MANNESMANN REXROTH

Brueninghaus Hydromatik

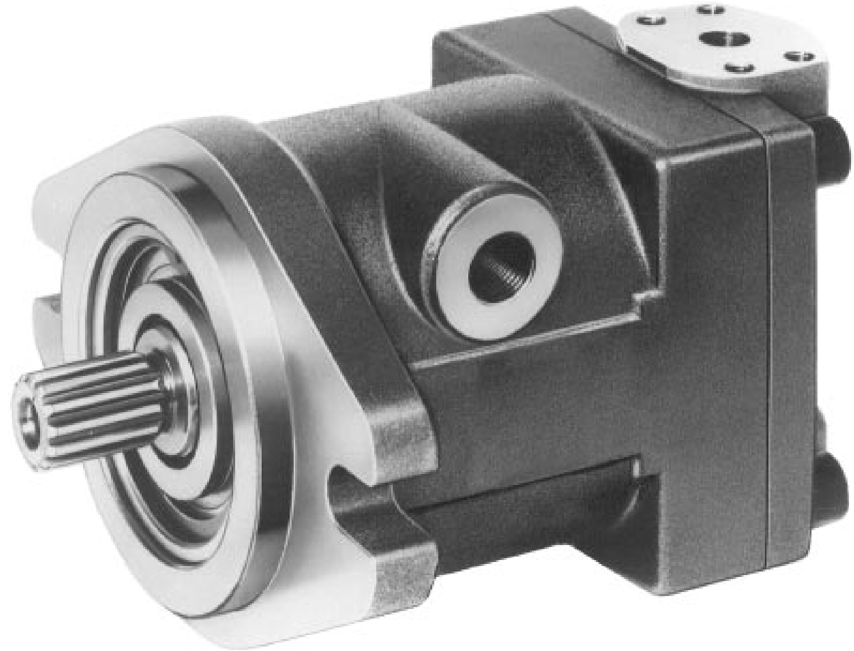
Fixed Displacement Motor A4FM

Series 3, for open and closed circuits
axial piston - swashplate design

Sizes 22…56	Nominal pressure 400 bar	Peak pressure 450 bar

RE 91100/12.95

replaces 10.90



Fixed displacement motor A4FM is an axial piston motor of swashplate design suitable for use in both open and closed circuits in high pressure ranges.
Output speed is proportional to input flow and inversely proportional to motor displacement. Output torque increases with the pressure drop across the motor between the high and low pressure sides.
This motor is suitable for both industrial and mobile applications.

Special Features

- Proven A4 rotary group
- Long service life
- Favourable power/weight ratio
- Compact design for special applications where A2FM cannot be applied
- Optimum efficiencies
- Economic design
- SAE mounting flange

Ordering Code

A4F	M		/	3	1	W	-	P		C	

Hydraulic fluid

Mineral oil (no code)

Axial piston unit

Swashplate design, fixed displacement	**A4F**

Mode of operation

Motor	**M**

Size

	22	28	40	56
≙ Displacement V_g (cm^3)	●	●	●	●

Series

	3

Index

	1

Direction of rotation

Viewed on shaft end	alternating	**W**

Seals

NBR (nitril-caoutchouc)	**P**

Shaft end

	22	28	40	56	
Splined shaft SAE 7/8"	●	●	–	–	**S**
Splined shaft SAE 1"	–	●	–	–	**T**
Splined shaft DIN 5480	–	–	●	●	**Z**

Mounting flange

	22	28	40	56	
SAE 2-hole	●	●	●	●	**C**

Service line connections

	22	28	40	56	
Ports A and B SAE at side (opposite side)	●	●	●	–	**02**
Ports A and B SAE at side (same side)	–	–	–	●	**10**

● = available
– = not available

Technical Data

Fluid

We request that before starting a project detailed information about the choice of pressure fluids and application conditions are taken from our catalogue sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (fire resistance fluids, HF).
When using HF- or environmentally acceptable hydraulic fluids possible limitations for the technical data have to be taken into consideration. If necessary please consult our technical department (please indicate type of the hydraulic fluid used for your application on the order sheet).

Operating viscosity range

In order to obtain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected from within the range:

ν_{opt} = operating viscosity 16...36 mm²/s

referred to the loop temperature (closed circuit) or tank temperature (open circuit).

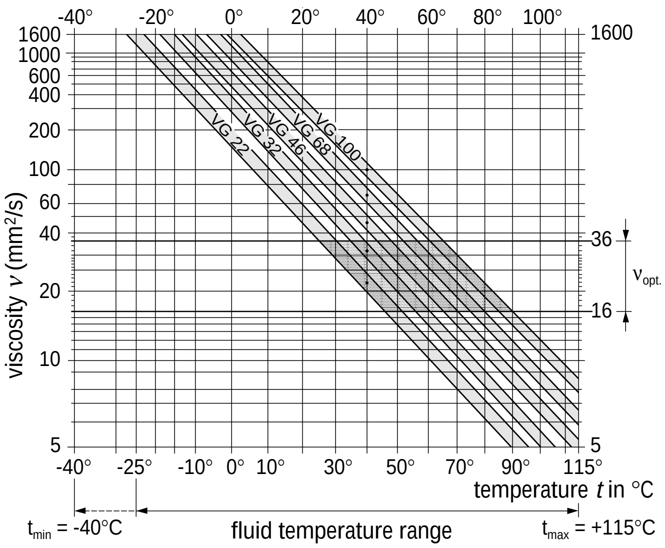
Viscosity limits

The limiting values for viscosity are as follows:
ν_{min} = 5 mm²/s,
short term at a max. permissible temperature of t_{max} = 115°C
ν_{max} = 1600 mm²/s, short term on cold start (t_{min} = -40°C)

Please note that the max. fluid temperature of 115°C is also not exceeded in certain areas (for instance bearing area).

At temperatures of -25°C up to -40°C special measures may be required for certain installation positions. Please contact us for further information.

Selection diagram



Notes on the selection of the hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the loop (closed circuit) or the tank temperature (open circuit) in relation to the ambient temperature.
The hydraulic fluid should be selected so that within the operating temperature range, the operating viscosity lies within the optimum range (ν_{opt}) (see shaded section of the selection diagram). We recommend that the highest possible viscosity range should be chosen in each case.
Example: At an ambient temperature of X°C the operating temperature is 60°C. Within the operating viscosity range (ν_{opt}; shaded area), this corresponds to viscosity ranges VG 46 or VG 68. VG 68 should be selected.
Important: The leakage oil (case drain oil) temperature is influenced by pressure and motor speed and is always higher than the circuit temperature. However, at no point in the circuit may the temperature exceed 115°C.
If it is not possible to comply with the above condition because of extreme operating parameters or high ambient temperatures we recommend housing flushing. Please consult us.

Filtration

The finer the filtration the better the achieved purity grade of the pressure fluid and the longer the life of the axial piston unit. To ensure the functioning of the axial piston unit a minimum purity grade of:

9 to NAS 1638
6 to SAE
18/15 to ISO/DIS 4406 is necessary.

At very high temperatures of the hydraulic fluid (90°C to max. 115°C) at least cleanless class

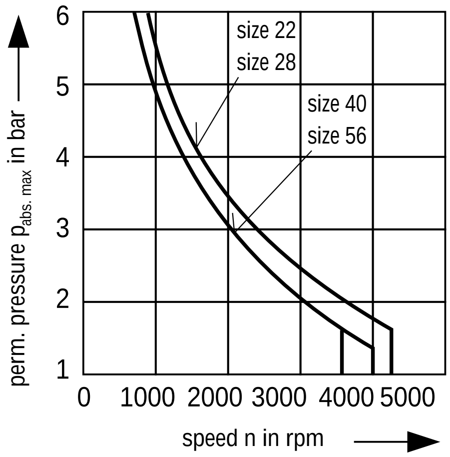
8 to NAS 1638
5 to SAE
17/14 to ISO/DIS 4406 is necessary.

If above mentioned grades cannot be maintained please consult supplier.

Case drain pressure

The lower the speed and the case drain pressure the higher the life expectation of the shaft seal ring.

Shaft seal ring **NBR** (nitril-caoutchouc)



The values shown in the diagram are permissible loads of the seal ring and shall not be exceeded.
If the values are exceeded, the life of the shaft seal will be reduced.

Note:
max. permissible speeds of the fixed displacement motor are given in the table on page 4.
max. perm. housing pressure ______________ $p_{abs\ max}$ 6 bar.

The pressure in the housing must be greater than the external pressure on the shaft seal.

Direction of flow

clockwise rotation	anti-clockwise rotation
A to **B**	**B** to **A**

Speed range
There is no limitation on minimum speed n_{min}. If uniformity of rotation is required, however, speed n_{min} should not be allowed to fall below 50 rpm. See table for max. permissible speeds.

Installation position
Optional. The motor housing must be filled with fluid prior the commissioning, and must remain full whenever it is operating. For extensive information on installation position, please consult our data sheet RE 90270 before completing your design work.

Operating pressure range
Maximum pressure at port A or B

Shaft end	size	nominal pressure p_N	peak pressure p_{max}
Splined shaft SAE 7/8" (S)	22	400 bar	450bar
Splined shaft SAE 7/8" (S)	28	315 bar	350 bar
Splined shaft SAE 1" (T)	28	400 bar	450 bar
Splined shaft DIN 5480 (Z)	40, 56	400 bar	450 bar

(Pressure data to DIN 24312)

The summ of the pressures at ports A and B may not exceed 700 bar. Pressure per side 450 bar max. or 350 bar.

Output drive
permissible axial and radial loading on drive shaft

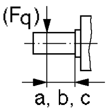
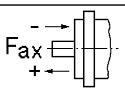
Size				**22**	**28**	**28**	**40**	**56**
Shaft end				S	S	T	Z	Z
Distance of Fq (from shaft shoulder) 		a	mm	17,5	17,5	17,5	17,5	17,5
		b	mm	30	30	30	30	30
		c	mm	42,5	42,5	42,5	42,5	42,5
Max. permissible radial force at distance	a	$F_{q\,max}$	N	1300	1300	2500	3600	5000
	b	$F_{q\,max}$	N	1100	1100	2000	2891	4046
	c	$F_{q\,max}$	N	900	900	1700	2416	3398
Max. permissible axial load 		$\pm F_{ax\,max}$	N	987	987	987	1500	2200
Minimum pinion dia		$D_{R\,min}$	mm	56	56	64	75	75
Minimum V-belt pulley dia		$D_{K\,min}$	mm	111	111	127	150	150

Table of values (theoretical values, without considering η_{mh} and η_v; values rounded)

Size			**22**	**28**	**40**	**56**
Displacement	V_g	cm^3	22	28	40	56
Max. speed	$n_{max\ continous}$	rpm	4250	4250	4000	3600
Intermittent max. speed [1])	$n_{max\ interm.}$	rpm	5000	5000	5000	4500
Max. flow	$q_{V\,max}$	L/min	93	119	160	202
Torque constants	T_K	Nm/bar	0,35	0,445	0,64	0,89
Torque at Δp = 400 bar	T	Nm	140	178	255	356
Output power at n_{max} u. Δp = 400 bar	P	kW	62	79	107	134
Moment of inertia about drive axis	J	kgm^2	0,0015	0,0015	0,0043	0,0085
Weight (approx.)	m	kg	11	11	15	21

[1]) Intermittent max. speed at overspeed: Δp = 70…150 bar

Calculation of size

Flow $$q_V = \frac{V_g \cdot n}{1000 \cdot \eta_v}$$ in L/min

Output speed $$n = \frac{q_V \cdot 1000 \cdot \eta_v}{V_g}$$ in rpm

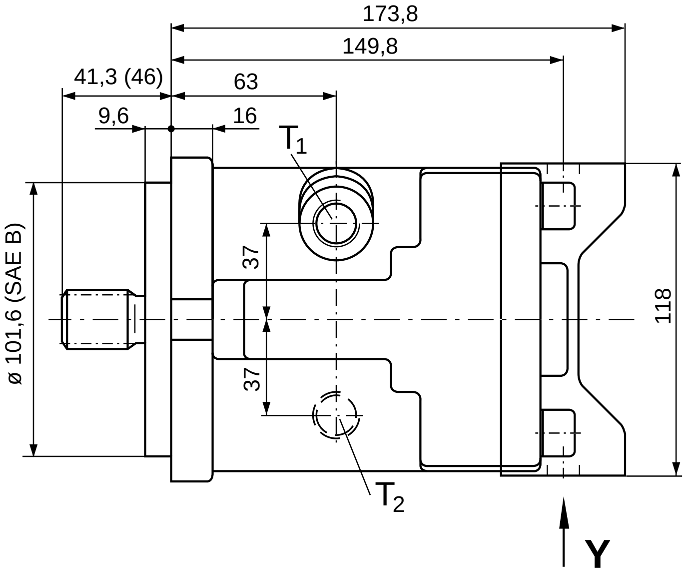
Output torque $$T = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi} = \frac{1{,}59 \cdot V_g \cdot \Delta p \cdot \eta_{mh}}{100}$$ in Nm

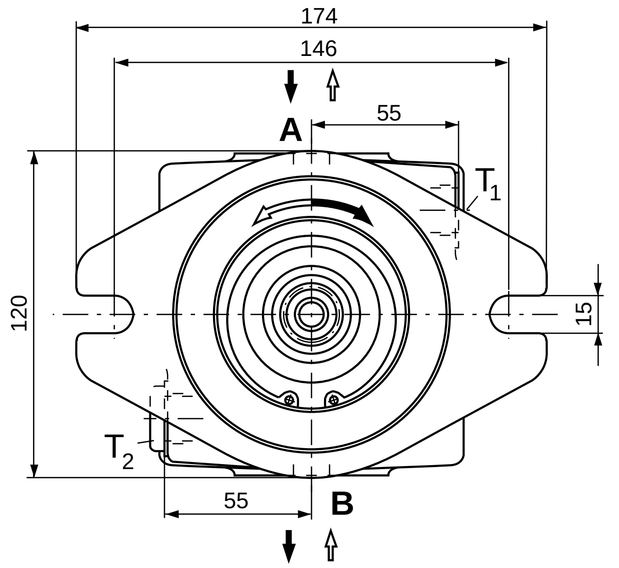
or $$T = T_K \cdot \Delta p \cdot \eta_{mh}$$ in Nm

Output power $$P = \frac{2\,\pi \cdot T \cdot n}{60\,000} = \frac{T \cdot n}{9549} = \frac{q_V \cdot \Delta p}{600} \cdot \eta_t$$ in kW

V_g = geometric displacement per rev. in cm^3
T = torque in Nm
Δp = pressure differential in bar
n = speed in rpm
T_K = torque constants in Nm/bar
η_v = volumetric efficiency
η_{mh} = mech. -hyd. efficiency
η_t = overall efficiency

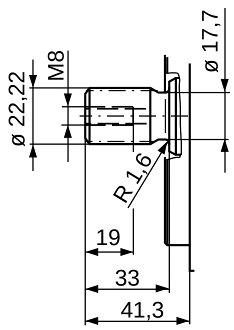
Unit Dimensions, Sizes 22, 28



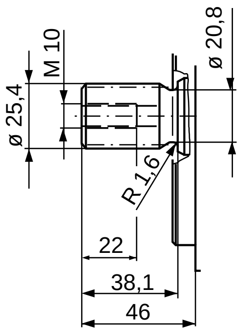


Shaft ends

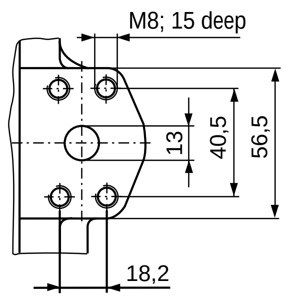
S (sizes 22, 28)
Splined shaft SAE 7/8",
(SAE B), 30° pressure angle,
13 teeth, 16/32 pitch,
flat root, side fit,
tolerance class 5
ANSI B92.1a-1976



T (sizes 28)
Splined shaft SAE 1",
(SAE B-B), 30° pressure angle,
15 teeth, 16/32 pitch,
flat root, side fit,
tolerance class 5
ANSI B92.1a-1976



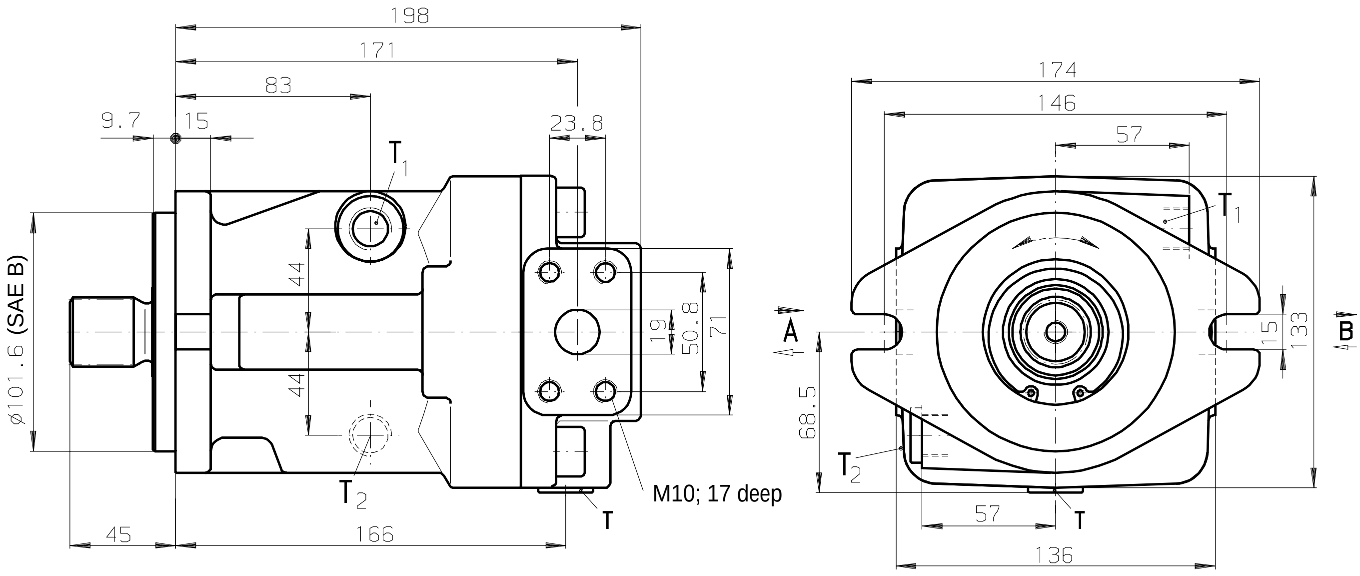
View Y



Connections

A, B	Service line ports	SAE 1/2", 420 bar (6000 psi) high pressure series
T1, T2	Leakage port / oil filling port	M18x1,5; 15 deep

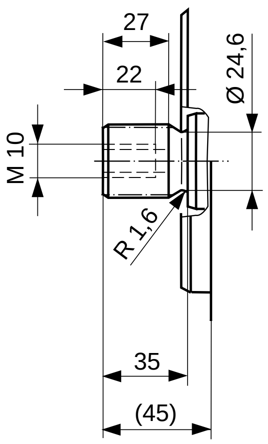
Unit Dimensions, Size 40



Shaft ends

Z

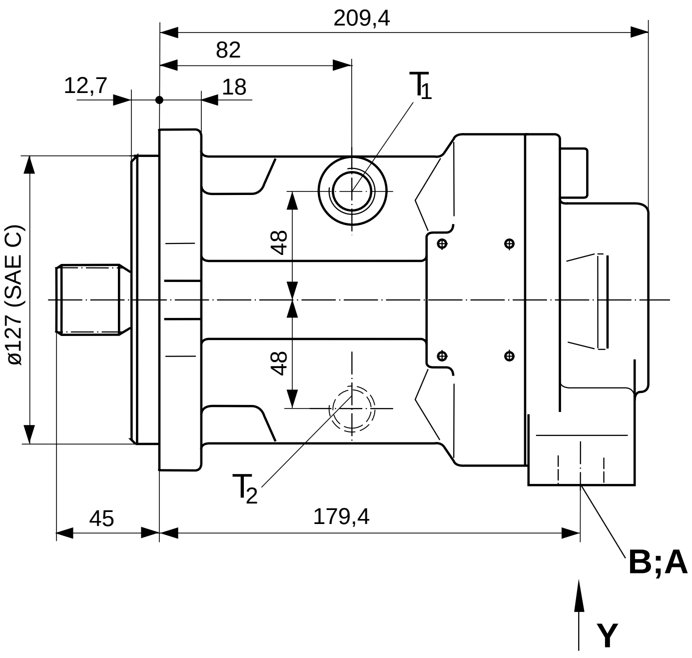
Splined shaft
W 30x2x30x14x9g
DIN 5480

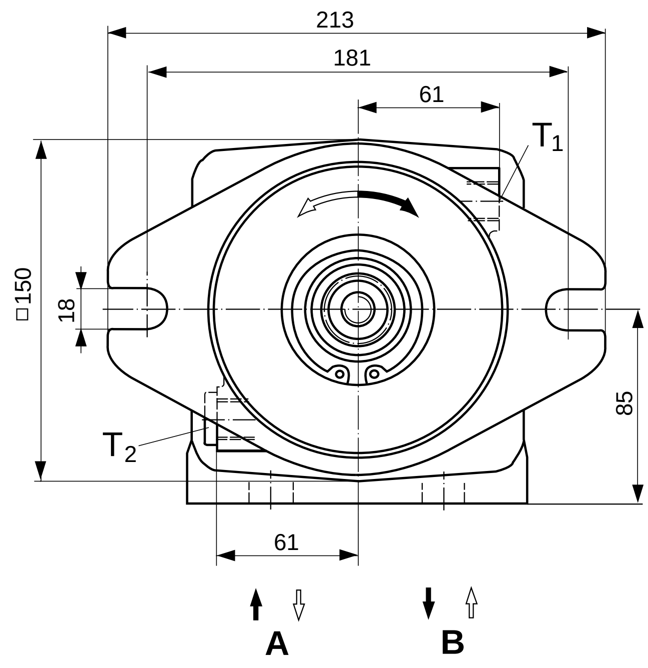


Connections

A, B	Service line ports	SAE 3/4", 420 bar (6000 psi) high pressure series
T, T1, T2	Leakage port / oil filling port	M18x1,5; 12 deep

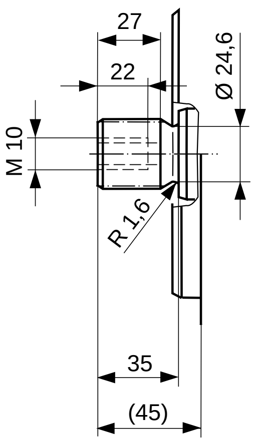
Unit Dimensions, Size 56



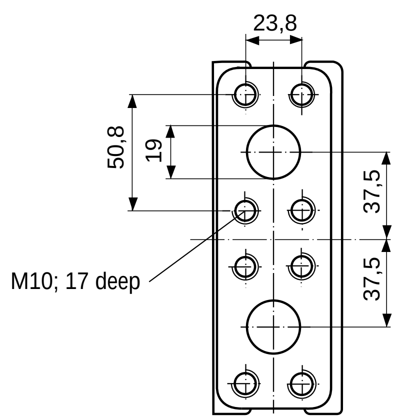


Shaft ends

Z
Splined shaft
W 30x2x30x14x9g
DIN 5480



View Y



Connections

A, B	Service line ports	SAE 3/4", 420 bar (6000 psi) high pressure series
T1, T2	Leakage port / oil filling port	M18x1,5; 12 deep

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