Technical Data

Fluid

To review the application of A2FM motors with the selected hydraulic fluid, detailed fluid compatibility and application data can be found in data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (fire resistant fluids, HF).

The fixed motor A2FM is not suitable for operation with HFA. When using HFB-, HFC-, HFD- 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 optain optimum efficiency and service life, we recommend that the operating viscosity (at operating temperature) be selected from within the range

ν_{opt} = 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:

sizes 5...200

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)

sizes 250...1000

ν_{min} = 10 mm²/s, short term at a max. permissible leakage oil temp. of t_{max} = 90°C
ν_{max} = 1000 mm²/s, short term on cold start (t_{min} = -25°C)

Please note that the max. fluid temperature 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.

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 (closed circuit: loop temperature; open circuit: tank 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 or tank temperature. However, at no point in the circuit may the temperature exceed 115°C for sizes 5...200 or 90°C for sizes 250...1000.

If it is not possible to comply with the above conditions because of extreme operating parameters or high ambient temperatures 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

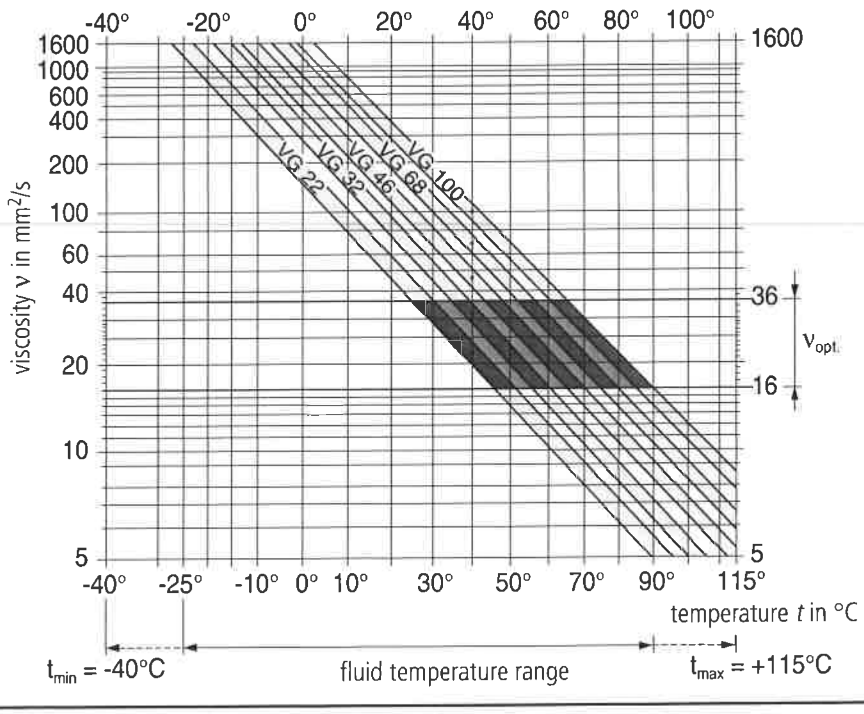
9 to NAS 1638
18/15 to ISO/DIS 4406 is necessary.

At very high temperatures of the hydraulic fluid (90°C to max. 115°C, not permissible for sizes 250...1000) at least cleanless class

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

If above mentioned grades cannot be maintained please consult us.

Selection diagram



Technical Data

Working pressure range

maximum pressure at port A or B (Pressure data to DIN 24312)

Size 5	Shaft end B	Shaft end C
Nominal pressure p_N	210 bar	315 bar
Peak pressure p_{max}	250 bar	350 bar

Size 10...200 [1])	Shaft end A, Z [2])	Shaft end B, P
Nominal pressure p_N	400 bar	350 bar
Peak pressure p_{max}	450 bar	400 bar

[1]) Attention: shaft end Z and P with drives of radial force loads at the drive shaft necessitate reduction of the nominal pressure to p_N = 315 bar.

[2]) Shaft end Z to size 56: p_N = 350 bar, p_{max} = 400 bar

Sizes 250...1000	
Nominal pressure p_N	350 bar
Peak pressure p_{max}	400 bar

With pulsating loads above 315 bar we recommend using the model with splined shaft, standard version A (sizes 10...200) or with splined shaft Z (sizes 250...1000).

The summ of the pressures at ports A und B may not exceed 700 bar (630 bar, A2F 5).

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 on page 6 for max. permissible speeds.

Long-Life bearings (L) (sizes 250...1000)

(for high life expectancy and use of HF-fluids)

The outer dimensions of the axial piston motors are identical to standard design (without long life bearings). The change from standard design to long life bearing system is possible.

We recommend to apply bearing flushing at port U.

Bearing flushing

For sizes 250...1000 bearing and housing flushing is possible through port U.

Flows (recommendation)

Sizes	**250**	**355**	**500**	**710**	**1000**
q_{flush} (L/min)	10	16	20	25	25

Case drain pressure

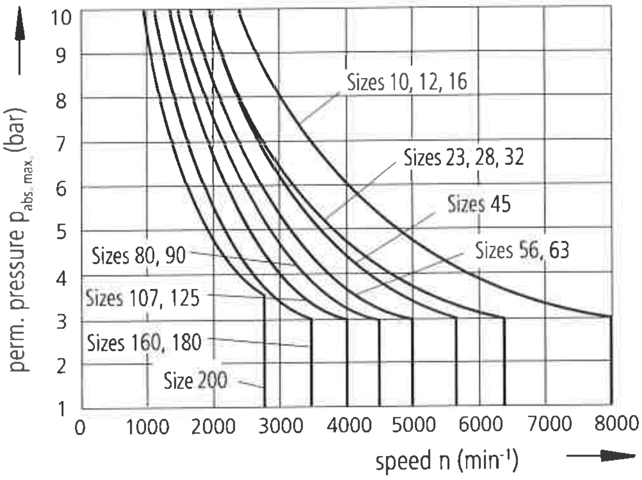
Shaft seal ring **FKM** (fluor-caoutchouc)

The lower the speed and the case drain pressure the higher the life expectation of the shaft seal ring. The values shown in the diagram are permissible loads of the seal ring and shall not be exceeded.

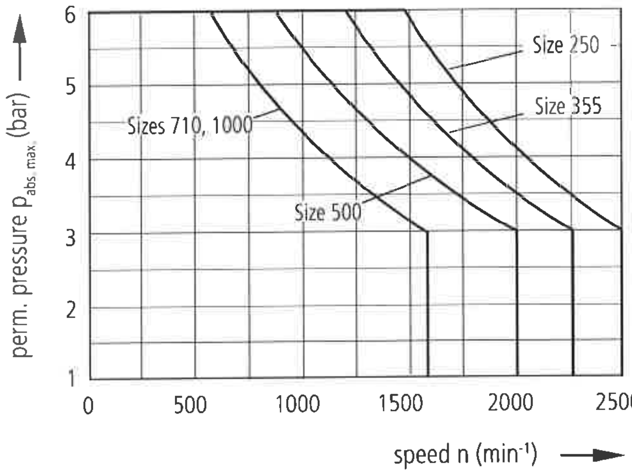
At stationary pressure loads in the range of the max. admissible leakage pressure a reduction of the life experience of the seal ring will result.

For a short period (t < 5 min.) are for the sizes 10...200 pressure loads up to 5 bar independent from rotational speeds are permissible.

Sizes 10...200



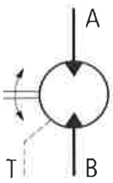
Sizes 250...1000



Note:

- max. permissible motor speeds are given in the table on page 6
- max. perm. housing pressure $p_{abs. max}$ —— 10 bar (sizes 5...200)
  —— 6 bar (sizes 250...1000)
- the pressure in the housing must be the same as or greater than the external pressure on the shaft seal.

Symbol



Connections

A, B	Service line ports
T	Drain port

Technical Data

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

Size				**5**	**10**	**12**	**16**	**23**	**28**	**32**	**45**	**56**	**63**	**80**
Displacement		V_g	cm^3	4,93	10,3	12	16	22,9	28,1	32	45,6	56,1	63	80,4
Max. Speed		n_{max}	min^{-1}	10 000	8000	8000	8000	6300	6300	6300	5600	5000	5000	4500
		$n_{max\ intermit}$ [1]	min^{-1}	11 000	8800	8800	8800	6900	6900	6900	6200	5500	5500	5000
Max. flow	n_{max}	$q_{V\ max}$	L/min	49	82	96	128	144	176	201	255	280	315	360
Torque constants		T_K	Nm/bar	0,076	0,164	0,19	0,25	0,36	0,445	0,509	0,725	0,89	1,0	1,27
Torque at	Δp = 350 bar	T	Nm	24,7 [2]	57	67	88	126	156	178	254	312	350	445
	Δp = 400 bar	T	Nm	–	65	76	100	144	178	204	290	356	400	508
Case volume			L		0,17	0,17	0,17	0,20	0,20	0,20	0,33	0,45	0,45	0,55
Moment of inertia about drive axis		J	kgm^2	0,00008	0,0004	0,0004	0,0004	0,0012	0,0012	0,0012	0,0024	0,0042	0,0042	0,0072
Weight (approx.)		m	kg	2,5	5,4	5,4	5,4	9,5	9,5	9,5	13,5	18	18	23

Size				**90**	**107**	**125**	**160**	**180**	**200**	**250**	**355**	**500**	**710**	**1000**
Displacement		V_g	cm^3	90	106,7	125	160,4	180	200	250	355	500	710	1000
Max. Speed		n_{max}	min^{-1}	4500	4000	4000	3600	3600	2750	2500	2240	2000	1600	1600
		$n_{max\ intermit.}$ [1]	min^{-1}	5000	4400	4400	4000	4000	3000	–	–	–	–	–
Max. flow	n_{max}	$q_{V\ max}$	L/min	405	427	500	577	648	550	625	795	1000	1136	1600
Torque constants T_K		Nm/bar	1,43	1,70	1,99	2,54	2,86	3,18	3,98	5,65	7,96	11,3	15,9	
Torque at	Δp = 350 bar	T	Nm	501	595	697	889	1001	1114	1393	1978	2785	3955	5570
	Δp = 400 bar	T	Nm	572	680	796	1016	1144	1272	–	–	–	–	–
Case volume			L	0,55	0,8	0,8	1,1	1,1		2,5	3,5			7,8
Moment of inertia about drive axis		J	kgm^2	0,0072	0,0116	0,0116	0,0220	0,0220	0,0378	0,061	0,102	0,178	0,55	0,55
Weight (approx.)		m	kg	23	32	32	45	45	66	73	110	155	322	336

[1]) Intermittent max. speed: overspeed at discharge and overtaking travel operations, t < 5 sek. and Δp < 150 bar

[2]) Δp = 315 bar

Calculation of size

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

Output speed $n = \frac{q_V \bullet 1000 \bullet \eta_v}{V_g}$ in min^{-1}

Outout torque $T = \frac{V_g \bullet \Delta p \bullet \eta_{mh}}{20 \bullet \pi}$

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

Output power $P = \frac{2\pi \bullet T \bullet n}{60\,000} = \frac{T \bullet n}{9549}$

$= \frac{q_V \bullet \Delta p}{600} \bullet \eta_t$ in kW

V_g	=	geometric displacement per rev.	in cm^3
T	=	torque	in Nm
Δp	=	pressure differential	in bar
n	=	speed	in min^{-1}
T_K	=	torque constants	in Nm/bar
η_v	=	volumetric efficiency	
η_{mh}	=	mech.-hyd. efficiency	
η_t	=	overall efficiency	

Technical Data

Output drive

Permissible axial and radial loads on drive shaft
The values given are maximum values and do not apply to continuous operation

Size		5	10	12	16	23	28	32	45	56	63	80
a	*mm*	12	16	16	16	16	16	16	18	18	18	20
$F_{q\,max}$	*N*	710	2350	2750	3700	4300	5400	6100	8150	9200	10300	11500
$\pm F_{ax\,max}$	*N*	180	320	320	320	500	500	500	630	800	800	1000
$\pm F_{ax\,perm.}$/bar	*N/bar*	1,5	3,0	3,0	3,0	5,2	5,2	5,2	7,0	8,7	8,7	10,6

Size		90	107	125	160	180	200	250	355	500	710	1000
a	*mm*	20	20	20	25	25	25	41	52,5	52,5	67,5	67,5
$F_{q\,max}$	*N*	12900	13600	15900	18400	20600	22900	1200[1])	1500[1])	1900[1])	3000[1])	2600[1])
$\pm F_{ax\,max}$	*N* $+F_{ax\,max}$	1000	1250	1250	1600	1600	1600	4000	5000	6250	10000	10000
	$-F_{ax\,max}$	1000	1250	1250	1600	1600	1600	1200	1500	1900	3000	2600
$\pm F_{ax\,perm.}$/bar	*N/bar*	10,6	12,9	12,9	16,7	16,7	16,7	[2])	[2])	[2])	[2])	[2])

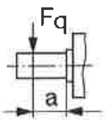
[1]) Axial piston unit stationary or in bypass operation, please contact us when appearing higher forces!

[2]) Please contact us!

Code explanation

a = distance of F_q from shaft shoulder

$F_{q\,max}$ = max. perm. radial force at distance a (at intermittent operation)



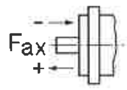
$\pm F_{ax\,max}$ = max. perm. axial force when stationary or when axial piston unit is running at zero pressure

$\pm F_{ax\,perm.}$/bar = perm. axial force/bar operating pressure

The direction of the max. perm. axial force must be noted by sizes 28...200:

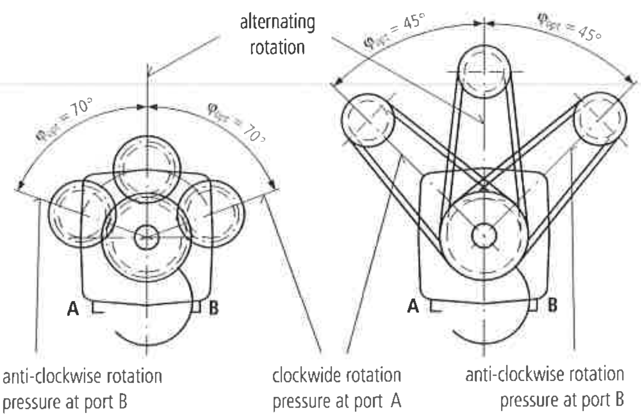
- F_{ax} = increases bearing life

+ F_{ax} = reduces bearing life (avoid if possible)



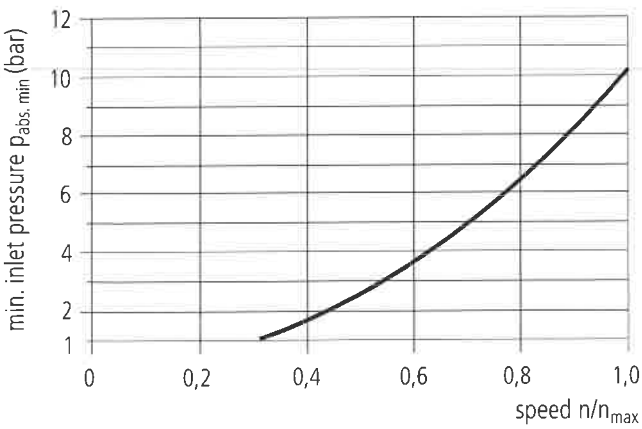
Optimal force direction of F_q (valid for sizes 10...180)

By means of appropriate force directions of F_q the bearing load caused by inside rotary group forces can be reduced. An optimal life expectation of the bearing can be reached.



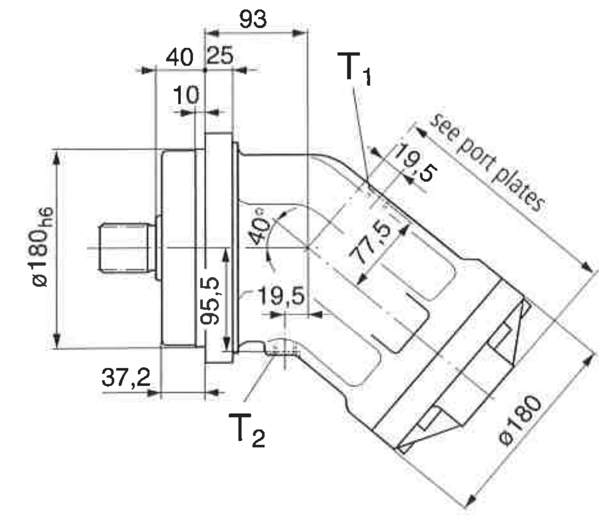
Minimum inlet pressure at port A (B)

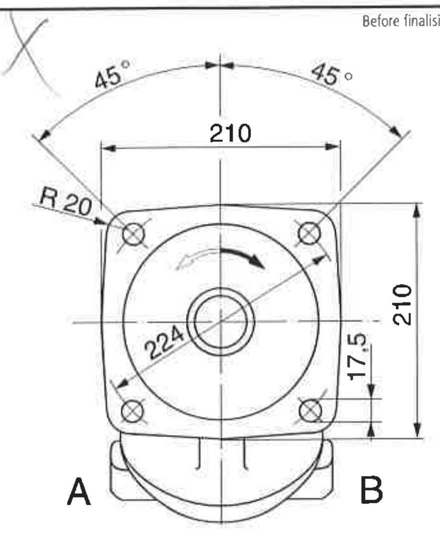
In order to avoid damage of the variable motor a minimum inlet pressure at the inlet zone must be assured. The minimum inlet pressure is related to the rotational speed of the fixed motor.



Unit Dimensions, Sizes 160, 180

Before finalising your design, please request a certified drawing.



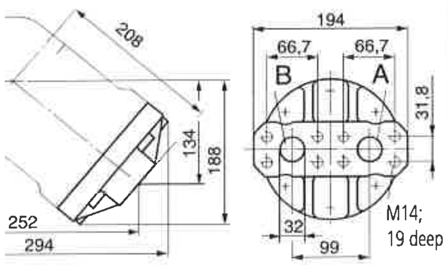


Connections

A, B	Service line ports (see port plates)	
T_1, T_2	Drain ports (1 port plugged)	M 22x1,5

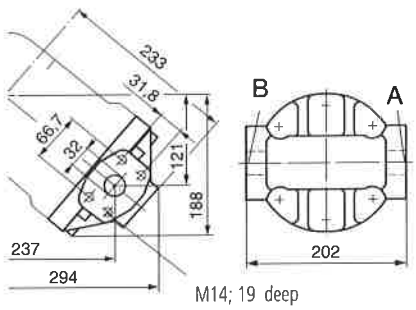
Port plates

01 SAE-ports, at rear end



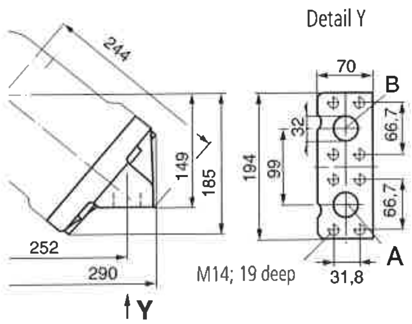
A, B Service line ports SAE $1^1/_4$"
420 bar (6000 psi) high pressure series

02 SAE-ports, at side



A, B Service line ports SAE $1^1/_4$"
420 bar (6000 psi) high pressure series

10 SAE-ports, at side, same side

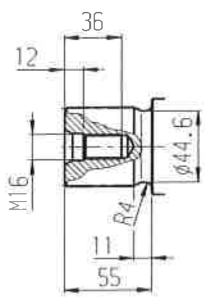


A, B Service line ports SAE $1^1/_4$"
420 bar (6000 psi) high pressure series

Shaft ends

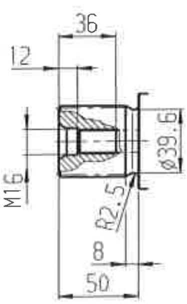
Sizes **160, 180**

A Splined shaft, DIN 5480
W 50x2x30x24x9g
p_N = 400 bar



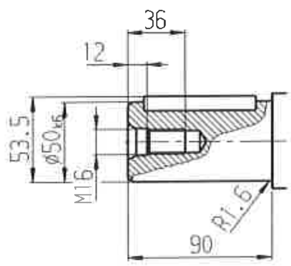
Size**160**

Z Splined shaft, DIN 5480
W 45x2x30x21x9g
p_N = 400 bar



Sizes **160, 180**

B Parallel shaft with key,
DIN 6885, AS 14x9x70
p_N = 350 bar



Size **160**

P Parallel shaft with key,
DIN 6885, AS 14x9x70
p_N = 350 bar