

Fixed Displacement Motor

A10FM

A10FE

RE 91 172/06.06 1/24
Replaces: 01 .03

Technical Data Sheet

Size 10...63
Series 52
Nominal pressure 280 bar
Peak pressure 350 bar
Open and closed circuit



A10FM 23...63

A10FE 10...45
(2-hole-flange)A10FE 11...18
(8-hole-flange)

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Features

- Fixed displacement motor, axial piston in swashplate design for hydrostatic transmissions in open and closed circuit applications
- Output speed proportional to inlet flow
- Output torque increases with the pressure gradient between high and low-pressure sides
- For mobile and industrial applications
- Long service life
- High permissible output speeds
- Well proven A10-rotary group
- High power to weight ratio - compact size
- Plug-in version for space saving installation
- Low noise level
- Mechanical and hydraulic connections acc. to SAE standards
- Speed pickup optional
- Integrated anti cavitation valve optional, i.e. fan drives

Ordering Code - Standard Program A10FM

A10F	M	/	5	2	-	V	C						
01	02	03	04	05	06	07	08	09	10	11	12		

Axial piston unit

01	Swashplate design, fixed	A10F
----	--------------------------	------

Operating mode

02	Motor	M
----	-------	---

Size

03	Displacement $V_{g\max}$ [cm ³]	18	23	28	37	45	58	63
		18	23	28	37	45	58	63

Series

04		5
----	--	---

Index

05		2
----	--	---

Direction of rotation

06	Looking at shaftend	changing	W
		right	R ¹⁾
		left	L ¹⁾

Seal

07	FKM fluor-rubber	V
----	------------------	---

Shaft end

		18	23	28	37	45	58	63	
08	Splined shaft to SAE J744	○	●	●	●	●	●	●	R
	Splined shaft to SAE J744	-	○	○	●	●	●	●	W
	Tapered with woodruff key	○	●	●	●	●	●	●	C

Mounting flange

09	SAE 2-hole	○	●	●	●	●	●	●	C
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Ports for service lines

10	Port A/B on side - same side; SAE flange; threaded bolt holes metric	-	●	●	●	●	●	●	10N00
	Port A/B on side - same side; thread metric	○	●	●	●	●	●	●	16N00

Valves

11	Without valve	○	●	●	●	●	●	●	0
	Integrated flushing valve	-	●	●	●	●	●	●	7
	Integrated anti cavitation valve	○	●	●	●	●	●	●	2

Speed pickup

12	Without speed pickup	○	●	●	●	●	●	●	
	Prepared for speed pickup (for inductive sensor ID)	○	●	●	●	●	●	●	D

● available ○ in preparation - not available

¹⁾ With valve option "2" (integrated anti cavitation valve) only.

Ordering Code - Standard Program A10FE

A10F	E	/	5	2	-	V						
01	02	03	04	05	06	07	08	09	10	11	12	

Axial piston unit

01	Swashplate design, fixed	A10F
----	--------------------------	-------------

Operating mode

02	Plug-in motor	E
----	---------------	----------

Size

03	Displacement $V_{g,max}$ [cm ³]	10	11	14	16	18	23	28	37	45	58	63
		10	11	14	16	18	23	28	37	45	58	63

Series

04		5
----	--	----------

Index

05		2
----	--	----------

Direction of rotation

06	Looking at shaft end	changing	W
		right	R¹⁾
		left	L¹⁾

Seal

07	FKM fluor-rubber	V
----	------------------	----------

Drive shaft

08		10	11	14	16	18	23	28	37	45	58	63	
	Splined shaft to SAE J744	○	○	○	○	●	●	●	●	●	○	○	R
	Splined shaft to SAE J744	-	-	-	-	-	○	○	○	○	○	○	W
	Tapered with woodruff key	●	●	●	●	●	●	●	●	●	○	○	C

Mounting flange

09	SAE 2-hole	●	●	●	●	●	-	-	-	-	-	-	C
	Special 2-hole flange	-	-	-	-	-	●	●	●	●	○	○	F
	Special 8-hole flange	-	●	●	●	●	-	-	-	-	-	-	H

Ports for service lines

10	Port A/B on side - same side; SAE flange; threaded bolt holes metric	-	-	-	-	-	●	●	●	●	○	○	10N00
	Port A/B on side - same side; thread metric	●	●	●	○	●	●	●	○	○	○	○	16N00

Valves

11	Without valve	○	●	○	●	●	●	●	●	●	○	○	0
	Integrated flushing valve	-	-	-	-	-	○	○	●	●	○	○	7
	Integrated anti cavitation valve	●	●	●	●	●	●	●	●	●	○	○	2

Speed pickup

12	Without speed pickup	●	●	●	●	●	●	●	●	●	○	○	
	Prepared for speed pickup (for inductive sensor ID)	-	-	-	-	○	○	●	○	○	○	○	D

● available ○ in preparation - not available

¹⁾ With valve option "2" (integrated anti cavitation valve) only.

Technical Data

Fluid

Prior to project design, please see our technical data sheets RE 90220 (mineral oil), RE 90221 (environmentally acceptable fluids) and RE 90223 (HF- fluids) for detailed information on fluids and operating conditions.

When using HF- or environmentally acceptable fluids attention must be paid to possible limitations of the technical data, if necessary contact us.

When ordering , please state in clear text the fluid to be used.

Operating viscosity range

For optimum efficiency and service life we recommend that the operating viscosity (at operating temperature) be selected in the range

$$v_{opt} = \text{optimum operating viscosity } 16 \dots 36 \text{ mm}^2/\text{s}$$

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

Limit of viscosity range

For critical operating conditions the following values apply:

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

$$v_{min} = 10 \text{ mm}^2/\text{s} \text{ (open circuit)}$$

for short periods ($t \leq 1 \text{ min}$) at max. perm. fluid temperature of $115 \text{ }^\circ\text{C}$.

Please note that the max. leakage fluid temperature of $115 \text{ }^\circ\text{C}$ is also not exceeded in certain areas (for instance bearing area).The fluid temperature in the bearing area is approx. 5 K higher than the average leakage fluid temperature

$$v_{max} = 1600 \text{ mm}^2/\text{s}$$

for short periods ($t \leq 1 \text{ min}$)
on cold start ($t_{min} = p \leq 30 \text{ bar}$, $n \leq 1000 \text{ min}^{-1}$, $-25 \text{ }^\circ\text{C}$).

At temperatures between $-40 \text{ }^\circ\text{C}$ and $-25 \text{ }^\circ\text{C}$ special measures are required, please consult us for further information.

For detailed information on operation with low temperatures see data sheet RE 90300-03-B.

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 tank (open circuit) in relation to the ambient temperature.

The fluid should be selected so that within the operating temperature range, the viscosity lies within the optimum range (v_{opt}), see shaded section of the selection diagram. We recommend to select the higher viscosity grade in each case.

Example: at an ambient temperature of $X \text{ }^\circ\text{C}$ the operating temperature in the tank is $60 \text{ }^\circ\text{C}$. in the optimum viscosity range (v_{opt} ; shaded area) this corresponds to viscosity grades VG 46 resp. VG 68; VG 68 should be selected.

Important: The leakage oil (case drain oil) temperature is influenced by pressure and input speed and is always higher than the tank temperature. However, at no point in the circuit may the temperature exceed $115 \text{ }^\circ\text{C}$.

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

Filtration of fluid

The finer the filtration the better the achieved cleanliness of the pressure fluid and the longer the life of the axial piston unit.

To ensure a reliable functioning of the axial piston unit, a minimum cleanliness of

20/18/15 to ISO 4406 is necessary.

At very high operating temperatures ($90 \text{ }^\circ\text{C}$ to max. $115 \text{ }^\circ\text{C}$) a cleanliness of

19/17/14 to ISO 4406 is necessary.

If above mentioned grades cannot be maintained please consult us.

Operating pressure range

Pressure at port A or B

(Pressure data to DIN 24312)

Nominal pressure p_N _____ 280 bar

Peak pressure p_{max} _____ 350 bar

Case drain pressure

Maximum permissible leakage fluid at port L

$p_{abs \text{ max}}$ Motor operation open circuit _____ 4 bar abs

$p_{abs \text{ max}}$ Motor operation closed circuit _____ 4 bar abs

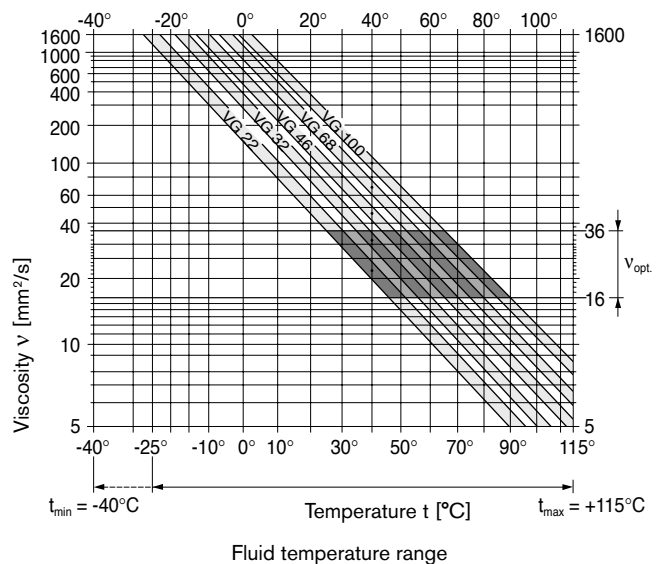
$p_{abs \text{ max}}$ Motor/Pump operation open circuit _____ 2 bar abs

Direction of flow

Flow A to B = right hand rotation

Durchfluss B nach A = left hand rotation

Selection chart



Technical Data

Table of values¹⁾

Size			10	11	14	16	18	23	
Displacement	$V_{g \max}$	cm ³	10,6	11,5	14,1	16,1	18	23,5	
Speed ²⁾									
max. at $V_{g \max}$	$n_{0 \max}$	min ⁻¹	5000	4200	4200	4200	4200	4900	
Inlet flow									
at $n_{0 \max}$	$q_{V0 \max}$	L/min	53	48	59	68	76	115	
Power									
at $n_{0 \max}$	$\Delta p = 280 \text{ bar}$	$P_{o \max}$	kW	24,7	22,5	27,6	31,6	35,3	53,6
Torque									
at $V_{g \max}$	$\Delta p = 280 \text{ bar}$	T_{\max}	Nm	47	51	63	72	80	105
Moment of inertia (about drive axis)	J	kgm ²	0,0006	0,00093	0,00093	0,00093	0,00093	0,00017	
Actual starting torque									
at $n = 0 \text{ min}^{-1}$	$\Delta p = 280 \text{ bar}$		Nm	37,5	30	45	53	67,5	75
Angular acceleration, max.		rad/s ²	8000	6800	6800	6800	6800	5500	
Torsional stiffness	Shaft R	Nm/rad	–	–	–	–	14835	28478	
	Shaft W	Nm/rad	–	–	–	–	–	–	
	Shaft C	Nm/rad	15084	18662	18662	18662	18662	30017	
Case volume		L	0,1	0,15	0,15	0,15	0,15	0,6	
Weight	m	kg	5	6,5	6,5	6,5	6,5	12	

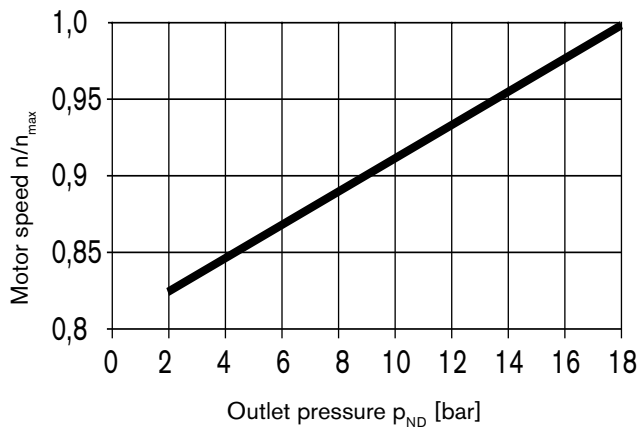
Size			28	37	45	58	63	
Displacement	$V_{g \max}$	cm ³	28,5	36,7	44,5	58	63,1	
Speed ²⁾								
max. at $V_{g \max}$	$n_{0 \max}$	min ⁻¹	4700	4200	4000	3600	3400	
Inlet flow								
at $n_{0 \max}$	$q_{V0 \max}$	L/min	134	154	178	209	215	
Power								
at $n_{0 \max}$	$\Delta p = 280 \text{ bar}$	$P_{o \max}$	kW	62,5	71,8	83,1	97,4	100,1
Torque								
at $V_{g \max}$	$\Delta p = 280 \text{ bar}$	T_{\max}	Nm	127	163	198	258	281
Moment of inertia (about drive axis)	J	kgm ²	0,00017	0,00033	0,00033	0,0056	0,0056	
Actual starting torque								
at $n = 0 \text{ min}^{-1}$	$\Delta p = 280 \text{ bar}$		Nm	105	125	170	205	230
Angular acceleration, max.		rad/s ²	5500	4000	4000	3300	3300	
Torsional stiffness	Shaft R	Nm/rad	28478	46859	46859	80590	80590	
	Shaft W	Nm/rad	–	38489	38489	60907	60907	
	Shaft C	Nm/rad	30017	46546	46546	87667	87667	
Case volume		L	0,6	0,7	0,7	0,8	0,8	
Weight	m	kg	12	17	17	22	22	

¹⁾ theoretical rounded values without considering of η_{mh} and η_v

²⁾ At max. speed the low pressure side must see at least 18 bar.

Technical Data

Permissible speed depending on outlet pressure

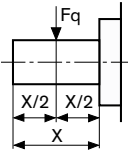
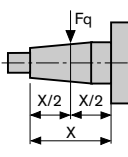
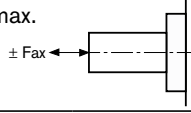


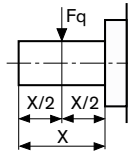
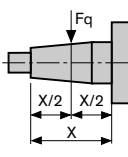
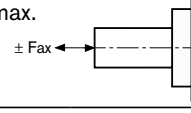
Calculation of size

Flow	$q_v = \frac{V_g \cdot n}{1000 \cdot \eta_v}$	[L/min]	V_g = geometr. displacement per revolution in cm^3
			Δp = pressure differential in bar
Torque	$T = \frac{1,59 \cdot V_g \cdot \Delta p \cdot \eta_{mh}}{100}$	[Nm]	n = drive speed in min^{-1}
or	$T = T_K \cdot \Delta p \cdot \eta_{mh}$		η_v = volumetric efficiency
Power	$P = \frac{2\pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p \cdot \eta_t}{600}$	[kW]	η_{mh} = mechanical-hydraulic efficiency
			η_t = overall efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)
Output speed	$n = \frac{q_v \cdot 1000 \cdot \eta_v}{V_g}$	[min^{-1}]	T_K = torque constant

Technical Data

Permissible radial and axial forces on drive shaft

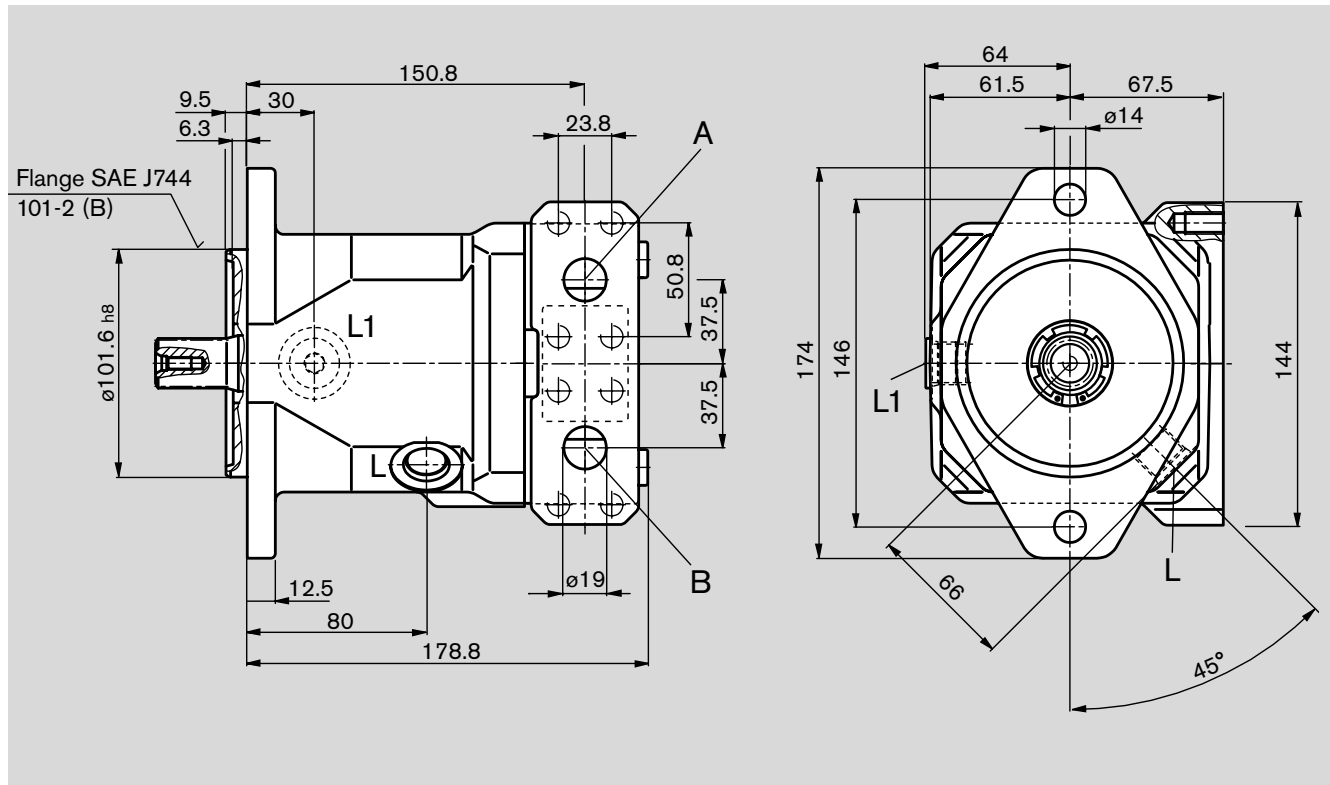
Size			10	11	14	16	18	23				
Radial force, max.	Shaft R, W	Shaft C	at X/2		$F_{q\ max}$	N	250	350	350	350	350	1200
												
Axial force, max.					F_{ax}	N	400	700	700	700	700	1000

Size			28	37	45	58	63				
Radial force, max.	Shaft R, W	Shaft C	at X/2		$F_{q\ max}$	N	1200	1500	1500	1700	1700
											
Axial force, max.					F_{ax}	N	1000	1500	1500	2000	2000

Unit Dimensions A10FM 23-28

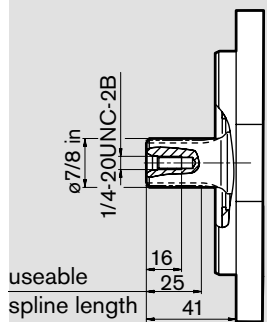
Before finalizing your design please request certified installation drawing.

A10FM 23-28/52W-VXC10N000

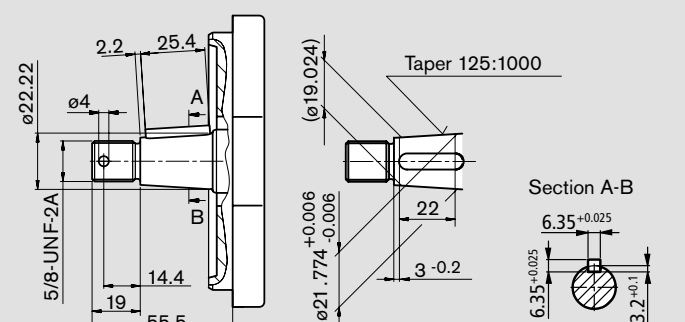


Shaft ends

R splined 7/8 in 13T 16/32DP¹⁾ (SAE J744 - 22-4 (B))



C tapered (SAE J744 - 22-3 (B))



Ports

Port	Description	Thread	Size	Tightening torque, max. ²⁾
A	Pressure port (high pressure series) Fixing thread	SAE J518C DIN 13	SAE 3/4 in M10; 17 deep	60 Nm
B	Pressure port (high pressure series) Fixing thread	SAE J518C DIN 13	SAE 3/4 in M10; 17 deep	60 Nm
L	Case drain port (L ₁ plugged)	ISO 11926	3/4-16 UNF-2B	160 Nm

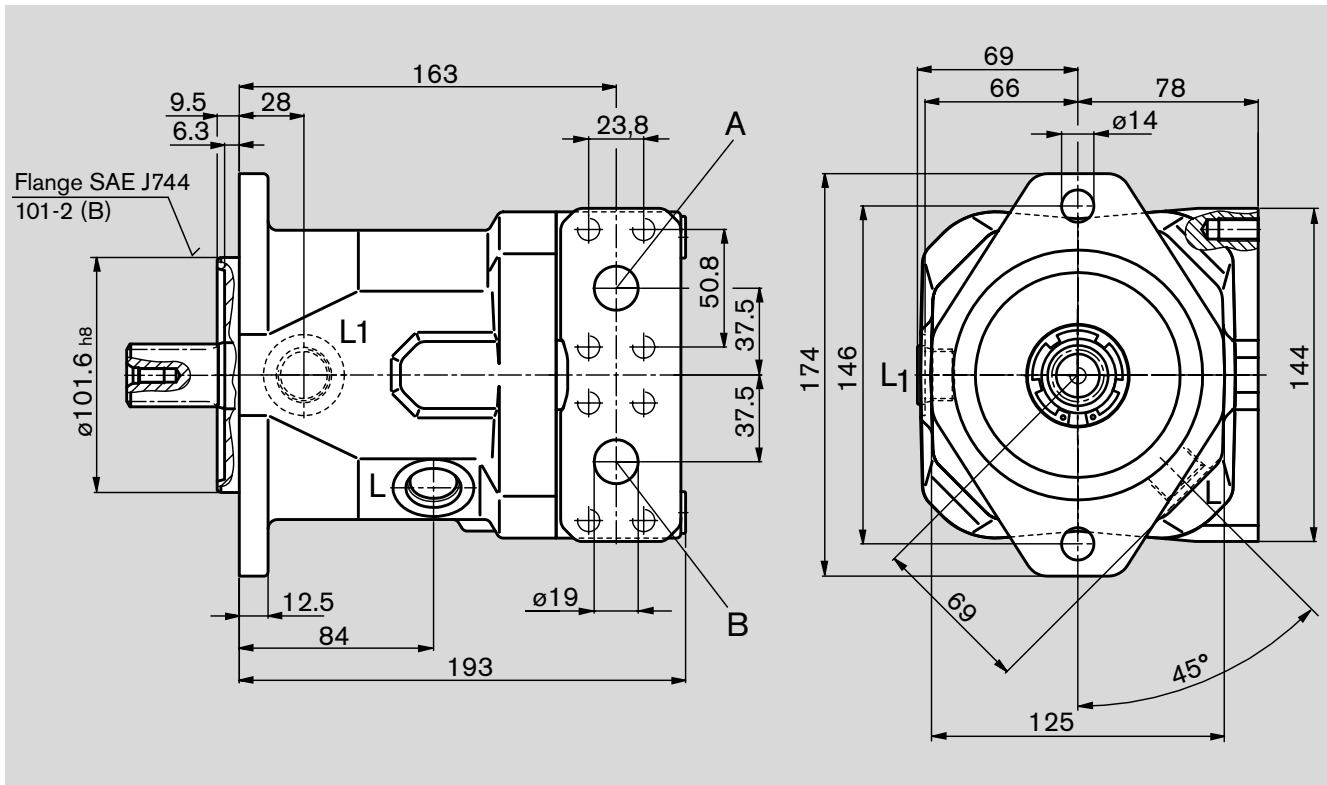
¹⁾ ANSI B92.1a-1996, 30° pressure angle, flat base, flank centering, fit class 5

²⁾ see General Notes

Unit Dimension A10FM 37-45

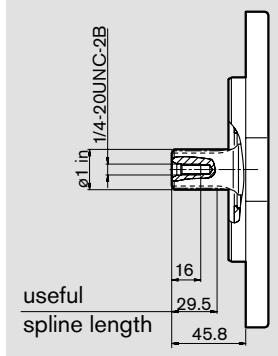
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A10FM 37-45/52W-VXC10N000

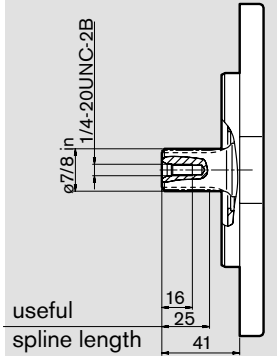


Shaft ends

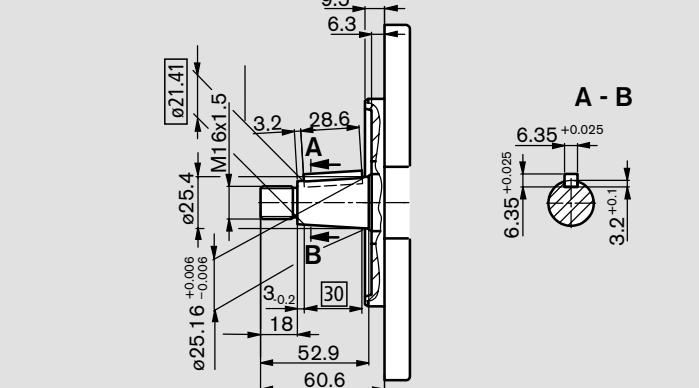
R splined 1 in 15T
16/32DP¹⁾
(SAE J744 - 25-4 (B-B))



W splined 7/8 in 13T
16/32DP¹⁾
(SAE J744 - 22-4 (B))



C tapered
(SAE J744 - 25-3 (B-B))



Ports

				Tightening torque, max. ²⁾
A	Pressure port (high pressure series) Fixing thread	SAE J518C DIN 13	SAE 3/4 in M10; 17 deep	60 Nm
B	Pressure port (high pressure series) Fixing thread	SAE J518C DIN 13	SAE 3/4 in M10; 17 deep	60 Nm
L	Case drain port (L ₁ plugged)	ISO 6199	7/8-14 UNF-2B	240 Nm

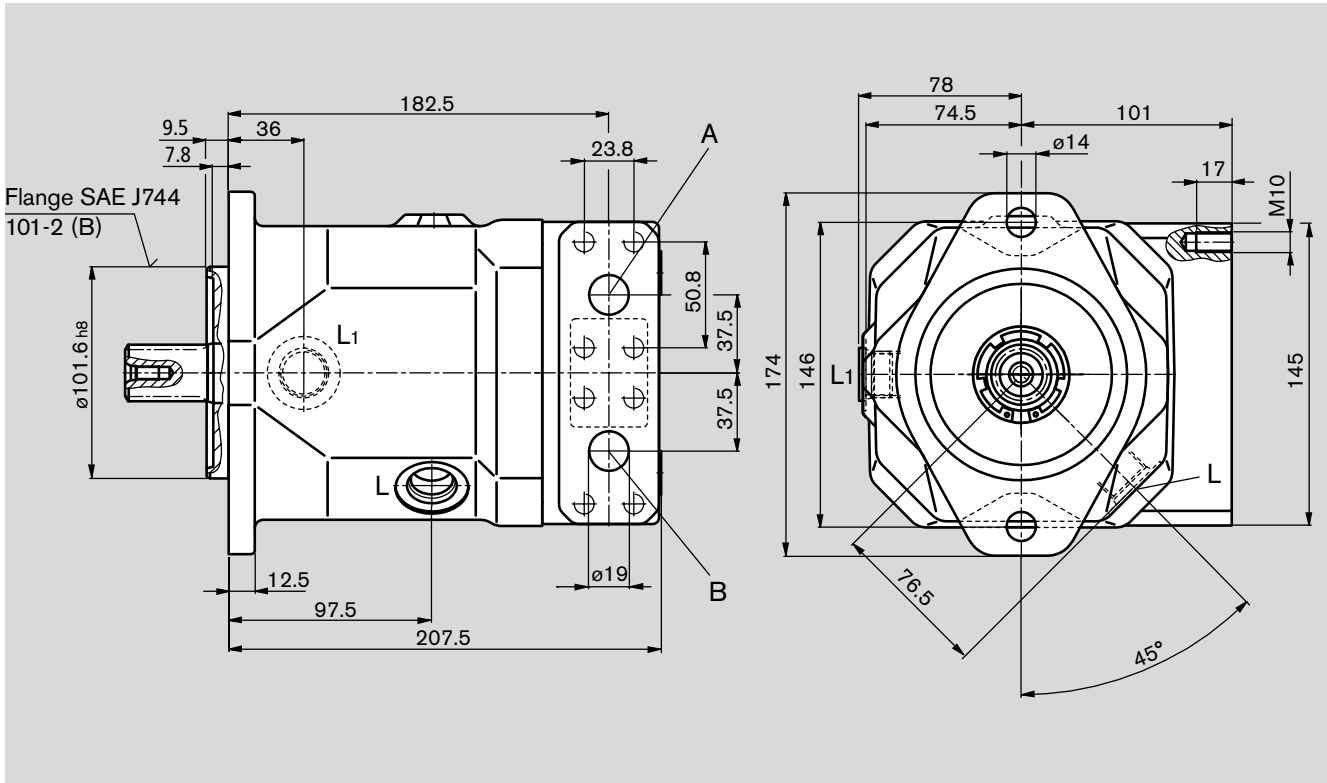
¹⁾ ANSI B92.1a-1996, 30° pressure angle, flat base, flank centering, fit class 5

²⁾ see General Notes

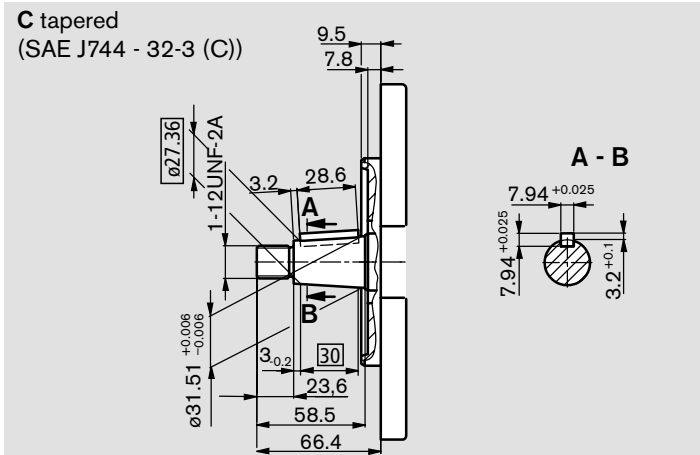
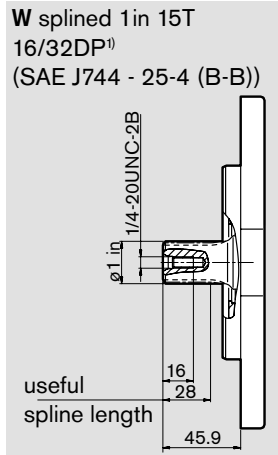
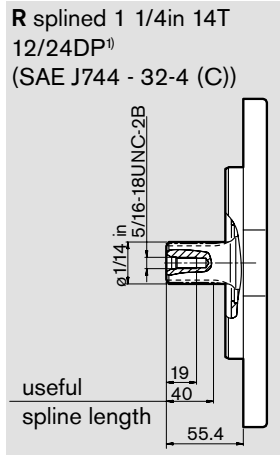
Unit Dimensions A10FM 58-63

Before finalizing your design please request certified installation drawing.

A10FM 58-63/52W-VXC10N000



Shaft ends



Ports

Port	Description	Thread	Size	Tightening torque, max. ²⁾
A	Pressure port (high pressure series) Fixing thread	SAE J518C DIN 13	3/4 in M10; 17 deep	60 Nm
B	Pressure port (high pressure series) Fixing thread	SAE J518C DIN 13	3/4 in M10; 17 deep	60 Nm
L	Case drain port (L ₁ plugged)	ISO 6199	7/8-14 UNF-2B	240 Nm

¹⁾ ANSI B92.1a-1996, 30° pressure angle, flat base, flank centering, fit class 5

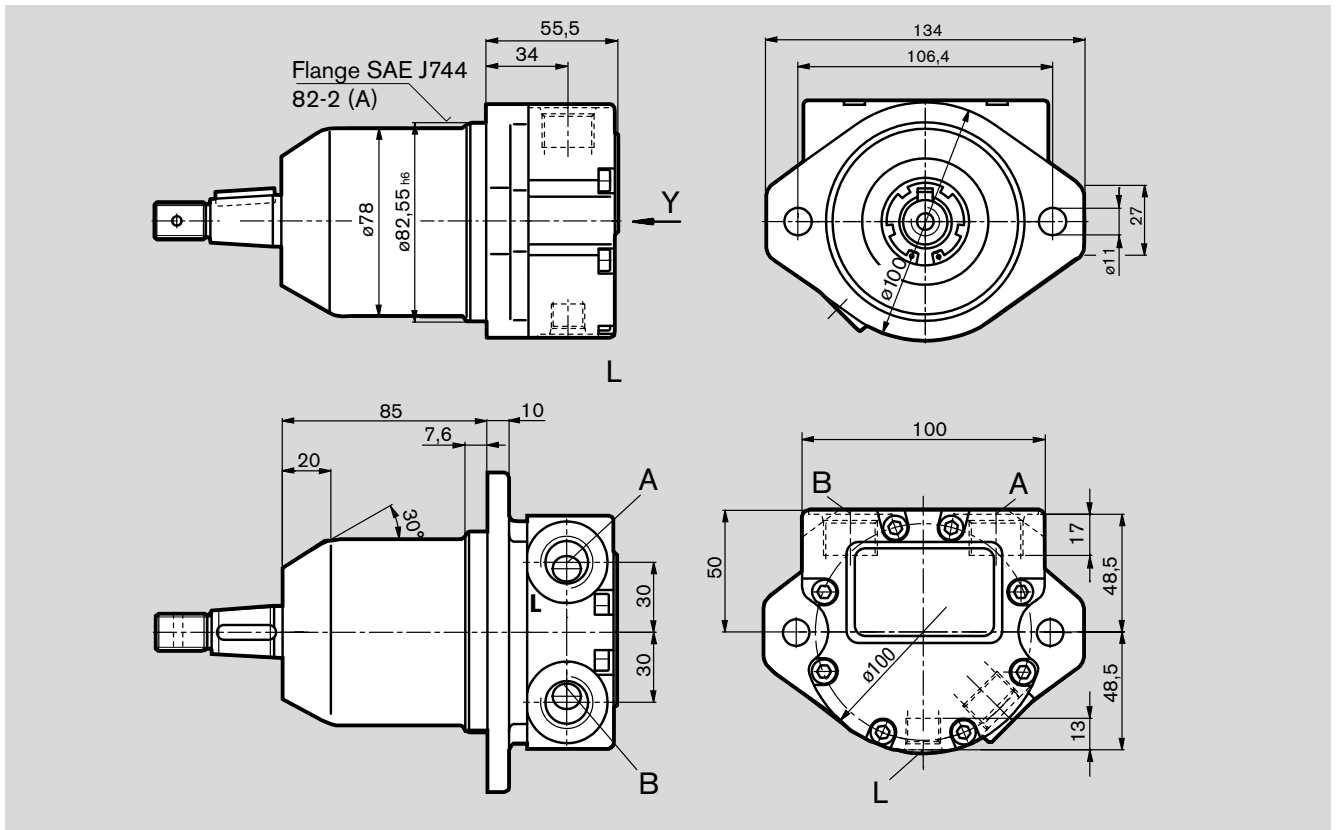
²⁾ see General Notes

Notes

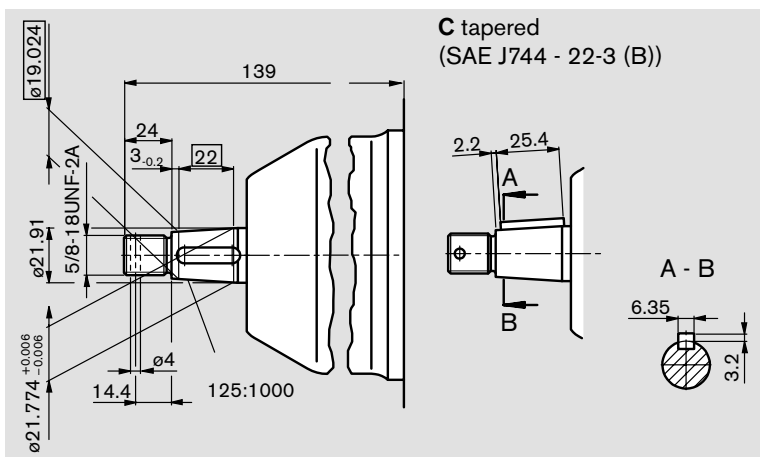
Unit Dimensions A10FE 10

Before finalizing your design please request certified installation drawing.

A10FE 10/52W-VXC16N000



Shaft ends



Ports

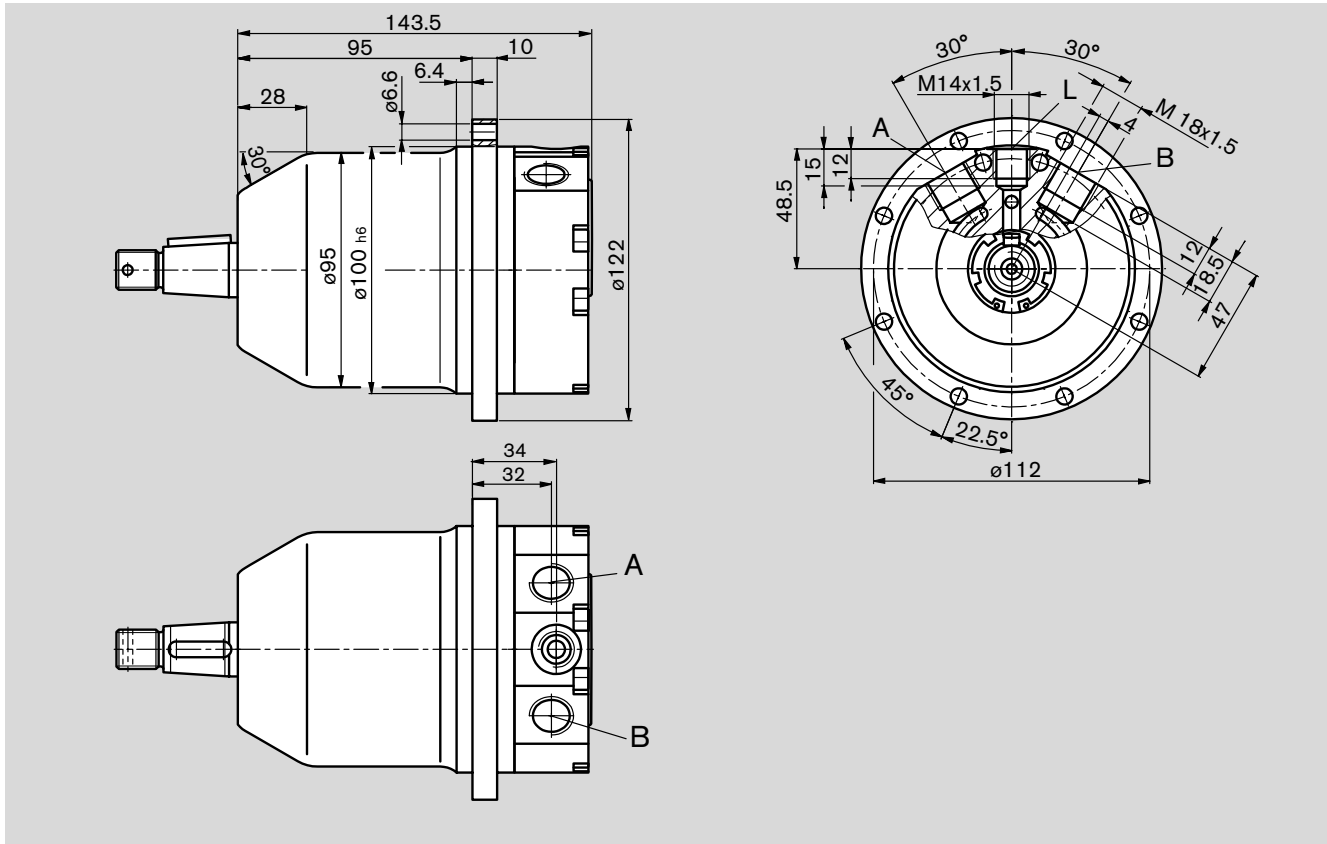
Port	Description	Standard	Thread	Depth	Tightening torque, max. ¹⁾
A	Pressure port	DIN 3852-1	M18x1,5	17 deep	70 Nm
B	Pressure port	DIN 3852-1	M18x1,5	17 deep	70 Nm
L	Case drain port	DIN 3852-1	M14x1,5	13 deep	45 Nm

¹⁾ see General Notes

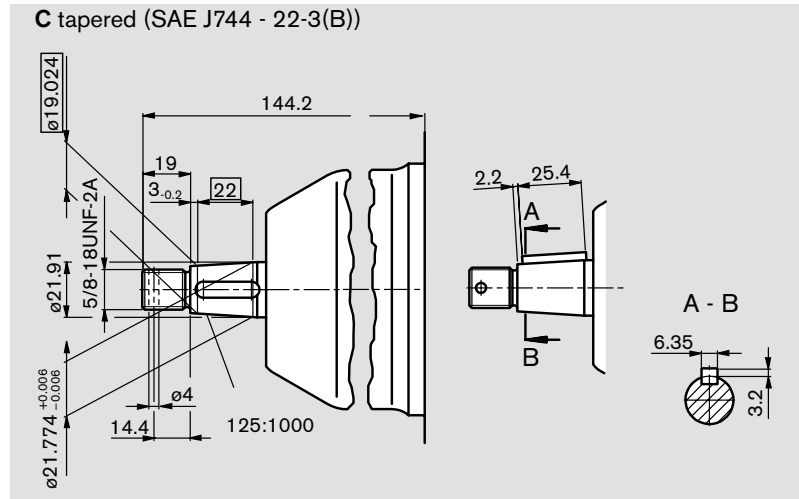
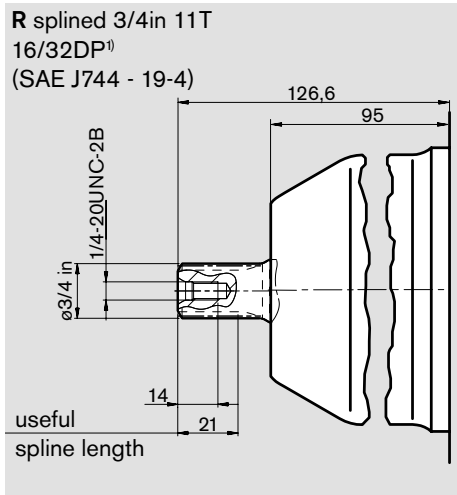
Unit Dimensions A10FE 11-18

Before finalizing your design please request certified installation drawing.

A10FE 11-18/52W-VXH16N000



Shaft ends



Ports

A	Pressure port	DIN 3852-1	M 18x1,5; 12 deep
B	Pressure port	DIN 3852-1	M 18x1,5; 12 deep
L	Case drain port	DIN 3852-1	M 14x1,5; 12 deep

Tightening torque, max.²⁾

140 Nm
140 Nm
80 Nm

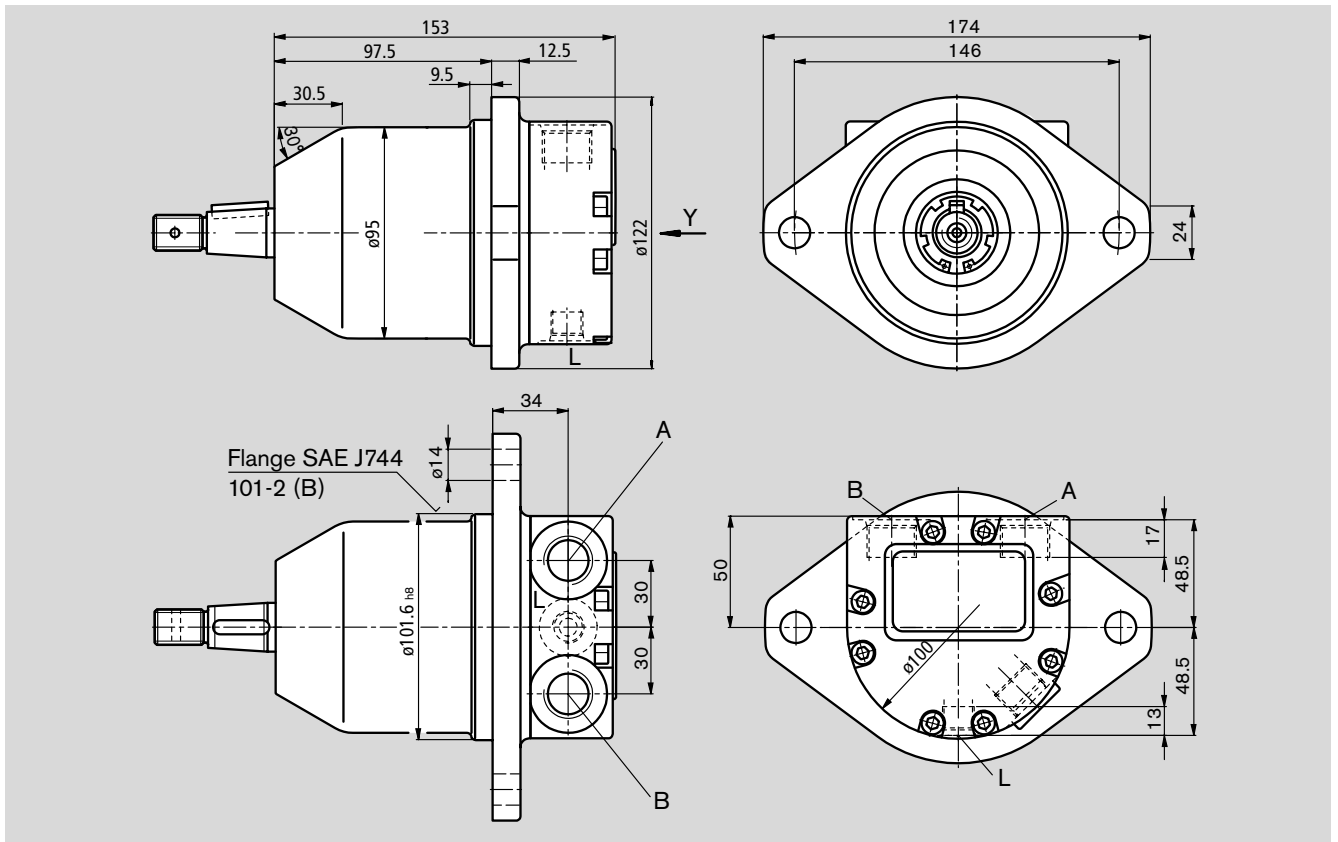
¹⁾ ANSI B92.1a-1996, 30° pressure angle, flat base, flank centering, fit class 5

²⁾ see General Notes

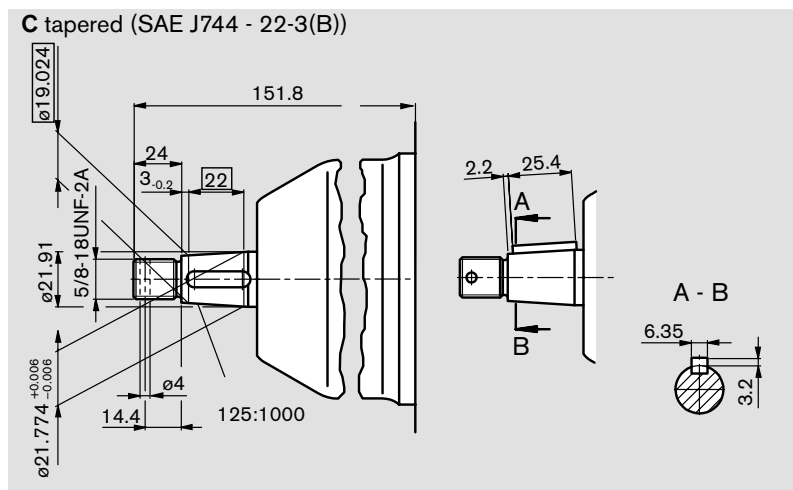
Unit Dimensions A10FE 11-18

Before finalizing your design please request certified installation drawing.

A10FE 11-18/52W-VCC16N000



Shaft ends



Ports

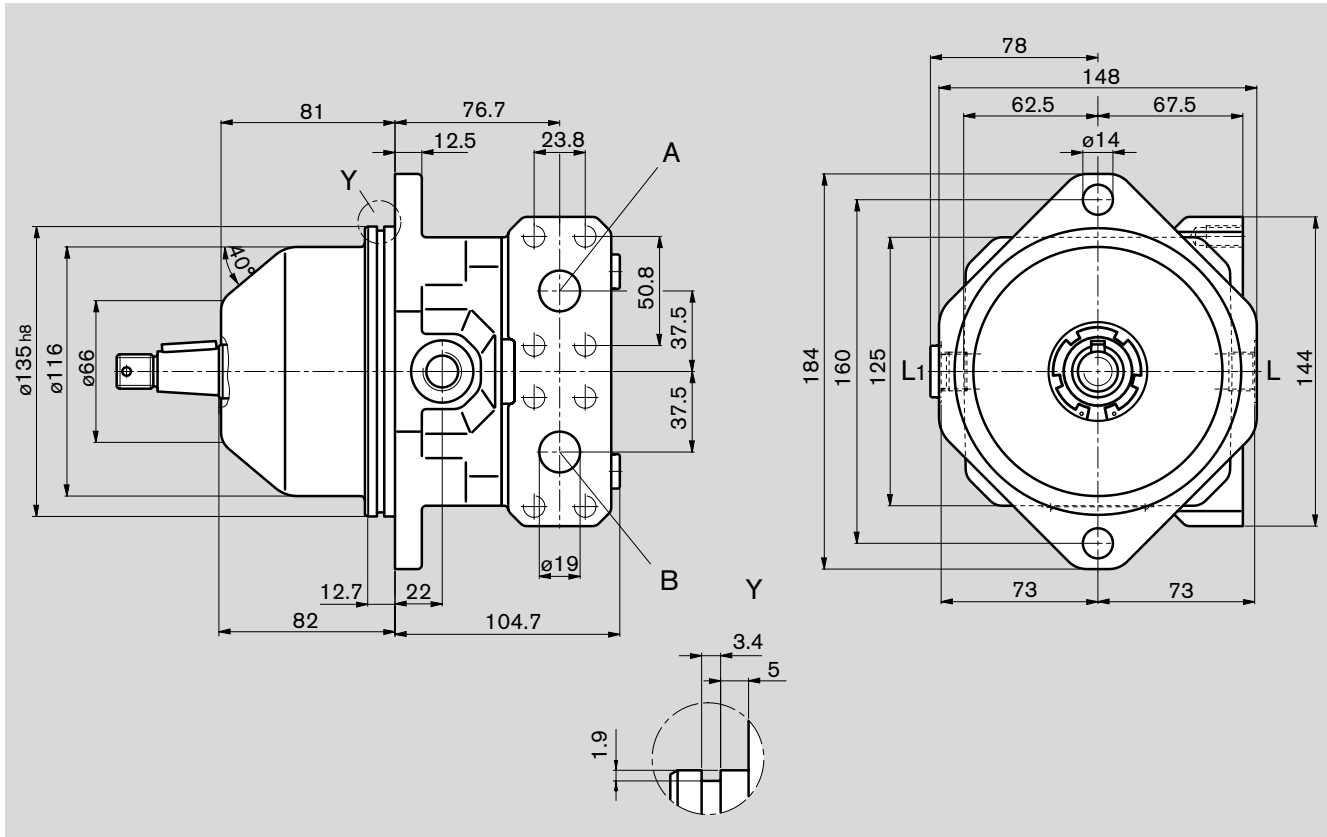
Port	Description	Standard	Thread	Tightening torque, max. ¹⁾
A	Pressure port	DIN 3852-1	M 18x1,5; 12 deep	140 Nm
B	Pressure port	DIN 3852-1	M 18x1,5; 12 deep	140 Nm
L	Case drain port	DIN 3852-1	M 14x1,5; 12 deep	80 Nm

¹⁾ see General Notes

Unit Dimensions A10FE 23-28

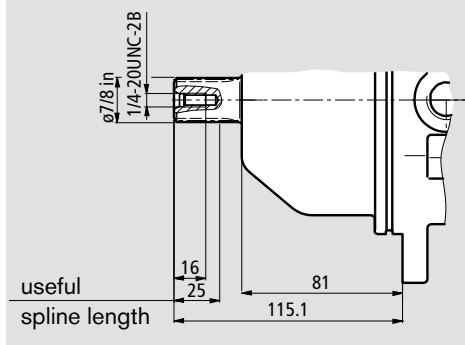
Before finalizing your design please request certified installation drawing.

A10FE 23-28/52W-VXF10N000

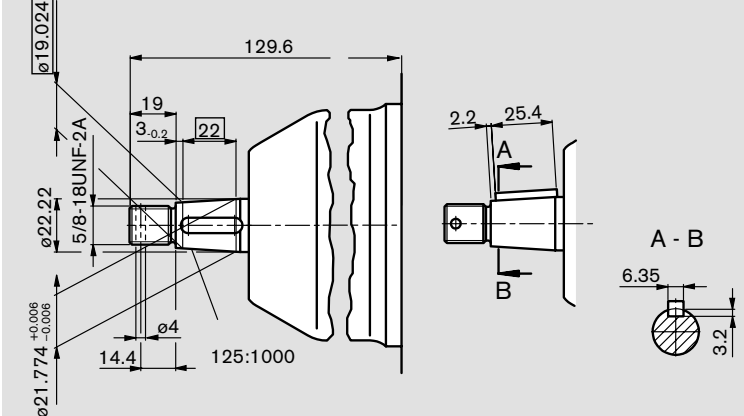


Shaft ends

R splined 7/8in 13T
16/32DP¹⁾
(SAE J744 - 22-4 (B))



C tapered (SAE J744 - 22-3 (B))



Ports

Port	Description	Thread	Size	Tightening torque, max. ²⁾
A	Pressure ports (High pressure series) Fixing thread	SAE J518C DIN 13	SAE 3/4 in M10; 17 deep	60 Nm
B	Pressure ports (High pressure series) Fixing thread	SAE J518C DIN 13	SAE 3/4 in M10; 17 deep	60 Nm
L	Case drain port (L ₁ plugged)	ISO 11926	3/4-16 UNF-2B	160 Nm

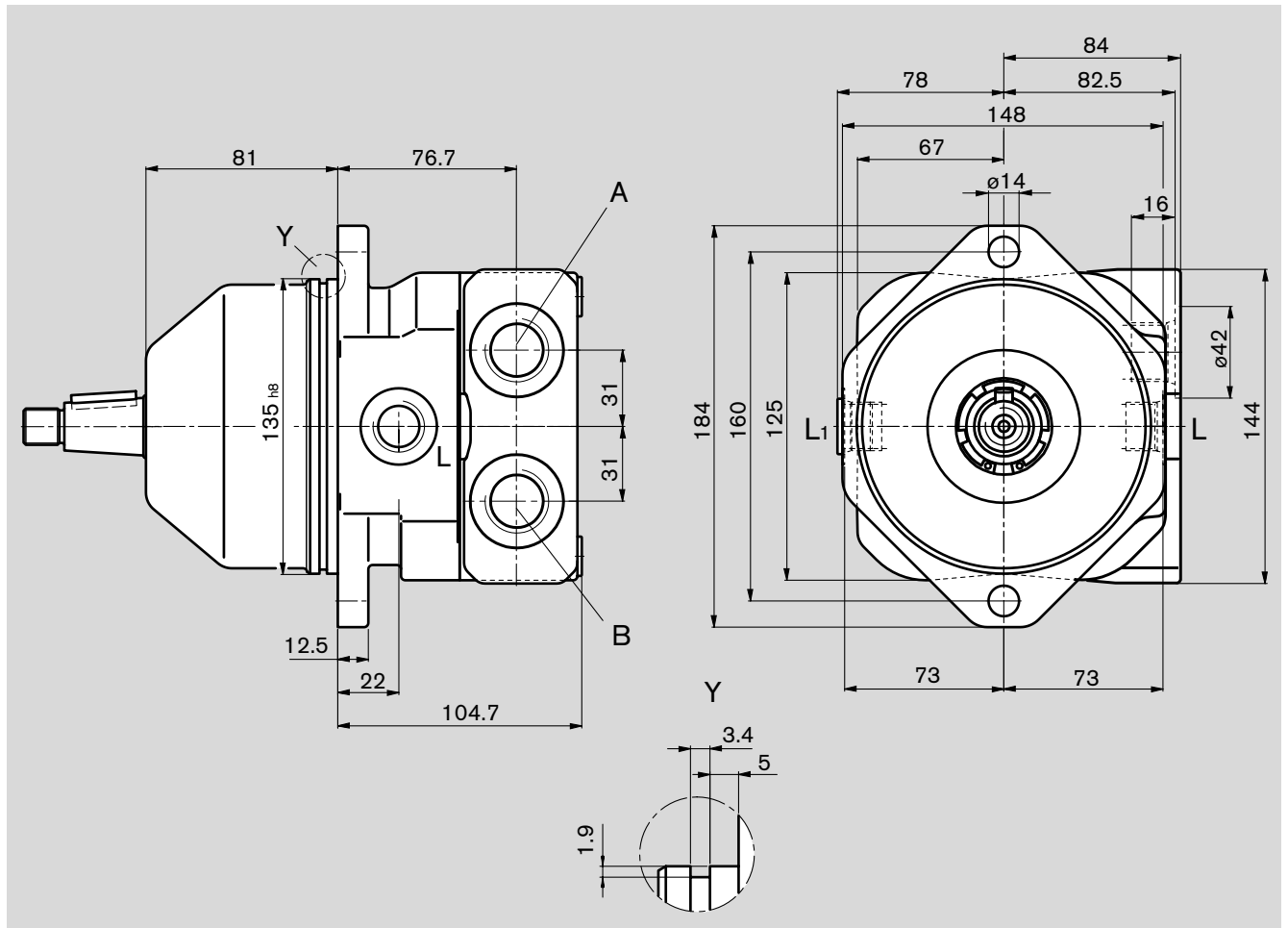
¹⁾ ANSI B92.1a-1996, 30° pressure angle, flat base, flank centering, fit class 5

²⁾ see General Notes

Unit Dimensions A10FE 23-28

Before finalizing your design please request certified installation drawing.

A10FE 23-28/52W-VXF16N000



Shaft ends see page: 18

Ports

				Tightening torque, max. ¹⁾
A	Pressure port	DIN 3852-1	M 27x2; 16 deep	330 Nm
B	Pressure port	DIN 3852-1	M 27x2; 16 deep	330 Nm
L	Case drain port (L ₁ , plugged)	DIN 3852-1	M18x1,5	140 Nm

¹⁾ see General Notes

Flushing and Boost Pressure Valve

Before finalizing your design please request certified installation drawing.

Ordering Option N007

This valve assembly is used to flush an unacceptable heat load out of the closed loop circuit, and to maintain the necessary minimum boost pressure (16 bar, fixed setting). The valve is integrated into the port plate.

A built-in fixed orifice determines the flushing flow, which is taken out of the low pressure side of the loop and directed into the motor housing. It leaves the housing together with the case drain flow. This combined flow is replenished with fresh oil by means of the boost pump.

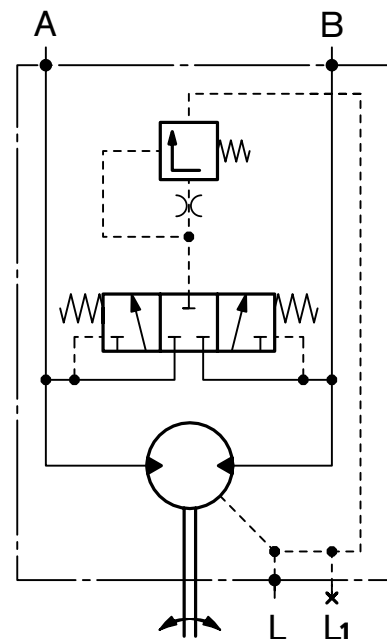
Standard flushing flow

With low press. side $p_{ND} = 20$ bar and an orifice dia. 1,6 mm: 5,5 L/min (sizes 23 - 63). Other orifice diameters are available, please state in clear text.

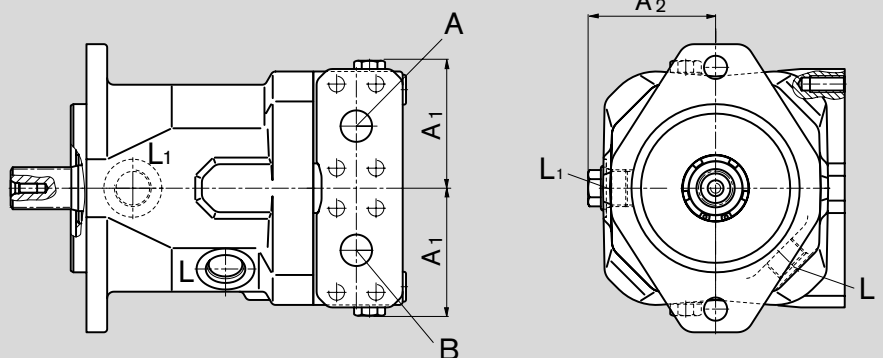
Further flushing flows for sizes 23 - 63 see table:

Flushing flow [L/min]	Orifice dia. [mm]
3,5	1,2
5,5	1,6
9	2

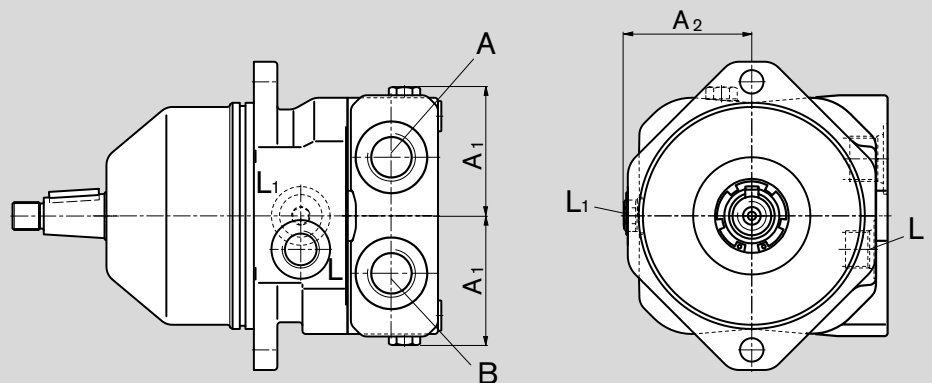
Circuit drawing



Unit Dimensions A10FM



Unit Dimensions A10FE



NG	A ₁	A ₂
23/28	72	72
37/45	77	77
58/63	77	82

Anti-cavitation Valve

Before finalizing your design please request certified installation drawing.

Ordering option N002

When stopping a system with a relatively large mass (i.e. fan drive) the anti-cavitation valve provides fluid to the motor inlet during the coasting time.

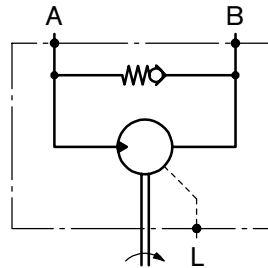
The valve assembly is integrated inside the port plate.

In this case it is necessary **to specify a direction of rotation (left or right hand)** looking at the shaft end of the motor.

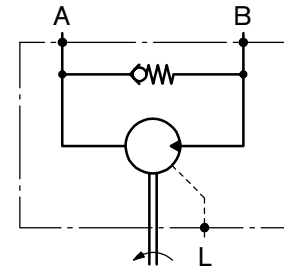
The outside dimensions are identical to the standard units except the A10FE 11 - 18 with the 8-hole mounting flange, for the difference in length see unit dimensions.

Schematic

Direction of rotation **cw**



Direction of rotation **ccw**



Speed Pickup

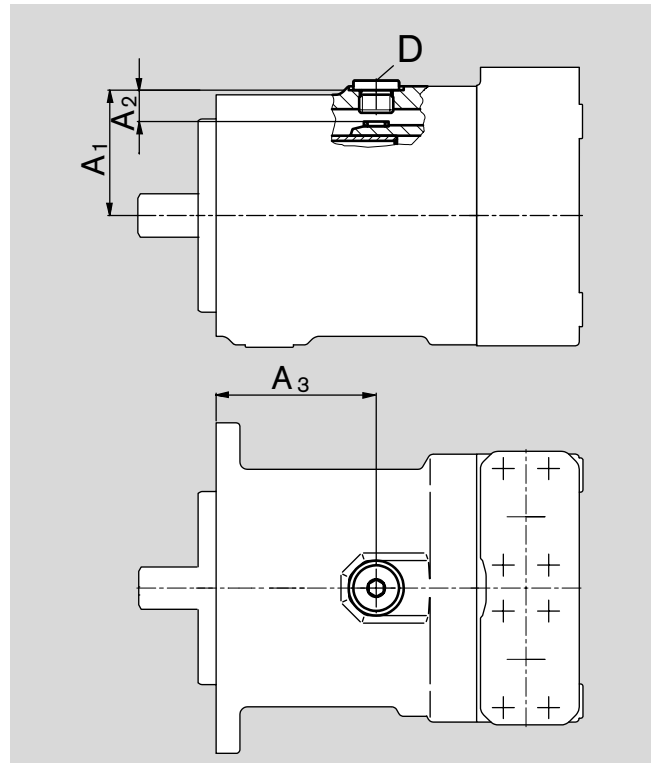
Ordering Option D

The version A10FM...D comprises gearing around the rotary unit (Prepared for speed pickup).

In this case, the rotating cylinder barrel can provide a speed dependent signal, which can be picked up by a suitable sensor and processed for further evaluation. Sensor port (D) will be closed for delivery.

For completion of the actual speed pickup function the necessary working parts must be ordered separately.

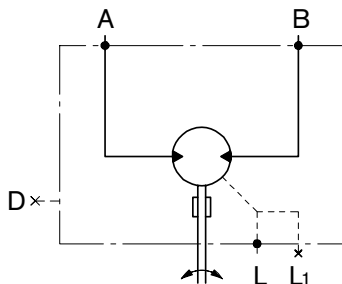
Inductive speed sensor ID R 18/20-L250 (see RE 95130) and mounting parts (spacer and 2 seals per kit) can be ordered separately with the following part numbers:



Size	Material part list No.	Nr. of teeth
23/28	R902428802	48
37/45	R902433368	48
58/63	R902437556	56

Size	A ₁	A ₂	A ₃	Port D (closed)
23/28	61	15,5	101,8	M 18x1,5
37/45	66	17	84,2	M 18x1,5
58/63	69	13,1	128,5	M 18x1,5

Schematic



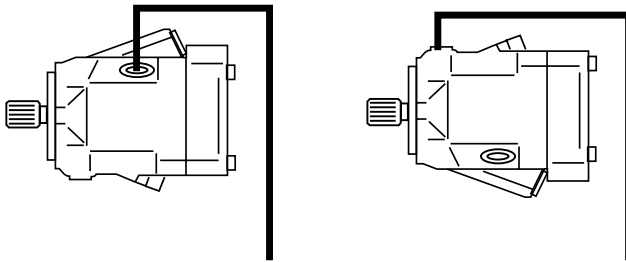
Installation Notes

The motor housing must be filled with hydraulic fluid when starting up and during operation. The drain line must be arranged so that the housing cannot empty itself when the motor is stationary. The end of the line must enter the tank below the minimum fluid level.

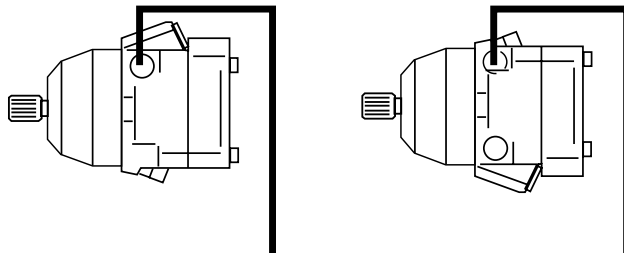
The port, located at the highest point must be used in all installation positions to fill the housing and to connect the drain line.

In case of vertical installation please consult us.

A10FM



A10FE



General Notes

- The A10FM/A10FE motor is designed to be used in open and closed loop circuits.
- Project planning, assembly, and startup of the motor require the involvement of trained personnel.
- The working and functional ports are only designed to accommodate hydraulic piping.
- Tightening torques: The tightening torques specified in this data sheet are maximum values and may not be exceeded (maximum value for screw thread). Manufacturer specifications for the max. permissible tightening torques of the used fittings must be observed!
For DIN 13 fastening screws we recommend checking the tightening torque individually according to VDI 2230 Edition 2003.
- The housing temperature rises during and shortly after operation. Take suitable safety precautions (e.g. wear protective clothing).
- The data and information contained herein must be adhered to.