

Axial Piston Fixed Motor AA2FM (A2FM)

RA 91001/03.08 1/36
Replaces: 07.05

Technical data sheet

Series 6

Sizes	Nominal pressure/Peak pressure
5	4550/5100 psi (315/350 bar)
10 to 200	5800/6500 psi (400/450 bar)
250 to 1000	5100/5800 psi (350/400 bar)
Open and closed circuits	



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Features

- Fixed motor with axial tapered piston rotary group of bent axis design, for hydrostatic drives in open and closed circuits
- For use in mobile and stationary application areas
- The output speed is dependent on the flow of the pump and the displacement of the motor
- The output torque increases with the pressure differential between the high and low pressure sides and with increasing displacement
- Careful selection of the displacements offered, permit sizes to be matched to practically every application
- High power density
- Compact design
- High overall efficiency
- Good starting characteristics
- Economical conception
- One piece pistons with piston rings

Technical Data

Hydraulic fluid

Before starting project planning, please refer to our data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable hydraulic fluids) and RE 90223 (HF hydraulic fluids) for detailed information regarding the choice of hydraulic fluid and application conditions.

The fixed motor AA2FM is unsuitable for operation with HFA. If HFB, HFC and HFD or environmentally acceptable hydraulic fluids are being used, the limitations regarding technical data and seals mentioned in RE 90221 and RE 90223 must be observed.

When ordering please indicate the used hydraulic fluid.

Operating viscosity range

For optimum efficiency and service life, select an operating viscosity (at operating temperature) within the optimum range of

$$v_{opt} = \text{optimum viscosity } 80 \dots 170 \text{ SUS } (16 \dots 36 \text{ mm}^2/\text{s})$$

depending on the circuit temperature (closed circuit) and tank temperature (open circuit).

Limits of viscosity range

The limiting values for viscosity are as follows:

Sizes 5 to 200:

$$v_{min} = 42 \text{ SUS } (5 \text{ mm}^2/\text{s})$$

short-term ($t < 3 \text{ min}$)
at max. permitted temperature of $t_{max} = +240^\circ\text{F}$ ($+115^\circ\text{C}$).

$$v_{max} = 7400 \text{ SUS } (1600 \text{ mm}^2/\text{s}),$$

short-term ($t < 3 \text{ min}$)
at cold start ($p \leq 435 \text{ psi} / 30 \text{ bar}$, $n \leq 1000 \text{ rpm}$,
 $t_{min} = -40^\circ\text{F} / -40^\circ\text{C}$).
Only for starting up without load. Optimum operating viscosity must be reached within approx. 15 minutes.

Sizes 250 to 1000:

$$v_{min} = 60 \text{ SUS } (10 \text{ mm}^2/\text{s}),$$

short-term ($t < 3 \text{ min}$)
at max. permitted temperature of $t_{max} = +195^\circ\text{F}$ ($+90^\circ\text{C}$)

$$v_{max} = 4600 \text{ SUS } (1000 \text{ mm}^2/\text{s}),$$

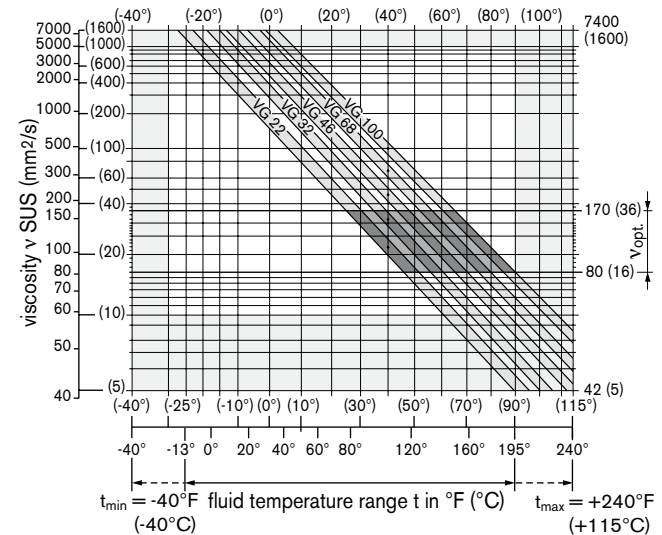
short-term ($t < 3 \text{ min}$)
at cold start ($p \leq 435 \text{ psi} / 30 \text{ bar}$, $n \leq 1000 \text{ rpm}$,
 $t_{min} = -13^\circ\text{F} / -25^\circ\text{C}$).
Only for starting up without load. Optimum operating viscosity must be reached within approx. 15 minutes.

Note that the maximum hydraulic fluid temperature of $+240^\circ\text{F}$ ($+115^\circ\text{C}$) ($+195^\circ\text{F}$ ($+90^\circ\text{C}$) at size 250 to 1000) must not be exceeded locally either (e.g. in the bearing area). The temperature in the bearing area is - depending on pressure and speed - up to 22°F (12 K) higher than the average case drain temperature.

Special measures are necessary in the temperature range from -40°F and -13°F (-40°C and -25°C) (cold start phase), please contact us.

For detailed information about use at low temperatures, see RE 90300-03-B.

Selection diagram



Details regarding the choice of hydraulic fluid

The correct choice of hydraulic fluid requires knowledge of the operating temperature in relation to the ambient temperature: in a closed circuit the circuit temperature, in an open circuit the tank temperature.

The hydraulic fluid should be chosen so that the operating viscosity in the operating temperature range is within the optimum range (v_{opt} ; shaded area) - the shaded area of the selection diagram. We recommended that the higher viscosity class be selected in each case.

Example: At an ambient temperature of $X^\circ\text{F}$ ($X^\circ\text{C}$) an operating temperature of 140°F (60°C) is set. In the optimum operating viscosity range (v_{opt} ; shaded area) this corresponds to the viscosity classes VG 46 or VG 68; to be selected: VG 68.

Please note:

The case drain temperature, which is affected by pressure and speed, is always higher than the control temperature or tank temperature. At no point in the system may the temperature be higher than 240°F (115°C) for sizes 5 to 200 or 195°F (90°C) for sizes 250 to 1000.

If the above conditions cannot be maintained due to extreme operating parameters, we recommend flushing the case at port U (size 250 to 1000) or using a flush and boost pressure valve (see page 30).

Filtration

The finer the filtration, the higher the cleanliness level of the hydraulic fluid and the longer the service life of the axial piston unit.

To ensure functional reliability of the axial piston unit, the hydraulic fluid must have a cleanliness level of at least

20/18/15 according to ISO 4406.

At very high hydraulic fluid temperatures (90°C to max. 115°C , not permitted for sizes 250 to 1000) at least cleanliness level

19/17/14 according to ISO 4406 is required.

If the above classes cannot be observed, please contact us.

Technical Data

Operational pressure range

Maximum pressure on port A or B (pressure data in accordance with DIN 24312)

AA2F Sizes	10	12	16	23	28	32	45	56	63	80	90	107	125	160	180	250	Nominal pressure	Peak pressure
Shaft end: S	●	●	●	●	●	●	●					●	●	●	●		5800 psi (400 bar)	6500 psi (450 bar)
S								●	●							●	5100 psi (350 bar)	5800 psi (400 bar)
Q										●							4350 psi (300 bar)	5100 psi (350 bar)
Q											●						4100 psi (280 bar)	4550 psi (315 bar)
T								●	●								5800 psi (400 bar)	6500 psi (450 bar)
U										●	●	●	●				5800 psi (400 bar)	6500 psi (450 bar)
B	●	●	●	●	●	●		●	●			●	●	●	●		5100 psi (350 bar)	5800 psi (400 bar)
P							●										5100 psi (350 bar)	5800 psi (400 bar)
K																●	5100 psi (350 bar)	5800 psi (400 bar)
A2F Sizes	5						200	355	500	710	1000	Nominal pressure	Peak pressure					
Shaft end: Z								●	●	●	●	5100 psi (350 bar)	5800 psi (400 bar)					
A							●					5800 psi (400 bar)	6500 psi (450 bar)					
P								●	●	●	●	5100 psi (350 bar)	5800 psi (400 bar)					
B							●					5100 psi (350 bar)	5800 psi (400 bar)					
B	●											3050 psi (210 bar)	3600 psi (250 bar)					
C	●											4550 psi (315 bar)	5100 psi (350 bar)					

With pulsating loads over $p_N = 4550 \text{ psi} / 315 \text{ bar}$ ($p_{max} = 5100 \text{ psi} / 350 \text{ bar}$); we recommend the use of a splined shaft (AA2FM 10 to 250: S, T or U / A2FM 200: A / A2FM 355 to 1000: Z)

The sum of the pressure at ports A and B may not exceed 10150 psi / 700 bar (A2F5: 9000 psi / 630 bar)

Attention: shaft end with drives of radial force loads at the drive shaft (pinion, V-belt drives) necessitate reduction of the nominal pressure to $p_N = 4550 \text{ psi}$ (315 bar)! Sizes 250 to 1000 please contact us.

Minimum inlet pressure, see page 8

Direction of flow

Direction of rotation, viewed on shaft end	
clockwise	counter-clockwise
A to B	B to A

Speed range

No limit to minimum speed n_{min} . If uniformity of motion is required, speed n_{min} must not be less than 50 rpm. See table of values on page 7 for maximum speed.

Long-life bearing (sizes 250 to 1000)

For long service life and use with HF hydraulic fluids. Same external dimensions as the motor with standard bearing. A long-life bearing can be specified. Flushing of bearing and case via port U is recommended.

Flushing volumes (recommended)

Size	250	355	500	710	1000
$q_{v \text{ flush}}$ gpm	2.6	4.2	4.2	4.2	4.2
L/min	10	16	16	16	16

Technical Data

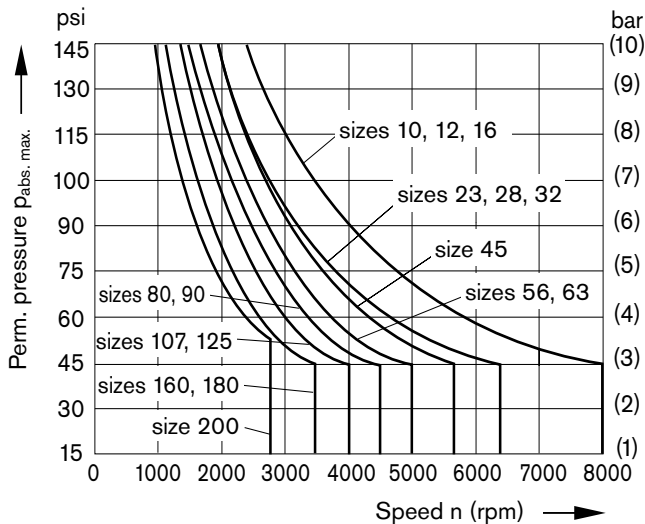
Shaft seal ring

Permissible pressure loading

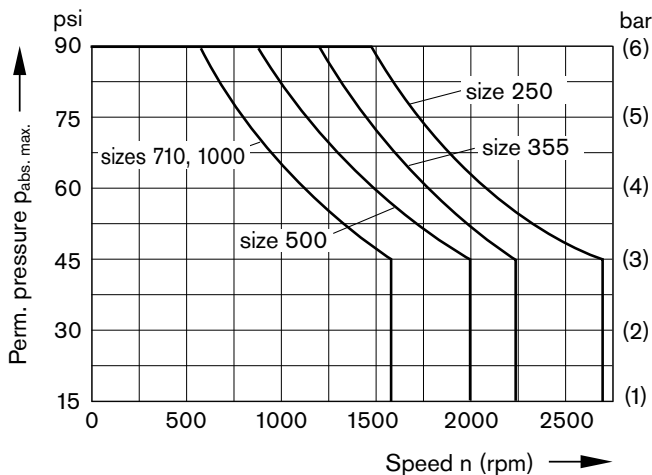
The service life of the shaft seal ring is affected by the speed of the motor and the case drain pressure. It is recommended that the average, continuous case drain pressure at operating temperature 45 psi (3 bar) absolute not be exceeded (max. permissible case drain pressure 90 psi (6 bar) absolute at reduced speed, see diagram). Short-term ($t < 0.1$ s) pressure spikes of up to 145 psi (10 bar) absolute are permitted. The service life of the shaft seal ring decreases with an increase in the frequency of pressure spikes.

The case pressure must be equal to or greater than the external pressure on the shaft seal ring.

Sizes 10 to 200



Sizes 250 to 1000



Temperature range

The FKM shaft seal ring is permissible for case temperatures of -13°F to +240°F (-25°C to +115°C) at sizes 5 to 200 and -13°F to +195°F (-25°C to +90°C) at sizes 250 to 1000

Note:

For application cases below -13°F (-25 °C) a Buna-N (NBR) shaft seal ring is necessary (permissible temperature range -40 °F to +195 °F / -40 °C to +90 °C). Please contact us.

Technical Data

Table of values (theoretical values, ignoring η_{mh} and η_v ; values rounded)

Size			5	10	12	16	23	28	32	45	56	63	80	
Displacement	V_g	in^3	0.30	0.63	0.73	0.98	1.40	1.71	1.95	2.78	3.42	3.84	4.91	
		cm^3	4.93	10.3	12	16	22.9	28.1	32	45.6	56.1	63	80.4	
Max. Speed	n_{\max}	rpm	10000	8000	8000	8000	6300	6300	6300	5600	5000	5000	4500	
		$n_{\max \text{ intermit.}}^{1)}$ rpm	11000	8800	8800	8800	6900	6900	6900	6200	5500	5500	5000	
Max. flow	$q_{V \max}$	gpm	13	21.8	25.3	33.9	38.2	46.6	52.2	67.4	74.0	83.1	95.6	
		L/min	49	82	96	128	144	176	201	255	280	315	360	
Torque at	$\Delta p = 5100 \text{ psi T}$	lb-ft	18 ²⁾	42	49	66	94	115	132	188	231	259	332	
		$\Delta p = 350 \text{ bar T}$	Nm	24,7 ²⁾	57	67	88	126	156	178	254	312	350	445
		$\Delta p = 5800 \text{ psi T}$	lb-ft	–	48	56	75	107	131	150	213	263	295	377
		$\Delta p = 400 \text{ bar T}$	Nm	–	65	76	100	144	178	204	290	356	400	508
Rotary stiffness	c	Nm/rad	625	922	1250	1590	2560	2930	3120	4180	5940	6250	8730	
Moment of inertia for rotary group	J_{TW}	lbs-ft ²	0.0014	0.0095	0.0095	0.0095	0.0285	0.0285	0.0285	0.0569	0.0997	0.0997	0.1708	
		kgm ²	0.00006	0.0004	0.0004	0.0004	0.0012	0.0012	0.0012	0.0024	0.0042	0.0042	0.0072	
Angular acceleration maximum	α	rad/s ²	5000	5000	5000	5000	6500	6500	6500	14600	7500	7500	6000	
Filling capacity	V	gal		0.045	0.045	0.045	0.053	0.053	0.053	0.087	0.119	0.119	0.145	
		L		0.17	0.17	0.17	0.20	0.20	0.20	0.33	0.45	0.45	0.55	
Mass (approx.)	m	lbs	5.5	12	12	12	21	21	21	30	40	40	51	
		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	in^3	5.49	6.51	7.63	9.79	10.98	12.20	15.25	21.66	30.51	43.33	61.02	
		cm^3	90	106.7	125	160.4	180	200	250	355	500	710	1000	
Max. Speed	n_{\max}	rpm	4500	4000	4000	3600	3600	2750	2700	2240	2000	1600	1600	
		$n_{\max \text{ intermit.}}^{1)}$ rpm	5000	4400	4400	4000	4000	3000	–	–	–	–	–	
Max. flow	$q_{V \max}$	gpm	106.9	112.7	132.1	152.5	171.1	145.2	178	210	264	300	422	
		L/min	405	427	500	577	648	550	675	795	1000	1136	1600	
Torque at	$\Delta p = 5100 \text{ psi T}$	lb-ft	371	440	516	662	742	825	1030	1465	2063	2930	4127	
		$\Delta p = 350 \text{ bar T}$	Nm	501	595	697	889	1001	1114	1393	1978	2785	3955	5570
		$\Delta p = 5800 \text{ psi T}$	lb-ft	422	500	587	753	844	938	–	–	–	–	–
		$\Delta p = 400 \text{ bar T}$	Nm	572	680	796	1016	1144	1272	–	–	–	–	–
Rotary stiffness	c	Nm/rad	9140	11200	11900	17400	18200	57300	73100	96100	144000	270000	324000	
Moment of inertia for rotary group	J_{TW}	lbs-ft ²	0.1708	0.2753	0.2753	0.5221	0.5221	0.8377	1.4475	2.4205	4.2240	13.052	13.052	
		kgm ²	0.0072	0.0116	0.0116	0.0220	0.0220	0.0353	0.061	0.102	0.178	0.55	0.55	
Angular acceleration maximum	α	rad/s ²	6000	4500	4500	3500	3500	11000	10000	8300	5500	4300	4000	
Filling capacity	V	gal	0.145	0.211	0.211	0.291	0.291	0.713	0.660	0.925	1.110	2.113	2.113	
		L	0.55	0.8	0.8	1.1	1.1	2.7	2.5	3.5	4.2	8	8	
Mass (approx.)	m	lbs	51	71	71	99	99	145	161	242	342	715	741	
		kg	23	32	32	45	45	66	73	110	155	325	336	

¹⁾ Intermittent maximum speed: overspeed at discharge and over-running travel operations, $t < 5 \text{ s}$ and $\Delta p < 2200 \text{ psi}$ (150 bar)

²⁾ Torque at $\Delta p = 4550 \text{ psi}$ (315 bar)

Caution: Exceeding the permissible limit values may result in a loss of function, a reduction in service life or in the destruction of the axial piston unit.

Other permissible limit values with respect to speed variation, reduced angular acceleration as a function of the frequency and the permissible startup angular acceleration (lower than the maximum angular acceleration) can be found in data sheet RE 90261.

Technical Data

Determining the size

$$\text{Flow} \quad q_v = \frac{V_g \cdot n}{231 \cdot \eta_v} \quad \text{gpm} \quad \left(q_v = \frac{V_g \cdot n}{1000 \cdot \eta_v} \quad \text{L/min} \right)$$

$$\text{Speed} \quad n = \frac{q_v \cdot 231 \cdot \eta_v}{V_g} \quad \text{rpm} \quad \left(n = \frac{q_v \cdot 1000 \cdot \eta_v}{V_g} \quad \text{rpm} \right)$$

$$\text{Torque} \quad T = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{24 \cdot \pi} \quad \text{lb-ft} \quad \left(T = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi} \quad \text{Nm} \right)$$

$$\text{Power} \quad P = \frac{2 \pi \cdot T \cdot n}{33\,000} = \frac{q_v \cdot \Delta p \cdot \eta_t}{1714} \quad \text{HP} \quad \left(P = \frac{2 \pi \cdot T \cdot n}{60\,000} = \frac{q_v \cdot \Delta p \cdot \eta_t}{600} \quad \text{kW} \right)$$

V_g = Displacement per revolution in in³ (cm³)

Δp = Differential pressure in psi (bar)

n = Speed in rpm

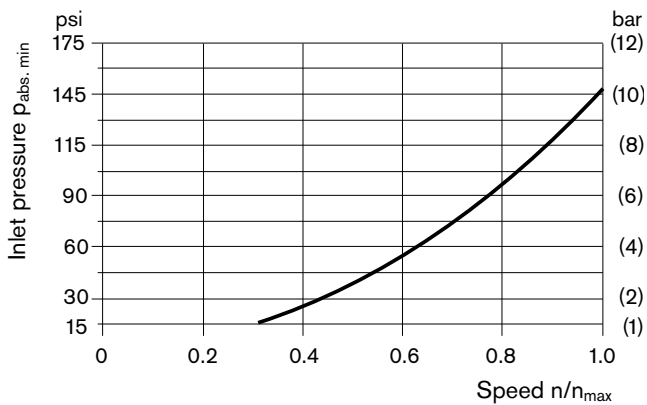
η_v = Volumetric efficiency

η_{mh} = Mechanical-hydraulic efficiency

η_t = Overall efficiency

Minimum inlet pressure on service line port A (B)

To prevent damage to the motor, there must be a minimum inlet pressure in the inlet area. The minimum inlet pressure is dependent on the speed of the fixed motor.







Please contact us if these conditions cannot be satisfied

Technical Data

Permissible radial and axial loading on the drive shaft

The specified values are maximum values and do not apply to continuous operation.

Size		5	10	12	16	23	28	32	45	56	63	80		
Radial force, max. ¹⁾ at distance a (from shaft collar)		$F_{q \max}$	lbf	160	472	562	730	865	1079	1214	1630	1832	2057	2304 ²⁾
			N	710	2100	2500	3250	3850	4800	5400	7250	8150	9150	10250
		a	in	0.47	0.63	0.63	0.63	0.63	0.63	0.63	0.71	0.71	0.71	0.79
		mm	12	16	16	16	16	16	18	18	18	20		
Axial force, max. ³⁾		$+F_{ax \max}$	lbf	40	72	72	72	112	112	112	142	180	180	225
			N	180	320	320	320	500	500	500	630	800	800	1000
		$-F_{ax \max}$	lbf	40	72	72	72	112	112	112	142	180	180	225
			N	180	320	320	320	500	500	500	630	800	800	1000
Permissible axial force/psi (bar) operating pressure	$\pm F_{ax \text{ per./psi}}$ (bar)	lbf/psi	0.023	0.05	0.05	0.05	0.08	0.08	0.08	0.11	0.13	0.13	0.16	
		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		
Radial force, max. ¹⁾ at distance a (from shaft collar)		$F_{q \max}$	lbf	2574 ²⁾	2720	3170	3664	4114	5148	270	337	427	674	584
			N	11450	12100	14100	16300	18300	22900	1200 ⁴⁾	1500 ⁴⁾	1900 ⁴⁾	3000 ⁴⁾	2600 ⁴⁾
		a	in	0.79	0.79	0.79	0.98	0.98	0.98	1.61	2.07	2.07	2.66	2.66
			mm	20	20	20	25	25	25	41	52.5	52.5	67.5	67.5
Axial force, max. ³⁾		$+F_{ax \max}$	lbf	225	281	281	360	360	360	450	562	674	989	989
			N	1000	1250	1250	1600	1600	1600	2000	2500	3000	4400	4400
		$-F_{ax \max}$	lbf	225	281	281	360	360	360	450	562	674	989	989
			N	1000	1250	1250	1600	1600	1600	2000	2500	3000	4400	4400
Permissible axial force/psi (bar) operating pressure	$\pm F_{ax \text{ per./psi}}$ (bar)	lbf/psi	0.16	0.20	0.20	0.26	0.26	0.26	⁵⁾	⁵⁾	⁵⁾	⁵⁾	⁵⁾	
		N/bar	10.6	12.9	12.9	16.7	16.7	16.7						

¹⁾ During intermittent operation (sizes 5 to 200)

²⁾ Value for Q-shaft: $F_{q \max} = 2023$ lbf (9000 N)

³⁾ Max. permissible axial force when at a standstill or when axial piston unit working in pressureless conditions

⁴⁾ When at a standstill or when axial piston unit operating in depressurized condition. Higher forces are permissible when under pressure. Please contact us.

⁵⁾ Please contact us

When considering the permissible axial force, the force-transfer direction must be taken into account.

$- F_{ax \max}$ = increase in service life of bearings

$+ F_{ax \max}$ = reduction in service life of bearings (avoid)

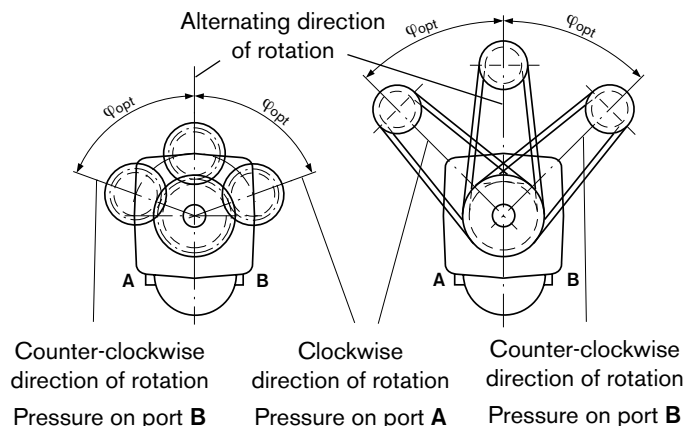
Effect of radial force F_q on the service life of the bearings

By selecting a suitable force-transfer direction of F_q , the stress on the bearings caused by the internal transmission forces can be reduced, thus achieving the optimum service life for the bearings. Recommended position of mating gear is dependent on direction of rotation. Examples:

Size	Toothed gear drive	V-belt drive
	$\varphi_{opt.}$	$\varphi_{opt.}$
10 to 180	$\pm 70^\circ$	$\pm 45^\circ$
200 to 1000	$\pm 45^\circ$	$\pm 70^\circ$

Toothed gear drive

V-belt drive



Ordering Code / Standard Program – Size 5

A2F	5	/	60	W	-		3
01	02		03	04		05	06

Axial piston unit

01	Bent axis design, fixed	A2F
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Size

02	Size	5
	≈ Displacement V_g	in ³ /rev. 0.30
		cm ³ /rev. 4.93

Series

03		60
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Direction of rotation

04	Viewed from shaft end	alternating	W
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Shaft end

05	Parallel keyed shaft DIN 6885	B
	Tapered shaft with spigot and spring washer DIN 6888	C

Service line ports

06	Threaded ports A und B at side, metric	3
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Additional instructions in text form

Seals

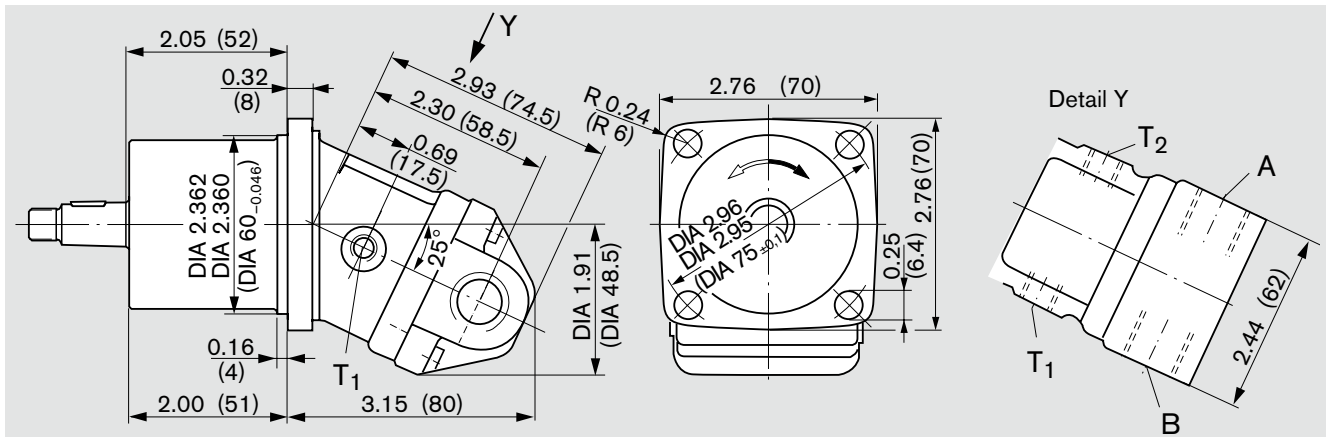
The fixed motor A2F5 is equipped with Buna-N (NBR) seals in standard design.

In case of need FKM- (fluor-caoutchouc) seals please indicate when ordering in plain text:

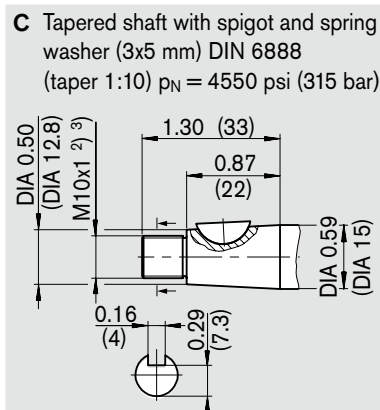
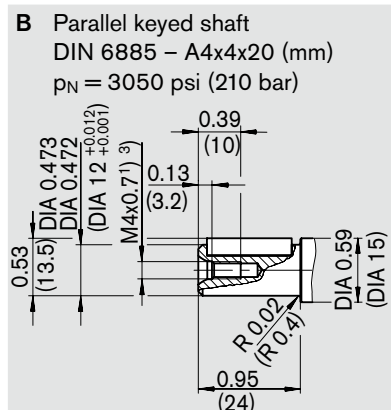
"with FKM-seals"

Unit Dimensions, Size 5 – ISO Design

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters)



Shaft ends



Ports

A, B	Service line ports	M18x1,5; DIN 3852	100 lb-ft ³ 0.47 (12) deep (140 Nm)
T ₁ , T ₂	Case drain ports	M10x1; DIN 3852	20 lb-ft ³ 0.31 (8) deep (30 Nm)

1) Center bore according to DIN 332 (thread according to DIN 13)

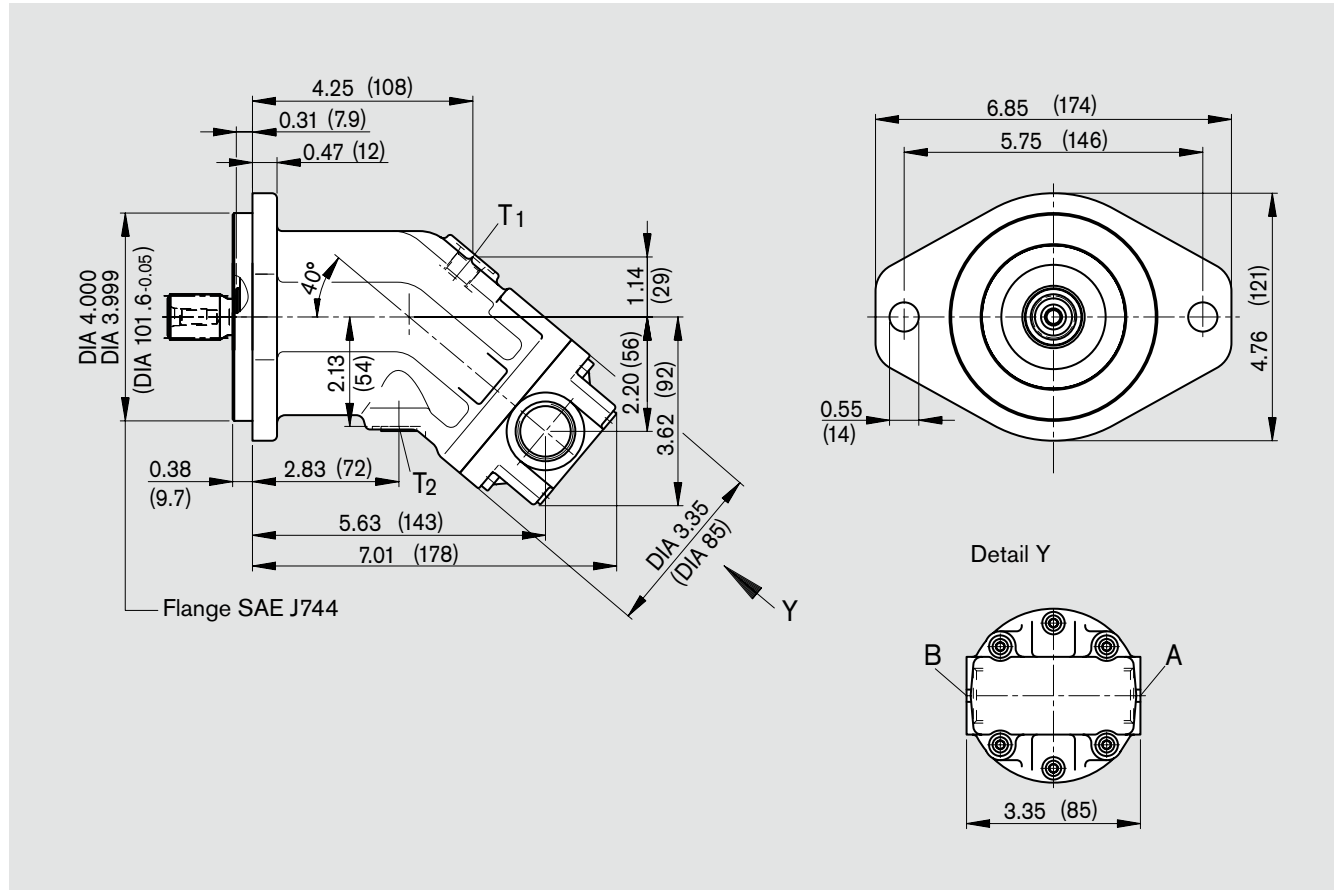
2) Thread according to DIN 3852, max. tightening torque: 20 lb-ft (30 Nm)

3) Please observe the general notes for the max. tightening torques on page 36

Unit Dimensions, Sizes 10, 12, 16 – SAE Design

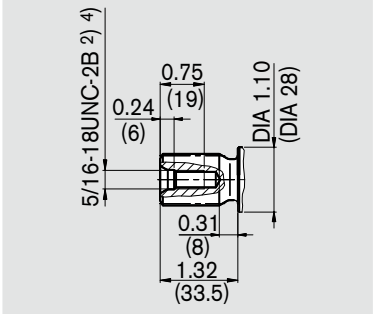
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Port plate 53: Threaded ports, at side

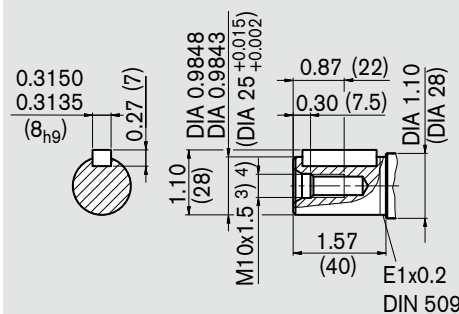


Shaft ends

S Splined shaft 7/8 in 13T 16/32 DP ¹⁾
(SAE J744 – 22-4 (B))
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS8x7x32 (mm)
p_N = 5100 psi (350 bar)



Ports

A, B	Service line ports	ISO 11926	1 1/16 in -12 UN-2B; 0.79 (20) deep	265 lb-ft (360 Nm) ⁴⁾
T ₁ , T ₂	Case drain ports (T ₂ plugged)	ISO 11926	9/16 in -18 UNF-2B; 0.51 (13) deep	60 lb-ft (80 Nm) ⁴⁾

¹⁾ ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5

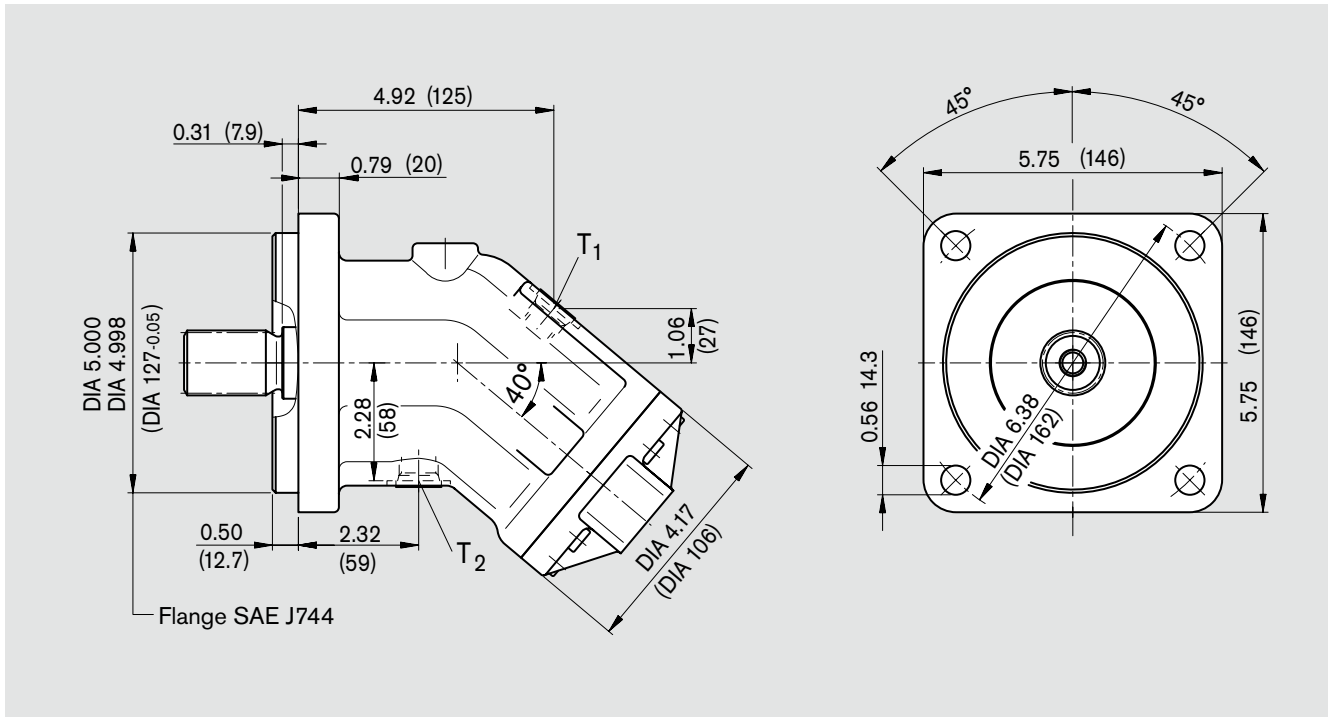
²⁾ Thread according to ISO 68

³⁾ Center bore according to DIN 332 (thread according to DIN 13)

⁴⁾ Please observe the general notes for the max. tightening torques on page 36

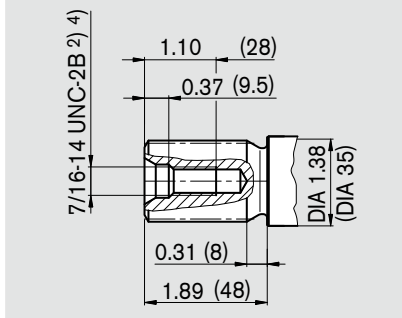
Unit Dimensions, Sizes 23, 28, 32 – SAE Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

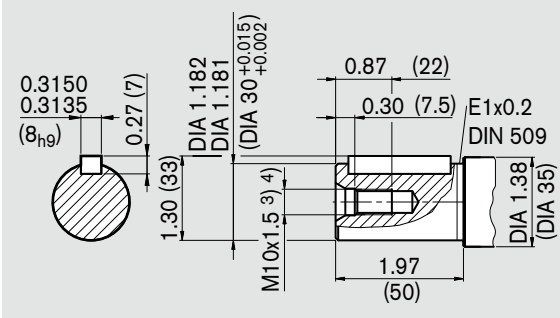


Shaft ends

S Splined shaft 1 1/4 in 14T 12/24 DP ¹⁾
(SAE J744 – 32-4 (C))
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS8x7x40 (mm)
p_N = 5100 psi (350 bar)



Ports

A, B Service line ports (see port plates)

T₁, T₂ Case drain ports (T₂ plugged) ISO 11926 3/4 in -16 UNF-2B; 0.59 (15) deep 120 lb-ft (160 Nm) ⁴⁾

¹⁾ ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to ISO 68

³⁾ Center bore according to DIN 332 (thread according to DIN 13)

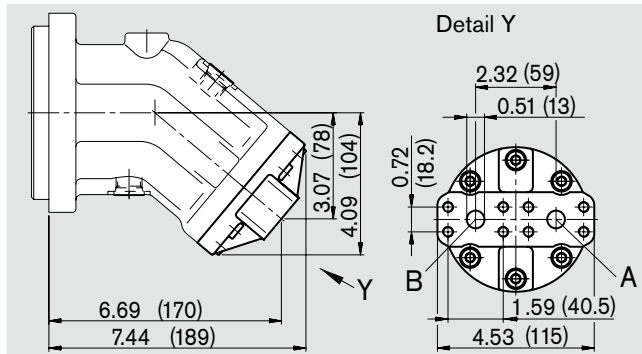
⁴⁾ Please observe the general notes for the max. tightening torques on page 36

Unit Dimensions, Sizes 23, 28, 32 – SAE Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

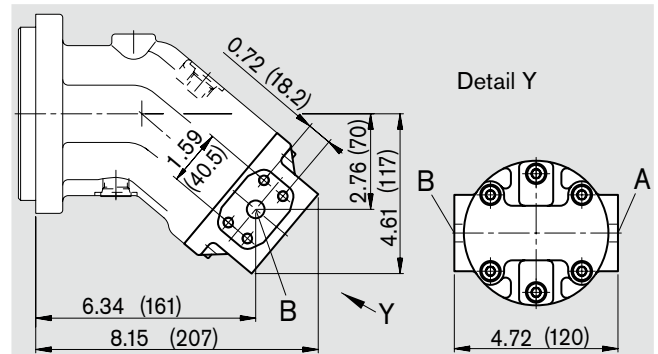
Port plates

51 SAE flange ports, rear



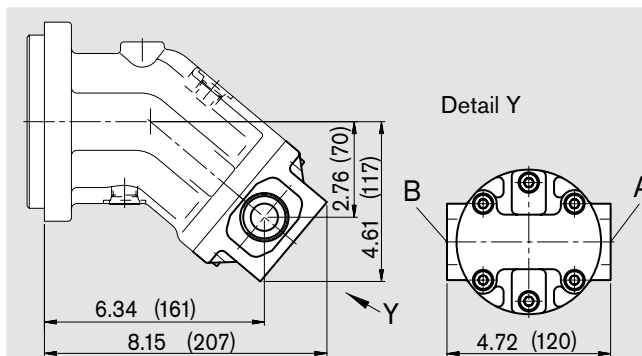
A, B Service line ports SAE J518 1/2 in
(high pressure series)
Fastening threads ISO 68 5/16 in-18 UNC-2B;
0.71 (18) deep ¹⁾

52 SAE flange ports, at side



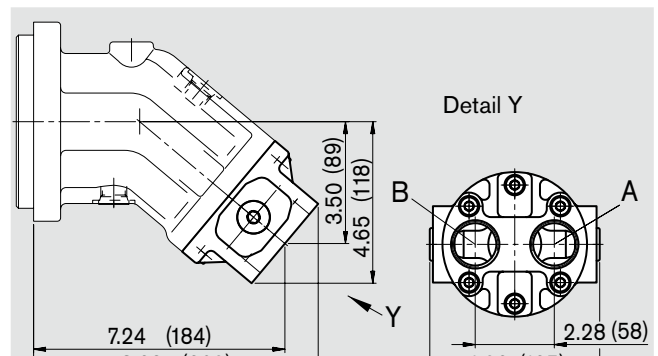
A, B Service line ports SAE J518 1/2 in
(high pressure series)
Fastening threads ISO 68 5/16 in-18 UNC-2B;
0.71 (18) deep ¹⁾

53 Threaded ports, at side



A, B Service line ports 1 5/16 in -12 UN-2B; 400 lb-ft ¹⁾
ISO 11926 0.79 (20) deep (540 Nm)

54 Threaded ports, at side and rear



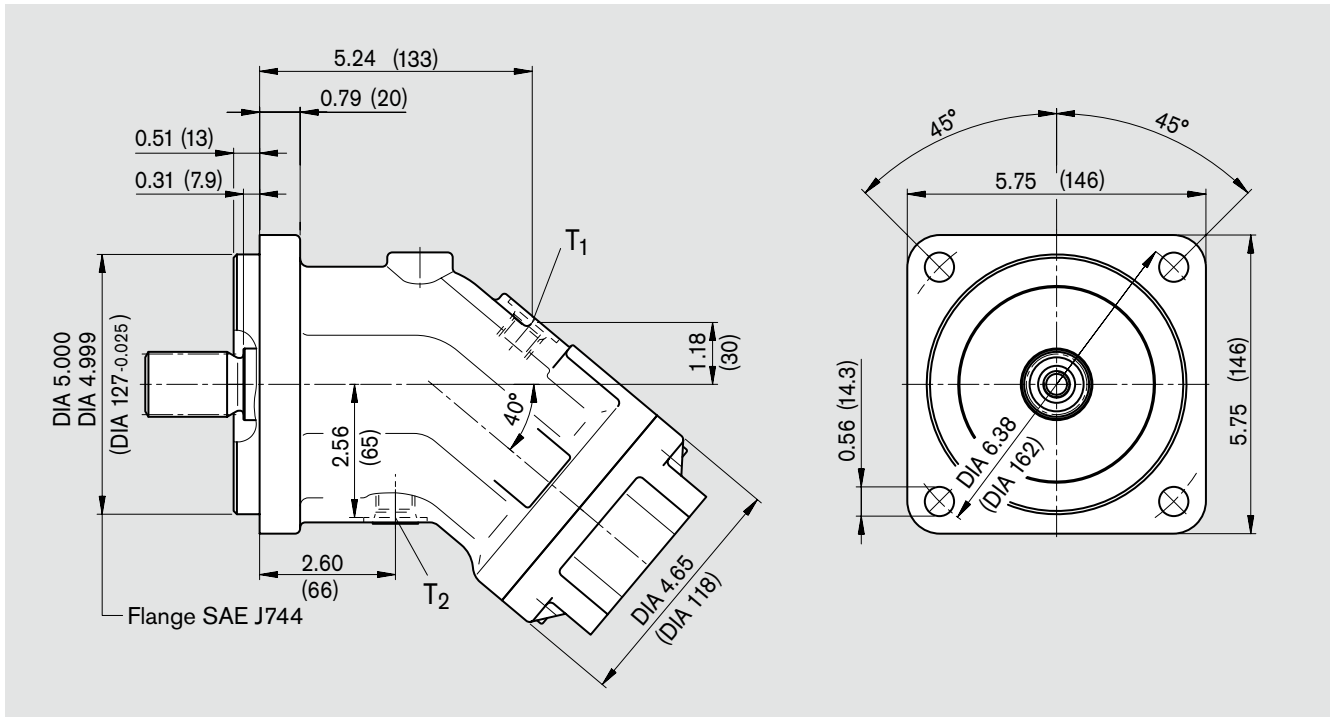
A, B Service line ports 1 5/16 in -12 UN-2B; 400 lb-ft ¹⁾
ISO 11926 0.79 (20) deep (540 Nm)
once plugged each

¹⁾ Please observe the general notes for the max. tightening torques on page 36

Note: port plates 18 and 19 see pages 31, 32

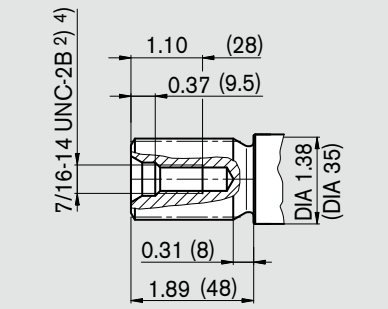
Unit Dimensions, Size 45 – SAE Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

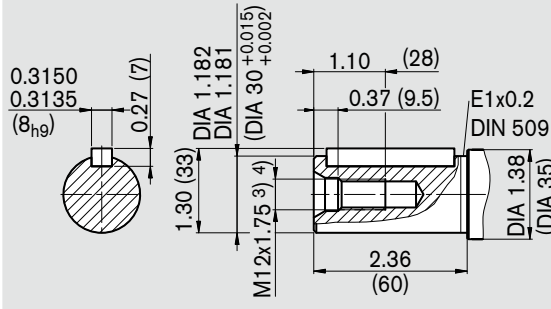


Shaft ends

S Splined shaft 1/4 in 14T 12/24 DP ¹⁾
(SAE J744 – 32-4 (C))
p_N = 5800 psi (400 bar)



P Parallel keyed shaft
DIN 6885 – AS8x7x50 (mm)
p_N = 5100 psi (350 bar)



Ports

A, B Service line ports (see port plates)

T₁, T₂ Case drain ports (T₂ plugged) ISO 11926 3/4 in -16 UNF-2B; 0.59 (15) deep 120 lb-ft (160 Nm) ⁴⁾

¹⁾ ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to ISO 68

³⁾ Center bore according to DIN 332 (thread according to DIN 13)

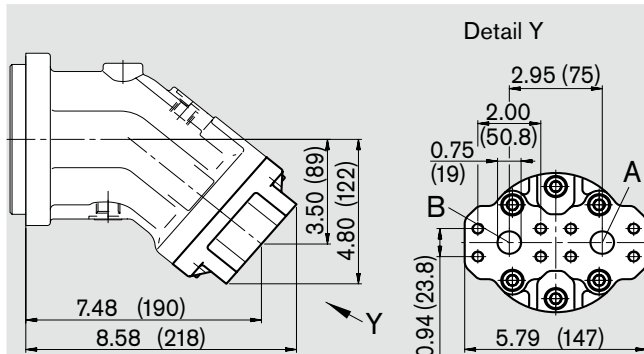
⁴⁾ Please observe the general notes for the max. tightening torques on page 36

Unit Dimensions, Size 45 – SAE Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

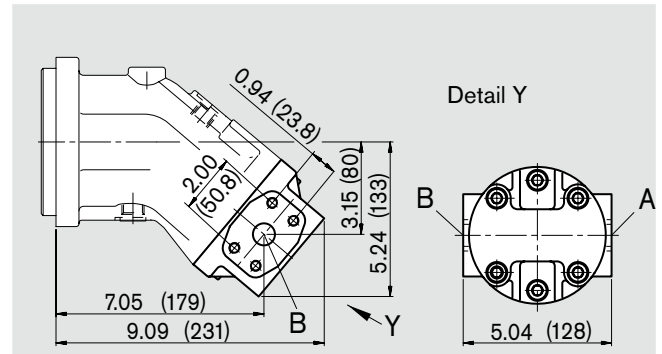
Port plates

51 SAE flange ports, rear



A, B	Service line ports (high pressure series)	SAE J518	3/4 in
	Fastening threads	ISO 68	3/8 in -16 UNC-2B; 0.82 (21) deep ¹⁾

52 SAE flange ports, at side



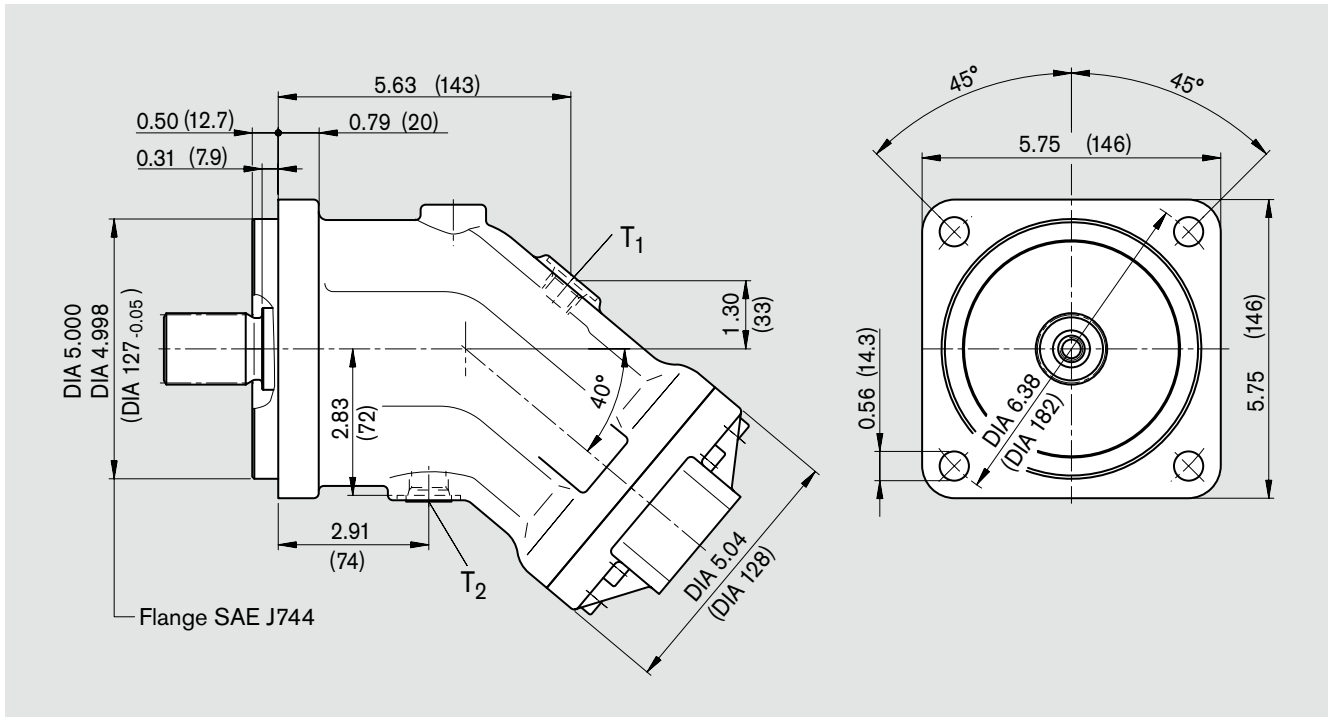
A, B	Service line ports (high pressure series)	SAE J518	3/4 in
	Fastening threads	ISO 68	3/8 in -16 UNC-2B; 0.82 (21) deep ¹⁾

¹⁾ Please observe the general notes for the max. tightening torques on page 36

Note: port plates 18 and 19 see pages 31, 32

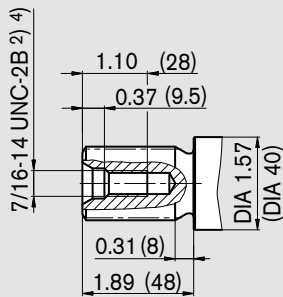
Unit Dimensions, Sizes 56, 63 – SAE Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

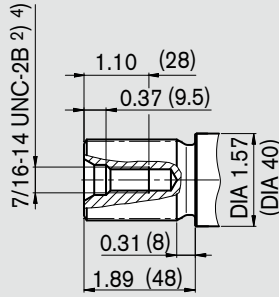


Shaft ends

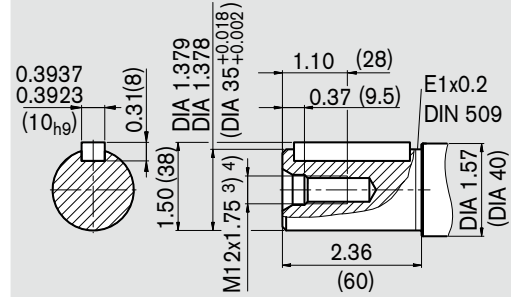
S Splined shaft 1 1/4 in 14T 12/24 DP ¹⁾
(SAE J744 – 32-4 (C))
 $p_N = 5100 \text{ psi (350 bar)}$



T Splined shaft 1 3/8 in 21T 16/32 DP ¹⁾
 $p_N = 5800 \text{ psi (400 bar)}$



B Parallel keyed shaft
DIN 6885 – AS10x8x50 (mm)
 $p_N = 5100 \text{ psi (350 bar)}$



Ports

A, B Service line ports (see port plates)

T₁, T₂ Case drain ports (T₂ plugged) ISO 11926 3/4 in -16 UNF-2B; 0.59 (15) deep 120 lb-ft (160 Nm) ⁴⁾

¹⁾ ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to ISO 68

³⁾ Center bore according to DIN 332 (thread according to DIN 13)

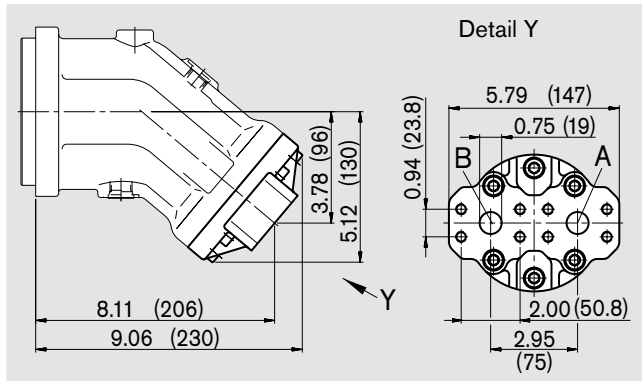
⁴⁾ Please observe the general notes for the max. tightening torques on page 36

Unit Dimensions, Sizes 56, 63 – SAE Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

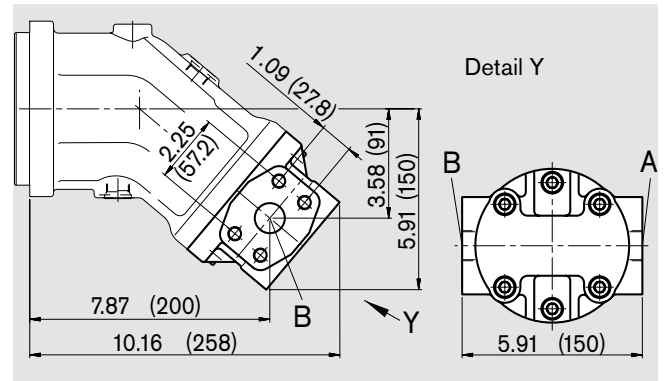
Port plates

51 SAE flange ports, rear



A, B	Service line ports (high pressure series)	SAE J518	3/4 in
	Fastening threads	ISO 68	3/8 in -16 UNC-2B; 0.82 (21) deep ¹⁾

52 SAE flange ports, at side



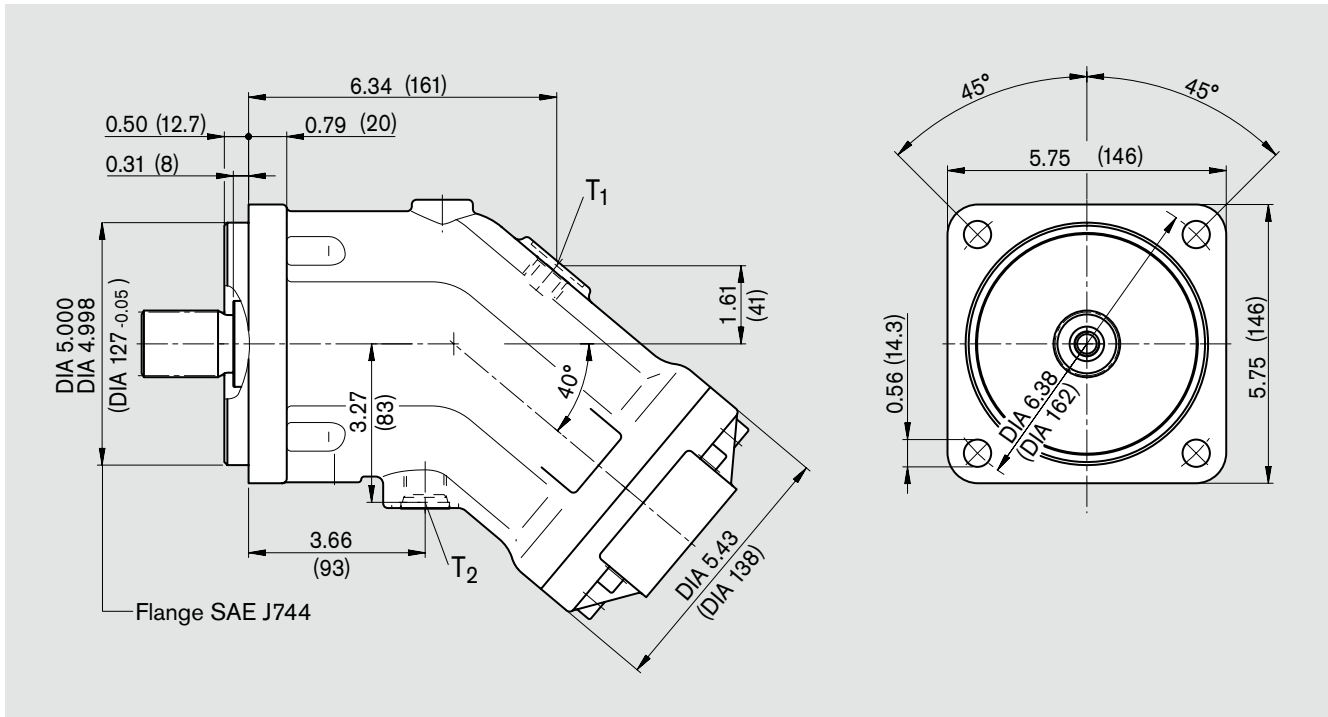
A, B	Service line ports (high pressure series)	SAE J518	1 in
	Fastening threads	ISO 68	7/16 in -14 UNC-2B; 0.87 (22) deep ¹⁾

¹⁾ Please observe the general notes for the max. tightening torques on page 36

Note: port plates 18 and 19 see pages 31, 32

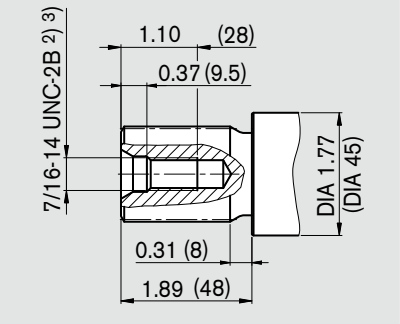
Unit Dimensions, Sizes 80, 90 – SAE Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

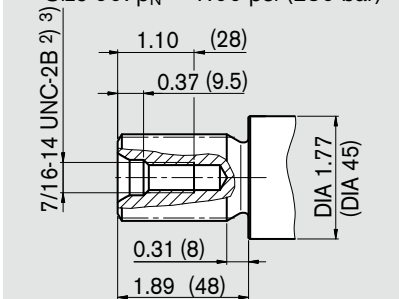


Shaft ends

U Splined shaft 1 3/8 in 21T 16/32 DP ¹⁾
p_N = 5800 psi (400 bar)



Q Splined shaft 1/4 in 14T 12/24 DP ¹⁾
(SAE J744 – 32-4 (C))
Size 80: p_N = 4350 psi (300 bar)
Size 90: p_N = 4100 psi (280 bar)



Ports

A, B Service line ports (see port plates)

T₁, T₂ Case drain ports (T₂ plugged) ISO 11926 7/8 in -14 UNF-2B; 0.67 (17) deep 180 lb-ft (240 Nm) ³⁾

¹⁾ ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to ISO 68

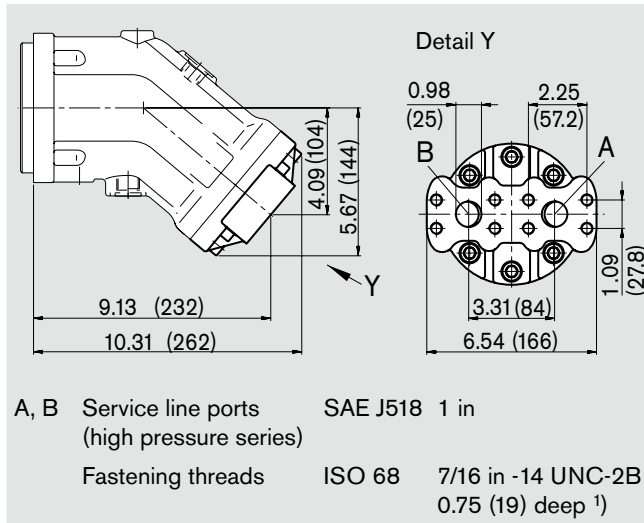
³⁾ Please observe the general notes for the max. tightening torques on page 36

Unit Dimensions, Sizes 80, 90 – SAE Design

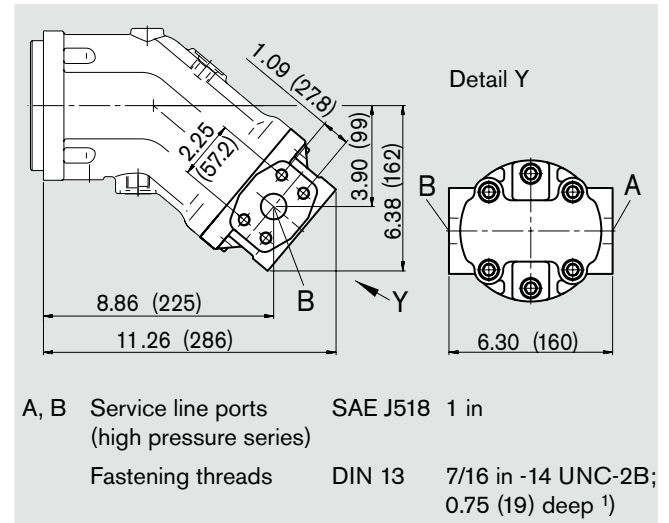
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters)

Port plates

51 SAE flange ports, rear



52 SAE flange ports, at side

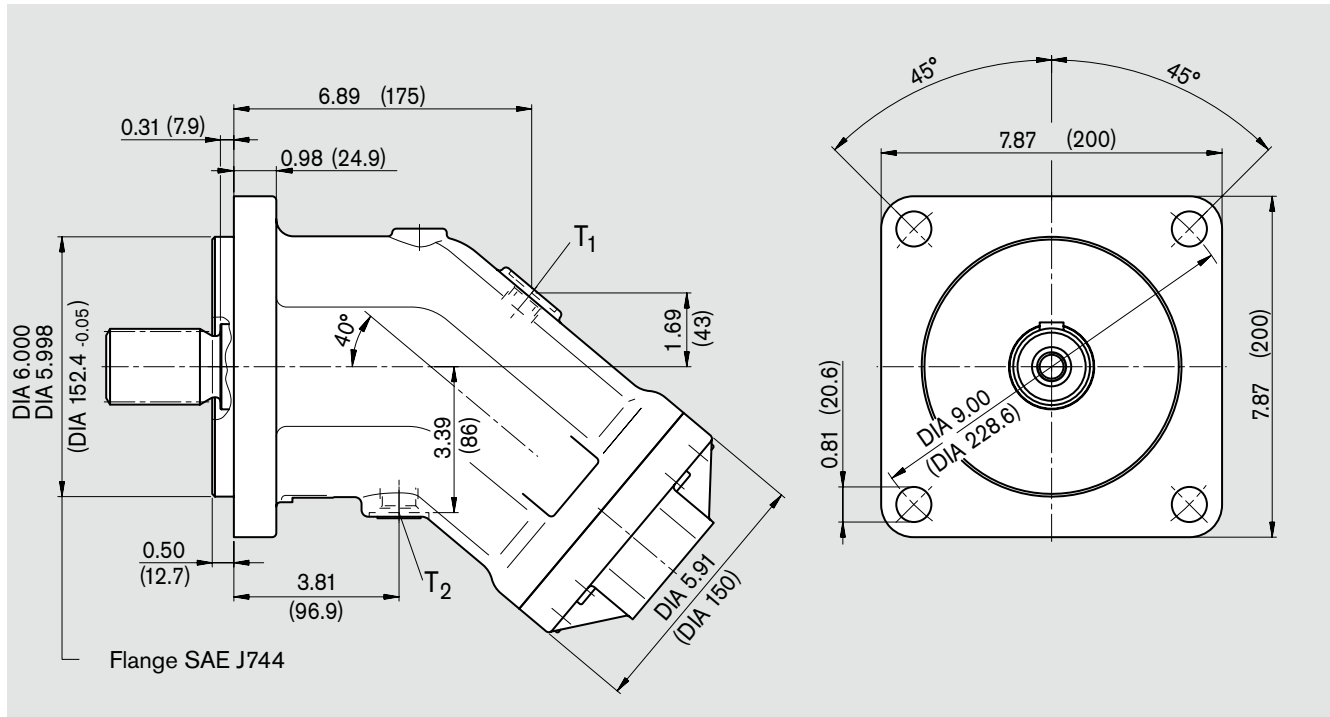


¹⁾ Please observe the general notes for the max. tightening torques on page 36

Note: port plates 18 and 19 see pages 31, 32

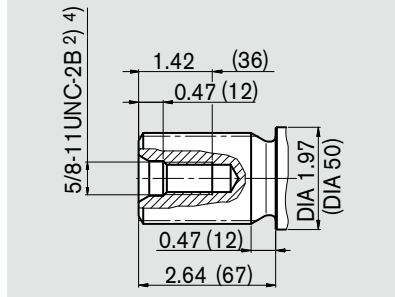
Unit Dimensions, Sizes 107, 125 – SAE Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

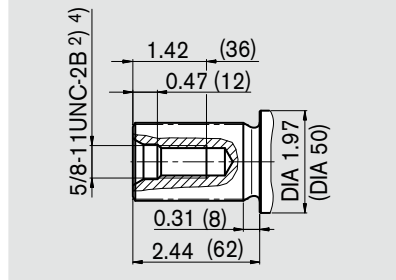


Shaft ends

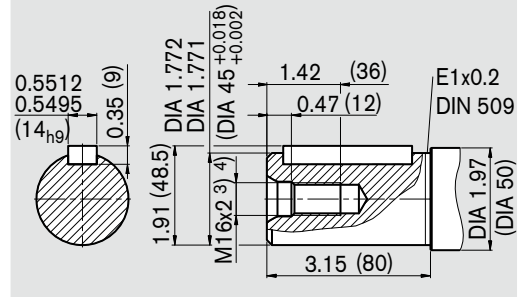
S Splined shaft 1 3/4 in 13T 8/16 DP ¹⁾
(SAE J744 – 44-4 (D))
p_N = 5800 psi (400 bar)



U Splined shaft 1 1/2 in 23T 16/32 DP ¹⁾
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS14x9x63 (mm)
p_N = 5100 psi (350 bar)



Ports

A, B Service line ports (see port plates)

T₁, T₂ Case drain ports (T₂ plugged) ISO 11926 7/8 in -14 UNF-2B; 0.67 (17) deep 180 lb-ft (240 Nm) ⁴⁾

¹⁾ ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to ISO 68

³⁾ Center bore according to DIN 332 (thread according to DIN 13)

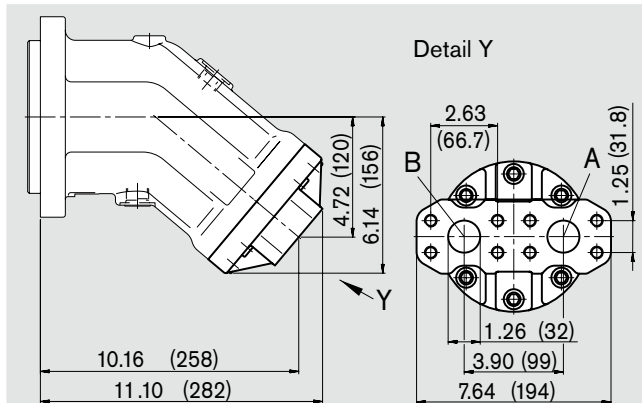
⁴⁾ Please observe the general notes for the max. tightening torques on page 36

Unit Dimensions, Sizes 107, 125 – SAE Design

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters)

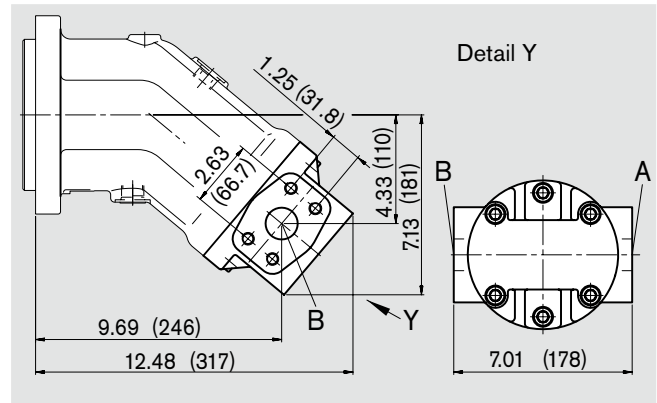
Port plates

51 SAE flange ports, rear



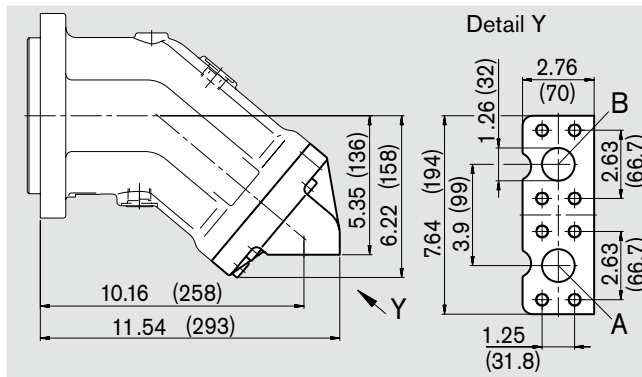
A, B	Service line ports (high pressure series)	SAE J518	1 1/4 in
	Fastening threads	ISO 68	1/2 in -13 UNC-2B; 0.75 (19) deep ¹⁾

52 SAE flange ports, at side



A, B	Service line ports (high pressure series)	SAE J518	1 1/4 in
	Fastening threads	ISO 68	1/2 in -13 UNC-2B; 0.75 (19) deep ¹⁾

60 SAE flange ports, bottom



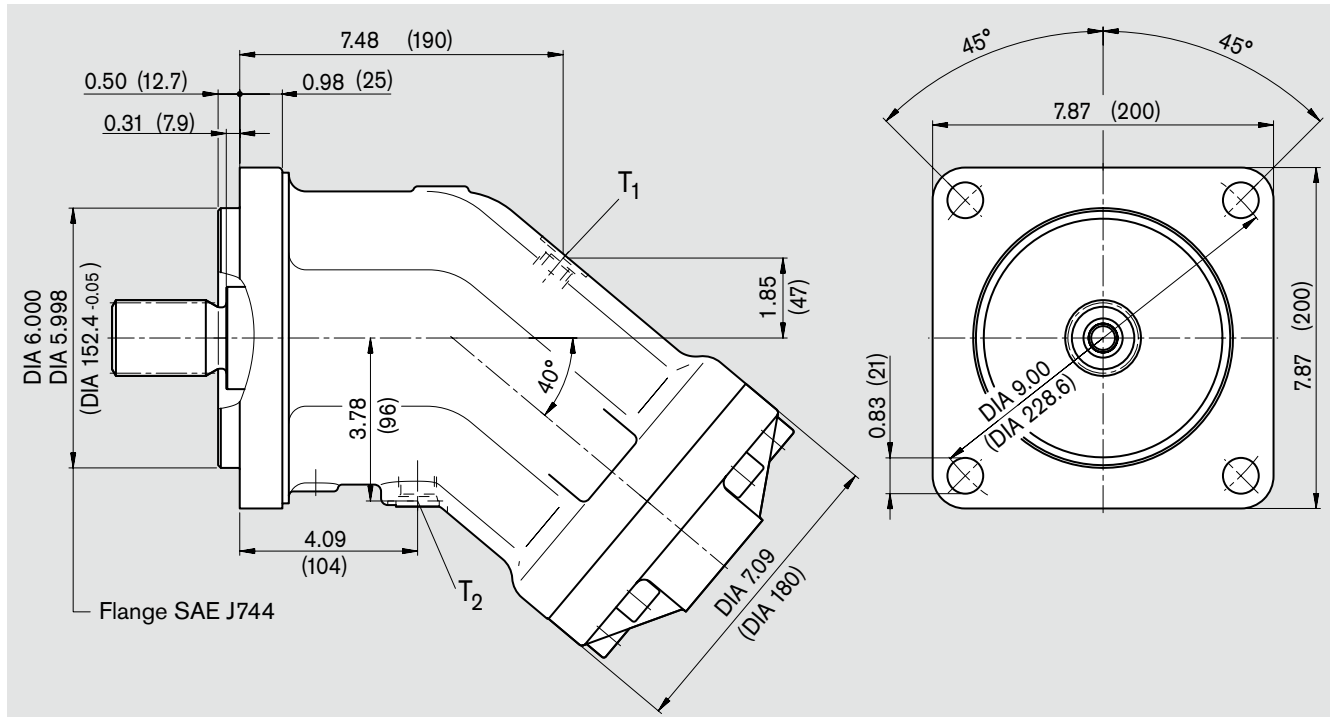
A, B	Service line ports (high pressure series)	SAE J518	1 1/4 in
	Fastening threads	ISO 68	1/2 in -13 UNC-2B; 0.75 (19) deep ¹⁾

¹⁾ Please observe the general notes for the max. tightening torques on page 36

Note: port plates 18 and 19 see pages 31, 32

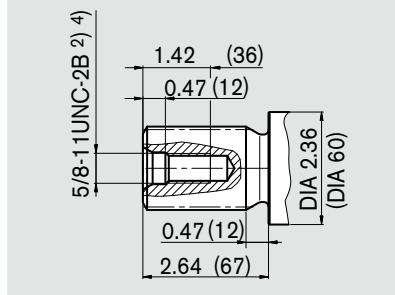
Unit Dimensions, Sizes 160, 180 – SAE Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

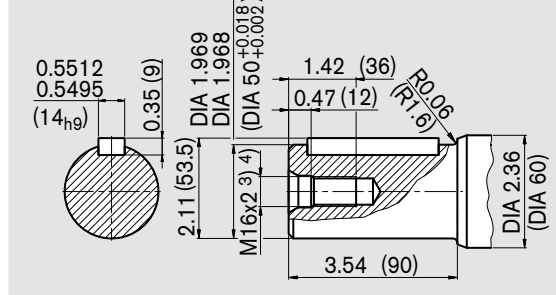


Shaft ends

S Splined shaft 1 3/4 in 13T 8/16 DP ¹⁾
(SAE J744 – 44-4 (D))
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS14x9x70 (mm)
p_N = 5100 psi (350 bar)



Ports

A, B Service line ports (see port plates)

T₁, T₂ Case drain ports (T₂ plugged) ISO 11926 7/8 in -14 UNF-2B; 0.67 (17) deep 180 lb-ft (240 Nm) ⁴⁾

¹⁾ ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5

²⁾ Thread according to ISO 68

³⁾ Center bore according to DIN 332 (thread according to DIN 13)

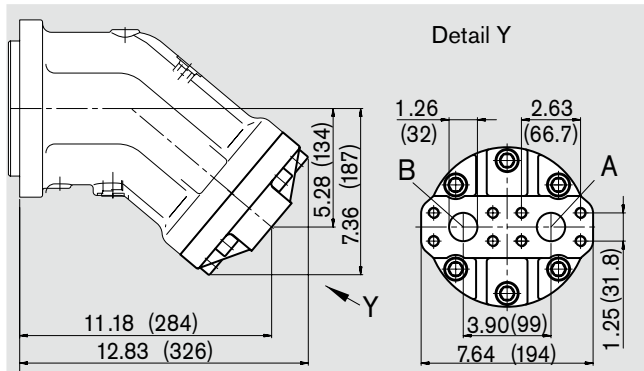
⁴⁾ Please observe the general notes for the max. tightening torques on page 36

Unit Dimensions, Sizes 160, 180 – SAE Design

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters)

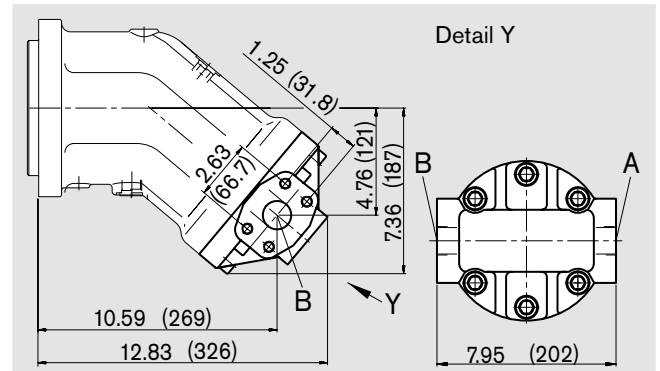
Port plates

51 SAE flange ports, rear



A, B	Service line ports (high pressure series)	SAE J518	1 1/4 in
	Fastening threads	ISO 68	1/2 in -13 UNC-2B; 0.75 (19) deep ¹⁾

52 SAE flange ports, at side



A, B	Service line ports (high pressure series)	SAE J518	1 1/4 in
	Fastening threads	ISO 68	1/2 in -13 UNC-2B; 0.75 (19) deep ¹⁾

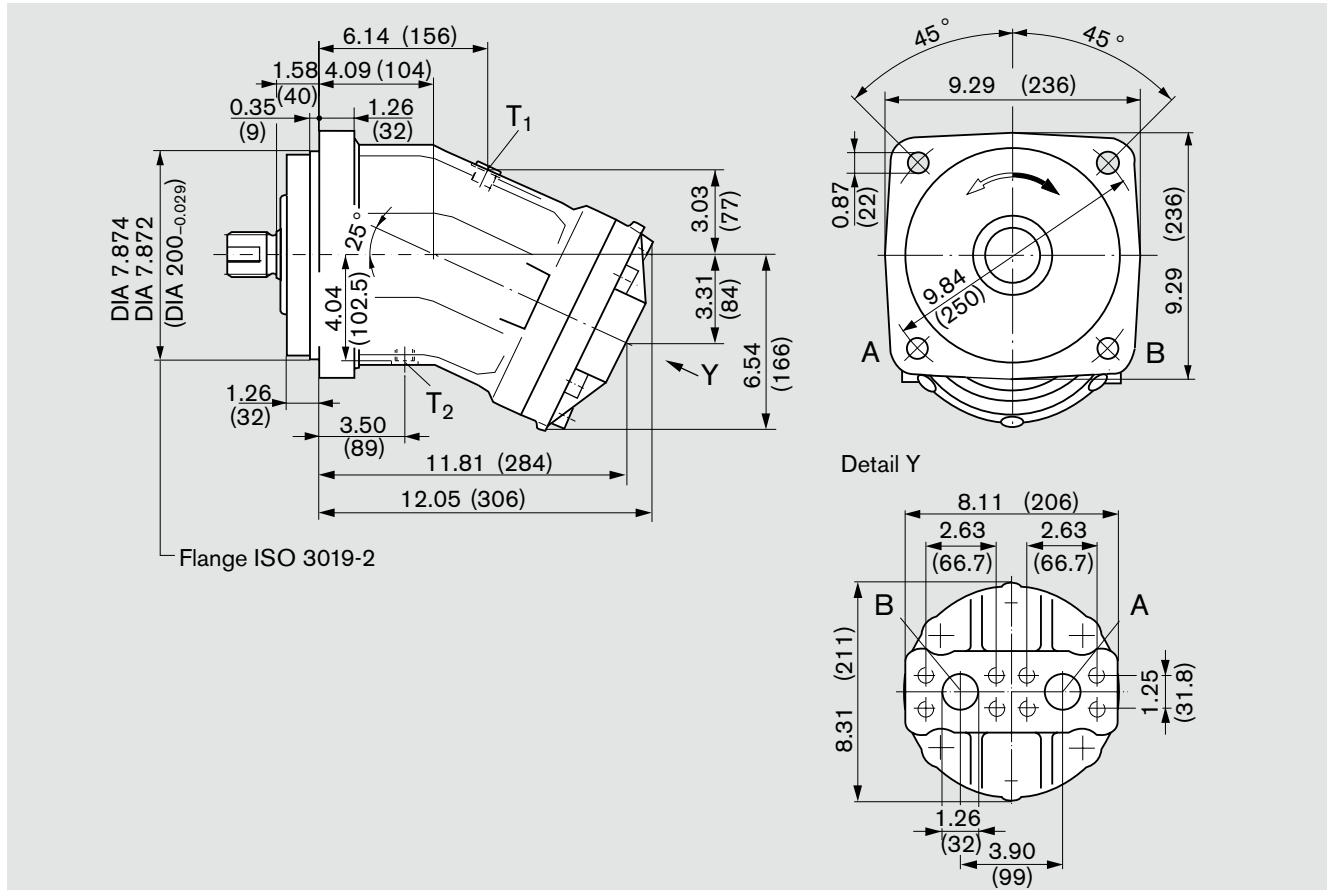
¹⁾ Please observe the general notes for the max. tightening torques on page 36

Note: port plates 18 and 19 see pages 31, 32

Unit Dimensions, Size 200 – ISO Design

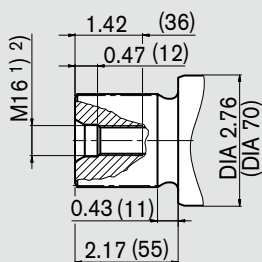
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Port plate 01: SAE flange ports, rear

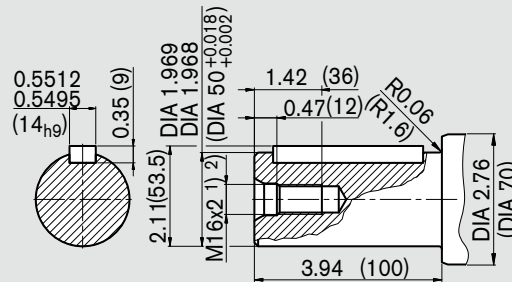


Shaft ends

A Splined shaft DIN 5480
W50x2x30x24x9g
p_N = 5800 psi (400 bar)



B Parallel keyed shaft
DIN 6885 – AS14x9x80 (mm)
p_N = 5100 psi (350 bar)



Ports

A, B	Service line ports (high pressure series)	SAE J518	1 1/4 in
	Fastening threads	DIN 13	M14x2; 0.75 (19) deep ²⁾
T ₁ , T ₂	Case drain ports (T ₁ plugged)	DIN 3852	M22x1.5; 0.55 (14) deep 155 lb-ft (210 Nm) ²⁾

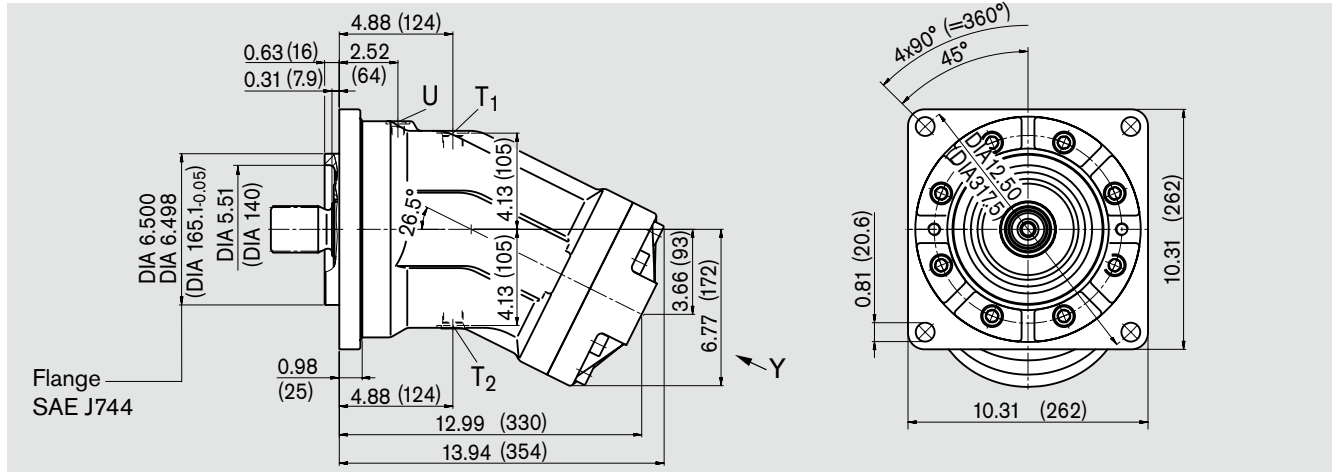
1) Center bore according to DIN 332 (thread according to DIN 13)

2) Please observe the general notes for the max. tightening torques on page 36

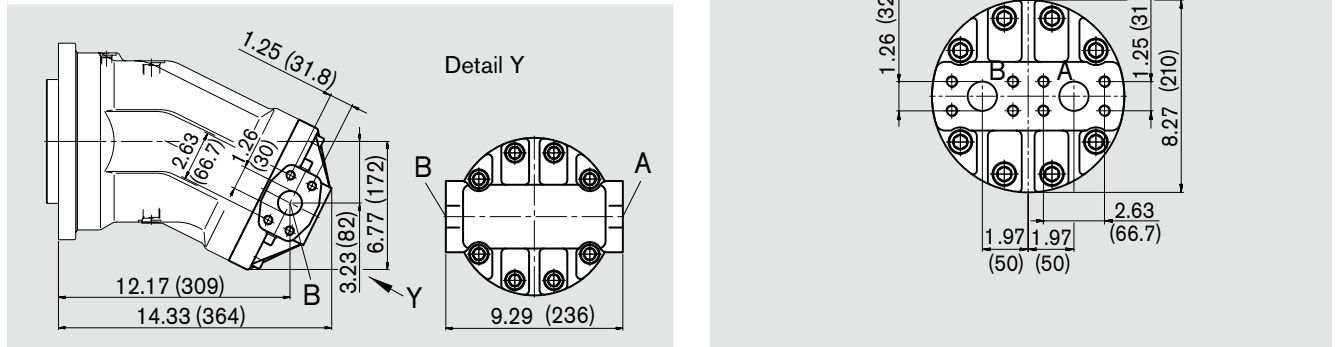
Unit Dimensions, Size 250 – SAE Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Port plate 51: SAE flange ports, rear

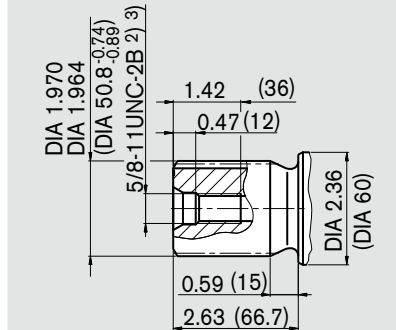


Port plate 52: SAE flange ports, at side

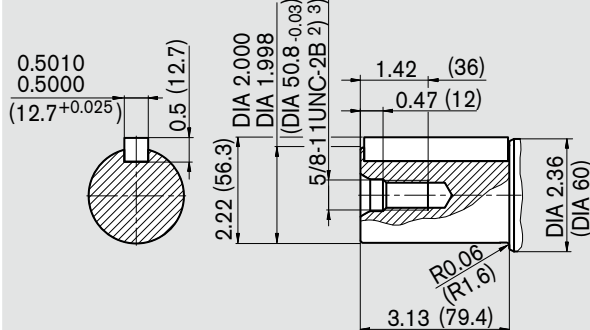


Shaft ends

S Splined shaft 2 in 15T 8/16 DP ¹⁾
(SAE J744 – 50-4 (F))
 $\rho_N = 5100$ psi (350 bar)



K Parallel keyed shaft
0.5x0.5x3.0 (in) 12.7x12.7x76.7 (mm)
 $\rho_N = 5100$ psi (350 bar)



Ports

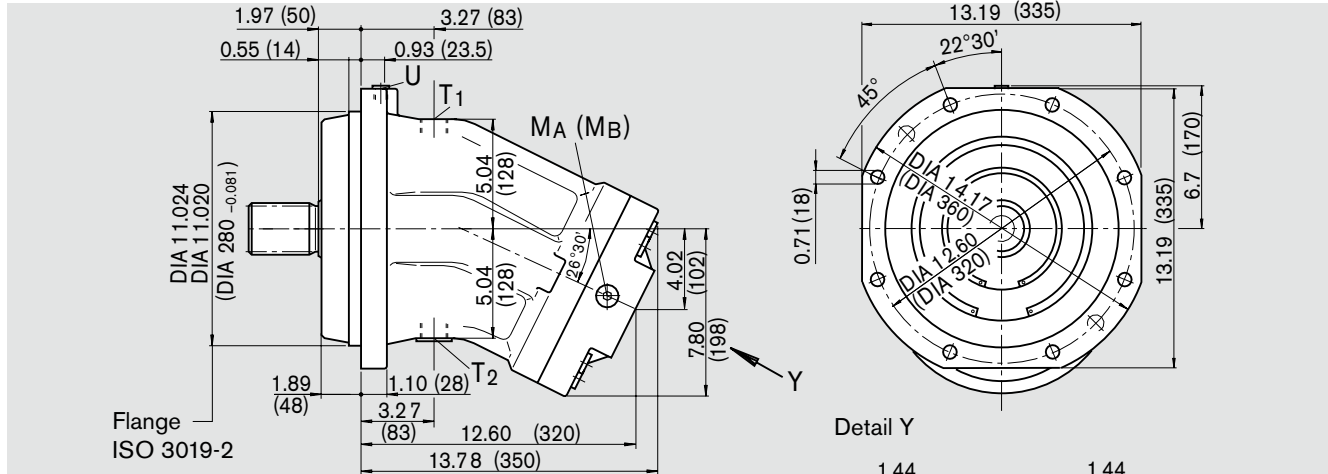
A, B	Service line ports (high pressure series) Fastening threads	SAE J518 ISO 68	1 1/4 in 1/2 in -13 UNC-2B; 0.75 (19) deep ³⁾
T ₁ , T ₂	Case drain ports (T ₂ plugged)	ISO 11926	7/8 in -14 UNF-2B; 0.67 (17) deep 180 lb-ft (240 Nm) ³⁾
U	Port for bearing flushing (plugged)	ISO 11926	9/16 in -18 UNF-2B; 0.51 (13) deep 60 lb-ft (80 Nm) ³⁾

1) ANSI B92.1a-1976, 30° pressure angle, flat root, side fit, tolerance class 5
2) Thread according to ISO 68
3) Please observe the general notes for the max. tightening torques on page 36

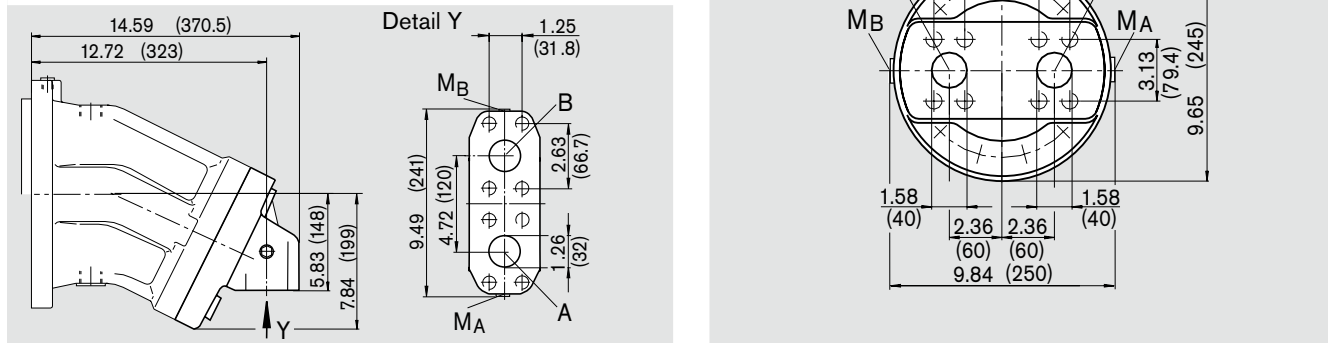
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters)

Unit Dimensions, Size 355 – ISO Design

Port plate 01: SAE flange ports, rear

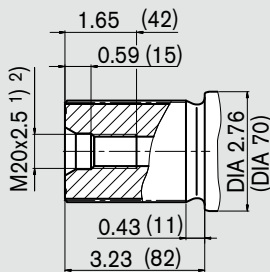


Port plate 10: SAE flange ports, bottom

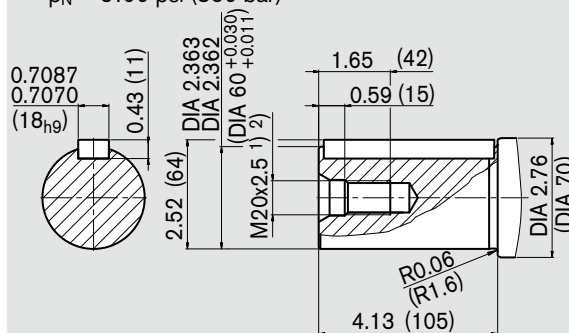


Shaft ends

Z Splined shaft DIN 5480
W60x2x30x28x9g
p_N = 5100 psi (350 bar)



P Parallel keyed shaft
DIN 6885 – AS18x11x100 (mm)
p_N = 5100 psi (350 bar)



Ports

			Port plate 01:	Port plate 10:
A, B	Service line ports (high pressure series) Fastening threads	SAE J518 DIN 13	1 1/2 in M16x2; 0.83 (21) deep ²⁾	1 1/4 in M14x2; 0.87 (22) deep ²⁾
T ₁ , T ₂	Case drain ports (T ₂ plugged)	DIN 3852	M33x2; 0.71 (18) deep	400 lb-ft (540 Nm) ²⁾
U	Port for bearing flushing (plugged)	DIN 3852	M14x1.5; 0.47 (12) deep	60 lb-ft (80 Nm) ²⁾
M _A , M _B	Gauge ports operating pressure (plugged)	DIN 3852	M14x1.5; 0.47 (12) deep	60 lb-ft (80 Nm) ²⁾

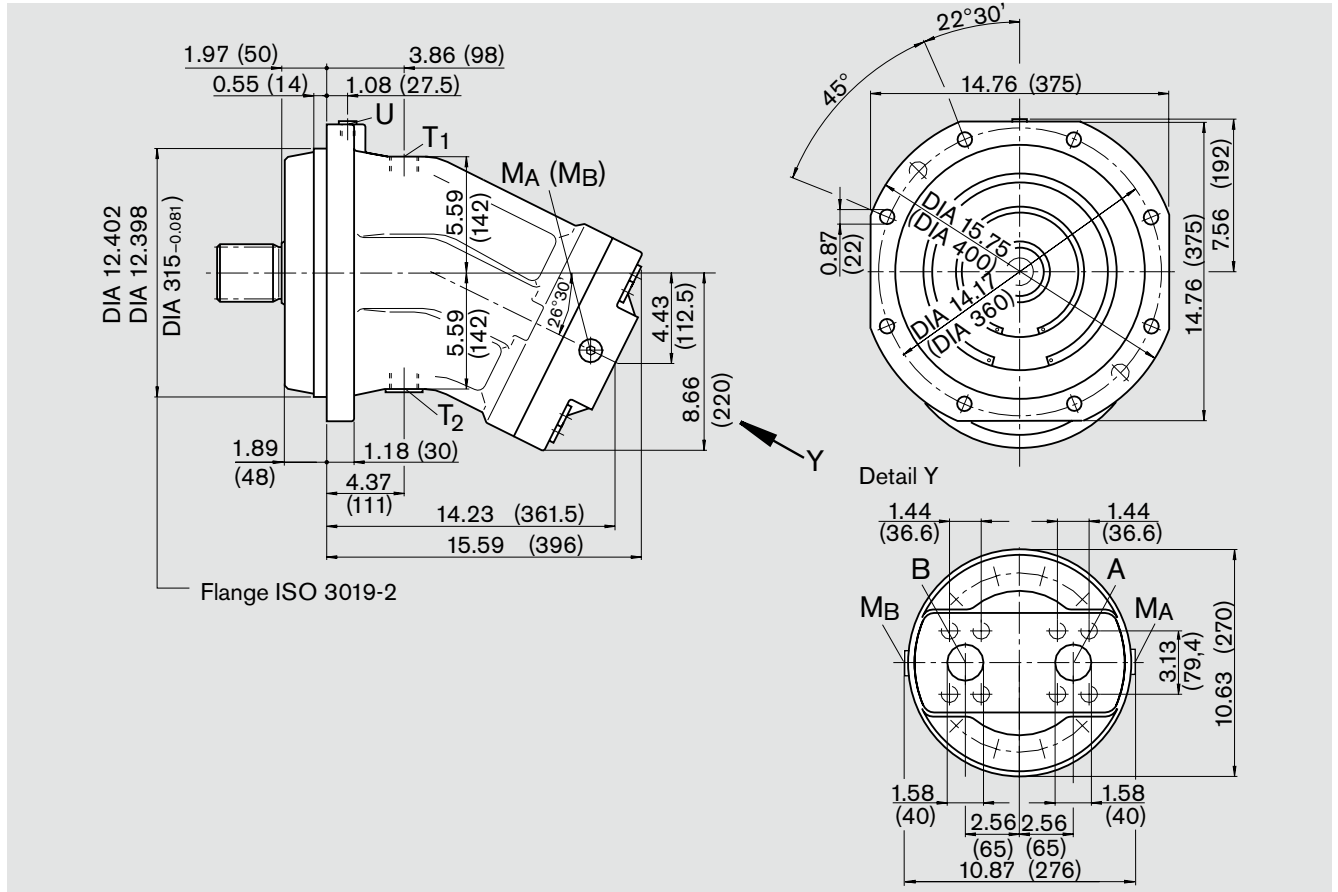
¹⁾ Center bore according to DIN 332 (thread according to DIN 13)

²⁾ Please observe the general notes for the max. tightening torques on page 36

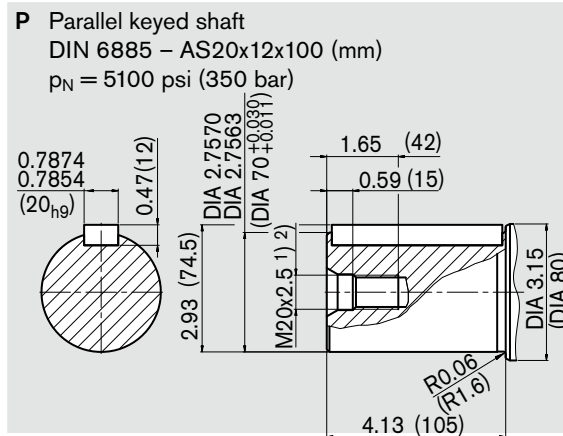
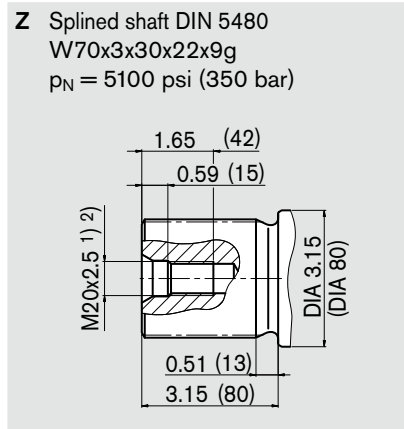
Unit Dimensions, Size 500 – ISO Design

Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Port plate 01: SAE flange ports, rear



Shaft ends



Ports

A, B	Service line ports (high pressure series) Fastening threads	SAE J518 DIN 13	1 1/2 in M16x2;	0.83 (21) deep ²⁾	
T ₁ , T ₂	Case drain ports (T ₂ plugged)	DIN 3852	M33x2;	0.71 (18) deep	400 lb-ft (540 Nm) ²⁾
U	Port for bearing flushing (plugged)	DIN 3852	M18x1.5;	0.47 (12) deep	100 lb-ft (140 Nm) ²⁾
M _A , M _B	Gauge ports operating pressure (plugged)	DIN 3852	M14x1.5;	0.47 (12) deep	60 lb-ft (80 Nm) ²⁾

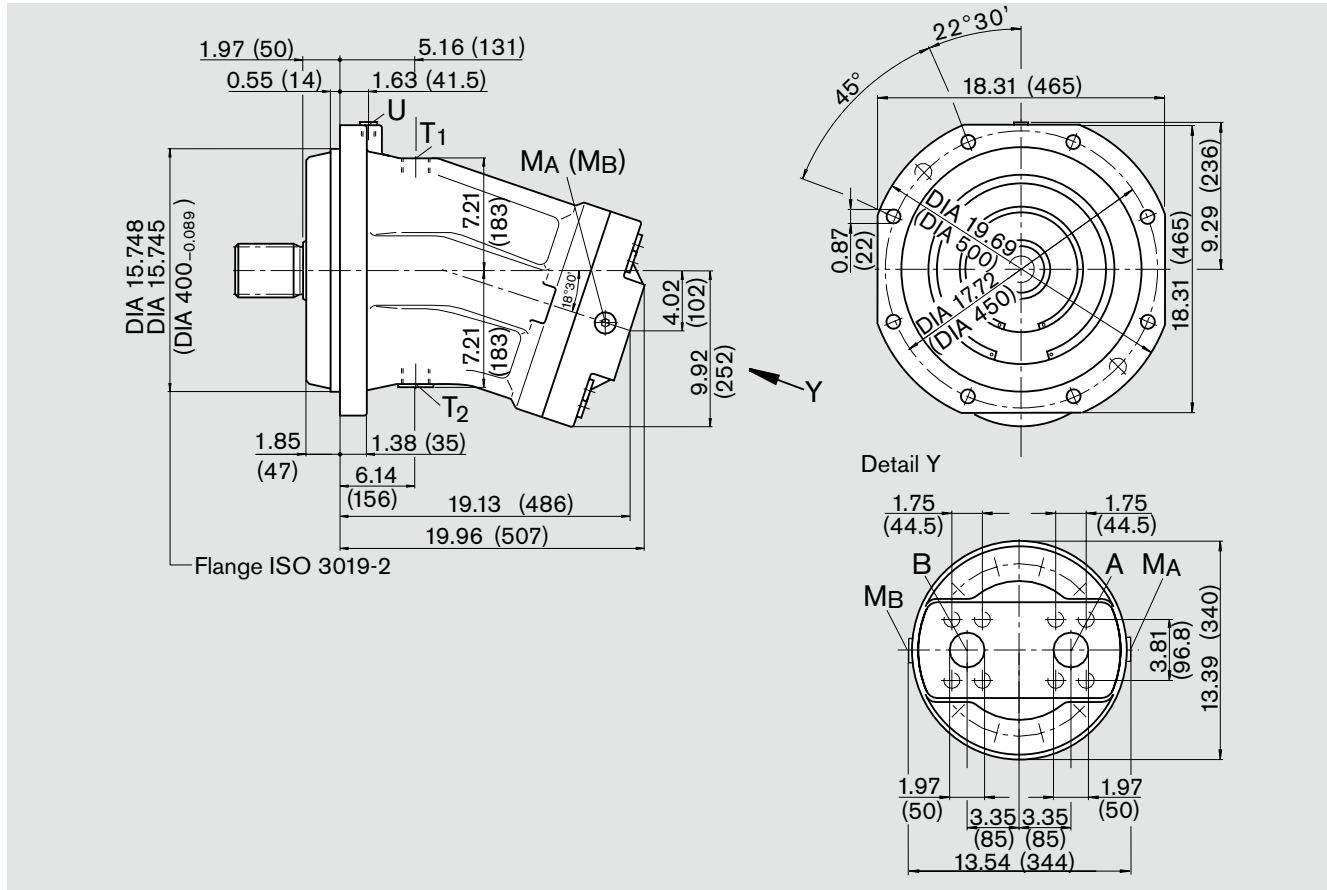
1) Center bore according to DIN 332 (thread according to DIN 13)

2) Please observe the general notes for the max. tightening torques on page 36

Unit Dimensions, Size 710 – ISO Design

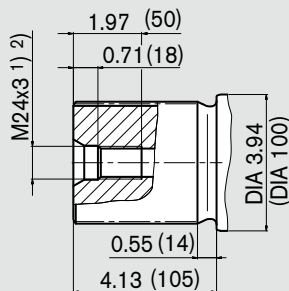
Before finalizing your design, please request a binding installation drawing.
Dimensions in inches and (millimeters)

Port plate 01: SAE flange ports, rear

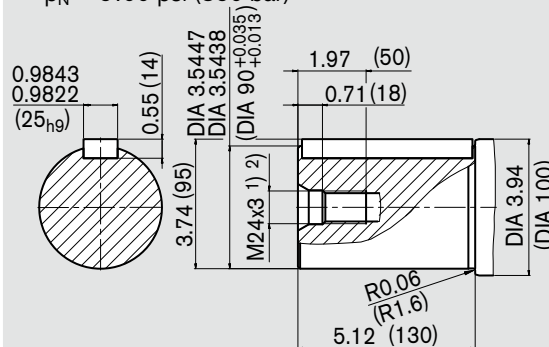


Shaft ends

Z Splined shaft DIN 5480
W90x3x30x28x9g
p_N = 5100 psi (350 bar)



P Parallel keyed shaft
DIN 6885 – AS25x14x125 (mm)
p_N = 5100 psi (350 bar)



Ports

A, B	Service line ports (high pressure series) Fastening threads	SAE J518 DIN 13	2 in M20x2.5; 1.18 (30) deep ²⁾
T ₁ , T ₂	Case drain ports (T ₂ plugged)	DIN 3852	M42x2; 0.79 (20) deep 530 lb-ft (720 Nm) ²⁾
U	Port for bearing flushing (plugged)	DIN 3852	M18x1.5; 0.47 (12) deep 100 lb-ft (140 Nm) ²⁾
M _A , M _B	Gauge ports operating pressure (plugged)	DIN 3852	M14x1.5; 0.47 (12) deep 60 lb-ft (80 Nm) ²⁾

¹⁾ Center bore according to DIN 332 (thread according to DIN 13)

²⁾ Please observe the general notes for the max. tightening torques on page 36

Flush and Boost Pressure Valve

The flush and boost pressure valve is used to remove heat from the closed control and to ensure that a minimum boost pressure is present (opening pressure 230 psi (16 bar), fixed; note when setting primary valve). A side effect is flushing of the case.

Warm hydraulic fluid is directed from the respective low pressure side into the motor case. This is then fed into the tank, together with the case drain. The hydraulic fluid drawn out of the closed control in this way must be replaced by cooled hydraulic fluid that is supplied by the boost pump.

In an open control system, the flush and boost pressure valve is used solely to flush the case from the return line.

On port plate 527, the valve is fitted directly onto the fixed motor (size 45 to 180, 250), while on port plate 017 (size 355 and 500), it is fitted on a plate.

Orifice can be used to adjust the flushing volumes as required.

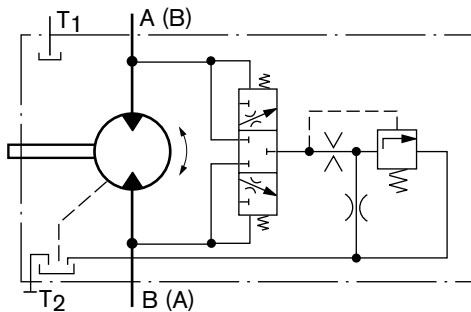
Standard flushing volumes

(at low pressure $\Delta p_{LP} = 365 \text{ psi} / 25 \text{ bar}$)

Size	Flushing flow	Mat.-no-orifice
45, 56, 63	0.93 gpm (3.5 L/min)	R909651766
80, 90	1.32 gpm (5 L/min)	R909419695
107, 125	2.11 gpm (8 L/min)	R909419696
160, 180	2.64 gpm (10 L/min)	R909419697
250	2.64 gpm (10 L/min)	on request
355, 500	4.23 gpm (16 L/min)	on request

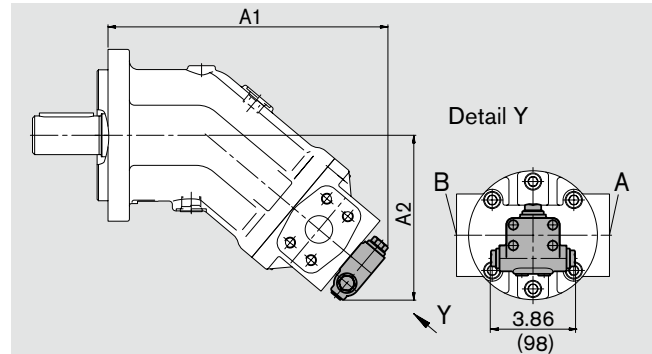
For sizes 45 to 180, orifices for flushing volumes of 0.93 - 2.64 gpm (3.5 - 10 L/min) can be supplied. In the case of non-standard flushing volumes, please specify the desired flushing volume when ordering. The flushing volume without orifice is approx. 3.2 to 3.7 gpm (12 to 14 L) at low pressure $\Delta p_{LP} = 365 \text{ psi} (25 \text{ bar})$.

Circuit diagram



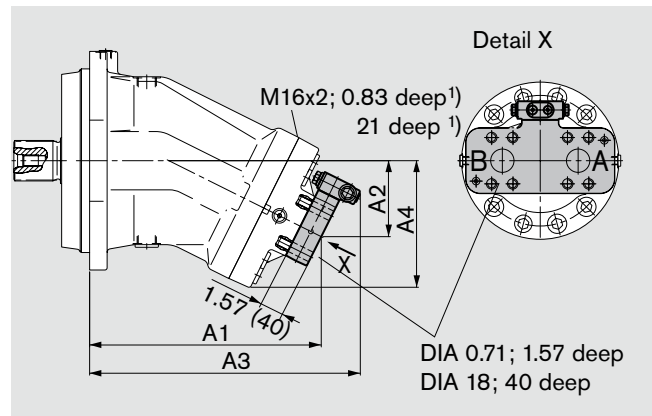
Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters)

Port plate 527: SAE flange ports, at side



Size	A1	A2
45	in 9.72	5.94
	mm (247)	(151)
56, 63	in 10.36	6.26
	mm (263)	(159)
80, 90	in 11.69	6.83
	mm (297)	(173.5)
107, 125	in 12.84	7.56
	mm (326.1)	(192)
160, 180	in 13.66	7.91
	mm (347)	(201)
250	in 15.20	6.06
	mm (386)	(154)

Port plate 017: SAE flange ports, rear



Size	A1	A2	A3	A4
355	in 14.02	4.72	16.57	7.80
	mm 356	120	421	198
500	in 15.63	5.12	18.27	8.66
	mm 397	130	464	220

Additional dimensions see page 26 (size 355) and page 27 (size 500).

1) DIN 13, please observe the general notes for the max. tightening torques on page 36

Pressure Relief Valves

The pressure relief valves MHDB (as to RE 64642) protect the motor from excess pressure. When the set opening pressure is reached the hydraulic fluid flows from the high pressure side to the low pressure side.

The pressure relief valves can only be supplied in conjunction with the port plates 181, 191 or 192 (counterbalance valve for fitting on port plate 181, see next page).

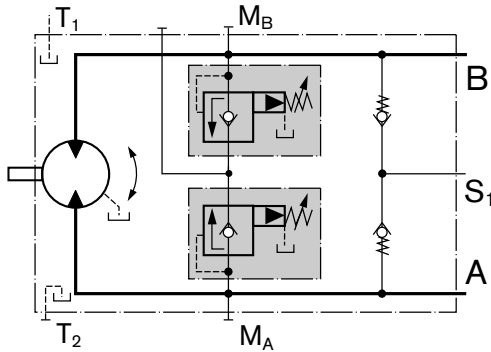
Setting range opening pressure ___ 725 - 6100 psi (50 - 420 bar)

At design "with pressure sequence range" (192) a higher pressure setting can be realized by applying an external pilot pressure of 365 - 435 psi (25 - 30 bar) at port P_{St}.

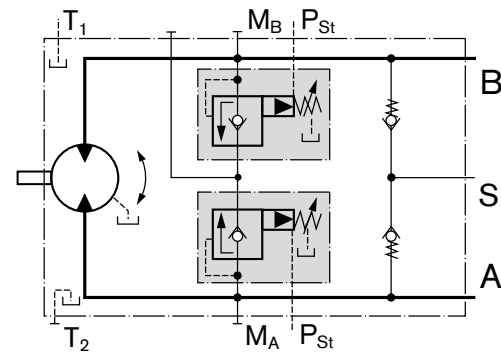
Please indicate in clear text when ordering:

- opening pressure of the pressure relief valve
- opening pressure at pilot pressure applied at P_{St} (for design 192 only)

Design without pressure sequence range "191"

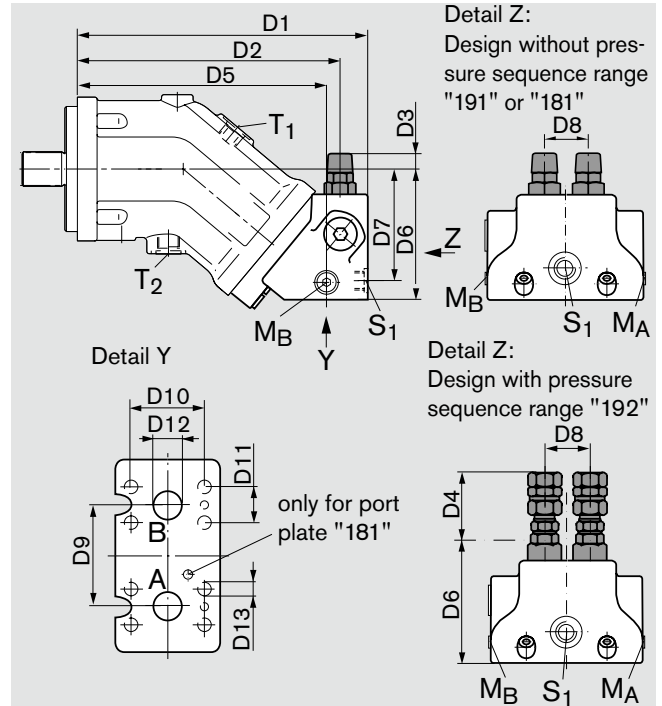


Design with pressure sequence range "192"



Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters)

Unit dimensions



Ports

- A, B Service line ports SAE J518
- S₁ Boosting (only for port plate 191/192)
- M_A, M_B Gauge ports (plugged)
- P_{St} Pilot pressure port (only for port plate 192)

Size	A, B ¹⁾	S ₁ ²⁾	M _A , M _B	p _{St} ³⁾
28, 32	SAE 3/4 in	M22x1,5; 0.55 (14) deep	M20x1,5; 0.55 (14) deep ²⁾	G 1/4
45	SAE 3/4 in	M22x1,5; 0.55 (14) deep	M20x1,5; 0.55 (14) deep ²⁾	G 1/4
56, 63	SAE 3/4 in	M26x1,5; 0.63 (16) deep	M26x1,5; 0.63 (16) deep ²⁾	G 1/4
80, 90	SAE 1 in	M26x1,5; 0.63 (16) deep	M26x1,5; 0.63 (16) deep ²⁾	G 1/4
107, 125	SAE 1 1/4 in	M26x1,5; 0.63 (16) deep	M26x1,5; 0.63 (16) deep ²⁾	G 1/4
160, 180	SAE 1 1/4 in	M26x1,5; 0.63 (16) deep	M30x1,5; 0.63 (16) deep	G 1/4

¹⁾ SAE J518 ²⁾ DIN 3852 ³⁾ DIN ISO 228

Size		D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13 ⁴⁾	
28, 32	MHDB.16	in	8.98	8.07	0.98	2.48	7.60	4.02	3.43	1.42	2.60	2.00	0.94	0.75	M10; 0.67 deep
		mm	228	205	25	63	193	102	87	36	66	50.8	23.8	19	17 deep
45	MHDB.16	in	9.72	8.78	0.87	2.36	8.35	4.45	3.86	1.42	2.60	2.00	0.94	0.75	M10; 0.67 deep
		mm	247	223	22	60	212	113	98	36	66	50.8	23.8	19	17 deep
56, 63	MHDB.22	in	10.87	9.76	0.75	2.24	9.21	4.88	4.13	1.65	2.95	2.00	0.94	0.75	M10; 0.51 deep
		mm	276	248	19	57	234	124	105	42	75	50.8	23.8	19	13 deep
80, 90	MHDB.22	in	11.81	10.73	0.69	2.17	10.16	5.28	4.49	1.65	2.95	2.25	1.09	0.98	M12; 0.71 deep
		mm	300	272.5	17.5	55	258	134	114	42	75	57.2	27.8	25	18 deep
107, 125	MHDB.32	in	13.11	11.89	0.39	1.89	11.26	5.89	5.12	2.09	3.31	2.63	1.25	1.26	M14; 0.75 deep
		mm	333	302	10	48	286	149.5	130	53	84	66.7	31.8	32	19 deep
160, 180	MHDB.32	in	14.33	13.11	0.20	1.69	12.48	6.69	5.87	2.09	3.31	2.63	1.25	1.26	M14; 0.75 deep
		mm	364	333	5	43	317	170	149	53	84	66.7	31.8	32	19 deep

⁴⁾ DIN 13, please observe the general notes for the max. tightening torques on page 36

Assembly instructions for port plate with pressure sequence range "192":
When fitting the hydraulic line on the P_{St} port, the lock nut must be held in place!

BVD Counterbalance Valve

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters)

Function

Driving/winch counterbalance valves are designed to reduce the danger of overspeeding and cavitation of axial piston motors in open controls. Cavitation occurs if the motor speed is greater than it should be for the given flow during braking, downhill travel or decrease in motor load.

Please note

- The BVD counterbalance valve must be specified explicitly in the order. We recommend ordering the counterbalance valve and the motor as a set.
Ordering example: AA2FM80/61W-VUDN181 + BVD20F27S/41B-V03K16D0400S12
- The counterbalance valve does not replace the mechanical service brake and parking brake.
- Note the detailed information about the BVD counterbalance valve contained in RE 95522!

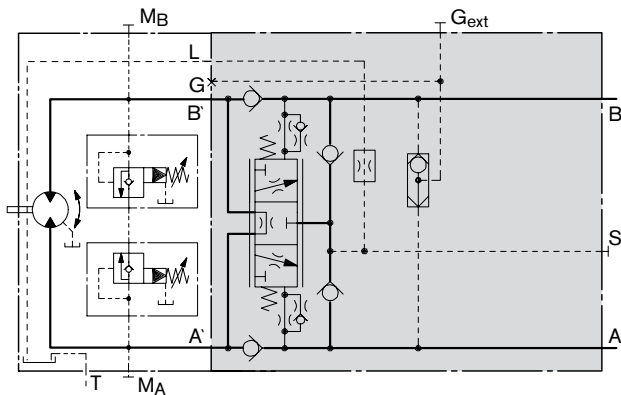
Application example for driving counterbalance valve BVD..F

- Travel drive of wheeled excavators

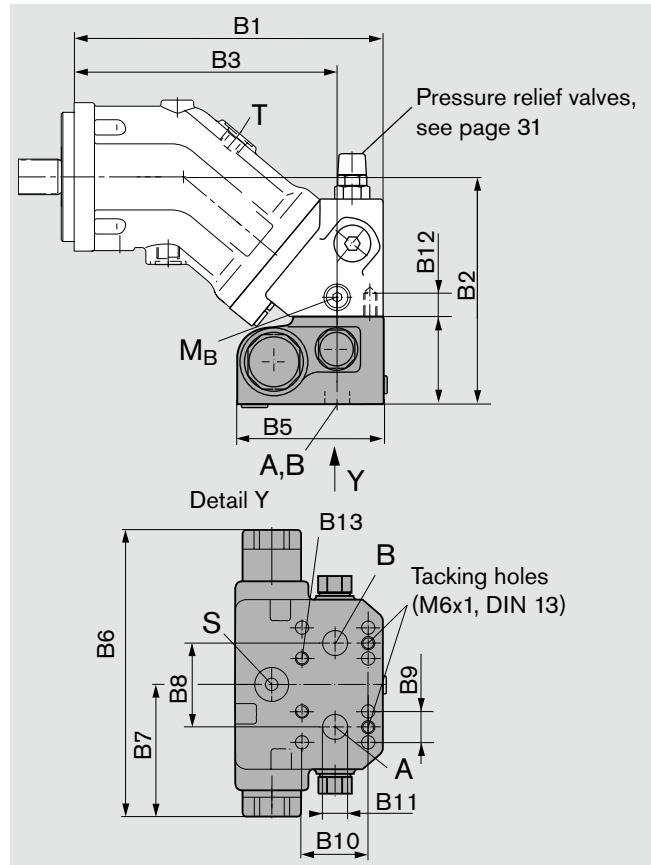
Application example for winch counterbalance valve BVD..W

- Winch drives in cranes
- Track drives in crawler excavator

Circuit diagram driving counterbalance valve BVD..F



Unit dimensions



Ports

- A, B Service line ports SAE J518
- S Boosting (plugged)
- MA, MB Gauge ports (plugged)

AA2FM	Motion control valve			
Size	Type	A, B ¹⁾	S ²⁾	MA, MB ²⁾
28, 32	BVD20..16	SAE 3/4 in	M 22x1.5	M12x1.5
45	BVD20..16	SAE 3/4 in	M 22x1.5	M12x1.5
56, 63	BVD20..17	SAE 3/4 in	M 22x1.5	M12x1.5
80, 90	BVD20..27	SAE 1 in	M 22x1.5	M12x1.5
107, 125	BVD25..38	SAE 1 1/4 in	M 27x2	M12x1.5
160, 180	BVD25..38	SAE 1 1/4 in	M 27x2	M12x1.5
250	on request			

Size		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12 ³⁾	B13 ³⁾	
28, 32	BVD20..16	in	8.98	7.09	7.60	3.07 ⁴⁾	5.39	9.25	3.78	2.60	0.94	2.00	0.75	M10;0.67 deep	M10;0.55 deep
		mm	228	180	193	78 ⁴⁾	137	235	96	66	23.8	50.8	19	17 deep	14 deep
45	BVD20..16	in	10.00	7.52	8.35	3.07 ⁴⁾	5.39	9.25	3.78	2.60	0.94	2.00	0.75	M10;0.67 deep	M10;0.55 deep
		mm	254	191	212	78 ⁴⁾	137	235	96	66	23.8	50.8	19	17 deep	14 deep
56, 63	BVD20..17	in	10.87	7.56	9.21	2.68	5.39	9.25	3.78	2.95	0.94	2.00	0.75	M10;0.67 deep	M10;0.55 deep
		mm	276	192	234	68	137	235	96	75	23.8	50.8	19	17 deep	14 deep
80, 90	BVD20..27	in	11.81	7.95	10.16	2.68	5.39	9.25	3.78	2.95	1.09	2.25	0.98	M12;0.71 deep	M12;0.63 deep
		mm	300	202	258	68	137	235	96	75	27.8	57.2	25	18 deep	16 deep
107, 125	BVD25..38	in	13.11	9.23	11.26	3.35	5.96	11.26	4.74	3.31	1.25	2.63	1.26	M14;0.75 deep	M14;0.75 deep
		mm	333	234.5	286	85	151.5	286	120.5	84	31.8	66.7	32	19 deep	19 deep
160, 180	BVD25..38	in	14.33	10.04	12.48	3.35	5.96	11.26	4.74	3.31	1.25	2.63	1.26	M14;0.75 deep	M14;0.75 deep
		mm	364	255	317	85	151.5	286	120.5	84	31.8	66.7	32	19 deep	19 deep

1) SAE J518 2) DIN 3852 3) DIN 13, please observe the general notes for the max. tightening torques on page 36

4) With adapting plate

BVD Counterbalance Valve

Before finalizing your design, please request a binding installation drawing. Dimensions in inches and (millimeters)

Attaching the counterbalance valve

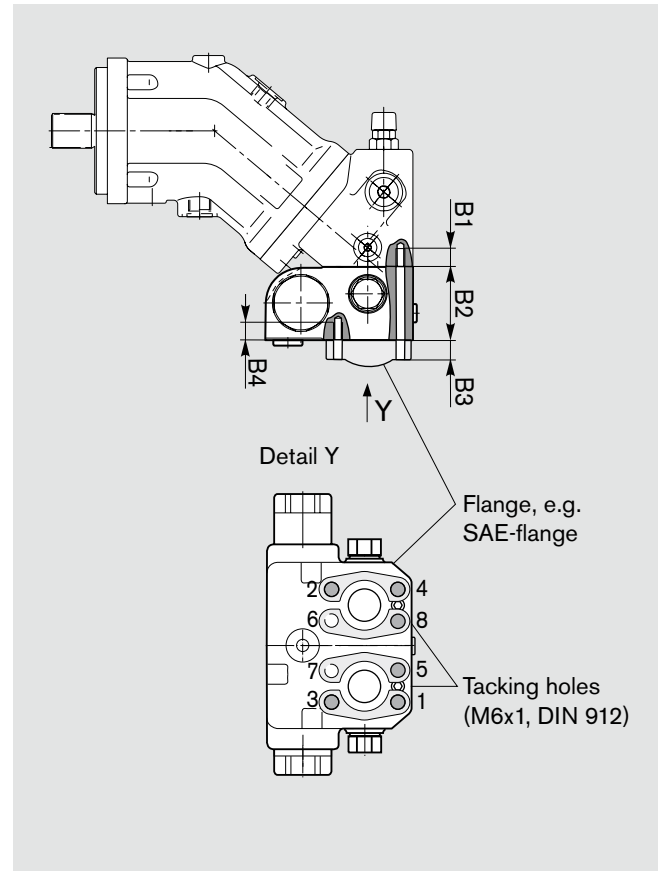
When delivered, the counterbalance valve is attached to the motor using 2 tacking screws. Do not remove the tacking screws when connecting the service lines. If the counterbalance valve and motor are delivered separately, the counterbalance valve must first be attached to the motor port plate using the provided tacking screws. In both cases, the final attachment of the counterbalance valve to the motor is by the connectio of the service lines, e.g. using SAE flanges. A total of 6 screws with thread lengths $B1+B2+B3$ and 2 screws with thread lengths $B3+B4$ are required.

When tightening the screws, it is imperative that the sequence (1 to 8) as shown in the adjacent diagram be adhered to and carried out in two phases.

In the first phase the screws should be tightened to 50% of their tightening torque before being tightened to maximum tightening torque in the second phase (see table below).

Thread ¹⁾	Property class	Tightening torque
M10x1.5	10.9	55 lb-ft (75 Nm)
M12x1.75	10.9	95 lb-ft (130 Nm)
M14x2	10.9	150 lb-ft (205 Nm)

¹⁾ Fastening screws according to DIN 912



Size	28, 32, 45	56, 63	80, 90	107, 125, 160, 180
Dim. B1 ¹⁾	M10x1.5 0.67 deep (17 deep)	M10x1.5 0.67 deep (17 deep)	M12x1.75 0.71 deep (18 deep)	M14x2 0.75 deep (19 deep)
Dim. B2	3.07 (78) ²⁾	2.68 (68)	2.68 (68)	3.35 (85)
Dim. B3	customer-specific			
Dim. B4	M10x1.5 0.59 deep (15 deep)	M10x1.5 0.59 deep (15 deep)	M12x1.75 0.63 deep (16 deep)	M14x2 0.75 deep (19 deep)

Fastening threads according to DIN 13, please observe the general notes for the max. tightening torques on page 36

¹⁾ Minimum reach required 1 x DIA, thread

²⁾ With adapting plate

Speed Measurement

The AA2FM...D and AA2FM...F ("prepared for speed measurement", i.e. without sensor) versions have teeth on the rotary group. The rotating, toothed rotary group generates a signal in proportion to the speed. The signal is picked up by a sensor and can be forwarded for evaluation.

The sensor is fitted to the special port D provided for this purpose. The following versions are available:

Version „D“ (sizes 23 to 180)

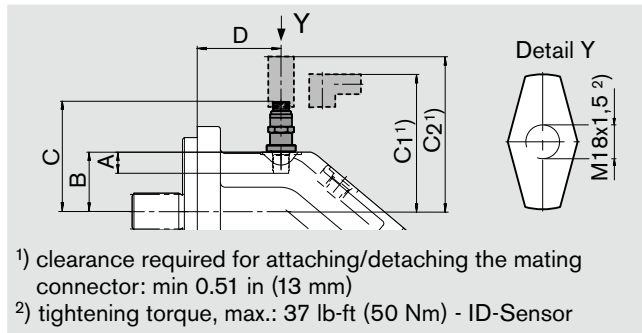
Suitable for mounting the inductive speed sensor ID (see RA 95130). The ID sensor is screwed into port D. The spacer ring adapter required for the inductive speed sensor ID is included in the supply volume of the sensor (only when ordering, speed sensor with installation parts).

Version „F“ (sizes 23 to 250)

Suitable for mounting of HDD Hall effect speed sensor (see RE 95135). The HDD sensor is flange mounted with two fastening screws. In the standard version, the port is plugged with a pressure-resistant flange cover.

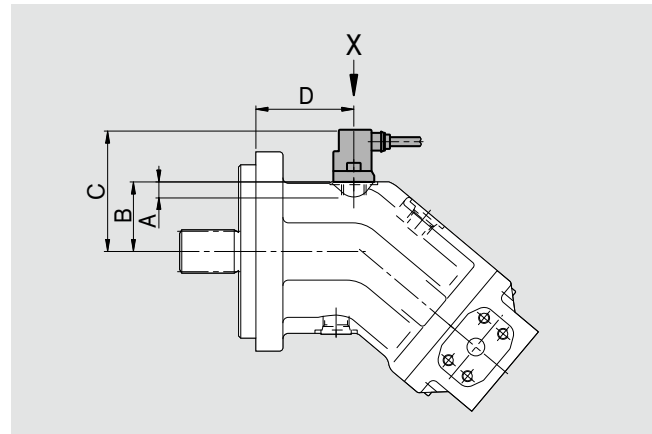
We recommend ordering the AA2FM fixed motor complete with mounted sensor. Please specify the ordering code for the sensor separately.

Version „D“ (sizes 23 to 180): with ID sensor

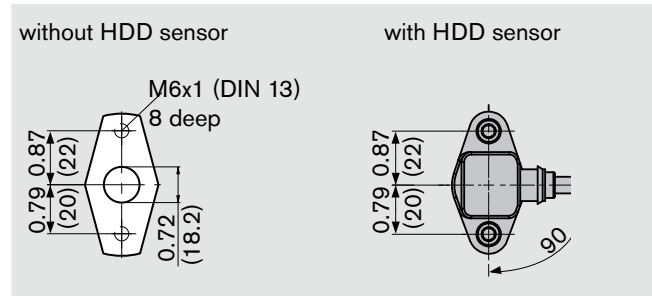


Please request a certified installation drawing before finalizing your design
Dimensions in inches and (millimeters).

Version „F“ (sizes 23 to 200): with HDD sensor



Detail X



Size		23,28,32	45	56,63	80, 90	107, 125	160, 180	200
Number of teeth		38	45	47	53	59	67	80
HDD ³⁾ A	Insertion depth (tolerance ± 0.004)	in 0.63	0.63	0.63	0.63	0.63	0.63	0.63
	(tolerance ±0.1)	mm 16	16	16	16	16	16	16
B	Contact surface	in 2.19	2.46	2.66	2.85	3.05	3.35	3.89
		mm 55.5	62.5	67.5	72.5	77.5	85	98.8
C		in 3.69	3.97	4.17	4.36	4.56	4.85	5.39
		mm 93.8	100.8	105.8	110.8	115.8	123.3	137
D		in 2.15	2.14	2.42	2.85	3.02	3.42	3.84
		mm 73.7	79.3	87.5	101.5	111.8	118.8	97.5
ID ³⁾ A	Insertion depth (tolerance ± 0.004)	in 0.37	0.33	0.33	0.33	0.33	0.43	–
	(tolerance ±0.1)	mm 9.5	8.5	8.5	8.5	8.5	11	–
B	Contact surface	in 1.93	2.17	2.36	2.56	2.76	3.15	–
		mm 49	55	60	65	70	80	–
C	without mating connector	in 4.61	4.89	5.09	5.28	5.48	5.78	–
		mm 117.2	124.2	129.2	134.2	139.2	146.7	–
C1	with 90° mating connector	in 5.93	6.21	6.41	6.59	6.79	7.09	–
		mm 150.7	157.7	162.7	167.5	172.5	180.2	–
C2	with 180° mating connector	in 6.82	7.06	7.25	7.42	7.65	7.94	–
		mm 173.2	179.2	184.2	188.2	194.2	201.7	–
D		in 2.15	2.14	2.42	2.85	3.02	3.42	–
		mm 73.7	79.3	87.5	101.5	111.8	118.8	–

³⁾ Suitable speed sensor: sizes 23-200: HDD.L16../20 (see RE 95135) resp. IDR18/20–L250 (see RE 95130)

⁴⁾ For size 250 see RE 91001 (ISO-Version)

Installation Notes

General

The motor case must be completely filled up with hydraulic fluid during startup and during operation (filling the case chamber). The motor must be started at low speed and no load until the system has been bled completely.

If stopped for an extended period, fluid may drain out of the case through the working lines. When restarting, make sure that the case contains sufficient fluid.

The leakage fluid inside the case chamber must be drained off to the tank through the highest case drain port.

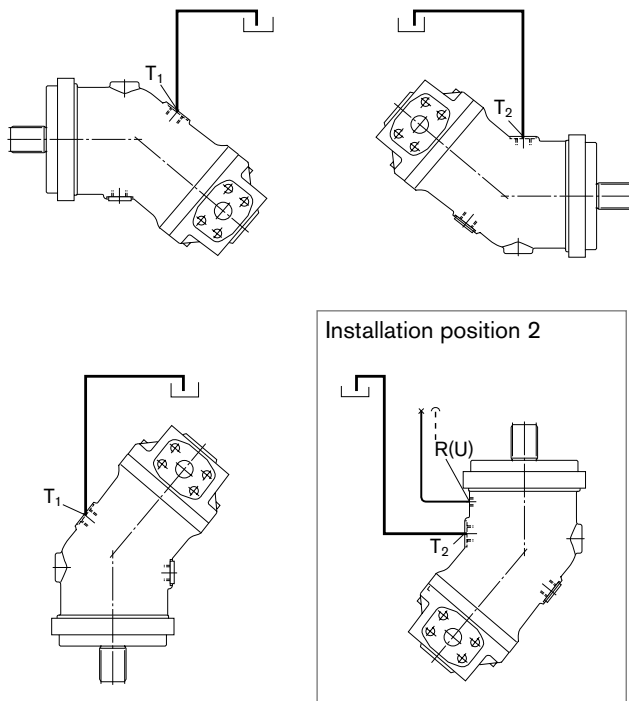
Installation position

Optional. At size 10 to 200 with installation position "shaft to the top" use motor with bleeding port R (indicate in clear when ordering; the port U in the bearing section for bleeding is included in production with sizes 250 to 1000).

Installation below tank level

Motors below minimum fluid level in the tank (standard)

- Fill axial piston motor before startup via the highest case drain port
- Run the motor at low speed until the system is bled completely (bleed through service line port A, B if tubing is long)
- Minimum immersion depth of leakage line in tank:
7.87 in (200 mm) (relative to the min. fluid level in the tank)
- Additional measures required for installation position 2 (shaft facing up): with installation position 2, make sure that the motor case is completely full before starting up. Bleed at port R (sizes 10 to 200) resp. U (sizes 250 to 1000). Order port R in clear text. An air pocket in the bearing area can cause damage to the motor.

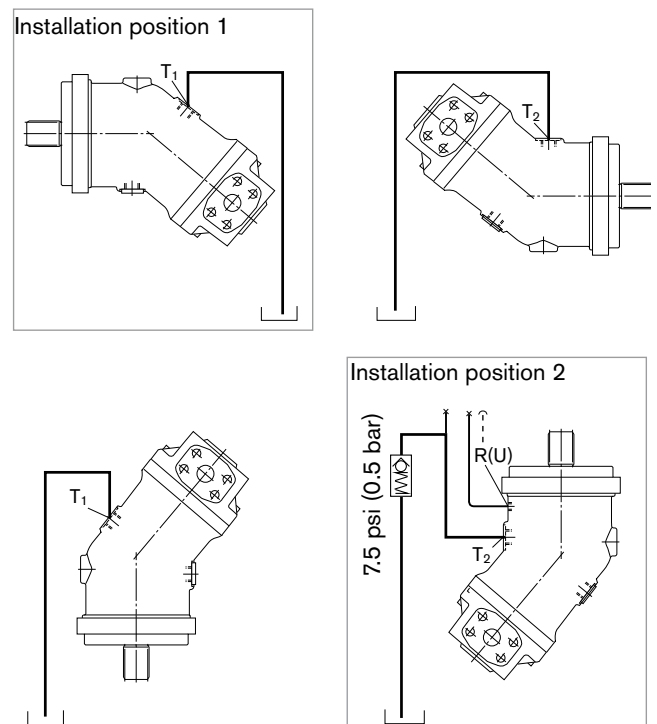


Installation above the tank

Motor above minimum fluid level in tank

- Proceed in same way as below the tank installation
- Additional measures for installation positions 1 and 2:
If stopped for an extended period, fluid may drain out of the case chamber through the service lines (air enters through the shaft seal). The bearings will therefore not be properly lubricated when the motor is started up again. Fill the axial piston motor before restarting via the highest case drain port. Installation position 2: bleed at port R (sizes 10 to 200) resp. U (sizes 250 to 1000). Order port R in clear text.
- Additional measures required for installation position 2 (shaft facing up)

In this installation position the bearings will not be properly lubricated, even if there is still some fluid in the case chamber. Putting a non-return valve (opening pressure 7.5 psi (0.5 bar)) in the leakage line can prevent the system emptying through the line.



General Notes

- The AA2FM motor is designed to be used in open and closed circuits.
- Project planning, assembly, and commissioning of the motor require the involvement of qualified personnel.
- The service line ports and function ports are only designed to accommodate hydraulic lines.
- During and shortly after operation, there is a risk of burns on the motor. Take suitable safety precautions, e.g. wear protective clothing
- There may be shifts in the characteristic depending on the operating state of the motor (operating pressure, fluid temperature).
- Tightening torques:
 - The tightening torques specified in this data sheet are maximum values and must not be exceeded (maximum values for screw thread).
Manufacturer's instruction for the max. permissible tightening torques of the used fittings must be observed!
 - For ISO 68 / DIN 13 fixing screws, we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.
- The data and information contained herein must be adhered to.