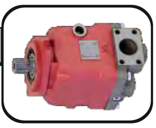
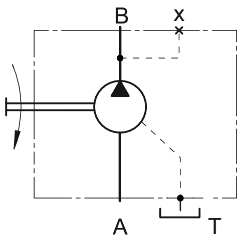


Hydraulic Pumps Type PAP62

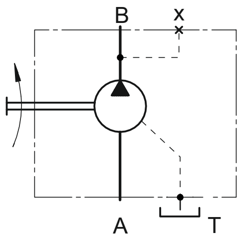
Heavy Duty Axial Piston Pumps Fixed Displacement
for open loop circuit

МОТОРІМПЕКС



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

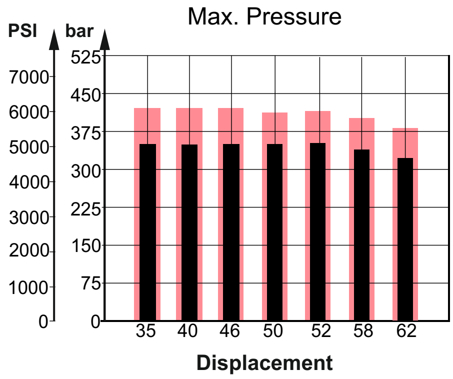
» Port options
» Shaft options
» High pressure ports

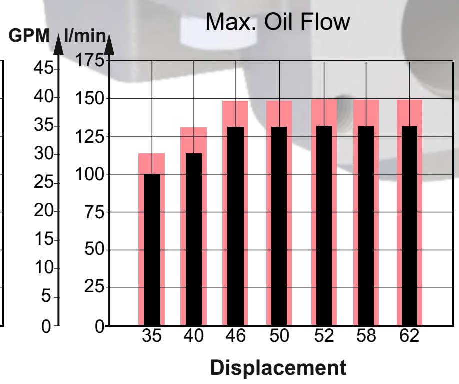
ADVANTAGES

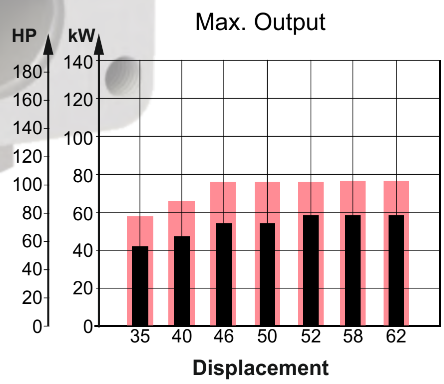
» Low noise
» Low pulsation
» Long service life
» High power density

GENERAL

Displacement, cm³/rev [in³/rev]	**36.16÷62.4 [2.21÷3.81]**
Max. Driving Speed, RPM	**2800**
Max. Driving Torque, Nm [lb-in]	**318 [2814]**
Max. Output, kW [HP]	**56 [77.8]**
Max. Pressure, bar [PSI]	**350 [5080]**
Max. Oil Flow, l/min [GPM]	**132 [35]**
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, mm²/s [SUS]	**12÷68 [66÷311]**
Filtration	**ISO code 18/16/13 (Min. recommended fluid filtration of 10 micron)**

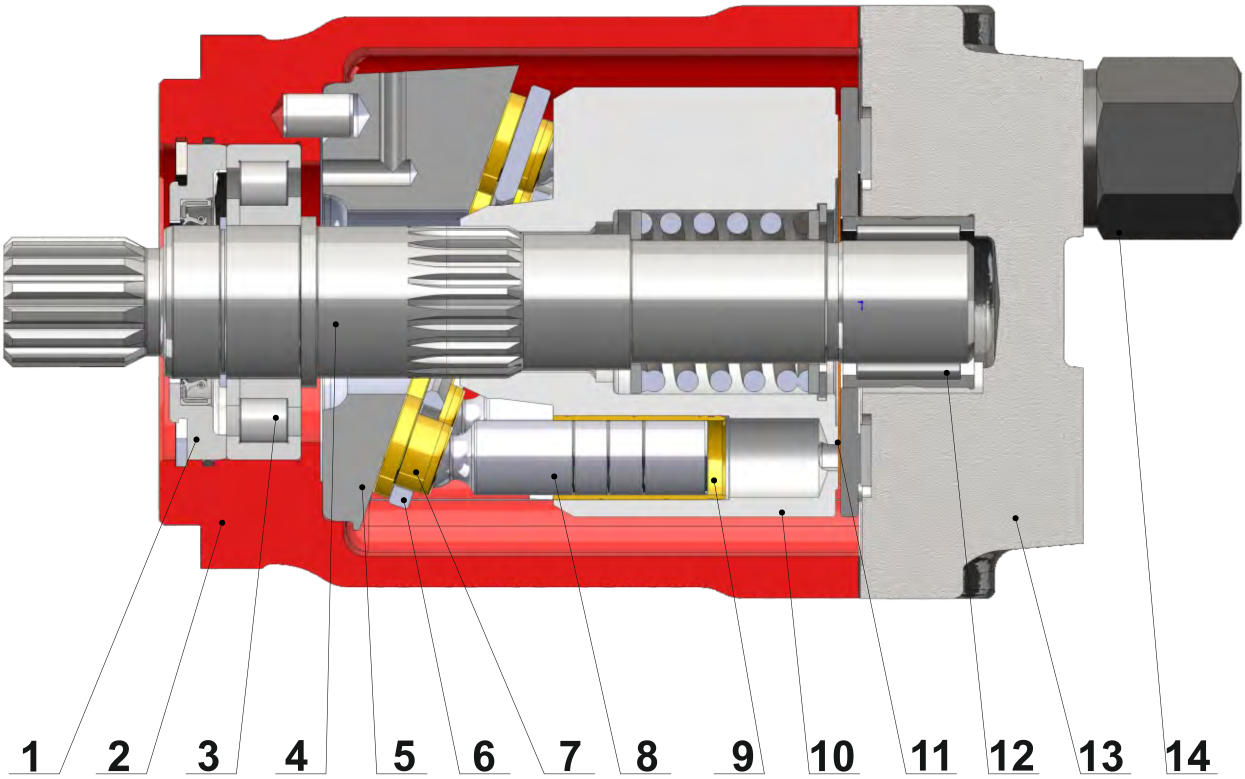






Intermittent values | Continuous values

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

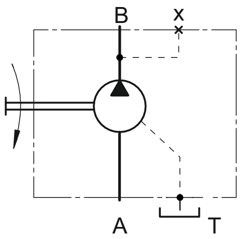
Type		PAP 35	PAP 40	PAP 46	PAP 50	PAP 52	PAP 58	PAP 62
Displacement, $cm^3/rev[in^3/rev]$		36.16 [2.21]	41.59 [2.54]	47.13 [2.88]	49.94 [3.05]	51.95 [3.17]	58.8 [3.59]	62.4 [3.81]
Max. Driving Speed, [RPM]	Cont.	2800	2800	2800	2500	2400	2130	2000
	Int.*	3150	3150	3150	2800	2700	2390	2250
Max. Driving Torque,*** Nm [lb-in]	Cont.	202 [1789]	232 [2053]	263 [2328]	278 [2460]	290 [2566]	320 [2832]	318 [2814]
	Int.**	242 [2142]	278 [2460]	315 [2788]	326 [2885]	347 [3071]	375 [3320]	377 [3337]
Output, kW [HP]	Cont.	41 [55]	47 [63]	54 [72.5]	54 [72.5]	58 [77.8]	58 [77.8]	58 [77.8]
	Int.**	58 [78]	67 [90]	77 [198]	77 [198]	77 [198]	77 [198]	77 [198]
Max. Pressure, bar [PSI]	Cont.	350 [5080]	350 [5080]	350 [5080]	350 [5080]	350 [5080]	340 [4930]	320 [4640]
	Int.**	420 [6100]	420 [6100]	420 [6100]	410 [5950]	420 [6100]	400 [5800]	380 [5510]
	Peak	450 [6527]	450 [6527]	450 [6527]	450 [6527]	450 [6527]	440 [6381]	410 [5950]
Max. Oil Flow, l/min [GPM]	Cont.	100 [26.4]	116 [30]	132 [34.9]	132 [34.9]	132 [34.9]	132 [34.9]	132 [34.9]
	Int.*	114 [30]	131 [35]	148 [39]	148 [39]	148 [39]	148 [39]	148 [39]
Permissible Shaft Load max Axial**** N[lb]		Fa=2000 [450]						
max Radial**** N[lb]		Fr=3600 [810]						
Min. Speed, [RPM]		500						
Max. Pressure in Drain Line, bar [PSI]		5 [70] open drain line is always required						
Weight, kg [lb]		18.14 [40]						

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.

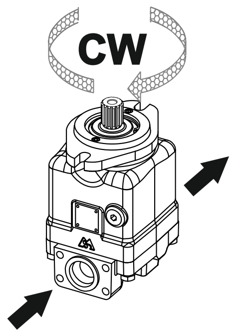
OVERALL DIMENSIONS AND PORTS

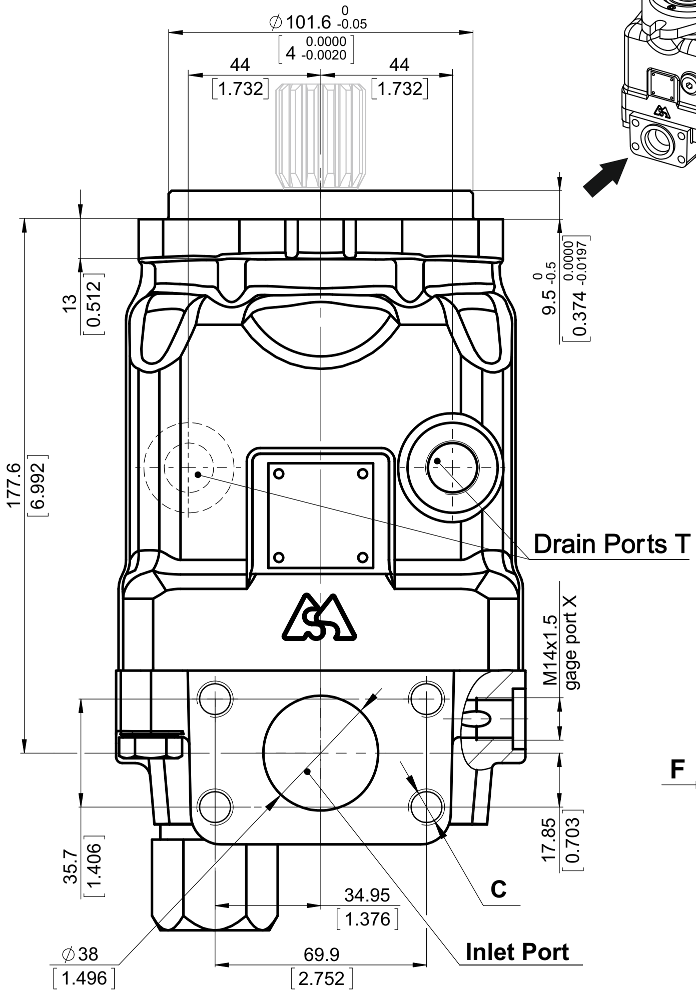


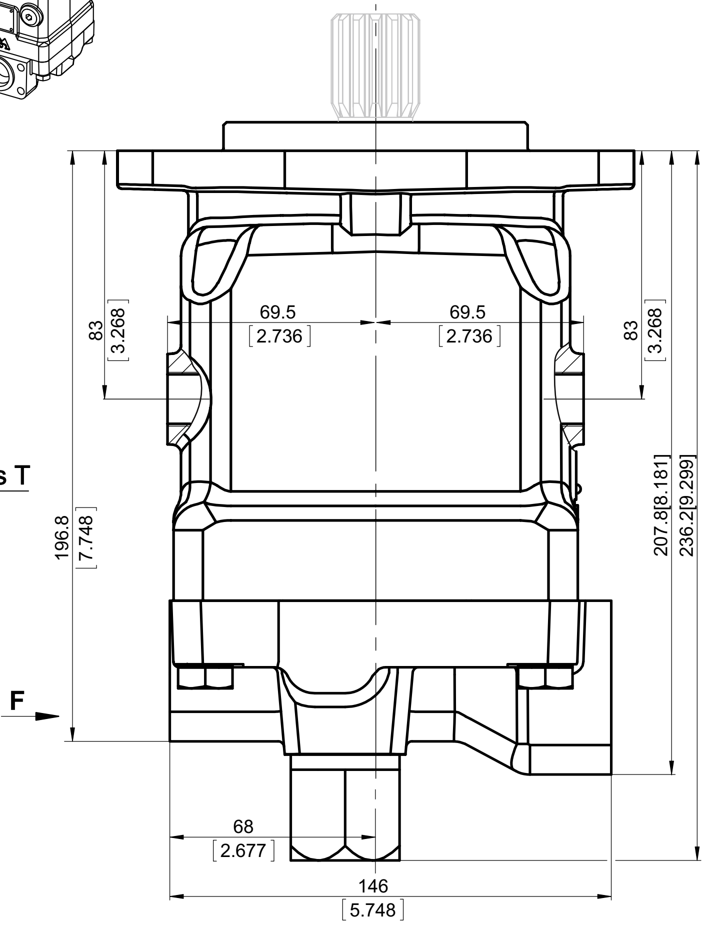
Direction of Rotation **CW**(Right)

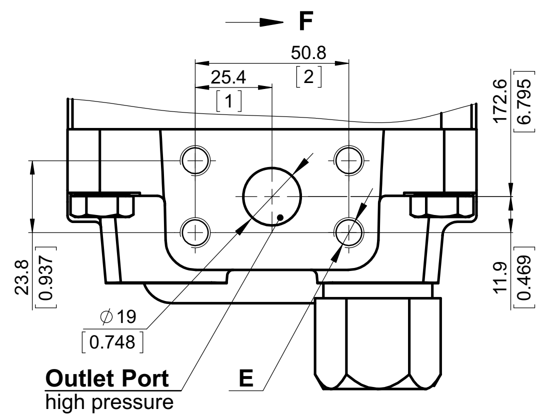
Port sizes **default** and **5**

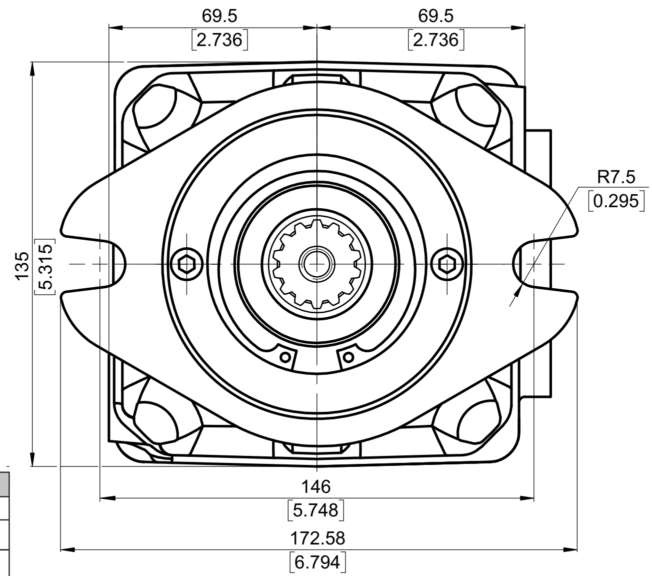
See the port sizes at the bottom of this page









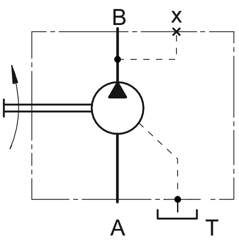


	Port Size		
	default	5	9
Inlet	ISO 6162-1 DN38	SAE J518 1½ PSI3000	ISO 6162-1 DN38
Outlet	ISO 6162-2 DN19	SAE J518 3/4 PSI6000	ISO 6162-2 DN19
T	M18x1,5	7/8-14 UNF	G1/2
C	4xM12	4x1/2-13 UNC	4xM12
E	4xM10	4x3/8-16 UNC	4xM10

Shaft Mounting
see page 67

mm [in]

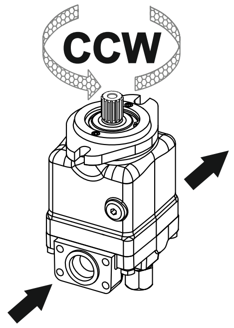
OVERALL DIMENSIONS AND PORTS

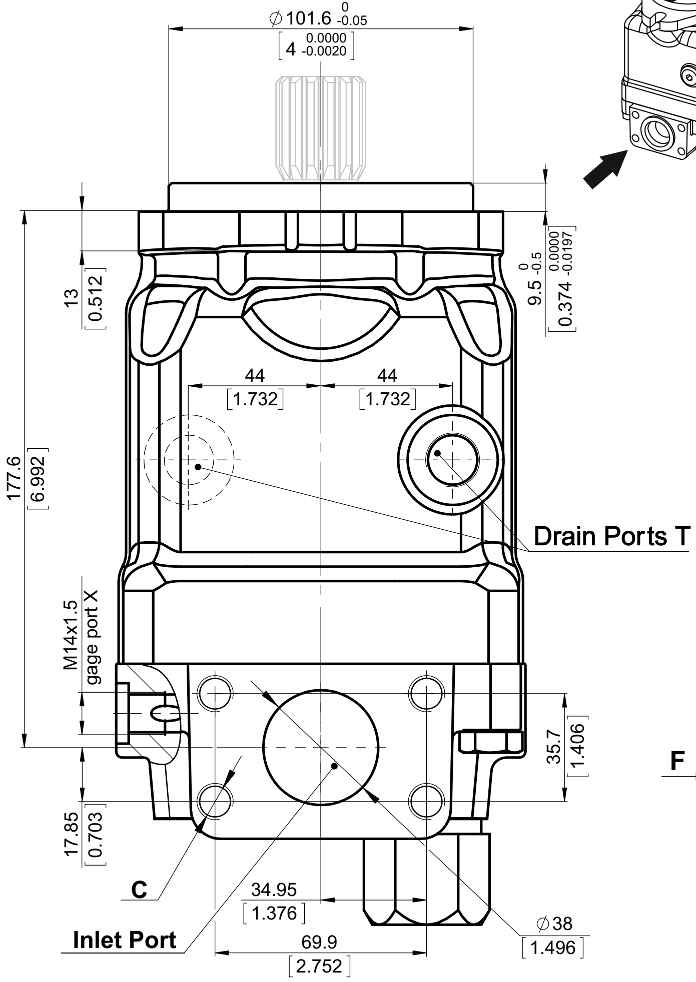


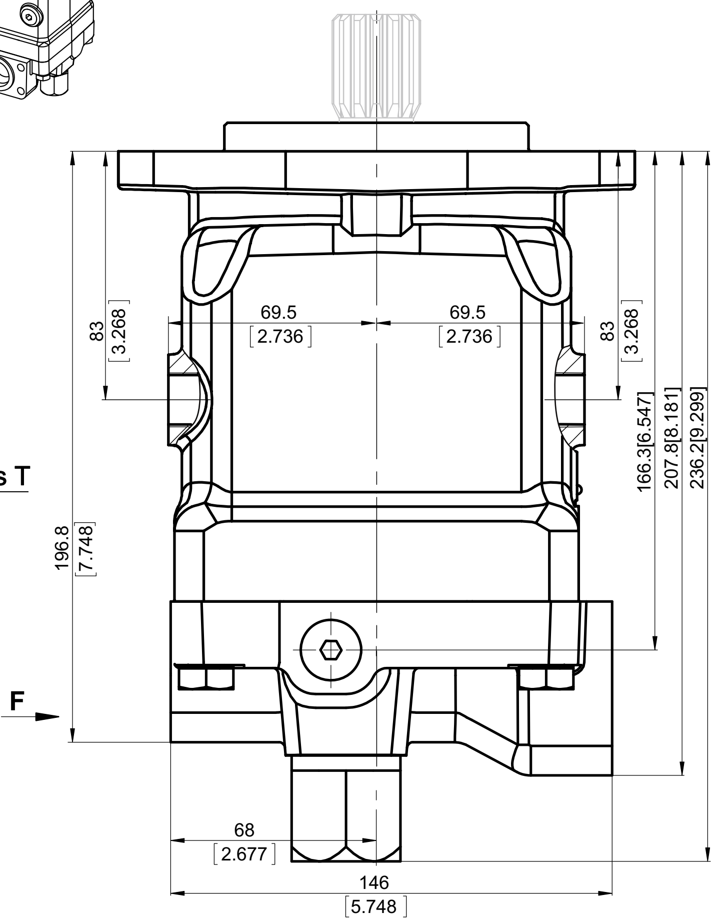
Direction of Rotation **CCW**(Left)

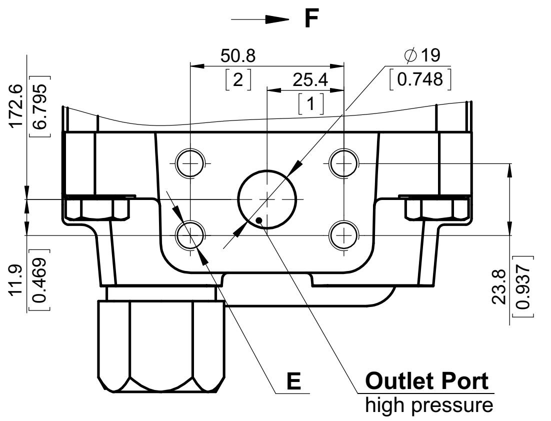
Port sizes **default** and **5**

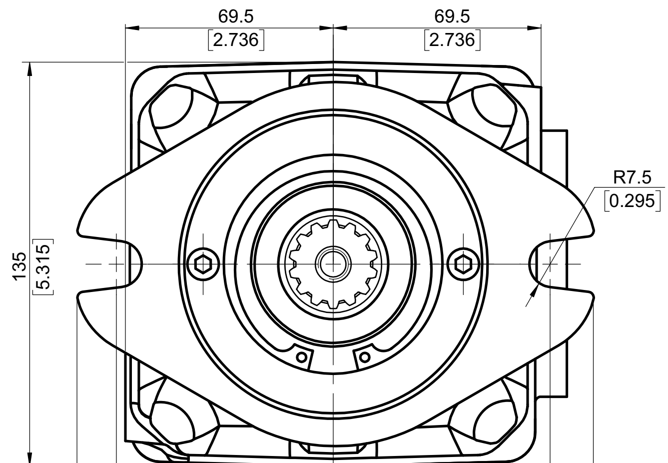
See the port sizes at the bottom of this page









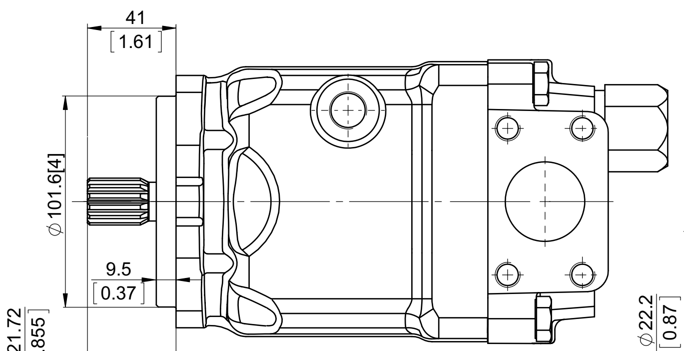


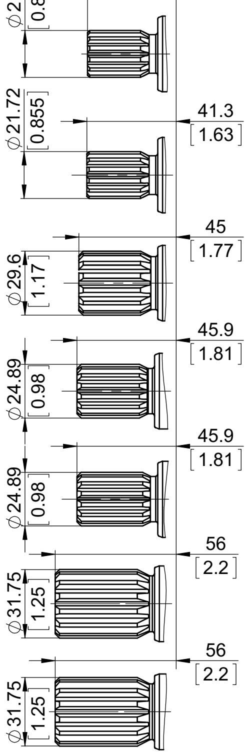
	Port Size		
	default	5	9
Inlet	ISO 6162-1 DN38	SAE J518 1½ PSI3000	ISO 6162-1 DN38
Outlet	ISO 6162-2 DN19	SAE J518 3/4 PSI6000	ISO 6162-2 DN19
T	M18x1,5	7/8-14 UNF	G1/2
C	4xM12	4x1/2-13 UNC	4xM12
E	4xM10	4x3/8-16 UNC	4xM10

Shaft Mounting
see next page

mm [in]

SHAFTS MOUNTING





Shaft SD
13T 16/32

Shaft GD
13T 16/32

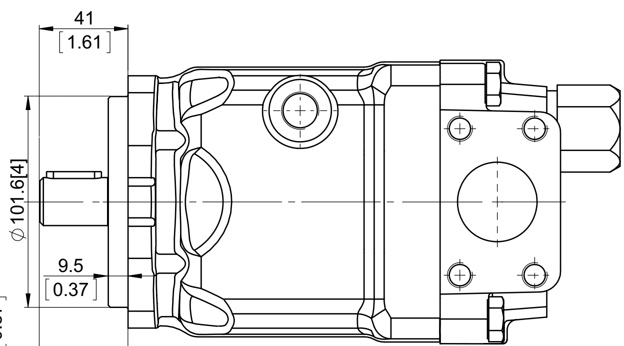
Shaft SH
W30x2x30x14x9g

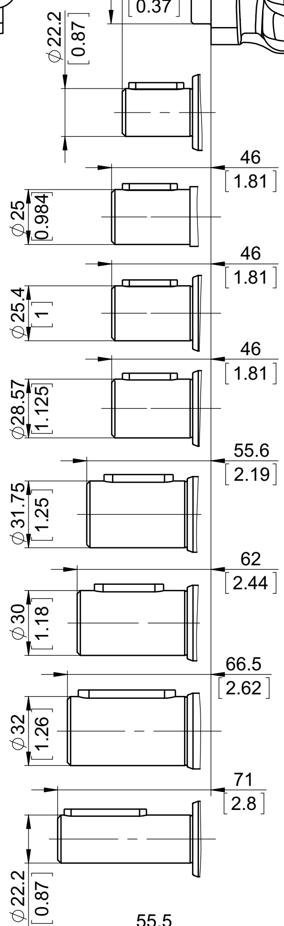
Shaft SF
15T 16/32

Shaft GF
15T 16/32

Shaft SK
14T 12/24

Shaft GK
14T 12/24





Shaft CK
Parallel key 1/4"x1/4"x1" BS46

Shaft ML
Parallel key A8x7x25 DIN6885

Shaft CM
Parallel key 1/4"x1/4"x1" BS46

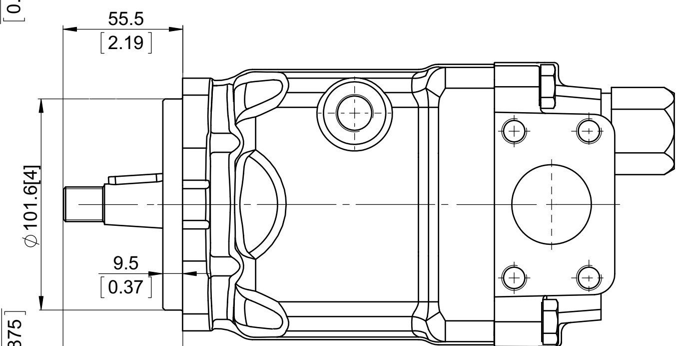
Shaft DO
Parallel key 5/16"x5/16"x1 ¼" BS46

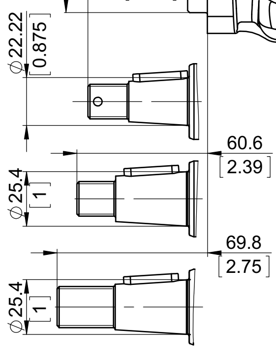
Shaft DR
Parallel key 5/16"x5/16"x1 ¼" BS46

Shaft CQ
Parallel key A8x7x32 DIN6885

Shaft CS
Parallel key A10x8x45 DIN6885

Shaft MK
Parallel key 1/4"x1/4"x1 ½" BS46





Shaft TD
Tapered 1:8, Parallel key 1/4"x1/4"x1"

Shaft KH
Tapered 1:8, Parallel key 1/4"x1/4"x1"

Shaft TH
Tapered 1:8, Parallel key 1/4"x1/4"x1"

Shaft Dimensions
See Page 69÷73

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 81).

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

mm [in]

ORDERING CODE

	1	2	3	4	5	6	7	8	9	9	9
P A P									[		]

Pos.1 - Mounting Flange

B - SAE B - 2-Bolt flange spigot diam. 101.6 [4"] - BC 146 [5.75"]

Pos.2 - 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]
52 - 51.95 cm^3/rev [3.17 in^3/rev]
58 - 58.8 cm^3/rev [3.59 in^3/rev]
62 - 62.4 cm^3/rev [3.81 in^3/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
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
GF - ø24.9 [0.98"] Spline SAE 15T 16/32, 3/8-16UNC
SH - ø29.6 [1,165"] Spline W30x2x30x14x9g DIN, M10 thread
SK - ø31.75 [1.25"] Spline SAE 14T 12/24 DP, M10
GK - ø31.75 [1.25"] Spline SAE 14T 12/24 DP, 7/16-14UNC 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"x1½" BS46
ML - ø25 [0.984"] Straight, M8 thread Parallel key A8x7x25 DIN6885
CM - ø25.4 [1"] Straight, M8 thread Parallel key 1/4"x1/4"x1" BS46
DO - ø28.75 [1.125"] Straight, 3/8-16UNC Parallel key 5/16"x5/16"x1¼" BS46
CQ - ø30 [1.181"] Straight, M8 thread Parallel key A8x7x32 DIN6885
DR - ø31.75 [1.25"] Straight, 3/8-16UNC Parallel key 5/16"x5/16"x1¼" BS46
CS - ø32 [1.26"] Straight, M8 thread Parallel key A10x8x45 DIN6885
TD - ø22.22 [7/8"] Tapered 1:8 [125:1000], Parallel key 1/4"x1/4"x1", 5/8-18 UNF
TH - ø25.4 [1"] Tapered 1:8 [125:1000], Parallel key 1/4"x1/4"x1", 3/4-16 UNF
KH - ø25.4 [1"] Tapered 1:8 [125:1000], Parallel key 1/4"x1/4"x1", M16x1.5

Pos.5 - Port Size

omit - Inlet ISO 6162-1 DN38,Outlet ISO 6162-2 DN19, metric thread, drain ports M18x1.5
5 - Inlet SAE J518 1½" PSI3000, Outlet SAEJ518 3/4" PSI6000, sae thread, drain 7/8-14 UNF
9 - Inlet ISO 6162-1 DN38,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

P A P B 4 6 R S H 5

PAP	B	46	R	SH	5				[		]

Flange B | Disp. 46cc | Right Pump | Shaft SH | Port size 5 | no special | no paint

P A P B 4 0 L S D 5 P S

PAP	B	40	L	SD	5			PS	[		]

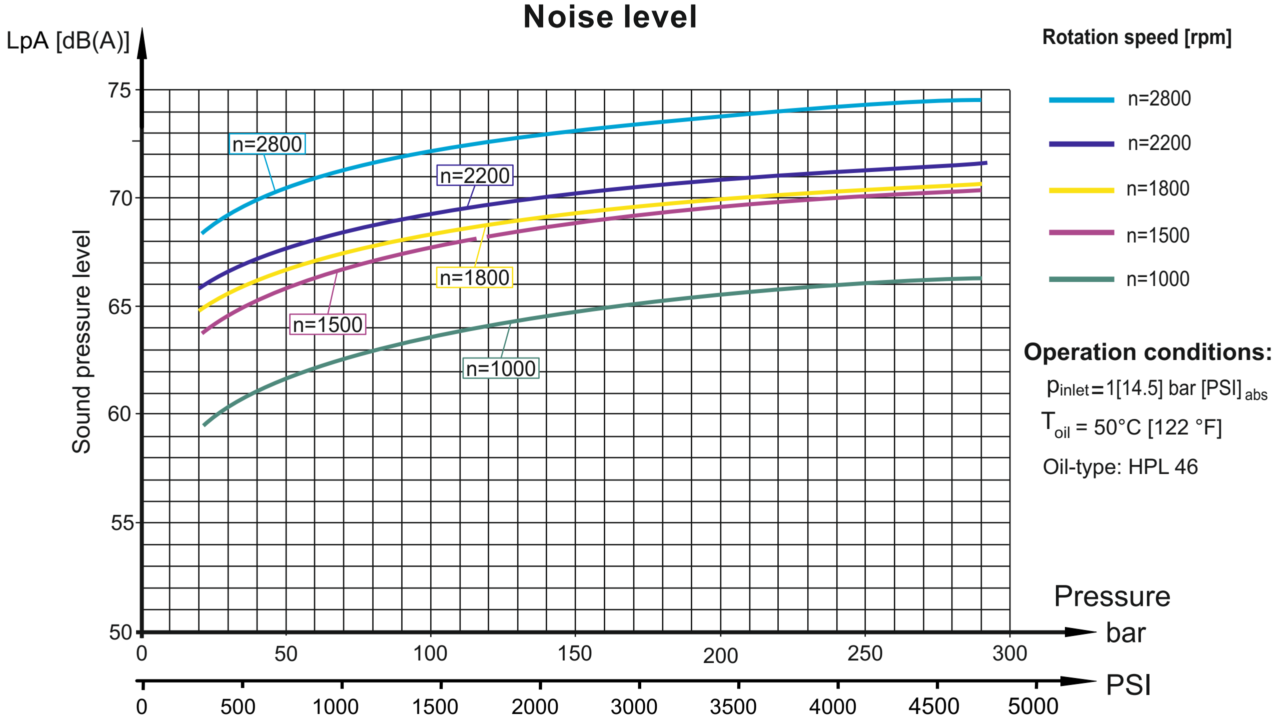
Flange B | Disp. 40cc | Left Pump | Shaft SD | Port size 5 | no special | Painted

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 .

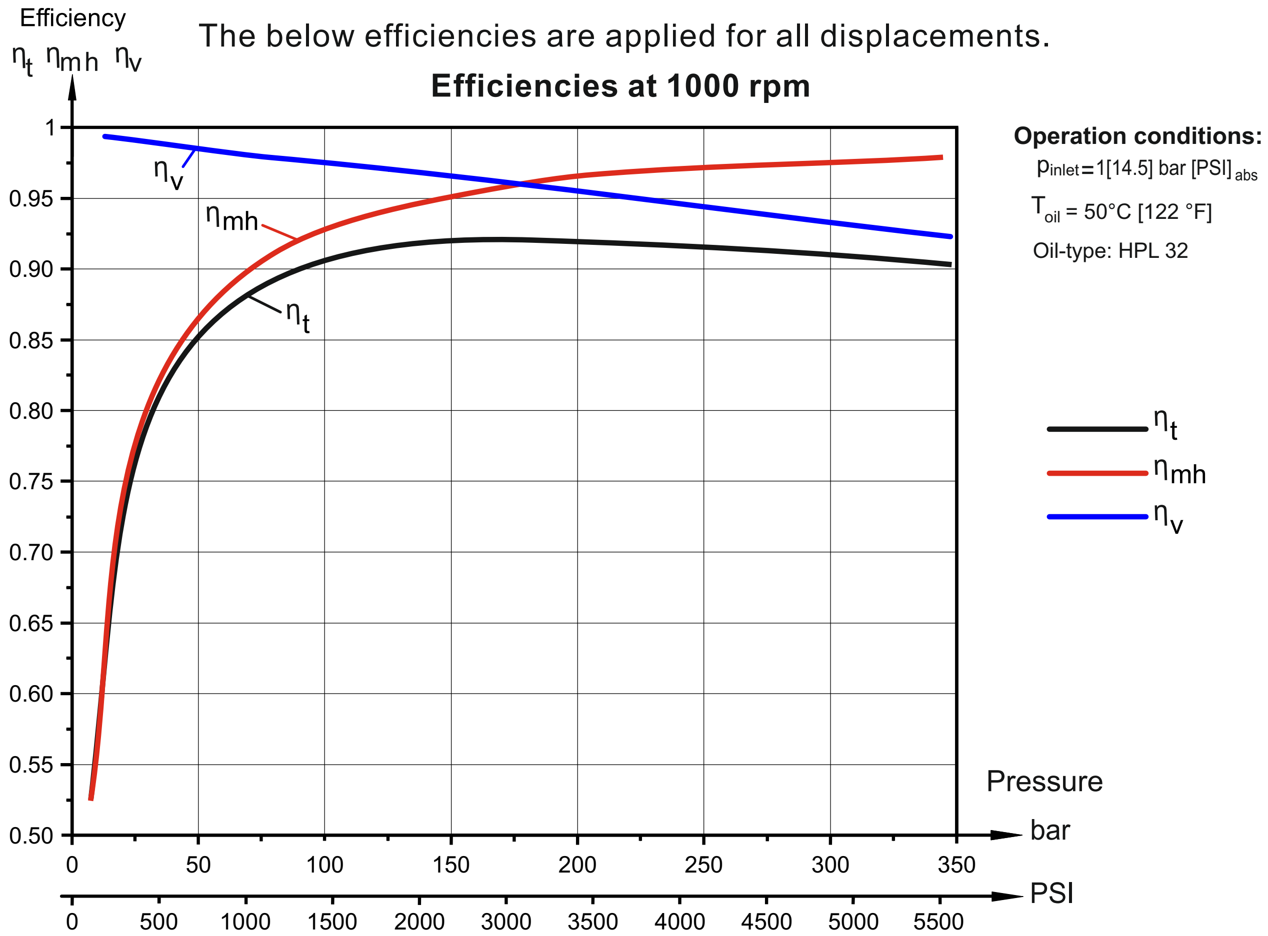
Noise level



The sound pressure level for a particular pump may vary ±2 dB(A) compared to what is shown in the diagram.

The below efficiencies are applied for all displacements.

Efficiencies at 1000 rpm



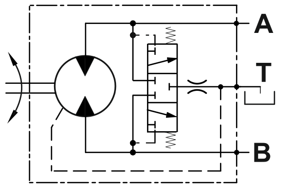
The pump size, pressure, torque, speed of rotation and flow rate required for a specific application can be calculated using the formulas on page 85

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

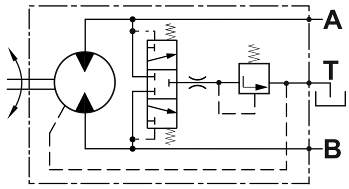
- For other options, please see Flow Setting of ordering code, considering the following possible values:

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

EXAMPLE

MAPB50SH2**PU**	purge valve flow rate 6±2 l/min
MAPB50SH2**PUL3.5**	purge valve flow rate 3.5±1 l/min
MAPB50SH2**PUL5.5**	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	**omit**	**10**		→ pressure
Flow setting	**omit**	**L3.5**	**L5.5**	→ flow rate

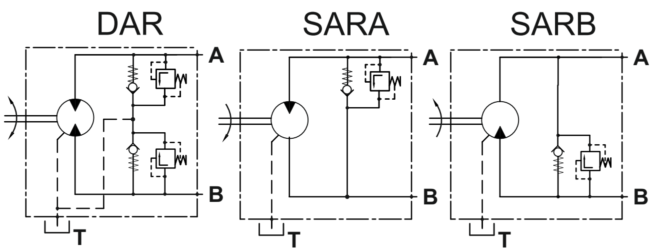
EXAMPLE

MAPB50SH2**FLU**	flow rate 6±2 l/min, charge pressure 16 bar
MAPB50SH2**FLU10L5.5**	flow rate 5.5±1 l/min, charge pressure 10 bar
MAPB50SH2**FLUL3.5**	flow rate 3.5±1 l/min, charge pressure 16 bar

Option **DAR, SARA, SARB**
Combined Anti-Cavitation and Reliev 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	**250**	**300**	**350**	→ pressure

EXAMPLE

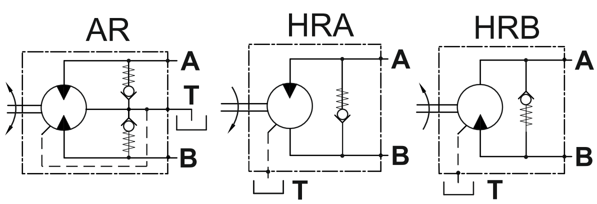
MAPB50SH2**DAR350**
Double Anti-Cavitation and Relief Valve, relief valve setting 350 bar

MAPB50SH2**SARA250**
Single Anti-Cavitation and Relief Valve, relief valve setting 250 bar
The valve is placed on port A

MAPB50SH2**SARB300**
Single Anti-Cavitation and ReliefValve, 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

MAPB50SH2**AR**
Double Anti-Cavitation Valve

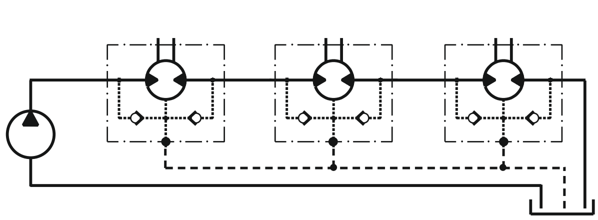
MAPB50SH2**HRA**
Single Anti-Cavitation Valve, the valve is placed on port A

MAPB50SH2**HRB**
Single Anti-Cavitation Valve, the valve is placed on port B

INSTALLATION

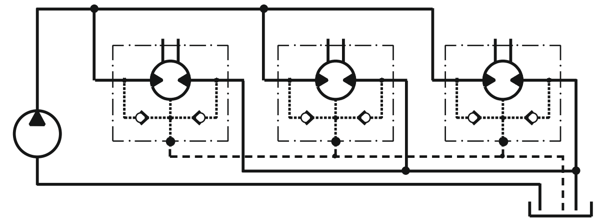
TYPE OF CONNECTION

Series connection
not recommended



open drain line is always required

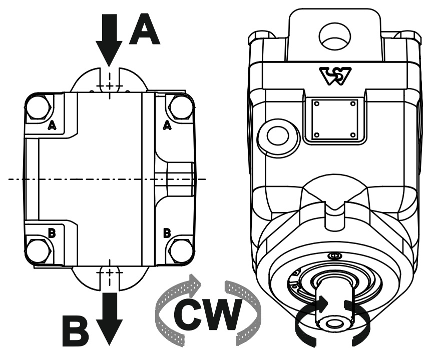
Parallel connection
recomended



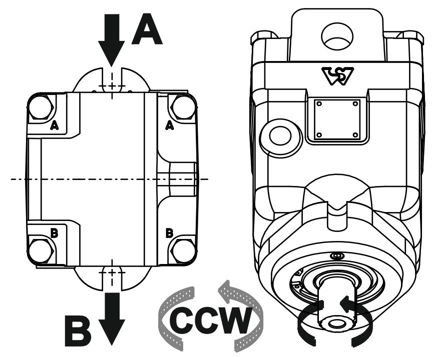
open drain line is always required

DIRECTION OF ROTATION

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



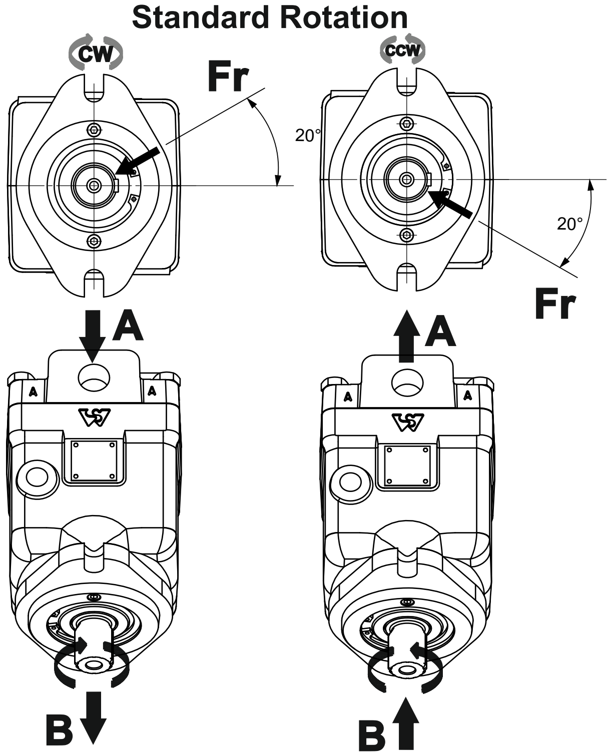
Reverse Rotation
Viewed from shaft end
Port **A** Pressurized - **CCW**
Port **B** Pressurized - **CW**



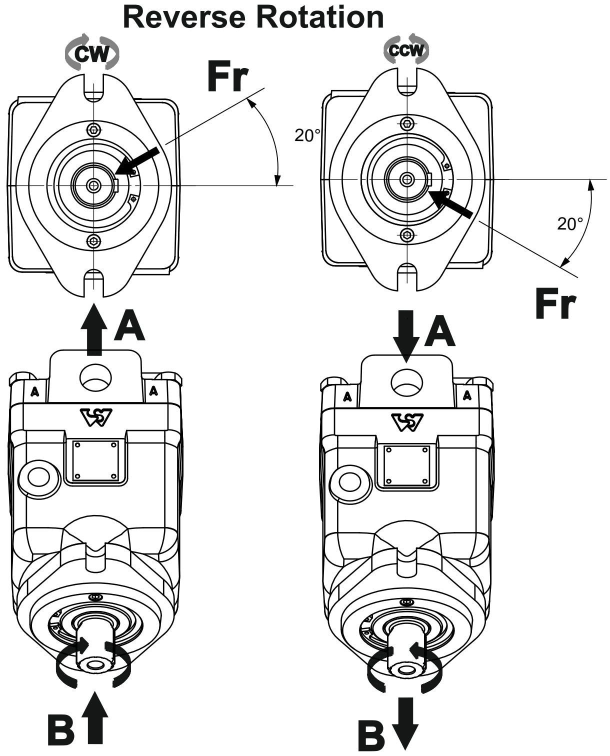
BEST POSITION FOR APPLYING RADIAL LOAD

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

Standard Rotation

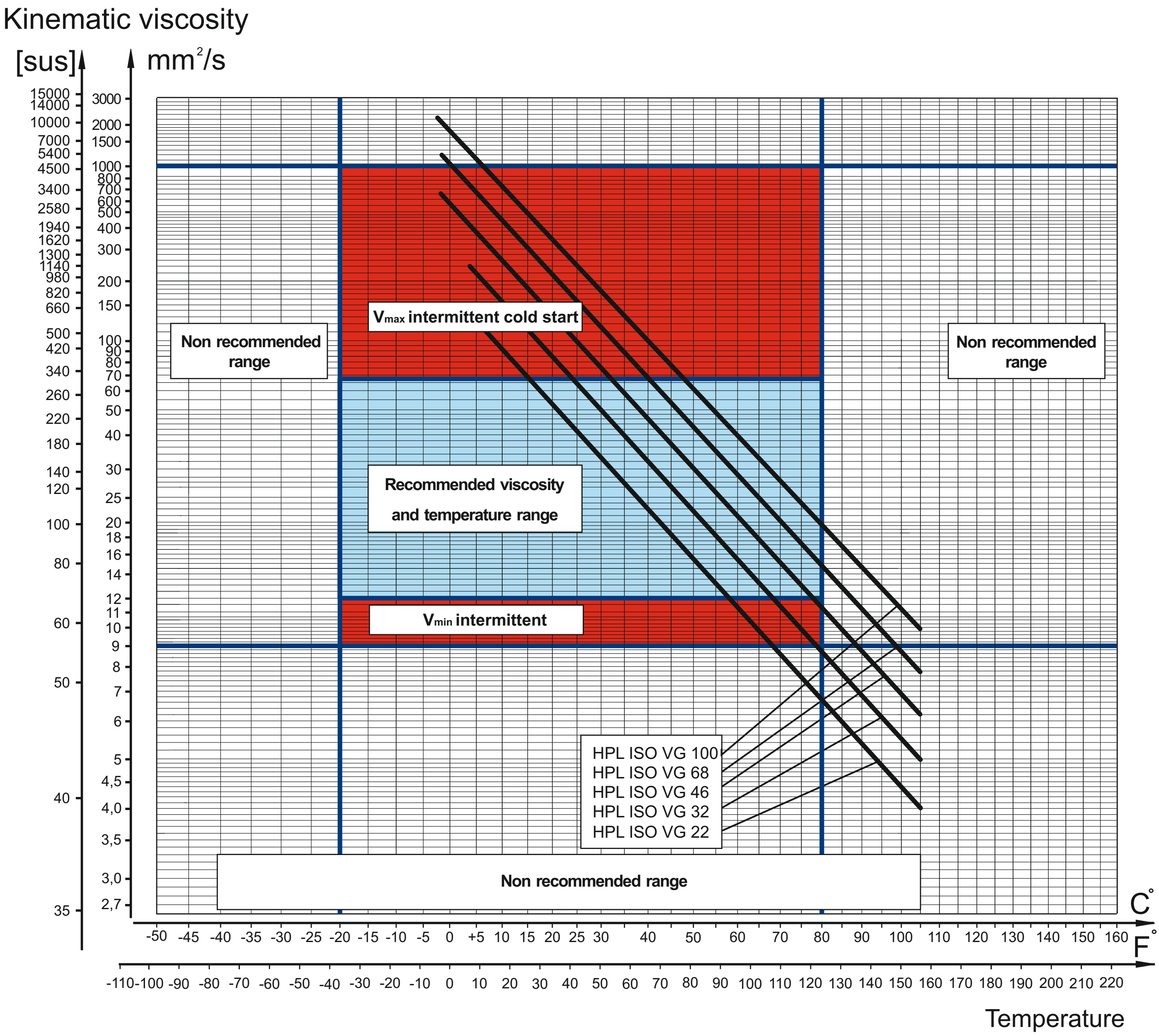


Reverse Rotation



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.



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

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

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

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

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

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

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

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

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

Vg	=	Displacement per rev.	[cm^3]
Δp	=	$p_{HP} - p_{LP}$	[bar]
p_{HP}	=	High pressure	[bar]
p_{LP}	=	Low pressure	[bar]
n	=	Rotation speed	[RPM]
Q	=	Oil flow	[l/min]
$T_{con.}$	=	Toque constant	[Nm/bar]
$N_{con.}$	=	Speed constant	[RPM/(l/min)]
η_v	=	Volumetric efficiency	
η_{mh}	=	Mechanical-hydraulic efficiency	
η_t	=	Overall efficiency	

Inch System

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

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

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

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

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

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

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

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

Vg	=	Displacement per rev.	[in^3]
Δp	=	$p_{HP} - p_{LP}$	[PSI]
p_{HP}	=	High pressure	[PSI]
p_{LP}	=	Low pressure	[PSI]
n	=	Rotation speed	[RPM]
Q	=	Oil flow	[GPM]
$T_{con.}$	=	Toque constant	[lb-in/PSI]
$N_{con.}$	=	Speed constant	[RPM/GPM]
η_v	=	Volumetric efficiency	
η_{mh}	=	Mechanical-hydraulic 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