

Axial piston fixed motor A2FM/A2FE series 70



- ▶ A2FMH, A2FEH (sizes 25 to 107):
 Nominal pressure 300 bar
 Maximum pressure 350 bar
- ▶ A2FMM, A2FEM (sizes 23 to 180):
 Nominal pressure 400 bar
 Maximum pressure 450 bar
- ▶ A2FMH, A2FEH (sizes 45 to 125):
 Nominal pressure 450 bar
 Maximum pressure 500 bar

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 applications
- ▶ Far-reaching integration of the plug-in version in mechanical parts due to recessed mounting flange located in the center of the case (extremely space-saving construction)
- ▶ Easy to install, simply plug the plug-in version into the mechanical gearbox
- ▶ The output speed depends on the flow of the pump and the displacement of the motor.
- ▶ The output torque increases with the pressure differential between the high-pressure side and the low-pressure side.
- ▶ Finely graduated sizes permit far-reaching adaptation to the drive concerned.
- ▶ High power density
- ▶ Small dimensions
- ▶ High total efficiency
- ▶ Good starting efficiency
- ▶ Optional with integrated flushing valve

Contents

Type code	2
Hydraulic fluids	5
Working pressure range	6
Technical data	8
Dimensions A2FM, sizes 23 to 45	12
Dimensions A2FE, sizes 23 to 45	16
Drive shafts, sizes 23 to 45	20
Dimensions A2FM, sizes 45 to 80	21
Dimensions A2FE, sizes 45 to 80	26
Drive shafts, sizes 45 to 80	30
Dimensions A2FM, sizes 80 to 107	31
Dimensions A2FE, sizes 80 to 107	34
Drive shafts, sizes 80 to 107	37
Dimensions A2FM, sizes 107 and 125	38
Dimensions A2FE, sizes 107 and 125	41
Drive shafts, sizes 107 and 125	44
Dimensions A2FM, sizes 180 and 180	45
Dimensions A2FE, sizes 180 and 180	48
Drive shafts, sizes 180 and 180	51
Flushing and boost-pressure valve, integrated	52
Pressure relief valve	53
Counterbalance valve BVD/BVE	56
Port plate with integrated check valve (U)	60
Flow direction	60
Speed sensor	61
Installation instructions	63
Project planning notes	64
Safety instructions	64

Type code

01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
A2F				/	70	N	W	V					-	

Axial piston unit

01	Swirl van design, fixed displacement	A2F
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Operating mode

02	Motor, standard version	M
	Motor, plug-in version	E

Pressure range

		022	028	032	037	045	054	063	080	090	107	125	160	190
03	Nominal pressure: 320 bar; maximum pressure: 370 bar	-	•	•	•	•	•	•	•	•	•	-	-	N
	Nominal pressure: 420 bar; maximum pressure: 470 bar	•	•	•	-	•	•	•	•	•	•	•	•	M
	Nominal pressure: 450 bar; maximum pressure: 500 bar	-	-	-	-	•	•	•	•	•	•	•	-	H

Size (N0)

04	Geometrical displacement, see technical data on page 6	022	028	032	037	045	054	063	080	090	107	125	160	190
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Series

05	Series, P, index 0	70
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Version of port and fastening thread

06	Metric ports according to DIN 2352 with profile sealing ring, metric fastening thread according to DIN 13	N
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Direction of rotation

07	Viewed on drive shaft, clockwise	W
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Sealing material

08	NBR (Nitrilebutadiene rubber)	V
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Mounting flange

				022	028	032	037	045	054	063	080	090	107	125	160	190
09	ISO 3019-2 code:	A2FM	100-4	•	•	•	•	• ¹⁾	-	-	-	-	-	-	-	L4
			175-4	-	-	-	-	• ¹⁾	•	•	• ¹⁾	-	-	-	-	M4
			140-4	-	-	-	-	-	-	-	• ¹⁾	•	• ¹⁾	-	-	N4
			130-4	-	-	-	-	-	-	-	-	• ¹⁾	•	-	-	P4
			180-4	-	-	-	-	-	-	-	-	-	-	•	•	R4
		A2FE	130-2	•	•	•	•	• ¹⁾	-	-	-	-	-	-	-	I2
			160-3	-	-	-	-	• ¹⁾	•	•	• ¹⁾	-	-	-	-	P2
			180-2	-	-	-	-	-	-	-	• ¹⁾	•	• ¹⁾	-	-	Y2
			200-3	-	-	-	-	-	-	-	-	• ¹⁾	•	•	•	S2

Drive shaft

				022	028	032	037	045	054	063	080	090	107	125	160	190
10	Splined shaft DN 5400	W25x1.25x1000		•	•	•	-	-	-	-	-	-	-	-	-	Z5
		W30x1.5x1000		•	•	•	•	•	• ¹⁾	-	-	-	-	-	-	Z6
		W35x1.5x1000		-	-	-	-	-	• ¹⁾	•	• ¹⁾	-	-	-	-	Z8
		W40x1.5x1000		-	-	-	-	-	-	• ¹⁾	•	•	-	-	-	Z9
		W45x2x1x1000		-	-	-	-	-	-	-	-	• ¹⁾	•	•	-	A1
		W50x2x1x1000		-	-	-	-	-	-	-	-	-	-	•	•	A2
	Parallel keyed shaft DN 5400	ø75		•	•	•	-	-	-	-	-	-	-	-	-	P5
		ø80		•	•	•	•	•	• ¹⁾	-	-	-	-	-	-	P6
		ø85		-	-	-	-	-	• ¹⁾	•	• ¹⁾	-	-	-	-	P8
		ø90		-	-	-	-	-	-	• ¹⁾	•	•	-	-	-	P9
		ø95		-	-	-	-	-	-	-	-	• ¹⁾	•	•	-	B1
		ø100		-	-	-	-	-	-	-	-	-	-	•	•	B2

	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15						
A2F				/	T0	N	W	V													
Working part							023	028	033	037	045	056	063	080	090	101	125	160	190		
11	SAE working ports A and B at bottom						•	•	•	•	•	•	•	•	•	•	•	•	•	11	
	SAE working ports A and B, 14 at side and 14 at bottom ¹⁰⁾						—	—	—	—	•	•	•	—	—	—	—	—	—	12	
	SAE working ports A and B at side						• ²⁾	•	•	•	• ¹⁾	•	•	•	•	• ²⁾	•	•	•	01	
	SAE working ports A and B at side, opposite						•	•	•	•	•	•	•	•	•	•	•	•	•	02	
	Threaded ports A and B at side and at side						•	•	•	•	•	•	•	• ³⁾	—	—	—	—	—	03	
	Threaded ports A and B at side, opposite						•	•	•	•	• ¹⁾	—	—	—	—	—	—	—	—	05	
	Version with pressure relief valve for mounting a counterbalance valve (W01UD) ¹⁴⁾						—	—	—	—	•	•	•	•	•	•	•	•	—	07	
	Version with pressure relief valve for mounting a counterbalance valve (W01UW12) ¹⁴⁾						—	—	—	—	—	—	—	—	—	•	•	—	—	08	
	Version with pressure relief valve ¹⁵⁾						—	—	—	—	•	•	•	•	•	•	•	•	—	09	
Valves							023	028	033	037	045	056	063	080	090	101	125	160	190		
12	Without valve						•	•	•	•	•	•	•	•	•	•	•	•	•	•	0
	With check valve, only for counter-clockwise or clockwise direction of rotation ¹⁾						• ²⁾	• ¹⁾	• ²⁾	• ²⁾	• ¹⁾	• ²⁾	• ²⁾	• ¹⁾	• ²⁾	• ²⁾	•	—	—	—	U
	Integrated flushing and back pressure valve Flushing flow (l/min)						2.5	•	•	•	•	•	•	•	•	•	•	•	•	•	C
	back pressure valve						4.0	•	•	•	•	•	•	•	•	•	•	•	•	•	D
	Flushing flow when $\Delta p = p_{in} - p_{out} = 20 \text{ bar}$ and $T = 50 \text{ mm}^2/s$						6.0	•	•	•	•	•	•	•	•	•	•	•	•	•	E
							7.4	•	•	•	•	•	•	•	•	•	•	•	•	•	F
							9.5	•	•	•	•	•	•	•	•	•	•	•	•	•	G
							10.0	•	•	•	•	•	•	•	•	•	•	•	•	•	H
							11.4	•	•	•	•	•	•	•	•	•	•	•	•	•	I
							12.5	•	•	•	•	•	•	•	•	•	•	•	•	•	J
							15	—	—	—	—	—	—	—	—	• ²⁾	•	•	•	•	K
							18	—	—	—	—	—	—	—	—	• ²⁾	•	•	•	•	L
							21	—	—	—	—	—	—	—	—	• ²⁾	•	•	•	•	M
							27	—	—	—	—	—	—	—	—	• ²⁾	•	•	•	•	N
							31	—	—	—	—	—	—	—	—	• ²⁾	•	•	•	•	O
							37	—	—	—	—	—	—	—	—	• ²⁾	•	•	•	•	P
	Pressure relief valve (without pressure sequencing stage) ¹⁶⁾						—	—	—	—	•	•	•	•	•	•	•	•	—	—	R
	Pressure relief valve (with pressure sequencing stage) ¹⁶⁾						—	—	—	—	•	•	•	•	•	•	•	•	—	—	S
	Counterbalance valve (W01UW12) mounted ¹⁴⁾						—	—	—	—	•	•	•	•	•	•	•	•	—	—	W

a) Only available for A2FMH, A2FEH (pressure range 300 to 350 bar)

q) Not available for A2FMH, A2FEH (pressure range 400 to 500 bar)

s) Not available for A2FMH, A2FEH (pressure range 300 to 350 bar)

a) Only in combination with working parts 11

u) Only in combination with working parts 11 or 12

v) Only in combination with check valve (valve design U)

x) Only in combination with integrated counterbalance valve
(valve design W)

y) Only in combination with pressure relief valve (valve design R or S)

z) Only in combination with working parts 09

aa) Only in combination with working parts 07 or 08

14) Type code for counterbalance valve to be quoted separately in
accordance with data sheet 95373 (W01U) and 95376 (W01V)

4 **A2FM/A2FE series 70** | Axial piston fixed motor
Type code

		01	02	03	04	05	06	07	08	09	10	11	12	13	14			70			
		A2F				/	70	N	W	V							-				
Speed sensor								033	038	039	037	045	050	063	080	090	107	125	160	180	
13	Without speed sensor		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0	
	Prepared for DSA sensor		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	A	
	DSA speed sensor mounted		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	B	
Special version								033	038	039	037	045	050	063	080	090	107	125	160	180	
14	Standard version		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	0
	Long life bearing ⁽¹⁾⁽²⁾		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	L
	Special version for slow drives ⁽³⁾		*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	J
Standard/special version																					
15	Standard version																				0
	Standard version with installation variants, e.g. 3 ports contrary to standard, open or closed																				Y
	Special version																				S

* = Available a = On request - = Not available

Notice

- Note the product planning notes on page 64.
- Please note that not all type code combinations are available although the individual functions are marked as being available.

(1) Type code version "L" not available in combination with A2FMN/A2FM (H axial) in the case of pressures range "70" (the long life bearing is already included in the standard version (type code designation "03").

(2) Not for PNs 73 to 37 and 45 (N)

(3) Not available for A2FMN, A2FBN (pressure range 200 to 210 bar)

Hydraulic fluids

The fixed motor A2FM/A2FE is designed for operation with HLP mineral oil according to DIN 51524.

Application instructions and requirements for hydraulic fluid selection, behavior during operation as well as disposal and environmental protection should be taken from the following data sheets before the start of project planning:

- 90226: Hydraulic fluids based on mineral oils and related hydrocarbons
- 90221: Environmentally acceptable hydraulic fluids

Selection of hydraulic fluid

Bosch Rexroth evaluates hydraulic fluids on the basis of the Fluid Rating according to the technical data sheet 90235.

Hydraulic fluids with positive evaluation in the Fluid Rating are provided in the following technical data sheet:

- 90245: Bosch Rexroth Fluid Rating List for Rexroth hydraulic components (pumps and motors)

Selection of hydraulic fluid shall make sure that the operating viscosity in the operating temperature range is within the optimum range (η_{opt} ; see selection diagram).

Notice

For operation with HF hydraulic fluids, please contact us.

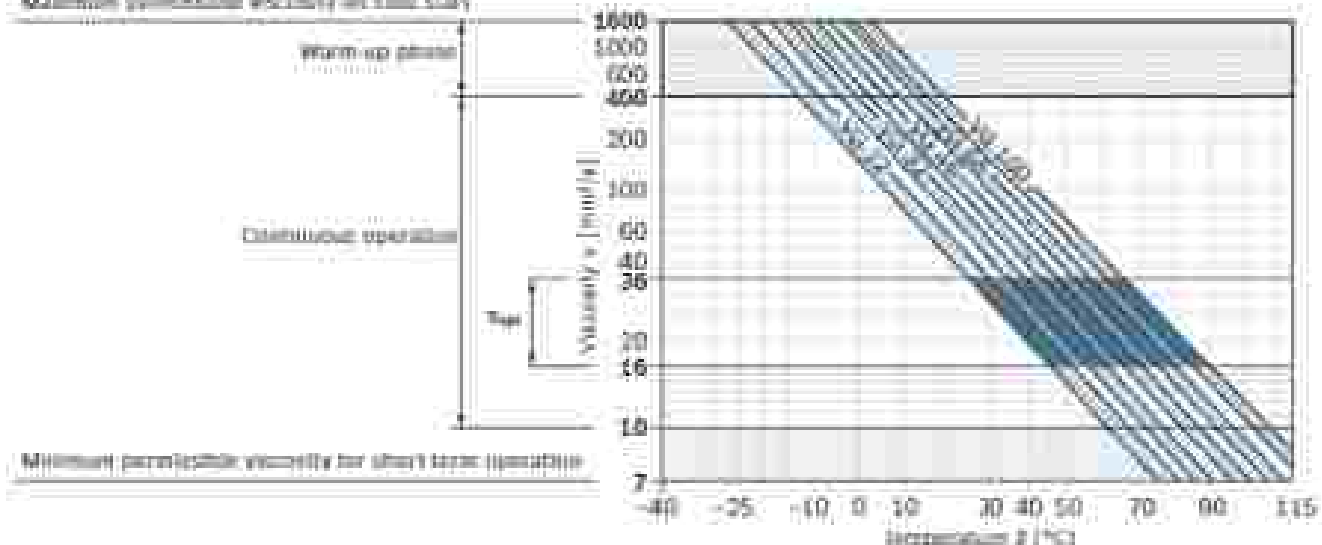
Viscosity and temperature of hydraulic fluids

	Viscosity	Shaft seal	Temperature ^{a)}	Remarks
Cold start	$\eta_{min} = 1400 \text{ mm}^2/\text{s}$	NBR ^{b)}	$T_a \geq -40^\circ\text{C}$	$t = 3 \text{ min}$, without load ($p \leq 50 \text{ bar}$), $n \leq 1000 \text{ rpm}$ Permissible temperature difference between shaft seal and hydraulic fluid in the system: maximum 25 K
		FKM	$T_a \geq -25^\circ\text{C}$	
Warm-up phase	$\eta = 1000 \dots 400 \text{ mm}^2/\text{s}$			$t = 10 \text{ min}$; $p \leq 0.7 \times p_{max}$ and $n \leq 0.5 \times n_{max}$
Continuous operation	$\eta = 400 \dots 30 \text{ mm}^2/\text{s}$	NBR ^{b)}	$T \leq +65^\circ\text{C}$	Measured at port T
		FKM	$T \leq +100^\circ\text{C}$	
	$\eta_{opt} = 30 \dots 10 \text{ mm}^2/\text{s}$			Optimal operating viscosity and efficiency range
Short-term operation	$\eta_{max} = 10 \dots 7 \text{ mm}^2/\text{s}$	NBR ^{b)}	$T \leq +70^\circ\text{C}$	$t = 3 \text{ min}$, $p \leq 0.3 \times p_{max}$, measured at port T
		FKM	$T \leq +100^\circ\text{C}$	

Notice: the maximum circuit temperature of $+115^\circ\text{C}$ must not be exceeded at the working ports A and B complying with the permissible viscosity.

Selection diagram

Maximum permissible viscosity at cold start



^{a)} This corresponds, for example, to the VU 40, for a temperature range of $+4^\circ\text{C}$ to $+65^\circ\text{C}$ (see selection diagram).

^{b)} Special version, please contact us.

^{c)} If the temperature at vehicle operating parameters cannot be achieved, please contact us.

Filtration of the hydraulic fluid

Finer filtration improves the cleanliness level of the hydraulic fluid, which increases the service life of the axial piston unit.

A cleanliness level of at least 20/10/15 is to be maintained according to ISO 4406.

At a hydraulic fluid viscosity of less than 10 mm²/s (e.g. due to high temperatures during short-term operation), a cleanliness level of at least 18/17/14 under ISO 4406 is required.

For example, the viscosity 10 mm²/s at:

- HLP 32 at temperature of 73 °C
- HLP 46 at temperature of 85 °C

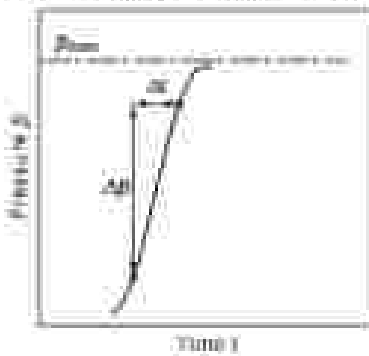
Flow direction

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

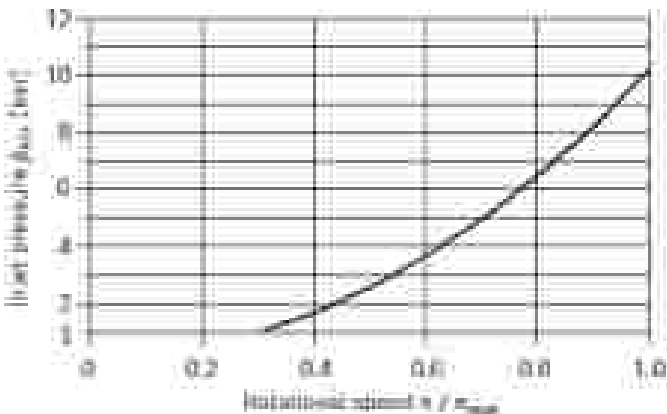
Working pressure range

Pressure at working port A or B			Definition
Nominal pressure p_{nom}	A2FM, A2FE	300 bar	The nominal pressure corresponds to the maximum design pressure.
	A2FM, A2FE	400 bar	
	A2FM, A2FE	450 bar	
Maximum pressure p_{max}	A2FM, A2FE	300 bar	The maximum pressure corresponds to the maximum working pressure within a single operating period. The sum of single operating periods must not exceed the total operating period.
	A2FM, A2FE	400 bar	
	A2FM, A2FE	450 bar	
Maximum single operating period		10 s	
Total operating period		300 h	
Minimum pressure – motor operating mode (start)	See the diagram (next page)		To prevent damage to the axial piston motor during operation at a pump (change of the high pressure side with constant direction of rotation, e.g. during brake applications) a minimum pressure has to be ensured at the working port (H10). The minimum pressure depends on the rotational speed and displacement of the axial piston unit.
Summation pressure p_{Σ}		100 bar	The summation pressure is the sum of the pressures at the ports for the working lines (A and B).
Rate of pressure change $p_{\Delta \text{max}}$			Maximum permissible pressure build up and reduction speed during a pressure change across the entire pressure range.
	with integrated pressure relief valve	1000 bar/s	
	without pressure relief valve	1500 bar/s	
Case pressure at port 1			
Continuous differential pressure $p_{\text{D1 max}}$		2 bar	Maximum allowed differential pressure at the shaft seal (case to ambient pressure).
Permitted peak $p_{\text{D1 max}}$		10 bar	$t < 0.1 \text{ s}$

• Rate of pressure change $R_{\Delta p_{max}}$

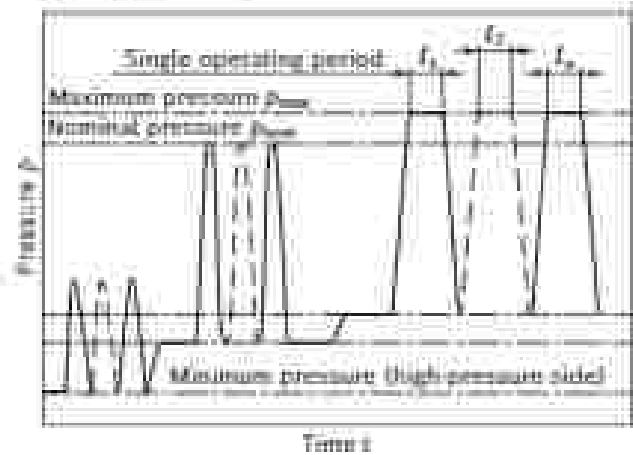


• Minimum pressure - pump operating mode (Gist)



This diagram is only valid for the optimum viscosity range of $\eta_{opt} = 38$ bis 70 mm²/s.
If the above-mentioned conditions cannot be ensured, please contact us.

• Pressure definition



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

Notice

- Working pressure range applies when using hydraulic fluids based on mineral oils. Please contact us for values for other hydraulic fluids.
- In addition to the hydraulic fluid and the temperature, the service life of the shaft seal is influenced by the rotational speed of the axial piston unit and the case pressure.
- The service life of the shaft seal decreases with increasing frequency of pressure peaks and increasing mean differential pressure.
- The case pressure must be greater than the external pressure (ambient pressure) at the shaft seal.

Technical data

A2FMN, A2FEN

Size	RG	28	32	37	45	55	63	80	90	107		
Displacement, geometrical, per revolution	V_g	cm ³	35.1	37.0	36.8	44.3	58.8	83.0	91.7	90.5	108.8	
Maximum rotational speed ^{a)}	n_{max}	rpm	4725	4725	4500	4000	3750	3750	3375	3375	3300	
	$n_{max}^{(2)}$	rpm	5175	5175	4820	4250	4125	4125	3750	3750	3300	
Inlet flow at n_{max}	q_{in}	l/min	133	151	156	188	212	238	225	225	226	
Torque ^{b)} at $p_p = 300$ bar	M	Nm	134	153	176	211	270	301	290	302	319	
Rotary stiffness	c_{rot}	Nm/grad	2.30	2.46	4.29	4.94	6.37	8.11	8.47	9.26	10.96	
Moment of inertia of the rotary group	J_{rg}	kgm ²	0.0010	0.0011	0.0012	0.0012	0.0034	0.0035	0.0037	0.0038	0.0047	
Case volume	V_c	l	0.3	0.3	0.3	0.3	0.3	0.6	0.6	0.65	0.85	
Weight approx.	m	kg	10.7	10.1	10.7	10.7	17	11	17	23	23	

A2FMM, A2FEM

Size	RG	23	26	32	45	55	63	80	90	107	125	160	180
Displacement, geometrical, per revolution	V_g	cm ³	22.8	26.1	37.0	44.3	58.8	83.0	91.7	90.5	108.7	175.3	182.4
Maximum rotational speed ^{a)}	n_{max}	rpm	6200	6500	6300	5000	5000	5000	4500	4500	4000	4000	3600
	$n_{max}^{(2)}$	rpm	6900	6900	6900	5000	5000	5000	5000	5000	4400	4400	4000
Inlet flow at n_{max}	q_{in}	l/min	144	172	202	229	283	315	355	407	437	500	577
Torque ^{b)} at $p_p = 400$ bar	M	Nm	146	179	204	268	360	401	508	576	679	795	1021
Rotary stiffness	c_{rot}	Nm/grad	1.75	2.20	2.48	4.43	6.37	8.11	9.79	9.26	12.49	13.36	21.32
Moment of inertia of the rotary group	J_{rg}	kgm ²	0.0010	0.0013	0.0011	0.0033	0.0034	0.0036	0.0050	0.0058	0.0085	0.0097	0.0348
Case volume	V_c	l	0.3	0.3	0.3	0.6	0.6	0.6	0.85	0.85	1.1	1.1	0.8
Weight approx.	m	kg	10.7	10.7	10.7	17	17	17	25	25	33.8	33.8	41

A2FMH, A2FEH

Size	RG	45	55	63	80	90	107	125		
Displacement, geometrical, per revolution	V_g	cm ³	44.3	58.8	63.0	75.8	90.5	108.7	125.0	
Maximum rotational speed ^{a)}	n_{max}	rpm	5000	5000	5000	4500	4500	4000	4000	
	$n_{max}^{(2)}$	rpm	5500	5500	5500	5000	5000	4400	4400	
Inlet flow at n_{max}	q_{in}	l/min	275	288	215	353	407	437	500	
Torque ^{b)} at $p_p = 400$ bar	M	Nm	303	405	401	572	648	758	890	
Rotary stiffness	c_{rot}	Nmm/grad	4.65	6.37	8.11	9.79	9.26	12.49	13.36	
Moment of inertia of the rotary group	J_{rg}	kgm ²	0.0033	0.0034	0.0035	0.0054	0.0058	0.0088	0.0097	
Case volume	V_c	l	0.8	0.8	0.8	0.85	0.85	1.1	1.1	
Weight approx.	m	kg	17	17	17	33	33	33.8	33.8	

Speed range

No limit to minimum speed n_{min} if uniformity of motion is required, rotational speed n_{min} must not be less than 50 rpm.

a) The rated speed (following the maximum permissible inlet flow)
 - for the optimum viscosity range, from $n_{opt} = 36$ to 16 min⁻¹
 - with hydraulic fluid based on mineral oil

b) Indicated maximum speed: Overspeed for uniaxial and overhauling processes, $t < 5$ s and $p_p = 150$ bar
 c) Torque without radial force, with radial force see page 71

Determination of the characteristics				
Inlet flow	Q_t	$= \frac{V_g \cdot n}{1000 \cdot \eta_v}$		(l/min)
Rotational speed	n	$= \frac{Q_t \cdot 1000 \cdot \eta_v}{V_g}$		(rpm)
Torque	M	$= \frac{V_g \cdot \Delta p \cdot \eta_{me}}{20 \cdot \pi}$		(Nm)
Power	P	$= \frac{2 \cdot \pi \cdot M \cdot n}{60000}$	$= \frac{Q_t \cdot \Delta p \cdot \eta_t}{600}$	(kW)

Key

V_g Displacement per revolution (cm³)

Δp Differential pressure (bar)

n Rotational speed (rpm)

η_v Volumetric efficiency

η_{me} Hydraulic-mechanical efficiency

η_t Total efficiency ($\eta_t = \eta_v \cdot \eta_{me}$)

Notice

- Theoretical values, without efficiency and tolerances; values rounded
- 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. Other permissible limit values, such as speed variation, reduced angular acceleration as a function of the frequency and the permissible angular acceleration at start (lower than the maximum angular acceleration) can be found in data sheet 90001.

Permissible radial and axial loading on the drive shafts

A2FMN, A2FEN

Size	NS		25	25	32	32	37	45	55	55	63	80	90	107
Drive shaft	Code		25/PS	25/PS	25/PS	25/PS	25/PS	25/PS	25/PS	25/PS	25/PS	25/PS	25/PS	25/PS
	with splined shaft	a	mm	25	30	25	30	30	30	30	30	30	40	40
	with keyed shaft	a	mm	25	30	25	30	30	30	30	30	30	40	40
Maximum radial force ^{a)} at distance s (for the shaft collar)		$F_{R\ max}$	kN	4.3	5.6	4.5	4.1	4.7	5.6	7.3	6.9	8.9	8.8	10.4
	s	mm	18	18	18	18	18	18	18	18	18	18	20	20
Maximum torque at $F_{R\ max}$	$M_{T\ max}$	Nm	134	134	153	153	176	211	279	301	390	437	518	
Maximum differential pressure at $F_{R\ max}$ $\Delta p_{F_{R\ max}}$		bar	100	100	100	100	100	100	100	100	100	100	100	100
Maximum axial force at standby or decompressed operation		+ $F_{A\ max}$	N	0	0	0	0	0	0	0	0	0	0	0
		- $F_{A\ max}$	N	500	500	500	500	500	500	800	800	800	1000	1000
Permissible axial force per bar working pressure	+ $F_{A\ max}/\Delta p$	N/bar	5.2	5.2	5.2	5.2	5.2	5.2	6.7	6.7	6.7	10.6	10.6	

A2FMM, A2FEM

Size	NS		25	25	25	25	32	32	45	55	55	63
Drive shaft	Code		25/PS	25/PS	25/PS	25/PS	25/PS	25/PS	25/PS	25/PS	25/PS	25/PS
	with splined shaft	a	mm	25	30	25	30	25	30	30	30	35
	with keyed shaft	a	mm	25	30	25	30	25	30	30	30	35
Maximum radial force ^{a)} at distance s (for the shaft collar)		$F_{R\ max}$	kN	4.7	5.8	5.7	4.8	6.3	7.4	8.6	8.3	9.7
	s	mm	12	16	16	16	16	16	16	16	16	16
Maximum torque at $F_{R\ max}$	$M_{T\ max}$	Nm	146	146	179	179	304	304	396	500	500	491
Maximum differential pressure at $F_{R\ max}$ $\Delta p_{F_{R\ max}}$		bar	400	400	400	400	400	400	400	400	400	400
Maximum axial force at standby or decompressed operation		+ $F_{A\ max}$	N	0	0	0	0	0	0	0	0	0
		- $F_{A\ max}$	N	500	500	500	500	500	800	800	800	800
Permissible axial force per bar working pressure	+ $F_{A\ max}/\Delta p$	N/bar	5.2	5.2	5.2	5.2	5.2	5.2	6.7	6.7	6.7	6.7

Size	NS		80	80	90	107	107	125	140	160	188
Drive shaft	Code		25/PS	25/PS	25/PS	25/PS	A1/B1	A1/B1	A1/B1	A3/B2	A3/B2
	with splined shaft	a	mm	25	40	40	40	45	45	50	50
	with keyed shaft	a	mm	25	40	40	40	45	45	50	50
Maximum radial force ^{a)} at distance s (for the shaft collar)		$F_{R\ max}$	kN	11.8	10.7	11.5	13.6	12.1	14.1	18.3	18.3
	s	mm	20	20	20	20	20	20	25	25	25
Maximum torque at $F_{R\ max}$	$M_{T\ max}$	Nm	508	508	526	623	623	735	1021	1021	1146
Maximum differential pressure at $F_{R\ max}$ $\Delta p_{F_{R\ max}}$		bar	400	400	400	400	400	400	400	400	400
Maximum axial force at standby or decompressed operation		+ $F_{A\ max}$	N	0	0	0	0	0	0	0	0
		- $F_{A\ max}$	N	1000	1000	1000	1100	1250	1600	1600	1600
Permissible axial force per bar working pressure	+ $F_{A\ max}/\Delta p$	N/bar	10.6	10.6	10.6	11.8	12.8	12.8	16.7	16.7	16.7

a) With intermittent operation

Permissible radial and axial loading on the drive shafts

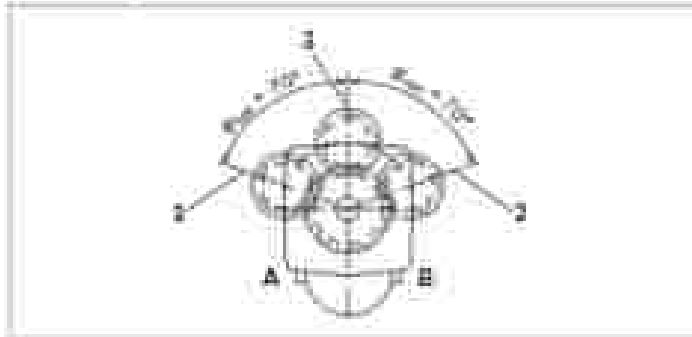
A2FMH, A2FEH

Size	80	45	55	63	80	90	107	127	125
Drive shaft	Code	25/P6	25/P6	25/P8	25/P9	25/P9	25/P9	A1/B1	A1/B1
with splined shaft	ϕ	mm	30	35	35	40	40	45	45
with keyed shaft	ϕ	mm	30	35	35	40	40	45	45
Maximum radial force $F_{R,max}$ at distance x (to the shaft collar)		$F_{R,max}$	kN	8.0	9.3	10.3	11.4	12.0	12.3
	x	mm	18	18	18	20	20	20	20
Maximum torque at $F_{R,max}$	$M_{R,max}$	Nm	320	405	451	512	548	594	605
Maximum differential pressure at $F_{R,max}$ $\Delta p_{F_{R,max}}$		bar	450	450	470	450	450	450	450
Maximum axial force at standstill or depressed load operation		$\pm F_{A,max}$	N	0	0	0	0	0	0
		N	1100	830	800	1100	1000	1350	1350
Permissible axial force per bar working pressure	$\pm F_{A,max}/\text{bar}$	N/bar	8.7	8.7	8.7	10.6	11.6	12.8	12.8

Effect of radial force F_R on bearing service life

By selecting a suitable direction of radial force F_R , the load on the bearings, caused by the internal rotary group forces can be reduced, thus optimizing the bearing service life. Recommended position of mating gear is dependent on the direction of rotation. Examples:

• Gear output drive



1 "Counter-clockwise" rotational direction, pressure at port B

2 "Clockwise" rotational direction, pressure at port A

3 "Bidirectional" direction of rotation

Notice

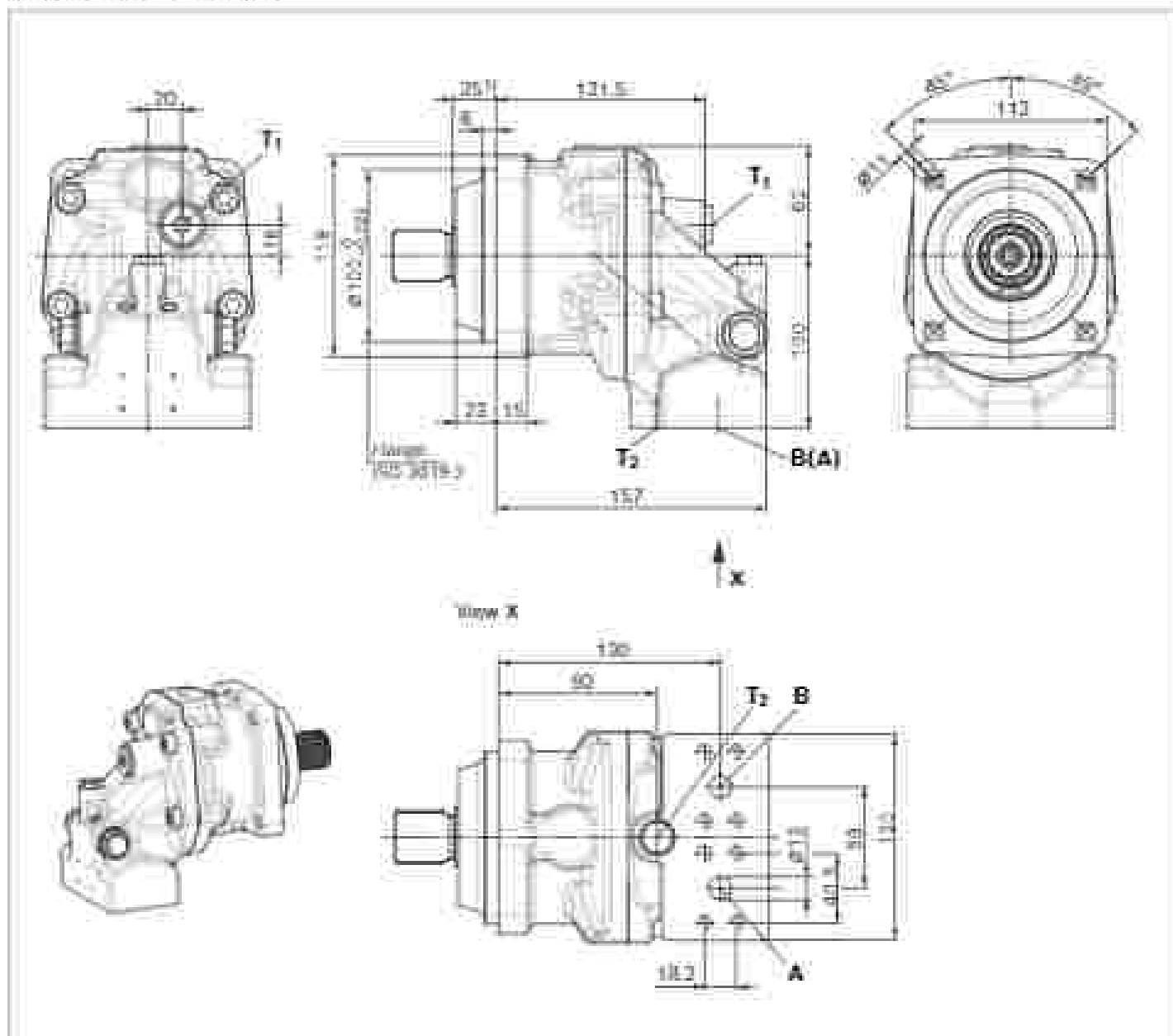
- The values given are maximum values and do not apply to continuous operation.
- The permissible axial force in direction $-F_{A,max}$ is to be avoided as the service life of the bearing is reduced.
- Special requirements apply in the case of belt output drives. Please contact us.

Dimensions A2FM, sizes 23 to 45

GAE working parts A and B at bottom (11)

12PM SATURDAY 11, 12, 17 and 49

A25MM Wave 21, 22 and 23



Parts		Standard	Size	P_{max} (bar) ²	State ⁽¹⁾
A, B	Working port Hydraulic thread A/B	SAE J1111 O/N 1.1	1/2 in M16 × 1.5, 14 deep	450	0
T ₁	Frame port	ISO 3852 ³	M16 × 1.5, 13 deep	5	2 ²
T ₂	Drain port	ISO 3852 ³	M16 × 1.5, 13 deep	5	0 ²

[illegible]

21. Depending on the application, monetary premium checks can prove costly in most cases, especially regarding interest charges and fines.

2. Depending on installation position, 1, or 1.5 must be connected (see also installation instructions on page 204).

4. The manufacturer may be wrong. Their own test is the standard.

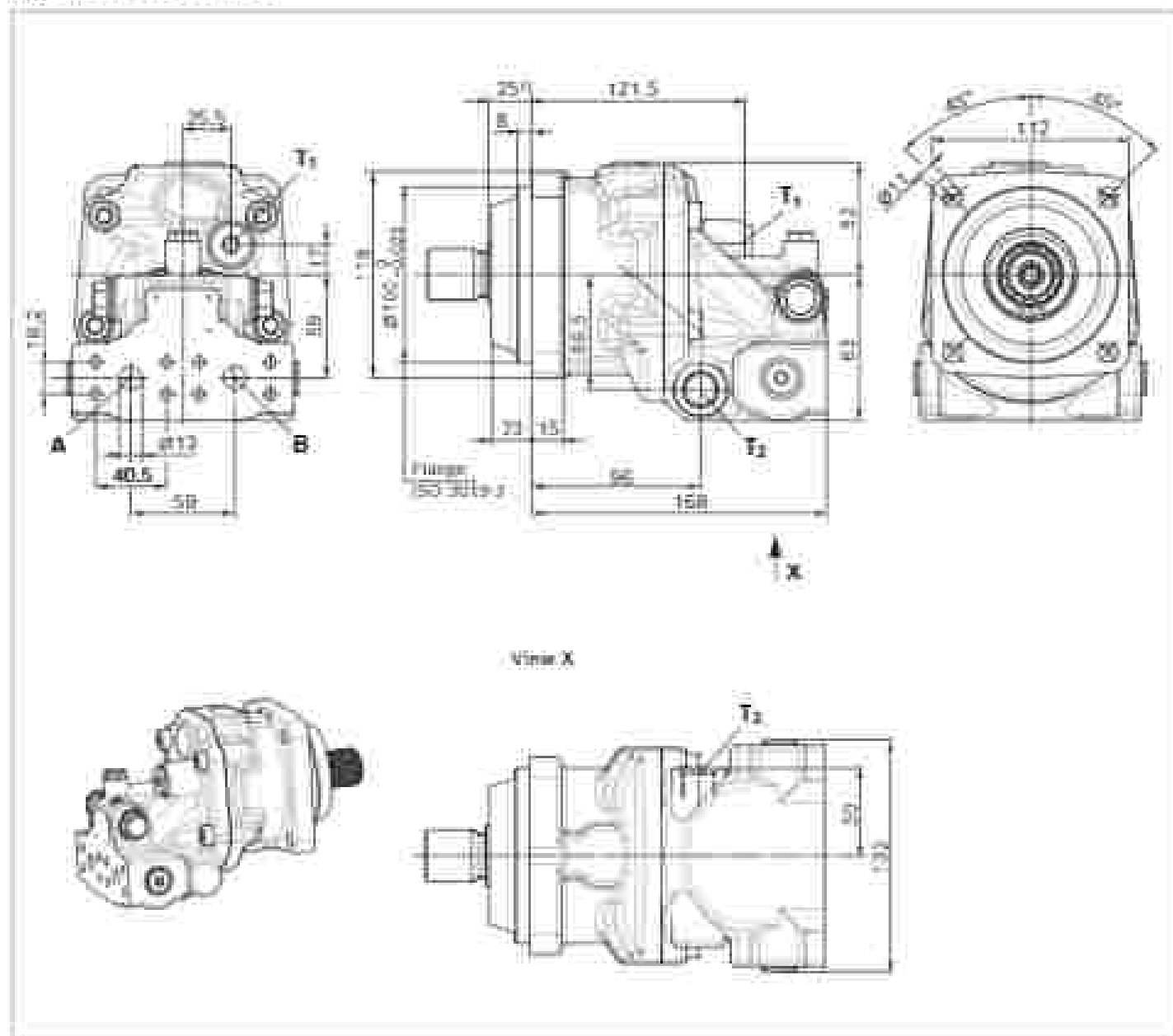
99. © — While the source of influence is different,

Fig. 1 *Phragmites* in the marsh

SAE working ports A and B at rear (G1)

A2FMN sizes 30, 32, 37 and 45

A2FMM sizes 33, 38 and 47



Ports	Standard	Size	P_{max} [bar] ^{a)}	State ^{b)}
A, B	SAE J518 DN 12	1/2 in M16 x 1.5; 16 deep	450 ^{c)}	0
T ₁	DN 38.5 ^{d)}	M18 x 1.5; 12 deep	3	0 ^{e)}
T ₂	DN 38.5 ^{d)}	M18 x 1.5; 12 deep	3	0 ^{e)}

a) To shaft only

b) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

c) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 67).

d) The connection may be deeper than specified is the standard.

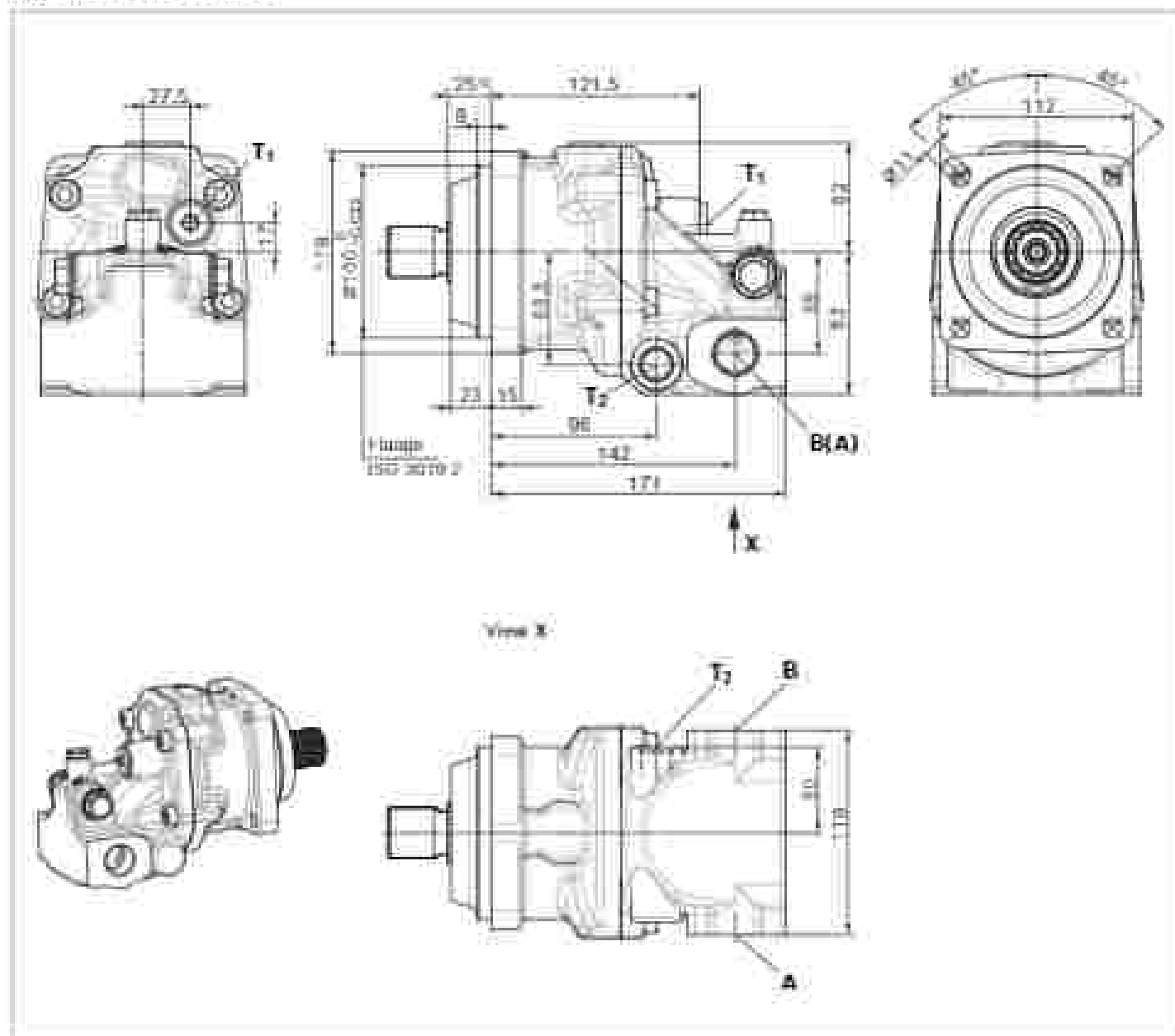
e) 0 = Must be connected (plugged on delivery)

X = Plugged (in normal position)

Threaded ports A and B at side, opposite (OS)

A2FMN 2000 10 11 17 and 45

ATFMM 6000 22.00 and 22.00



Parts	Standard	Size	Pass (Bar) ¹⁾	State ²⁾
A, B Working port	100 2012 ³⁾	M27 = 2, 16 deep	450	0
T ₁ Drain port	100 3812 ³⁾	M16 = 1.50, 12 deep	3	2 ³⁾
T ₂ Drain port	100 2012 ³⁾	M16 = 3.0, 12 deep	3	0 ³⁾

- Depositing on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring device and fittings.
- Depositing on a restriction position, T_1 or T_2 must be connected over also restriction restrictions (see page 632).

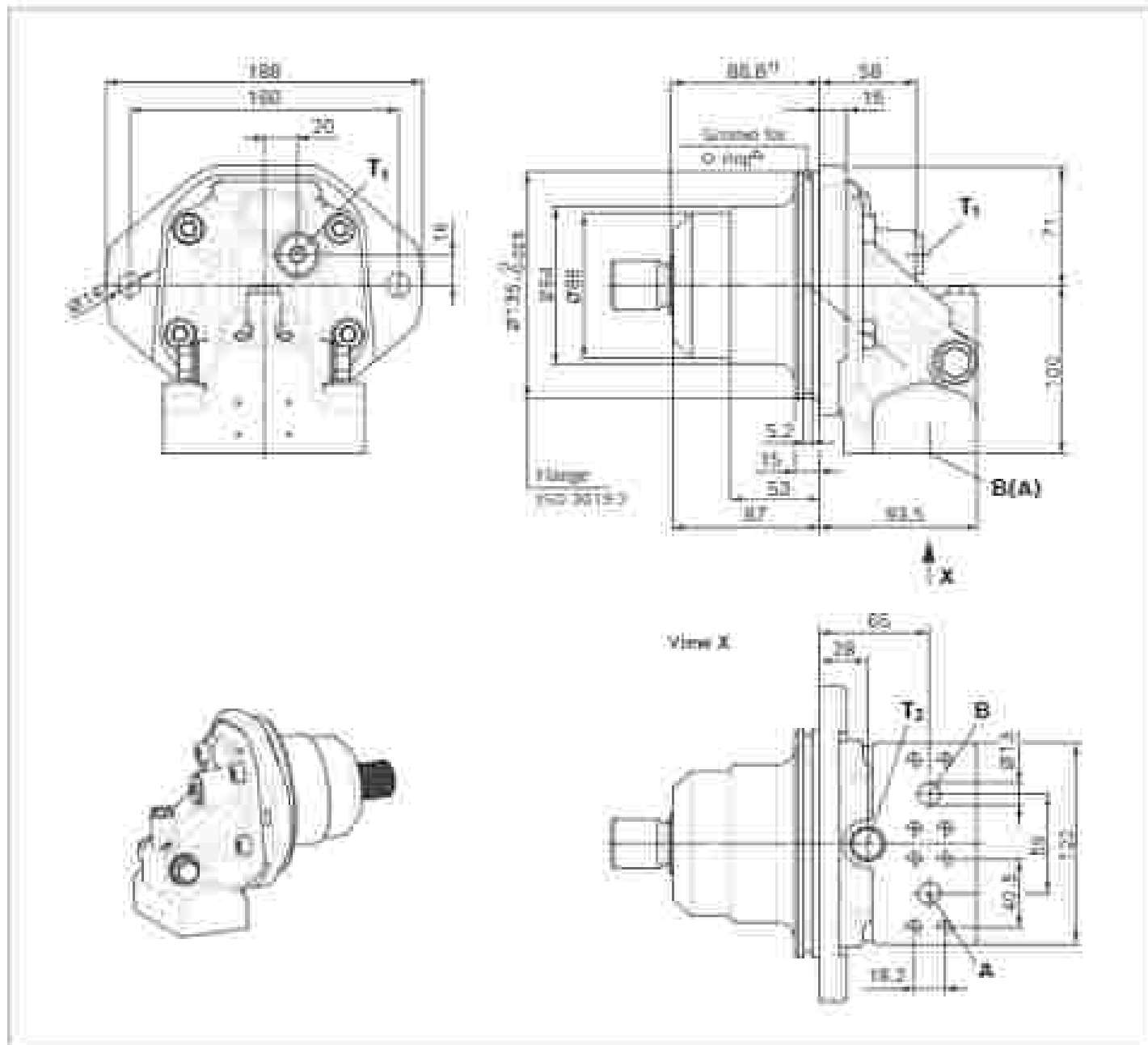
- a - The connector may be deeper than specified in the standard.
 b - O - Must be connected (plugged on delivery)
 X - Plugged (delivered disconnected)

Dimensions A2FE, sizes 23 to 45

SAE working parts A and B at bottom (11)

A2FEN sizes 26, 32, 37 and 45

A2FEM sizes 23, 28 and 33



Parts	Standard	Size	P_{max} [bar] ^a	State ^b
A, B	SAE J514	1/2 in	400	0
	DN 17	M8 × 1.25, 16 deep		
T ₁	DN 3812 ^c	M16 × 1.5, 12 deep	3	2 ^d
T ₂	DN 3812 ^c	M16 × 1.5, 12 deep	3	0 ^d

a. No shaft input

b. Depending on the application, secondary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

c. Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 50).

d. The countclock may be deeper than specified in the standard.

0 → Must be connected (plugged in delivery)

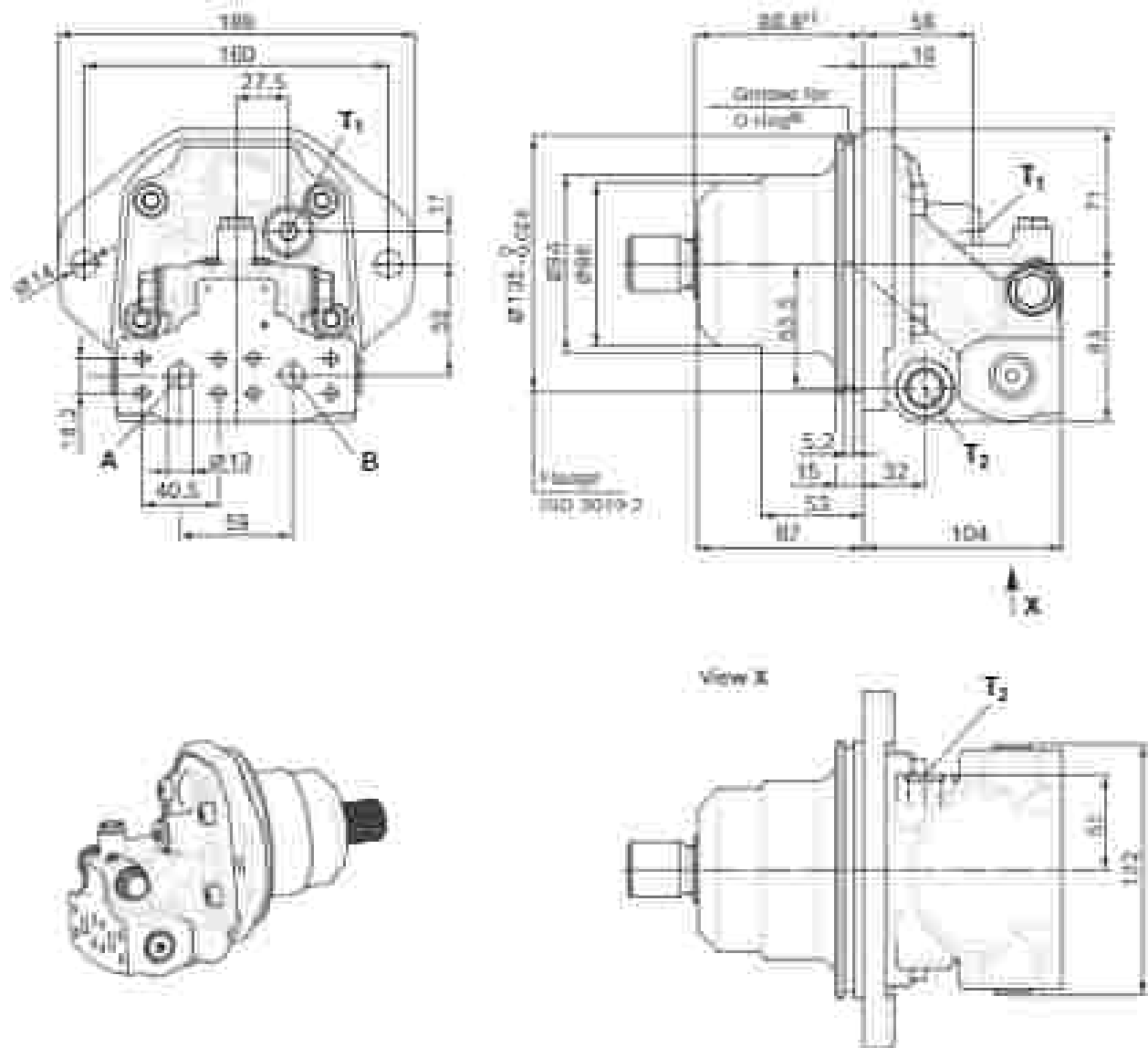
X → Plugged (in service condition)

0-ring Ø12h × 4 not included in the scope of delivery

SAE working ports A and B at rear (51)

A2FEN 62, 20, 32, 37 and 40

APPENDIX 23, 28 and 32



Part	Standard	Size	$P_{\text{rel}} [\text{Bar}]^{\text{a}}$	State ^b
A, E	Working port Fastening thread A/B	1/2" UNF DN 1.1	450 M16 x 1.25; 14 mm	0
T₁	Drain port	DN 20/25 ^c	M16 x 1.5; 12 mm	1 ^b
T₂	Drain port	DN 20/25 ^c	M16 x 1.5; 12 mm	0 ^b

	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100
1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061	2062	2063	2064	2065	2066	2067	2068	2069	2070	2071	2072	2073	2074	2075	2076	2077	2078	2079	2080	2081	2082	2083	2084	2085	2086	2087	2088	2089	2090	2091	2092	2093	2094	2095	2096	2097	2098	2099	2100	

g. Depending on the application, momentary pressure peaks can occur. About this, it must be noted when selecting measuring devices and fittings.

g. Depositing on ventilation position, T_1 or T_2 must be connected to the other ventilation ducts on 5-sec 432.

6. The counterion may be smaller than SO_4^{2-} and is the strongest

10. O - Must be completed (regardless of delivery)

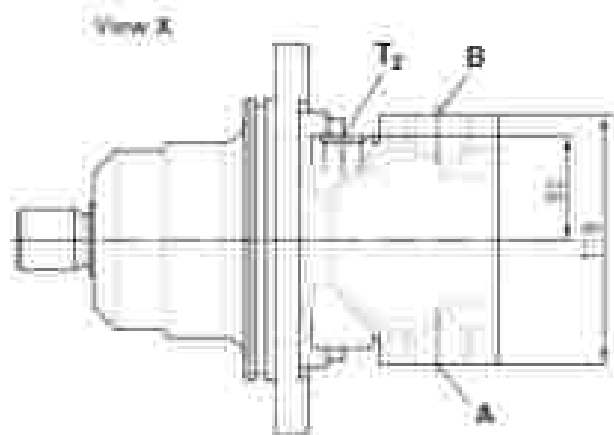
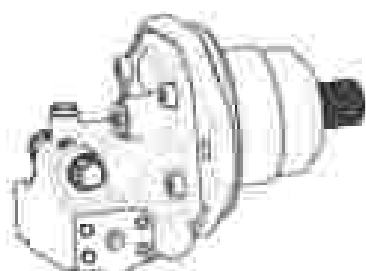
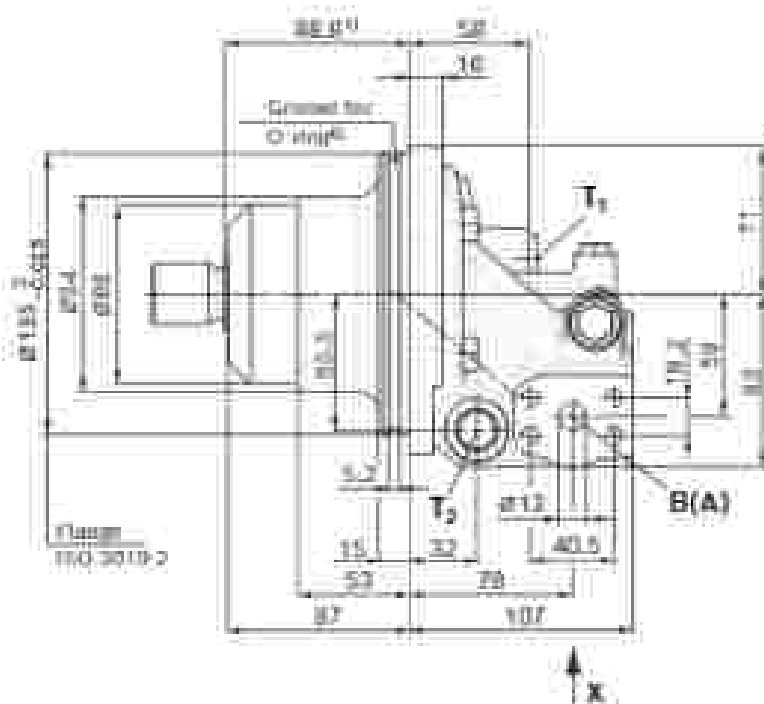
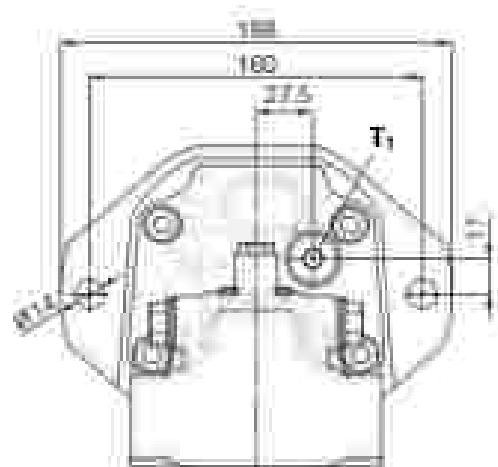
26. **Answer: D** The correct answer is D. The correct answer is D.

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SAE working ports A and B at side, opposite (62)

A2FEN 100 20 22 24 26

ATTEN **NOV 23 2000**



Ports		Standard	Size	P_{max} (bar) ^a	State ^b
A, B	Working port Filling/vented A/B	SAE J518 1000 psi	1/2 in. M18 × 1.5, 16 deep	450	0
T ₁	Drain port	DN 3852 [®]	M18 × 1.5, 13 deep	3	1 ^c
T ₂	Drain port	DN 3852 [®]	M18 × 1.5, 13 deep	3	0 ^c

[illegible]

21. Depending on the application, monetary premium peaks can occur. Keep this in mind when selecting monetary deficits and fills.

2. Depending on ventilation position, V_1 or V_2 must be connected from above installation instructions for each unit.

• The manufacturer may be aware that something is the standard

99. Q—What has your research influenced in children?

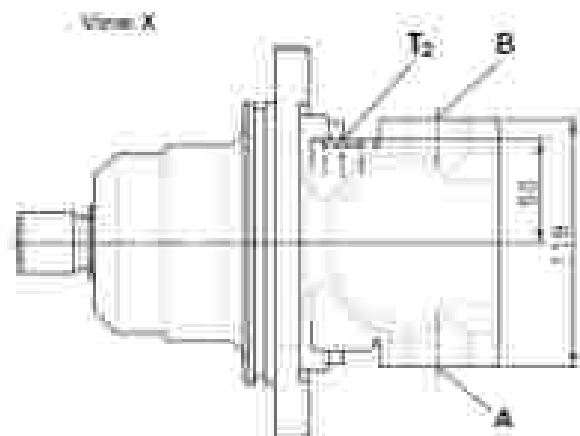
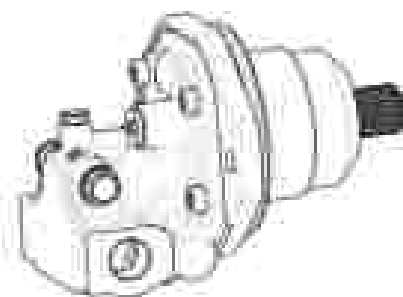
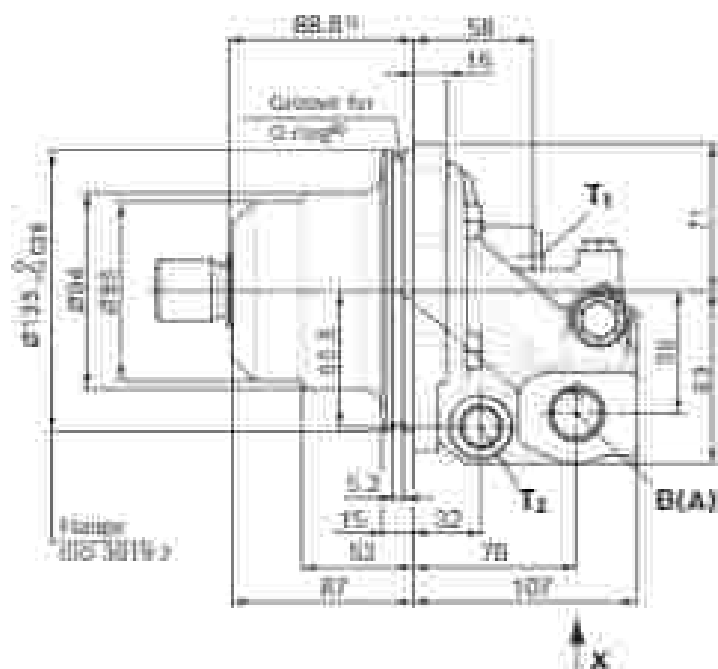
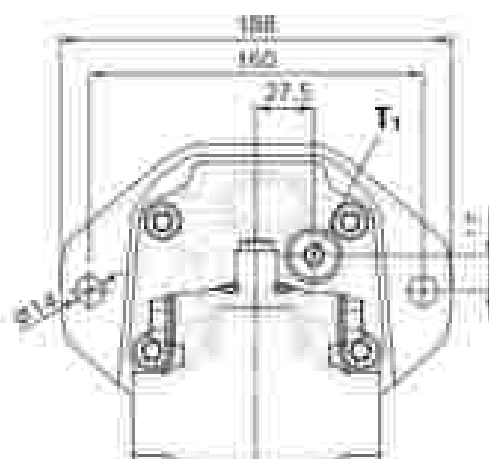
 $\bar{X}$ = Placebo (the normal population)

a. *Chlorophyll* is a green pigment found in the chloroplasts of plants.

Thru-hull ports A and B at side, opposite (05)

A2FEN 68, 20, 32, 37 and 40

APPENDIX 23, 28 and 32



Parts	Standard	Size	Pass (Bar) ¹	State ²
A, B Working part	EN 3012 ³	M27 = 2, 16 deep	450	0
T ₁ Drive part	EN 3012 ³	M16 = 1.50, 12 deep	3	1 ²
T ₂ Drive part	EN 3012 ³	M16 = 3.0, 12 deep	3	0 ²

[illegible]

■ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measures for drying and filling.

a. Depending on installation position, I_2 or I_3 must be connected
 (see also installation instructions on page 63)

a. The concentration may be lower than specified in the standard.

10. C - Must be connected (thought as delivery)

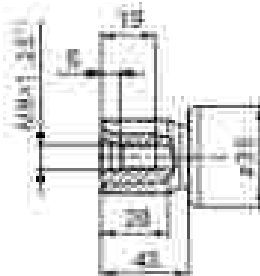
100% = 100% (100% = 100%)

a. B-year at 12% = \$ not included in the scope of delivery

Drive shafts, sizes 23 to 45

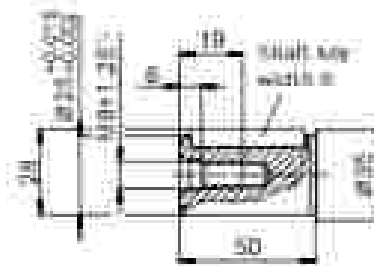
- Splined shaft DIN 5480,
Sizes 23¹⁾, 29 and 32

25 - W75x1.25x50kg



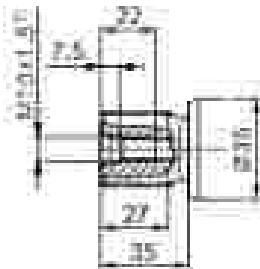
- Parallel keyed shaft DIN 6885,
Sizes 23¹⁾, 28 and 32

25 - 455x7x50



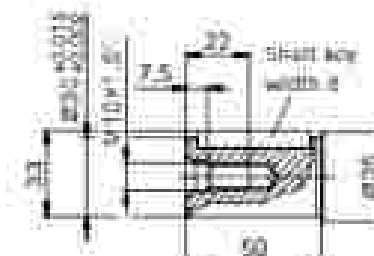
- Splined shaft DIN 5480,
Sizes 23¹⁾, 28, 32, 37 and 45²⁾

25 - W70x2x140kg



- Parallel keyed shaft DIN 6885,
Sizes 23¹⁾, 28, 32, 37 and 45²⁾

25 - 455x7x50



1) Center bore according to DIN 552 (Honed according to DIN 10)
2) Not available for A2FMN, A2FEN (pressure range 300 to 350 bar)
3) Only available for A2FMN, A2FEN (pressure range 300 to 350 bar)

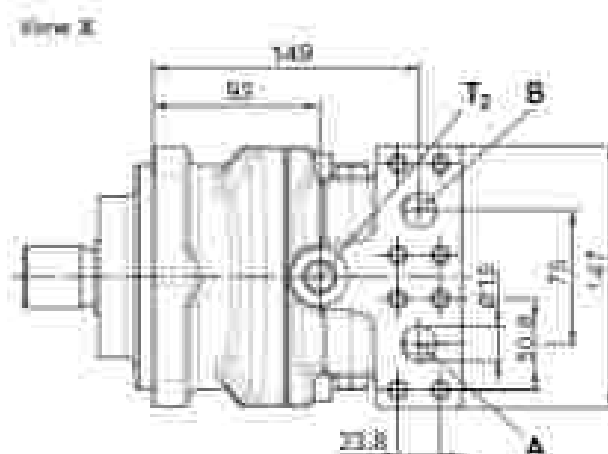
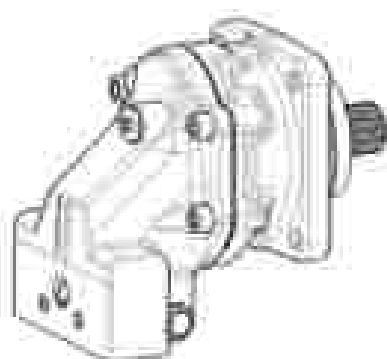
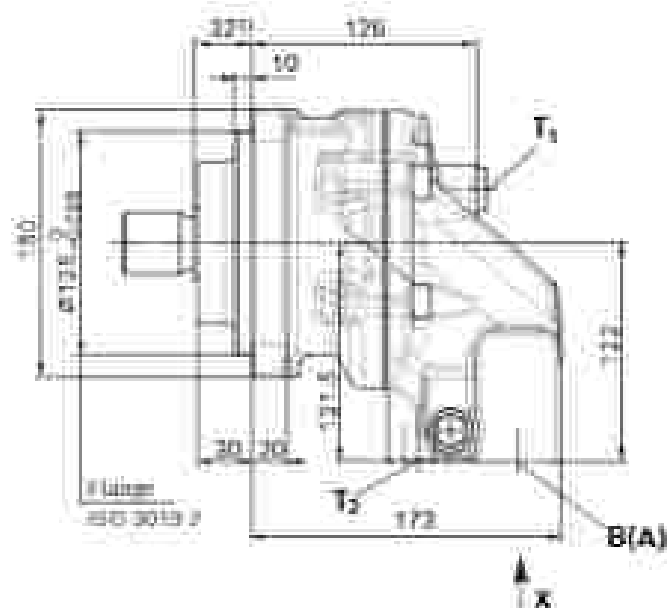
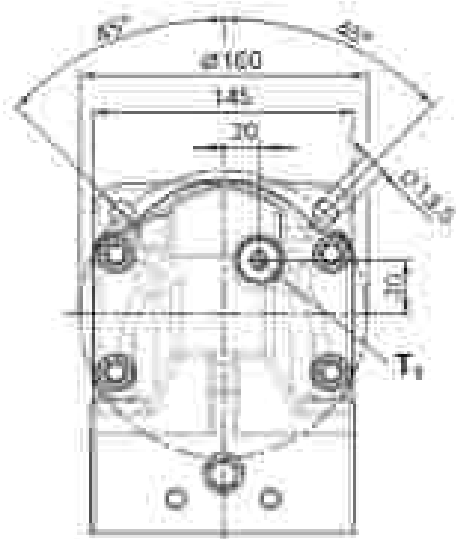
Dimensions A2FM, sizes 45 to 80

SAC working ports A and B at bottom (11)

ATTN: Mr. E. J. McLaughlin

A2FMM pages 45, 50 and 63

ATM 100 4. 3. 2003



Parts		Standard	Size	Ass. [Inch] ²	State ³
A, B	Working port	SAT 25.16	3/4 in.	500	1
	Exhausting thread 3/8"	SBF 7.1	M18 x 1.5, 12 deep		
T ₁	Drain port	10% 3812 ⁴	M18 x 1.5, 12 deep	3	1 ²
T ₂	Drain port	10% 3812 ⁴	M18 x 1.5, 12 deep	3	1 ²

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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g. Depending on the application, momentary premium peaks can occur. About this, it must be noted when selecting measuring devices and fittings.

8. Depositing on ventilation position, P_1 or P_2 must be connected from plus ventilation distribution on point 8/21.

a. The concentration may be lower than specified in the standard.

10. O - Must be completed (regardless of delivery)

See Appendix: The research instrument

SAE working ports, 1" at side and 1" at bottom** (12)

ASFINN 1000 1000 1000 1000

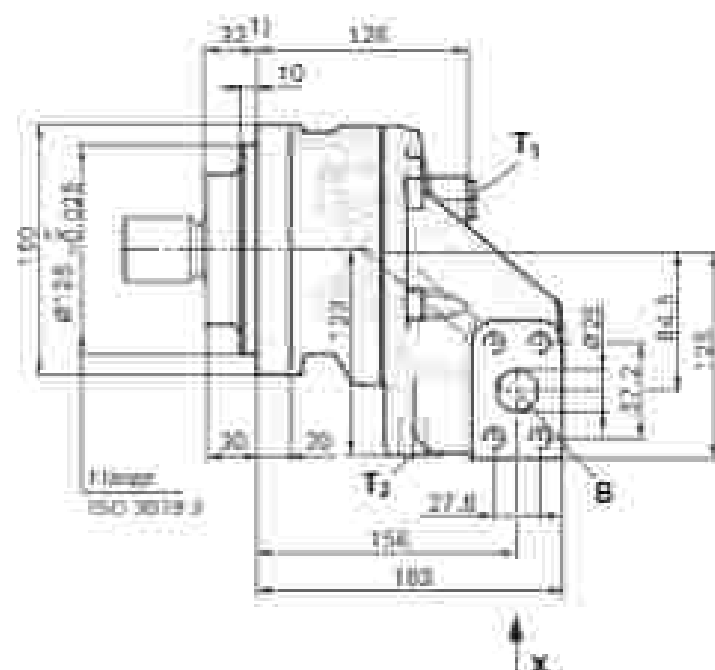
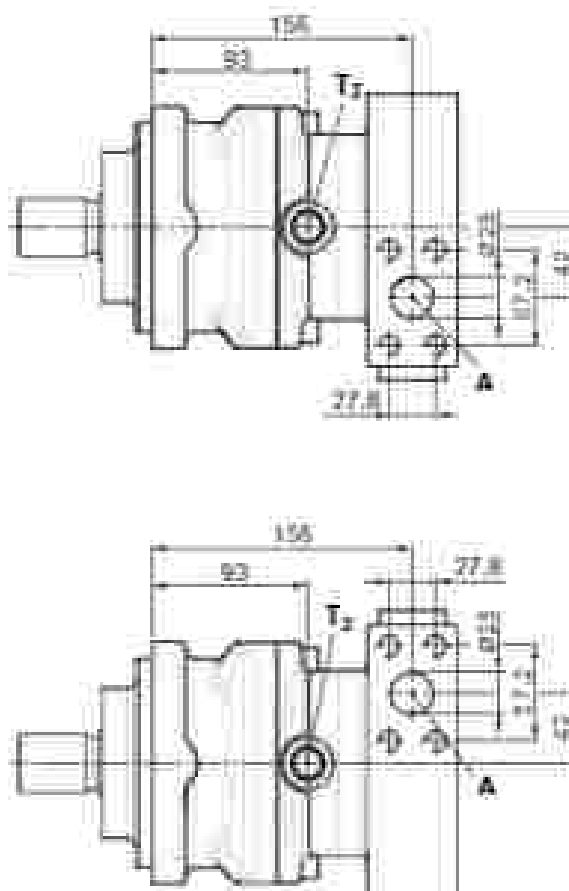


Figure 8
Counter-clockwise rotation



Parts		Standard	Size	P_{max} (bar) ¹⁾	Stand ²⁾
A, B	Working part Extruding thread A/B	SAE J311 DIN 913	1.16 M12 × 1.75, 12 deep	350	C
T ₁	Turn part	M8 3052 [®]	M18 × 1.5, 12 deep	1	29
T ₂	Drive part	DIN 3052 [®]	M18 × 1.5, 12 deep	1	C9

[illegible]

3. Depending on the application, secondary pressure peaks can occur. Keep this in mind when selecting measuring devices and fillers.

a. Depending on ventilation position, R_1 or R_2 must be connected to the other side of the installation according to your unit.

4. The argument is that the means that simplified is the standard

10. ☐ **C** = Billie has completed shipment of delivery.

X = Placenta (14 normal, 10 abnormal)

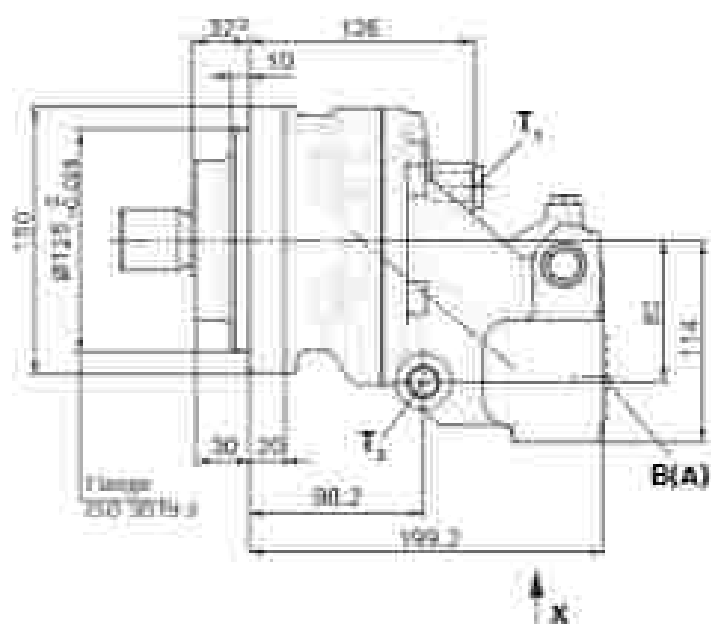
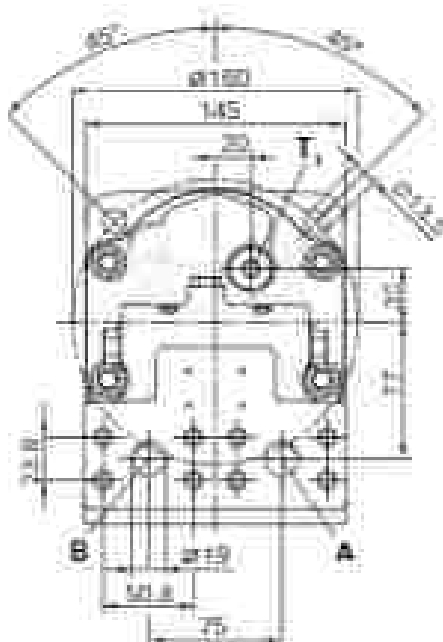
a) $C_{\text{eff}} = 0$ is consistent with stock when scaled position X_0

SAC working ports A and B at rear (91)

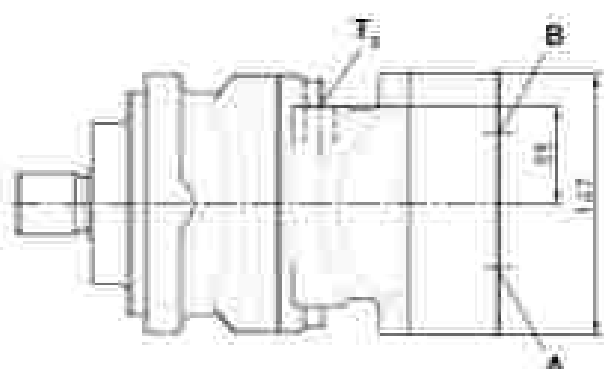
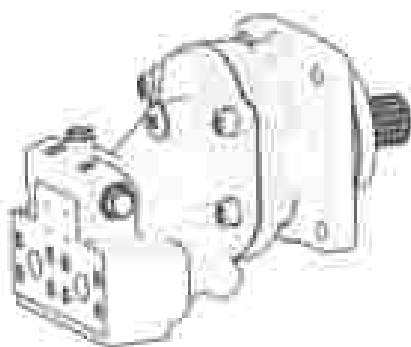
ABFMM with G1, G3 and G5

A3FMM (CNC) AS, BS and BS

ABFW sizes 45, 55 and 65



100



Parts		Standard	Size	Proc. (bar) ¹⁾	State ²⁾
A, B	Working pins (passing thread 4/8)	142.20.14	3/4 in	500	0
T ₁	Drive pin	DN 200.2 ³⁾	M 10 = 1.5; 17 deep	1	3 ⁴⁾
T ₂	Drive pin	DN 200.2 ³⁾	M 10 = 1.5; 17 deep	1	0 ⁴⁾

1998, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020, 2021, 2022, 2023, 2024, 2025, 2026, 2027, 2028, 2029, 2030, 2031, 2032, 2033, 2034, 2035, 2036, 2037, 2038, 2039, 2040, 2041, 2042, 2043, 2044, 2045, 2046, 2047, 2048, 2049, 2050, 2051, 2052, 2053, 2054, 2055, 2056, 2057, 2058, 2059, 2060, 2061, 2062, 2063, 2064, 2065, 2066, 2067, 2068, 2069, 2070, 2071, 2072, 2073, 2074, 2075, 2076, 2077, 2078, 2079, 2080, 2081, 2082, 2083, 2084, 2085, 2086, 2087, 2088, 2089, 2090, 2091, 2092, 2093, 2094, 2095, 2096, 2097, 2098, 2099, 2100, 2101, 2102, 2103, 2104, 2105, 2106, 2107, 2108, 2109, 2110, 2111, 2112, 2113, 2114, 2115, 2116, 2117, 2118, 2119, 2120, 2121, 2122, 2123, 2124, 2125, 2126, 2127, 2128, 2129, 2130, 2131, 2132, 2133, 2134, 2135, 2136, 2137, 2138, 2139, 2140, 2141, 2142, 2143, 2144, 2145, 2146, 2147, 2148, 2149, 2150, 2151, 2152, 2153, 2154, 2155, 2156, 2157, 2158, 2159, 2160, 2161, 2162, 2163, 2164, 2165, 2166, 2167, 2168, 2169, 2170, 2171, 2172, 2173, 2174, 2175, 2176, 2177, 2178, 2179, 2180, 2181, 2182, 2183, 2184, 2185, 2186, 2187, 2188, 2189, 2190, 2191, 2192, 2193, 2194, 2195, 2196, 2197, 2198, 2199, 2200, 2201, 2202, 2203, 2204, 2205, 2206, 2207, 2208, 2209, 2210, 2211, 2212, 2213, 2214, 2215, 2216, 2217, 2218, 2219, 2220, 2221, 2222, 2223, 2224, 2225, 2226, 2227, 2228, 2229, 2230, 2231, 2232, 2233, 2234, 2235, 2236, 2237, 2238, 2239, 2240, 2241, 2242, 2243, 2244, 2245, 2246, 2247, 2248, 2249, 2250, 2251, 2252, 2253, 2254, 2255, 2256, 2257, 2258, 2259, 2260, 2261, 2262, 2263, 2264, 2265, 2266, 2267, 2268, 2269, 2270, 2271, 2272, 2273, 2274, 2275, 2276, 2277, 2278, 2279, 2280, 2281, 2282, 2283, 2284, 2285, 2286, 2287, 2288, 2289, 2290, 2291, 2292, 2293, 2294, 2295, 2296, 2297, 2298, 2299, 2300, 2301, 2302, 2303, 2304, 2305, 2306, 2307, 2308, 2309, 2310, 2311, 2312, 2313, 2314, 2315, 2316, 2317, 2318, 2319, 2320, 2321, 2322, 2323, 2324, 2325, 2326, 2327, 2328, 2329, 2330, 2331, 2332, 2333, 2334, 2335, 2336, 2337, 2338, 2339, 2340, 2341, 2342, 2343, 2344, 2345, 2346, 2347, 2348, 2349, 2350, 2351, 2352, 2353, 2354, 2355, 2356, 2357, 2358, 2359, 2360, 2361, 2362, 2363, 2364, 2365, 2366, 2367, 2368, 2369, 2370, 2371, 2372, 2373, 2374, 2375, 2376, 2377, 2378, 2379, 2380, 2381, 2382, 2383, 2384, 2385, 2386, 2387, 2388, 2389, 2390, 2391, 2392, 2393, 2394, 2395, 2396, 2397, 2398, 2399, 2400, 2401, 2402, 2403, 2404, 2405, 2406, 2407, 2408, 2409, 2410, 2411, 2412, 2413, 2414, 2415, 2416, 2417, 2418, 2419, 2420, 2421, 2422, 2423, 2424, 2425, 2426, 2427, 2428, 2429, 2430, 2431, 2432, 2433, 2434, 2435, 2436, 2437, 2438, 2439, 2440, 2441, 2442, 2443, 2444, 2445, 2446, 2447, 2448, 2449, 2450, 2451, 2452, 2453, 2454, 2455, 2456, 2457, 2458, 2459, 2460, 2461, 2462, 2463, 2464, 2465, 2466, 2467, 2468, 2469, 2470, 2471, 2472, 2473, 2474, 2475, 2476, 2477, 2478, 2479, 2480, 2481, 2482, 2483, 2484, 2485, 2486, 2487, 2488, 2489, 2490, 2491, 2492, 2493, 2494, 2495, 2496, 2497, 2498, 2499, 2500, 2501, 2502, 2503, 2504, 2505, 2506, 2507, 2508, 2509, 2510, 2511, 2512, 2513, 2514, 2515, 2516, 2517, 2518, 2519, 2520, 2521, 2522, 2523, 2524, 2525, 2526, 2527, 2528, 2529, 2530, 2531, 2532, 2533, 2534, 2535, 2536, 2537, 2538, 2539, 2540, 2541, 2542, 2543, 2544, 2545, 2546, 2547, 2548, 2549, 2550, 2551, 2552, 2553, 2554, 2555, 2556, 2557, 2558, 2559, 2560, 2561, 2562, 2563, 2564, 2565, 2566, 2567, 2568, 2569, 2570, 2571, 2572, 2573, 2574, 2575, 2576, 2577, 2578, 2579, 2580, 2581, 2582, 2583, 2584, 2585, 2586, 2587, 2588, 2589, 2590, 2591, 2592, 2593, 2594, 2595, 2596, 2597, 2598, 2599, 2600, 2601, 2602, 2603, 2604, 2605, 2606, 2607, 2608, 2609, 2610, 2611, 2612, 2613, 2614, 2615, 2616, 2617, 2618, 2619, 2620, 2621, 2622, 2623, 2624, 2625, 2626, 2627, 2628, 2629, 2630, 2631, 2632, 2633, 2634, 2635, 2636, 2637, 2638, 2639, 2640, 2641, 2642, 2643, 2644, 2645, 2646, 2647, 2648, 2649, 2650, 2651, 2652, 2653, 2654, 2655, 2656, 2657, 2658, 2659, 2660, 2661, 2662, 2663, 2664, 2665, 2666, 2667, 2668, 2669, 2670, 2671, 2672, 2673, 2674, 2675, 2676, 2677, 2678, 2679, 26

g. Depending on the application, momentary premium peaks can occur. As a rule, it is used when selecting measuring devices and fittings.

When depositing on irradiation position, T_1 or T_2 must be connected with glass irradiation detectors or some RTD.

g. The command may be longer than specified in the standard.

10. $\text{C} = \text{Must be connected (plugged in delivery)}$

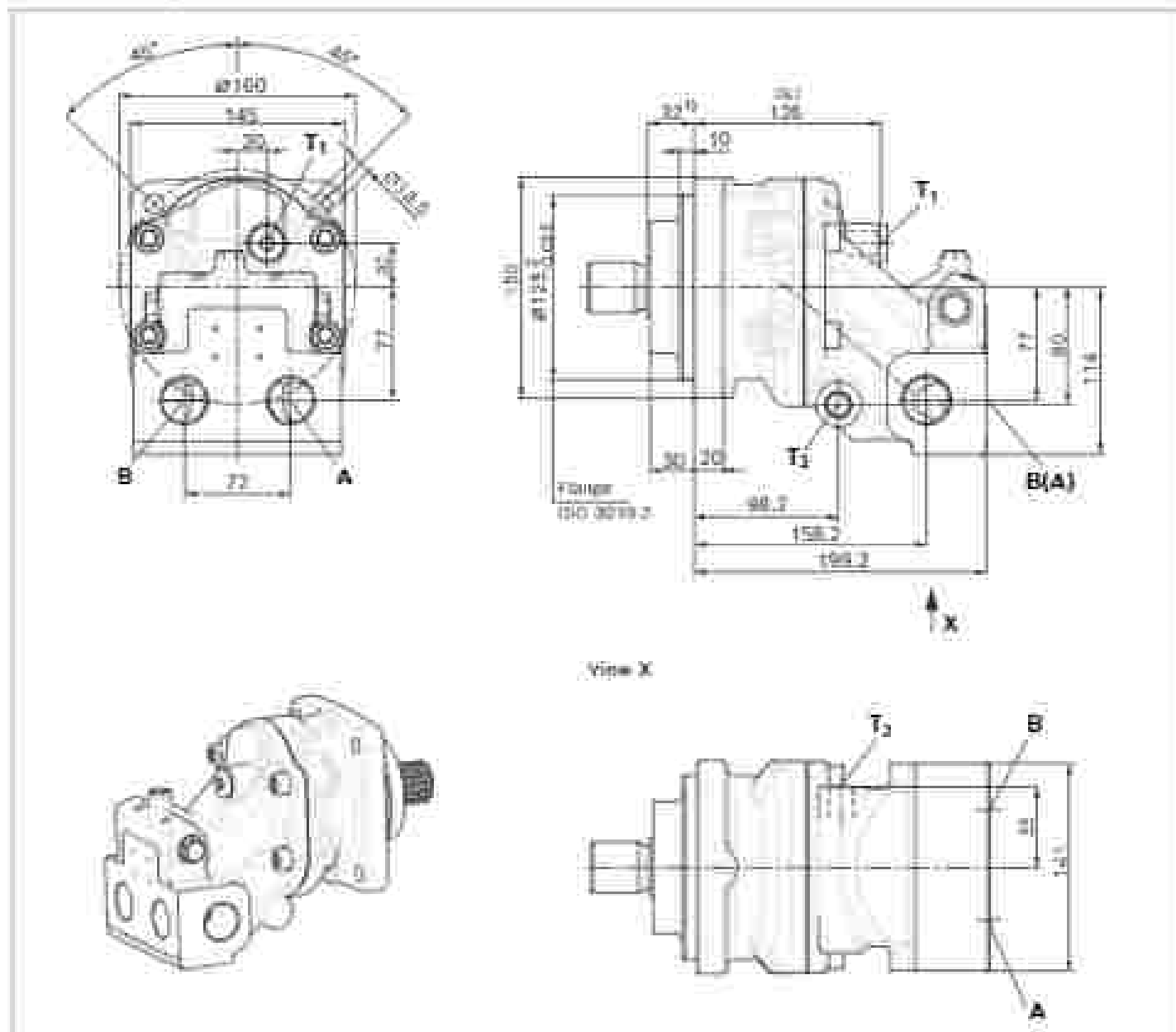
DOI: 10.1002/for

Threaded ports A and B at side and at rear (03)

A2FMN sizes 50, 63 and 80

A2FMM sizes 45, 56 and 63

A2FMH sizes 45, 56 and 63



Parts	Standard	Size	Pmax. (bar) ^a	State ^b
A, B	ISO 3813	M32 x 2, 16-16mp	500	O (1+ each)
T ₁	ISO 3813 ^c	M18 x 1.5, 17 deep	3	P ^d
T ₂	ISO 3813 ^c	M18 x 1.5, 17 deep	3	O ^e

a) 16 shaft input

b) Depending on the application, momentary pressure peaks can occur. Adapt this to need when selecting measuring devices and fittings.

c) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 67).

d) The connection may be deeper than specified in the standard.

e) O = Must be connected (plugged on delivery)

X = Plugged (in normal operation)

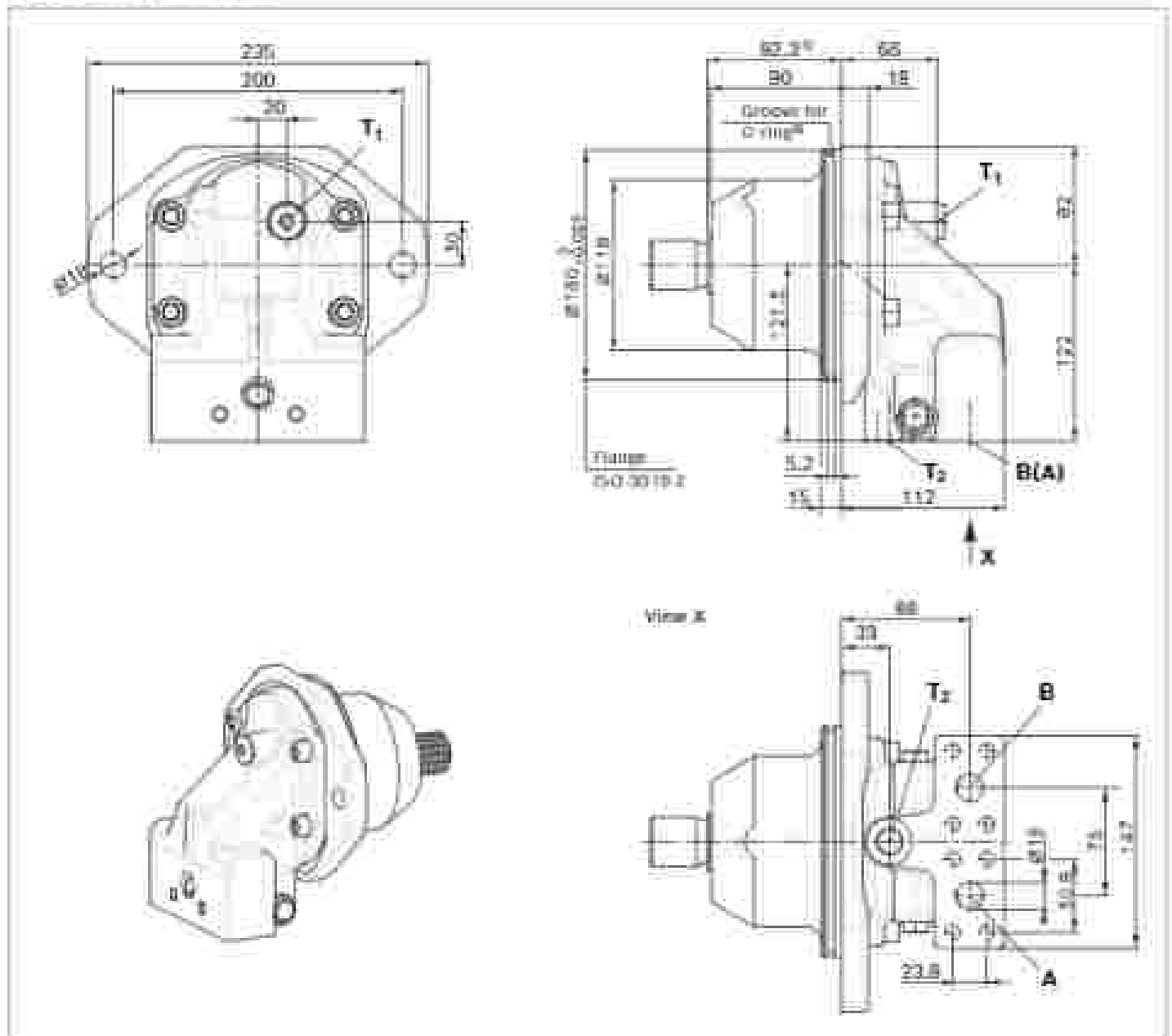
Dimensions A2FE, sizes 45 to 80

SAE working parts A and B at bottom (11)

A2FEN sizes 50, 63 and 80

A2FEM sizes 45, 50 and 63

A2FEH sizes 45, 50 and 63



Parts		Standard	Size	P_{max} [bar] ¹⁾	Stroke ²⁾
A, B	Working port fastening thread A/B	SAE J1110 DIN 13	3/8 in M10 × 1.5, 3/2 deep	300	0
T ₁	Drain port	DN 385 ³⁾	M10 × 1.5, 12 deep	3	2 ⁴⁾
T ₂	Drain port	DN 385 ³⁾	M10 × 1.5, 12 deep	3	5 ⁵⁾

1) to shaft center

2) Depending on the application, constant pressure leaks can occur. Keep this in mind when selecting measuring devices and fittings.

3) Depending on installation position, T₁ or T₂ must be connected (see also Installation instructions on page 61).

4) The counterbore may be deeper than specified in the standard.

5) O – Must be connected (plugged on delivery)

X – Plugged (in normal operation)

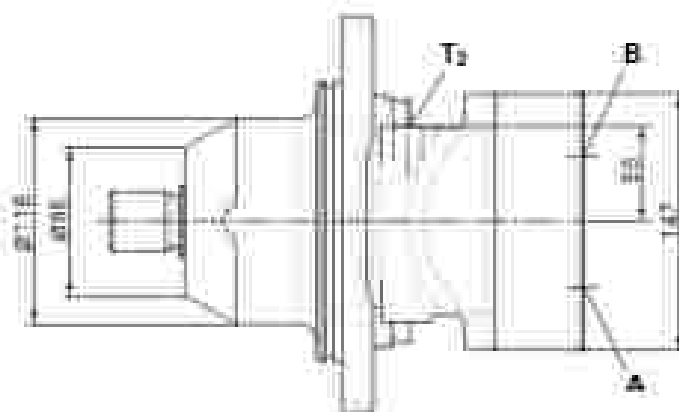
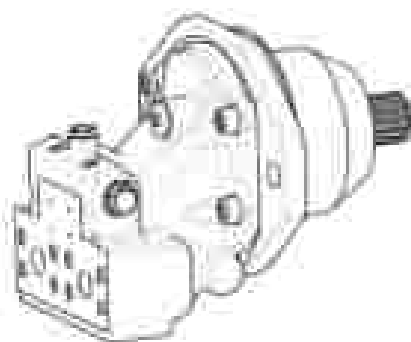
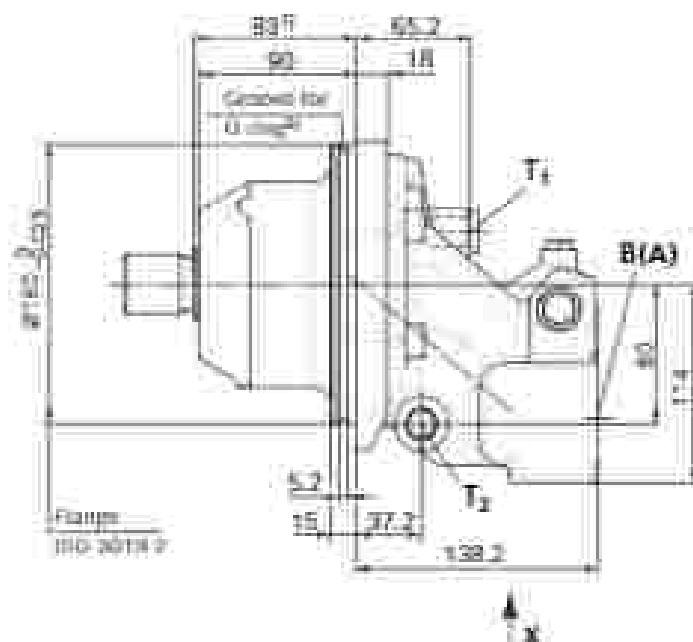
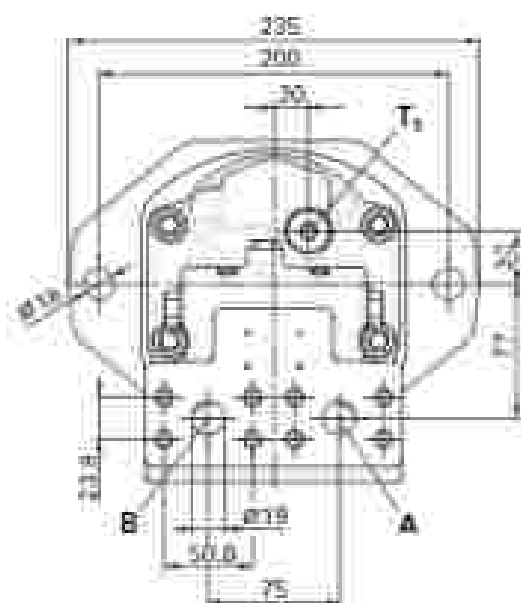
6) O ring Ø110 × 4 not included in the scope of delivery.

SAC working ports A and B at rear (51)

A2FEM 6666 341 413 and 400

ATTEND pages 45, 55 and 63

A2FEH 6255 45, 50 and 60



Parts		Standard	Size	F_{res} [bar] ¹	State ²
A, B	Working port Fastening thread (A) (1)	SAE J514 10% (1)	1/4 in M10 × 1.5, 17 deep	500	0
T ₁	Drain port	DN 2003 ³	M10 × 1.5, 12 deep	3	3 ²
T ₂	Drain port	DN 2003 ³	M10 × 1.5, 12 deep	3	0 ²

W. D. CHAFF, Editor

2. Depending on the application, momentary produced gases can often keep this in mind when selecting measuring devices and fittings.

g) Depending on teststation position, T_2 or T_3 must be corrected (see also teststation instructions on page 82).

a. The challenges may be more than identified in the statement.

As a result, the model is able to predict the number of days that a patient will be in the hospital.

 $\Delta = \text{Thyroidal TSH-related iodination}$

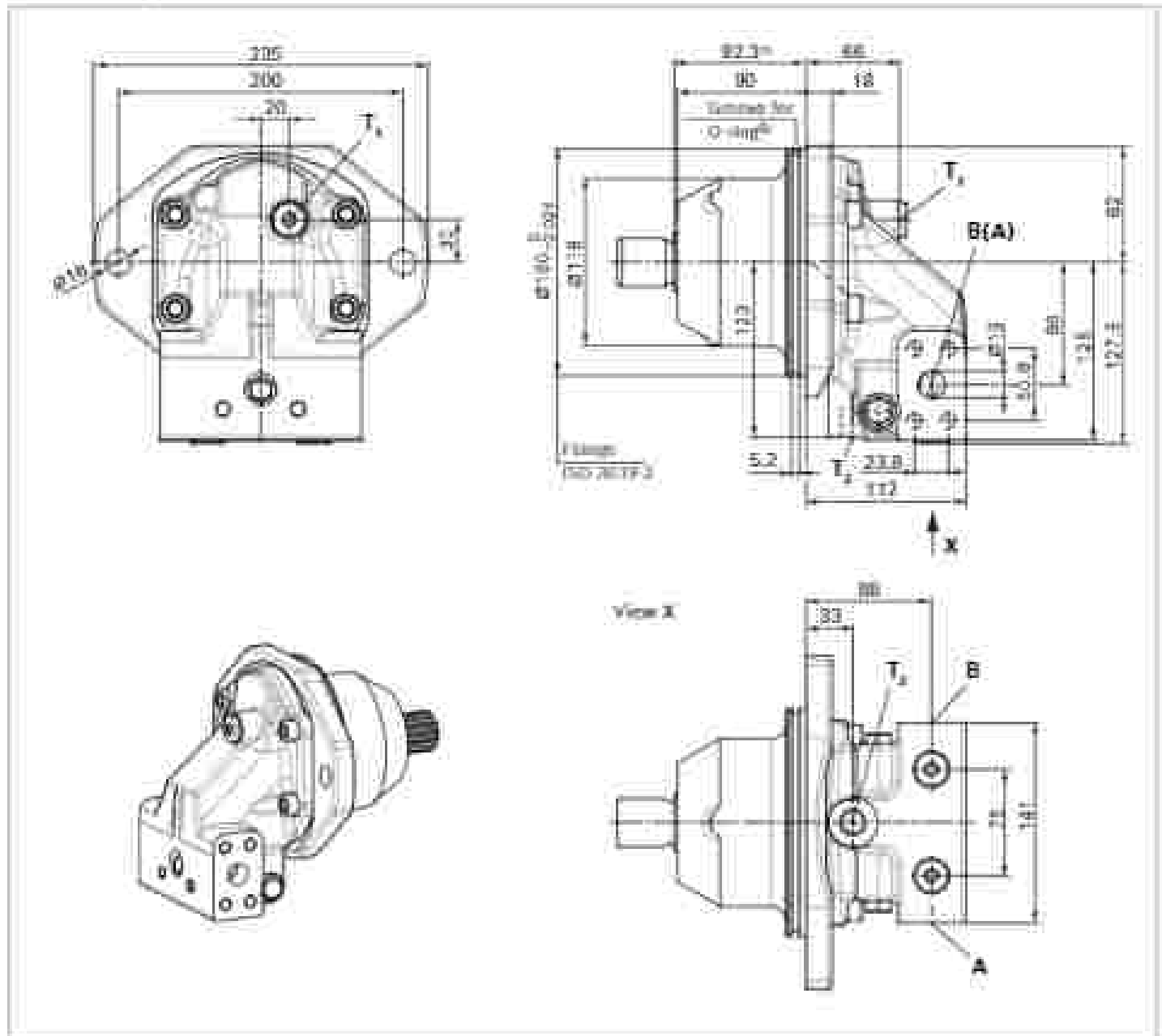
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SAE working ports at side, opposite (02)

A2FEN sizes 55, 63 and 80

A2FEM sizes 45, 55 and 63

A2FEN sizes 45, 50 and 60



Parts	Standard	Size	p_{max} [bar] ^a	State ^b
A, B	SAE J518	3/4 in	500	0
	working fluid A/B	M10 × 1.5, 17 deep		
T1	ISO 3812 ^c	M18 × 1.5, 12 deep	3	sh
T2	ISO 3812 ^c	M18 × 1.5, 12 deep	3	cr
	return port			

a. To shaft motor

b. Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

c. Depending on installation position, T1 or T2 must be connected (see also installation instructions on page 33).

d. The counterbore may be deeper than specified in the standard.

e. 0 = Must be connected (plugged in delivery)

X = Plugged (in service condition)

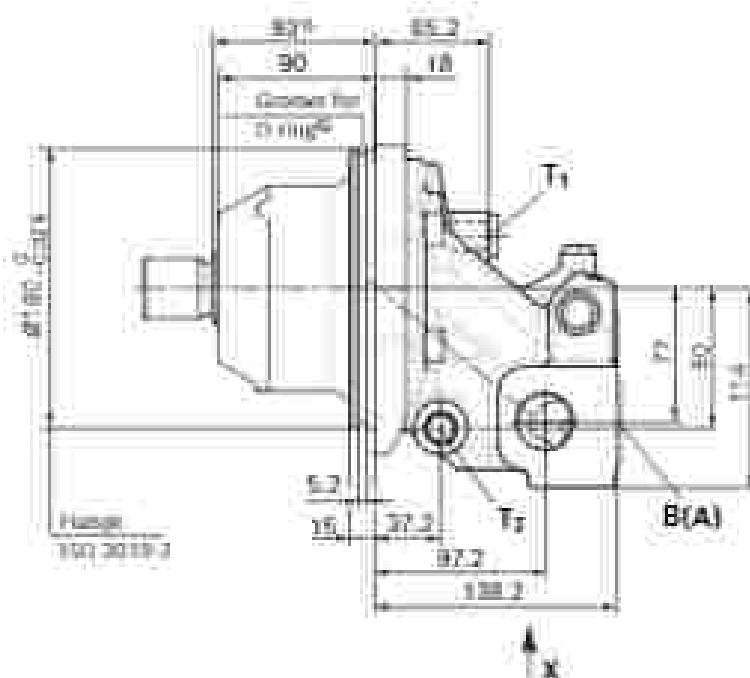
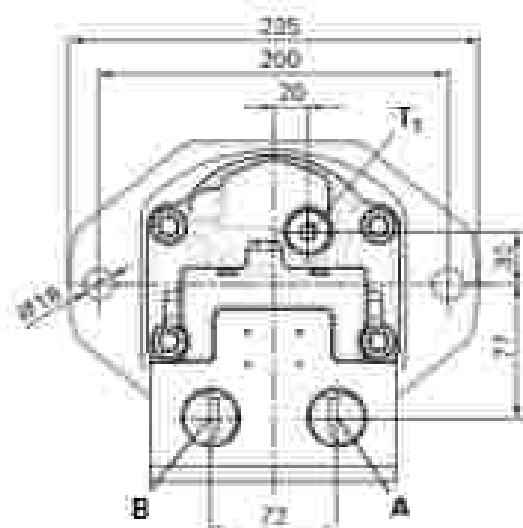
f. O ring Ø10 × 4 not included in the scope of delivery.

Threaded ports A and B at side and at rear (03)

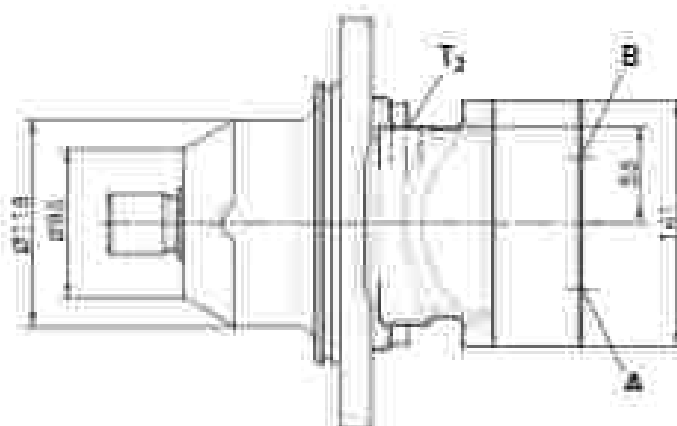
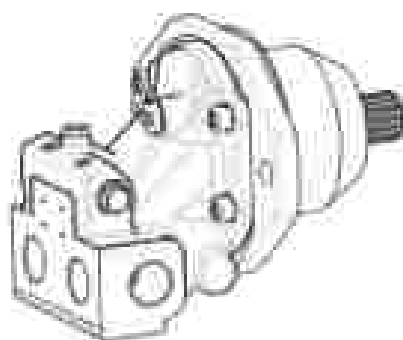
ALLEN 62540

ATTEND items 53 and 63

A2FEH 62mm 340 and 63



References



Parts		Standard	Size	Pos. Dwg. ¹⁾	State ²⁾
A, B	Working port	DN 3353	M33 = 3, 18 comp	500	0 (1+ each)
T ₁	Drain port	DN 3352 ³⁾	M18 = 1, 31 17 comp	3	3 ⁴⁾
T ₂	Drain port	DN 3353 ⁴⁾	M18 = 1, 52 17 comp	3	0 ⁴⁾

[illegible]

■ Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measures for drying and filling.

a. Depending on installation position, I_1 or I_2 must be connected
 (see also installation instructions on page 63)

a. The confidence interval may be smaller than $\frac{1}{\sqrt{n}}$ if the standard deviation is smaller than 1.

W - Must be connected (through an delivery)

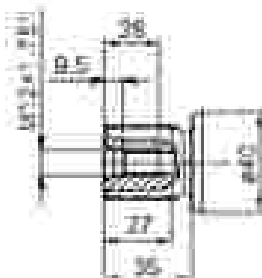
RESEARCH DESIGN

iii. O-ring of 100 x 4 mm not included in the scope of delivery.

Drive shafts, sizes 45 to 80

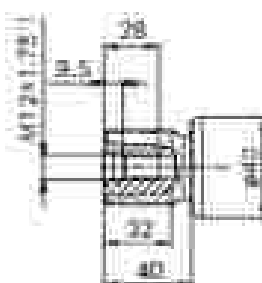
- Splined shaft DIN 6480,
Sizes 45^{a)} and 55^{a)}

28 - W50-C-14mg



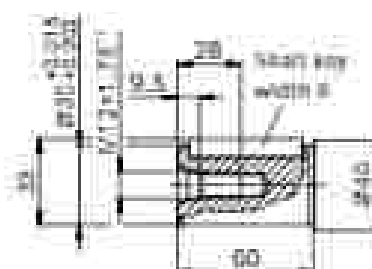
- Splined shaft DIN 6480,
Sizes 55^{a)}, 63 and 80^{a)}

28 - W75-C-15-mg



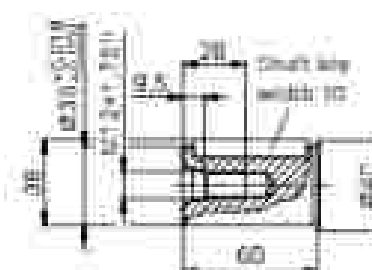
- Parallel keyed shaft DIN 6885,
Sizes 45^{a)} and 55^{a)}

76 - A55-C-10



- Parallel keyed shaft DIN 6885,
Sizes 55^{a)}, 63 and 80^{a)}

76 - A75-C-10



a) Center bore according to DIN 332 (alternatively according to DIN 101)
b) Not available for A2FM, A2FE (pressure range 450 to 500 bar)
c) Not available for A2FM, A2FE (pressure range 300 to 350 bar)
d) Only available for A2FM, A2FE (pressure range 300 to 350 bar)

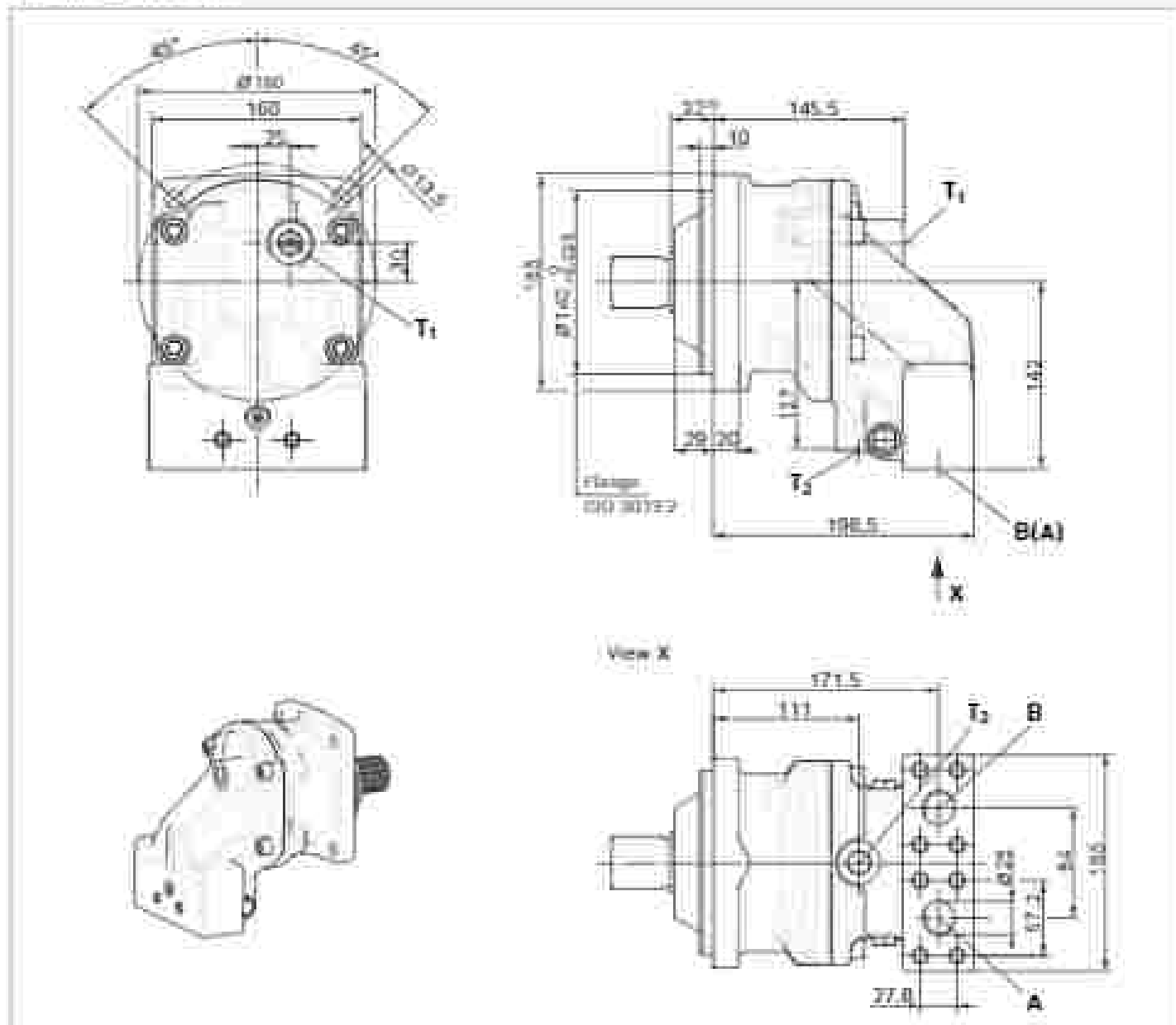
Dimensions A2FM, sizes 80 to 107

SAE working ports at bottom (11)

A2FMM sizes 90 and 107

A2FMM sizes 80 and 80

A2FMH sizes 80 and 90



Parts	Standard	Size	Press. (bar) ^a	State ^b
A, B:	SAE J2019 UNF 1/8	1/8 M12 x 1.75, 17 deep	100	O
T ₁	DN 25G ^c	M18 x 1.5, 17 deep	3	X ^d
T ₂	DN 25G ^c	M18 x 1.5, 15 deep	3	O ^d

^a To shaft collar

^b Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting the sealing devices and fittings.

^c Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 62).

^d The counterbores may be deeper than specified in the standard.

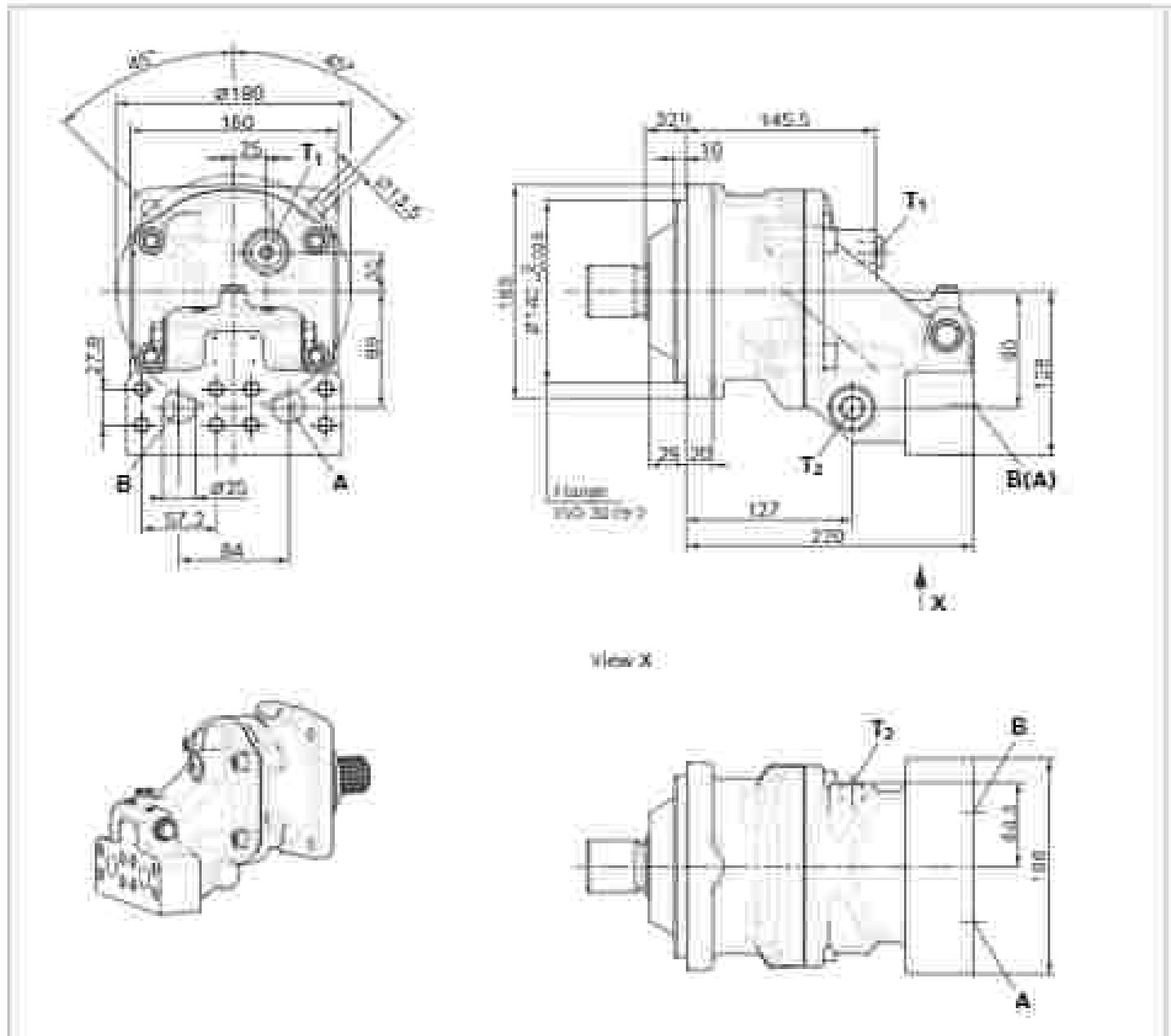
^e O - Must be connected (plugged on delivery)
X - Plugged (in normal operation)

SAE working ports A and B at rear (01)

A2FMN sizes 60 and 107

A2FMM sizes 80 and 90

A2FMH sizes 80 and 90



Parts	Standard	Size	P_{max} [bar] ¹⁾	State ²⁾
A, B	SAE J518 Orifice Ø16	1 in M12 × 1.75, 17 deep	500	O
T ₁	Orifice Ø16	M18 × 1.5, 12 deep	3	X ³⁾
T ₂	Orifice Ø16	M18 × 1.5, 12 deep	3	O ³⁾

1) In shaft order

2) Depending on the application, intermittent pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

3) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 63).

4) The coumlink may be longer than specified in the standard.

O - Must be connected (plugged on delivery)

X - Plugged (in normal condition)

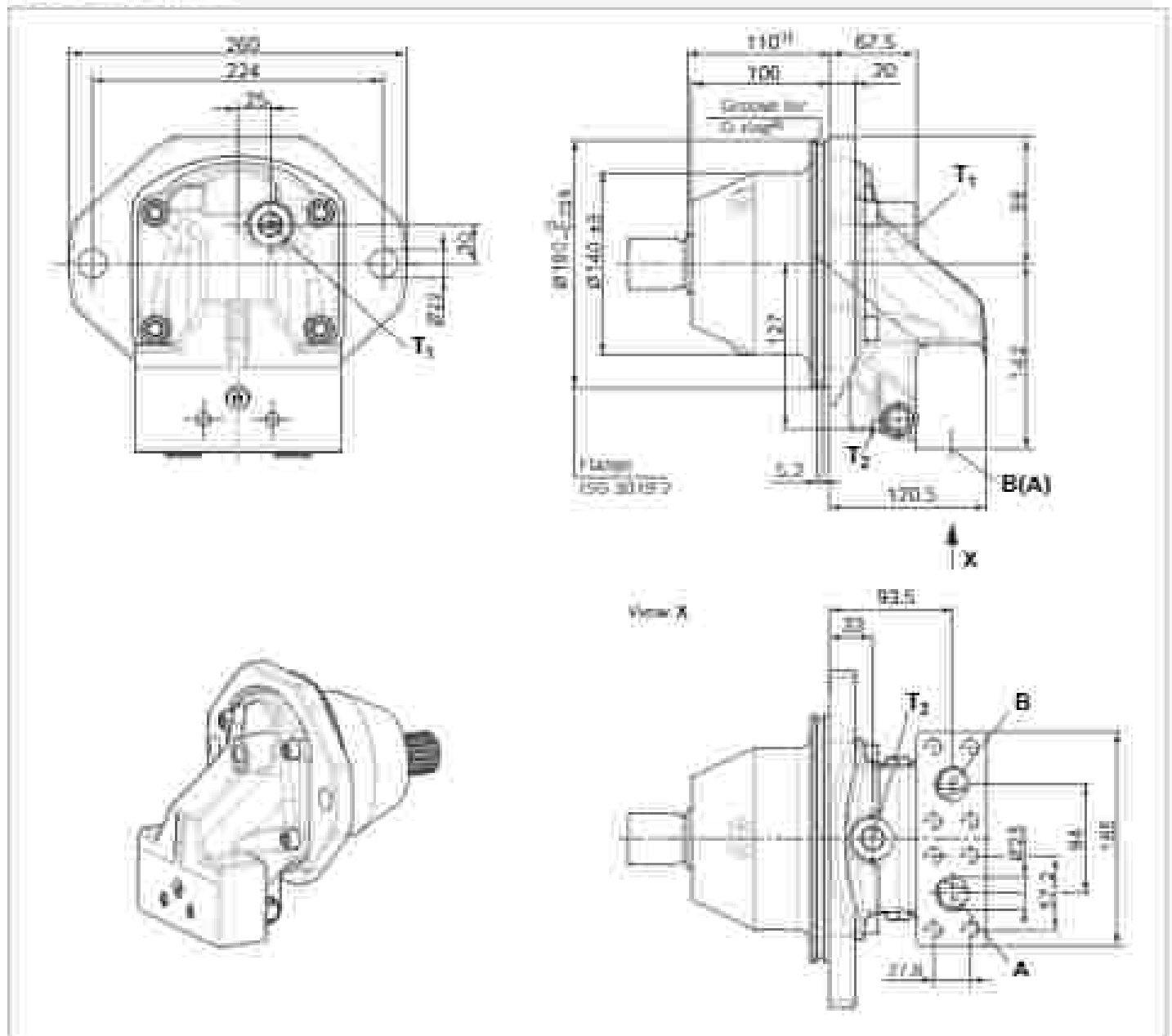
Dimensions A2FE, sizes 80 to 107

SAE working parts at bottom (11)

A2FEN sizes 90 and 107

A2FEM sizes 80 and 90

A2FEH sizes 80 and 90



Parts	Standard	Size	P_{max} bar ⁽¹⁾	State ⁽²⁾
A, B	SAE J1110 Flaring thread A/F	1 in M12 × 1.75, 17 deep	300	0
T ₁	DN 3852 ⁽³⁾	M10 × 1.5, 12 deep	3	2 ⁽⁴⁾
T ₂	DN 3852 ⁽³⁾	M10 × 1.5, 12 deep	3	2 ⁽⁴⁾

a) In shaft only

b) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

c) Depending on installation position, T₁ or T₂ must be connected (see also Installation Instructions on page 61).

d) The coefficient may be higher than specified in the standard.

e) 0 = Must be connected (plugged on delivery)

2 = Plugged (in normal operation)

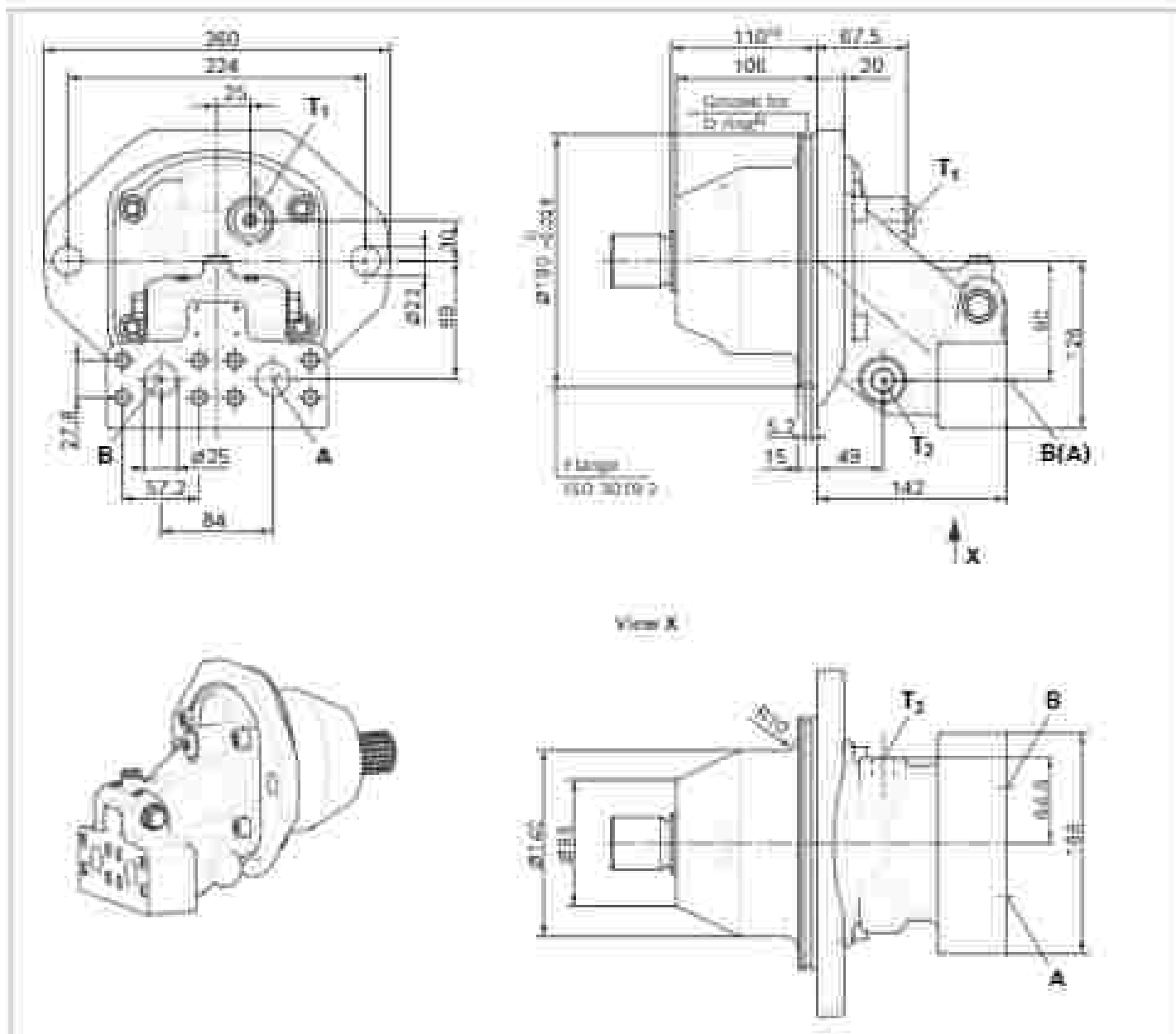
f) O-ring Ø 100 × 4 not included in the scope of delivery.

SAE working ports A and B at rear (G1)

A2FEN sizes 90 and 107

A2FEM sizes 90 and 90

A2FEH sizes 90 and 90



Parts	Standard	Size	Pos. (mm)	State
A, B	Working port Unfueled thread A/B	1/2"	100	0
T1	Drain port	M18 x 1.5, 1/2 deep	3	X ^a
T2	Drain port	M18 x 1.5, 1/2 deep	3	O ^b

^a To shaft collar

^b Depending on the application, secondary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

^c Depending on installation position, T1 or T2 must be connected (see also installation instructions on page 67).

^a The condition may be deeper than specified in the standard.

^b O - Must be connected (plugged on delivery)

^c X - Plugged (in normal operation)

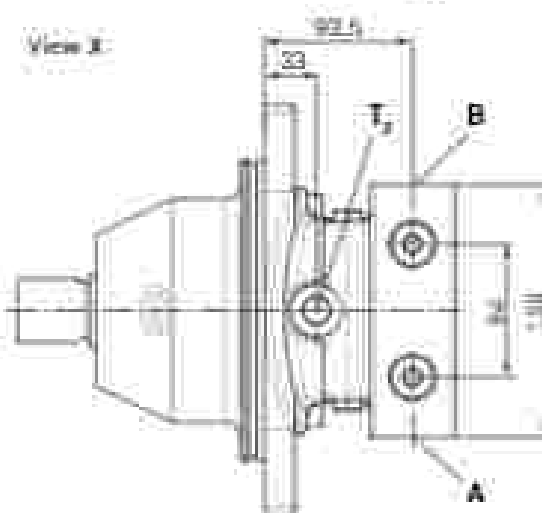
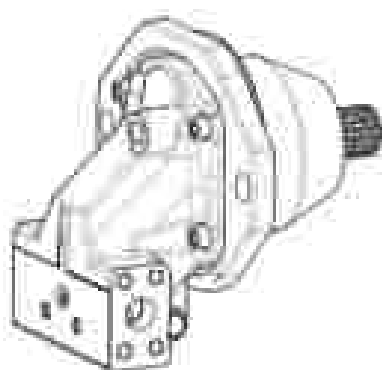
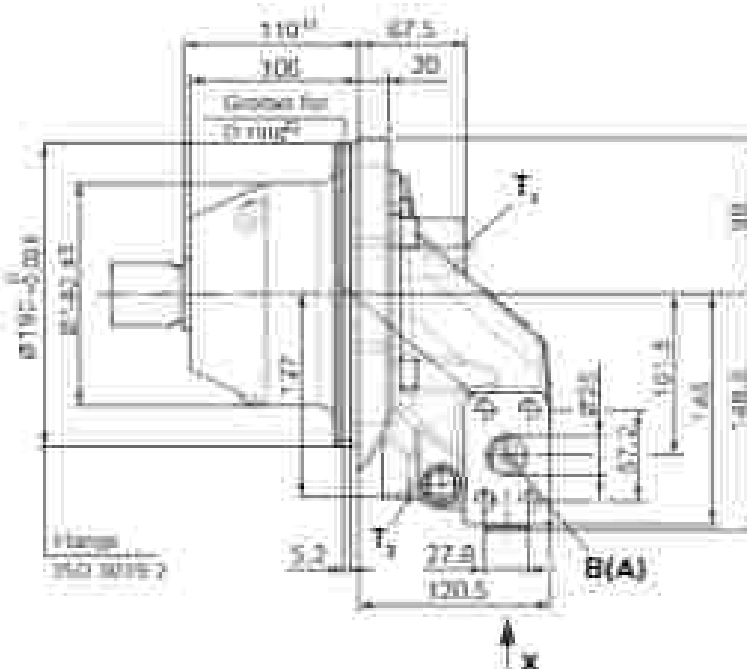
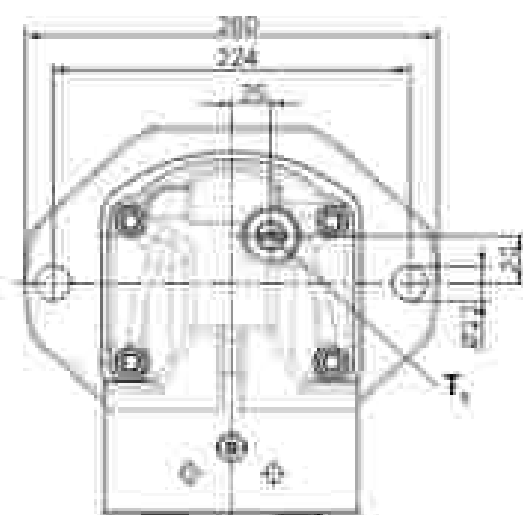
^d O-ring Ø 110 x 4 not included in the scope of delivery.

SAE working ports at side, opposite (03)

A2FEN 30 and 107

ATTEMPTING TO GO AND NO

A2FEH 98ms 20 and 30



Parts		Standard	Size	P_{max} (bar) ¹	State ²
A_1 & A_2	Working part fastening thread A/B	SAE J514 DIN 13	1 in M12 × 1.25, 17 deep	3.00	0
T_1	Drain part	DIN 934 ³	M18 × 1.5, 12 deep	3	3 ⁴
T_2	Drain part	DIN 934 ³	M18 × 1.5, 12 deep	3	0 ⁴

[illegible]

21. Depending on the application, monetary premium peaks can occur. Keep this in mind when selecting monetary amounts and bills.

2. Depending on installation position, T_2 or T_3 must be connected (see also installation instructions on page 90).

a. The characteristic may be stronger than specified in the standard

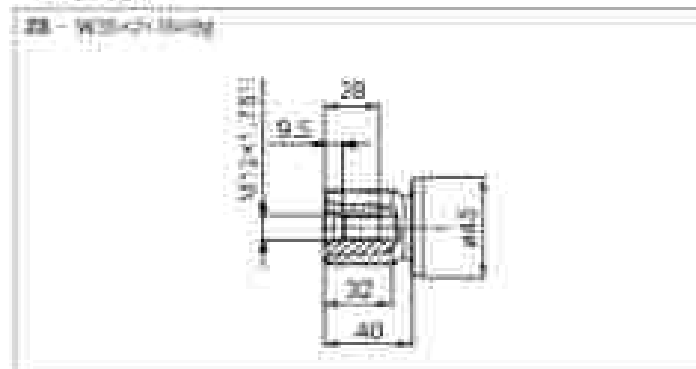
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1. Flipped classroom conditions

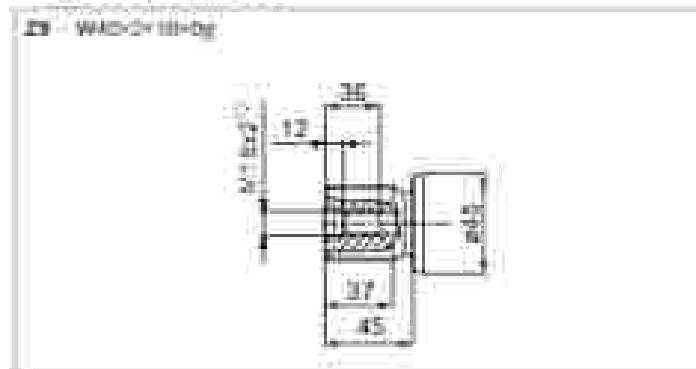
ii. Owing to the α - β unsaturation in the α - β unsaturated ketone, the α - β unsaturated ketone is more reactive than the α - β unsaturated ketone.

Drive shafts, sizes 80 to 107

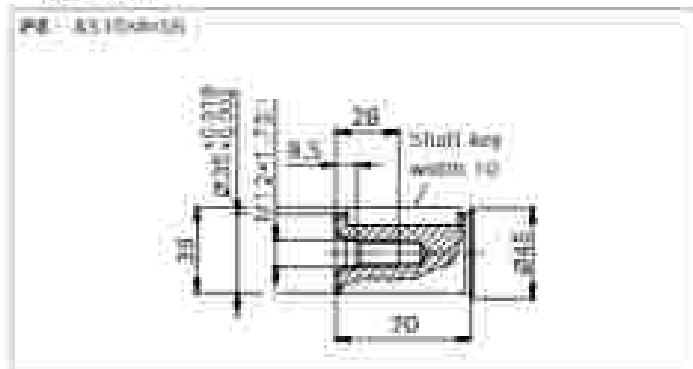
- Splined shaft DIN 5480,
Size 80^a



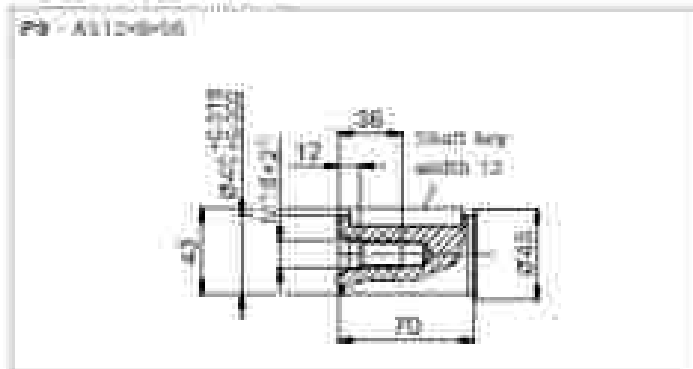
- Splined shaft DIN 5480,
Size 90^b, 90 and 107^b



- Parallel keyed shaft DIN 6805,
Size 80^a



- Parallel keyed shaft DIN 6805,
Size 90^b, 90 and 107^b



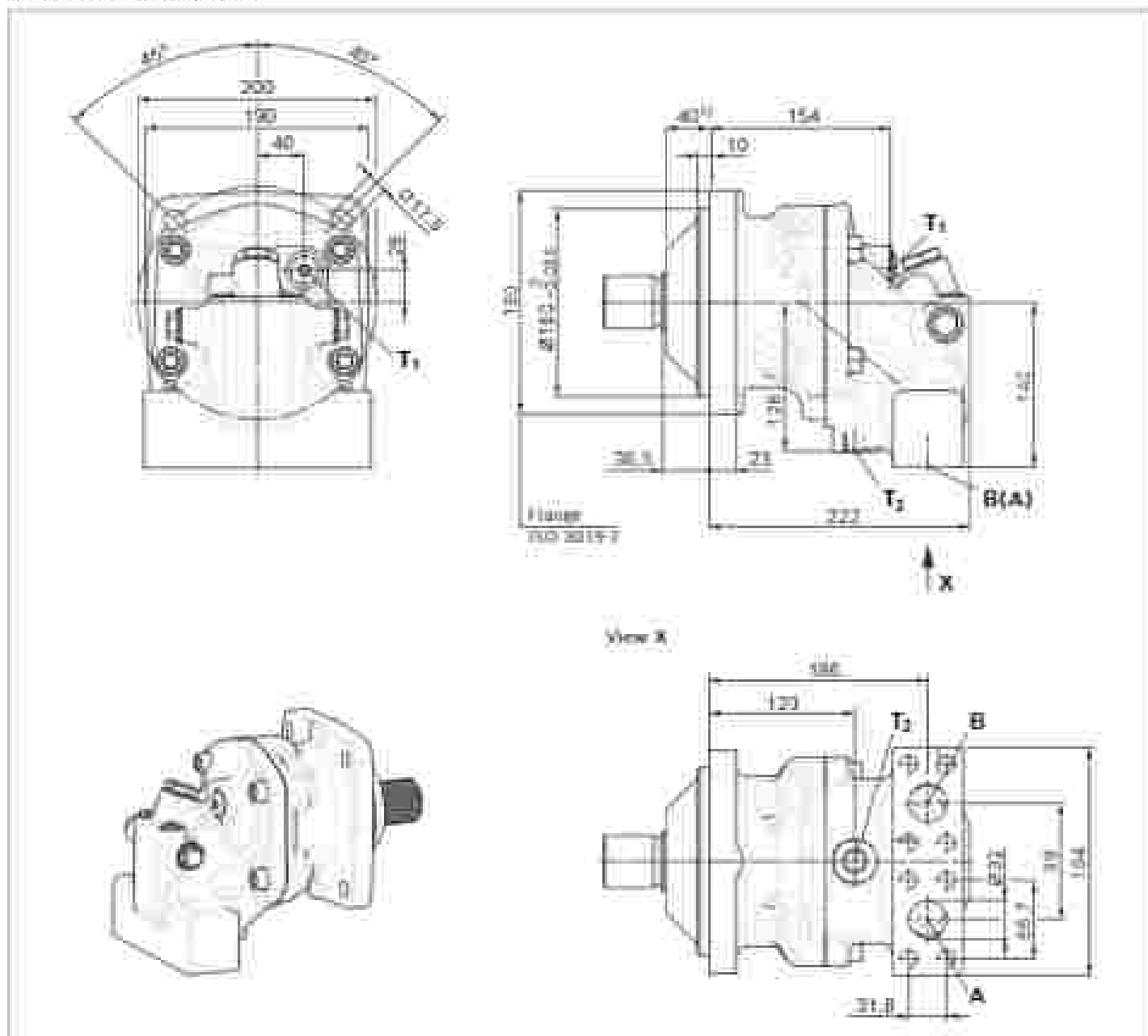
a. Center bore according to DIN 232 (thread according to DIN 133)
b. Not available for A2FM, A2FE (pressure range 400 to 500 bar)
c. Not available for A2FM, A2FE (pressure range 300 to 350 bar)
d. Only available for A2FM, A2FE (pressure range 300 to 350 bar)

Dimensions A2FM, sizes 107 and 125

SAE working parts at bottom (11)

A2FMM sizes 107 and 125

A2FMM sizes 107 and 125



Parts	Standard	Size	P_{max} [bar] ¹⁾	State ²⁾
A, B	SAE J518 DIN 13	1.124 in M14 × 1, 23 deep	500	O
T ₁	DIN 3524 ³⁾	M18 × 1.5, 12 deep	3	X ⁴⁾
T ₂	DIN 3524 ³⁾	M18 × 1.5, 12 deep	3	O ⁵⁾

1) To shaft (max)

2) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

3) Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 43).

4) The connection may be longer than specified in the standard.

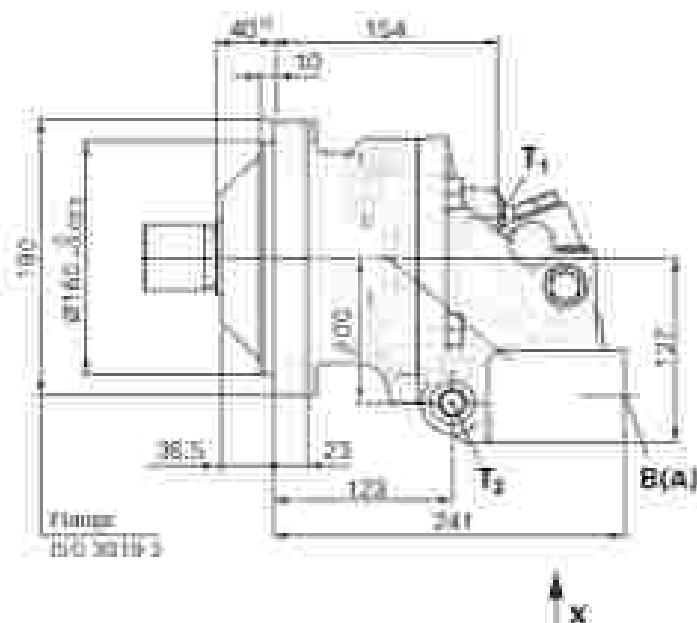
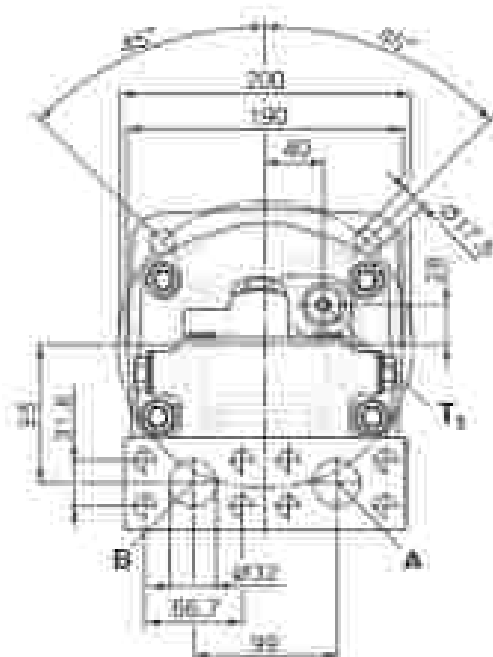
5) O = Must be connected (plugged in delivery)

X = Plugged (in excess condition)

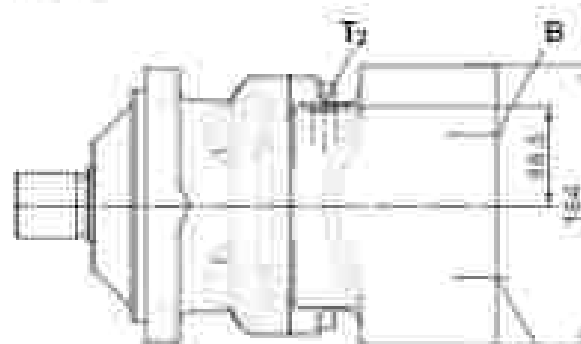
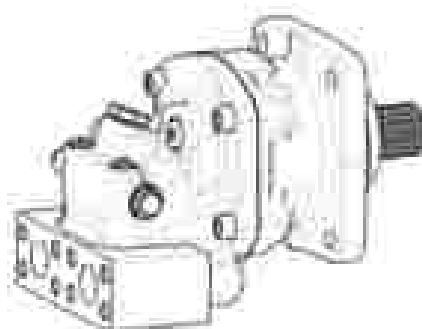
SAE working ports at rear (B1)

A2FMM sizes 107 and 125

A2FMM sizes 107 and 125



View X



Parts	Standard	Size	Press. (bar) ^a	State ^b
A, B	Working ports Fastening thread A/B	SAE 20-16 DN 12	1: 1/4 in M14 x 2, 21 deep	500 O
T ₁	Drive port	DN 20/2 ^c	M16 x 1.5, 12 deep	1 O ^d
T ₂	Drive port	DN 20/2 ^c	M16 x 1.5, 12 deep	1 O ^d

^a 10 shall apply

^b Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring device and fittings.

^c Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 67).

^d The dimensions may be deeper than specified in the standard.

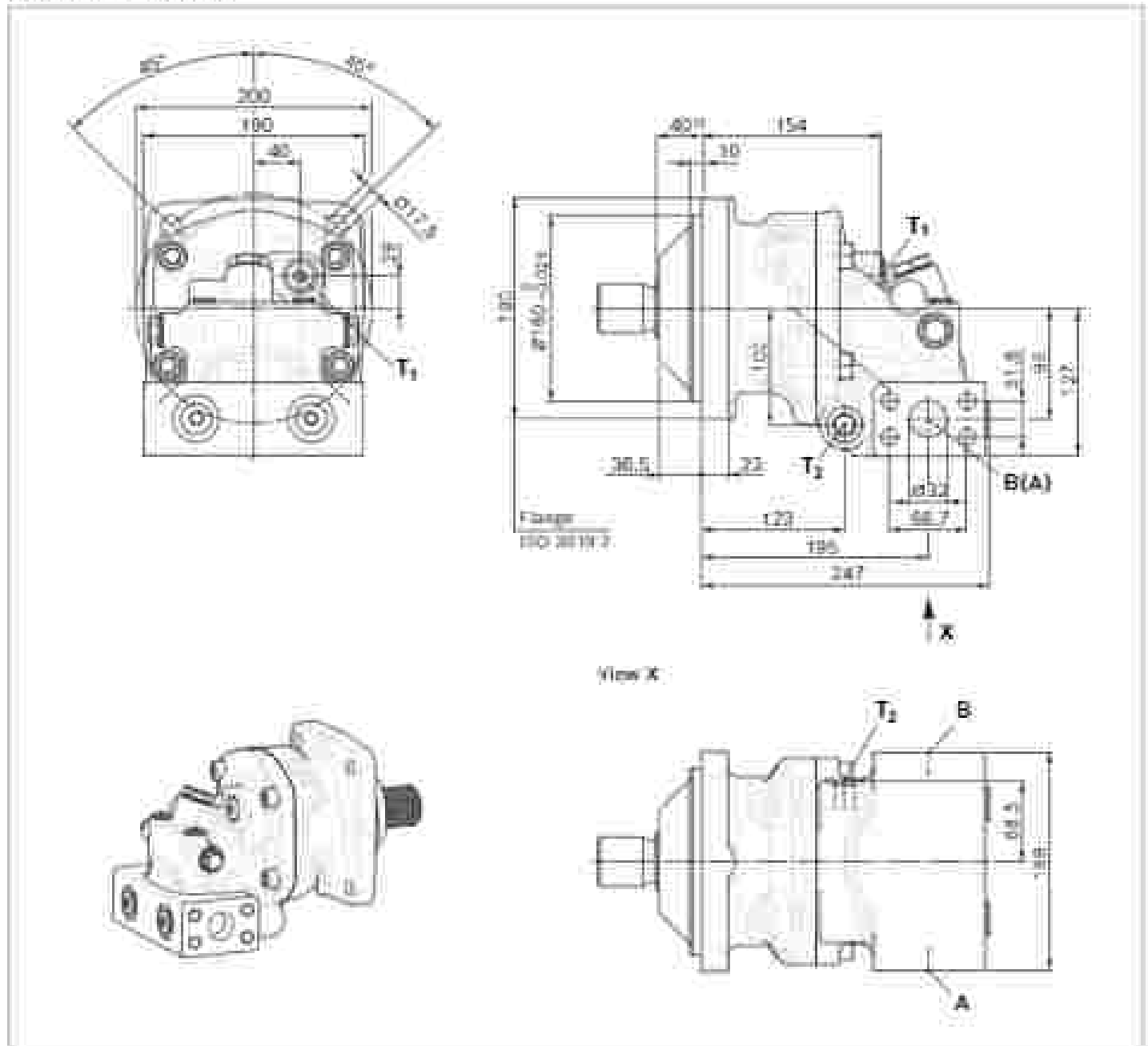
O = Must be connected (plugged on delivery)

Ø = Plugged (is normal position)

SAE working ports at side, opposite (02)

A2FMM sizes 107 and 125

A2FMM sizes 107 and 125



Parts	Standard	Size	P_{max} [bar] ¹⁾	State ²⁾
A, B	SAE J518 Orifice 13	1.124 in M14 x 1, 23 deep	500	0
T ₁	Orifice 3/32"	M18 x 1.5, 12 deep	3	X ³⁾
T ₂	Orifice 3/32"	M18 x 1.5, 12 deep	3	0 ³⁾

¹⁾ To shaft code

²⁾ Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring devices and tubing.

³⁾ Depending on installation position, T₁ or T₂ must be connected
(see also installation instructions on page 60).

⁴⁾ The counterbore may be deeper than specified in the standard.

0 - Must be connected (plugged in delivery)

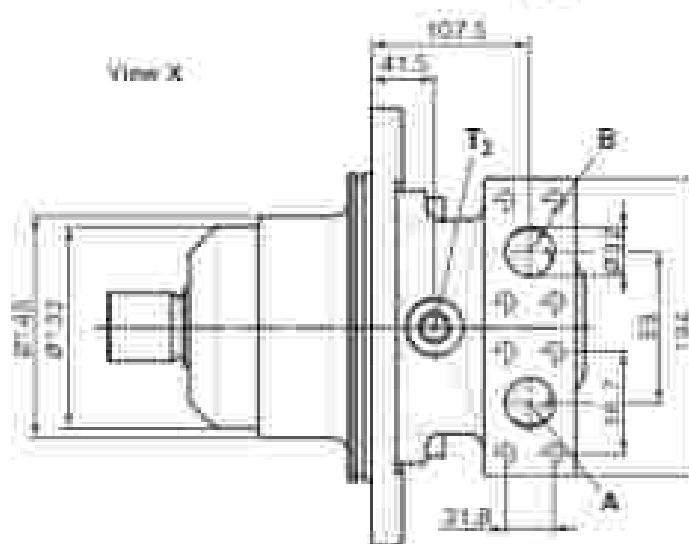
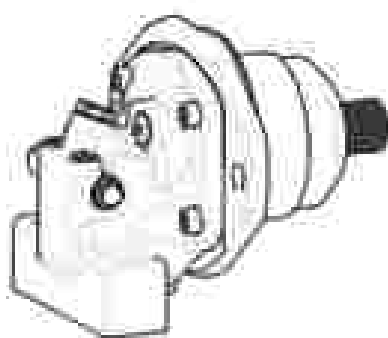
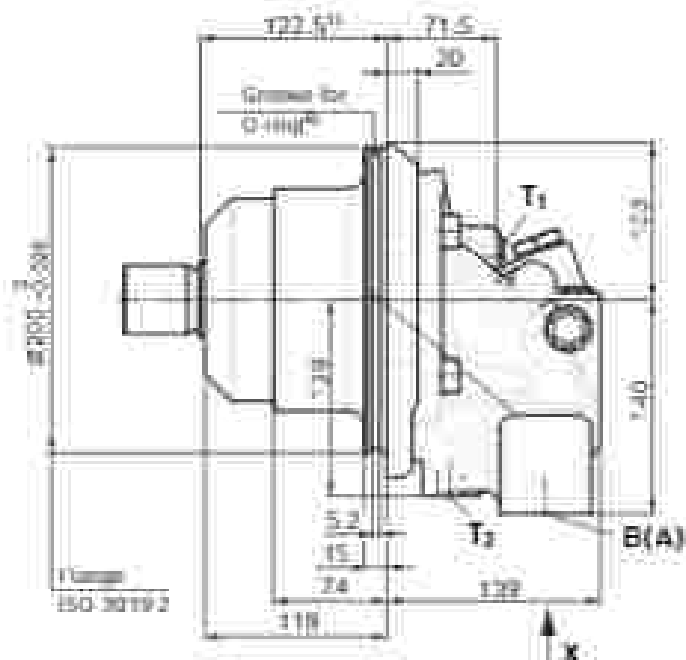
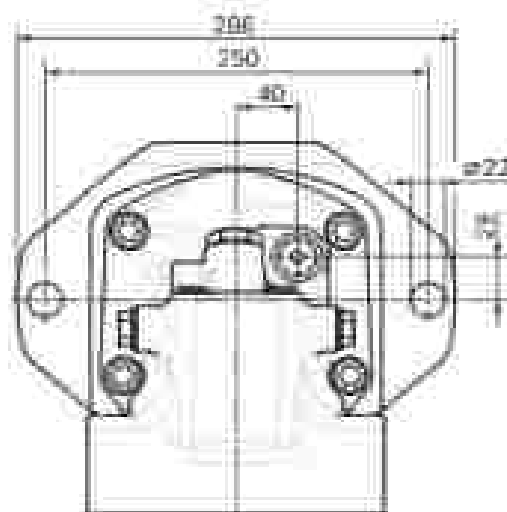
X - Plugged (in serial operation)

Dimensions A2FE, sizes 107 and 125

SAE working ports at bottom (11)

AEFEM 50TH 107 AND 125

A2FEM 3000 10T and 125



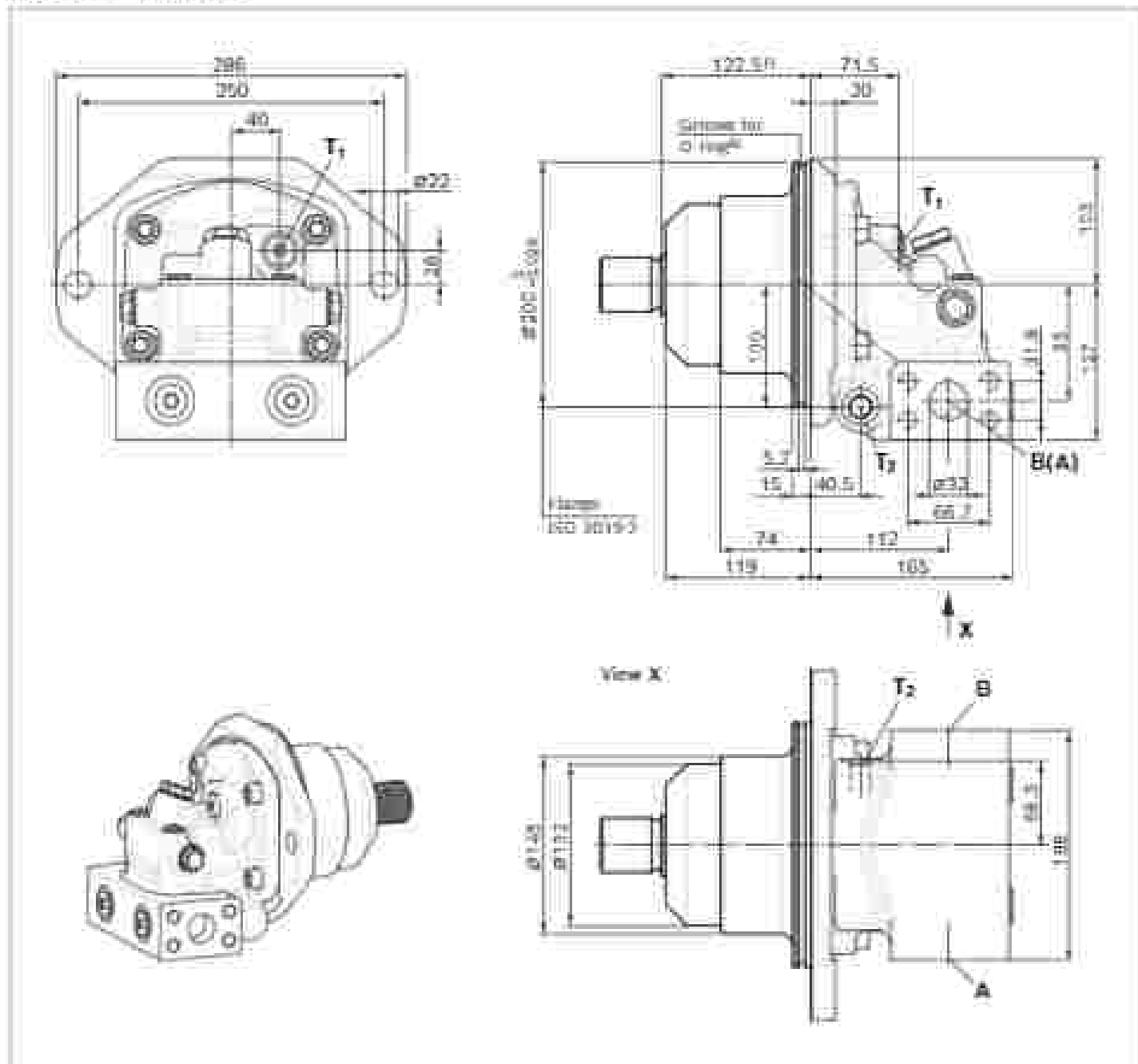
Parts		Standard	Size	F_{max} [N/m²]	State ¹⁾
A, B	Working port Fastening thread (A/B)	SAE J514 UNF 11	1 1/4 W M16 x 2, 23 mm	100	9
T ₁	Drain port	SW 2813 [®]	M18 x 1.5, 17 mm	3	10
T ₂	Drain port	UNF 3813 [®]	M18 x 1.5, 17 mm	3	10

- | | |
|---|--|
| <p>a. It shall collar.</p> <p>b. Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring device and fittings.</p> <p>c. Depending on installation position, F_1 or F_2 must be connected (see also installation instructions on page 632).</p> | <p>d. The command Δ may be deeper than specified in the standard.</p> <p>e. Δ - Must be connected (plugged in delivery)
 $\times$ - Plugged (in normal installation)</p> <p>f. Δ - Ring M 102 = if not included in the scope of delivery.</p> |
|---|--|

SAE working ports at side, opposite (82)

A2FEM sizes 107 and 125

A2FEM sizes 107 and 125



Ports	Standard	Size	Press. (bar) ^a	State ^b
A, B Working port Fastening thread A/B)	SAE J2011 UNF 1/1	1 1/4 in M14 x 2, 23.8mm	500	O
T1 Drain port	DNF 3812 ^c	M18 x 1.5, 17 deep	3	Y ^d
T2 Drain port	DNF 3812 ^c	M18 x 1.5, 17 deep	3	O ^d

a) In shaft motor

b) Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

c) Depending on installation position, T1 or T2 must be connected (see also installation instructions on page 62).

d) The maximum may be deeper than specified in the standard.

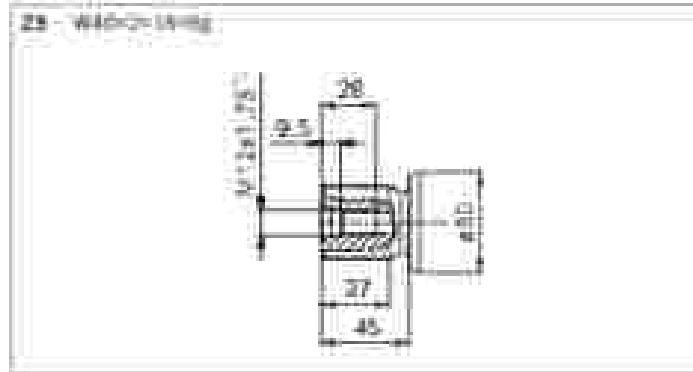
Y - Must be connected (plugged on delivery)

X - Plugged (in normal operation)

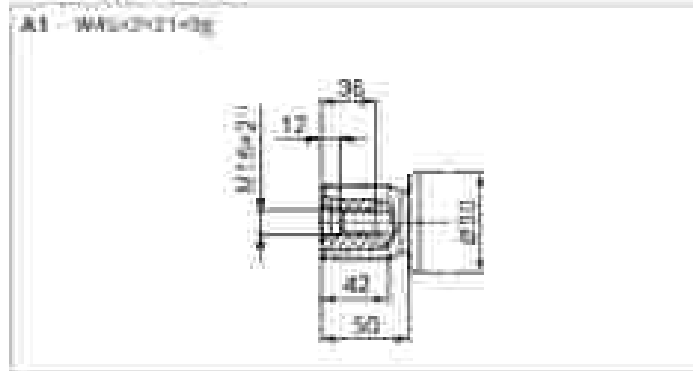
O - Ring Ø 102 x 4 not included in the scope of delivery.

Drive shafts, sizes 107 and 125

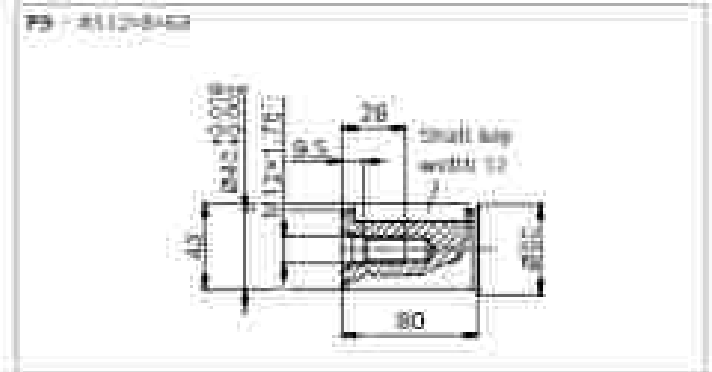
- Splined shaft DIN 5480,
Size 107^{a)}



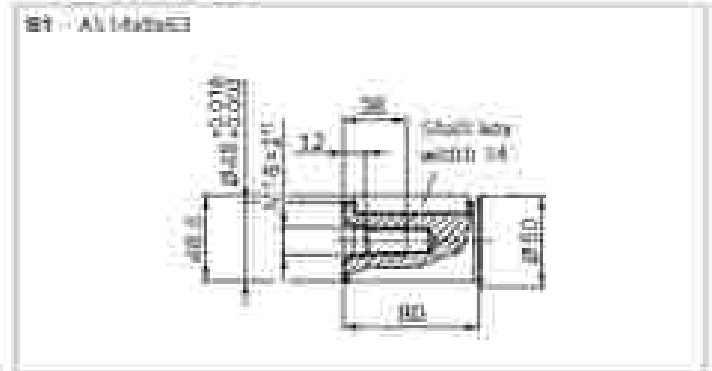
- Splined shaft DIN 5480,
Size 107^{b)} and 125



- Parallel keyed shaft DIN 6885,
Size 107^{a)}



- Parallel keyed shaft DIN 6885,
Size 107^{b)} and 125

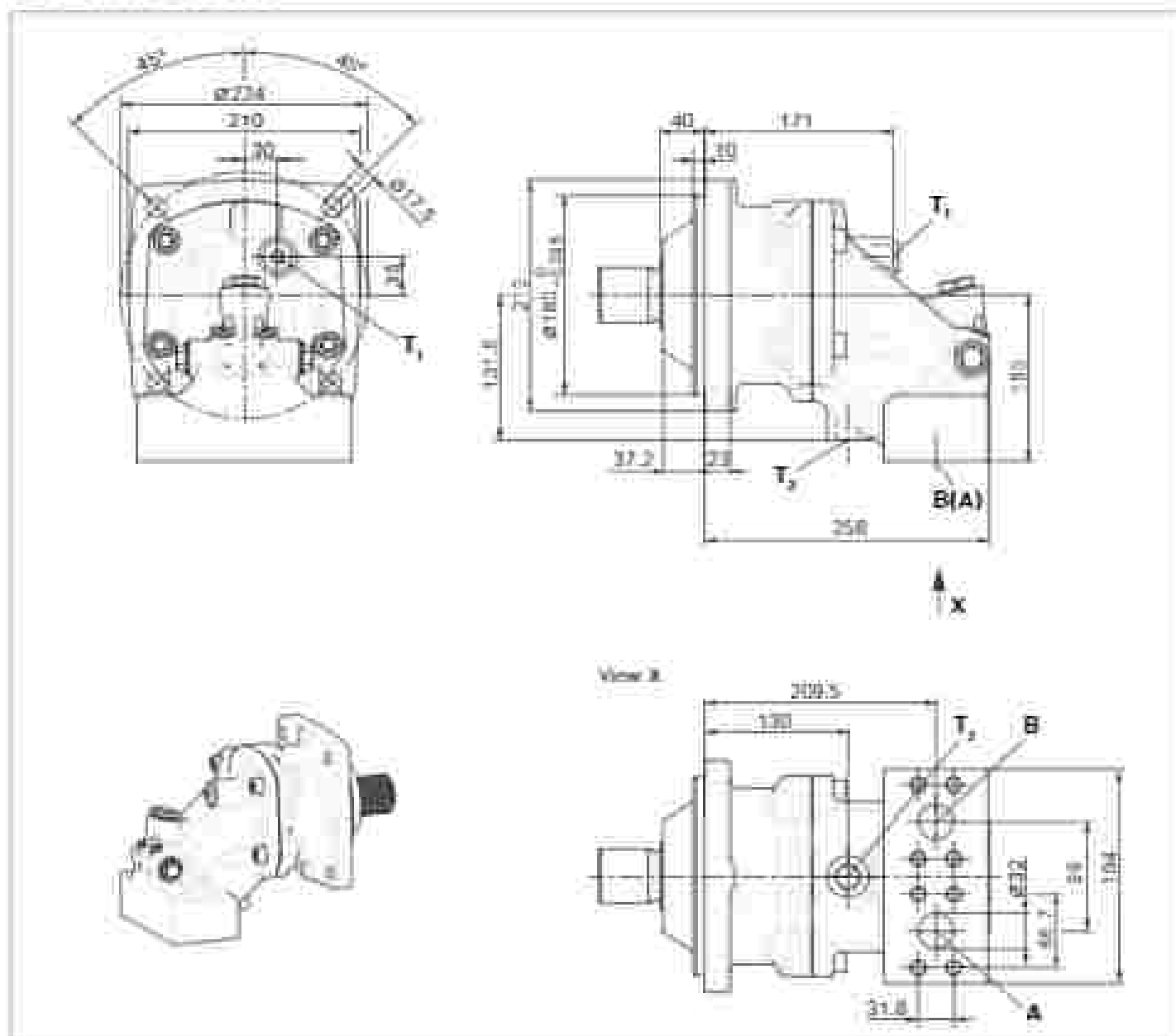


a) Center bore according to DIN 302 (fillet according to DIN 12)
b) Not available for A2FM/A2FE (pressure range 200 to 350 bar)

Dimensions A2FM, sizes 160 and 180

SAE working ports at bottom (11)

A2FMM sizes 160 and 180



Parts	Standard	Size	Pressure ^{a)}	State ^{b)}
A, B	SAE J2018 DIN 11	1 1/4 in M14 x 2, 21 deep	450	0
T ₁	ISO 3812 ^{c)}	M22 x 1.5, 14 deep	3	1 ^{b)}
T ₂	ISO 3812 ^{c)}	M27 x 1.5, 14 deep	3	0 ^{b)}

^{a)} To shell only

^{b)} Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring device and fittings.

^{c)} Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 67).

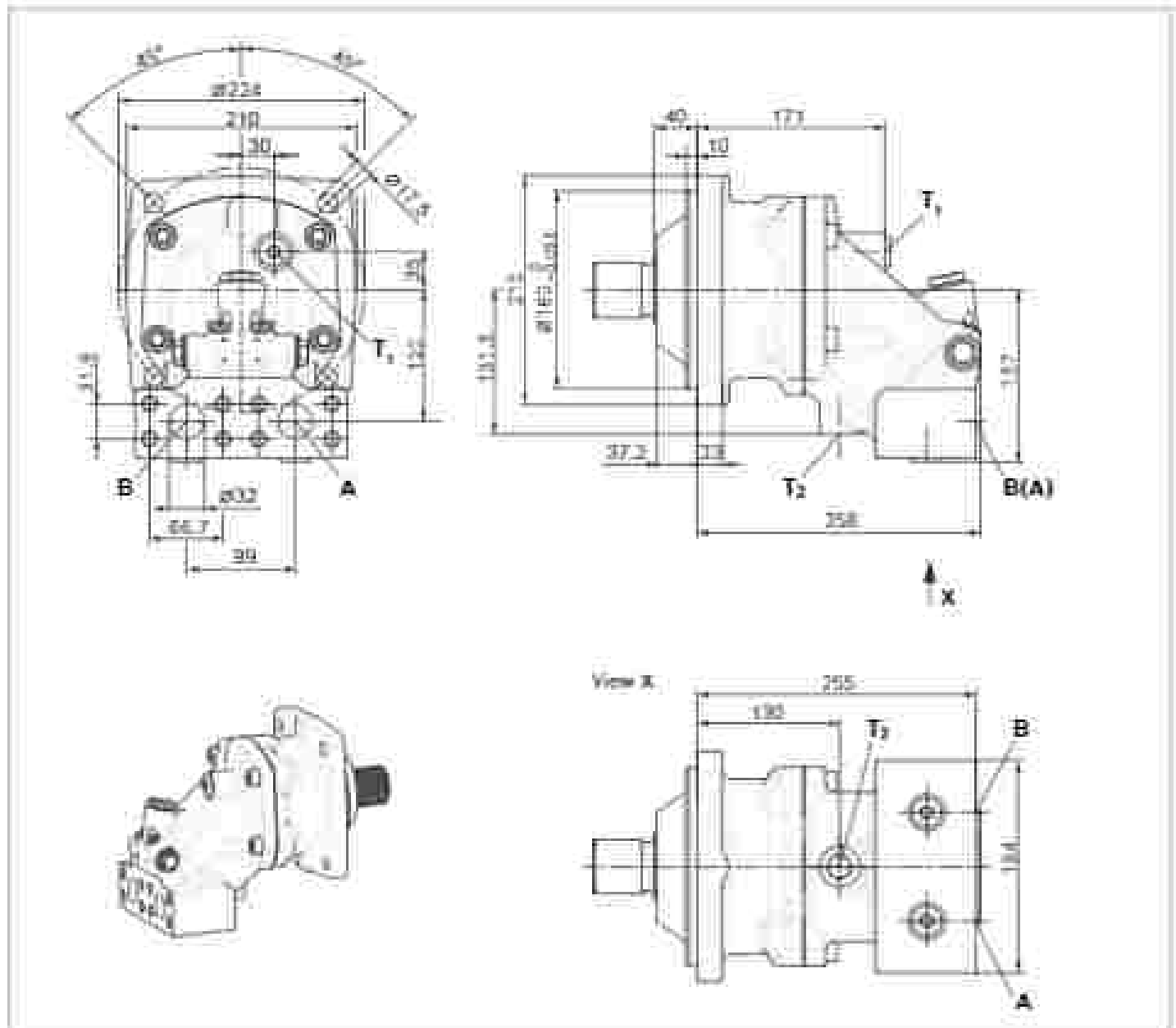
^{d)} The dimensions may be deeper than specified in the standard.

^{e)} 0 - Must be connected (plugged on delivery)

^{f)} 1 - Plugged (is normal position)

SAE working ports at rear (Ø1)

A2FMM sizes 100 and 100



Parts	Standard	Size	P_{max} [bar] ^a	State ^b
A, B	SAE J514H DIN 13	1.1/4 in M14 x 2, 23 deep	450	O
T ₁	DIN 3852 ^c	M22 x 1.5, 14 deep	3	X ^b
T ₂	DIN 3852 ^c	M22 x 1.5, 14 deep	3	O ^b

a. 10 shaft mm2

b. Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring devices and fittings.

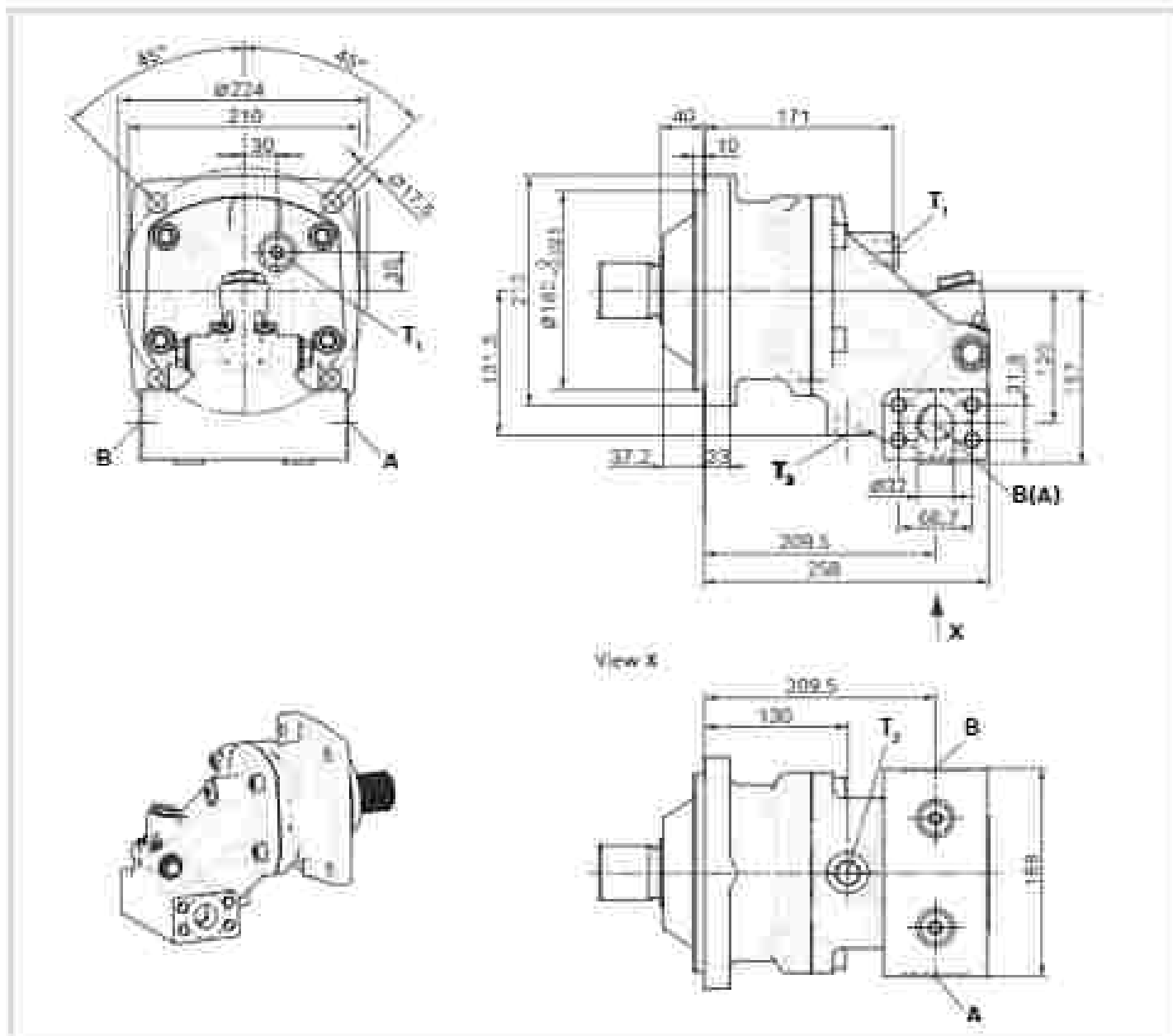
c. Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 50).

d. The connection may be longer than specified in the standard.

e. O → Must be connected (plugged in delivery)

X → Plugged (in normal condition)

SAE working ports at side, opposite (B2)
A2FMM sizes 160 and 180



Parts	Standard	Size	Press. (bar) ^a	State ^b
A, B	Working port Fastening thread A/B	102.25/16 DN 13	1.1/4 in M14 = 3, 23 deep	450 O
T ₁	Drive port	DN 38.1 ^c DN 38.1 ^c	M22 = 1.7, 14 deep M22 = 1.5, 14 deep	3 O
T ₂	Drive port	DN 38.1 ^c DN 38.1 ^c	M22 = 1.7, 14 deep M22 = 1.5, 14 deep	3 O

^a To shell only

^b Depending on the application, momentary pressure peaks can occur. Keep this in mind when selecting measuring device and fittings.

^c Depending on installation position, T₁ or T₂ must be connected (see also installation instructions on page 67).

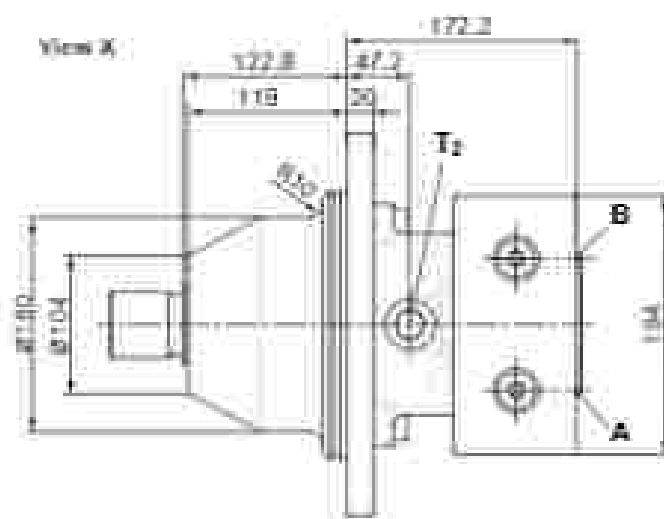
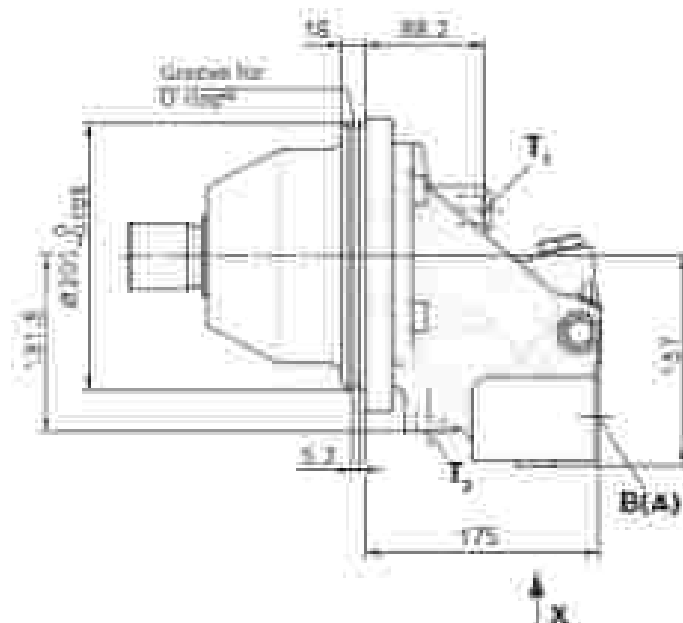
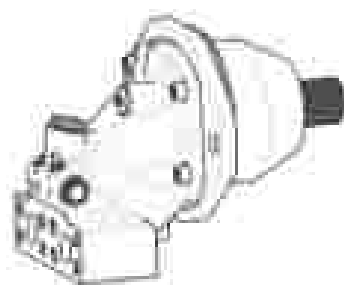
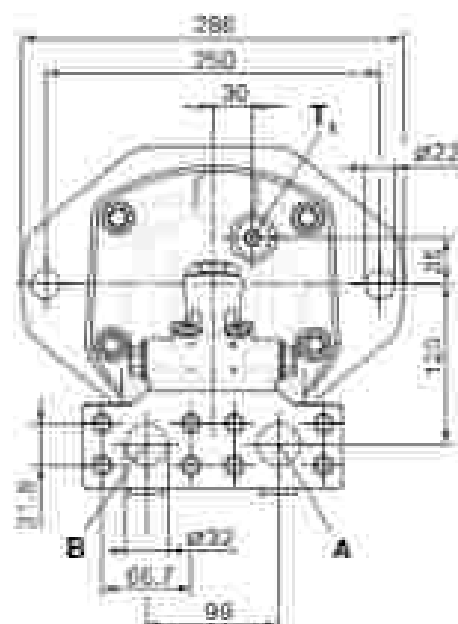
^d The manufacturer may be deeper than specified in the standard.

O = Must be connected (plugged on delivery)

X = Plugged (is normal operation)

SAE working ports at rear (201)

A3FEM uses 100 and 150



Parts		Standard	Size	Press (bar) ¹	State ²
A, B	Working port Fastening thread A/B	G3/8" J510 UNF 7/8	1 1/4 in M14 = 3, 23 deep	450	0
T ₁	Drain port	DN 3012 ³	M23 = 1.3(14 deep	3	2 ⁴
T ₂	Drain port	DN 3012 ³	M23 = 1.5(14 deep	3	0 ⁴

[illegible]

g. Depending on the application, momentary premium peaks can occur. About this, it must be noted when selecting measuring devices and fittings.

8. Depositing on ventilation position, P_1 or P_2 must be connected from plus ventilation distribution on point 8/21.

6. The password may be shorter than specified in the attached

10. O - Must be completed (regardless of delivery)

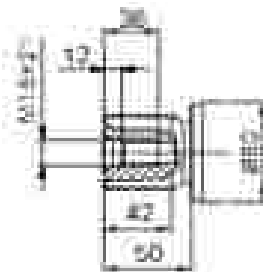
26. **Answer: D** The correct answer is D. The correct answer is D.

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Drive shafts, sizes 160 and 180

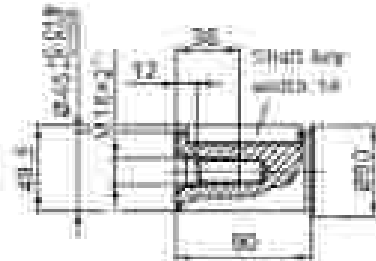
- Splined shaft DIN 5480,
Size 160

A1 - With O-ring



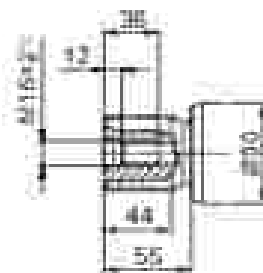
- Parallel keyed shaft DIN 6801,
Size 160

B1 - AS (AS-PM-F)



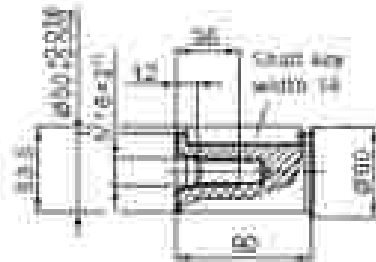
- Splined shaft DIN 5480,
Size 160 and 180

A2 - With O-ring



- Parallel keyed shaft DIN 6801,
Size 160 and 180

B2 - AS (AS-PM-F)



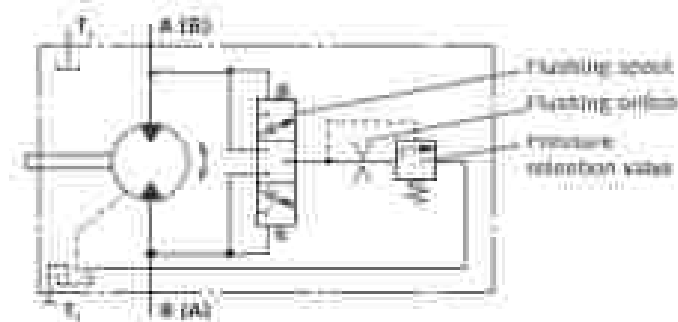
Flushing and boost-pressure valve, integrated

The flushing and boost-pressure valve is used to remove heat from the hydraulic circuit.

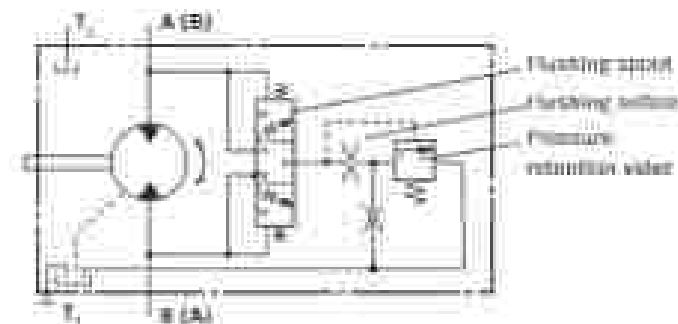
In a closed circuit, it is used for flushing the housing and safeguarding the minimum boost pressure.

Hydraulic fluid is directed from the respective low-pressure side into the motor housing. This is then led into the reservoir, together with the leakage. In the closed circuit, the removed hydraulic fluid must be replaced by cooled hydraulic fluid supplied by the boost pump.

• Circuit diagram, sizes 23 to 107(N)



• Circuit diagram, sizes 107 to 180



Cracking pressure of pressure retention valve
(observe when setting the primary valve)

- Sizes 23 to 100, fixed setting 16 bar

Switching pressure of flushing spool

- Sizes 23 to 107(N)
 $\Delta p = 8 \times 1 \text{ bar}$
- Sizes 107 to 180
 $\Delta p = 17.5 \times 1.5 \text{ bar}$

Flushing flow

Orifices can be used to adjust the flushing flows as required. The following parameters are based on:

$\Delta p_{\text{low}} = p_{\text{low}} - p_c = 25 \text{ bar}$ and $v = 10 \text{ mm}^3/\text{s}$

(p_{low} = low pressure, p_c = case pressure)

Size	Code	Orifice dia. [mm]	Flushing flow q _v [l/min]
23, 26, 32, 37, 45, 56, 63, 68, 80, 107(N)	C	1.0	2.6
	D	1.3	4
	E	1.5	6
	F	1.7	7.4
	G	1.8	8.5
	H	2.0	10
	I	2.2	11.4
107, 125, 160, 180	J	3	22.5
	D	1.3	4
	E	1.4	6
	G	1.8	8.5
	H	2.0	10
	K	2.5	15
	L	2.8	18
	M	3.1	21
	N	3.8	27
	O	4.0	31
	P	5.0	37

Pressure relief valve

The MFDRI pressure relief valves (see data sheets 6400 and 64012) protect the hydraulic motor from overload.

As soon as the set cracking pressure is reached, the hydraulic fluid flows from the high pressure side to the low pressure side.

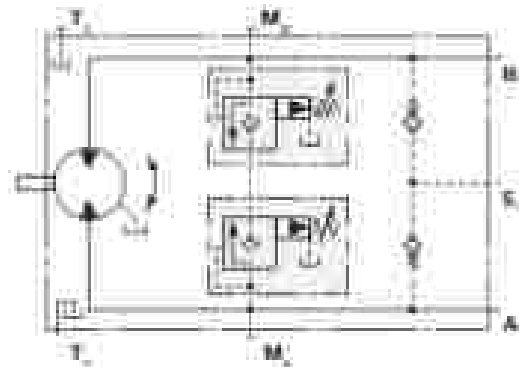
The pressure relief valves are only available in conjunction with the working ports D7, D8 and D9 (for the counterbalance valve for mounting to working ports D7 and D8, see next page).

Cracking pressure setting range 50 to 400 bar.

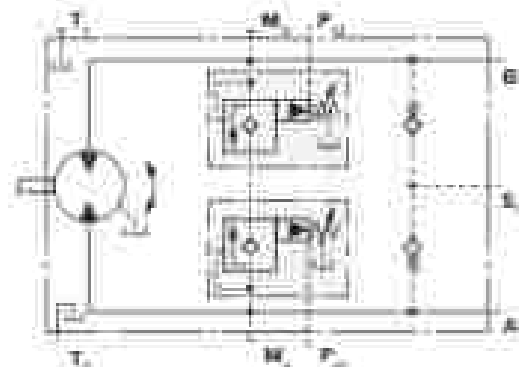
For versions "with pressure sequencing stage" 095, a higher pressure setting can be implemented by connecting an external pilot pressure of 25 up to 30 bar at port P₁₀. When ordering, state in plain text:

- Cracking pressure of pressure relief valve
- Cracking pressure with pilot pressure applied to P₁₀ (only with version 095)

• Circuit diagram version without pressure sequencing stage 095



• Circuit diagram version with pressure sequencing stage 095

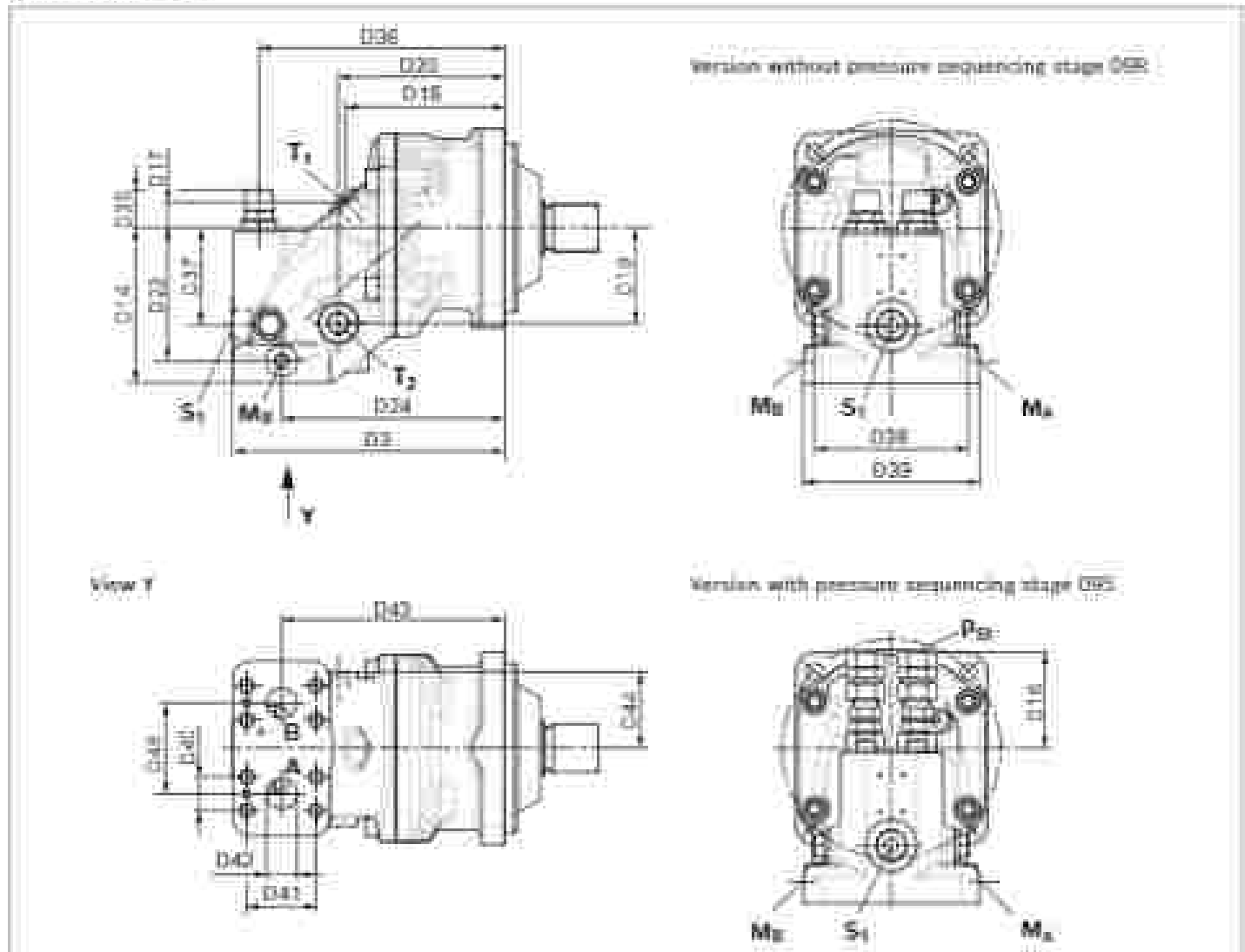


Permissible inlet flow or pressure for version with pressure relief valves

Motor NG	Without valve		Limited values when using pressure relief valves (DRV)			
	P _{max} /P _{min} [bar]	Q _{max} [l/min]	DRV NG	P _{max} /P _{min} [bar]	Q _{max} [l/min]	Code
45	400/410	7,75	23	300/400	340	095, 096
58		280				
63		3,75				
80		300				
90		425				
107		477	23		400	
125		500				

DRV = Pressure relief valve

Dimensions A2FM



Size		D5	D14	D16	D17	D18	D19	D28	D23	D34	D36	D37	D38	D39	D40
45, 56, 63	M10H-22	205	129	74	72	114	70	113	126	163	32.5	182	75	127	130
80, 90	M10H-22	225.5	129	77	71.5	115.5	79	132.5	115	164.5	32.5	201	80	127	140
102, 125	M10H-22	258	130	73.5	71	147.5	88	150	150	201	32	228	80	127	144

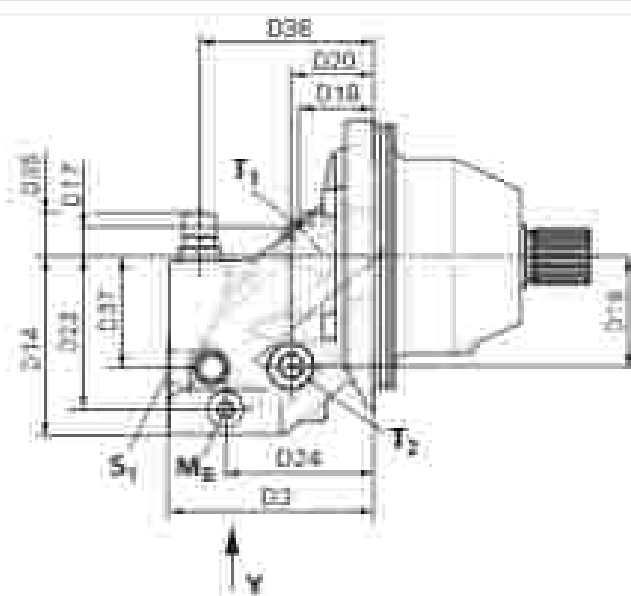
Size		D41	D42	D43	D44	D46	A, B	T1	M2, M3	P95	T2, T3
45, 56, 63	M10H-22	30.8	418	133	55.3	75	1/4 in	M22 × 1.5, 14 deep	M12 × 1.5, 12 deep	Ø 1/8	M18 × 1.5, 12 deep
80, 90	M10H-22	57.3	476	164.5	83	75	1/2 in	M25 × 1.5, 16 deep	M12 × 1.5, 12 deep	Ø 1/4	M18 × 1.5, 12 deep
102, 125	M10H-22	68.1	483	201	74	84	1/2 in	M28 × 1.5, 16 deep	M12 × 1.5, 12 deep	Ø 1/8	M18 × 1.5, 12 deep

Ports		Standard	Size	Pmax [bar] ¹⁾	State ²⁾
A, B	Working port	SAE J518	See table above	420	Ø
S1	Mount port the working ports (D95/D95 only)	DN 385 ³⁾	See table above	5	Ø
M2, M3	Measuring port (pressure A/N)	DN 385 ³⁾	See table above	420	X
P95	Fluit pressure port (for working ports D95 only)	DN ISO 229	See table above	20	Ø
T1, T2	Drain port	DN 385 ³⁾	See table above	5	X, Ø ⁴⁾

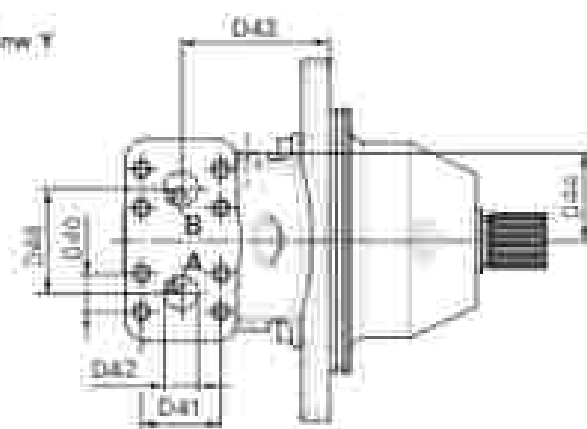
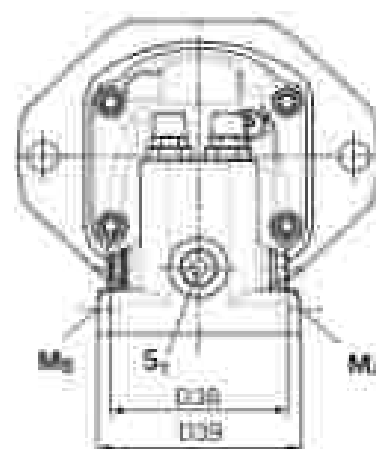
- 1) Depending on the application, momentary pressure peaks can occur.
Keep this in mind when selecting measuring devices and fittings.
2) The recommended drag is deeper than specified in the standard.

- 3) Ø - Must be connected (plugged on delivery)
X - Plugged (in normal operation)
4) Depending on installation position, T1 or T2 must be connected
(see the installation instructions on page 52).

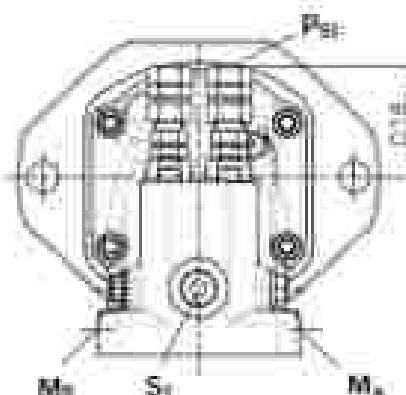
Drinking Life



WILSON, T.

Weather without compromise www.rockwell.com 023

Keywords: health; behavior change; implementation science



Site		D1	D4	D16	D17	D18	D19	D29	D33	D34	D35	D36	D37	D38	D39	D40
46, 58, 67	MICH-22	145	130	74	37	54	75	53	105	109	30.5	162	75	137	138	21.8
80, 96	MICH-22	147.5	129	73	21.3	53.5	78	52.5	110	105.5	31.5	203	80	177	145	77.8
107, 125	MICH-22	175.5	120	73.5	21	65	88	47.5	110	114.5	32	165.5	85	127	144	31.6

Site		D41	D42	D43	D44	D46	A, B	S ₁		M ₁₀ , M ₉	P ₁₀	T ₁₀ , T ₉
45, 56, 63	MF0108_22	50.0	49.9	103	55.5	75	3/4 in	M23 + 1.5, 14 deep	M13 + 1.5, 17 deep	0.194	M10 + 1.5, 13 deep	
80, 96	MF0108_32	57.2	57.6	106.5	83	75	1 in	M20 + 1.5, 16 deep	M17 + 1.5, 17 deep	0.194	M10 + 1.5, 13 deep	
107, 126	MF0108_32	68.7	69.3	108.5	74	84	1 1/4 in	M20 + 1.5, 16 deep	M13 + 1.5, 17 deep	0.194	M10 + 1.5, 13 deep	

Parts		Standard	Size	P_{max} [bar] [†]	Style [‡]
A, B	Working port	SAE J1118	See table above	400	0
S_1	Reset port (for working ports ON/OFF only)	ON 300/2 ^h	See table above	5	0
M_A, M_B	Monitoring port pressure A/B	ON 300/2 ^h	See table above	400	1
P_{12}	Port pressure port (for working ports ON only)	ON (50) 238	See table above	30	0
T_1, T_2	Drain port	ON 300/2 ^h	See table above	5	1, 0 [§]

g. Depending on the application, secondary peaks can occur. Read this in mind when selecting measuring times and times.

10. The countabilities may be smaller than specified in the standard.

2. $\square$ - Must be connected to ground on delivery

[illegible]

d. Depending on installation position, T_1 or T_2 must be connected from the installation instructions on page 33.

Counterbalance valve BVD/BVE

Function

Counterbalance valves for travel drives and winches should reduce the danger of overspeed and cavitation of axial piston motors in open circuits. Cavitation occurs if, during braking, when going downhill or during the load-lowering process, the motor speed is greater than it should be for the given inlet flow and thus the supply pressure falls sharply.
If the supply pressure falls below the value specified for the relevant counterbalance valve, the counterbalance spool moves into the closed position. The cross-sectional area of the counterbalance valve return passage is then reduced, creating a bottleneck in the return flow of the hydraulic fluid. The pressure increases and brakes the motor until the rotational speed of the motor reaches the specified value for the given inlet flow.

Notice

- BVD available for sizes 45 to 125 and BVE available for sizes 107 and 125.
- The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set.
Order example:
A2FMM30/70NWM42507W000 + BVD20F275/4118-V00H1603400512
- The counterbalance valve does not replace the mechanical service brake and holding brake.
- Observe the detailed notes on the BVD counterbalance valve contained in data sheet 95523 and BVE in data sheet 95526.
- For the design of the brake release valve, we must know the following data for the mechanical holding brake:
 - the cracking pressure
 - the volume of the brake spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
 - the required closing time for a worn device (Oil viscosity approx. 15 mm²/s)

Permissible inlet flow or pressure in case of version with counterbalance valves

Motor RG	Without valve		Limited values when using BVD/BVE			
	P_{max}/P_{min} [bar]	Q_{max} [l/min]	BVD/BVE RG	P_{max}/P_{min} [bar]	Q_{v}^{*} [l/min]	Code
45	400/450	725	20	350/420	220	07W
56		100				
63		115				
80		150				
96		205				
107		221				
125		300				
127		421	25		220	08W
125		500				

BVD – Counterbalance valve, double-acting

BVE – Counterbalance valve, single-acting

* Reduction of inlet flow with counterbalance valve

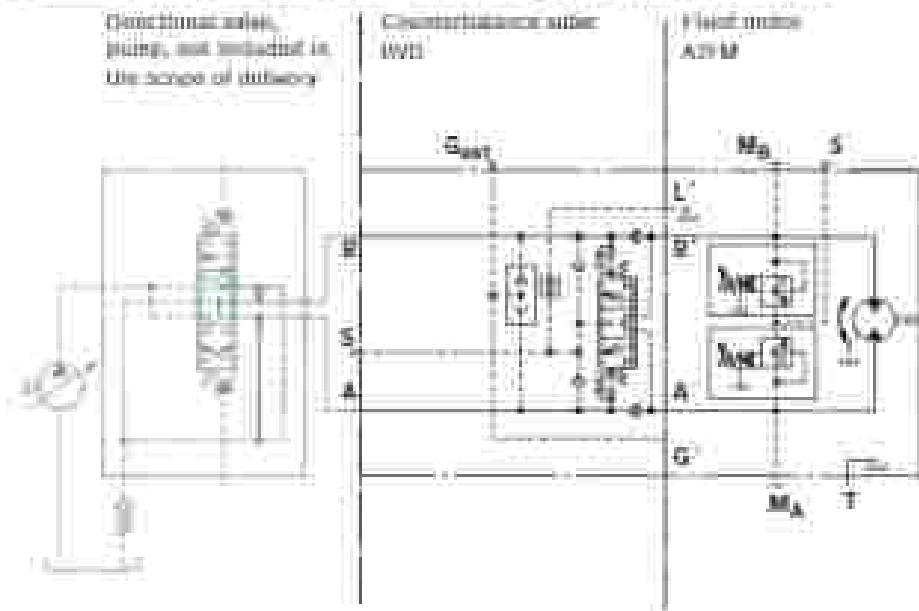
Counterbalance valve for travel drives BVD..F

Application option

- Travel drive for wheeled excavators

Example circuit diagram for travel drive in wheeled excavators

A2FMM50/70NWN4250TWO00 + BVD30F275/41B-V53K1600400512



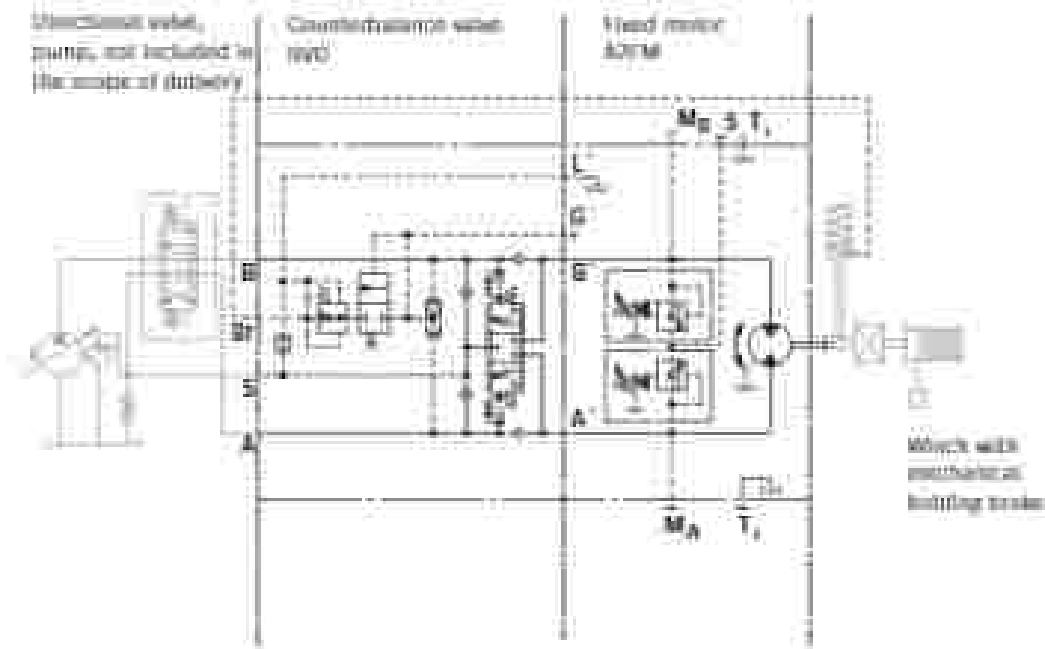
Counterbalance valve for winch drives BVD..W and BVE

Application possibilities

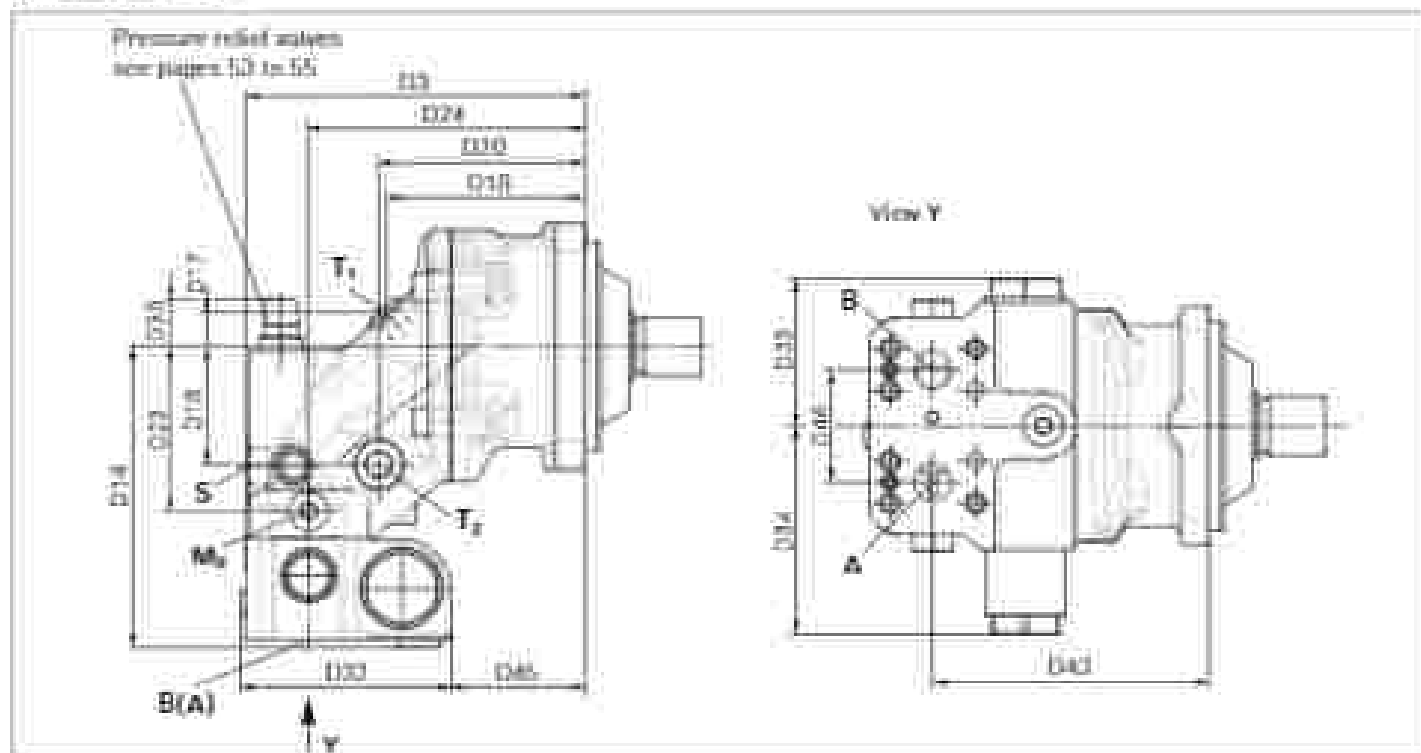
- Winch drives in cranes (BVD and BVE)
- Track drive in excavator crawlers (BVD)

Example circuit diagram for winch drive in cranes

A2FMM50/70NWN4250TWO00 + BVD30W275/41B-V01K0000000500



Dimensions A2FM



Size		D8	D14	D17	D18	D19	D20	D23	D24	D25	D33	D34	D35	D43	D45	D48
45, 56, 63	10/120-17	200	103	27	114	20	113	105	103	140.5	96	120	27.5	103	68	75
80, 90	10/120-27	226.5	201	21.8	131.5	78	127.5	110	184.5	140.5	96	120	31.5	184.5	85	75
107, 125	10/120-28	258	203	21	147.5	96	130	130	201	140.5	96	120	37	201	106	84
	10/125-38	258	220	21	147.5	96	130	110	201	118	120.5	117.5	37	201	94	84
	10/125-38	258	221	21	147.5	96	130	110	201	167	127	214	37	201	85	84

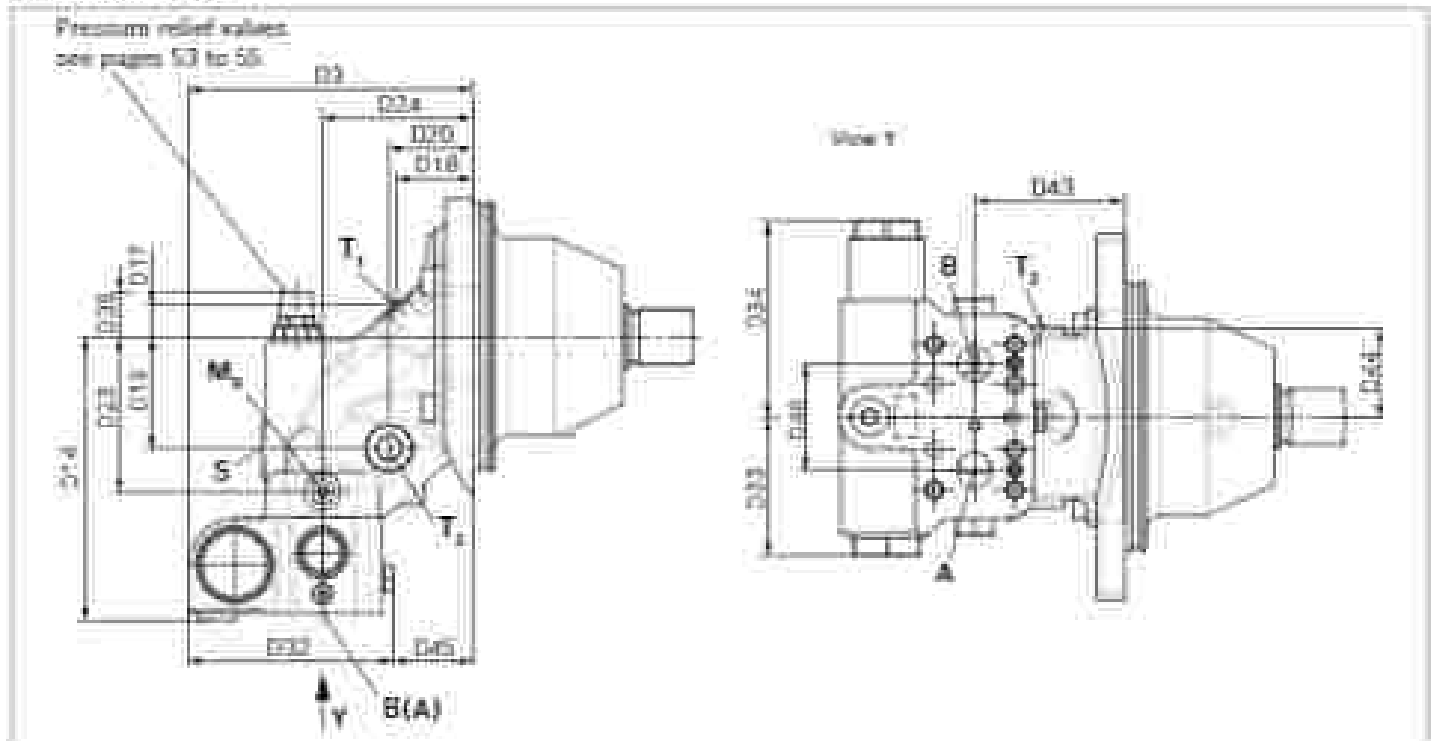
Size	A, B	S	Bt, S _{rel}	M ₆ , M ₆	P ₆	T ₁ , T ₂
45, 56, 63	10/120-17	3/8 in	M22 x 1.5, 14 deep	M12 x 1.5, 12.5 deep	M12 x 1.5, 17 deep	G 1/4
80, 90	10/120-27	1 in	M22 x 1.5, 14 deep	M12 x 1.5, 12.5 deep	M12 x 1.5, 17 deep	G 1/4
107, 125	10/120-28	1 in	M22 x 1.5, 14 deep	M12 x 1.5, 12.5 deep	M12 x 1.5, 17 deep	G 1/4
	10/125-38	1 1/8 in	M22 x 2, 15 deep	M12 x 1.5, 12.5 deep	M12 x 1.5, 17 deep	G 1/4
	10/125-38	1 1/4 in	M22 x 2, 15 deep	M12 x 1.5, 12.5 deep	M12 x 1.5, 17 deep	G 1/4

Parts		Version	Standard	Size	P_{max} [bar] ¹⁾	State ²⁾
A, B	Working port		SAT 25 16	See table above	400	0
S	Reset port		10N 3832 ³⁾	See table above	30	1
Bt	Break release port, reduced high pressure	1	10N 3832 ³⁾	See table above	30	0
S _{rel}	Break release port, high pressure	2	10N 3832 ³⁾	See table above	400	1
M ₆ , M ₆	Measuring port pressure A/P		10N 3832 ³⁾	See table above	400	0
T ₁ , T ₂	Main port		10N 3832 ³⁾	See table above	3	1, 0 ⁴⁾

a) Depending on the application, secondary pressure peaks can occur.
Keep this in mind when selecting measuring devices and fittings.
b) The counterbalance valve is deeper than specified in the standard.

c) G - Must be converted (plugged or empty)
X - Plugged (in normal operation)
d) Depending on installation position, T₁ or T₂ must be converted
(see the installation instructions on page 52).

Dimensions A2FE



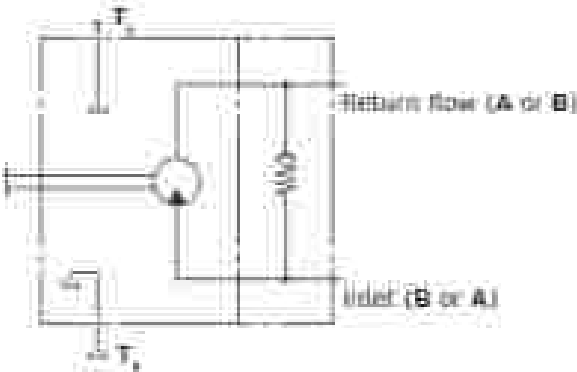
Size		D3	D14	D17	D18	D19	D20	D23	D24	D25	D26	D27	D28	D29	D30	D31	D32	D33	D34	D35	D43	D44	D45	D46	D47
48, 56, 68	HW120-17	205	183	22	54	70	53	105	103	140.3	98	138	27.5	103	111.3	57.3	76								
60, 90	HW120-17	238.5	201	21.3	53.5	79	59.5	110	106.3	140.3	98	138	21.5	108.5	93	81	75								
107, 125	HW120-38	113	203	21	85	88	110	47.3	118.3	140.3	98	138	27	118.3	74	74	84								
	HW25-18	135	120	21	85	96	110	47.3	118.3	158	120.3	175	32	118.3	74	87	84								
	HW25-38	225	221	21	85	98	110	47.3	118.3	167	137	214	32	118.3	85	87	84								

Port plate with integrated check valve (U)

Function

The motor with defined direction of rotation is supplied via the inlet port (A or B). As soon as the inlet is disabled and the driven component (e.g. fan wheel) is running due to its own flywheel mass, the motor operates as pump. Since the turning motor is no longer supplied by the inlet, it will get the required hydraulic fluid via the check valve from the return line.

• **Circuit diagram**



Flow direction

Direction of rotation, viewed on drive shaft	
Clockwise	counterclockwise
A to B	B to A

Speed sensor

The motor speed can be recorded by the fitted DSA speed sensor. The frequency signal required is generated by splines at the rotary group.

In addition to the rotational speed, the DSA sensor will record the direction of rotation of the motor.

Type code, technical data, dimensions and details on the plug, plus safety instructions about the sensor can be found in the relevant data sheet DSA (95133).

The sensor is mounted on the port provided for this purpose with a mounting bolt. On deliveries without sensor, the port is plugged with a pressure-resistant cover. We recommend ordering the A2F fixed motor complete with mounted sensor.

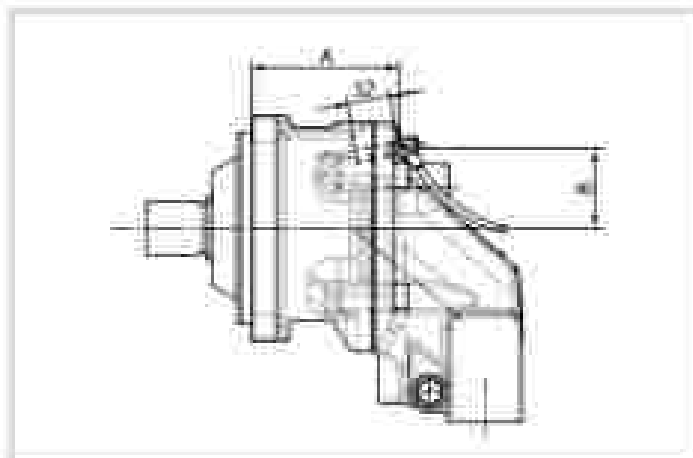
The following versions are available:

- with mounted DSA speed sensor (Code B)
- prepared for DSA speed sensor (delivery without sensor) (Code A)

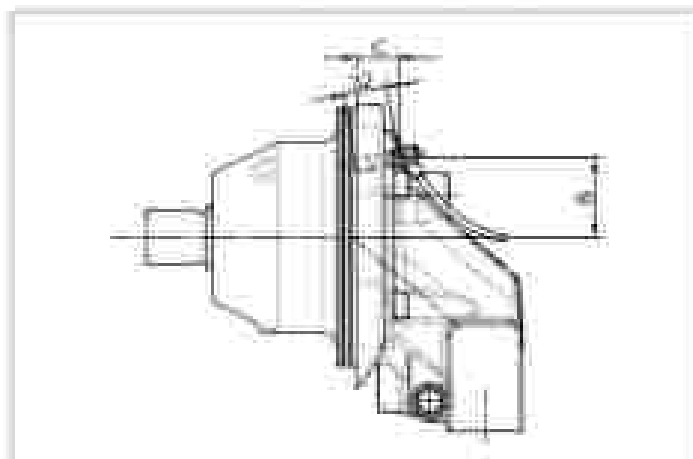
Size						
A2F.B	20, 22, 27, 45	54, 55, 60, 90, 107	–	–	–	–
A2F.M	23, 28, 32	45, 56, 63, 90, 90	107, 125	150, 190	–	–
A2F.H	23, 28, 32	45, 56, 63, 90, 90	107, 125	–	–	–
Number of teeth	30	47	53	59	67	–
Dimensions						
A	110.3	95.4	108.4	113.8	124.5	–
B	64.5	54.8	58.8	67.7	65.0	–
C	37.1	38.3	30.8	31.7	41.7	–

Dimensions

- A2FM with mounted DSA speed sensor (Code B)



- A2FE with mounted DSA speed sensor (Code E)



Installation instructions

General

The axial piston unit must be filled with hydraulic fluid and air bled during commissioning and operation. This must also be observed following a longer standstill as the axial piston unit may empty via the hydraulic lines. Particularly in the installation position "drive shaft upwards", filling and air bleeding must be carried out completely as there is, for example, a danger of dry running. The leakage in the housing area must be directed to the reservoir via the highest drain port (T₁, T₂). If a shared drain line is used for several units, make sure that the respective case pressure in each unit is not exceeded. The shared drain line must be dimensioned to ensure that the maximum permissible case pressure of all connected units is not exceeded in any operating conditions, particularly at cold start. If this is not possible, separate drain line must be laid, if necessary. To prevent the transmission of structure-borne noise, use elastic elements to decouple all connecting lines from all vibration-capable components (e.g. reservoir, frame parts). Under all operating conditions, the drain line must flow into the reservoir below the minimum fluid level.

Notice

- For A2FM with installation position "shaft upwards" an air bleed port R is required (specify in plain text when ordering, special version).
- For A2FE the "shaft upwards" installation position is not permissible.

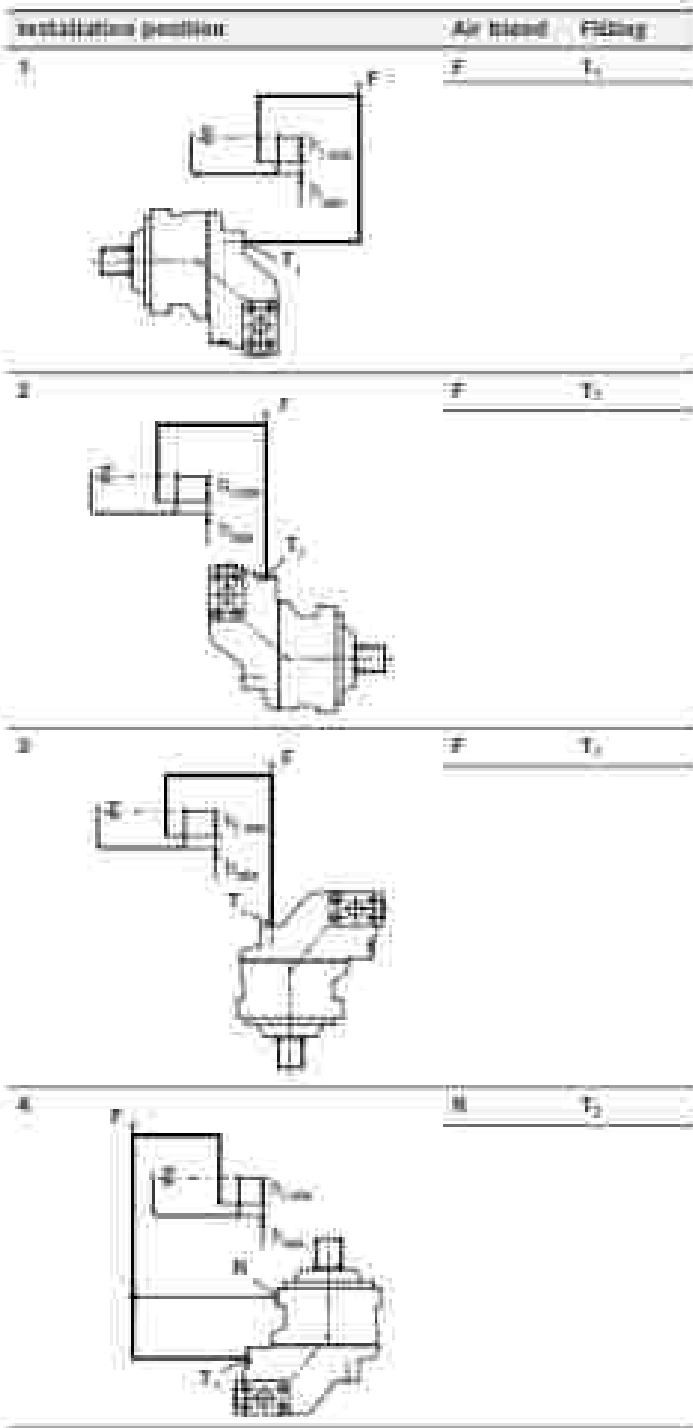
Key	
F	Filling / air bleeding
R	Air bleed port (special version)
T ₁ , T ₂	Drain port
h _{min}	Minimum required immersion depth (200 mm)
h _{max}	Minimum required distance to reservoir bottom (100 mm)

Installation position

See the following examples 1 to 4.
Further installation positions are available upon request.
Recommended installation position: 1 and 2.

Below-reservoir installation (standard)

Below-reservoir installation means that the axial piston unit is installed outside of the reservoir below the minimum fluid level.



Above-reservoir installation

Above-reservoir installation means that the axial piston unit is installed above the minimum fluid level of the reservoir. Recommendation for installation position 6 (drive shaft up). A check valve in the drain line (cracking pressure 0.5 bar) can prevent draining of the housing area.

Installation position	Air bleed	Filling
6	F	T ₁ (F)
5	F	T ₂ (F)
7	F	T ₁ (F)
8	B	T ₃ (F)

Notice

Port F is part of the external piping and must be provided on the customer side to simplify the filling and air bleeding.

Project planning notes

- The motor A2FM/A2FE is designed to be used in open and closed circuits.
- Project planning, installation and commissioning of the axial piston units requires the involvement of skilled personnel.
- Before using the axial piston unit, please read the corresponding instruction manual completely and thoroughly. If necessary, this can be requested from Bosch Rexroth.
- Before finalizing your design, request a binding installation drawing.
- The specified data and notices contained herein must be observed.
- Preservation: Our axial piston units are supplied as standard with preservation protection for a maximum of 12 months. If longer preservation protection is required (maximum 24 months), please specify this in plain text when placing your order. The preservation periods apply for optimal storage conditions, which can be found in data sheet 80312 or in the instruction manual.
- Not all versions of the product are approved for use in a safety function according to ISO 13849. Please consult the responsible contact person at Bosch Rexroth if you require reliability parameters (e.g. MTTF_d) for functional safety.
- Be sure to add a pressure relief valve to the hydraulic system.
- Please note that a hydraulic system is an oscillating system. This can lead, for example, to the excitation of the natural frequency within the hydraulic system during operation at constant rotational speed over a long period of time. The frequency of the motor to be observed is 7 times the rotational speed frequency. This can be prevented, for example, with suitably designed hydraulic lines.
- Please note the details regarding the tightening torques of port threads and other threaded joints in the instruction manual.

- The ports and fastening threads are designed for the p_{max} permissible pressures of the respective ports, see the port tables. The machine or system manufacturer must ensure that the connecting elements and lines correspond to the specified application conditions (pressure, flow, hydraulic fluid, temperature) with the necessary safety factors.
- The working ports and function ports are only intended to accommodate hydraulic lines.

Safety instructions

- During and shortly after operation, there is a risk of getting burnt on the axial piston unit. Take the appropriate safety measures (e.g. by wearing protective clothing).
- Moving parts in control equipment (e.g. valve spools) can, under certain circumstances, get stuck in position as a result of contamination (e.g. contaminated hydraulic fluid, abrasion, or residual dirt from components). As a result, the hydraulic fluid flow and the build-up of torque in the axial piston unit can no longer respond correctly to the operator's specifications. Even the use of various filter elements (external or internal flow filtration) will not rule out a fault but merely reduce the risk. The machine/system manufacturer must test whether remedial measures are needed on the machine for the application concerned in order to bring the driver consumer into a safe position (e.g. safe stop) and ensure any measures are properly implemented.
- In certain conditions, moving parts in high pressure relief valves might get stuck in an undefined position due to contamination (e.g. contaminated hydraulic fluid). This can result in restriction or loss of load holding functions in lifting winches. The machine/system manufacturer must check whether additional measures are required on the machine for the relevant application in order to keep the load in a safe position and ensure they are properly implemented.

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