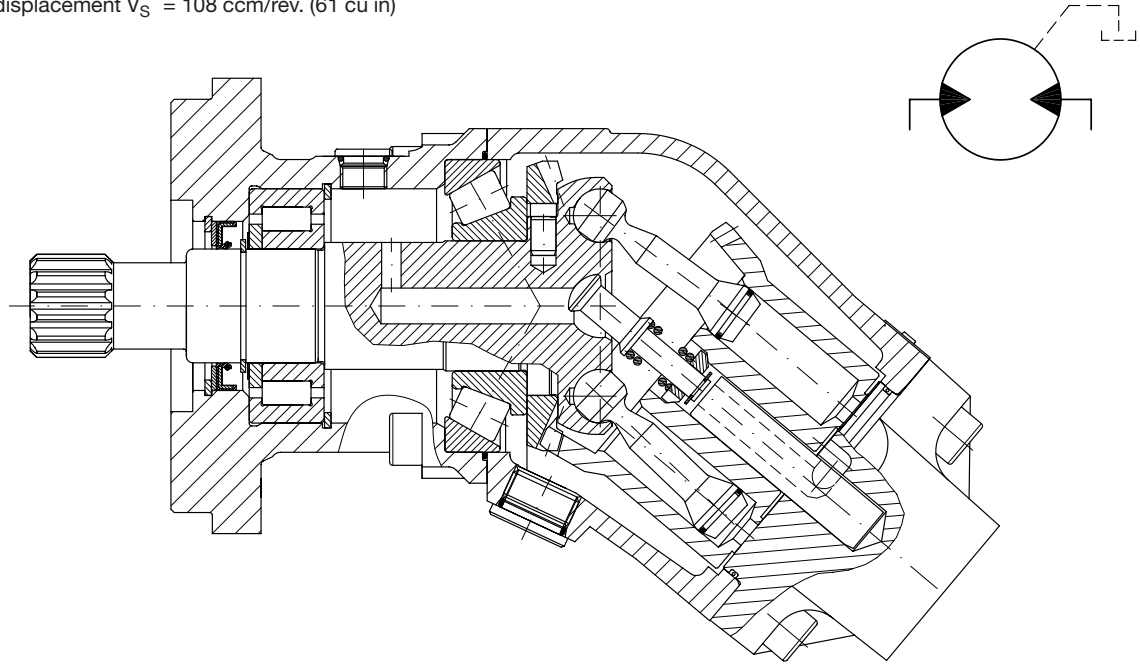


Axial piston motors type M60N

Max. operating pressure $p_{\max} = 400 \text{ bar}$ (5500 psi)

Max. geom. displacement $V_S = 108 \text{ ccm/rev.}$ (61 cu in)



1. General

The axial piston motors with fixed displacement are designed as bent-axes motors. Spherical pistons arranged at 40° ensure an efficient motor as well as a high starting torque. High reliability and small dimensions make it specially suited for truck hydraulics.

Advantages:

- Flange and shaft acc. SAE-standard (SAE-B, SAE-C, SAE-D)
- Tapered roller bearings for high radial load tolerance and long life time
- Optimized connection cover for optimal performance and durability
- Spherical pistons - 5 for 12 - 17 ccm and 7 for more than 25 ccm eliminate pulsation and ensure a high start torque, high pressure, and high speed.
- Bent-axis principle provides a compact design with few moving parts, low bearing loads high reliability and high overall efficiency.

2. Available versions, main data

Order example:

M60N - 034 B S B N / 4

Basic type

Nom. size (table 1)

Direction of rotation: **B** = AnyShaft design: **S** = Spline shaft (SAE)
K = Key shaft

Connections:

4 = Tapped ports G 3/4 (BSPP)
(Nom. size 012, 017, 025, 034)**4 UNF** = Tapped ports 1 1/16-12 UN (SAE-12)
(Nom. size 012, 017, 025, 034)**SAE 4** = SAE-flange (Nom. size 047, 064)**SAE 5** = SAE-flange (Nom. size 084, 108)

Seals:

N = NBR (Nitril)**V** = FKM (Viton)

Mounting flange:

B = (SAE-B, for nom.size 012, 017, 025, 034)**C** = (SAE-C, for nom.size 047, 064, 084, 108)**D** = (SAE-D, for nom.size 084, 108)**Table 1:** Nom. size

Coding		012	017	025	034	047	064	084	108
Geom. displacement V_S	(ccm/rev.)	12.6	17.0	25.4	34.2	47.1	63.5	83.6	108.0
Pressure	intermittent ¹⁾ p_{max} (bar)	400	400	400	400	400	400	400	400
	continuous p_{nom} (bar)	350	350	350	350	350	350	350	350
Speed	intermittent ¹⁾ n_{max} (rev./min)	5400	5400	5400	5400	4700	4700	3800/ 3200 ²⁾	3800/ 3200 ²⁾
	continuous n_{nom} (rev./min)	4800	4800	4800	4800	4000	4000	3400/ 2800 ²⁾	3400/ 2800 ²⁾
	minimal n_{min} (rev./min)	300	300	300	300	300	300	300	300
Power	intermittent ¹⁾ P_{max} (kW)	21	28	42	59	74	84	115	140
	continuous P_{nom} (kW)	15	20	30	42	53	60	80	100
Starting torque (theoretical figure)	(Nm/bar)	0.2	0.27	0.4	0.54	0.75	1.0	1.33	1.71
Inertia moment ($10^{-3} \times \text{kg m}^2$)		0.9	0.9	1.1	1.1	2.6	2.6	6.3/ 7.4 ²⁾	6.3/ 7.4 ²⁾
Mass (weight)	(kg)	9	9	9	9	15	15	18/35 ²⁾	18/35 ²⁾
Mounting flange		SAE-B	SAE-B	SAE-B	SAE-B	SAE-C	SAE-C	SAE-C/ SAE-D ²⁾	SAE-C/ SAE-D ²⁾

1) Intermittent operation, duty cycle of max. 10 sec./min

2) Values valid for flange SAE-C / SAE-D

3. Additional versions

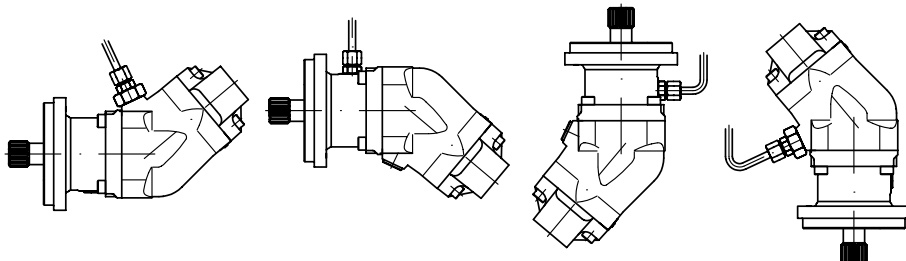
3.1 General

Calculation:

<p>Flow rate</p> $Q = \frac{V_s \cdot n}{1000 \eta_v} \text{ (lpm)}$	<p>Torque</p> $M = \frac{V_s \cdot \Delta p \cdot \eta_{mh}}{63} \text{ (Nm)}$	<p>Power</p> $P = \frac{2\pi \cdot M \cdot n}{60000} = \frac{M \cdot n}{9549} = \frac{Q \cdot \Delta p \cdot \eta_t}{600} \text{ (kW)}$	<p>Speed</p> $n = \frac{1000 \cdot Q \cdot \eta_v}{V_s} \text{ (rpm)}$
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V_s = Displacement (ccm/rev.) η_v = Volumetric efficiency
 Δp = Diff. pressure (bar) η_{mh} = Mechanical-hydraulic efficiency
 n = Speed (rpm) η_t = Total efficiency ($\eta_t = \eta_v \times \eta_{mh}$)
 Q = Flow (lpm)

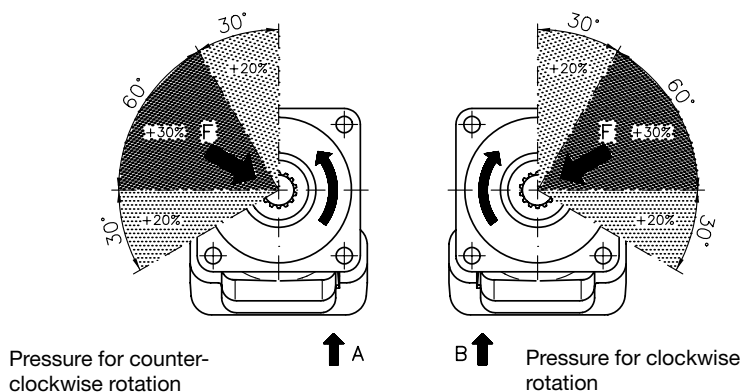
Working principle	Fixed displacement axial piston motor acc. to bent-axis principle
Installation	Flange SAE-B, -C or -D, conf. type and nom. size
Direction of rotation	Any
Mounting position	Any
Pressure fluid	Hydraulic fluid (DIN 51524 table 2 and 3): ISO VG 10 to 68 (DIN 51519) Viscosity range: min. 10; max. 1000 mm ² /s optimal operation range: 20 ... 40 mm ² /s Also suitable are biodegradable pressure fluids of the type HEES (synth. Ester) at operation temperatures up to +70°C.
Temperature	Ambient: -40 ... +60°C Fluid: -25 ... +80°C, pay attention to the viscosity range! Start temperature down to -40°C is allowable (Pay attention to the viscosity range during start-up!), as long as the operation temperature during consequent running is at least 20K (Kelvin) higher.
Filtration	Should conform to ISO standard 4406 code 16/13.
Flushing	Additional flushing of the casing should be provided, when an excessive viscosity drop is anticipated due to high fluid temperature. Flushing is a must, when the following motor speeds are exceeded: Nom. size 012, 017, 025, 034: $n > 2800$ rpm with approx. 2..8 lpm Nom. size 047, 064: $n > 2500$ rpm with approx. 4..10 lpm Nom. size 084, 108: $n > 2200$ rpm with approx. 6..12 lpm
Start-up	All hydraulic lines should be flushed with the same fluid intended for later operation before start-up. The motorcase should then be primed via the uppermost drain port. The drain line must be routed in such a way that running empty of the casing is prevented.



Shaft loads

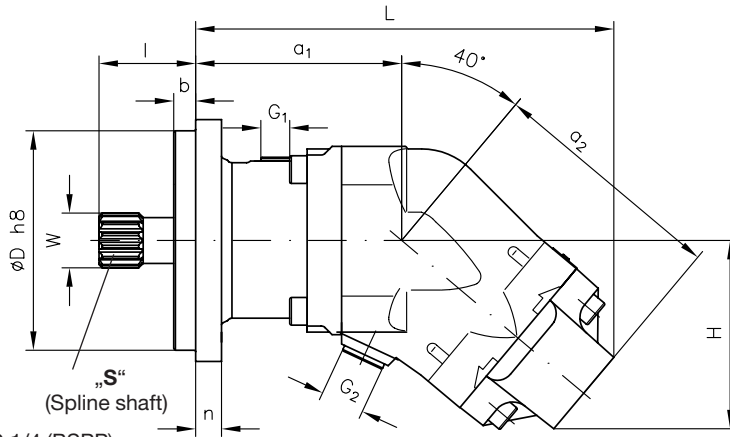
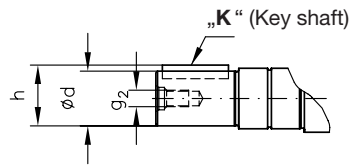
Permissible radial loads in relation to the shaft center (angle dependant):
 (higher radial loads are allowed in the mentioned sectors)

Nom. size	012	017	025	034	047	064	084	108
Radial load F (kN)	2.3	2.2	2.0	1.8	2.5	2.3	3.2/4.8	3.0/4.3



4. Unit dimensions

All dimensions are in mm, subject to change without notice!



- $G_1 = G\ 1/4$ (BSPP)
- $G_2 = G\ 1/2$ (BSPP)
- $G_1 = 9/16''-18$ UNF (with M60N...-SAE)
- $G_2 = 7/8''-14$ UNF (with M60N...-SAE)

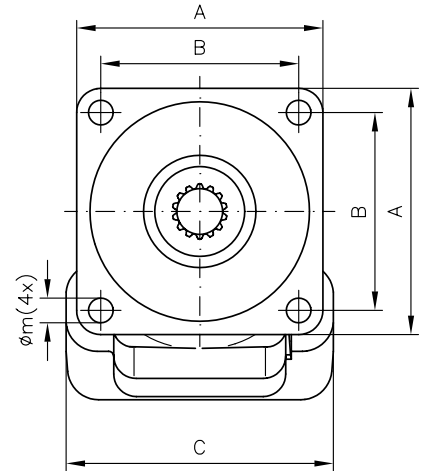
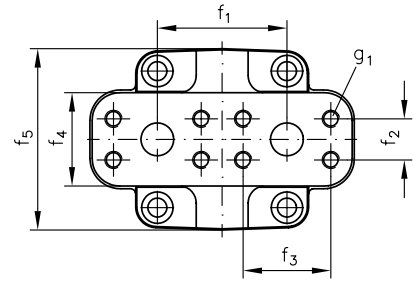


Table:

Nom. size	L	H	A	B	C	$\varnothing D$	b	l	a_1	a_2	f_1	f_2	f_3	f_4	f_5	$\varnothing m$	n
012 017 025 034	206	97	117.8	89.8	-	101.6	9.7	46	101	117	60	-	-	-	96	14.3	12
047 064	242	109	142.5	114.5	155	127	12.7	56	119.25	137	75	23.8	50.8	54	-	14.3	15
084/108 SAE-C	264	129	142.5	114.5	-	127	12.7	56	121.6	151	88	57.2	27.8	85	-	14.3	13
084/108 SAE-D	256	129	200	161.6	-	152.4	13	74	113	151	88	57.2	27.8	85	-	21	20

Nom. size	Shaft design „K“ (key shaft)				Shaft design „S“ (spline shaft)	Suction/ Pressure port coding		
	$\varnothing d$	h	g_2	K	W	4	4 UNF	SAE4(5)
012 017 025 034	25.4	28.1	5/16"- 18 UNC	1/4" x 1/4" x 1.3/16"	13T 16/32 30° Class 5	G 3/4	1 1/16"-12 UN	-
047 064	31.7	35.2	3/8"- 24 UNF	5/16" x 5/16" x 1.1/2"	14T 12/24 30° Class 5	-	-	3/4" (SAE6000 J 518) $g_1 = 3/8''-16$ UNC-2B
084/108 (SAE-C)	31.7	35.2	3/8"- 24 UNF	5/16" x 5/16" x 1.1/2"	14T 12/24 30° Class 5	-	-	1" (SAEJ 6000 J 518) $g_1 = 7/16''-14$ UNC-2B
084/108 (SAE-D)	44.45	49.3	5/8"- 18 UNF	7/16" x 7/16" x 2.1/8"	13T 8/16 30° Class 5	-	-	1" (SAE 6000 J 518) $g_1 = 7/16''-14$ UNC-2B