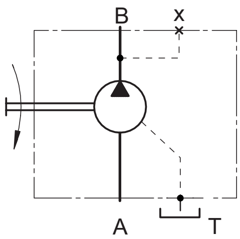
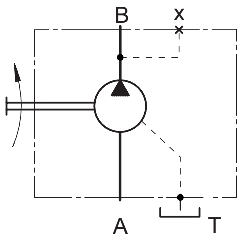
Hydraulic Pumps Type PAP62

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

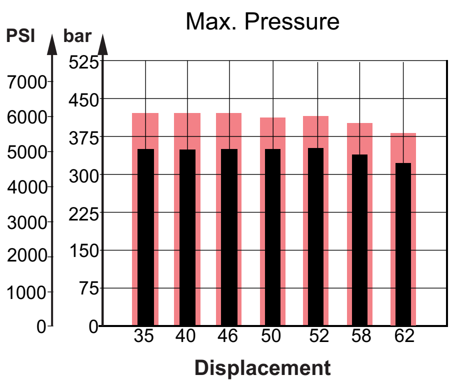
» Port options
» Shaft options
» High pressure ports

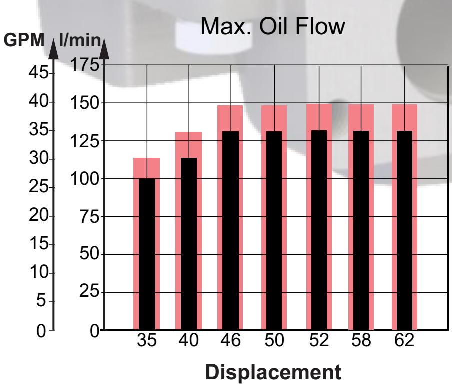
ADVANTAGES

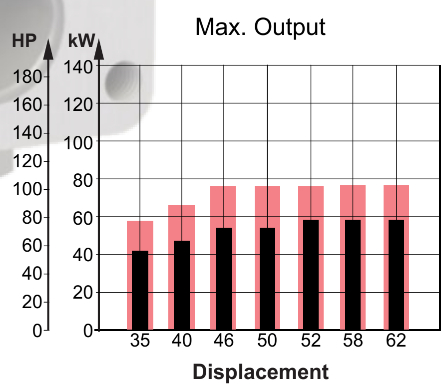
» Low noise
» Low pulsation
» Long service life
» High power density

GENERAL

Displacement,	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)**

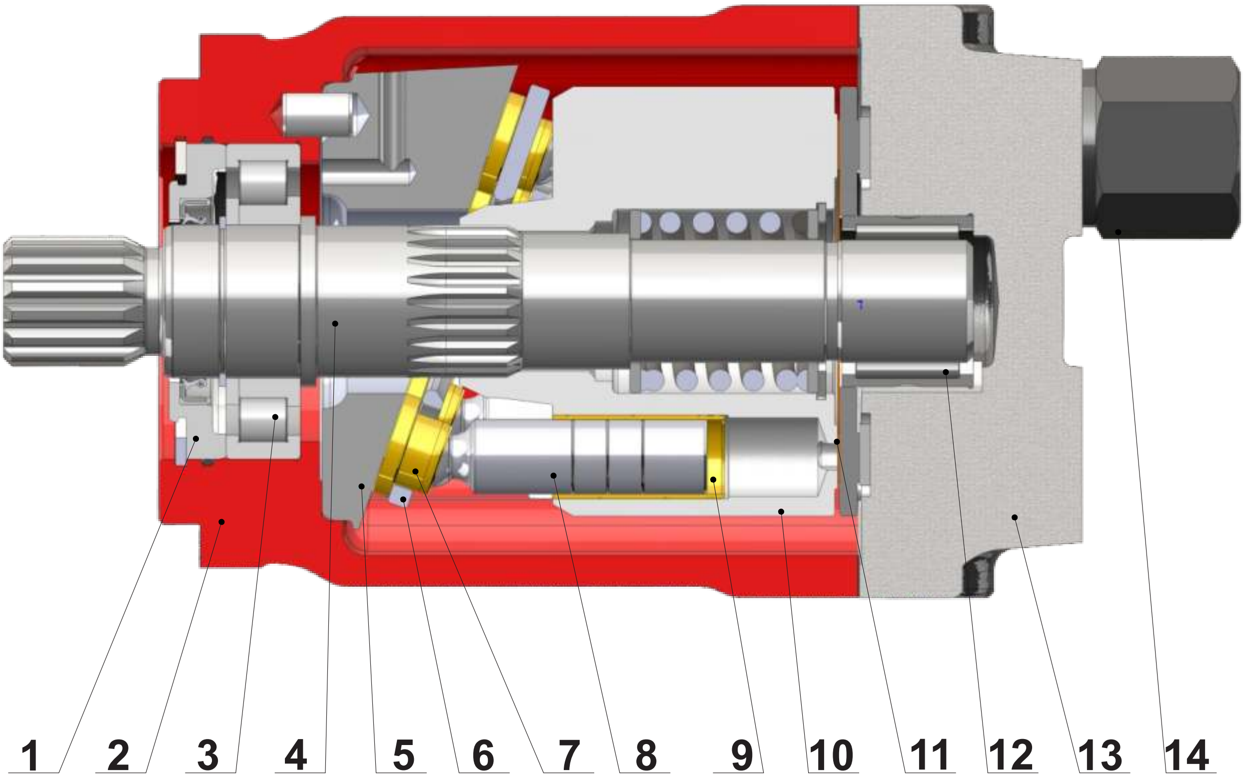






Intermittent values   Continuous values

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

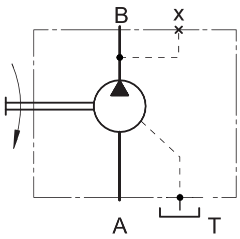
Type		PAP 35	PAP 40	PAP 46	PAP 50	PAP 52	PAP 58	PAP 62
Displacement, $cm^3/rev[in^3/rev]$		36.16 [2.21]	41.59 [2.54]	47.13 [2.88]	49.94 [3.05]	51.95 [3.17]	58.8 [3.59]	62.4 [3.81]
Max. Driving Speed, [RPM]	Cont.	2800	2800	2800	2500	2400	2130	2000
	Int.*	3150	3150	3150	2800	2700	2390	2250
Max. Driving 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.

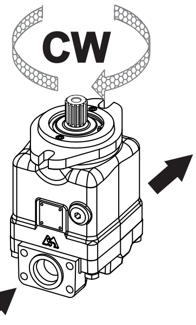
OVERALL DIMENSIONS AND PORTS

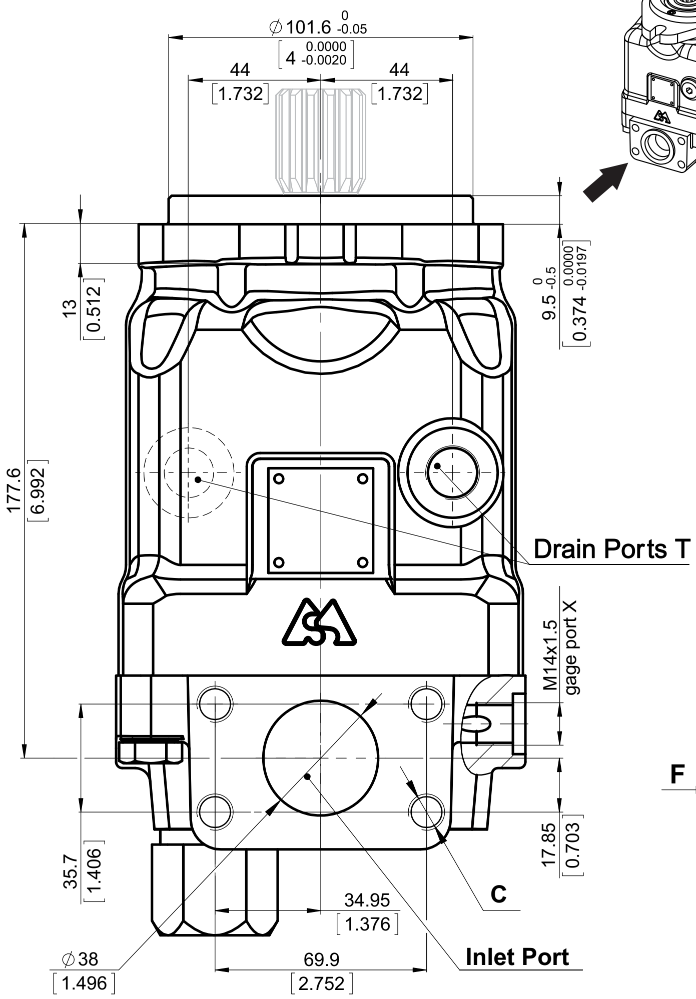


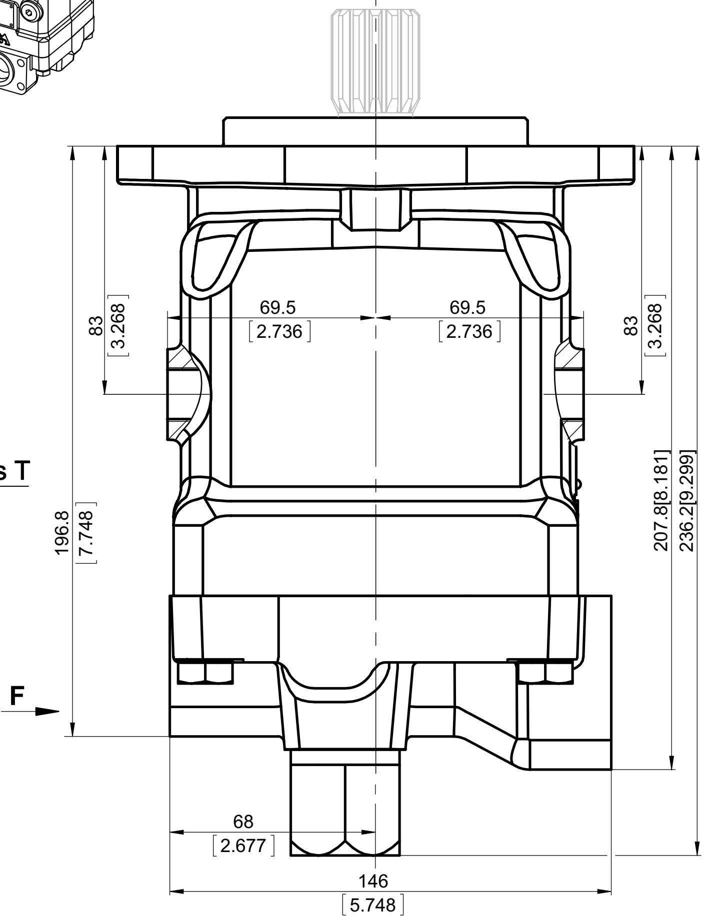
Direction of Rotation **CW**(Right)

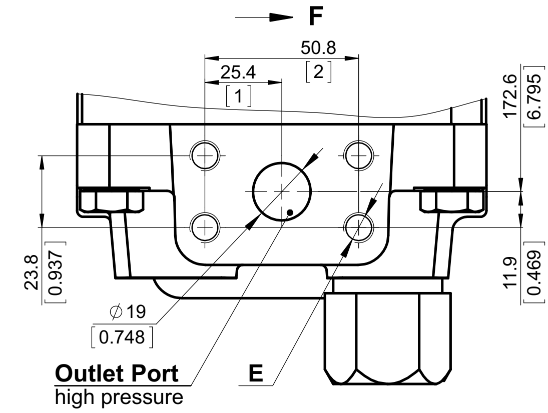
Port sizes **default** and **5**

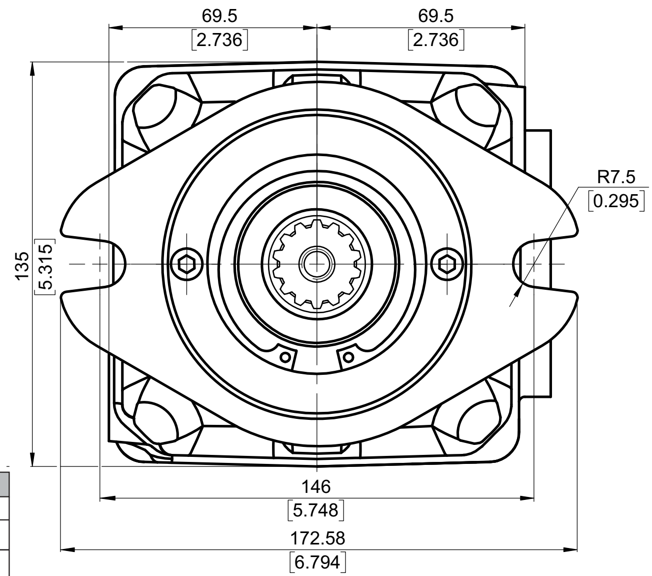
See the port sizes at the bottom of this page





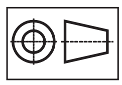






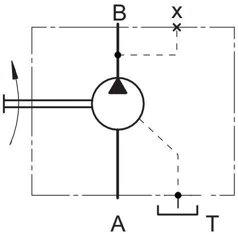
	Port Size		
	default	5	9
Inlet	ISO 6162-1 DN38	SAE J518 1½ PSI3000	ISO 6162-1 DN38
Outlet	ISO 6162-2 DN19	SAE J518 3/4 PSI6000	ISO 6162-2 DN19
T	M18x1,5	7/8-14 UNF	G1/2
C	4xM12	4x1/2-13 UNC	4xM12
E	4xM10	4x3/8-16 UNC	4xM10

Shaft Mounting
see page 67



mm [in]

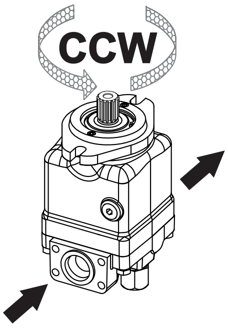
OVERALL DIMENSIONS AND PORTS

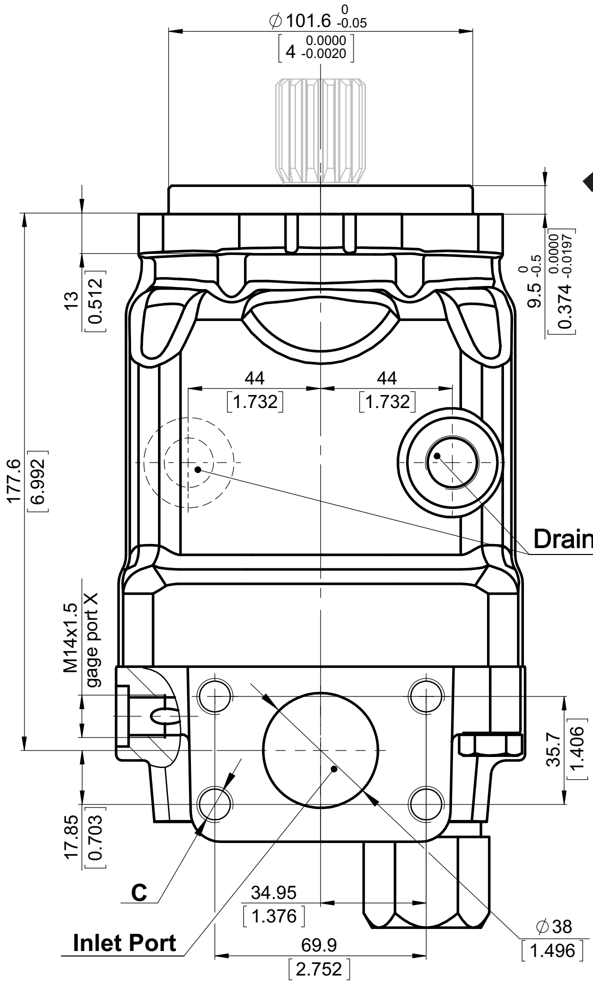


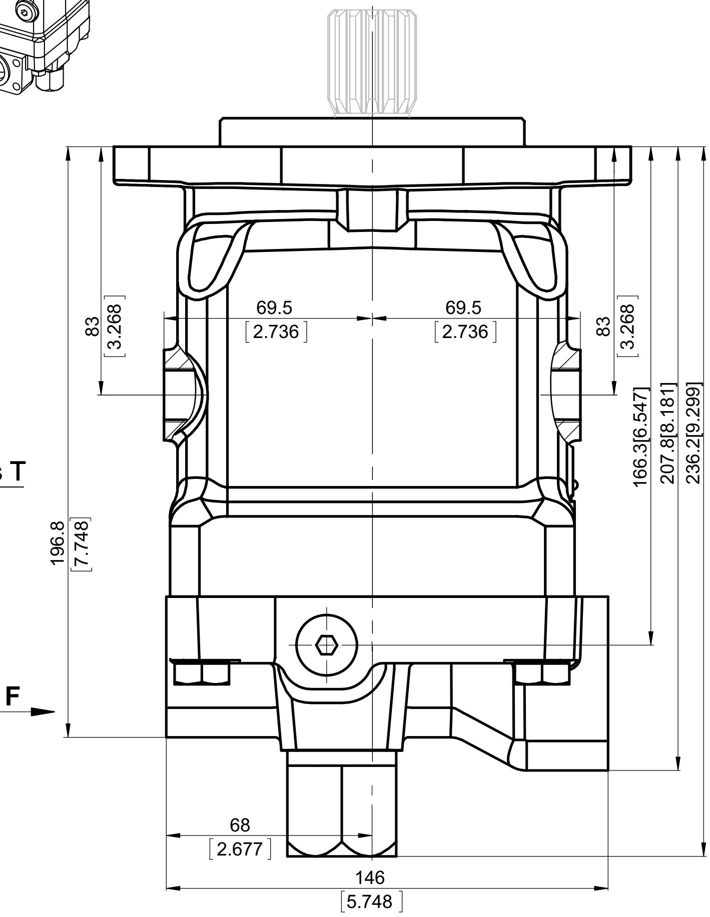
Direction of Rotation **CCW**(Left)

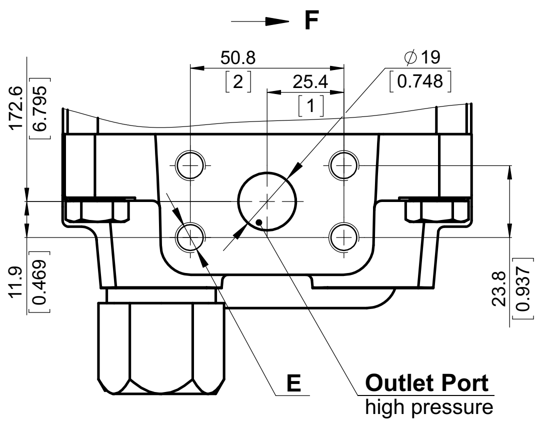
Port sizes **default** and **5**

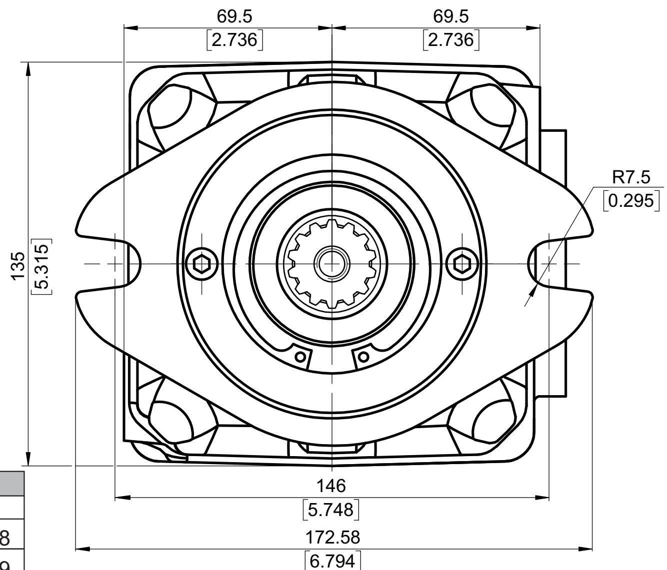
See the port sizes at the bottom of this page









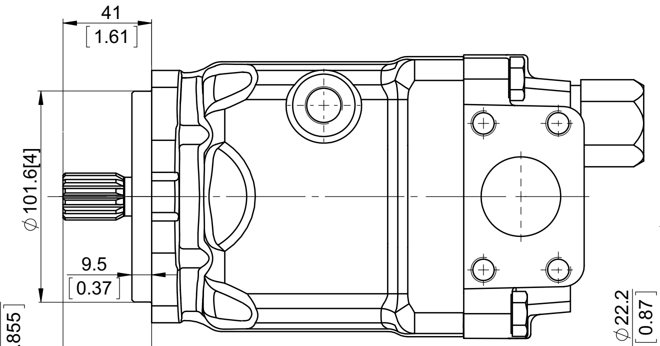


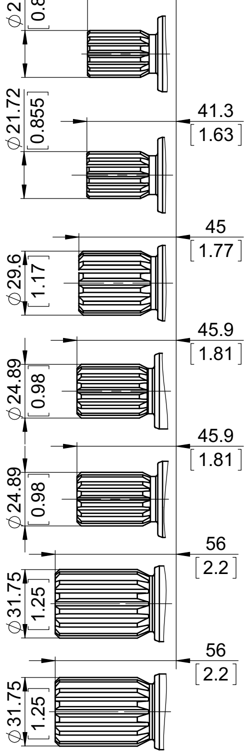
	Port Size		
	default	5	9
Inlet	ISO 6162-1 DN38	SAE J518 1½ PSI3000	ISO 6162-1 DN38
Outlet	ISO 6162-2 DN19	SAE J518 3/4 PSI6000	ISO 6162-2 DN19
T	M18x1,5	7/8-14 UNF	G1/2
C	4xM12	4x1/2-13 UNC	4xM12
E	4xM10	4x3/8-16 UNC	4xM10

Shaft Mounting see next page

mm [in]

SHAFTS MOUNTING





Shaft SD
13T 16/32
Max. torque
220 Nm [1950 lb-in]

Shaft GD
13T 16/32
Max. torque
220 Nm [1950 lb-in]

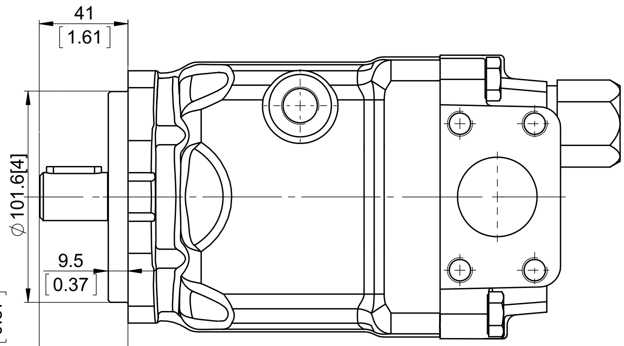
Shaft SH
W30x2x30x14x9g
Max. torque
600 Nm [5310 lb-in]

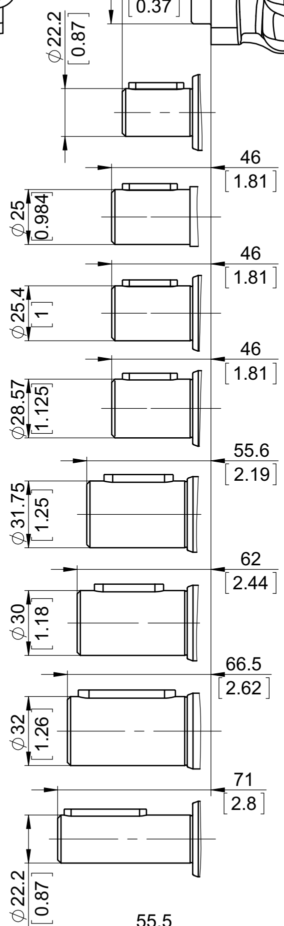
Shaft SF
15T 16/32
Max. torque
360 Nm [3180 lb-in]

Shaft GF
15T 16/32
Max. torque
360 Nm [3180 lb-in]

Shaft SK
14T 12/24
Max. torque
600 Nm [5310 lb-in]

Shaft GK
14T 12/24
Max. torque
600 Nm [5310 lb-in]





Shaft CK
Parallel key 1/4"x1/4"x1" BS46
Max. torque
180 Nm [1600 lb-in]

Shaft ML
Parallel key A8x7x25 DIN6885
Max. torque
250 Nm [2210 lb-in]

Shaft CM
Parallel key 1/4"x1/4"x1" BS46
Max. torque
250 Nm [2210 lb-in]

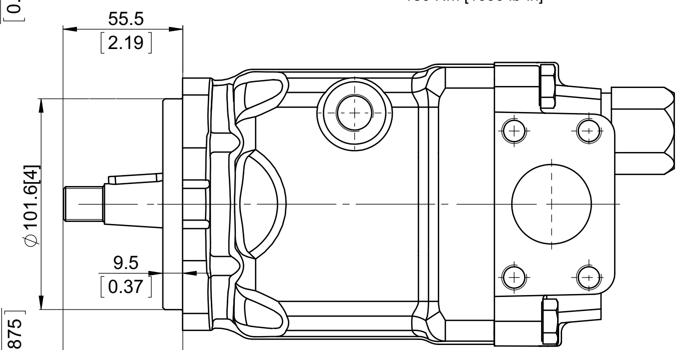
Shaft DO
Parallel key 5/16"x5/16"x1 ¼" BS46
Max. torque
280 Nm [2480 lb-in]

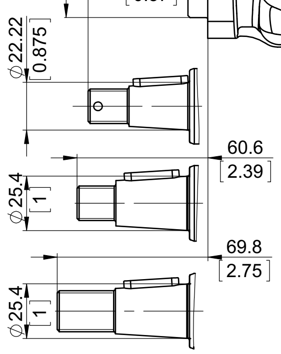
Shaft DR
Parallel key 5/16"x5/16"x1 ¼" BS46
Max. torque
300 Nm [2655 lb-in]

Shaft CQ
Parallel key A8x7x32 DIN6885
Max. torque
300 Nm [2655 lb-in]

Shaft CS
Parallel key A10x8x45 DIN6885
Max. torque
350 Nm [3100 lb-in]

Shaft MK
Parallel key 1/4"x1/4"x1½" BS46
Max. torque
180 Nm [1600 lb-in]





Shaft TD
Tapered 1:8, Parallel key 1/4"x1/4"x1"
Max. torque
220 Nm [1950 lb-in]

Shaft KH
Tapered 1:8, Parallel key 1/4"x1/4"x1"
Max. torque
300 Nm [2655 lb-in]

Shaft TH
Tapered 1:8, Parallel key 1/4"x1/4"x1"
Max. torque
300 Nm [2655 lb-in]

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
PAP									[		]

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

PAPB46RSH5

PAP	B	46	R	SH	5				[		]
	Flange B	Disp. 46cc	Right Pump	Shaft SH	Port size 5	no special	no paint				

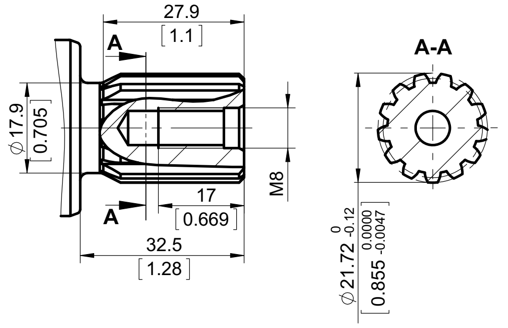
PAPB40LSD5PS

PAP	B	40	L	SD	5			PS	[		]
	Flange B	Disp. 40cc	Left Pump	Shaft SD	Port size 5	no special	Painted				

SHAFT TYPES AND DIMENSIONS

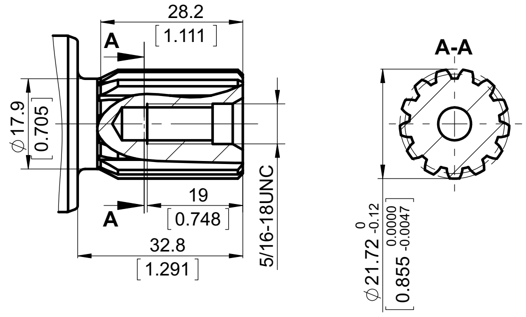
SD

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



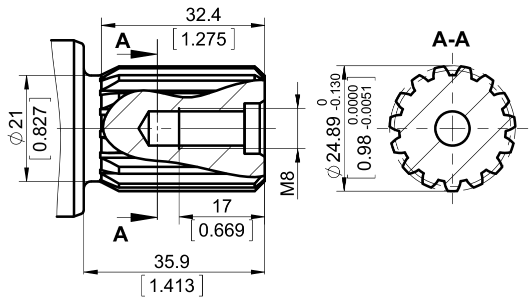
GD

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]



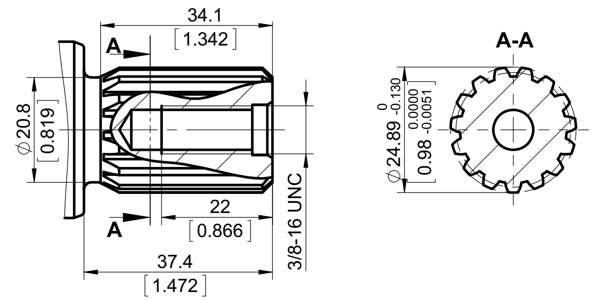
SF

ø24.89 [0.98], M8 thread
15T 16/32 DP splined ANSI B92.1-1970
Max. torque 330 Nm [3180 lb-in]



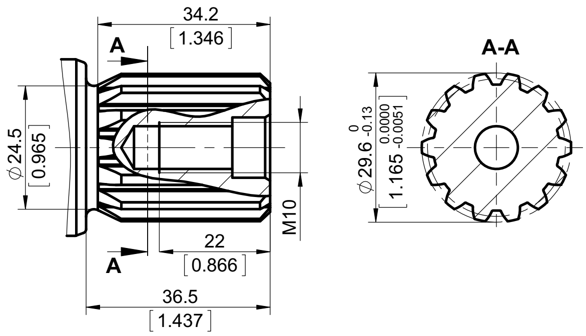
GF

ø24.89 [0.98], 3/8-16 UNC thread
15T 16/32 DP splined ANSI B92.1-1970
Max. torque 310 Nm [3180 lb-in]



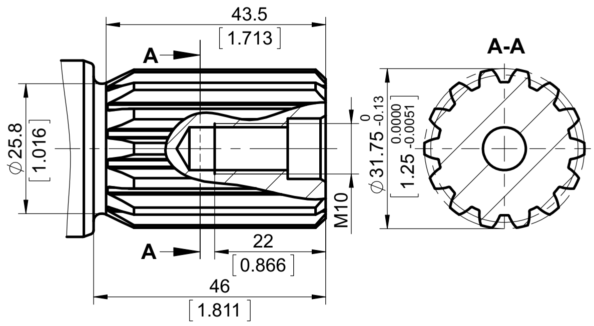
SH

ø29.6 [1.165], M10 thread
W30x2x30x14x9g splined DIN 5480
Max. torque 500 Nm [5310 lb-in]

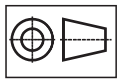


SK

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

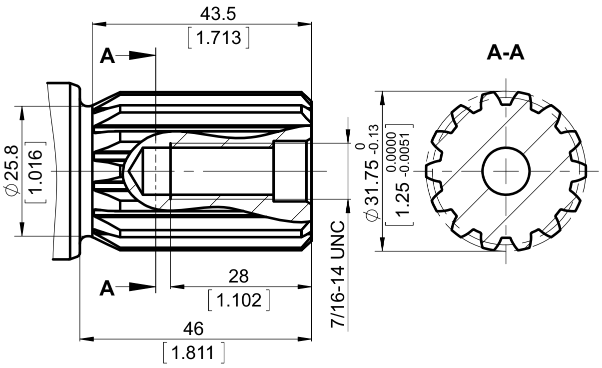


mm [in]

SHAFT TYPES AND DIMENSIONS

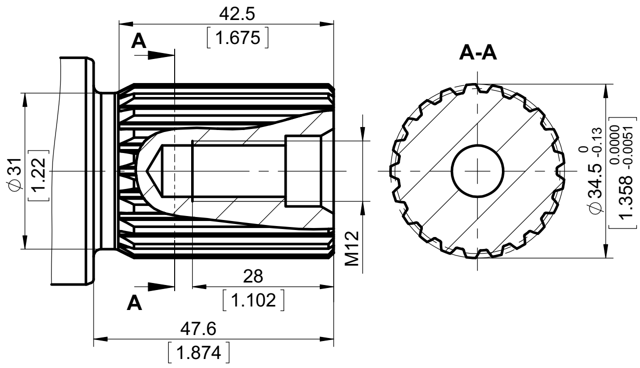
GK

ø31.75 [1.25], 7/16-14 UNC thread
14T 12/24 DP splined ANSI B92.1-1970
Max. torque 600 Nm [5310 lb-in]



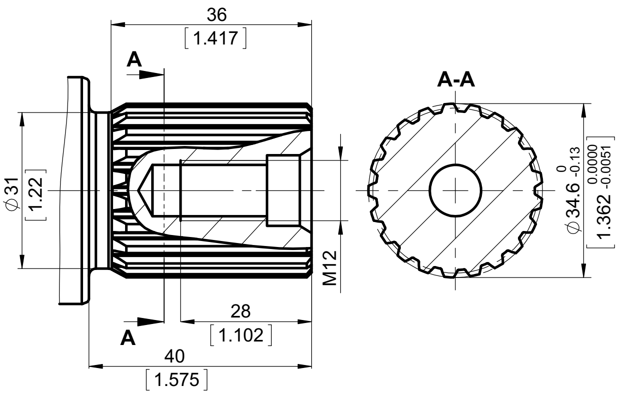
SP

ø34.5 [1.358], M12 thread
21T 16/32 DP splined ANSI B92.1-1970
Max. torque 1085 Nm [9600 lb-in]



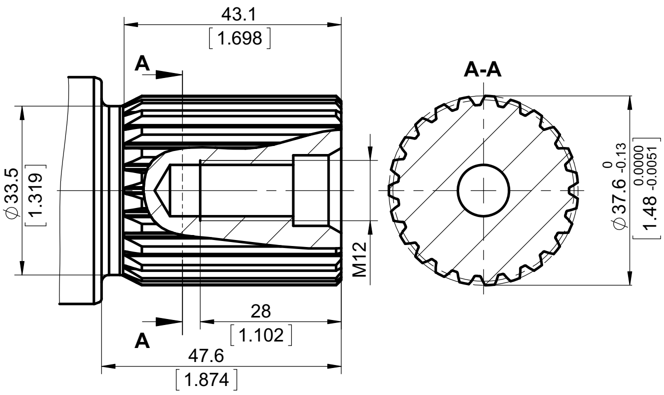
QH

ø34.6 [1.36], M12 thread
W35x2x30x16x9g splined DIN 5480
Max. torque 1085 Nm [9600 lb-in]



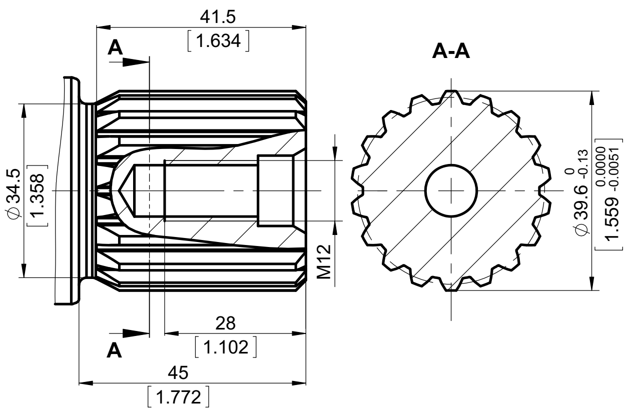
SR

ø37.6 [1½], M12 thread
23T 16/32 DP splined ANSI B92.1-1970
Max. torque 1300 Nm [11500 lb-in]



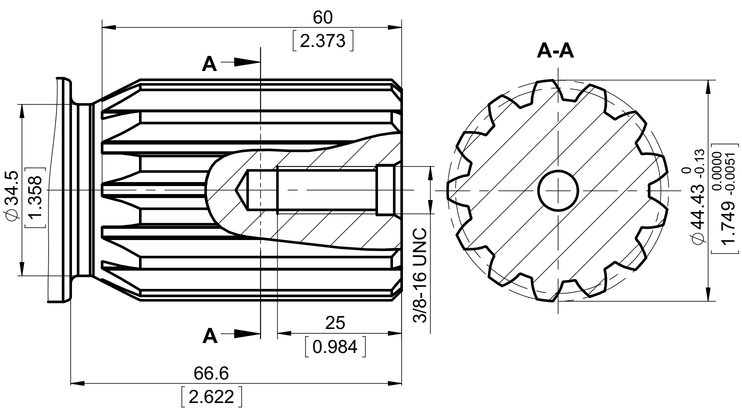
ST

ø39.6 [1.559], M12 thread
W40x2x30x18x9g splined DIN 5480
Max. torque 1400 Nm [12400 lb-in]



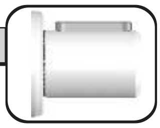
GU

ø44.43 [1¾], 3/8-16 UNC thread
13T 8/16 DP splined ANSI B92.1-1970
Max. torque 1400 Nm [17700 lb-in]



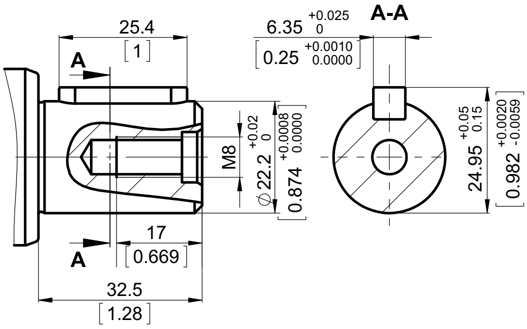
The required max. torque must not be exceeded

mm [in]

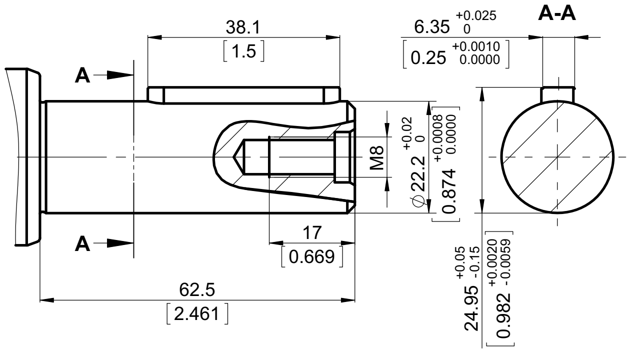


SHAFT TYPES AND DIMENSIONS

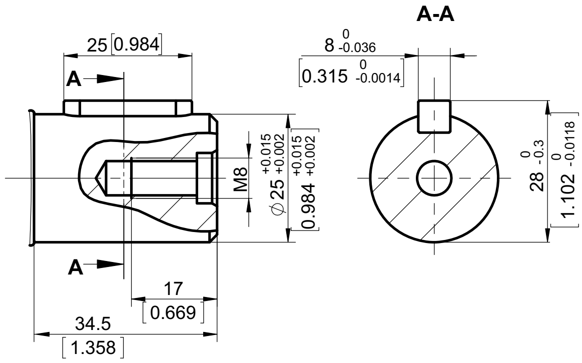
CK
ø22.2 [7/8] straight, M8 thread
Parallel key **1/4"x1/4"x1**" BS46
Max. torque 180 Nm [1600 lb-in]



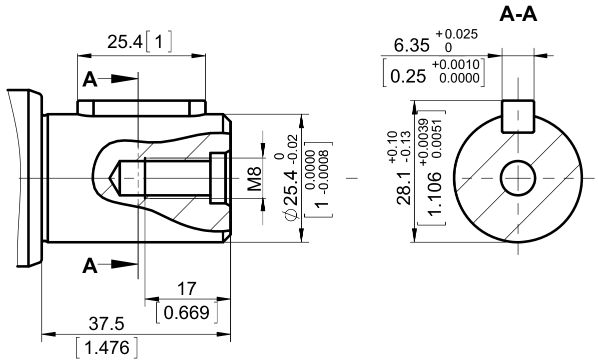
MK
ø22.2 [7/8] straight, M8 thread
Parallel key **1/4"x1/4"x1½**" BS46
Max. torque 180 Nm [1600 lb-in]



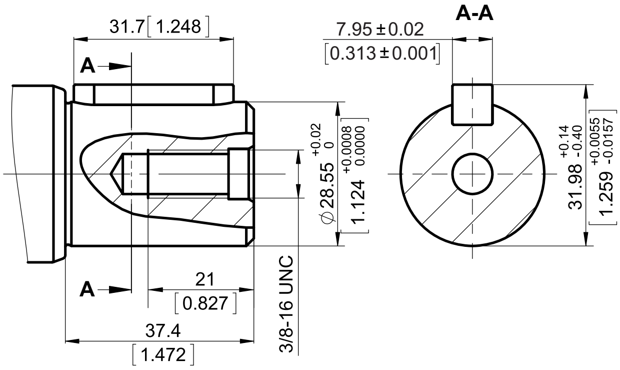
ML
ø25 [0.984] straight, M8 thread
Parallel key **A8x7x25** DIN6885
Max. torque 250 Nm [2210 lb-in]



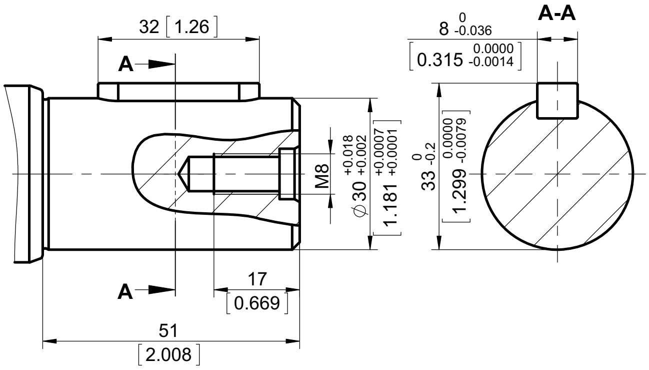
CM CMN
ø25.4 [1] straight, M8 thread
Parallel key **1/4"x1/4"x1**" BS46
Max. torque 250 Nm [2210 lb-in]



DO
ø28.55 [1.125] straight, 3/8-16 UNC thread
Parallel key **5/16"x5/16"x1**¼"
Max. torque 280 Nm [2480 lb-in]

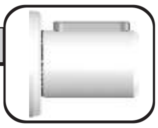


CQ
ø30 [1.181] straight, M8 thread
Parallel key **A8x7x32** DIN6885
Max. torque 300 Nm [2655 lb-in]



The required max. torque
must not be exceeded

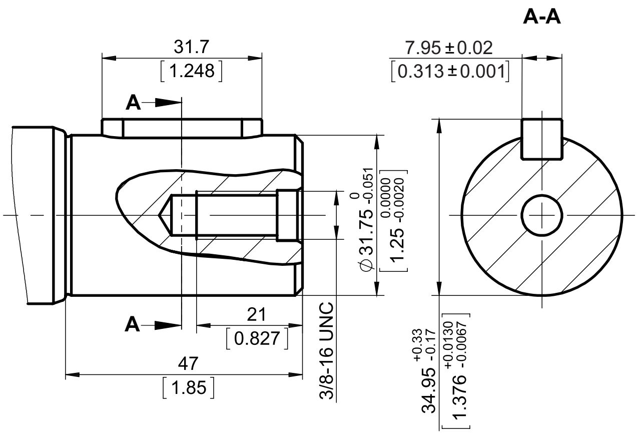
mm [in]



SHAFT TYPES AND DIMENSIONS

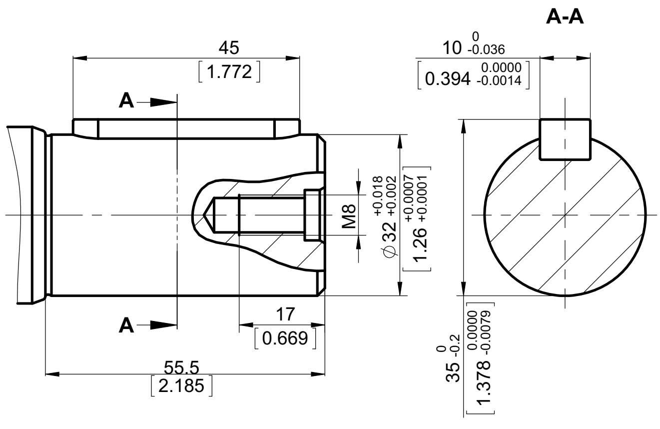
DR

ø31.75 [1.25] straight, 3/8-16 UNC thread
Parallel key **5/16"x5/16"x1¼"**
Max. torque 300 Nm [2655 lb-in]



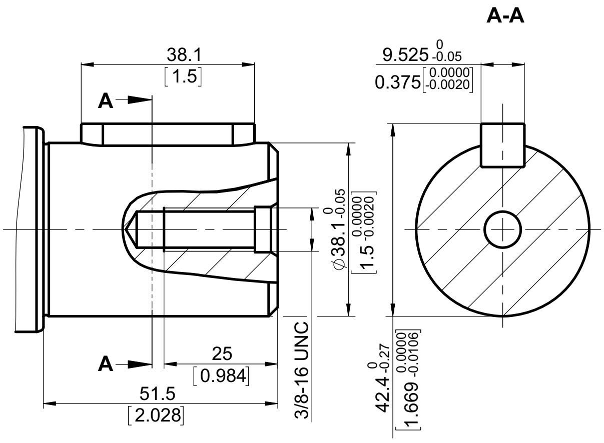
CS

ø32 [1.26] straight, M8 thread
Parallel key **A10x8x45** DIN6885
Max. torque 350 Nm [3100 lb-in]



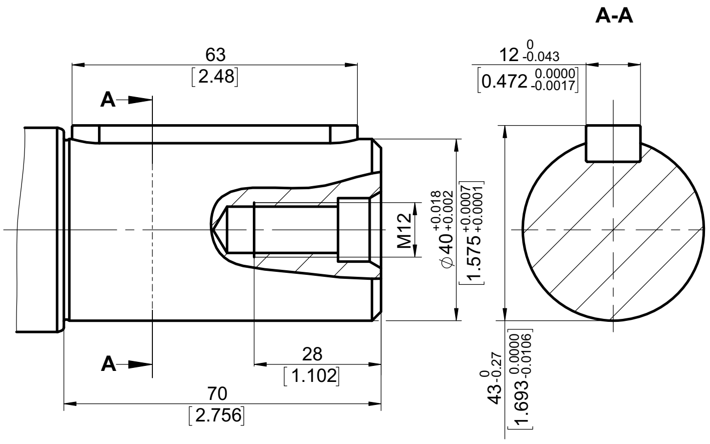
DU

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]



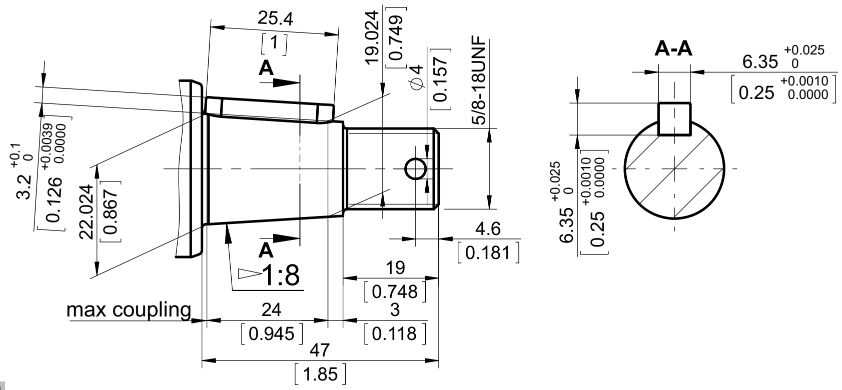
The required max. torque
must not be exceeded

mm [in]

SHAFT TYPES AND DIMENSIONS

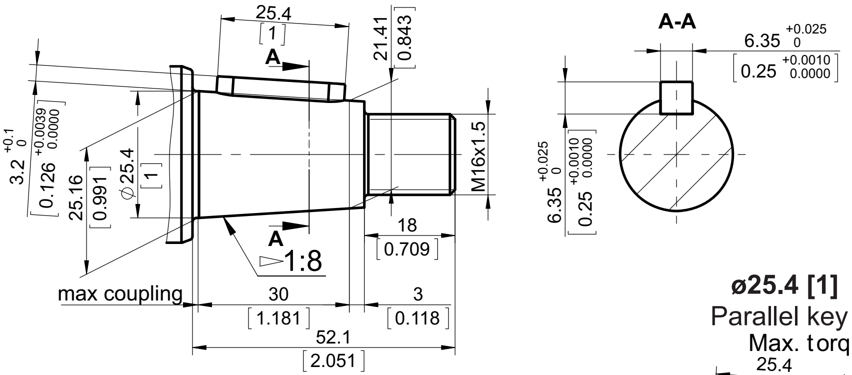
TD

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]



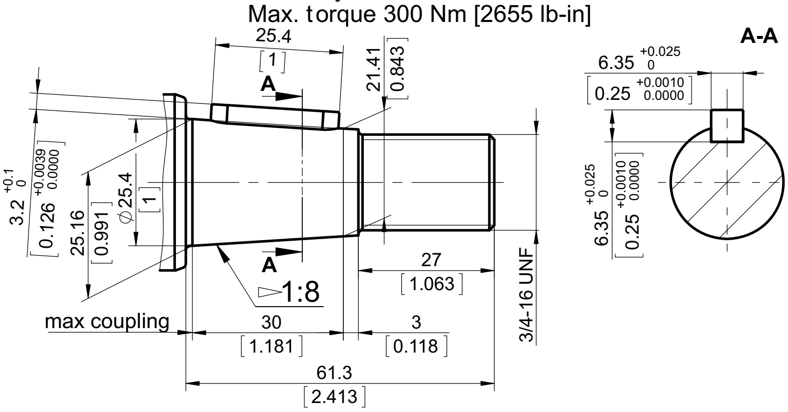
KH

ø25.4 [1] Tapered **1:8 [125:1000],**
Parallel key **1/4"x1/4"x1"**, M16x1.5
Max. torque 300 Nm [2655 lb-in]



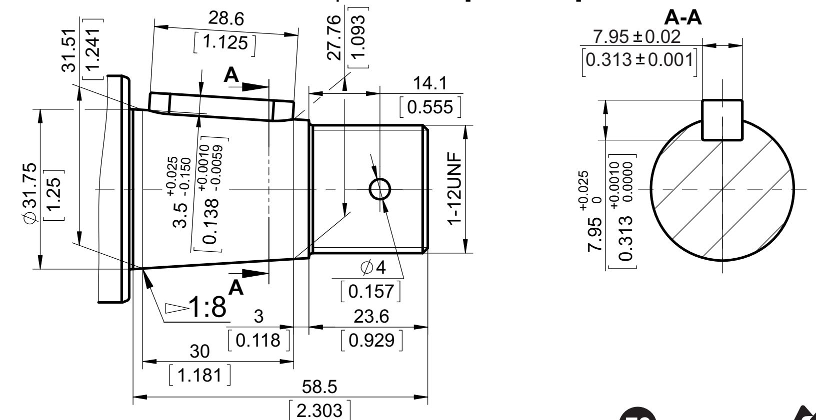
TH

ø25.4 [1] Tapered **1:8 [125:1000],**
Parallel key **1/4"x1/4"x1"**, 3/4-16 UNF
Max. torque 300 Nm [2655 lb-in]



TN

ø31.75 [1¼] Tapered **1:8 [125:1000],**
Parallel key **5/16"x5/16"x1⅛"**, 1-12UNF
Max. torque 500 Nm [4425 lb-in]



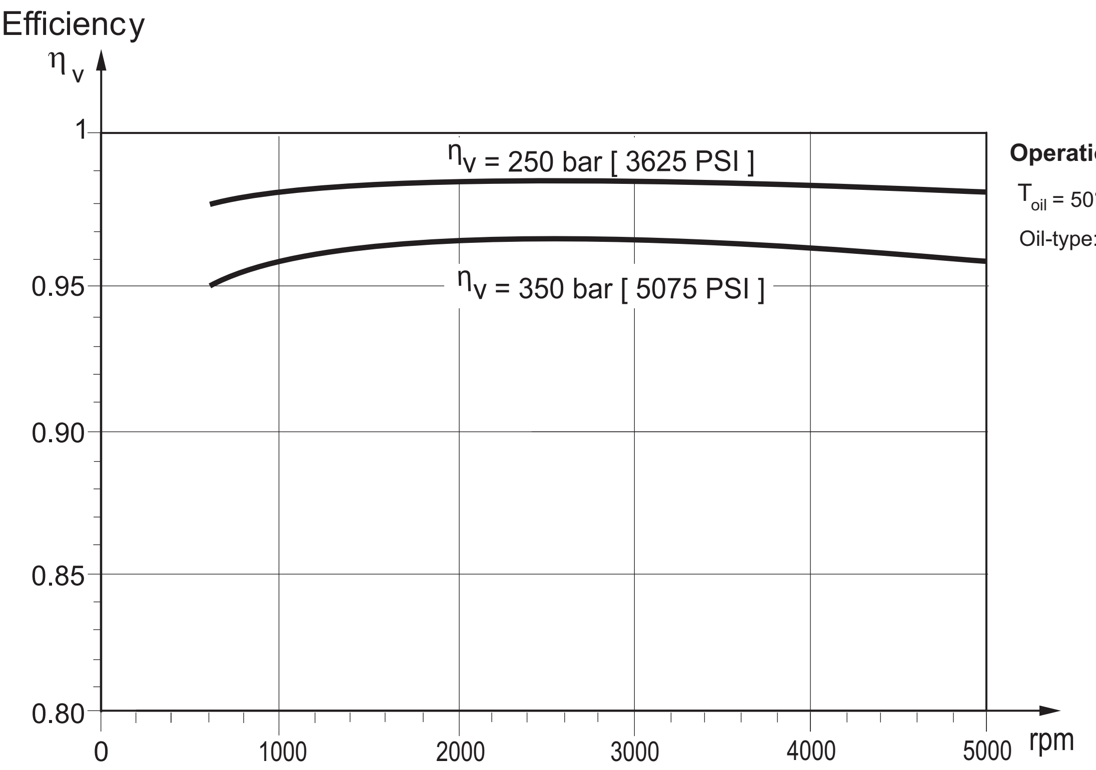
The required max. torque
must not be exceeded

mm [in]

MOTOR FUNCTION DIAGRAMS

The below efficiencies are applied for all motor displacements.

VOLUMETRIC EFFICIENCIES

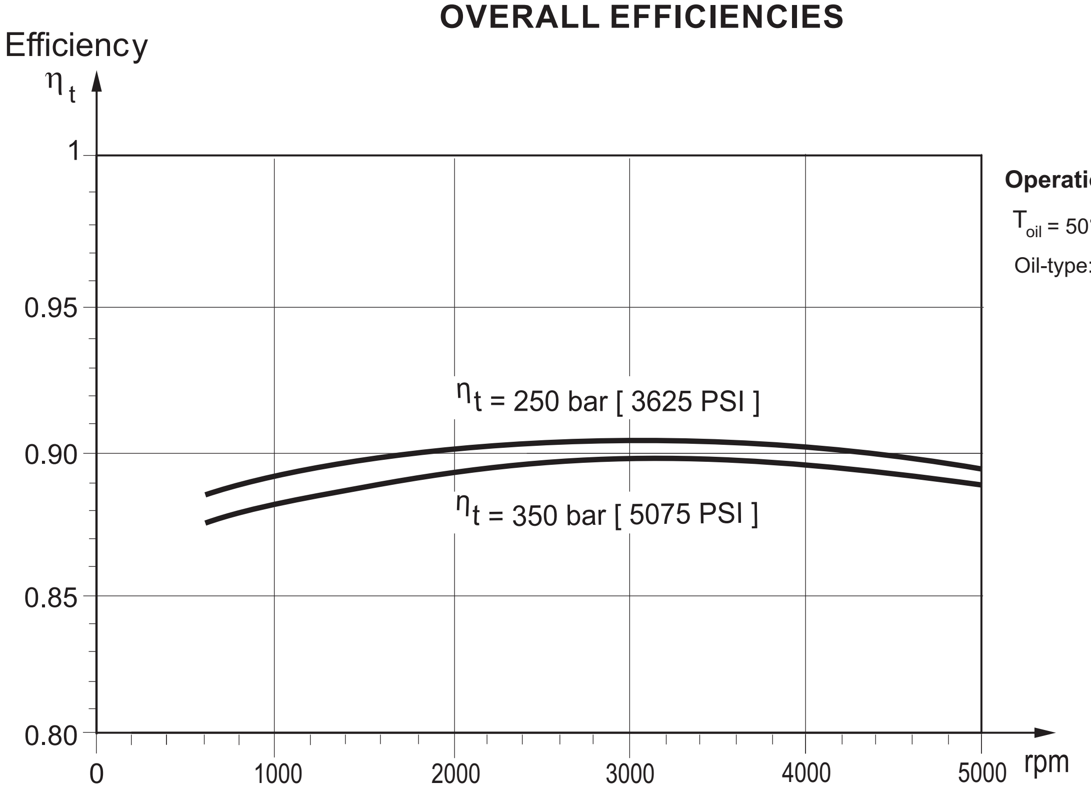


Operation conditions:

T_{oil} = 50°C [122 °F]

Oil-type: HPL 46

OVERALL EFFICIENCIES



Operation conditions:

T_{oil} = 50°C [122 °F]

Oil-type: HPL 46

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

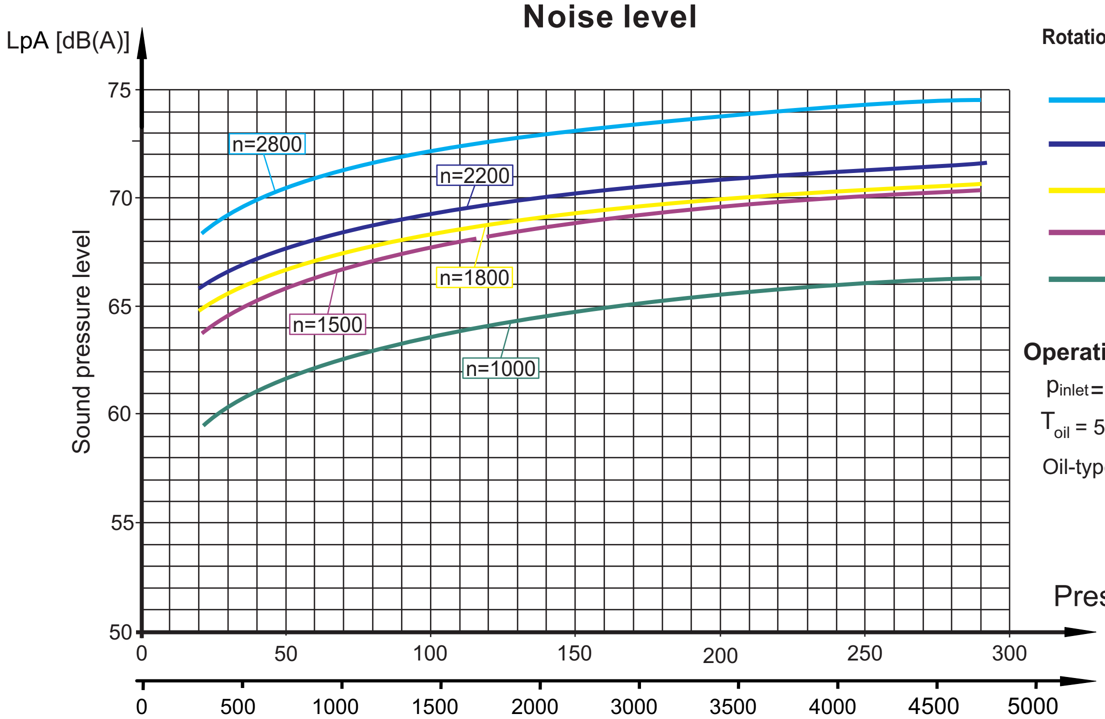
Efficiencies for a particular motor may vary from the shown in the diagram depending on the operating conditions.

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



Operation conditions:

p_{inlet}=1[14.5] bar [PSI] $_{abs}$

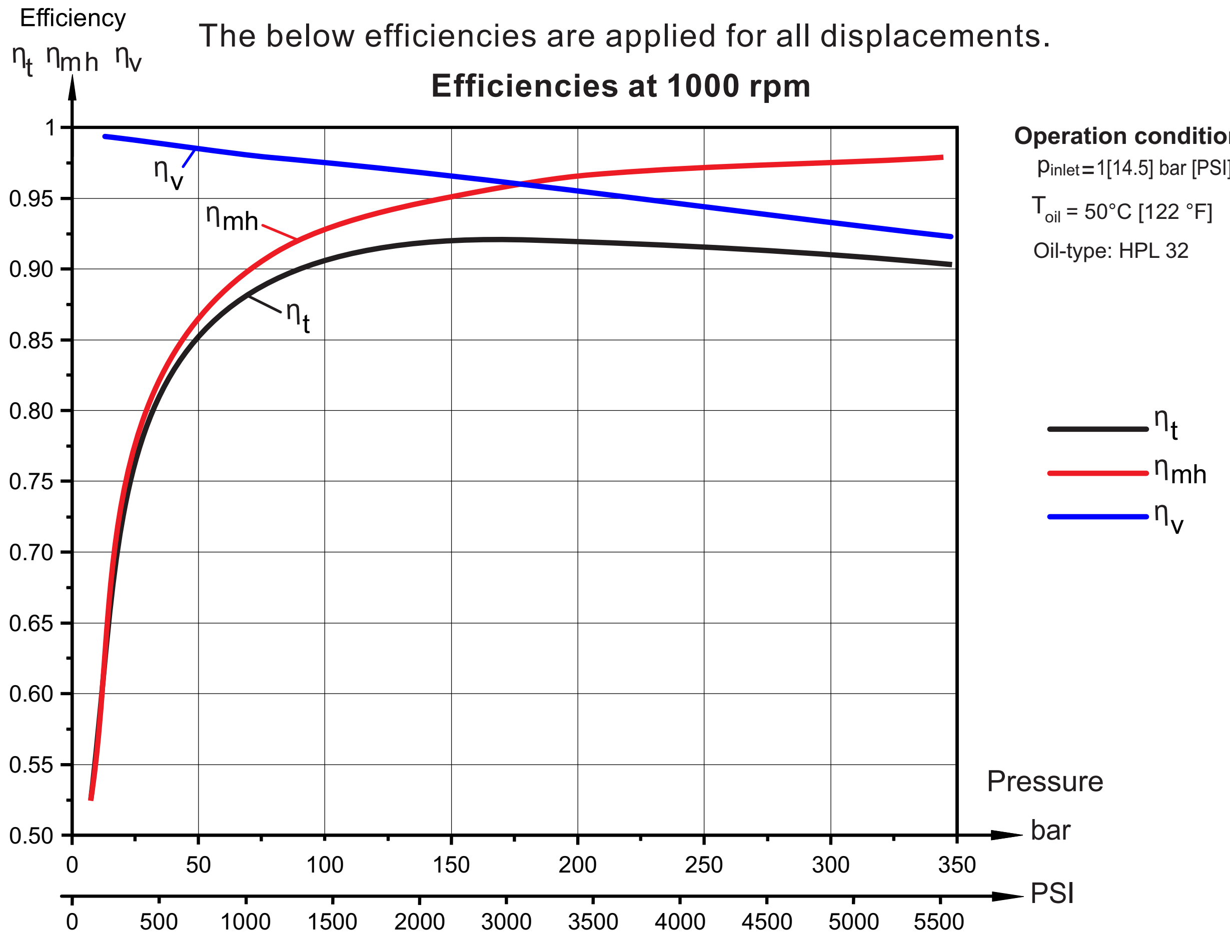
T_{oil} = 50°C [122 °F]

Oil-type: HPL 46

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



Operation conditions:

p_{inlet}=1[14.5] bar [PSI] $_{abs}$

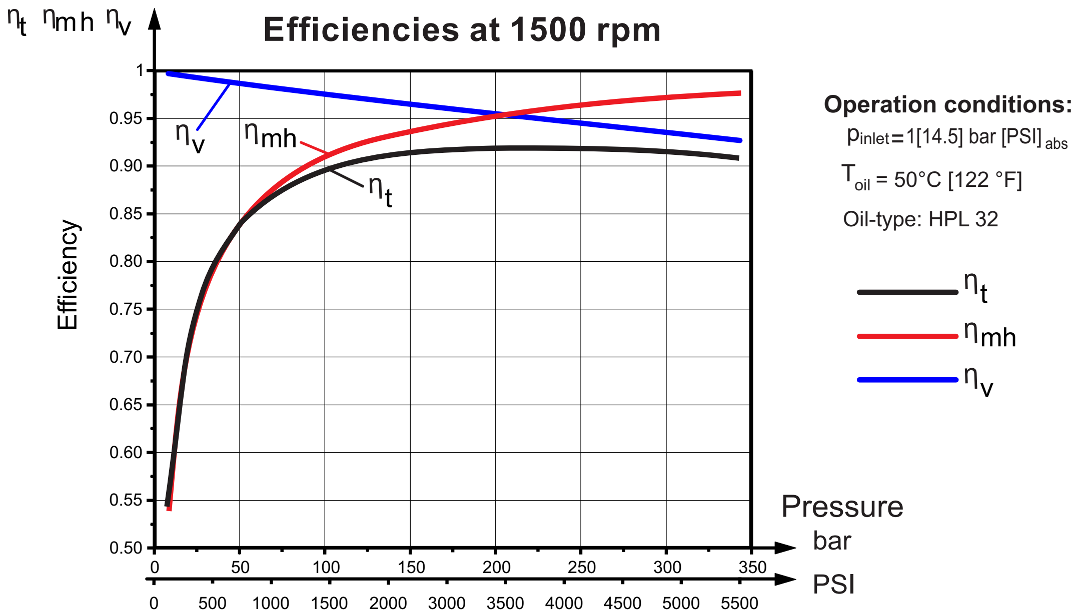
T_{oil} = 50°C [122 °F]

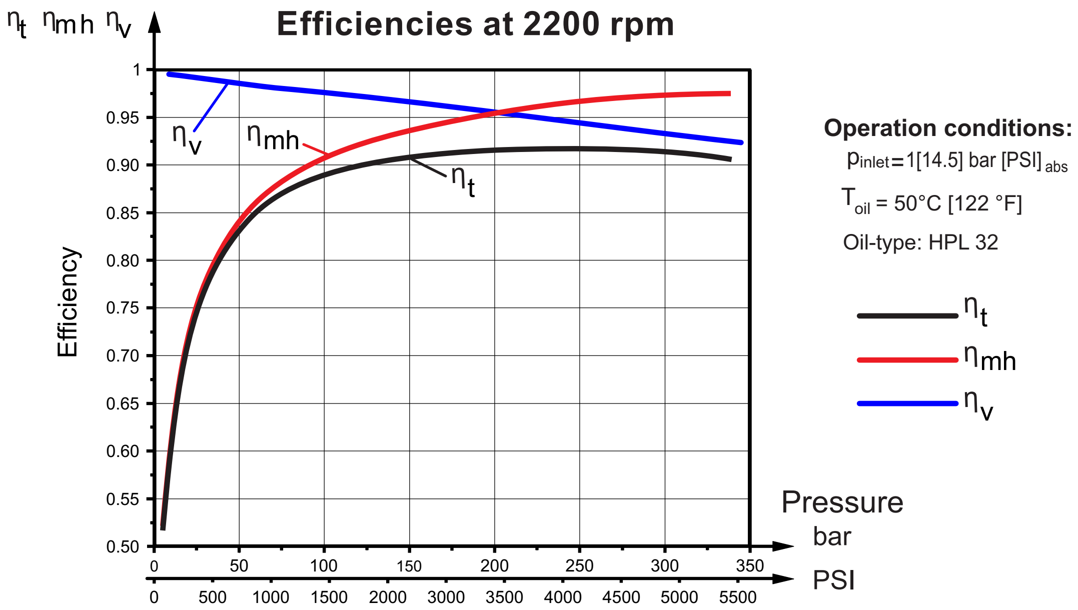
Oil-type: HPL 32

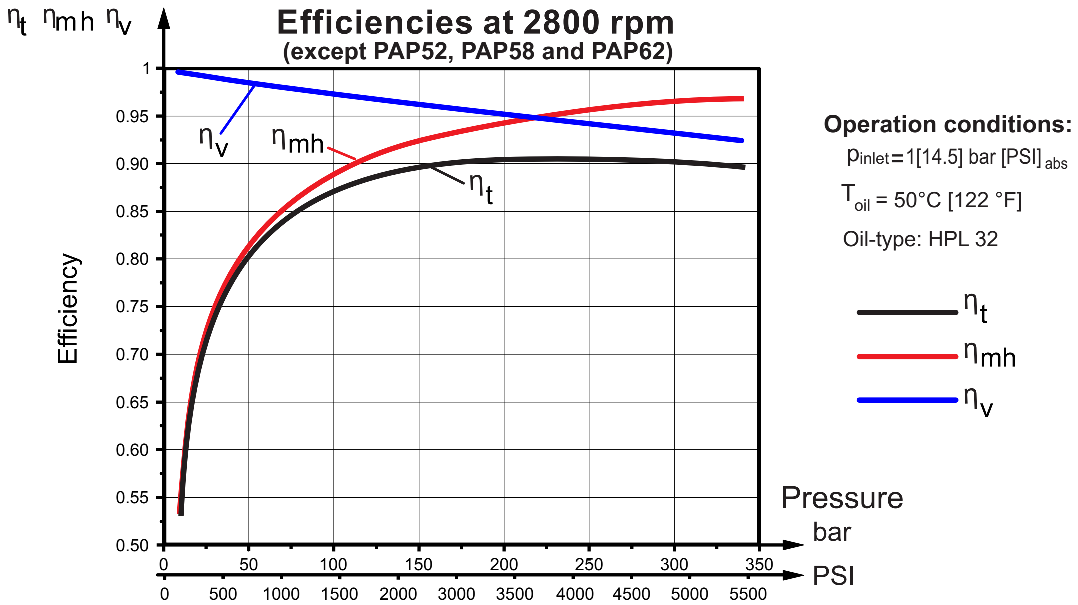
The pump size, pressure, torque, speed of rotation and flow rate required for a specific application can be calculated using the formulas on page 85

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

PUMP FUNCTION DIAGRAMS







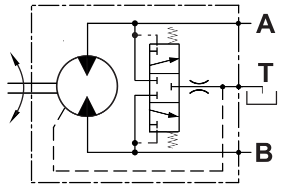
The pump size, pressure, torque, speed of rotation and flow rate required for a specific application can be calculated using the formulas on page 85

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

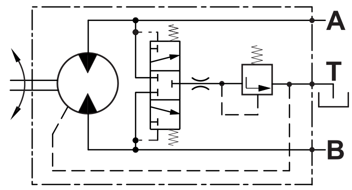
- For other options, please see Flow Setting of ordering code, considering the following possible values:

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

EXAMPLE

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 | **omit** | **10** | → pressure
Flow setting | **omit** | **L3.5** | **L5.5** | → flow rate

EXAMPLE

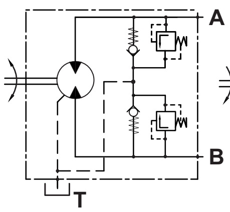
M A P B 5 0 S H 2 **F L U** — flow rate 6±2 l/min, charge pressure 16 bar
M A P B 5 0 S H 2 **F L U 1 0 L 5 . 5** — flow rate 5.5±1 l/min, charge pressure 10 bar
M A P B 5 0 S H 2 **F L U L 3 . 5** — flow rate 3.5±1 l/min, charge pressure 16 bar

Option **DAR, SARA, SARB**
Combined Anti-Cavitation and Reliev Valve

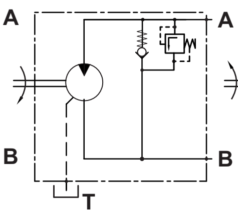
- Anti-cavitation check valve is used for applications such as Fan drive control;

- Pressure relief valves prevent excessive pressures in the high pressure loop.

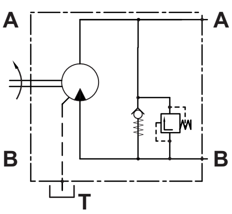
DAR



SARA



SARB



Please, consider the following possible values:

Pressure setting | **250** | **300** | **350** | → 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

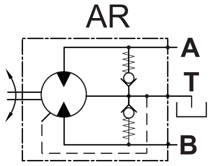
M A P B 5 0 S H 2 **S A R A 2 5 0**
Single Anti-Cavitation and Relief Valve, relief valve setting 250 bar
The valve is placed on port A

M A P B 5 0 S H 2 **S A R B 3 0 0**
Single Anti-Cavitation and ReliefValve, relief valve setting 300 bar
The valve is placed on port B

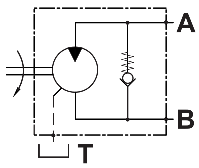
Option **AR, HRA, HRB**
Anti-Cavitation Valve

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

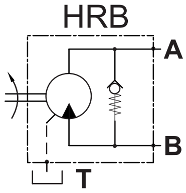
AR



HRA



HRB



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

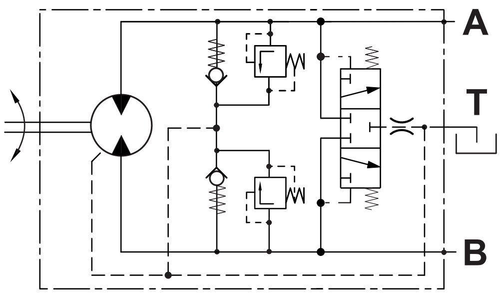
M A P B 5 0 S H 2 **H R B**
Single Anti-Cavitation Valve, the valve is placed on port B

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-cavitaion, 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

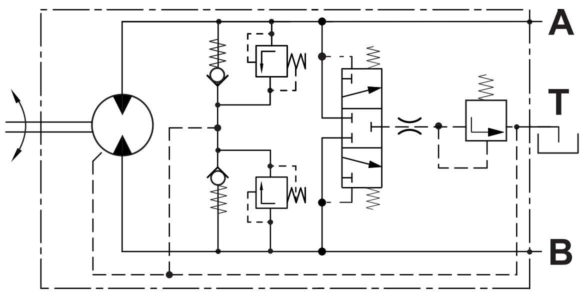
MAPB50SH2**DARP350**
Double Anti-Cavitation, Relief and Purge Valve,
relief valve setting 350 bar, purge valve flow rate 6±2 l/min

MAPB50SH2**DARP250L3.5**
Double Anti-Cavitation, Relief and Purge Valve,
relief valve setting is 250 bar, purge valve flow rate 3.5±1 l/min

MAPB50SH2**DARP300L5.5**
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-cavitaion, 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

MAPB50SH2**DARF350**
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

MAPB50SH2**DARF350-10**
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

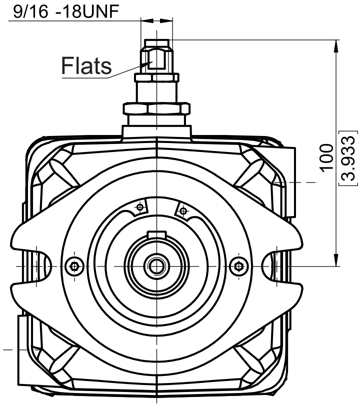
MAPB50SH2**DARF250L3.5**
Double Anti-Cavitation, Relief and Flush Valve, relief valve setting 250 bar
flush valve charge pressure 16 bar, flush valve flow rate is 3.5±1 l/min

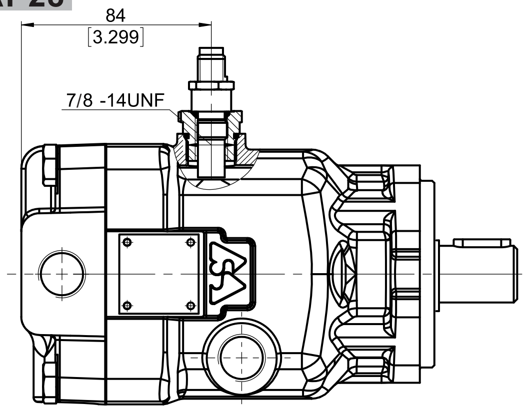
MAPB50SH2**DARF300-10L5.5**
Double Anti-Cavitation, Relief and Flush Valve, relief valve setting 300 bar
flush valve charge pressure 10 bar, flush valve flow rate 5.5±1 l/min

SPEED SENSORS

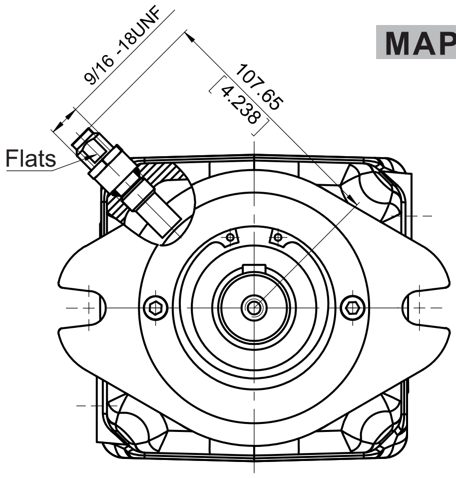
MOUNTING DIMENSIONS

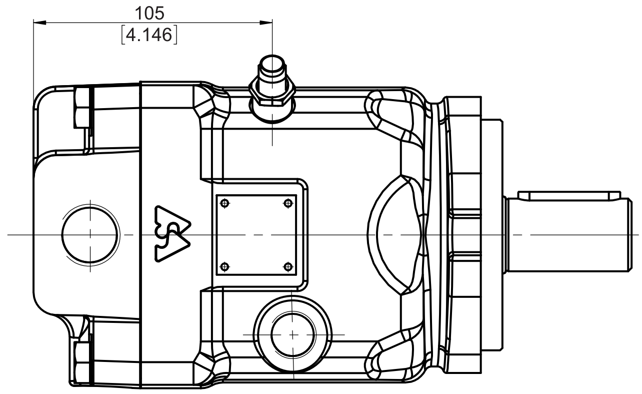
MAP28 and PAP28



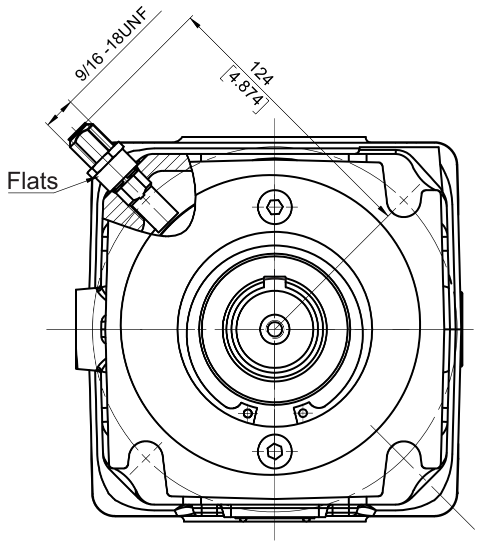


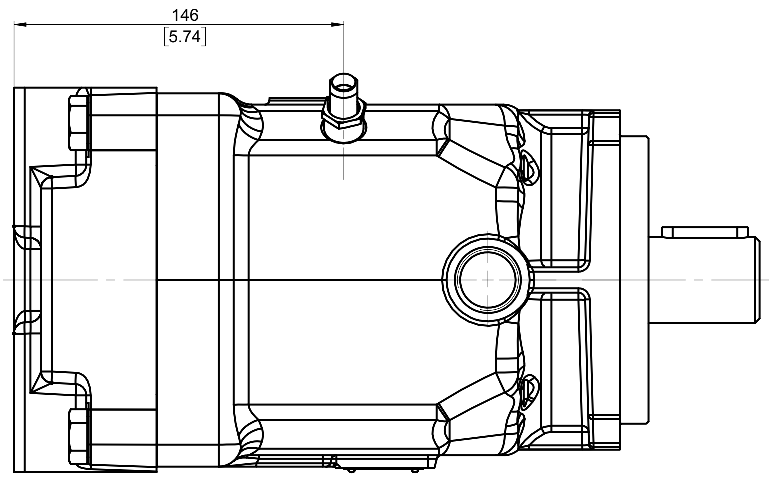
MAP62, MAPW62 and PAP62



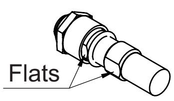


MAP100





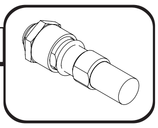
INSTALLATION



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 10^{+5}[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 insructions.

mm [in]



SPEED SENSORS

TECHNICAL DATA OF THE SPEED SENSOR

TECHNICAL DATA

Power supply	4.5 ... 30 VDC
Power consummation	< 15 mA without load
Pin connector	universal /PUSH-PULL/ 4P Delphi Connector DJ3042-2.5-21
Output measurements	Speed, Direction
Output maximum current	100 mA
Resident output voltage	1.5 V with 100 mA of the output 0.5 V without load of the output
Frequence range	0 ... 15 000 Hz
Degree of protection	IP 67
Temperature	-40 ... + 100 °C
Humidity	0 ... 95% RH

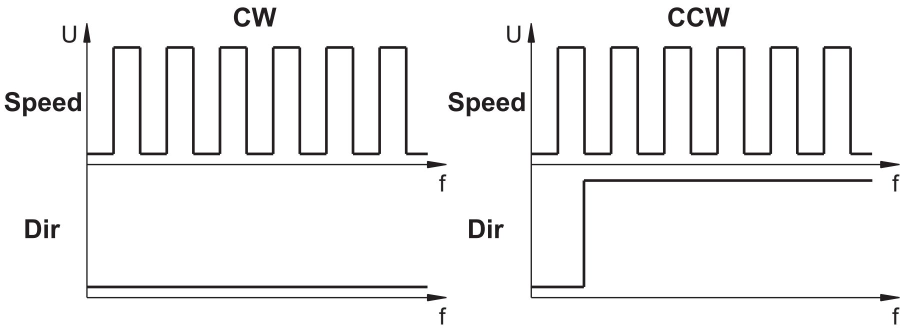
OUTPUT PULSES

per revolution

Motor Type	MAP28	MAP62	MAPW62	MAP100
Output Pulses	42	50	50	65

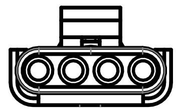
Pump Type	PAP28	PAP62
Output Pulses	42	50

OUTPUT DIAGRAMS



PIN CONNECTOR

4 pin Delphi Connector

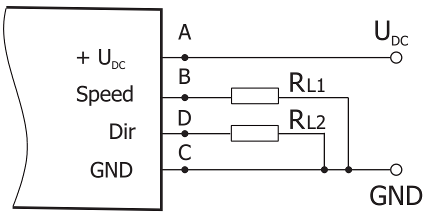


Pin	Connection	Cable Output
A	Power+	Red
B	Speed	White
C	Ground	Black
D	Direction	Green

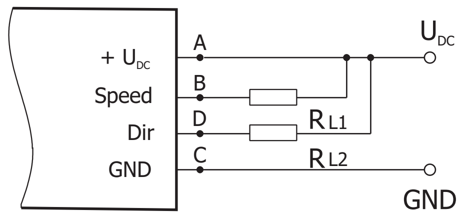
WIRING DIAGRAMS

Sensor could be in use for both type of connections - PNP or NPN

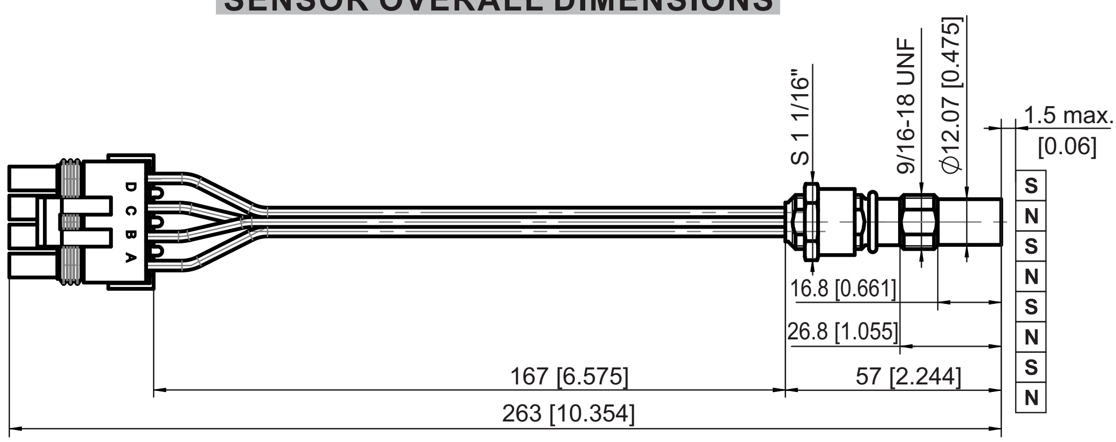
PNP



NPN



SENSOR OVERALL DIMENSIONS

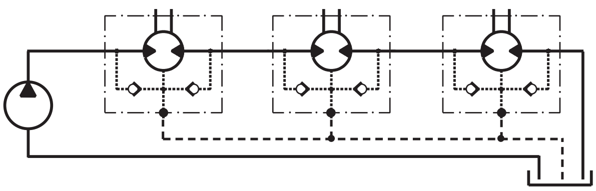


mm [in]

INSTALLATION

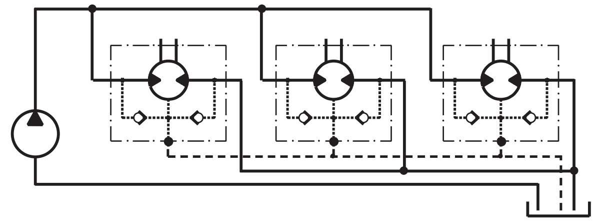
TYPE OF CONNECTION

Series connection
not recommended



open drain line is always required

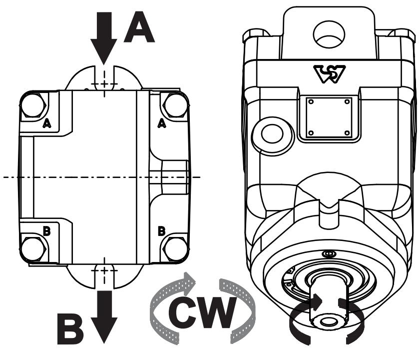
Parallel connection
recomended



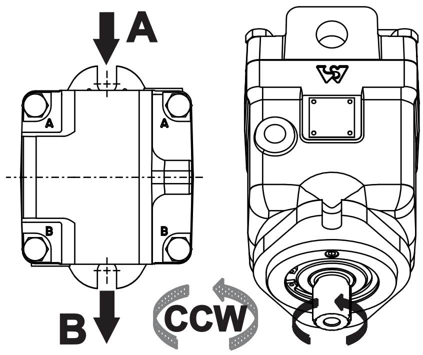
open drain line is always required

DIRECTION OF ROTATION

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



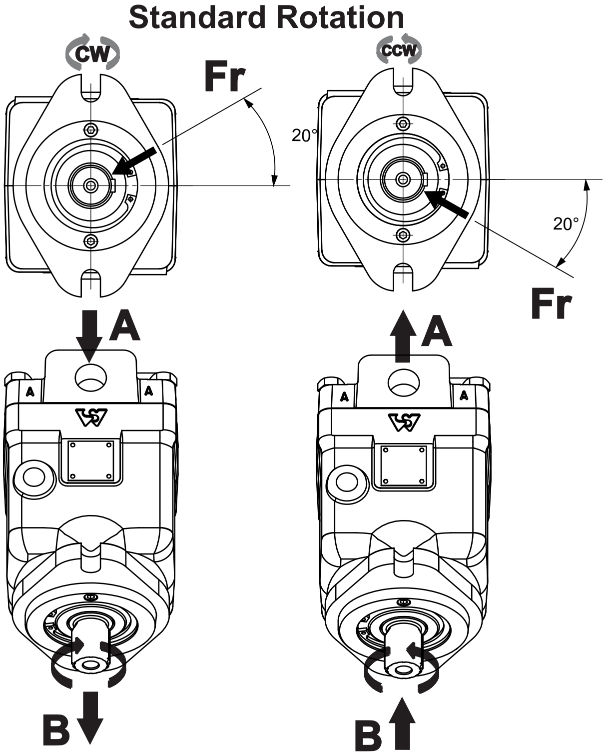
Reverse Rotation
Viewed from shaft end
Port **A** Pressurized - **CCW**
Port **B** Pressurized - **CW**



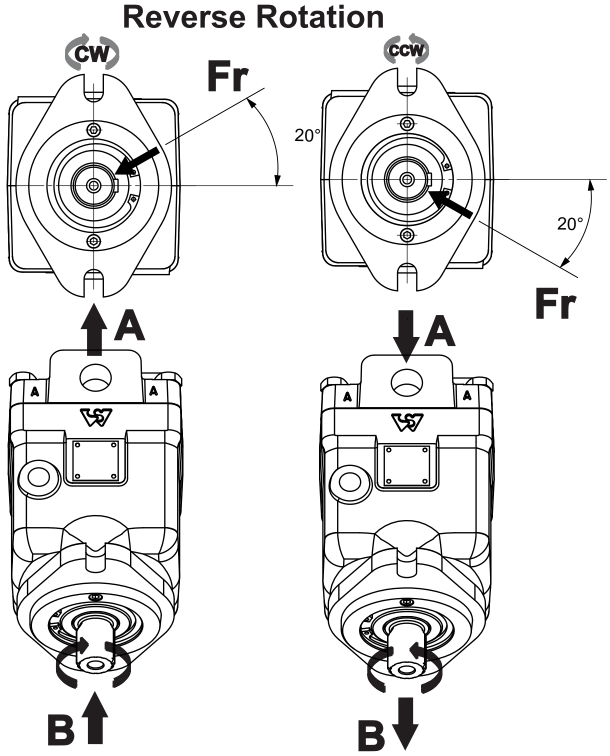
BEST POSITION FOR APPLYING RADIAL LOAD

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

Standard Rotation

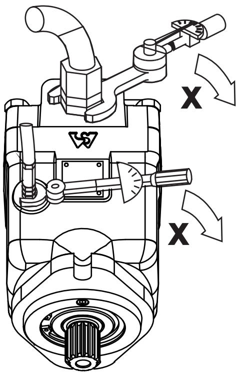


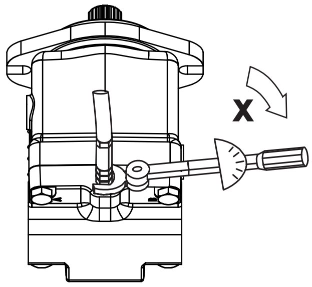
Reverse Rotation

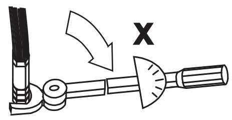
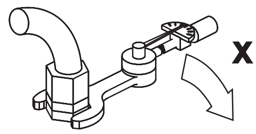


INSTALLATION

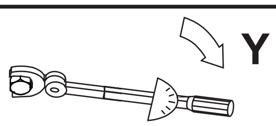
Recommended max. tightening torque X for metal plugs and orifice

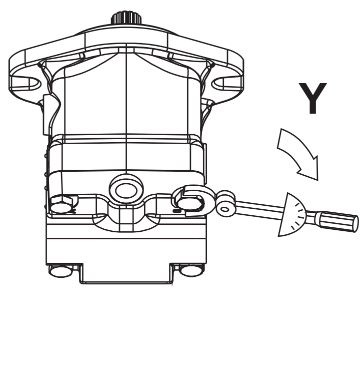




Screwed connection Anschlussart Raccord Tipo di collegamento Especie de unir Присоединительные резбы	 Max. Tightening Torque X, daNm [lb-in] Max. Anzugsmoment X, daNm [lb-in] Couple de serrage maxi X, daNm [lb-in] Momento di serraggio max. X, daNm [lb-in] Momento d'apretadura max. X, daNm [lb-in] Момент затяжки X, daNm [lb-in] 			
	With copper washer Mit Kupferscheibe Avec rondelle en cuivre Con rondella di rame De arandela de cobre С медной шайбой	With aluminium washer Mit Aluminiumscheibe Avec rondelle en aluminium Con rondella di alluminio De arandela d'aluminio С алюминиевой шайбой	With cutting edge Mit Dichtkante Tranchant Con tagliente di guarnizione De borde compactar С крутым бортиком	With "O" ring Mit "O" Ring Avec joint torique Con "O"-anello De "O"-anillo С резиновым кольцом
M 8	1.6 [150]	1 [88.5]	2 [180]	
M 10	3.2 [300]	1 [88.5]	2 [180]	
M 12	3.5 [310]	3 [265]	4 [360]	
M14x1.5	4 [360]	3 [265]	4 [360]	3 [265]
M16x1.5	5 [450]	5 [450]	6 [550]	5 [450]
M18x1.5	6 [550]	5 [450]	6 [550]	5 [450]
M20x1.5	8 [710]	8 [700]	10 [885]	8 [700]
M22x1.5	10 [900]	8 [700]	10 [885]	8 [700]
M24x1.5	12 [1070]	10 [885]	10 [885]	10 [885]
M27x2	16 [1420]	13 [1150]	10 [885]	10 [885]
G 1/4	4 [360]	3 [265]	4 [360]	2 [180]
G 3/8	5 [450]	5 [450]	6 [550]	2 [180]
G 1/2	8 [710]	8 [700]	10 [885]	3 [265]
G 3/4	16 [1420]	13 [1150]	16 [1400]	5 [450]
G 1	20 [1800]	20 [1770]	25 [2200]	8 [700]
1/8 - 14(UNF)	2.5 [230]			0.7 [62]
3/8-24(16)UNF(UNC)	3 [270]			1.5[130]
7/16-20(16) UNF	3.5 [310]			2 [180]
9/16-18 UNF	4 [360]			2 [180]
9/16-20 UNF	5 [450]			3.5[310]
3/4 -16 UNF	6 [550]			6 [550]
7/8 -14(16)UNF	10 [900]			7 [620]
1 1/16 - 12 UN	16 [1420]			9 [800]
1 5/16 -12 UN	20 [1800]			16 [1400]
1/2 -14 NPTF				3 [265]
1/4 - 18 NPTF				3 [265]

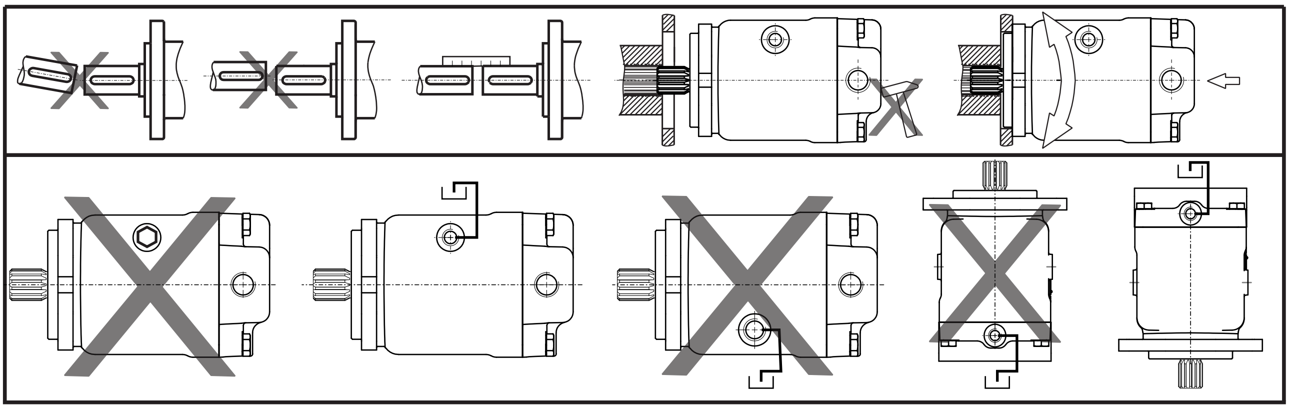
Recommended max. tightening torque Y for screws and bolts

Max. Tightening Torque Y, daNm [lb-in] Max. Anzugsmoment Y, daNm [lb-in] Couple de serrage maxi Y, daNm [lb-in] Momento di serraggio max. Y, daNm [lb-in] Momento d'apretadura max. Y, daNm [lb-in] Момент затяжки Y, daNm [lb-in] 						
Motor Type	End Cover - Body		Axial Piston Group - Body		Axial Piston Group	
	Bolt	daNm [lb-in]	Screw	daNm [lb-in]	Screw	daNm [lb-in]
MAPA28	M10 - 12.9	7[620]	M4 - 12.9	0.4[40]	M5 - 12.9	0.6[60]
MAPB28	M10 - 12.9	7[620]	M5 - 12.9	0.6[60]	M5 - 12.9	0.6[60]
MAP62	M12 - 12.9	10[890]	M6 - 12.9	1.3[120]	M6 - 12.9	1.3[120]
MAPW62	M12 - 12.9	10[890]	M6 - 12.9	1.3[120]	M6 - 12.9	1.3[120]
MAP100	M14 - 12.9	13[1160]	M8 - 12.9	3.5[310]	M6 - 12.9	1.3[120]
PAPA28	M10 - 12.9	7[620]	M4 - 12.9	0.4[40]	M5 - 12.9	0.6[60]
PAP62	M12 - 12.9	10[890]	M6 - 12.9	1.3[120]	M6 - 12.9	1.3[120]



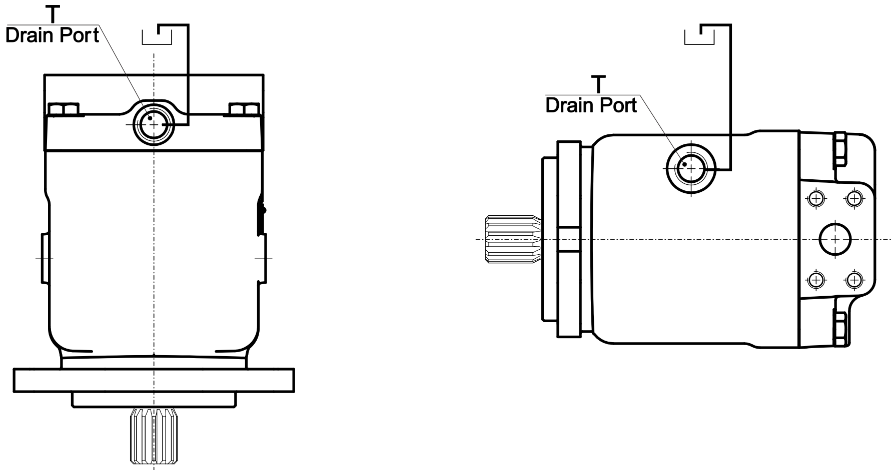
INSTALLATION

At start-up and during operation the motor(pump) housing has to be filled up with hydraulic fluid. Start-up has to be carried out at low or moderate speed and without load (for example 1000 rpm and pressure 50[725] bar [PSI]) till the motor(pump) and the hydraulic scheme are filled up with oil. Generally the start-up needs 10-15 minutes to finish. The leakage oil in the housing has to be discharged to the tank through the highest positioned drain port T. The max. pressure in the drain line is 5 [70] bar [PSI].



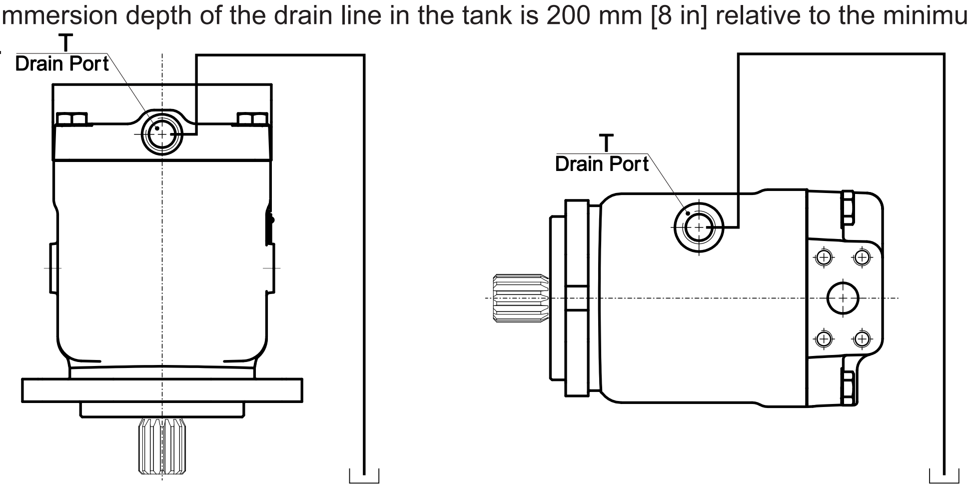
Installation below the tank level (recommended)

- Fill up the axial piston motor(pump) before the start-up through the highest positioned drain port T.
- Operate the motor(pump) at low speed till the motor system is completely filled up.
- The minimum immersion depth of the drain line in the tank is 200 mm [8 in] relative to the minimum oil level in the tank.



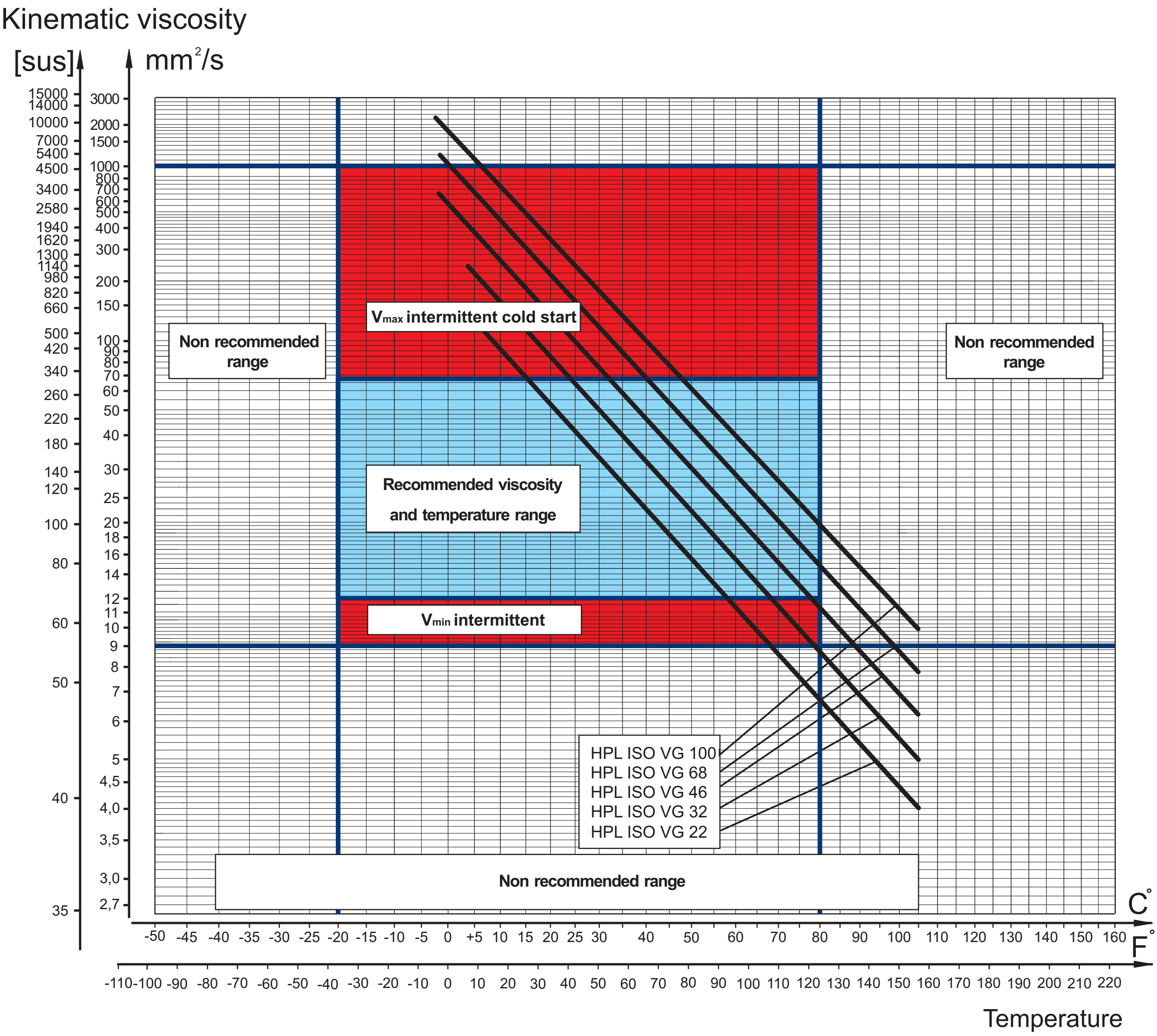
Installation on top of the tank level

- Fill up the axial piston motor(pump) before the start-up through the highest positioned drain port T.
- Operate the motor(pump) at low speed till the motor system is completely filled up.
- The minimum immersion depth of the drain line in the tank is 200 mm [8 in] relative to the minimum oil level in the tank.



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 $\eta_t = \eta_{mh} . \eta_v \quad \eta_{mh} = \frac{\eta_t}{\eta_v} \quad \eta_v = \frac{\eta_t}{\eta_{mh}}$

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 $\eta_t = \eta_{mh} . \eta_v \quad \eta_{mh} = \frac{\eta_t}{\eta_v} \quad \eta_v = \frac{\eta_t}{\eta_{mh}}$

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

APPLICATION FORMULAS

1.Motor speed: n, RPM

$$n=\frac{2{,}65\,.\,v_{km}\,.\,i}{R_m} \qquad n=\frac{168\,.\,v_{ml}\,.\,i}{R_{in}}$$

v_{km}- vehicle speed [km/h]
v_{ml}- vehicle speed [mil/h]
R_m- wheel rolling radius [m]
R_{in}- wheel rolling radius [in]
i- gear ratio between motor and wheels.
If no gearbox, use i=1.

2.Rolling resistance: RR, daN [lbs]
The resistance force resulted in wheels contact with different surfaces:

$$RR=G\,.\,\rho$$

G- total weight loaded on vehicle, daN [lbs];
ρ- rolling resistance coefficient (Table 1).

3.Grade resistance: GR, daN [lbs]

$$GR=G\,.\,(\sin\alpha+\rho\,.\,\cos\alpha)$$

α - gradient negotiation angle (Table 2)

Table 2

Grade %	α Degrees	Grade %	α Degrees
1%	0° 35'	12%	6° 5'
2%	1° 9'	15%	8° 31'
5%	2° 51'	20%	11° 19'
6%	3° 26'	25%	14° 3'
8%	4° 35'	32%	18°
10%	5° 43'	60%	31°

Table 3

Surface	Frictional factor f
Steel on steel	0.15 ÷ 0.20
Rubber tire on polluted surface	0.5 ÷ 0.7
Rubber tire on asphalt	0.8 ÷ 1.0
Rubber tire on concrete	0.8 ÷ 1.0
Rubber tire on grass	0.4

4. Acceleration force: FA, daN [lbs]
Force **FA** necessary for acceleration from 0 to maximum speed **v** and time **t** can be calculated with a formula:

$$FA=\frac{v_{km}\,.\,G}{3{,}6\,.\,t\,.\,10}\ [daN] \qquad FA=\frac{v_{ml}\,.\,G}{2{,}2\,.\,t}\ [lbs]$$

FA- acceleration force, daN [lbs]
t- time, [s]

5.Tractive effort: DP, daN [lbs]
Tractive effort DP is the additional force of trailer. This value will be established as follows:
-acc.to constructor's assessment;
-as calculating forces in items 2, 3 and 4 of trailer. The calculated sum corresponds to the tractive effort requested.

6.Total tractive effort: TE, daN [lbs]
Total tractive effort **TE** is total effort necessary for vehicle motion; that the sum of forces calculated in items from 2 to 5 and increased with 10 % because of air resistance.

$$TE=1{,}1.(RR+GR+FA+DP)$$

RR - force required to overcome the rolling resistance;
GR- force required to slope upwards;
FA- force required to accelerate (acceleration force);
DP- additional tractive effort (trailer).

7.Motor Torque moment: M, daNm [in-lb]
Necessary torque moment for every hydraulic motor:

$$M=\frac{TE\,.\,R_m[R_{in}]}{N\,.\,i\,.\,\eta_M}$$

N- motor numbers;
η_M- mechanical gear efficiency (if it is available).

8.Cohesion between tire and road covering: M_w, daNm [in-lb]

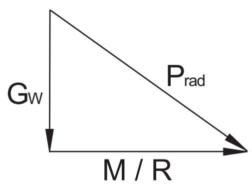
$$M_W=\frac{G_W\,.\,f\,.\,R_m[R_{in}]}{i\,.\,\eta_M}$$

To avoid wheel slipping, the following condition should be observed $M_W > M$
f - frictional factor;
G_w- total weight over the wheels, daN [lbs].

9.Radial motor loading: P_{rad}, daN [lbs]
When the motor is used for motion with a ring or gear mounted directly on the motor shaft, the total radial load of the motor shaft **P_{rad}** is the sum of the motion force and the weight force acting on the ring .

G_W - Weight held by wheel;
P_{rad} - Total radial loading of motor shaft;
M/R- Motion force.

$$P_{rad}=\sqrt{G_W^2+\left(\frac{M}{R}\right)^2}$$



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