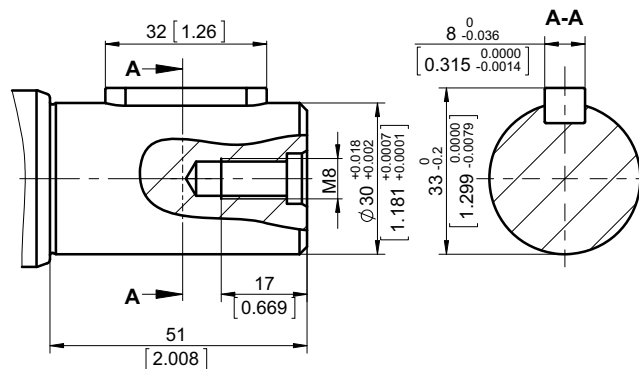
DO

$\varnothing 28.55$ [1.125] straight, 3/8-16 UNC thread
Parallel key $5/16 \times 5/16 \times 1/4$ "
Max. torque 280 Nm [2480 lb-in]

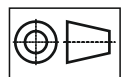


CQ

$\varnothing 30$ [1.181] straight, M8 thread
Parallel key $A8 \times 7 \times 32$ DIN6885
Max. torque 300 Nm [2655 lb-in]



The required max. torque
must not be exceeded

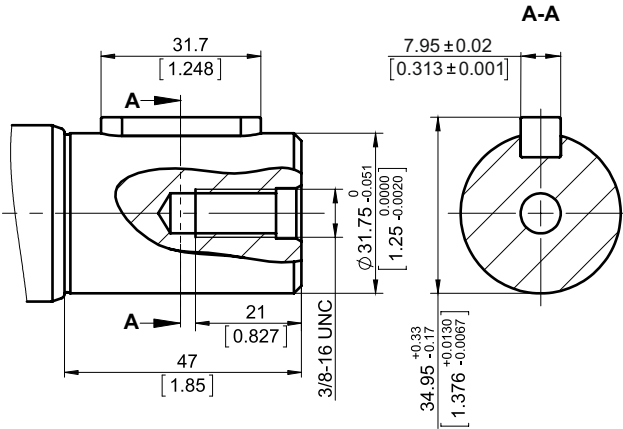


mm [in]

SHAFT TYPES AND DIMENSIONS

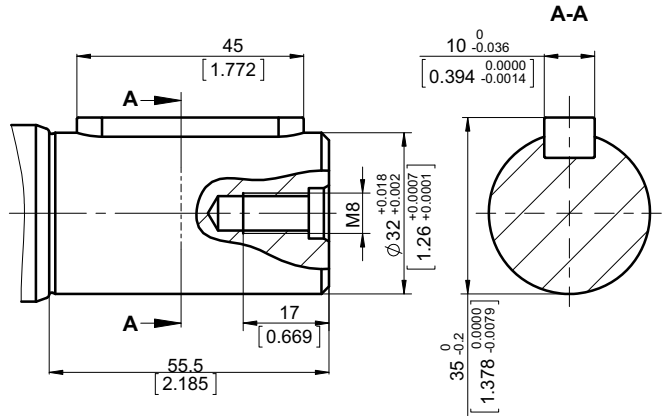
DR

ø31.75 [1.25] straight, 3/8-16 UNC thread
 Parallel key **5/16"x5/16"x1 ¼"**
 Max. torque 770 Nm [6815 lb-in]



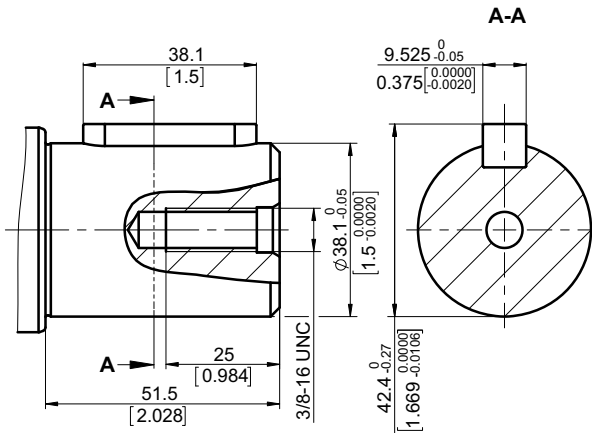
CS

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



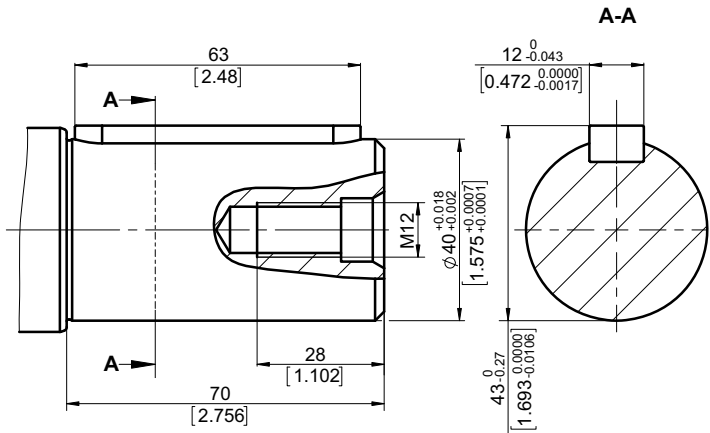
DU

ø38.1 [1½] straight, 3/8-16 UNC thread
 Parallel key **3/4"x3/4"x1½"** BS46
 Max. torque 1000 Nm [8850 lb-in]

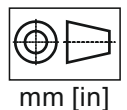


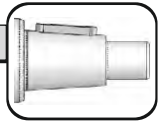
CV

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

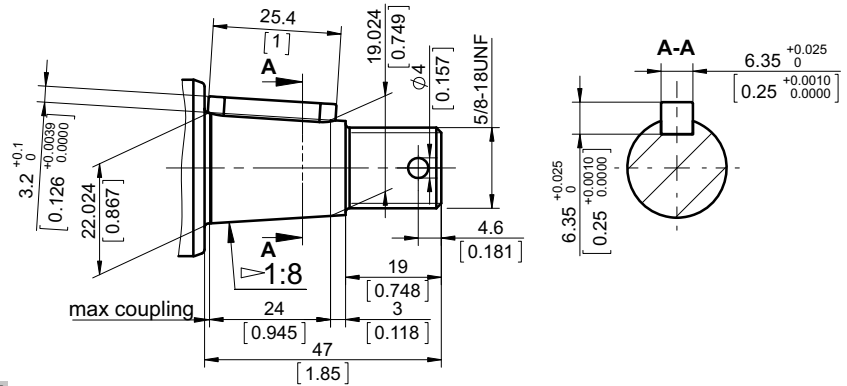




SHAFT TYPES AND DIMENSIONS

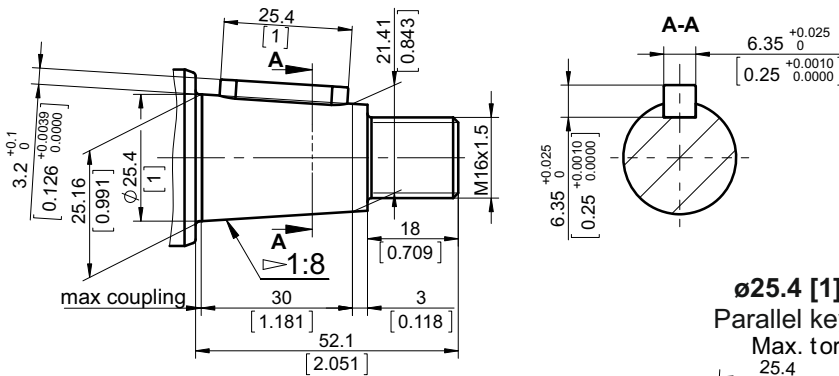
TD

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]



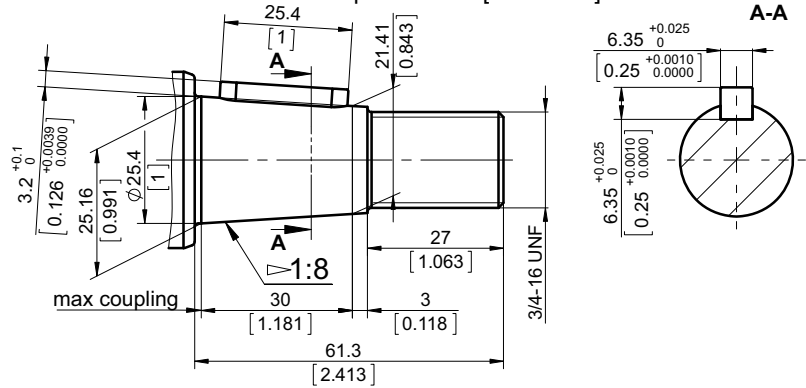
KH

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



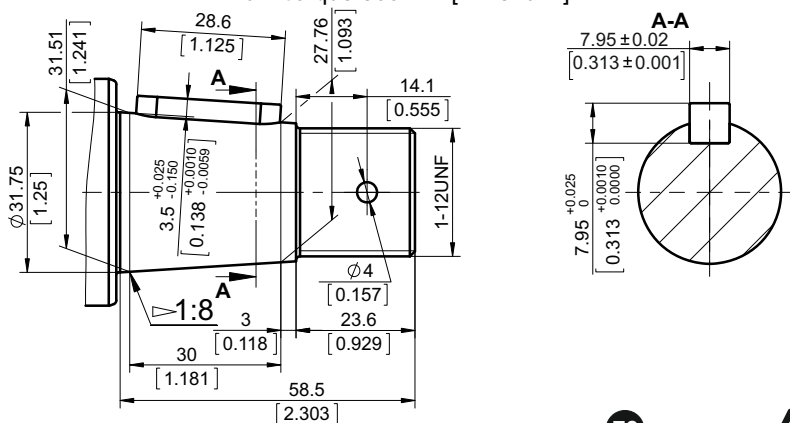
TH

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]

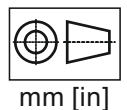


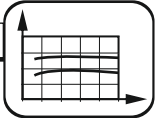
TN

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



The required max. torque must not be exceeded



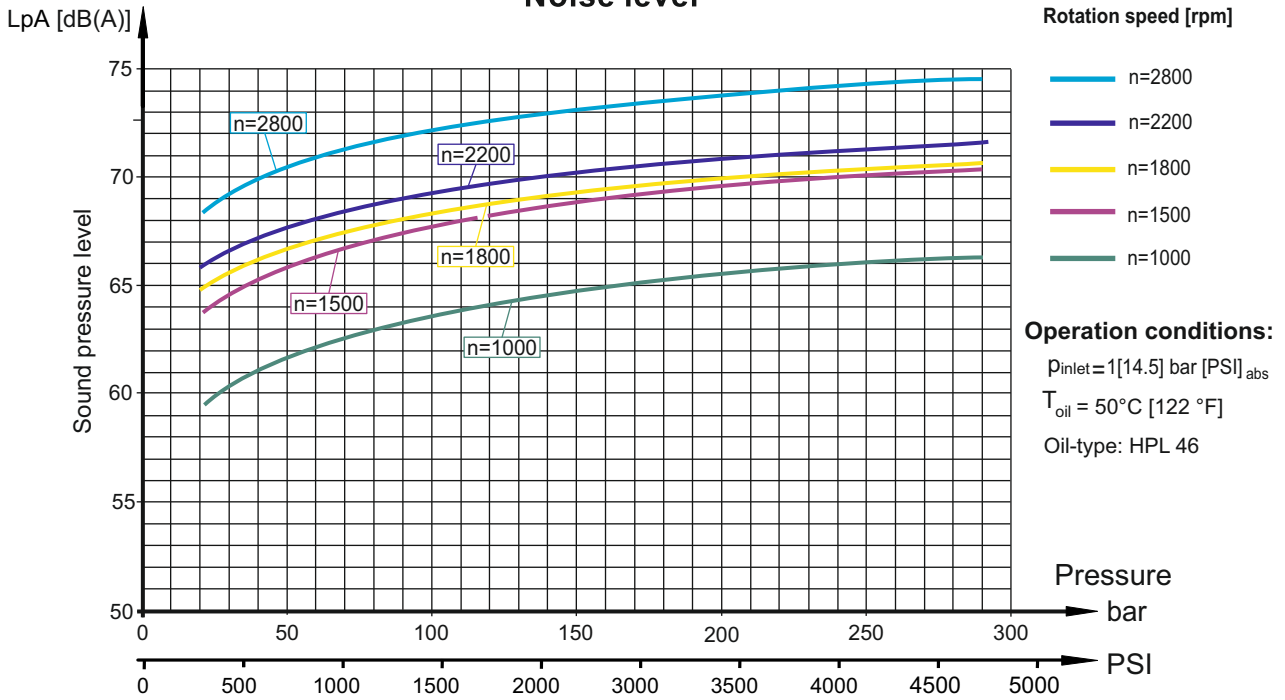


PUMP FUNCTION DIAGRAMS

The diagram is applied for all pump displacements.

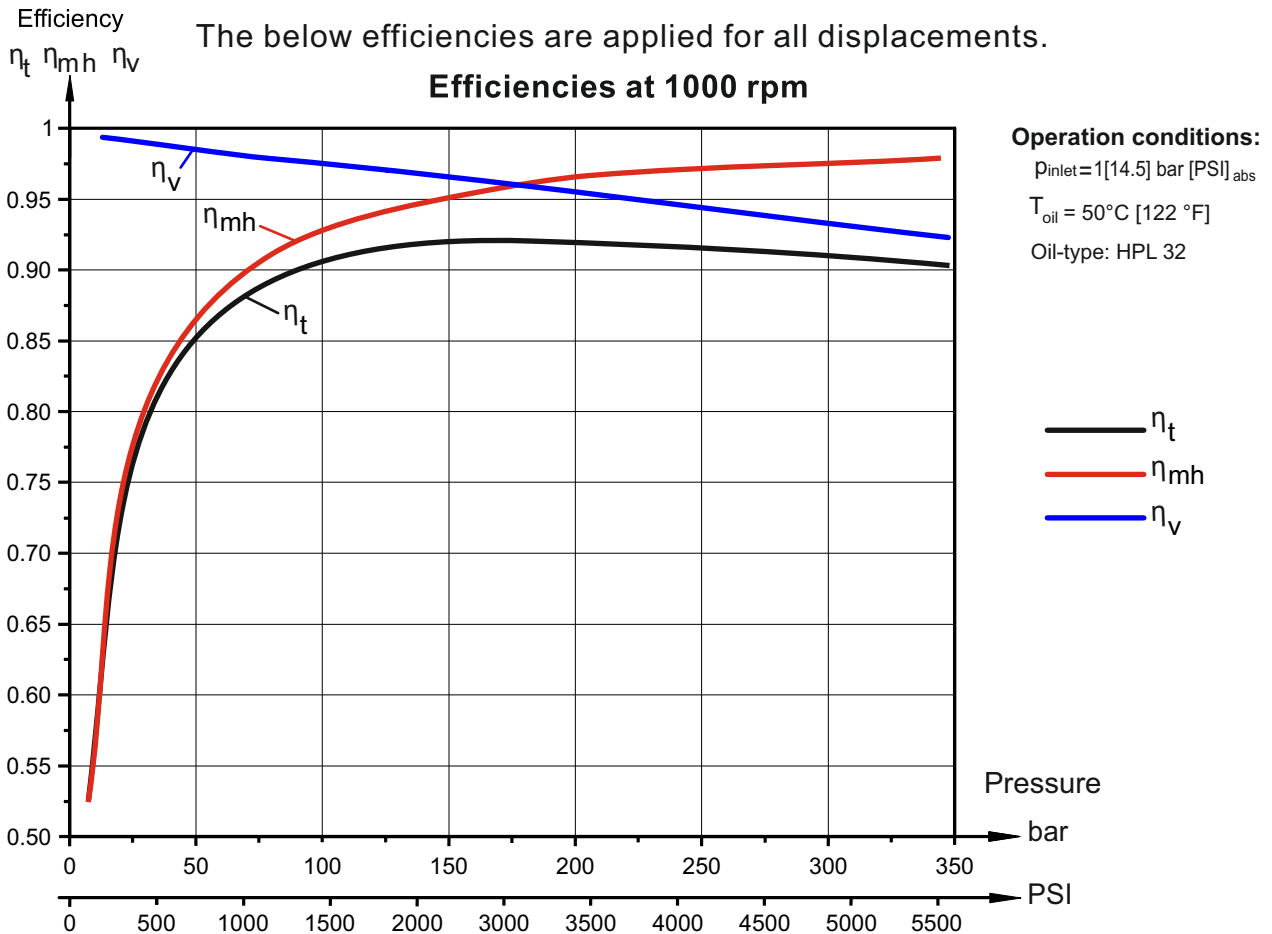
Sound pressure level (noise) is measured in acoustic chamber according to DIN 45635 Part 1 and Part 26. These .

Noise level



The sound pressure level for a particular pump may vary $\pm 2 \text{ dB(A)}$ compared to what is shown in the diagram.

The below efficiencies are applied for all displacements.



The pump 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 pump may vary from the shown in the diagram depending on the operating conditions.

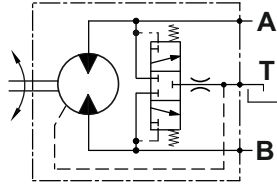


VALVE OPTIONS

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:

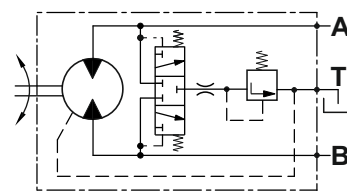
Flow setting → flow rate

EXAMPLE

- M A P B 5 0 S H 2 P U purge valve flow rate 6±2 l/min
- M A P B 5 0 S H 2 P U L 3 . 5 purge valve flow rate 3.5±1 l/min
- M A P B 5 0 S H 2 P U L 5 . 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

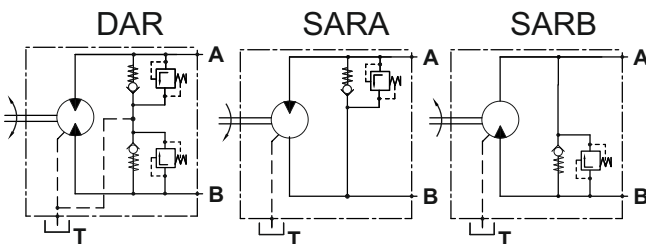
EXAMPLE

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

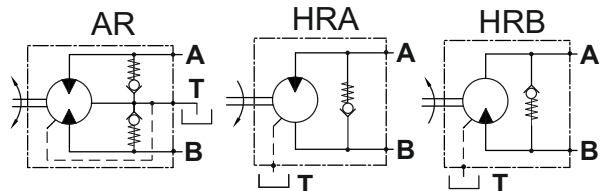
EXAMPLE

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

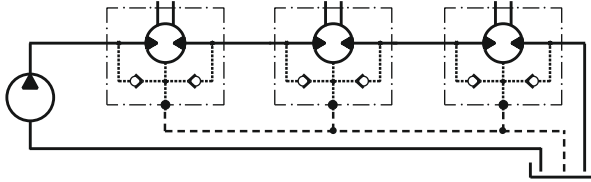
- M A P B 5 0 S H 2 A R
Double Anti-Cavitation Valve
- M A P B 5 0 S H 2 H R A
Single Anti-Cavitation Valve, the valve is placed on port A
- M A P B 5 0 S H 2 H R B
Single Anti-Cavitation Valve, the valve is placed on port B



INSTALLATION

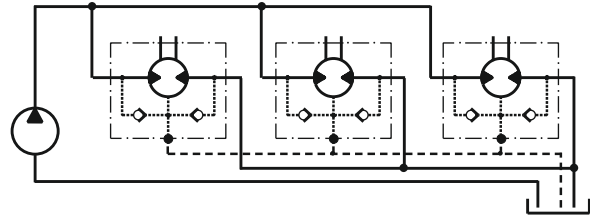
TYPE OF CONNECTION

Series connection
not recommended



open drain line is always required

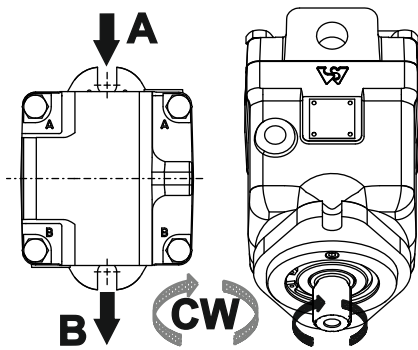
Parallel connection
recommended



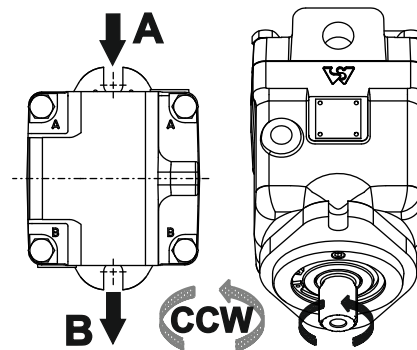
open drain line is always required

DIRECTION OF ROTATION

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



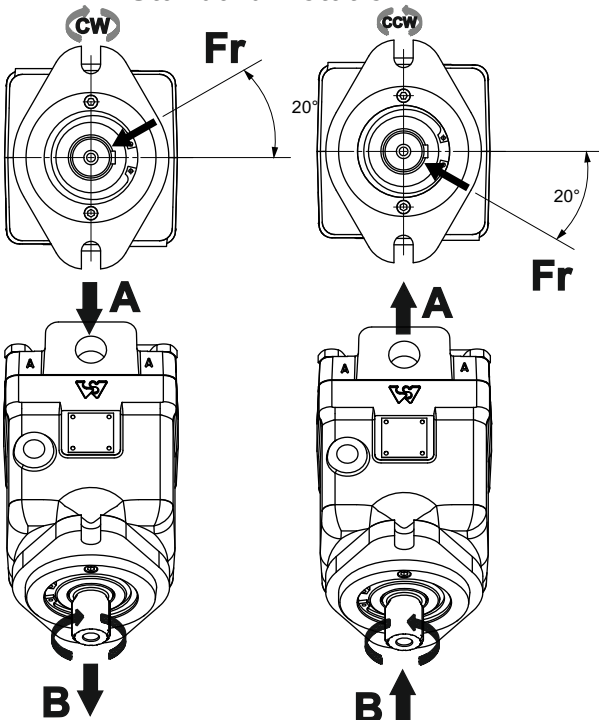
Reverse Rotation
Viewed from shaft end
Port A Pressurized - CCW
Port B Pressurized - CW



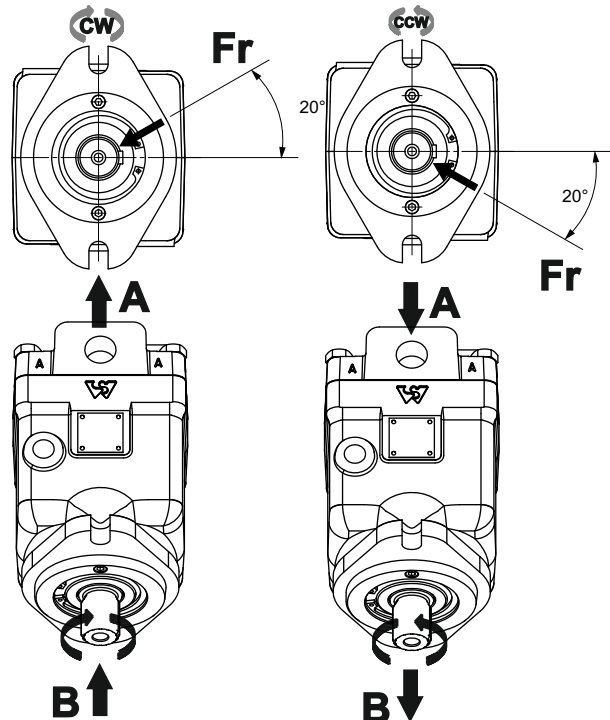
BEST POSITION FOR APPLYING RADIAL LOAD

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

Standard Rotation



Reverse Rotation

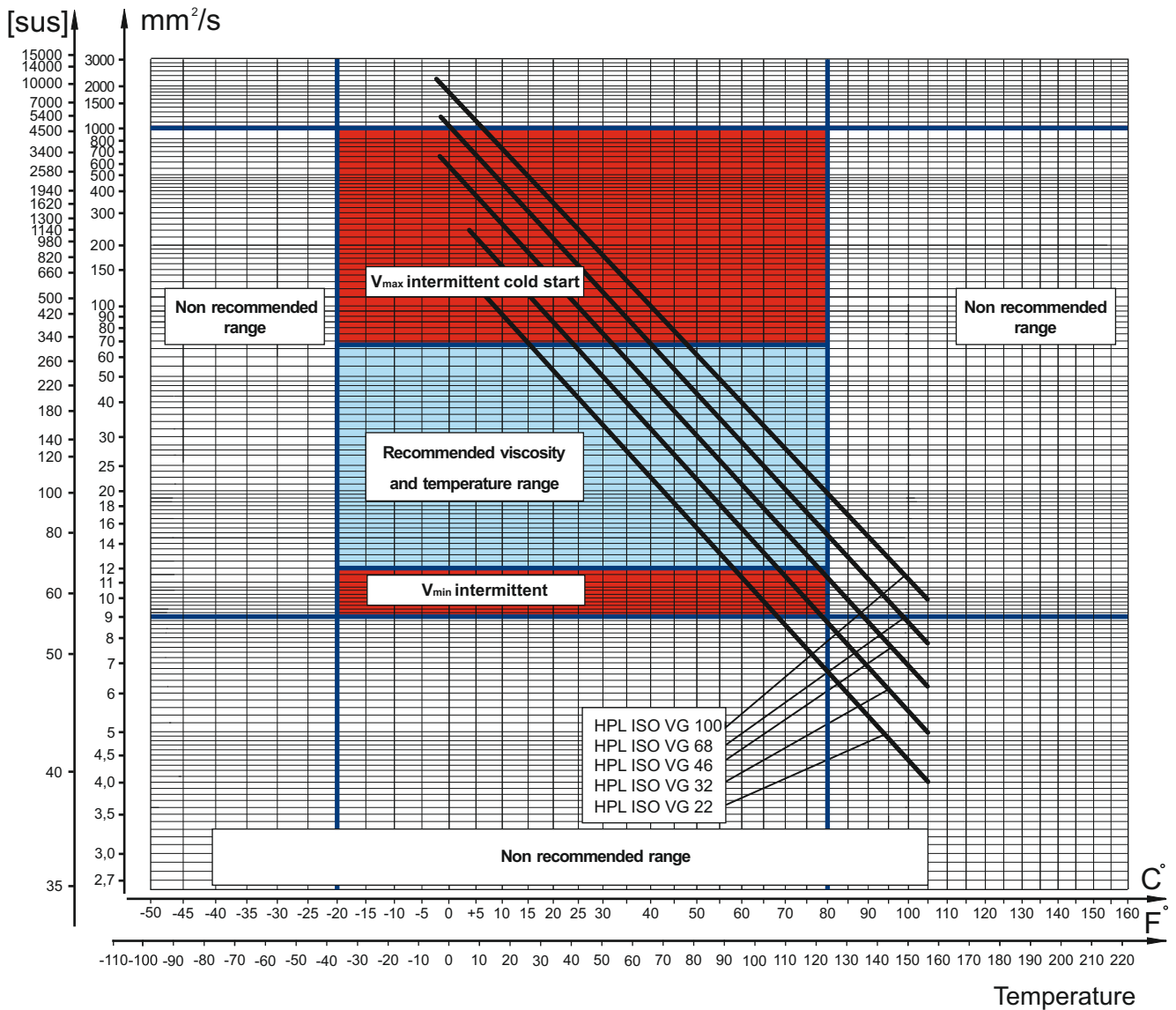




FLUID VISCOSITY LIMITS

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		Inch System	
Efficiency	$\eta_t = \eta_{mh} \cdot \eta_v$ $\eta_{mh} = \frac{\eta_t}{\eta_v}$ $\eta_v = \frac{\eta_t}{\eta_{mh}}$	Efficiency	$\eta_t = \eta_{mh} \cdot \eta_v$ $\eta_{mh} = \frac{\eta_t}{\eta_v}$ $\eta_v = \frac{\eta_t}{\eta_{mh}}$
Input flow (for Motor)	$Q = \frac{Vg \cdot n}{1000 \cdot \eta_v}$ [l/min]	Input flow (for Motor)	$Q = \frac{Vg \cdot n}{231 \cdot \eta_v}$ [GPM]
Output torque (for Motor)	$M = \frac{Vg \cdot \Delta p \cdot \eta_{mh}}{62,8}$ or $M = \Delta p \cdot T_{con.}$ [Nm]	Output torque (for Motor)	$M = \frac{Vg \cdot \Delta p \cdot \eta_{mh}}{2 \cdot \pi}$ or $M = \Delta p \cdot T_{con.}$ [lb-in]
Output power (for Motor)	$P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p \cdot \eta_t}{600}$ [kW]	Output power (for Motor)	$P = \frac{Vg \cdot n \cdot \Delta p \cdot \eta_t}{396000}$ [hp]
Speed (for Motor)	$n = \frac{Q \cdot 1000 \cdot \eta_v}{Vg}$ or $n = Q \cdot N_{con.}$ [min ⁻¹]	Speed (for Motor)	$n = \frac{Q \cdot 231 \cdot \eta_v}{Vg}$ or $n = Q \cdot N_{con.}$ [min ⁻¹]
Output flow (for pump)	$Q = \frac{Vg \cdot n \cdot \eta_v}{1000}$ [l/min]	Output flow (for pump)	$Q = \frac{Vg \cdot n \cdot \eta_v}{231}$ [GPM]
Driving torque (for pump)	$M = \frac{Vg \cdot \Delta p}{62,8 \cdot \eta_{mh}}$ [Nm]	Driving torque (for pump)	$M = \frac{Vg \cdot \Delta p}{2 \cdot \pi \cdot \eta_{mh}}$ [lb-in]
Input power (for pump)	$P = \frac{M \cdot n}{9550} = \frac{Q \cdot \Delta p}{600 \cdot \eta_t}$ [kW]	Input power (for pump)	$P = \frac{Vg \cdot n \cdot \Delta p}{396000 \cdot \eta_t}$ [hp]
Legend:	Legend:	Legend:	Legend:
Vg = Displacement per rev.	[cm ³]	Vg = Displacement per rev.	[in ³]
Δp = p _{HP} - p _{LP}	[bar]	Δp = p _{HP} - p _{LP}	[PSI]
p _{HP} = High pressure	[bar]	p _{HP} = High pressure	[PSI]
p _{LP} = Low pressure	[bar]	p _{LP} = Low pressure	[PSI]
n = Rotation speed	[RPM]	n = Rotation speed	[RPM]
Q = Oil flow	[l/min]	Q = Oil flow	[GPM]
T _{con.} = Toque constant	[Nm/bar]	T _{con.} = Toque constant	[lb-in/PSI]
N _{con.} = Speed constant	[RPM/(l/min)]	N _{con.} = Speed constant	[RPM/GPM]
η _v = Volumetric efficiency		η _v = Volumetric efficiency	
η _{mh} = Mechanical-hydraulic efficiency		η _{mh} = Mechanical-hydraulic efficiency	
η _t = Overall efficiency		η _t = 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