



HYDSTAR

ISO9001认证企业

液压泵专业生产厂家-江苏海斯特

Hydraulic Pump Manufacture-Hydstar Hydraulic

Technical Manual
2023



江苏海斯特液压科技有限公司

Jiangsu Hydstar Hydraulic Technology Co., Ltd.

CONTENTS

Piston Pump

Variable Displacement Pump

<u>A10VSO 31 Series</u>	<u>1-48</u>
<u>A10VSO 32 Series</u>	<u>49-120</u>
<u>A10VSO 52/53 Series</u>	<u>121-164</u>
<u>A4VSO Series</u>	<u>164-240</u>
<u>A7VO Series</u>	<u>241-282</u>
<u>A11VO Series</u>	<u>283-346</u>

Piston Motor

Fixed Motor

<u>A2FM Series</u>	<u>346-392</u>
<u>A2FE Series</u>	<u>393-416</u>
<u>A10FM/A10FE Series</u>	<u>417-448</u>

Variable Displacement Motor

<u>A6VM Series</u>	<u>449-616</u>
<u>A6VE Series</u>	<u>617-706</u>
<u>A10VM/A10VE Series</u>	<u>707-750</u>

Axial Piston Fixed Motor A10FM / A10FE (US-Version)

Data sheet

Series 52
 Sizes 10 to 63
 Nominal pressure 4000 psi (280 bar)
 Maximum pressure 5100 psi (350 bar)
 Open and closed circuit



A10FM 23..63

A10FE 10..45
(2-hole-flange)

A10FE 11..18
(8-hole-flange)

Contents

Ordering code for standard program	2
Technical data	4
Dimensions A10FM size 23 - 63	10
Dimensions A10FE size 10 - 63	16
Flushing and boost pressure valve	26
Anti cavitation valve	26
Speed sensor	27
Installation instructions	28
General instructions	32

Features

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

Ordering code for standard program

A10F	M		/	52		-	V		C			
01	02	03		04	05		06	07	08	09	10	11

Axial piston unit

01	Swashplate design, fixed displacement, nominal pressure 4000 psi (280 bar), maximum pressure 5100 psi (350 bar)										A10F
----	---	--	--	--	--	--	--	--	--	--	-------------

Operating mode

02	Motor, open and closed circuit										M
----	--------------------------------	--	--	--	--	--	--	--	--	--	----------

Size (NG)

03	Theoretical displacement see page 6						018	023	028	037	045	058	063
----	-------------------------------------	--	--	--	--	--	------------	------------	------------	------------	------------	------------	------------

Series

04	Series 5, Index 2										52
----	-------------------	--	--	--	--	--	--	--	--	--	-----------

Direction of rotation

05	Viewed on drive shaft	clockwise	R¹⁾
		counter-clockwise	L¹⁾
		bidirectional	W

Seals

06	FKM (fluor-caoutchouc)										V
----	------------------------	--	--	--	--	--	--	--	--	--	----------

Drive shaft

		018	023	028	037	045	058	063	
07	Splined shaft to ISO 3019-1 (SAE J744)	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	R
	Splined shaft to ISO 3019-1 (SAE J744)	-	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	W
	Tapered with woodruff key and threaded end	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	C

Mounting flange

		018	023	028	037	045	058	063	
08	SAE 2-hole	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	C

Ports for service lines

		018	023	028	037	045	058	063	
09	SAE-flange ports A and B on side, same side, mounting bolts UNF	-	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	60N00
	Threaded ports A and B, on side, same side, UNF thread	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	66N00

Valves

		018	023	028	037	045	058	063	
10	Without valves	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	0
	With integrated flushing valve	-	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	7
	With integrated anti cavitation valve	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	2

Speed sensor

		018	023	028	037	045	058	063	
11	Without speed sensor	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	
	Prepared for speed sensor (for inductive speed sensor ID)	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	D

1) Only necessary in conjunction with valve configuration „2“ (integrated anti cavitation valve)

● = Available ○ = On request - = Not available

Ordering code for standard program

A10F	E		/	52		-	V					
01	02	03		04	05		06	07	08	09	10	11

Axial piston unit

01	Swashplate design, fixed displacement, nominal pressure 4000 psi (280 bar), maximum pressure 5100 psi (350 bar)	A10F
----	---	-------------

Operating mode

02	Motor, open and closed circuit; plug-in design	E
----	--	----------

Size (NG)

03	Theoretical displacement see page 6	010	011	014	016	018	023	028	037	045	058	063
----	-------------------------------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------	------------

Series

04	Series 5, Index 2	52
----	-------------------	-----------

Direction of rotation

05	Viewed on drive shaft	clockwise	R¹⁾
		counter-clockwise	L¹⁾
		bidirectional	W

Seals

06	FKM (fluor-caoutchouc)	V
----	------------------------	----------

Drive shaft

		010	011	014	016	018	023	028	037	045	058	063	
07	Splined shaft to ISO 3019-1 (SAE J744)	○	●	●	●	●	●	●	●	●	●	●	R
	Splined shaft to ISO 3019-1 (SAE J744)	-	-	-	-	-	○	○	●	●	●	●	W
	Tapered with woodruff key and threaded end	●	●	●	●	●	●	●	●	●	●	●	C

Mounting flange

		010	011	014	016	018	023	028	037	045	058	063	
08	SAE 2-hole	●	●	●	●	●	-	-	-	-	-	-	C²⁾
	Special 2-hole	-	-	-	-	-	●	●	●	●	●	●	F
	Special 8-hole	-	●	●	●	●	-	-	-	-	-	-	H

Ports for service lines

		010	011	014	016	018	023	028	037	045	058	063	
09	SAE-flange ports A and B, on side, same side mounting bolts metric	-	-	-	-	-	●	●	●	●	●	●	60N00
	Threaded ports A and B, metric, on side, same side	●	●	●	●	●	●	●	●	●	●	●	66N00

Valves

		010	011	014	016	018	023	028	037	045	058	063	
10	Without valves	○	●	○	●	●	●	●	●	●	●	●	0
	With integrated flushing valve	-	-	-	-	-	●	●	●	●	●	●	7
	With integrated anti cavitation valve	●	●	●	●	●	●	●	●	●	●	●	2

Speed sensor

		010	011	014	016	018	023	028	037	045	058	063	
11	Without speed sensor	●	●	●	●	●	●	●	●	●	●	●	
	Prepared for speed sensor (for inductive speed sensor ID)	-	-	-	-	○	●	●	●	●	○	○	D

1) Only necessary in conjunction with valve configuration „2“ (integrated anti cavitation valve)

2) Combination R-shaft with C-flange for sizes 10 to 18 in preparation

● = Available ○ = On request - = Not available

Technical data

Fluids

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

For operation on environmentally acceptable fluids please consult us (when ordering, please state in clear text the fluid to be used).

Operating viscosity range

To achieve optimum values for efficiency and service life we recommend an operation viscosity (at operating temperature) within the range,

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

referred to the tank temperature (open circuit).

Limit of viscosity range

For critical operation conditions the following values apply:

$$v_{min} = \begin{aligned} &42 \text{ SUS (5 mm}^2\text{/s) (closed circuit)} \\ &60 \text{ SUS (10 mm}^2\text{/s) (open circuit)} \\ &\text{for short periods (t} \leq 1 \text{ min)} \\ &\text{at a max. perm. temperature of } 239 \text{ }^\circ\text{F (115 }^\circ\text{C)}. \end{aligned}$$

Please note that the max. leakage fluid temperature of 239 °F (115 °C) is also not exceeded in certain areas (for instance bearing area). The fluid temperature in the bearing area is approx.

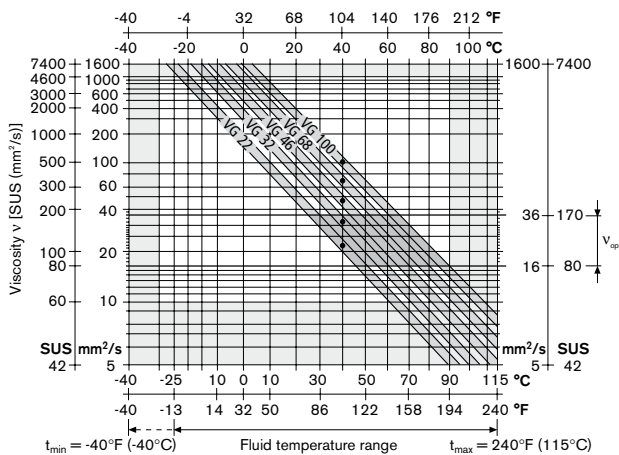
9 °F (5 °C) higher than the average leakage fluid temperature

$$v_{max} = \begin{aligned} &7500 \text{ SUS (1600 mm}^2\text{/s)} \\ &\text{for short periods (t} \leq 1 \text{ min)} \\ &\text{on cold start} \\ &(\text{t}_{min} = p \leq 435 \text{ psi (30 bar), } n \leq 1000 \text{ min}^{-1}, \\ &-13 \text{ }^\circ\text{F (-25 }^\circ\text{C)}). \end{aligned}$$

At temperatures between -40 °F (-40 °C) and -13 °F (-25 °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.

Selection diagram



Notes on the selection of the hydraulic fluid

In order to select the correct fluid, it is necessary to know the operating temperature in the 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 °F (X °C) the operating temperature in the tank is 140 °F (60 °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 fluid (case drain fluid) temperature is influenced by pressure and input speed and is always higher than the tank temperature. However, at no point of the component may the temperature exceed 239 °F (115 °C).

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

Filtration of the hydraulic fluid

Filtration improves the cleanliness level of the hydraulic fluid, which, in turn, increases the service life of the axial piston unit.

To ensure the functional reliability of the axial piston unit, a gravimetric evaluation is necessary for the hydraulic fluid to determine the amount of contamination by solid matter and to determine the cleanliness level according to ISO 4406. A cleanliness level of at least 20/18/15 to ISO 4406 is to be maintained.

If above requirements cannot be maintained please consult us.

Technical data

Operating pressure range

Pressure at service line port (pressure port) A or B

Nominal pressure p_{nom} _____ 4000 psi (280 bar) absolute

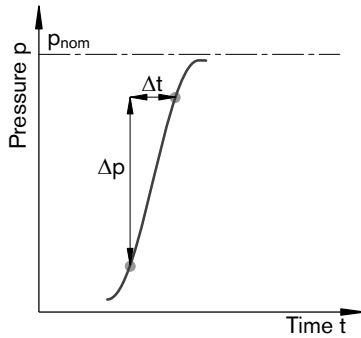
Maximum pressure p_{max} _____ 5100 psi (350 bar) absolute

Single operating period _____ 2,5 ms

Total operating period _____ 300 h

Minimum pressure (high pressure side) _ 145 psi (10 bar)²⁾

Rate of pressure change $R_{A_{max}}$ 235000 psi/s (16000 bar/s)



Outlet pressure

at n_{max}

Minimum pressure at low pressure side $p_{abs_{max}}$ 260 psi (18 bar)

Case drain pressure

Maximum permissible case drain pressure
(at port L, L₁):

$p_{max_{abs}}$ motor operation in open circuit _____ 60 psi(4 bar) abs

$p_{max_{abs}}$ motor operation in closed circuit _____ 60 psi(4 bar) abs

$p_{max_{abs}}$ pump/motor operation in open circuit _ 30 psi(2 bar) abs

Direction of flow

Viewed on drive shaft

clockwise rotation

counter-clockwise rotation

A to B

B to A

Definitions

Nominal pressure p_{nom}

The nominal pressure corresponds to the maximum design pressure.

Maximum pressure p_{max}

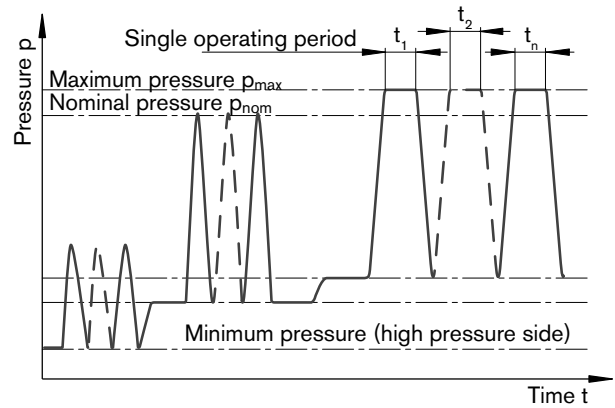
The maximum pressure corresponds to the maximum operating pressure within the single operating period. The sum of the single operating periods must not exceed the total operating period.

Minimum pressure (high-pressure side)

Minimum pressure at the high pressure side (A or B) which is required in order to prevent damage to the axial piston unit.

Rate of pressure change R_A

Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range.



Total operating period = $t_1 + t_2 + \dots + t_n$

- 1) Other values on request
- 2) Lower pressures time dependent, please consult us.

Technical data

Table of values (theoretical values, without efficiency and tolerances: values rounded)

Size	NG	010	011	014	016	018	023	
Displacement	$V_{g \max}$ in ³ (cm ³)	0.65 (10.6)	0.70 (11.5)	0.86 (14.1)	0.98 (16.1)	1.10 (18)	1.43 (23.5)	
Speed ¹⁾								
at $V_{g \max}$	n_{nom} rpm (min ⁻¹)	5000	4200	4200	4200	4200	4900	
Input flow								
at n_{nom}	$q_{v \max}$ gpm (L/min)	14 (53)	12.7 (48)	15.6 (59)	17.9 (68)	20.1 (76)	30.4 (115)	
Power								
at n_{nom} , $\Delta p = 4000$ psi (280 bar)	P_{\max} HP (kW)	33 (24.7)	30 (22.5)	37 (27.6)	42 (31.6)	47 (35.3)	71 (53.6)	
Actual starting torque								
at $n = 0$ rpm (min ⁻¹), $\Delta p = 4000$ psi (280 bar)	lb-ft (Nm)	27.6 (37.5)	22.1 (30)	33.2 (45)	39.1 (53)	49.8 (67.5)	55.3 (75)	
Torque								
at $V_{g \max}$	$\Delta p = 4000$ psi (280 bar) T_{\max} lb-ft (Nm)	34.6 (47)	37.5 (51)	46.5 (63)	53.1 (72)	59 (80)	77.4 (105)	
Torsional stiffness	R	c	lb-ft/rad (Nm/rad)	-	-	-	10942 (14835)	21005 (28478)
Drive shaft	W	c	lb-ft/rad (Nm/rad)	-	-	-	-	-
	C	c	lb-ft/rad (Nm/rad)	11126 (15084)	13765 (18662)	13765 (18662)	13765 (18662)	22140 (30017)
Moment of inertia rotary group	J_{TW}	lb-ft ² (kgm ²)	0.014 (0.0006)	0.022 (0.00093)	0.022 (0.00093)	0.022 (0.00093)	0.022 (0.00093)	0.04 (0.0017)
Maximum angular acceleration	α	rad/s ²	8000	6800	6800	6800	6800	5500
Case volume	V	gal (L)	0.03 (0.1)	0.04 (0.15)	0.04 (0.15)	0.04 (0.15)	0.04 (0.15)	0.16 (0.6)
Mass approx.	m	lbs (kg)	11.0 (5)	14.3 (6.5)	14.3 (6.5)	14.3 (6.5)	14.3 (6.5)	26.5 (12)

¹⁾ for maximum speed an outlet pressure (in low pressure side) of 261 psi (18 bar) is required (see diagram on page 7)

Note

Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. We recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

Technical data

Table of values (theoretical values, without efficiency and tolerances: valuea rounded)

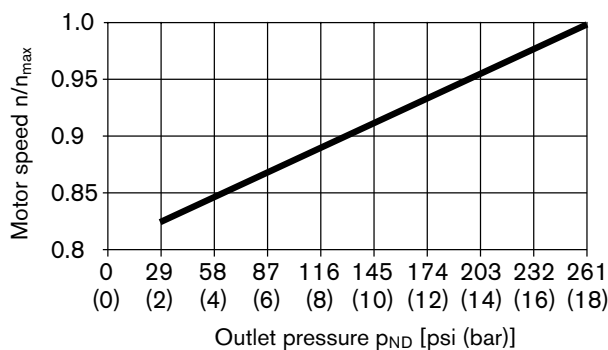
Size	NG		028	037	045	058	063	
Displacement	$V_{g \max}$	in ³ (cm ³)	1.73 (28.5)	2.24 (36.7)	2.71 (44.5)	3.53 (58)	3.84 (63.1)	
Speed ¹⁾ at $V_{g \max}$	n_{nom}	rpm (min ⁻¹)	4700	4200	4000	3600	3400	
Input flow at n_{nom}	$q_{v \max}$	gpm (L/min)	35.4 (134)	40.7 (154)	47 (178)	55.2 (209)	56.8 (215)	
Power at n_{nom} , $\Delta p = 4000$ psi (280 bar)	P_{\max}	HP (kW)	83 (62.5)	95 (71.8)	111 (83.1)	130 (97.4)	133 (100.1)	
Actual starting torque at $n = 0$ rpm (min ⁻¹), $\Delta p = 4000$ psi (280 bar)		lb-ft (Nm)	77.5 (105)	92.2 (125)	125 (170)	151 (205)	169 (230)	
Torque at $V_{g \max}$	$\Delta p = 4000$ psi (280 bar)	T_{\max}	lb-ft (Nm)	93.7 (127)	120 (163)	146 (198)	190 (258)	207 (281)
Torsional stiffness	R	c	lb-ft/rad Nm/rad	21005 (28478)	34563 (46859)	34563 (46859)	59443 (80590)	59443 (80590)
Drive shaft	W	c	lb-ft/rad Nm/rad	-	28389 (38489)	28389 (38489)	44925 (60907)	44925 (60907)
	C	c	lb-ft/rad Nm/rad	22140 (30017)	34332 (46546)	34332 (46546)	64663 (87667)	64663 (87667)
Moment of inertia rotary group		J_{TW}	lb-ft ² kgm ²	0.04 (0.0017)	0.078 (0.0033)	0.078 (0.0033)	0.133 (0.0056)	0.133 (0.0056)
Maximum angular acceleration		α	rad/s ²	5500	4000	4000	3300	3300
Case volume		V	gal (L)	0.16 (0.6)	0.18 (0.7)	0.18 (0.7)	0.21 (0.8)	0.21 (0.8)
Mass approx.		m	lbs (kg)	26.5 (12)	37.5 (17)	37.5 (17)	48.5 (22)	48.5 (22)

¹⁾ for maximum speed an outlet pressure (in low pressure side) of 261 psi (18 bar) is required (see diagram on this page)

Note

Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit. We recommend testing the loads by means of experiment or calculation / simulation and comparison with the permissible values.

Permissible motor speed in relation to outlet pressure



Technical data

Determination of motor size (NG)

$$\begin{aligned} \text{Input flow } q_v &= \frac{V_g \cdot n}{231 \cdot \eta_v} && [\text{gpm}] \\ &= \frac{V_g \cdot n}{1000 \cdot \eta_v} && [\text{L/min}] \end{aligned}$$

$$\begin{aligned} \text{Torque } T &= \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{24 \cdot \pi} && [\text{lb-ft}] \\ T &= \frac{1.59 \cdot V_g \cdot \Delta p \cdot \eta_{mh}}{100} && [\text{Nm}] \end{aligned}$$

$$\text{or } T = T_k \cdot \Delta p \cdot \eta_{mh}$$

$$\begin{aligned} \text{Power } P &= \frac{T \cdot n}{5252} = \frac{q_v \cdot \Delta p \cdot \eta_t}{600} && [\text{HP}] \\ P &= \frac{2 \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p \cdot \eta_t}{600} && [\text{kW}] \end{aligned}$$

$$\begin{aligned} \text{Output speed } n &= \frac{q_v \cdot 231 \cdot \eta_v}{V_g} && [\text{rpm}] \\ n &= \frac{q_v \cdot 1000 \cdot \eta_v}{V_g} && [\text{min}^{-1}] \end{aligned}$$

V_g = Displacement per revolution in in^3 (cm^3)

Δp = Differential pressure in psi (bar)

n = Speed in rpm (min^{-1})

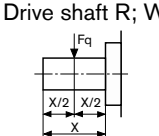
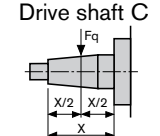
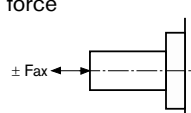
η_v = Volumetric efficiency

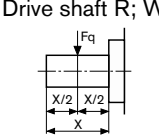
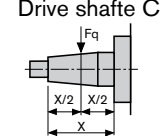
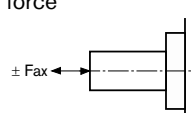
η_{mh} = Mechanical-hydraulic efficiency

η_t = Overall efficiency ($\eta_t = \eta_v \cdot \eta_{mh}$)

T_k = Torque constant

Permissible radial and axial forces of the drive shaft

Size		NG	10	11	14	16	18	23			
Max. radial force at X/2	Drive shaft R; W			$F_{q \max}$	lb-f (N)	56	79	79	79	79	270
						(250)	(350)	(350)	(350)	(350)	(1200)
Maximum axial force		$\pm F_{ax \max}$	lb-f (N)	90 (400)	157 (700)	157 (700)	157 (700)	157 (700)	225 (1000)		

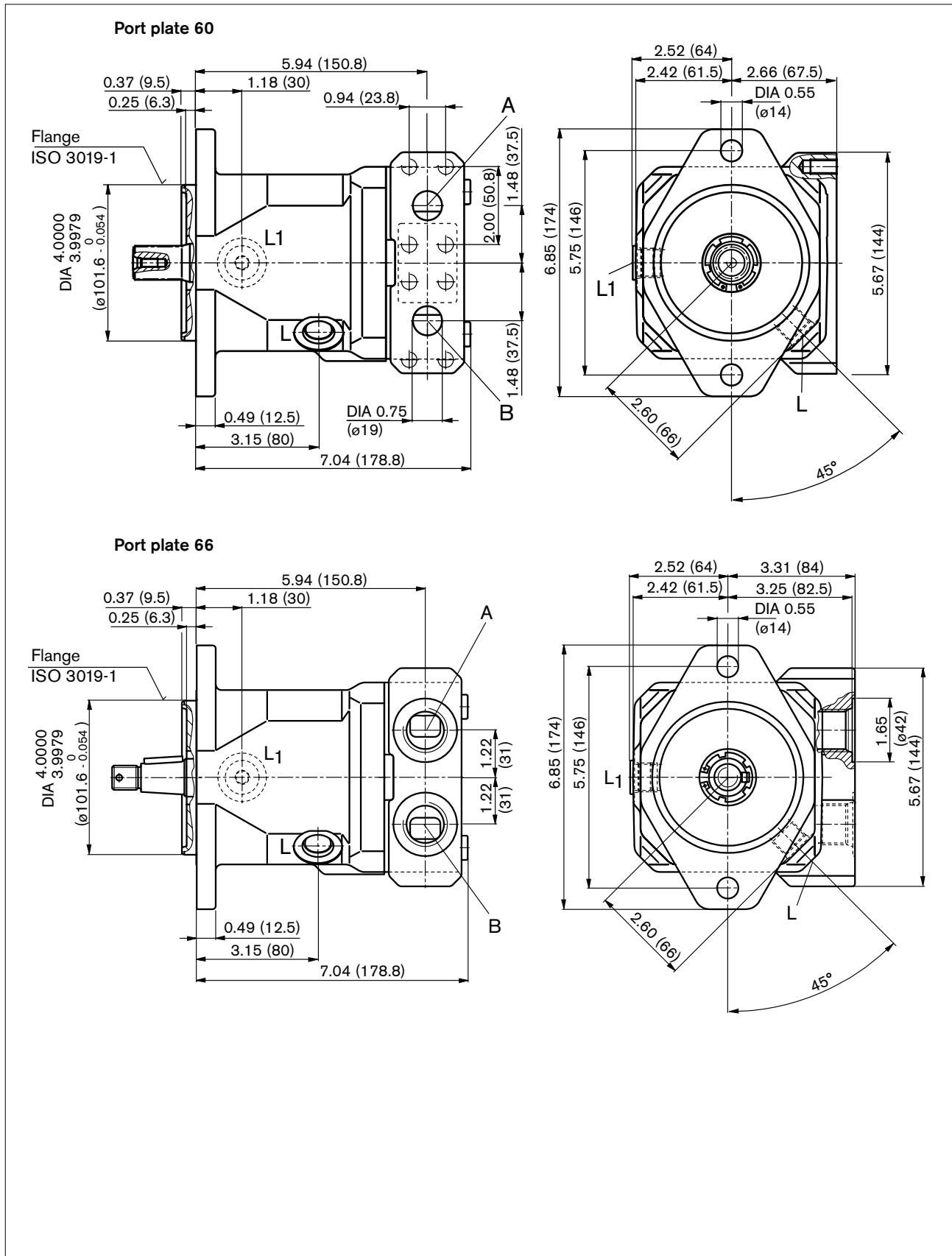
Size		NG	28	37	45	58	63			
Max. radial force at X/2	Drive shaft R; W			$F_{q \max}$	lb-f (N)	270	337	337	382	382
						(1200)	(1500)	(1500)	(1700)	(1700)
Maximum axial force		$\pm F_{ax \max}$	lb-f (N)	225 (1000)	337 (1500)	337 (1500)	450 (2000)	450 (2000)		

Notes

Dimensions A10FM size 23 - 28

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

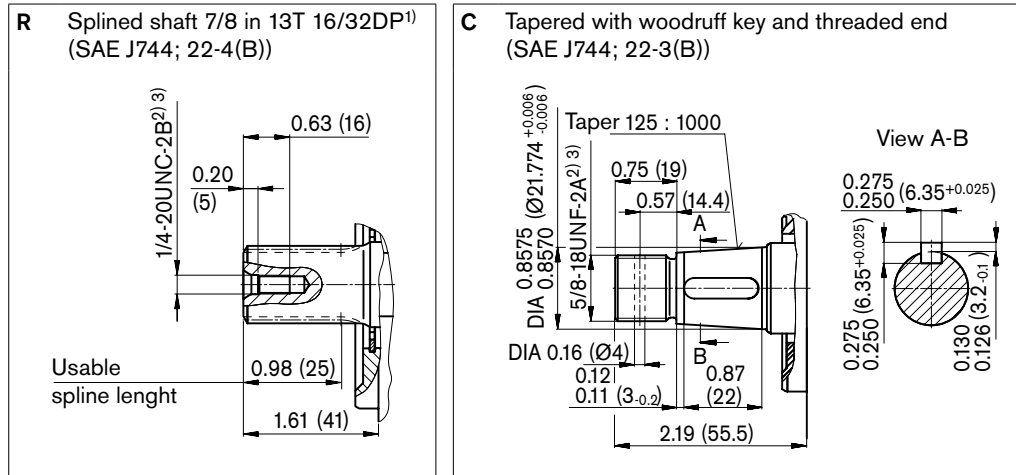
A10FM 23-28/52W-VxCxxN000



Dimensions A10FM size 23 - 28

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Max. pressure [psi (bar)] ⁴⁾	State
A, B Port plate 60	Service line (high pressure series) Mounting bolts	SAE J518 ISO 68	3/4 in 3/8-16 UNC-2B; 0.67 (17) deep	5100 (350)	O
A, B Port plate 66	Service line	ISO 11926	1 1/16-12 UN-2B; 0.63 (16) deep	5100 (350)	O
L	Case drain	ISO 11926 ⁶⁾	3/4-16 UNF-2B; 0.43 (11) deep	60 (4)	O ⁵⁾
L ₁	Case drain	ISO 11926 ⁶⁾	3/4-16 UNF-2B; 0.43 (11) deep	60 (4)	X ⁵⁾

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

²⁾ Observe the general instructions on page 32 for the maximum tightening torques.

³⁾ Threaded end according to ASME B1.1.

⁴⁾ Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

⁵⁾ Depending on the installation position, L or L₁ must be connected (see also page 28).

⁶⁾ The counterbore can be deeper than stipulated in the standard.

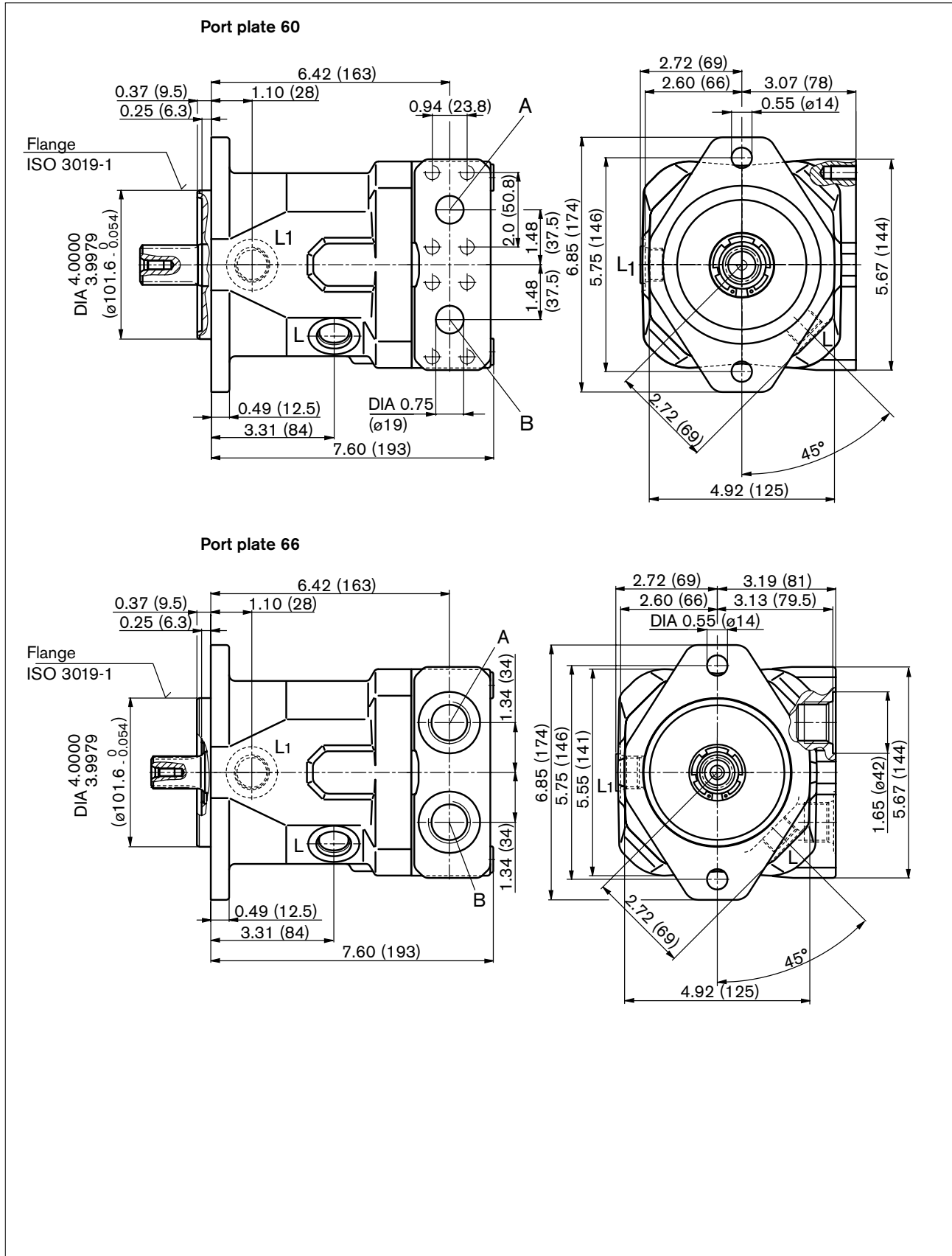
O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Dimensions A10FM size 37 - 45

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

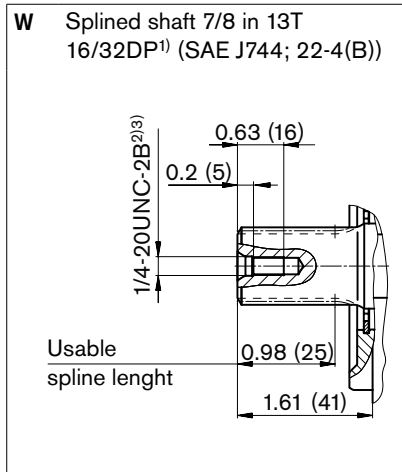
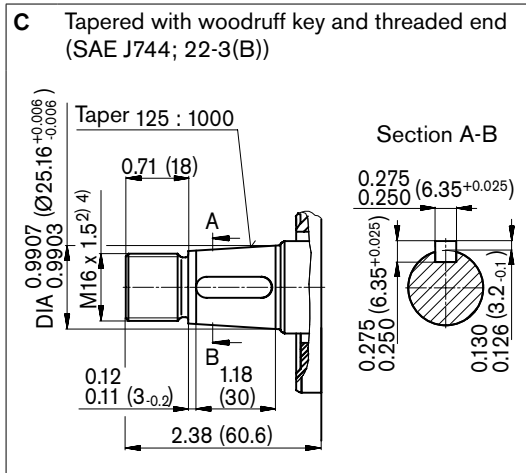
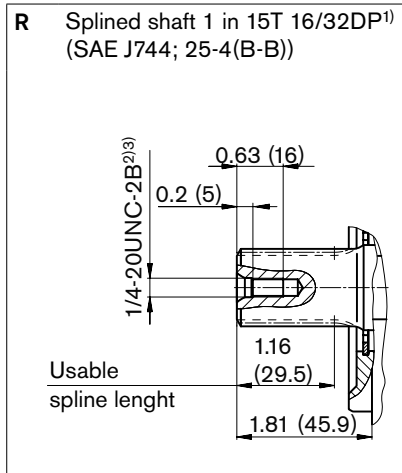
A10FM 37-45/52W-VxCxxN000



Dimensions A10FM size 37 - 45

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Max. pressure [psi (bar)] ⁵⁾	State
A, B	Service line (high pressure series)	SAE J518	3/4 in	5100 (350)	O
Port plate 60	Mounting bolts	ISO 68	3/8-16 UNC-2B; 0.83 (21) deep		
A, B	Service line	ISO 11926	1 1/16-12UN-2B; 0.79 (20) deep	5100 (350)	O
L	Case drain	ISO 11926 ⁷⁾	7/8-14 UNF-2B; 0.51 (13) deep	60 (4)	O ⁶⁾
L ₁	Case drain	ISO 11926 ⁷⁾	7/8-14 UNF-2B; 0.51 (13) deep	60 (4)	X ⁶⁾

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

²⁾ Observe the general instructions on page 32 for the maximum tightening torques.

³⁾ Mounting bolt according to ASME B1.1.

⁴⁾ Threaded end according to DIN 13.

⁵⁾ Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

⁶⁾ Depending on the installation position, L or L₁ must be connected (see also page 28).

⁷⁾ The counterbore can be deeper than stipulated in the standard.

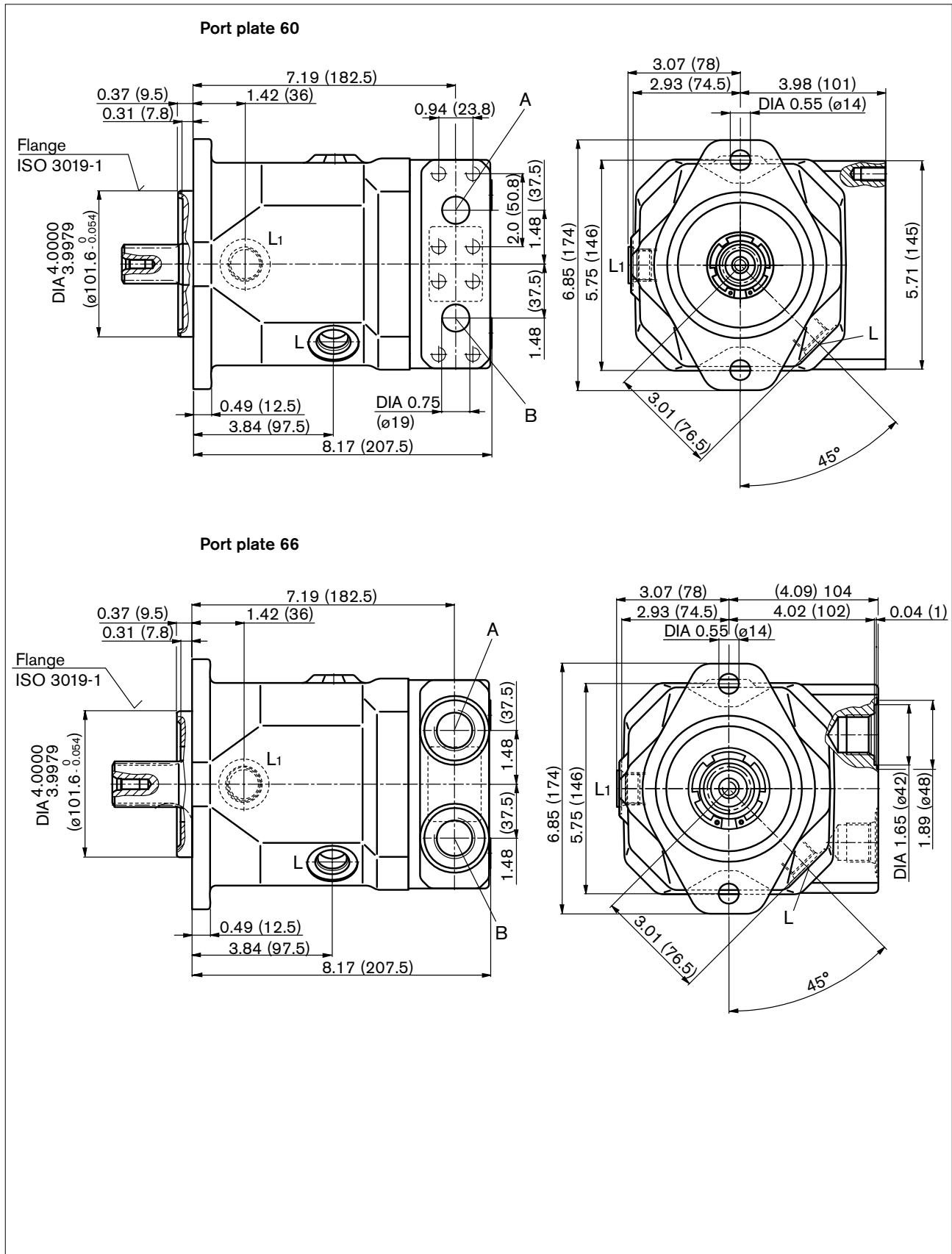
O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Dimensions A10FM size 58 - 63

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

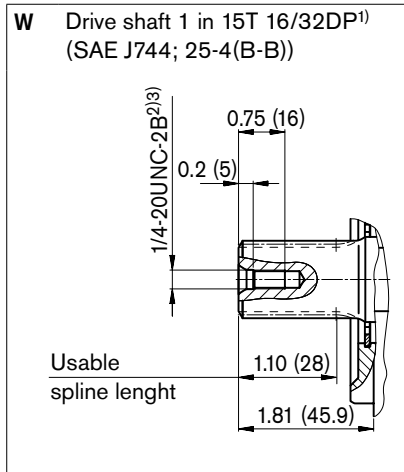
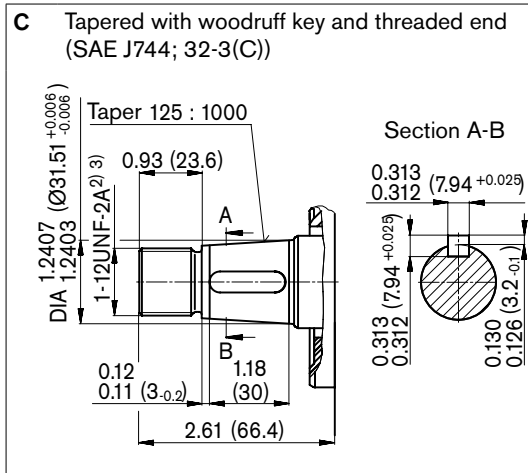
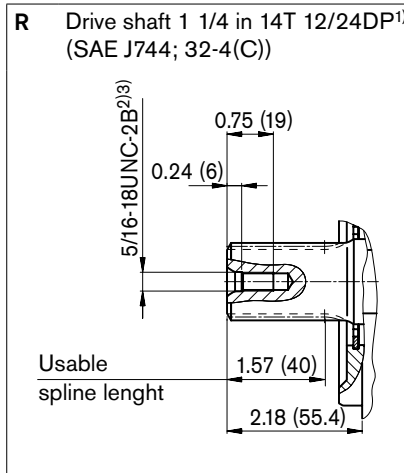
A10FM 58-63/52W-VxCxxN000



Dimensions A10FM size 58 - 63

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Max. press. [psi (bar)] ⁴⁾	State
A, B	Service line (high pressure series)	SAE J518	3/4 in	5100 (350)	O
Port plate 60	Mounting bolts	ISO 68	3/8-16 UNC-2B; 0.83 (21) deep		
A, B	Service line	ISO 11926	1 1/16-12UN-2B; 0.79 (20) deep	5100 (350)	O
L	Case drain	ISO 11926 ⁶⁾	7/8-14 UNF-2B; 0.51 (13) deep	60 (4)	O ⁵⁾
L ₁	Case drain	ISO 11926 ⁶⁾	7/8-14 UNF-2B; 0.51 (13) deep	60 (4)	X ⁵⁾

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

²⁾ Observe the general instructions on page 32 for the maximum tightening torques.

³⁾ Threaded end and mounting bolt according to ASME B1.1.

⁴⁾ Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

⁵⁾ Depending on the installation position, L or L₁ must be connected (see also page 28).

⁶⁾ The counterbore can be deeper than stipulated in the standard.

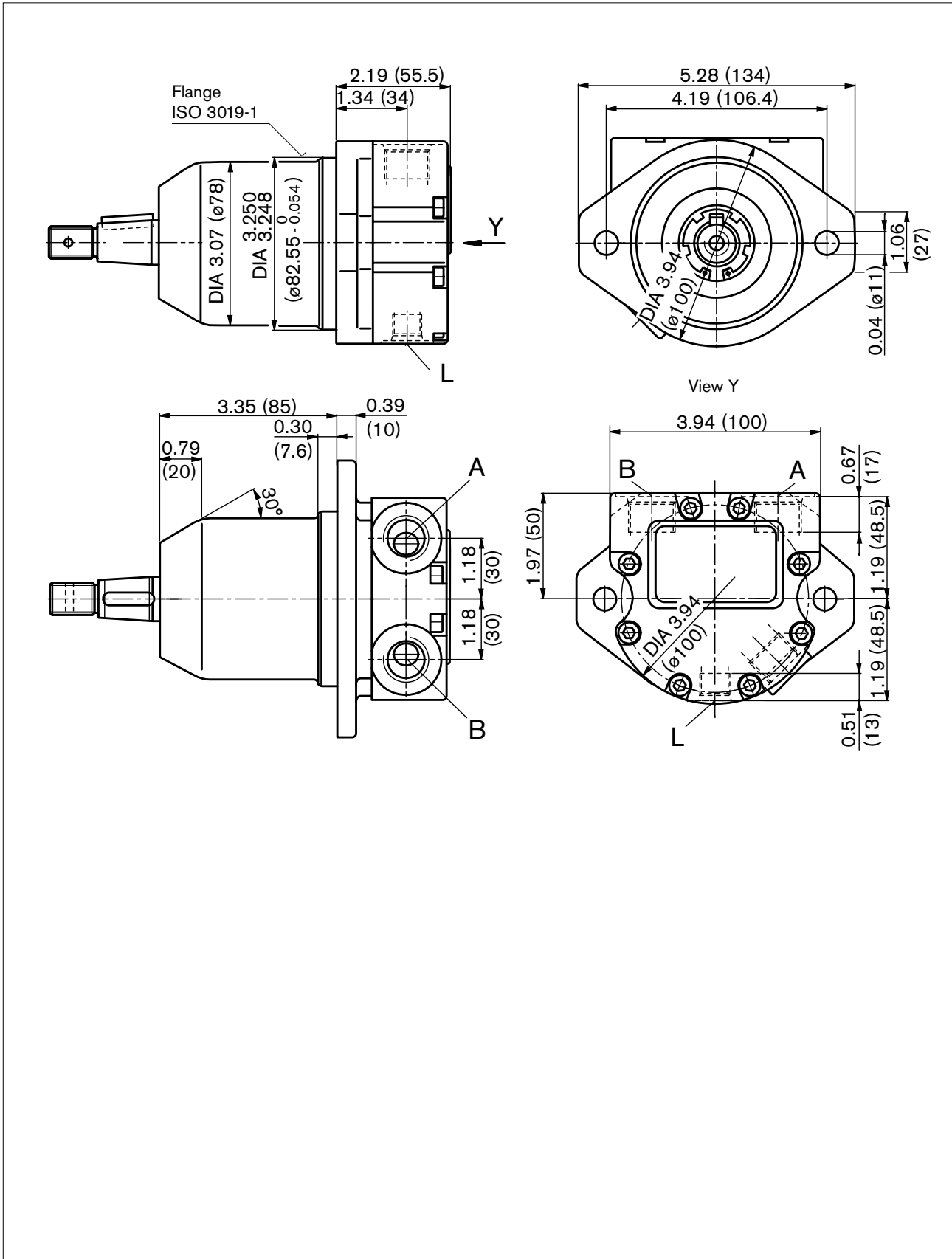
O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Dimensions A10FE size 10

A10FE 10/52W-VxC66N000

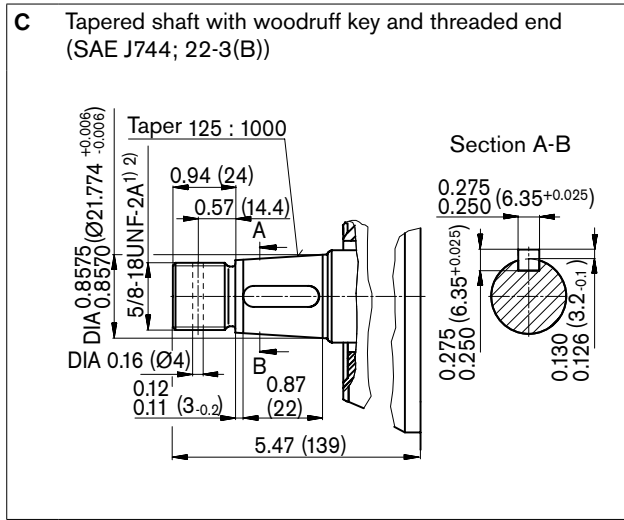
Before finalising your design request a certified installation drawing.
Dimensions in in (mm).



Dimensions A10FE size 10

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

Drive shaft



Ports

Designation	Port for	Standard	Size ³⁾	Max. pressure [psi (bar)] ⁴⁾	State
A, B	Service line	ISO 11926	7/8 UNF-2B; 0.67 (17) deep	5100 (350)	O
L	Case drain	ISO 11926	9/16-18 UNF-2B; 0.51 (13) deep	60 (4)	O ⁵⁾

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

2) Threaded end according to ASME B1.1.

3) Observe the general instructions on page 32 for the maximum tightening torques.

4) Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

5) Depending on the installation position, L or L₁ must be connected (see also page 28).

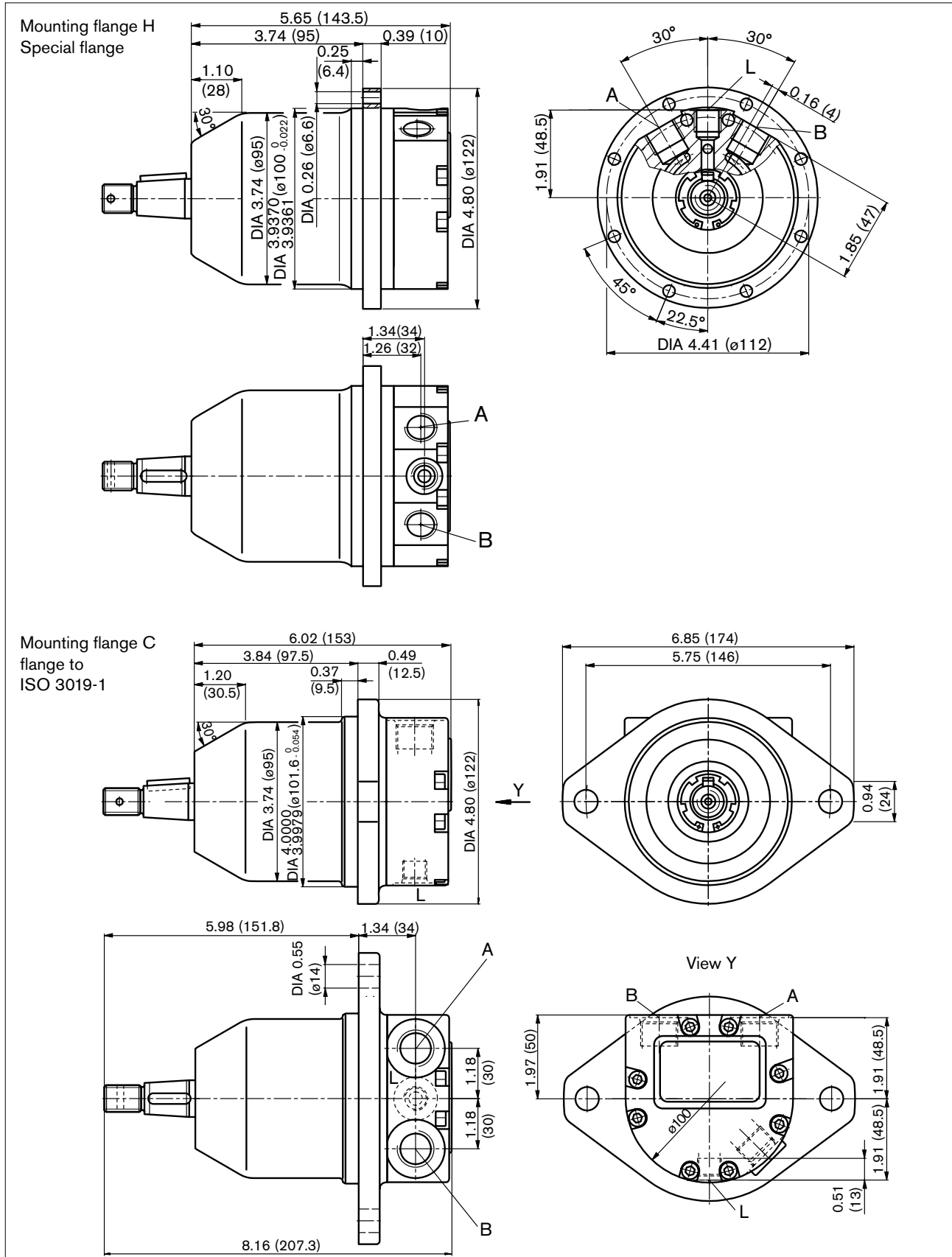
O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Dimensions A10FE size 11 - 18

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

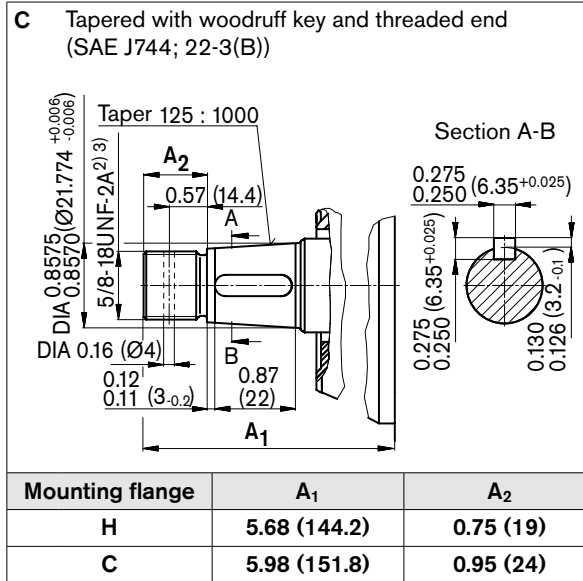
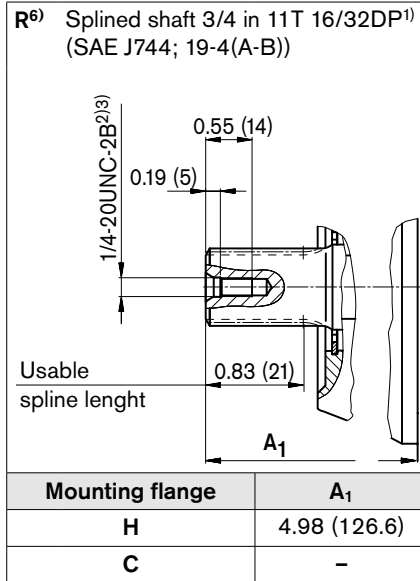
A10FE 11-18/52W-Vxx66N000



Dimensions A10FE size 11 - 18

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Max. pressure [psi (bar)] ⁴⁾	State
A, B Mounting flange C	Service line	ISO 11926	7/8-14 UNC-2B; 0.67 (17) deep	5100 (350)	O
A, B Mounting flange H	Service line	ISO 11926	3/4-16 UNF-2B; 0.59 (15) deep	5100 (350)	O
L	Case drain	ISO 11926	9/16-18 UNF-2B; 0.51 (12) deep	60 (4)	O ⁵⁾
L ₁	Case drain	ISO 11926	9/16-18 UNF-2B; 0.51 (13) deep	60 (4)	X ⁵⁾

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

²⁾ Observe the general instructions on page 32 for the maximum tightening torques.

³⁾ Threaded end and mounting bolt according to ASME B1.1.

⁴⁾ Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

⁵⁾ Depending on the installation position, L or L₁ must be connected (see also page 28).

⁶⁾ Combination R-shaft with C-flange for size 11 to 18 in preparation.

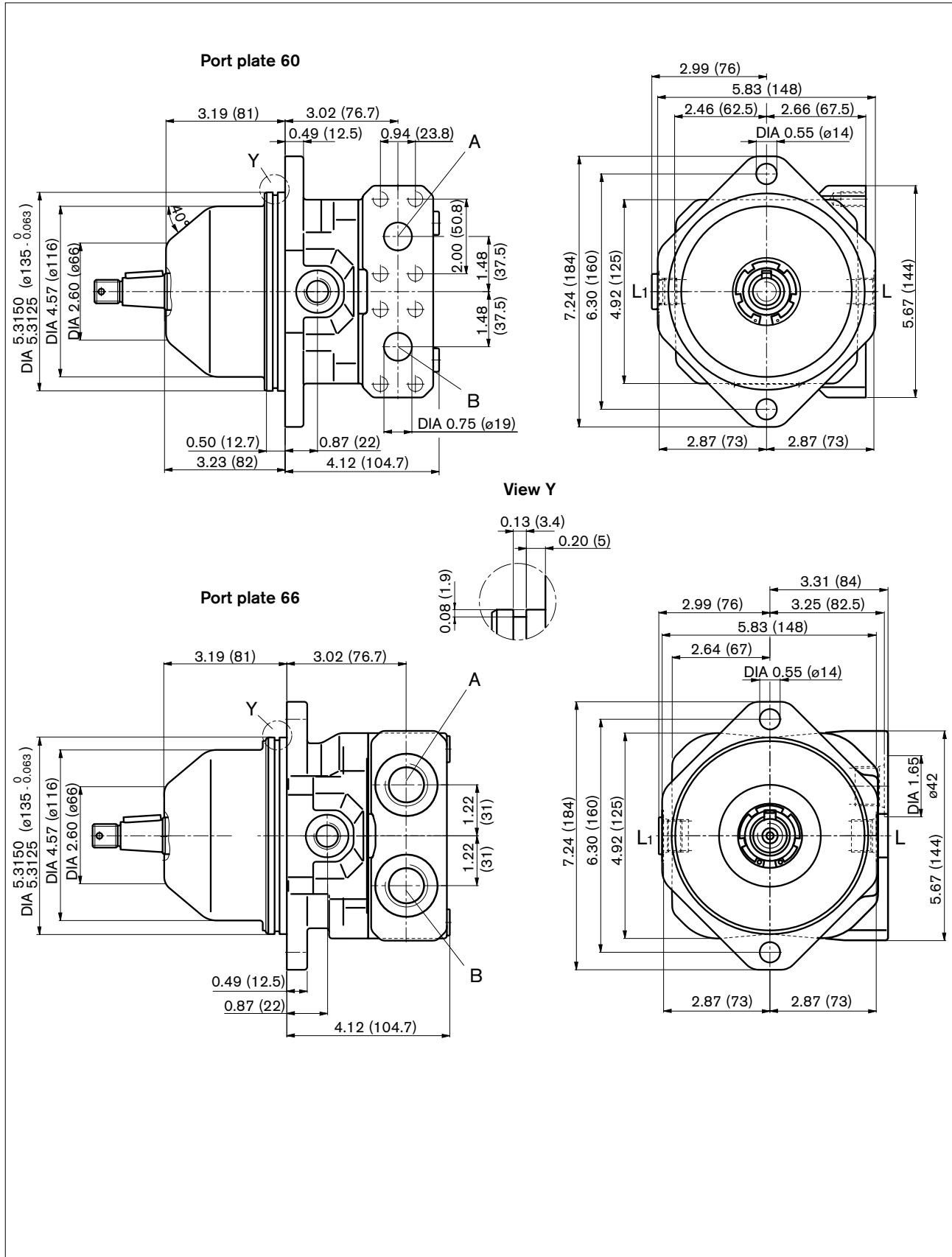
O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Dimensions A10FE size 23 - 28

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

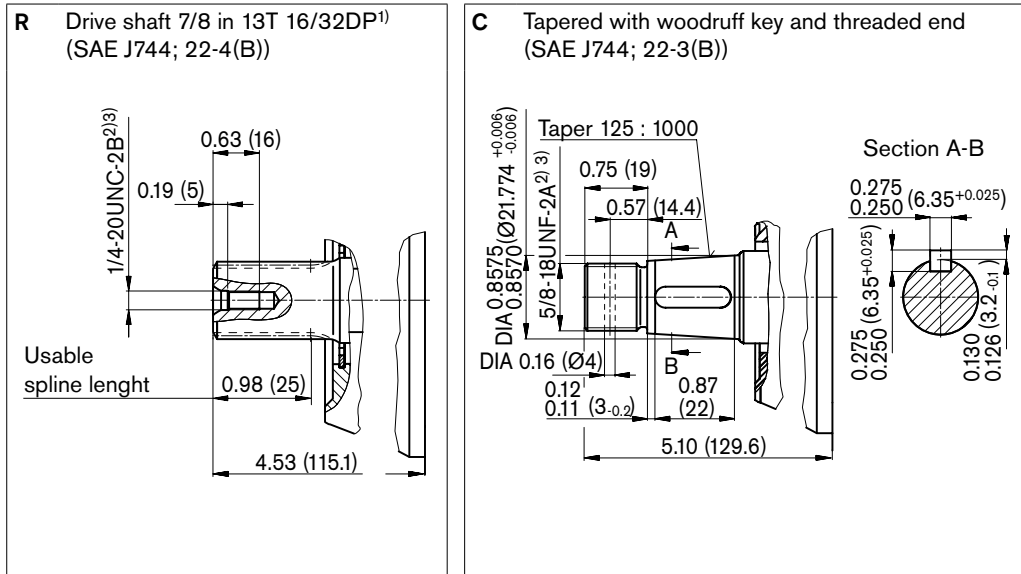
A10FE 23-28/52W-VxFxxN000



Dimensions A10FE size 23 - 28

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Max. pressure [psi (bar)] ⁴⁾	State
A, B	Service line (high pressure series)	SAE J518	3/4 in	5100 (350)	O
Port plate 60	Mounting bolts	ISO 68	3/8-16 UNC-2B; 0.83 (17) deep		
A, B	Service line	ISO 11926	1 1/16-12 UN-2B; 0.79 (16) deep	5100 (350)	O
Port plate 66					
L	Case drain	ISO 11926 ⁶⁾	3/4-16 UNF-2B; 11 deep	58 (4)	O ⁵⁾
L ₁	Case drain	ISO 11926 ⁶⁾	3/4-16 UNF-2B; 11 deep	58 (4)	X ⁵⁾

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

²⁾ Observe the general instructions on page 32 for the maximum tightening torques.

³⁾ Threaded end and mounting bolt according to ASME B1.1.

⁴⁾ Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

⁵⁾ Depending on the installation position, L or L₁ must be connected (see also page 28).

⁶⁾ The counterbore can be deeper than stipulated in the standard.

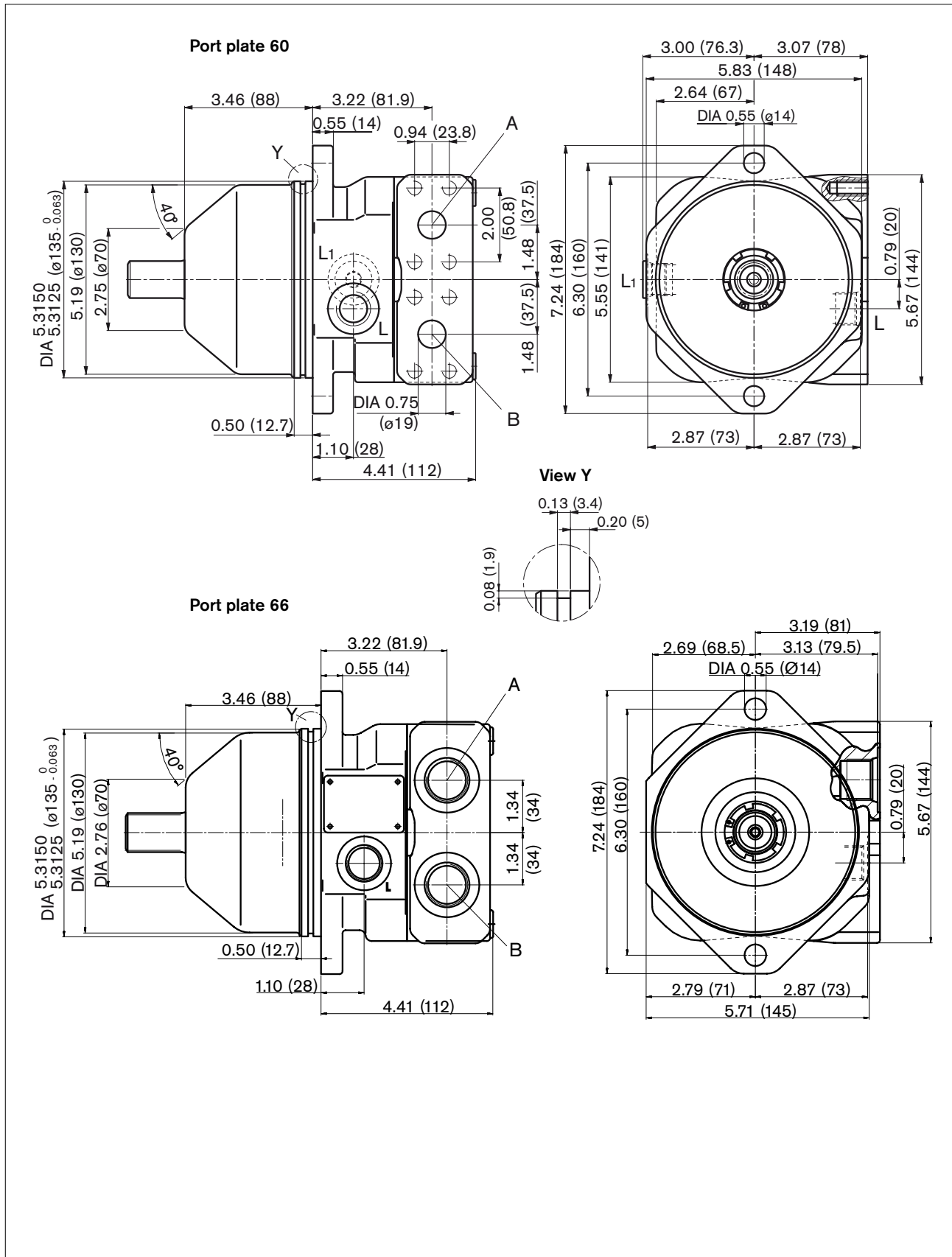
O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Dimensions A10FE size 37 - 45

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

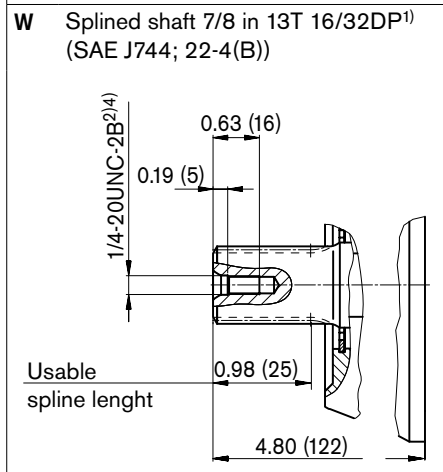
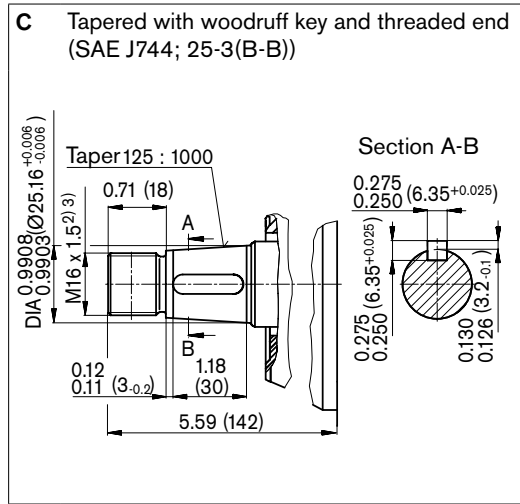
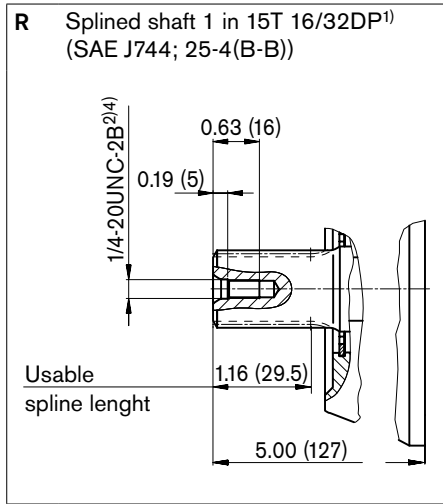
A10FE 37-45/52W-VxFxxN000



Dimensions A10FE size 37 - 45

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Max. pressure [psi (bar)] ⁵⁾	State
A, B	Service line (high pressure range)	SAE J518	3/4 in	5100 (350)	O
Port plate 60	Mounting bolts	ISO 68	3/8-16 UNC-2B; 0.83 (21) deep		
A, B	Service line	ISO 11926	1 1/16-12 UN-2B; 0.79 (16) deep	5100 (350)	O
Port plate 66					
L	Case drain	ISO 11926 ⁷⁾	7/8-14 UNF-2B; 13 deep	58 (4)	O ⁶⁾
L ₁	Case drain	ISO 11926 ⁷⁾	7/8-14 UNF-2B; 13 deep	58 (4)	X ⁶⁾

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

²⁾ Observe the general instructions on page 32 for the maximum tightening torques.

³⁾ Threaded end according to DIN 13.

⁴⁾ Mounting bolt according to ASME B1.1.

⁵⁾ Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

⁶⁾ Depending on the installation position, L or L₁ must be connected (see also page 28).

⁷⁾ The counterbore can be deeper than stipulated in the standard.

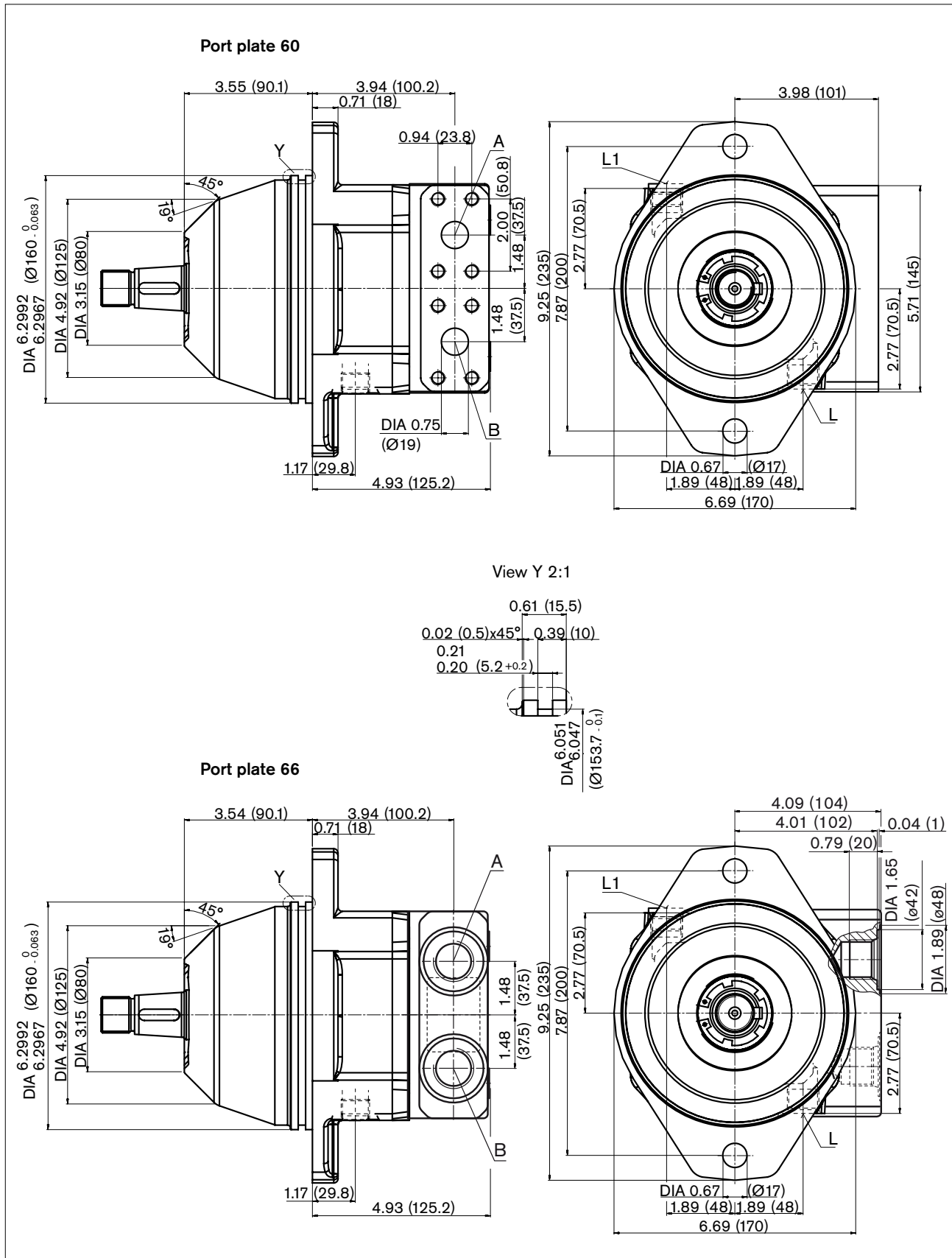
O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Dimensions A10FE size 58 - 63

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

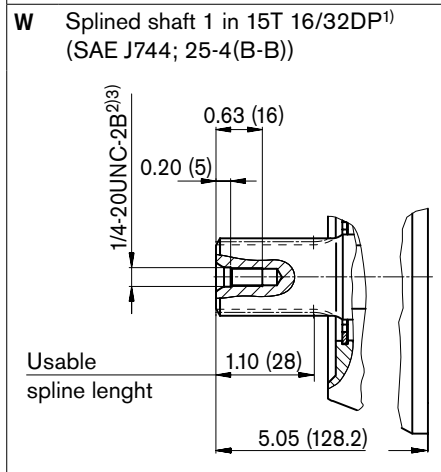
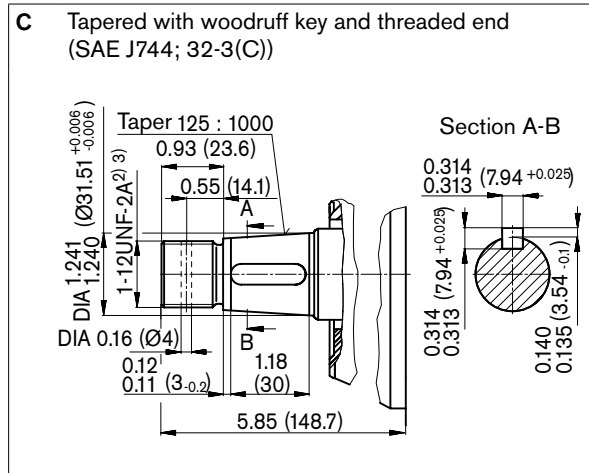
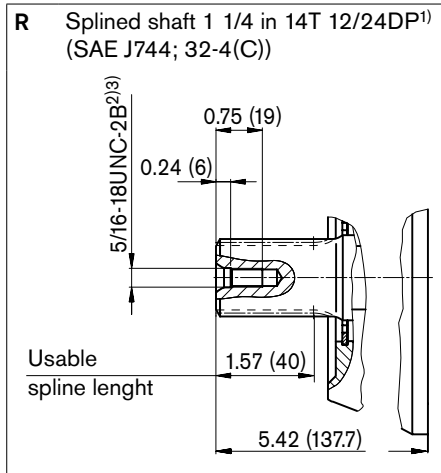
A10FE 58-63/52W-VxFxxN000



Dimensions A10FE size 58 - 63

Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

Drive shafts



Ports

Designation	Port for	Standard	Size ²⁾	Max. pressure [psi (bar)] ⁴⁾	State
A, B	Service line (high pressure range)	SAE J518	3/4 in	5100 (350)	O
Port plate 60	Mounting bolts	ISO 68	3/8-16 UNC-2B; 0.83 (21) deep		
A, B	Service line	ISO 11926	1 1/16-12 UN-2B; 0.79 (16) deep	5100 (350)	O
L	Case drain	ISO 11926 ⁶⁾	7/8-14 UNF-2B; 13 deep	58 (4)	O ⁵⁾
L ₁	Case drain	ISO 11926 ⁶⁾	7/8-14 UNF-2B; 13 deep	58 (4)	X ⁵⁾

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

²⁾ Observe the general instructions on page 32 for the maximum tightening torques.

³⁾ Threaded end and mounting bolt according to ASME B1.1.

⁴⁾ Momentary pressure spikes may occur depending on the application. Keep this in mind when selecting measuring devices and fittings.

⁵⁾ Depending on the installation position, L or L₁ must be connected (see also page 28).

⁶⁾ The counterbore can be deeper than stipulated in the standard.

O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

Flushing and boost pressure valve

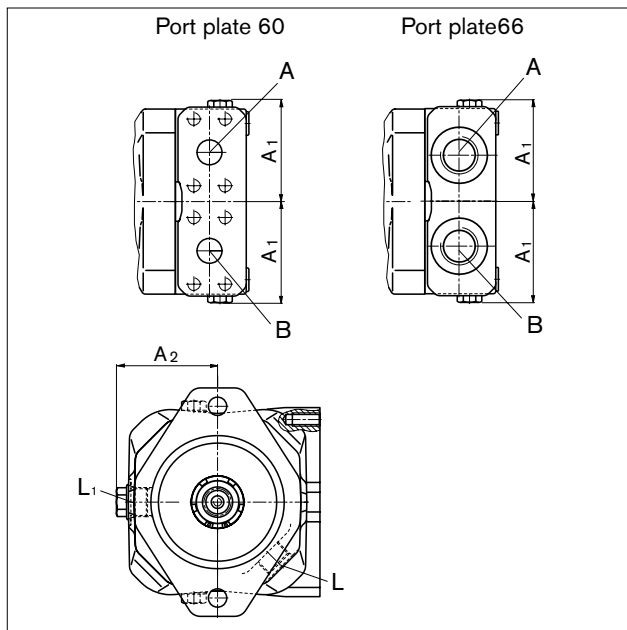
Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

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 (230 psi (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.

Dimensions A10FM / A10FE



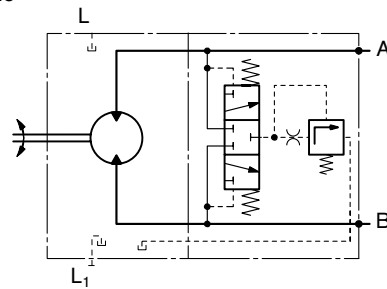
Standard flushing flow

With low press. side $p_{ND} = 290$ psi (20 bar) and an orifice dia. 0.06 in (1.6 mm): 1.45 gpm (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 [gpm (L/min)]	Orifice ϕ [in (mm)]
0.92 (3.5)	0.05 (1.2)
1.45 (5.5)	0.06 (1.6)
2.48 (9)	0.08 (2)

Schematic



Port for	
A; B	Service line
L, L ₁	Case drain (L ₁ plugged)

Size (NG)	A ₁	A ₂
23/28	2.83 (72)	283 (72)
37/45	3.03 (77)	3.03 (77)
58/63	3.03 (77)	3.23 (82)

Anti cavitation valve

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.

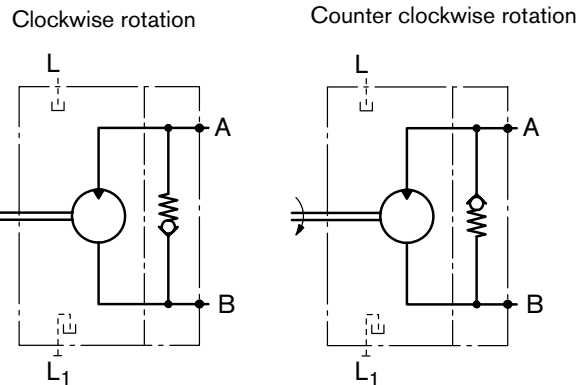
The valve assembly is integrated inside the port plate.

Important

It is necessary to specify a direction of rotation (clockwise or counter clockwise) 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, before finalising your design request a certified installation drawing.

Schematic



Port for	
A; B	Service line
L, L ₁	Case drain (L ₁ plugged)

Speed sensor

Ordering option D

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

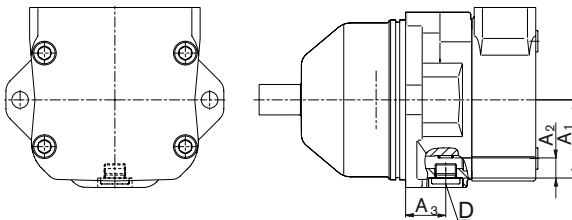
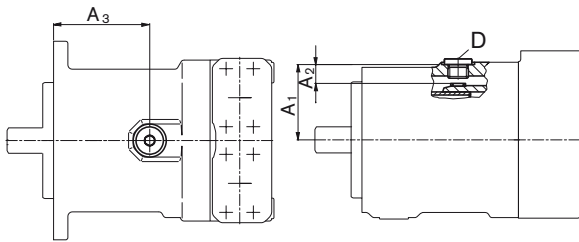
In this case, the rotating cylinder barrel can provide a speed dependent signal, which can be picked up by a suitable sensor and processed for further evaluation. Sensor port (D) will be closed for delivery.

A motor, prepared for speed sensing will be delivered without the necessary accessory parts which 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:

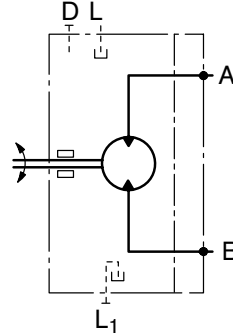
Size (NG)	Ordering Nr.	Nr. of teeth
23/28	R902428802	48
37/45	R902433368	48
58/63	in preparation	9

Dimensions



Before finalising your design request a certified installation drawing.
Dimensions in in (mm).

Schematic



	Port for
A; B	Service line
L, L ₁	Case drain (L ₁ plugged)

A10FM...D

Size (NG)	A1	A2	A3	Port „D“ (plugged)
23/28	2.40 (61)	0.61 (15.5)	4.00 (101.8)	M18 x 1.5
37/45	2.60 (66)	0.67 (17)	3.31 (84.2)	M18 x 1.5
58/63	2.73 (69)	0.58 (14.8)	5.60 (128.5)	M18 x 1.5

A10FE...D

Size (NG)	A1	A2	A3	Port „D“ (plugged)
23/28	2.40 (61)	0.61 (15.5)	1.09 (27.7)	M18 x 1.5
37/45	2.60 (66)	0.67 (17)	1.33 (33.9)	M18 x 1.5
58/63	2.73 (69)	0.58 (14.8)	1.81 (46.1)	M18 x 1.5

Installation instructions

General

At all times, the axial piston unit must be filled with fluid and air bled during commissioning and operation. This must also be observed after a prolonged period of standstill as the system may drain back to the reservoir via the hydraulic lines.

The case drain fluid in the motor housing must be directed to tank via the highest available tank port and must drain the fluid below the minimum fluid level in the reservoir.

Installation position

See following examples 1 to 8.

Recommended installation positions: 1 and 3 resp. 2 and 4.

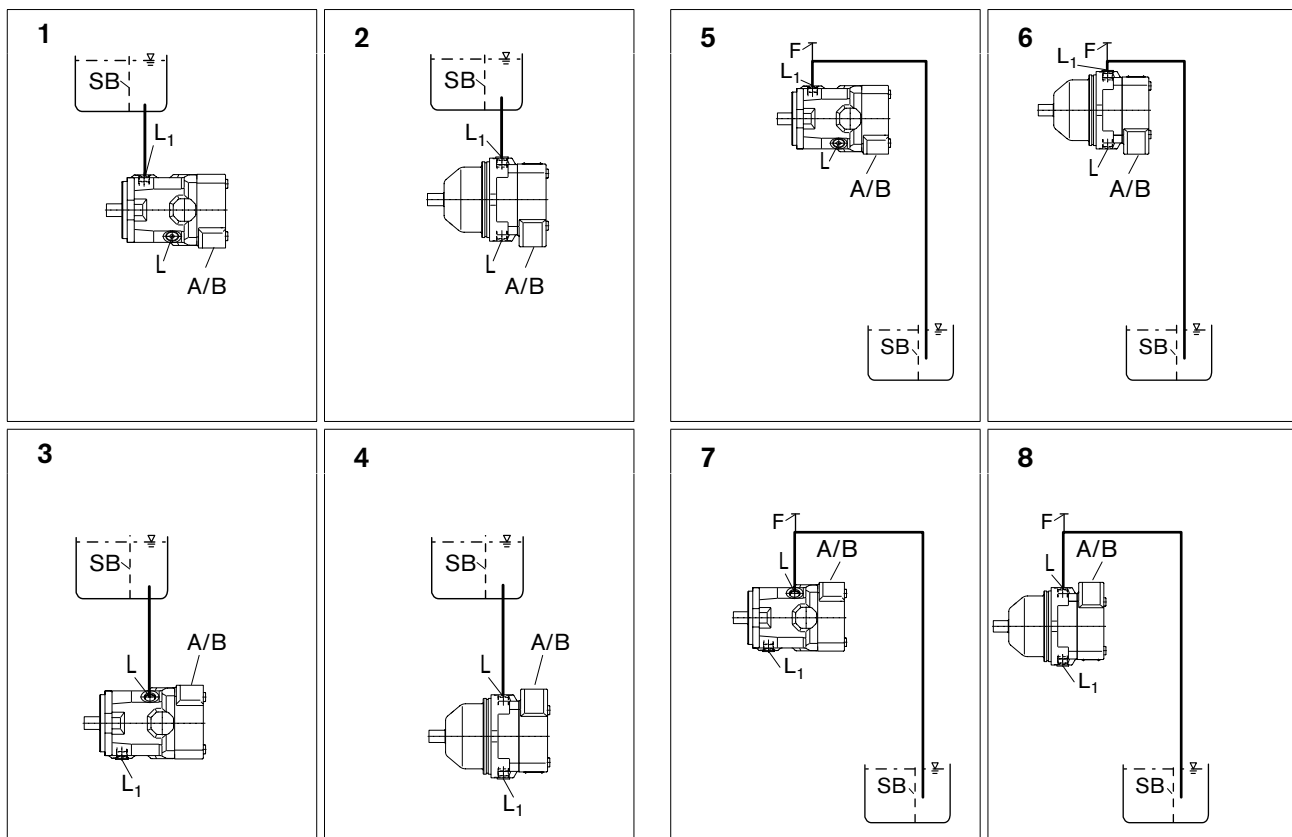
Additional installation positions are available on request.

Below reservoir installation (standard)

Below reservoir installation means, that the motor is mounted below the minimum fluid level.

Above reservoir installation

Above reservoir installation means, that the motor is mounted above the minimum fluid level. A check valve in the case drain line is only permissible under certain conditions; please consult us.



Install. position	Air bleed	Filling
1, 2	-	L ₁
3, 4	-	L

Install. position	Air bleed	Filling
5, 6	F	L ₁ (F)
7, 8	F	L (F)

L/L₁ = Case drain port, F = Air bleed resp. filling port, SB = Baffle.

Notes

Notes

Notes

General instructions

- The motor A10FM and A10FE has been designed to be used in open and closed circuits.
- Project planning, assembly and commissioning of the axial piston unit require the involvement of qualified personnel.
- Before operating the axial piston unit read the relevant operating manual thoroughly and completely.
- During and shortly after operation, there is a risk of burns on the axial piston unit and especially on the solenoids. Take appropriate safety measures (e.g. by wearing protective clothing).
 - Pressure ports:

The ports and fastening threads are designed for the specified maximum pressure. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified operating conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- The service line ports and function ports are only designed to accommodate hydraulic lines.
- The data and notes contained herein must be adhered to.
- The product is not approved as a component for the safety concept of a general machine according to DIN 13849.
- The following tightening torques apply:
 - Fittings:

Observe the manufacturer's instructions regarding the tightening torques of the fittings used.
 - Mounting bolts:

For mounting bolts with metric thread according to DIN 13 or threads according ASME B1.1 we recommend checking the tightening torque individually according to VDI 2230.
 - Mounting bolts threads and threaded ports in the axial piston unit:

The maximum permissible tightening torques $M_{G \max}$ are maximum values for the female threads and must not be exceeded. For values, see the following table.
 - Threaded plugs:

For the threaded plugs, supplied with the axial piston unit, the required tightening torques M_V apply. For values, see the following table.

Ports		Maximum permissible tightening torque for the female threads $M_{G \max}$	Required tightening torque for the threaded plugs M_V	WAF hexagon socket of the threaded plugs
Standard	Thread sizes			
ISO 11926	3/4-16 UNF-2B	117 lb-ft (160 Nm)	45 lb-ft (62 Nm)	5/16 in
	7/8-14 UNF-2B	176 lb-ft (240 Nm)	92 lb-ft (127 Nm)	3/8 in
	9/16-18 UNF-2B	58 lb-ft (80 Nm)	17 lb-ft (25 Nm)	1/4 in
	1 1/16-12 UN-2B	265 lb-ft (360 Nm)	107 lb-ft (147 Nm)	9/16 in