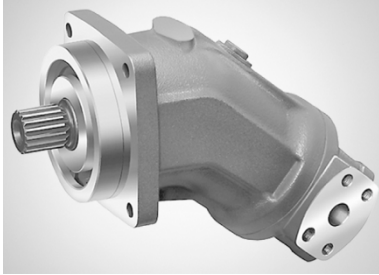
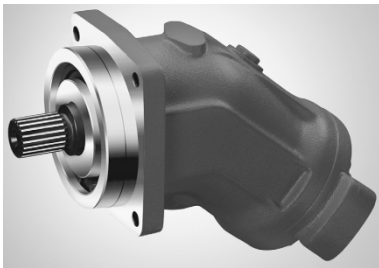


Pump HD-A2FO Sizes 5 ~ 500 Series 6 Nominal pressure 400 bar Maximum pressure 45 0 bar



- Fixed pump with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in an open circuit.
- For use in mobile and stationary applications, the flow is proportional to the drive speed and displacement.
- The drive shaft bearings are designed for the bearing service life requirements usually encountered in these areas.
- High power density, Small dimensions, High total efficiency, Economical design, One-piece tapered piston with piston rings for sealing.

Motor HD-A2FM Sizes 5 ~ 500 Series 6 Nominal pressure 400 bar Maximum pressure 45 0 bar



- 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, The output speed is dependent on the flow of the pump and the displacement of the motor.
- Finely graduated sizes permit far-reaching adaptation to the drive case
- High power density, Small dimensions, High total efficiency, Good starting characteristics, Economical design, One-piece tapered piston with piston rings for sealing.

Motor HD-A2FE Sizes 28 ~ 355 Series 6 Nominal pressure 400 bar Maximum pressure 45 0 bar



- Fixed plug-in motor with axial tapered piston rotary group of bent-axis design, for hydrostatic drives in open and closed circuits.
- Far-reaching integration in mechanical gearbox due to recessed mounting flange located in the center of the case (extremely space-saving construction)
- Small dimensions, High total efficiency, Complete unit, ready-assembled and tested, Easy to install, simply plug into the mechanical gearbox, No configuration specifications to be observed when installing.



■ Ordering Code For Standard Program

HD	-	A2F	M	90	/	6	1	W	-	V	A	B	010			-	
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		

0	Manufacturer	Code
	HUADE HYDRAULIC 华德液压	HD

1	Oil types / Specifications	5 ~200	250	355	500	Code
	Mineral oilwithout code	■	■	■	■	-
	HFD for sizes 250 ~ 500 only in combination with long-life bearings L	■	■	■	■	-
	HFB,HFC Size 5 ~ 200.....without code	■	-	-	-	-
	Size 250 ~ 500 only in combination with long-life bearings L	-	■	■	■	E

2	Axial piston unit	5	10/12/16	23/28/32	45	56/63	80/90	107/125	160/180	200 ~ 500	Code
	Bent-axis design, fixed	□	■	■	■	■	■	■	■	□	A2F

3	Drive shaft bearing	5 ~200	250	355	500	Code
	Standard bearing.....without code	■	-	-	-	-
	Long-life bearing	-	■	■	■	L

4	Operation mode	5	10/12/16	23/28/32	45	56/63	80/90	107/125	160/180	200 ~ 500	Code
	Motor	□	■	■	■	■	■	■	■	□	M

5	Displacement	5	10/12/16	23/28/32	45	56/63	80/90	107/125	160/180	200	250	355	500	Code
	$\cong V_{gmax} (cm^3/r)$	5	10/12/16	23/28/32	45	56/63	80/90	107/125	160/180	200	250	355	500	-

6	Series	5 ~500	Code
	Series 6	■	6

7	Index	5	10 ~ 180	200	250	355	500	Code
	Size 10 ~ 180	-	■	-	-	-	-	1
	Size 200	-	-	■	-	-	-	3
	Size 5 and 250 ~ 500	■	-	-	■	■	■	0

8	Direction of rotation	Code
	Viewed on drive shaft	bidirectional W

9	Sealing material	5 ~500	Code
	FKM (Fluoro-rubber)	■	V
	NBR(Nitrile-rubber),Shaft seal FKM (Fluoro-rubber)	■	P

■ Ordering Code For Standard Program

HD	-	A2F	M	90	/	6	1	W	-	V	A	B	010			-	
0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15		

10	Drive shaft	5	10/12	16	23/28	32	45	56	63	80	90	107	125	160	180/200	250/355/500	Code	
	Splined shaft	I	-	■	■	■	■	-	■	■	■	■	■	■	■	-	A	
		II	-	■	-	■	-	■	■	-	■	-	■	-	■	-	Z	
	Parallel shaft	I	■	■	■	■	■	-	■	■	■	■	■	■	■	■	-	B
		II	-	■	-	■	-	■	■	-	■	-	■	-	■	-	■	P
	Conical shaft ¹⁾	■	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	C

11	Mounting flange	5 ~ 250	355 ~ 500	Code	
	ISO 3019-2	2 hole	■	-	B
		4 hole	-	■	H

12	Working port	5	10,12 16	23	28 32	45	56 63	80	90	107	125	160	180	200	250	355 500	Code
	SAE flange ports A and B at rear	01	0	-	-	■	■	■	■	■	■	■	■	■	■	■	010
			7	-	-	-	-	-	-	-	-	-	-	-	-	-	■
	SAE flange ports A and B at side, opposite	02	0	-	-	■	■	■	■	■	■	■	■	-	■	-	020
			7	-	-	-	-	■	□	□	■	■	-	■	-	-	027
			9			-	-	-	■	■	-	-	-	-	-	-	-
	Threaded ports A and B at side, opposite	03	0	■	■	■	■	-	-	-	-	-	-	-	-	-	030
	Threaded ports A and B ²⁾ at side and rear	04	0	-	■	■	■	■	■	-	-	-	-	□	-	-	040
	SAE flange ports A and B at bottom (same side)	10	0	-	-	-	■	■	■	■	■	■	-	-	-	□	100
	Port plate with 1-level pressure relief valves for mounting a counterbalance valve ³⁾	BVD	17	1	-	-	-	-	-	-	-	■	-	-	-	-	171
				8	-	-	-	-	-	-	-	-	■	-	-	-	-
	Port plate with pressure relief valves	BVE	18	1	-	-	-	■	■	■	■	■	■	-	-	-	181
				8	-	-	-	-	-	-	-	■	■	-	-	-	-
		19		1	-	-	-	■	■	■	■	■	■	-	-	-	191
				2	-	-	-	■	■	■	■	■	■	-	-	-	-

↑ Valves

0	Without valve
1	Pressure-relief valve (without pressure boost facility)
2	Pressure-relief valve (with pressure boost facility)
7	Flushing and boost pressure valve, mounted
8	Counterbalance valve BVD/BVE ³⁾
9	Flushing and boost pressure valve, integrated

■ Ordering Code For Standard Program

HD	-	A2F	M	90	/	6	1	W	-	V	A	B	010			-	
0	1	2	3	4	5	6	7	8	9	10	11	12	1 ₃	14	15		

13	Speed sensors	5 ~16	23 ~ 180	200	250 ~ 500	Code
	Without speed sensor.....without code	■	■	■	■	-
	Prepared for HDD speed sensor	-	-	-	■	F
	HDD speed sensor mounted ⁴⁾	-	-	-	■	H
	Prepared for DSA speed sensor	-	■	■	-	U
	DSA speed sensor mounted ⁴⁾	-	■	■	-	V

14	Special version	Code
	Standard version.....without code	-
	Special version for slew drives	J

15	Standard / special version	Code
	Standard version.....without code	-
	Standard version with installation variants, e. g. T ports against standard open or closed	Y
	Special version	S

□ Note

- 1) Conical shaft with threaded pin and woodruff key (DIN 6888). The torque must be transmitted via the tapered press fit
- 2) Threaded ports at the sides (sizes 10 to 63) plugged with threaded plugs
- 3) Specify ordering code of counterbalance valve according to data sheet eparately
- 4) Specify ordering code of sensor according to data sheet separately and observe the requirements on the electronics

- = Optimization scheme (shorter delivery time)
- = Available
- = On request
- = Not available

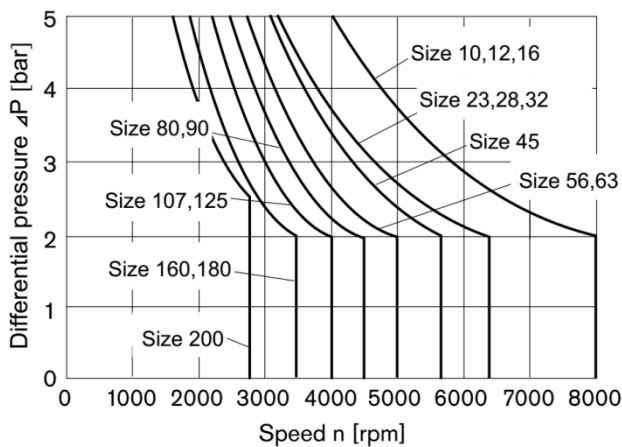
■ Shaft seal...Permissible pressure loading

The service life of the shaft seal is influenced by the speed of the axial piston unit and the case drain pressure (case pressure).

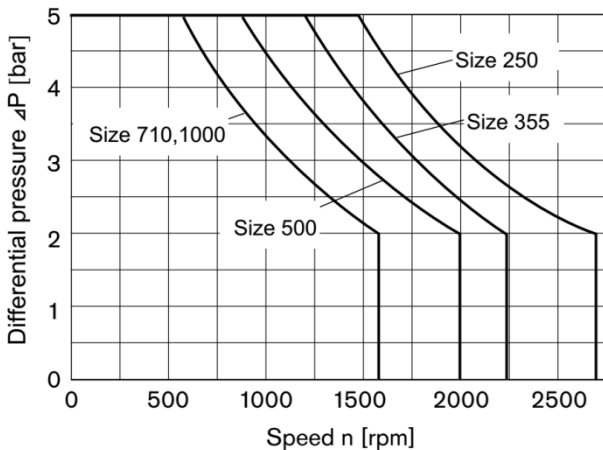
- The mean differential pressure of 2 bar between the case and the ambient pressure may not be enduringly exceeded at normal operating temperature.
- For a higher differential pressure at reduced speed, see diagram. Momentary pressure spikes ($t < 0.1$ s) of up to 10 bar are permitted. The service life of the shaft seal decreases with an increase in the frequency of pressure spikes.
- The case pressure must be equal to or higher than the ambient pressure.

Static characteristic

Sizes 10 to 200



Sizes 250 to 500



■ The values are valid for an ambient pressure $P_{abs} = 1$ bar

Temperature range

The FKM shaft seal may be used for case drain temperatures from -25 °C to +115 °C

- For application cases below -25 °C, an NBR shaft seal is required (permissible temperature range -40 °C to +90 °C). State NBR shaft seal in plain text when ordering. Please contact us.

Direction of flow

Direction of rotation, viewed on drive shaft	Direction of flow
clockwise (R)	A → B
counter-clockwise (L)	B → A

Speed range

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

Long-life bearing

Sizes 250 ~ 500

- For long service life and use with HF hydraulic fluids. Identical external dimensions as motor with standard bearings. Subsequent conversion to long-life bearings is possible.
- Bearing and case flushing via port U is recommended.

Flushing flow...Recommended

Sizes	250	355	500
$Q_{v \text{ flush}}$ (l/min)	10	16	16

Ports

Ports	Port for	Diagram
A, B T	Working port Drain port	

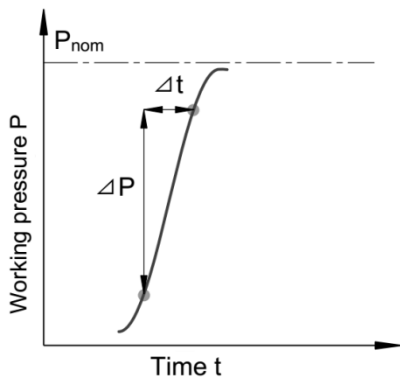
■ Working pressure range

Working pressure range valid when using hydraulic fluids based on mineral oils

Pressure at service line port A or B		Definition	
Nominal pressure P_{nom}	Size 5	315 bar (absolute)	
	Size 10 ~ 200	400 bar (absolute)	
	Size 250 ~ 500	350 bar (absolute)	
Maximum pressure P_{Bmax}	Size 5	350 bar (absolute)	
	Size 10 ~ 200	450 bar (absolute)	
	Size 250 ~ 500	400 bar (absolute)	
	Single operating period	10 s	
	Total operating period	300 h	
Summation pressure $(P_A + P_B) P_{Su}$		700 bar	
Minimum pressure P_{min} high-pressure side		25 bar (absolute)	
Rate of pressure change R_{Amax}		Maximum permissible rate of pressure rise and reduction during a pressure change over the entire pressure range	
With integrated pressure-relief valve			9000 bar/s
Without pressure-relief valve			16000 bar/s

⚡ Note: Values for other hydraulic fluids, please contact us

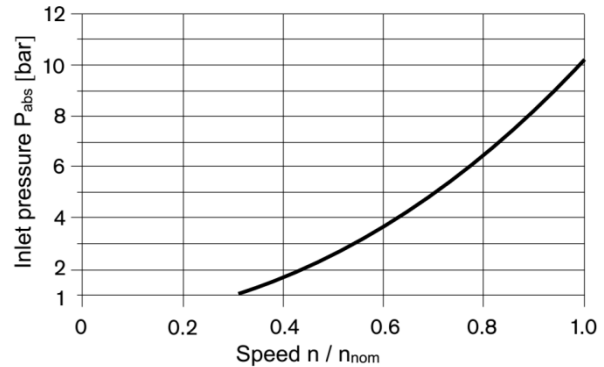
■ Rate of pressure change R_{Amax}



Minimum pressure...pump mode (inlet)

To prevent damage to the axial piston motor in pump operating mode (change of high-pressure side with unchanged direction of rotation, e. g. when braking), a minimum pressure must be guaranteed at the service line port (inlet).

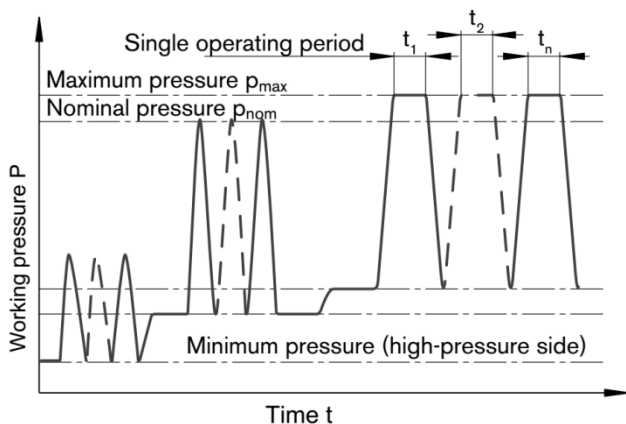
- The minimum pressure depends on the speed of the axial piston unit (see characteristic curve below).



This diagram is valid only for the optimum viscosity range from $V_{opt} = 36$ to $16 \text{ mm}^2/\text{s}$.

- Please contact us if these conditions cannot be satisfied.

Pressure definition



- Total operating period = $t_1 + t_2 + t_3 + \dots + t_n$

■ Table of values

Theoretical values, without considering efficiencies and tolerances, values rounded off

Technical Data	A2FM		5	10	12	16	23	28	32	45	56	63	80
Displacement	V_g	cm ³	4.93	10.3	12	16	22.9	28.1	32	45.6	56.1	63	80.4
Speed ¹⁾	maximum	n_{nom}	rpm	10000	8000	8000	8000	6300	6300	6300	5600	5000	4500
		n_{max} ²⁾	rpm	11000	8800	8800	8800	6900	6900	6900	6200	5500	5500
Input flow ³⁾	at n_{nom} and V_g	q_v	l/min	49	82	96	128	144	177	202	255	281	362
Torque ⁴⁾	$\Delta P=350$ bar	T	Nm	24.7 ⁵⁾	57	67	89	128	157	178	254	313	448
	at V_g and $\Delta P=400$ bar	T	Nm	-	66	76	102	146	179	204	290	357	512
Case volume	V	l	0.12	0.17	0.17	0.17	0.20	0.20	0.20	0.33	0.45	0.45	0.55
Weight	approx	m	Kg	2.5	5.4	5.4	5.4	9.5	9.5	9.5	13.5	18	23

Technical Data	A2FM		90	107	125	160	180	200	250	355	500		
Displacement	V_g	cm ³	90	106.7	125	160.4	180	200	250	355	500		
Speed ¹⁾	maximum	n_{nom}	rpm	4500	4000	4000	3600	3600	2750	2700	2240	2000	
		n_{max} ²⁾	rpm	5000	4400	4400	4000	4000	3000	-	-	-	
Input flow ³⁾	at n_{nom} and V_g	q_v	l/min	405	427	500	577	648	550	675	795	1000	
Torque ⁴⁾	$\Delta P=350$ bar	T	Nm	501	594	696	893	1003	1114	1393	1978	2785	
	at V_g and $\Delta P=400$ bar	T	Nm	573	679	796	1021	1146	1273	-	-	-	
Case volume	V	l	0.55	0.8	0.8	1.1	1.1	2.7	2.5	3.5	4.2		
Weight	approx	m	Kg	23	32	32	45	45	66	73	110	155	

Note

- 1) The values are applicable
 - for an absolute pressure $P_{abs}=1$ bar at suction port S
 - within the optimum viscosity range from $V_{opt} = 16$ to 36 mm²/s
- 2) Intermittent maximum speed: overspeed for unload and overhauling processes, $t < 5$ s and $\Delta P < 150$ bar
- 3) Restriction of input flow with counterbalance valve
- 4) Torque without radial force, with radial force.
- 5) Torque at $\Delta P = 315$ bar


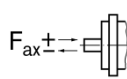
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
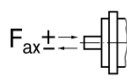
Operation above the maximum values or below the minimum values may result in a loss of function, a reduced service life or in the destruction of the axial piston unit.


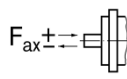
- Other permissible limit values, with respect to speed variation, reduced angular acceleration as a function of the frequency and the permissible start up angular acceleration (lower than the maximum angular acceleration) can be found in data sheet.

■ Technical Data

Permissible radial and axial loading on the drive shaft


Technical Data	A2FM		5	5 ³⁾	10	10	12	12	16	23	23	28	28
Drive shaft		Φ mm	12	12	20	25	20	25	25	25	30	25	30
Max.radial force ¹⁾ at distance a (from shaft collar)		$F_{q \max}$ KN	1.6	1.6	3.0	3.2	3.0	3.2	3.2	5.7	5.4	5.7	5.4
		a mm	12	12	16	16	16	16	16	16	16	16	16
permissible torque		T_{\max} Nm	24.7	24.7	66	66	76	76	102	146	146	179	179
permissible pressure		ΔP_{perm} bar	315	315	400	400	400	400	400	400	400	400	400
Maximum axial force ²⁾		$+F_{\text{ax max}}$ N	180	180	320	320	320	320	320	500	500	500	500
		$-F_{\text{ax max}}$ N	0	0	0	0	0	0	0	0	0	0	0
Permissible axial force per bar operating pressure		$\pm F_{\text{ax max/bar}}$ N/bar	1.5	1.5	3.0	3.0	3.0	3.0	3.0	5.2	5.2	5.2	5.2

Technical Data	A2FM		32	45	56	56 ⁴⁾	56	63	80	80 ⁴⁾	80	90	
Drive shaft		Φ mm	30	30	30	30	35	35	35	35	40	40	
Max.radial force ¹⁾ at distance a (from shaft collar)		$F_{q \max}$ KN	5.4	7.6	9.5	7.8	9.1	9.1	11.6	11.1	11.4	11.4	
		a mm	16	18	18	18	18	18	20	20	20	20	
permissible torque		T_{\max} Nm	204	290	357	294	357	401	512	488	512	573	
permissible pressure		ΔP_{perm} bar	400	400	400	330	400	400	400	380	400	400	
Maximum axial force ²⁾		$+F_{\text{ax max}}$ N	500	630	800	800	800	800	1000	1000	1000	1000	
		$-F_{\text{ax max}}$ N	0	0	0	0	0	0	0	0	0	0	0
Permissible axial force per bar operating pressure		$\pm F_{\text{ax max/bar}}$ N/bar	5.2	7.0	8.7	8.7	8.7	8.7	10.6	10.6	10.6	10.6	

Technical Data	A2FM		107	107	125	160	160	180	200	250	355	500	
Drive shaft		Φ mm	40	45	45	45	50	50	50	50	60	70	
Max.radial force ¹⁾ at distance a (from shaft collar)		$F_{q \max}$ KN	13.6	14.1	14.1	18.1	18.3	18.3	20.3	1.2 ⁵⁾	1.5 ⁵⁾	1.9 ⁵⁾	
		a mm	20	20	20	25	25	25	25	41	52.5	52.5	
permissible torque		T_{\max} Nm	679	679	796	1021	1021	1146	1273	-	-	-	
permissible pressure		ΔP_{perm} bar	400	400	400	400	400	400	400	-	-	-	
Maximum axial force ²⁾		$+F_{\text{ax max}}$ N	1250	1250	1250	1600	1600	1600	1600	2000	2500	-	
		$-F_{\text{ax max}}$ N	0	0	0	0	0	0	0	0	0	0	0
Permissible axial force per bar operating pressure		$\pm F_{\text{ax max/bar}}$ N/bar	12.9	12.9	12.9	16.7	16.7	16.7	16.7	-	-	-	

Note

- 1) With intermittent operation
- 2) Maximum permissible axial force during standstill or when the axial piston unit is operating in non-pressurized condition.
- 3) Conical shaft with threaded pin and woodruff key (DIN 6888)
- 4) Restricted technical data only for splined shaft
- 5) When at a standstill or when axial piston unit operating in nonpressurized conditions. Higher forces are permissible when under pressure, please contact us

 Note:Influence of the direction of the permissible axial force F

- + $F_{\text{ax max}}$ = Increase in service life of bearings
- $F_{\text{ax max}}$ = Reduction in service life of bearings (avoid)

■ Effect of radial force

By selecting a suitable direction of radial force F_q , the load on the bearings, caused by the internal rotary group forces can be reduced, thus optimizing the service life of the bearings.

□ Recommended position of mating gear is dependent on direction of rotation. Examples

	Toothed gear drive	V-belt output
Size	Ψ_{opt}	Ψ_{opt}
5 ~ 180	$\pm 70^\circ$	$\pm 45^\circ$
200 ~ 500	$\pm 45^\circ$	$\pm 70^\circ$

Determining the operating characteristics

Input flow $q_v = \frac{V_g \cdot n}{1000 \cdot \eta_v}$ [L/min]

Speed $n = \frac{q_v \cdot 1000 \cdot \eta_v}{V_g}$ [min⁻¹]

Torque $T = \frac{V_g \cdot \Delta p \cdot \eta_{mh}}{20 \cdot \pi}$ [Nm]

Power $P = \frac{2 \pi \cdot T \cdot n}{60000} = \frac{q_v \cdot \Delta p \cdot \eta_t}{600}$ [kW]

V_g = Displacement per revolution in cm³

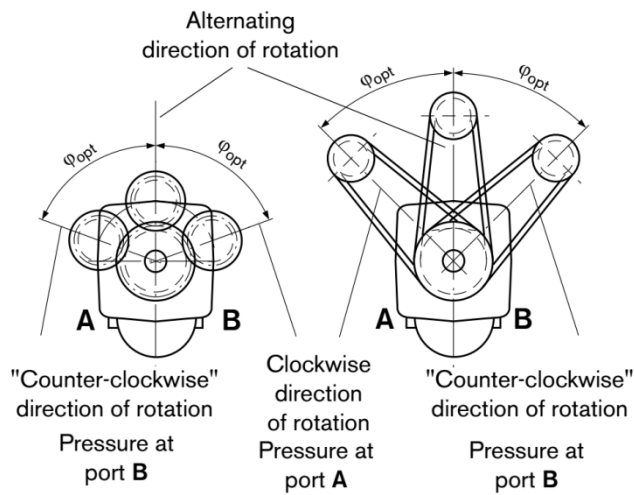
Δp = Differential pressure in bar

n = Speed in rpm

η_v = Volumetric efficiency

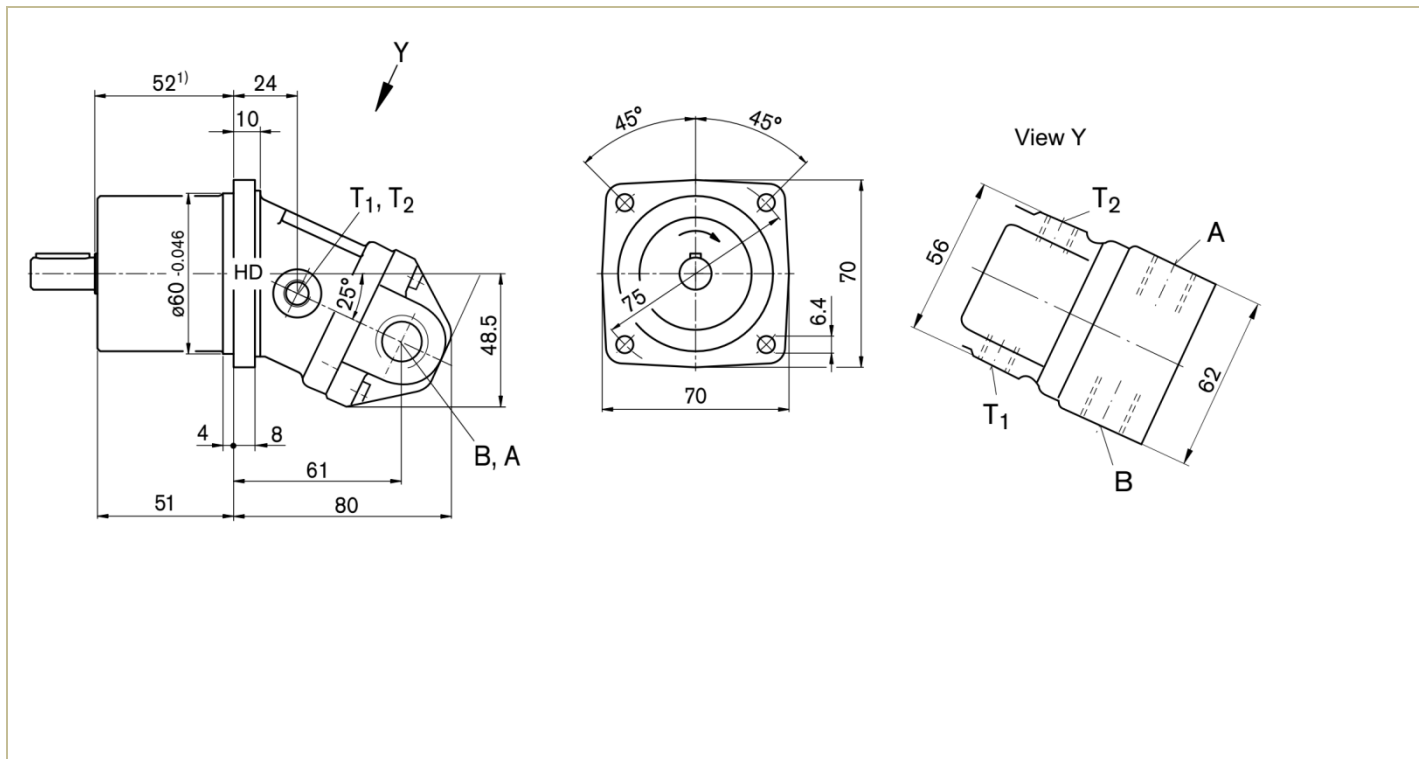
η_{mh} = Mechanical-hydraulic efficiency

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



■ Size 5...Dimensions in mm

Port plate 030...Threaded ports A and B at side, opposite.

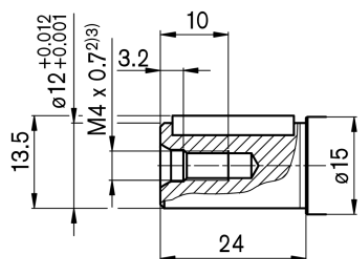


□ Drive shaft

Size 5

B Parallel keyed shaft DIN 6885

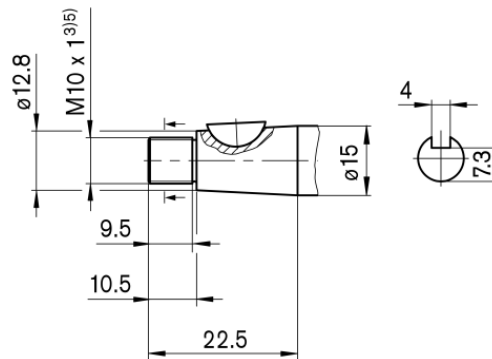
A 4 x 4 x 20



■ Size 5

C Conical shaft DIN 6888

with threaded pin and woodruff key 3 x 5 tapering 1:10



□ Ports

Ports	Port for	Standard ⁶⁾	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁷⁾
A, B	Working port	DIN 3852	M18 x 1.5 deep 12	350	O
T ₁	Drain port	DIN 3852	M10 x 1 deep 8	3	O
T ₂	Drain port	DIN 3852	M10 x 1 deep 8	3	O

Note

1) To shaft colla

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

3) For the maximum tightening torques the general instructions must be observed.

4) Momentary pressure spikes may occur depending on the application.

Keep this in mind when selecting measuring devices and fittings.

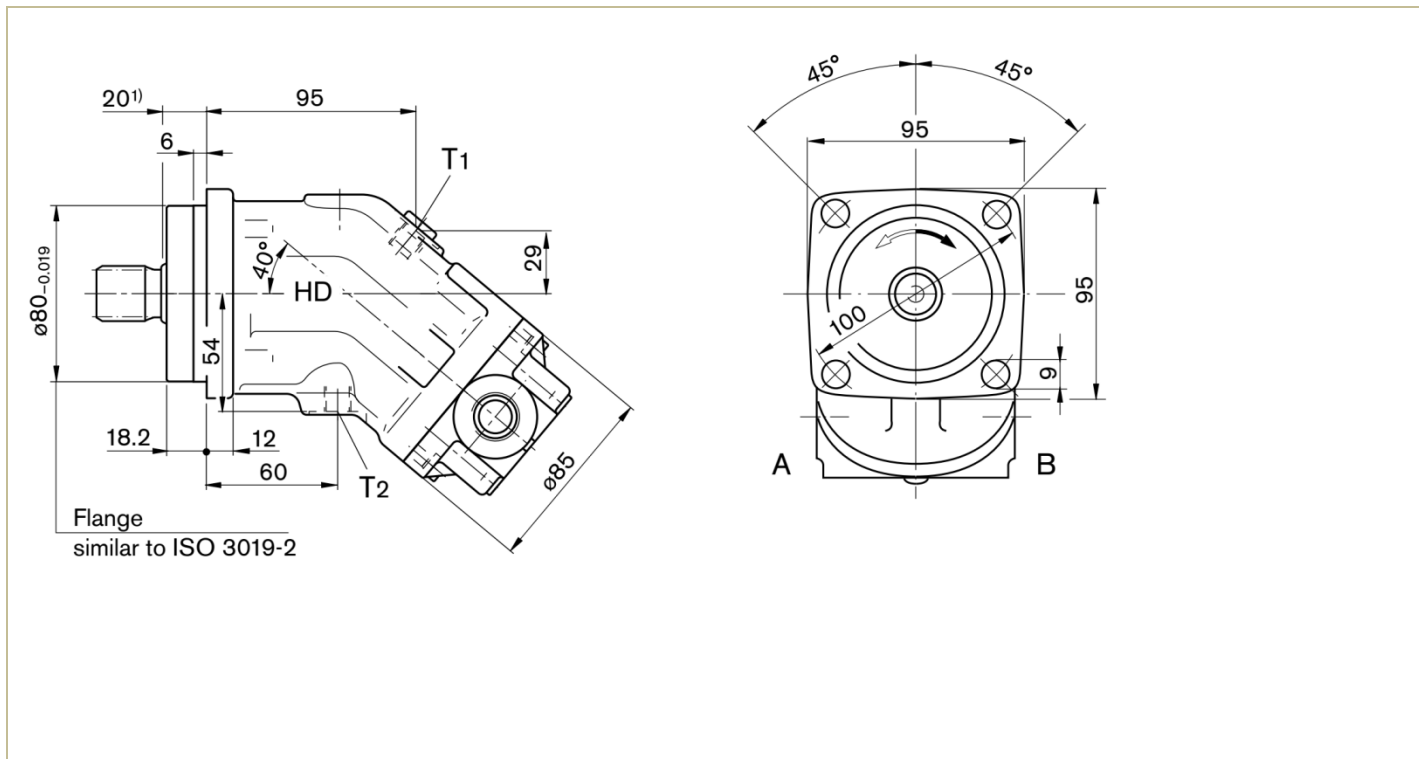
5) Thread according to DIN 3852, maximum tightening torque 30 Nm

6) The spot face can be deeper than specified in the appropriate standard

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

■ Size 10, 12, 16...Dimensions in mm

Port plate 030...Threaded ports A and B at side, opposite.



□ Drive shaft

<p>Size 10, 12, 16</p> <p>A Splined shaft DIN 5480 W 25 x 1.25 x 18 x 9g</p>	<p>■ Size 10, 12</p> <p>Z Splined shaft DIN 5480 W 20 x 1.25 x 14 x 9g</p>	<p>■ Size 10, 12, 16</p> <p>B Parallel keyed shaft DIN 6885 AS 8 x 7 x 32</p>	<p>■ Size 10, 12</p> <p>P Parallel keyed shaft DIN 6885 AS 6 x 6 x 32</p>
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□ Ports

Ports	Port for	Standard	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁸⁾
A, B	Working port		see port plates	450	
T ₁	Drain port	DIN 3852 ⁵⁾	M12 x 1.5 deep 12	3	X ⁷⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M12 x 1.5 deep 12	3	O ⁷⁾

Note

- 1) To shaft colla
- 2) Center bore according to DIN 332 (thread according to DIN 13)
- 3) For the maximum tightening torques the general instructions must be observed.
- 4) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.

- 5) The spot face can be deeper than specified in the appropriate standard
- 7) Depending on the installation position, T₁ or T₂ must be connected
- 8) O = Must be connected (plugged on delivery)
X = plugged (in normal operation)

■ Size 10, 12, 16...Dimensions in mm

Location of the service line ports on the port plates

Plate 03...Threaded ports at side, opposite

■ Plate 04...Threaded ports at side and rear

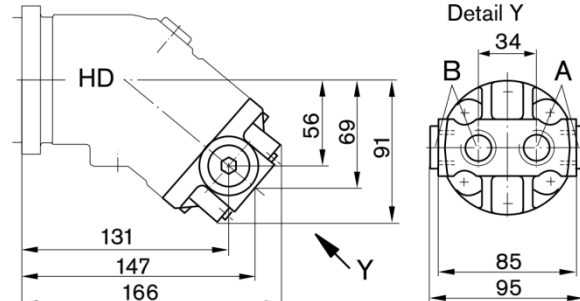
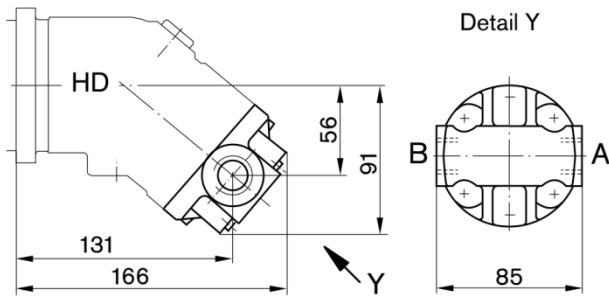


Plate	Ports	Port for	Standard	Size ¹⁾	P _{Max} [bar] ²⁾	State ⁵⁾
03	A, B	Working port	DIN 3852 ³⁾	M22 x 1.5 deep 14	450	X
04	A, B	Working port	DIN 3852 ³⁾	M22 x 1.5 deep 14	450	O

Note

1) For the maximum tightening torques the general instructions must be observed.

2) Momentary pressure spikes may occur depending on the application.

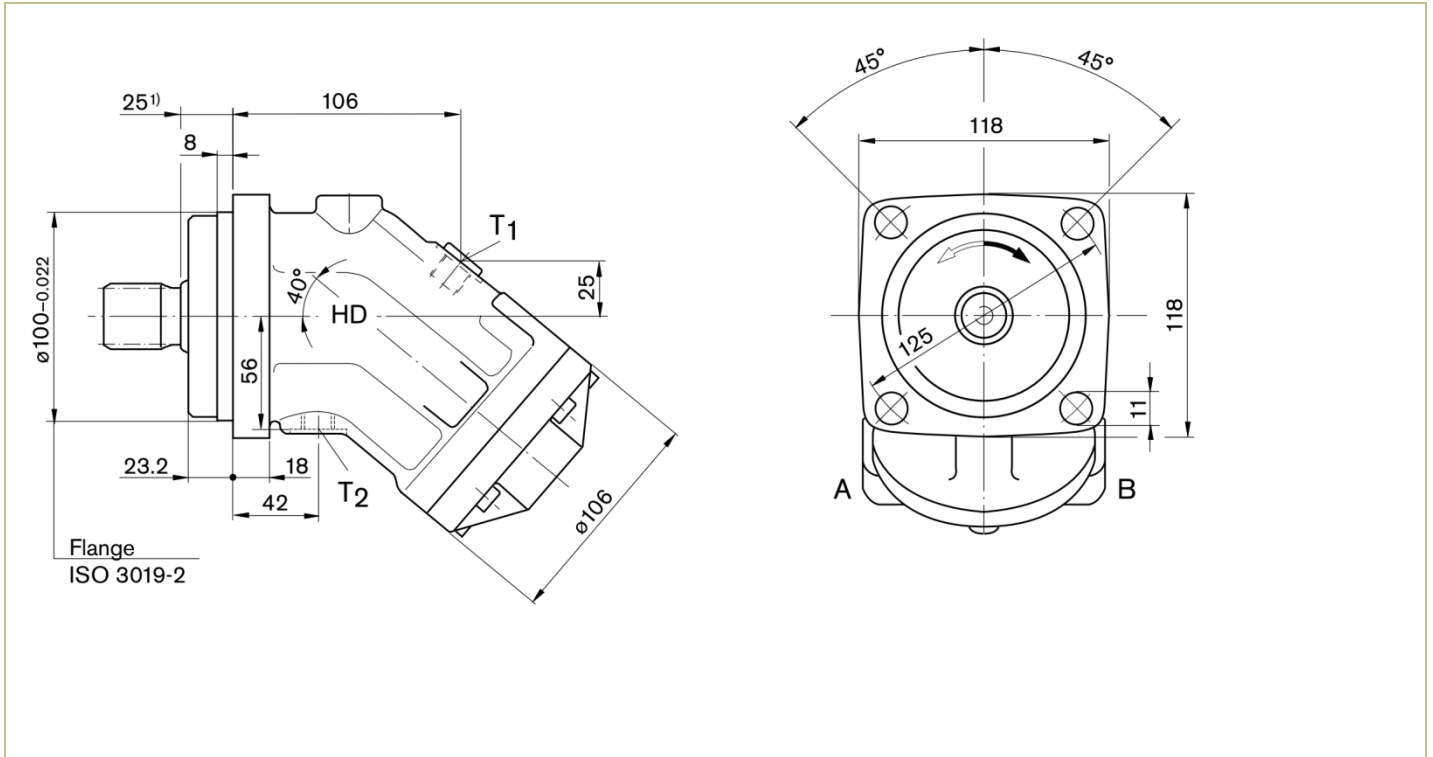
Keep this in mind when selecting measuring devices and fittings.

3) The spot face can be deeper than specified in the appropriate standard

5) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

■ Size 23, 28, 32...Dimensions in mm

Port plate 010... SAE flange ports at rear.



□ Drive shaft

<p>Size 23, 28, 32</p> <p>A Splined shaft DIN 5480 W 30 x 2 x 14 x 9g</p>	<p>■ Size 23, 28</p> <p>Z Splined shaft DIN 5480 W 25 x 1.25 x 18 x 9g</p>	<p>■ Size 23, 28, 32</p> <p>B Parallel keyed shaft DIN 6885 AS 8 x 7 x 40</p>	<p>■ Size 23, 28</p> <p>P Parallel keyed shaft DIN 6885 AS 8 x 7 x 40</p>
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□ Ports

Ports	Port for	Standard	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁸⁾
A, B	Working port		see port plates	450	
T ₁	Drain port	DIN 3852 ⁵⁾	M16 x 1.5 deep 12	3	X ⁷⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M16 x 1.5 deep 12	3	O ⁷⁾

Note

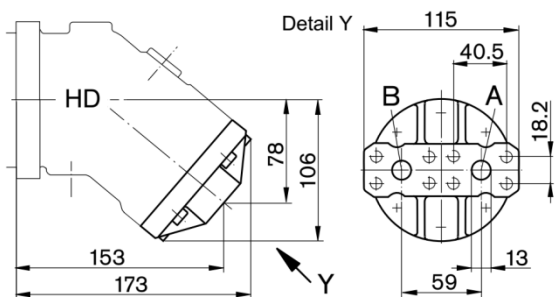
- 1) To shaft colla
- 2) Center bore according to DIN 332 (thread according to DIN 13)
- 3) For the maximum tightening torques the general instructions must be observed.
- 4) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.

- 5) The spot face can be deeper than specified in the appropriate standard
- 7) Depending on the installation position, T₁ or T₂ must be connected
- 8) O = Must be connected (plugged on delivery)
X = plugged (in normal operation)

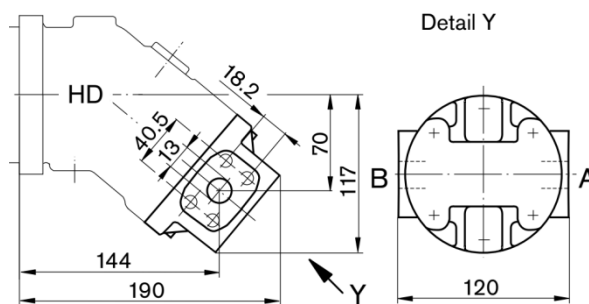
■ Size 23, 28, 32...Dimensions in mm

Location of the service line ports on the port plates

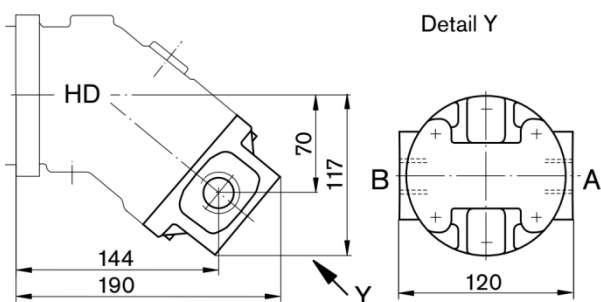
Plate 01...SAE flange ports at rear



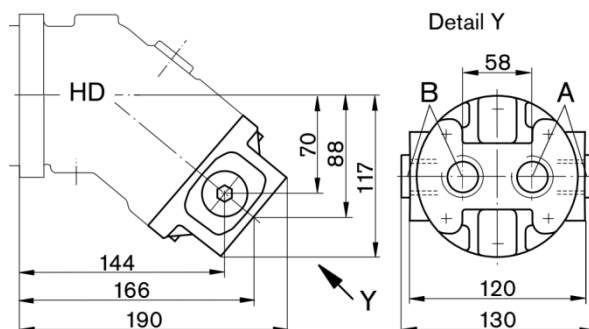
■ Plate 02...SAE flange ports at side, opposite



■ Plate 03...Threaded ports at side, opposite



■ Plate 04...Threaded ports at side and rear



■ Plate 10...SAE flange ports at bottom (same side)

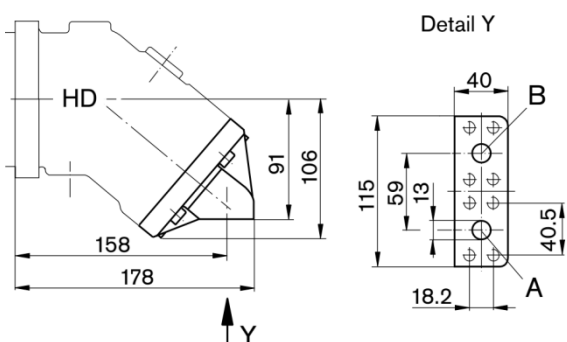


Plate	Ports	Port for	Standard	Size ¹⁾	P _{Max} [bar] ²⁾	State ⁵⁾
01, 02, 10	A, B	Working port Fastening thread	SAE J518 ⁴⁾ DIN 13	1/2" M8 x 1.25 deep 15	450	O
03	A, B	Working port	DIN 3852 ³⁾	M27 x 2 deep 16	450	X
04	A, B	Working port	DIN 3852 ³⁾	M27 x 2 deep 16	450	O

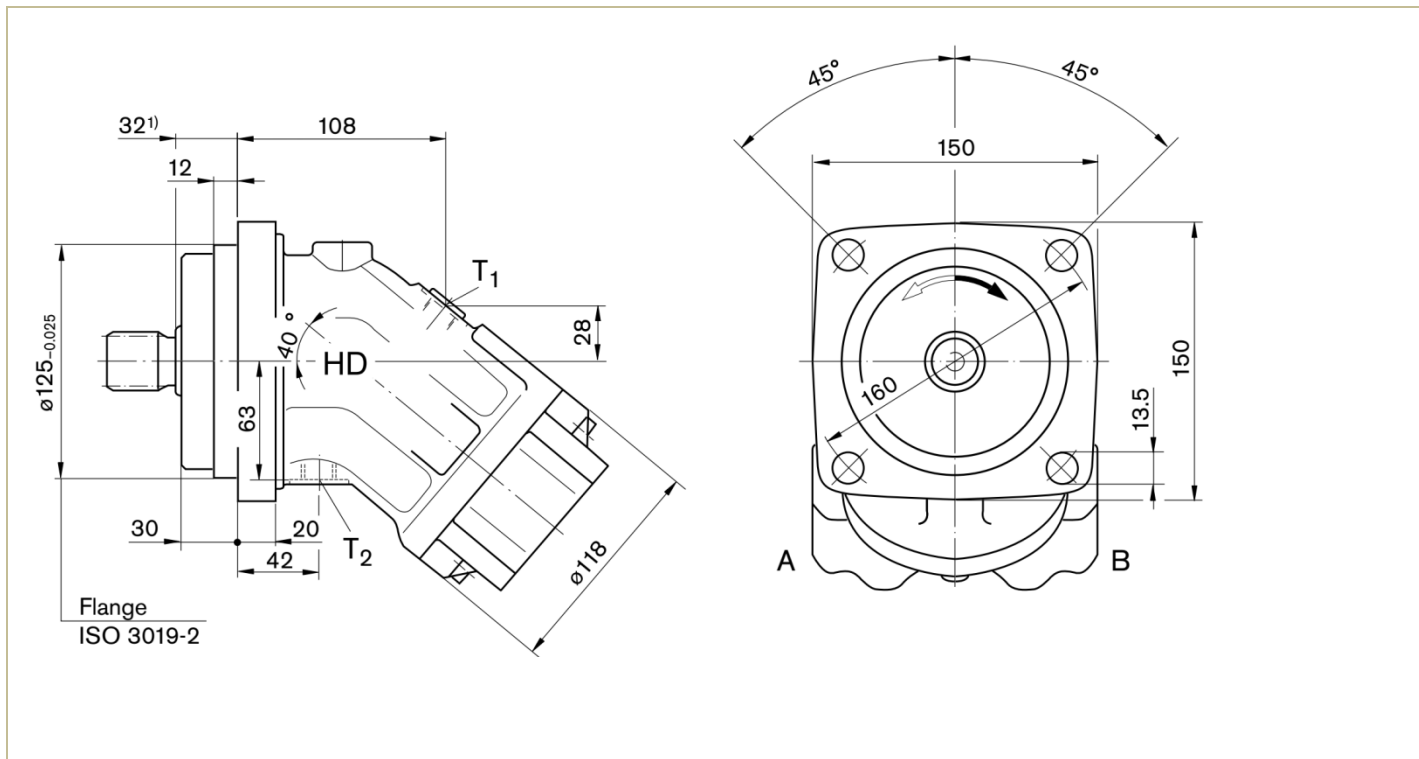
Note

- 1) For the maximum tightening torques the general instructions must be observed.
- 2) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.

- 3) The spot face can be deeper than specified in the appropriate standard
- 4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
- 5) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

■ Size 45...Dimensions in mm

Port plate 010... SAE flange ports at rear.



□ Drive shaft

<p>Size 45 Z Splined shaft DIN 5480 W 30 x 2 x 14 x 9g</p>	<p>Size 45 P Parallel keyed shaft DIN 6885 AS 8 x 7 x 50</p>
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□ Ports

Ports	Port for	Standard	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁸⁾
A, B	Working port		see port plates	450	
T ₁	Drain port	DIN 3852 ⁵⁾	M18 x 1.5 deep 12	3	X ⁷⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M18 x 1.5 deep 12	3	O ⁷⁾

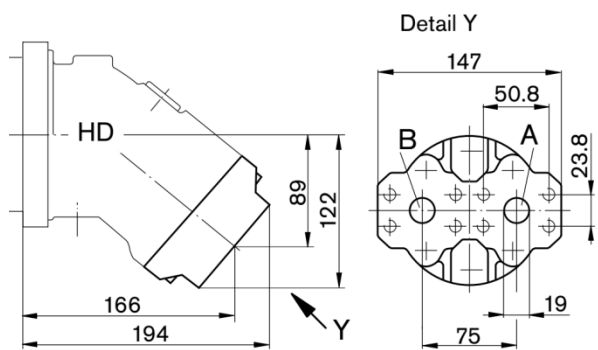
Note

- 1) To shaft colla
- 2) Center bore according to DIN 332 (thread according to DIN 13)
- 3) For the maximum tightening torques the general instructions must be observed.
- 4) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.
- 5) The spot face can be deeper than specified in the appropriate standard
- 7) Depending on the installation position, T₁ or T₂ must be connected
- 8) O = Must be connected (plugged on delivery)
X = plugged (in normal operation)

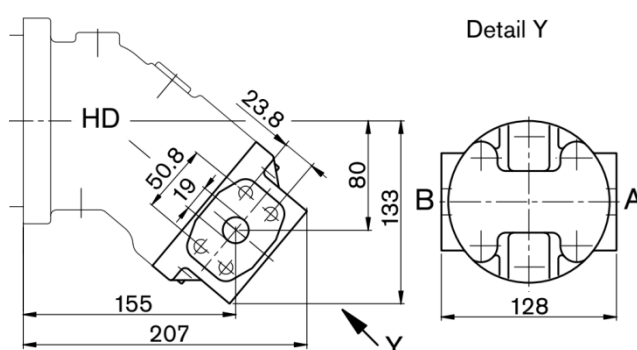
■ Size 45...Dimensions in mm

Location of the service line ports on the port plates

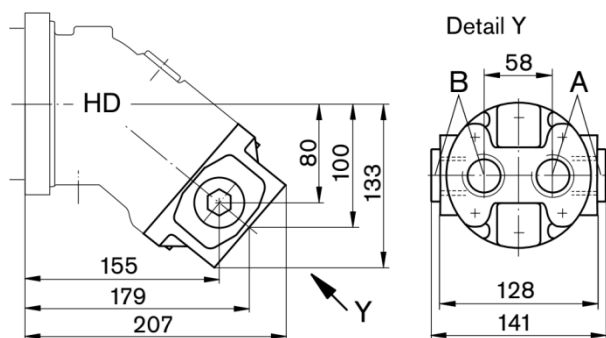
Plate 01...SAE flange ports at rear



■ Plate 02...SAE flange ports at side, opposite



■ Plate 04...Threaded ports at side and rear



■ Plate 10...SAE flange ports at bottom (same side)

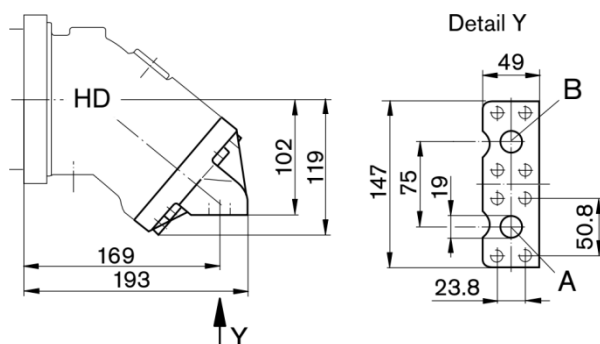


Plate	Ports	Port for	Standard	Size ¹⁾	P _{Max} [bar] ²⁾	State ⁵⁾
01, 02, 10	A, B	Working port	SAE J518 ⁴⁾	3/4"	450	O
		Fastening thread	DIN 13	M10 x 1.5 deep 17		
04	A, B	Working port	DIN 3852 ³⁾	M33 x 2 deep 18	450	O

Note

1) For the maximum tightening torques the general instructions must be observed.

2) Momentary pressure spikes may occur depending on the application.

Keep this in mind when selecting measuring devices and fittings.

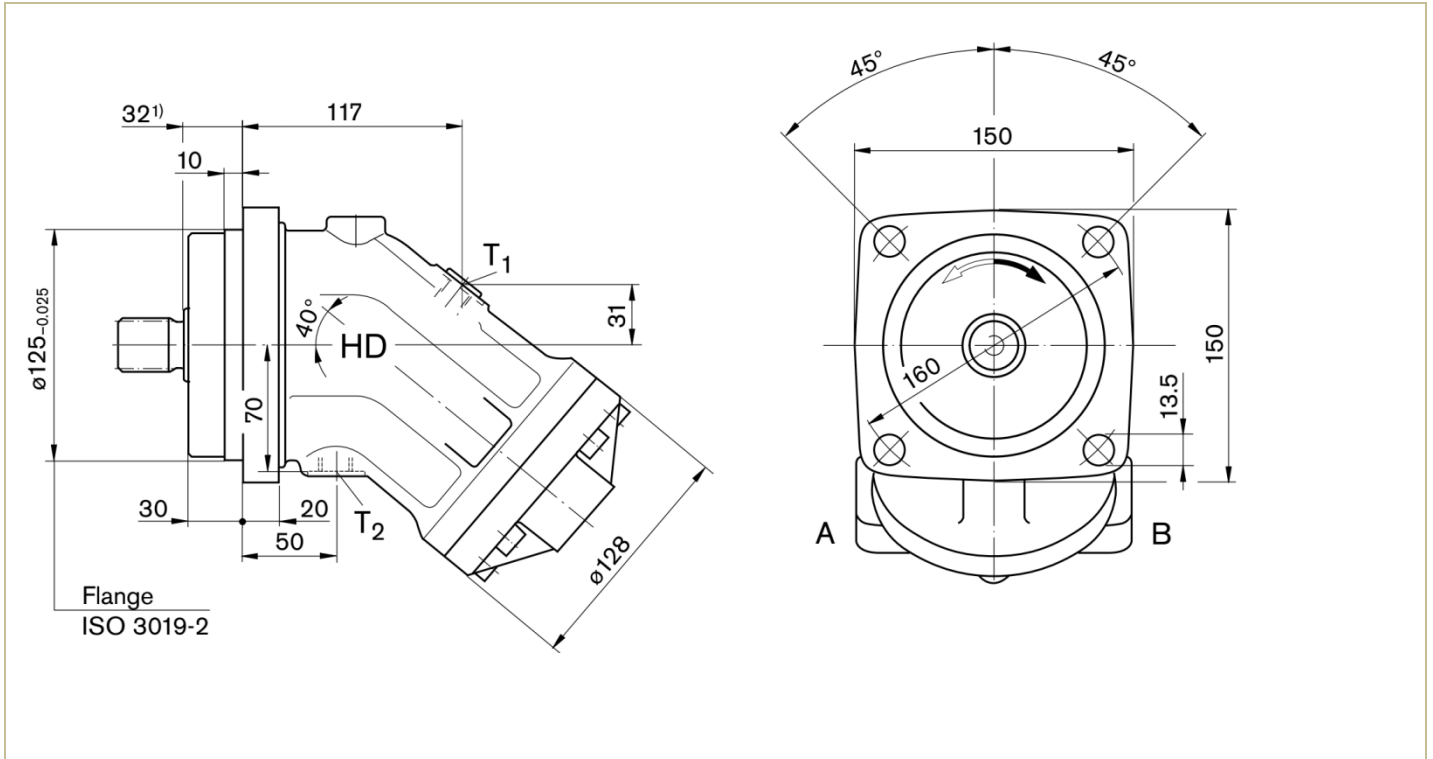
3) The spot face can be deeper than specified in the appropriate standard

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

5) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

■ Size 56, 63...Dimensions in mm

Port plate 010... SAE flange ports at rear.



□ Drive shaft

<p>Size 56, 63</p> <p>A Splined shaft DIN 5480 W 35 x 2 x 16 x 9g</p>	<p>■ Size 56</p> <p>Z Splined shaft DIN 5480 W 30 x 2 x 14 x 9g</p>	<p>■ Size 56, 63</p> <p>B Parallel keyed shaft DIN 6885 AS 10 x 8 x 50</p>	<p>■ Size 56</p> <p>P Parallel keyed shaft DIN 6885 AS 8 x 7 x 50</p>
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□ Ports

Ports	Port for	Standard	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁸⁾
A, B	Working port		see port plates	450	
T ₁	Drain port	DIN 3852 ⁵⁾	M18 x 1.5 deep 12	3	X ⁷⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M18 x 1.5 deep 12	3	O ⁷⁾

Note

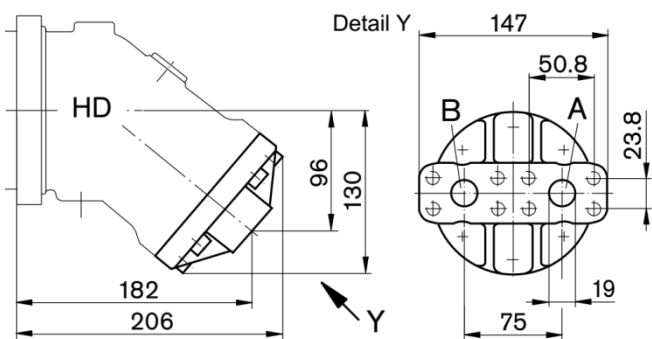
- 1) To shaft colla
- 2) Center bore according to DIN 332 (thread according to DIN 13)
- 3) For the maximum tightening torques the general instructions must be observed.
- 4) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.

- 5) The spot face can be deeper than specified in the appropriate standard
- 7) Depending on the installation position, T₁ or T₂ must be connected
- 8) O = Must be connected (plugged on delivery)
X = plugged (in normal operation)

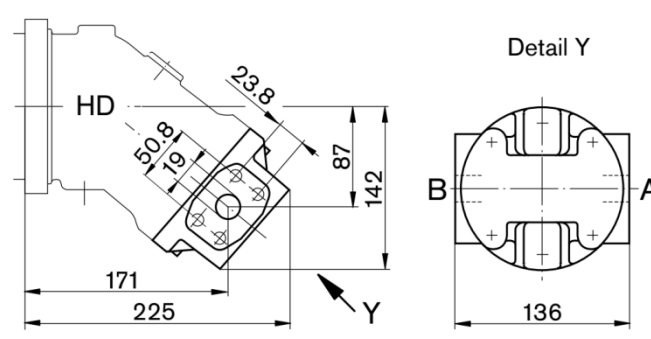
■ Size 56, 63...Dimensions in mm

Location of the service line ports on the port plates

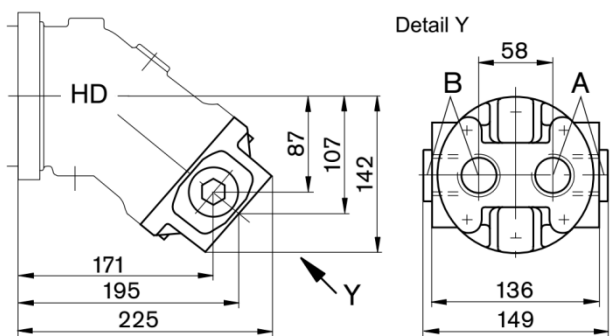
Plate 01...SAE flange ports at rear



■ Plate 02...SAE flange ports at side, opposite



■ Plate 04...Threaded ports at side and rear



■ Plate 10...SAE flange ports at bottom (same side)

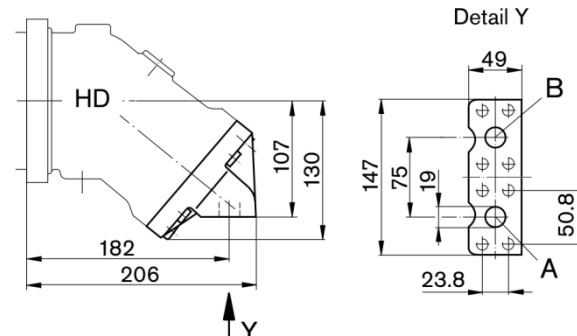


Plate	Ports	Port for	Standard	Size ¹⁾	P _{Max} [bar] ²⁾	State ⁵⁾
01, 02, 10	A, B	Working port Fastening thread	SAE J518 ⁴⁾ DIN 13	3/4" M10 x 1.5 deep 17	450	O
04	A, B	Working port	DIN 3852 ³⁾	M33 x 2 deep 18	450	O

Note

1) For the maximum tightening torques the general instructions must be observed.

2) Momentary pressure spikes may occur depending on the application.

Keep this in mind when selecting measuring devices and fittings.

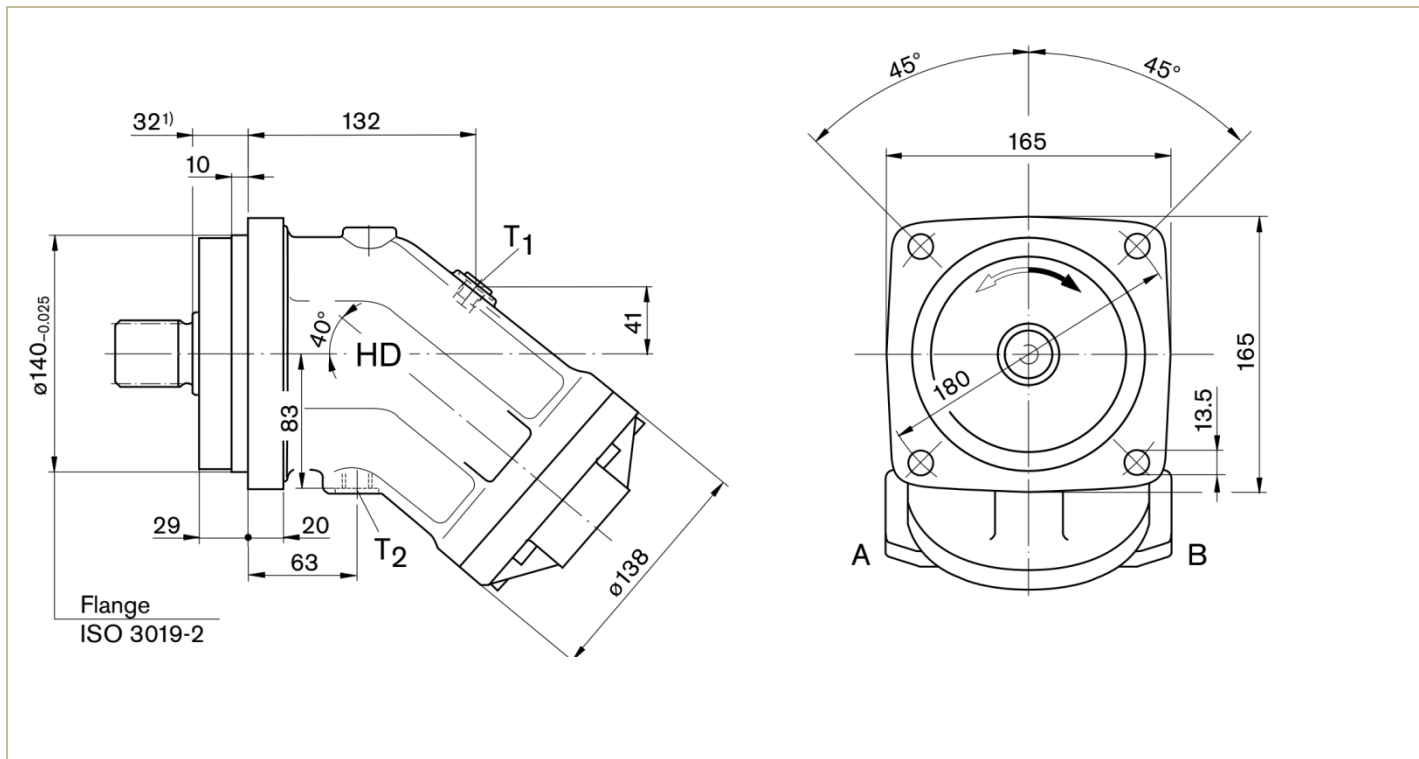
3) The spot face can be deeper than specified in the appropriate standard

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

5) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

■ Size 80, 90...Dimensions in mm

Port plate 010... SAE flange ports at rear.



□ Drive shaft

<p>Size 80, 90</p> <p>A Splined shaft DIN 5480 W 40 x 2 x 18 x 9g</p>	<p>■ Size 80</p> <p>Z Splined shaft DIN 5480 W 35 x 2 x 16 x 9g</p>	<p>■ Size 80, 90</p> <p>B Parallel keyed shaft DIN 6885 AS 12 x 8 x 56</p>	<p>■ Size 80</p> <p>P Parallel keyed shaft DIN 6885 AS 10 x 8 x 56</p>
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□ Ports

Ports	Port for	Standard	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁸⁾
A, B	Working port		see port plates	450	
T ₁	Drain port	DIN 3852 ⁵⁾	M18 x 1.5 deep 12	3	X ⁷⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M18 x 1.5 deep 12	3	O ⁷⁾

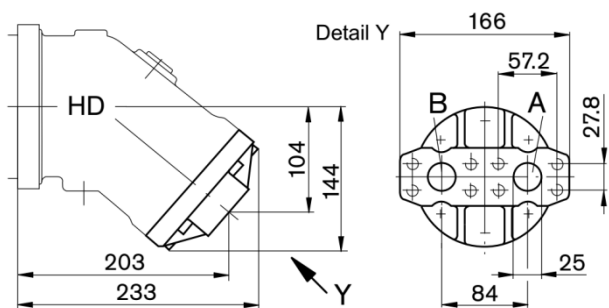
Note

- 1) To shaft colla
- 2) Center bore according to DIN 332 (thread according to DIN 13)
- 3) For the maximum tightening torques the general instructions must be observed.
- 4) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.
- 5) The spot face can be deeper than specified in the appropriate standard
- 7) Depending on the installation position, T₁ or T₂ must be connected
- 8) O = Must be connected (plugged on delivery)
X = plugged (in normal operation)

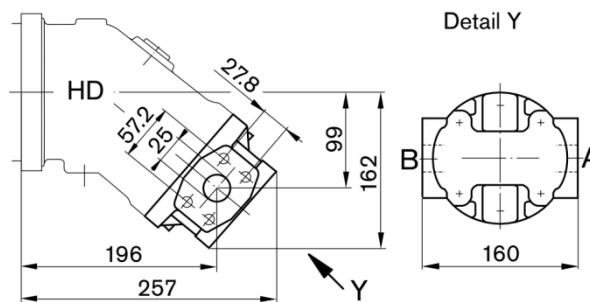
■ Size 80, 90...Dimensions in mm

Location of the service line ports on the port plates

Plate 01...SAE flange ports at rear



■ Plate 02...SAE flange ports at side, opposite



■ Plate 10...SAE flange ports at bottom (same side)

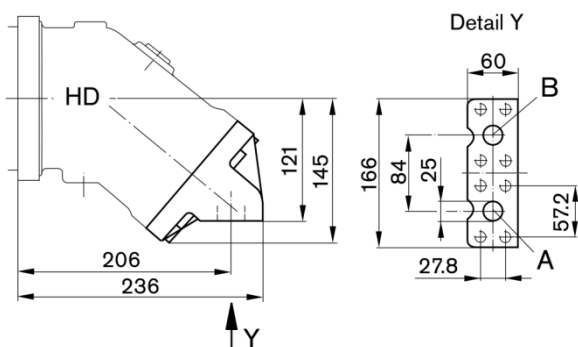


Plate	Ports	Port for	Standard	Size ¹⁾	P _{Max} [bar] ²⁾	State ⁵⁾
01, 02, 10	A, B	Working port Fastening thread	SAE J518 ⁴⁾ DIN 13	3/4" M10 x 1.5 deep 17	450	O

Note

1) For the maximum tightening torques the general instructions must be observed.

2) Momentary pressure spikes may occur depending on the application.

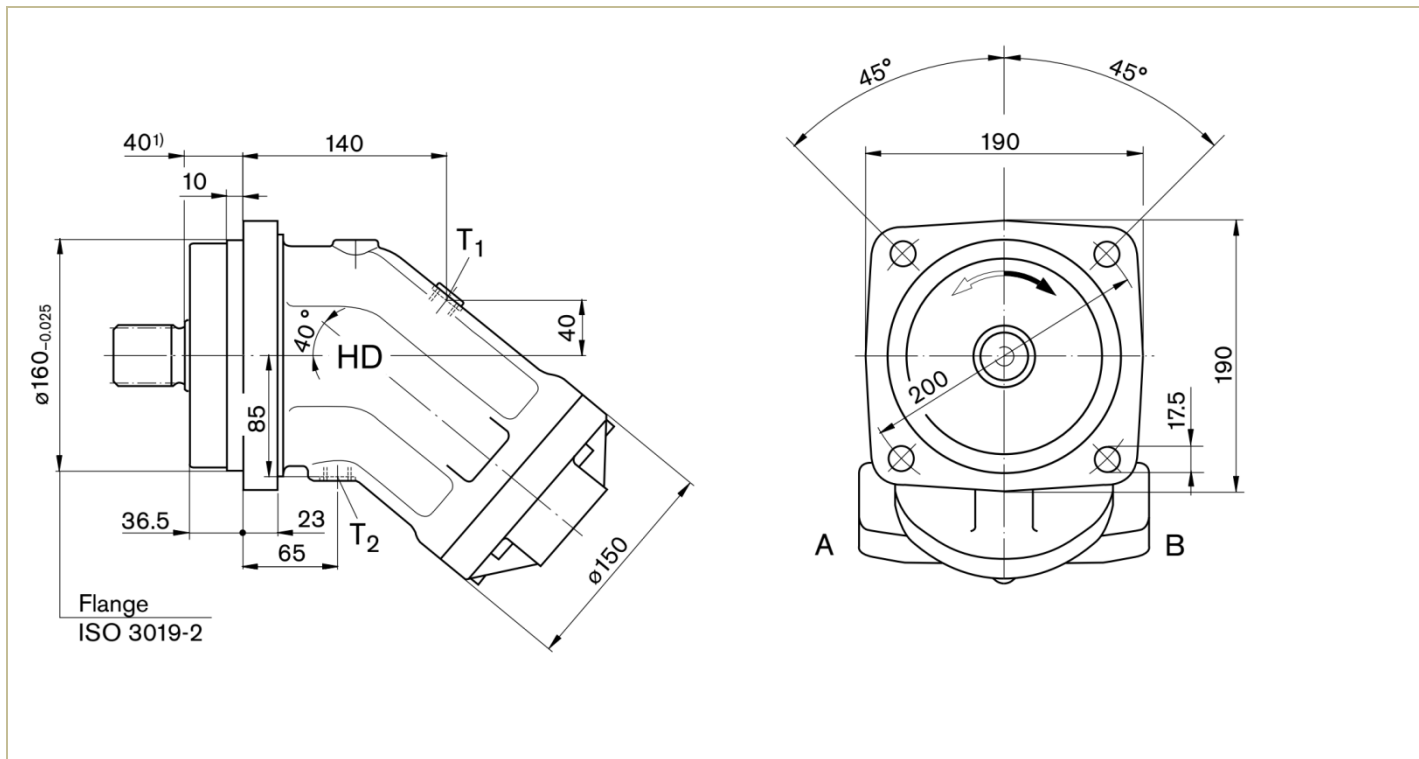
Keep this in mind when selecting measuring devices and fittings.

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

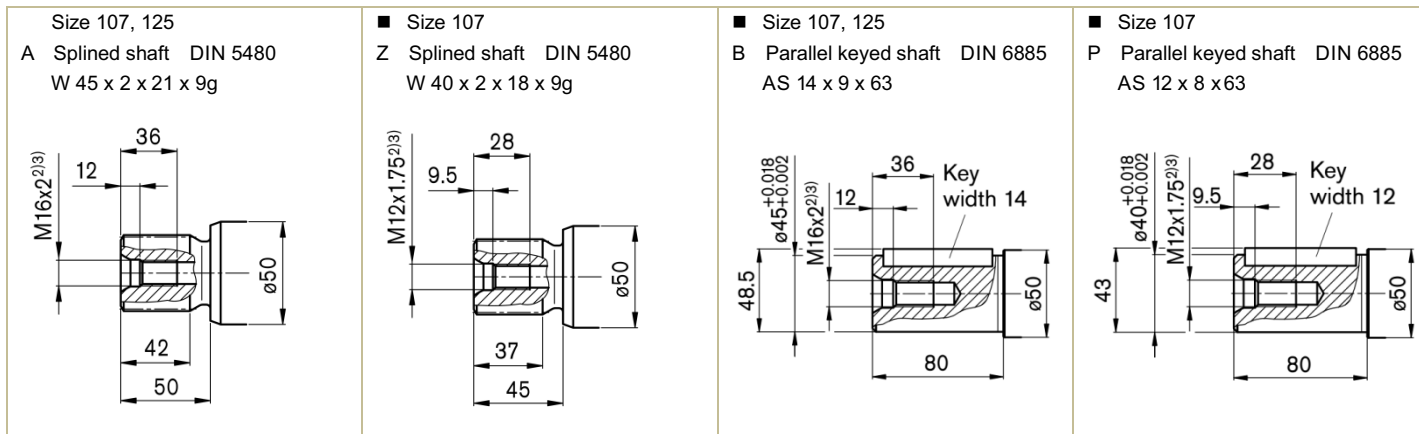
5) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

■ Size 107, 125...Dimensions in mm

Port plate 010... SAE flange ports at rear.



□ Drive shaft



□ Ports

Ports	Port for	Standard	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁶⁾
A, B	Working port		see port plates	450	
T ₁	Drain port	DIN 3852 ⁵⁾	M18 x 1.5 deep 12	3	X ⁷⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M18 x 1.5 deep 12	3	O ⁷⁾

Note

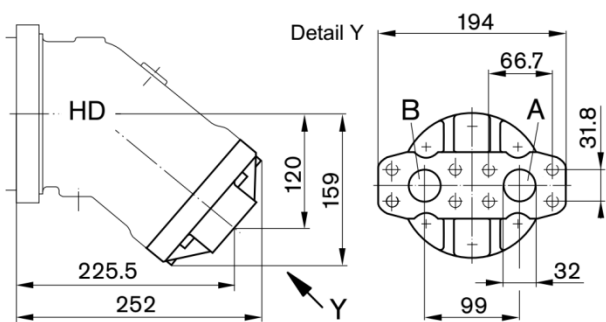
- 1) To shaft colla
- 2) Center bore according to DIN 332 (thread according to DIN 13)
- 3) For the maximum tightening torques the general instructions must be observed.
- 4) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.

- 5) The spot face can be deeper than specified in the appropriate standard
- 7) Depending on the installation position, T₁ or T₂ must be connected
- 8) O = Must be connected (plugged on delivery)
X = plugged (in normal operation)

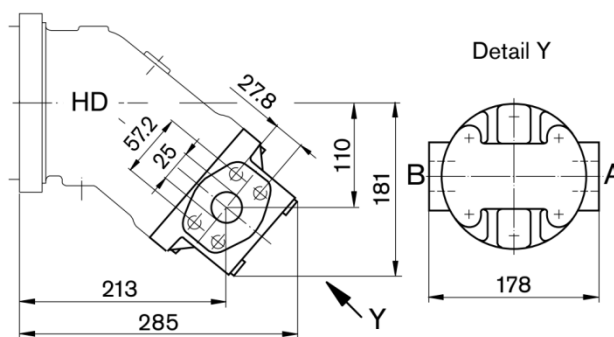
■ Size 107, 125...Dimensions in mm

Location of the service line ports on the port plates

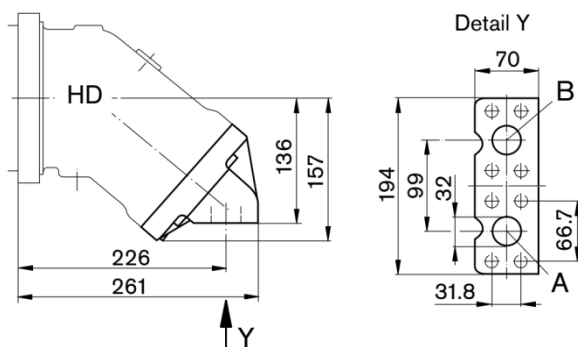
Plate 01...SAE flange ports at rear



■ Plate 02...SAE flange ports at side, opposite



■ Plate 10...SAE flange ports at bottom (same side)



■ Plate 02...SAE flange ports at side, opposite (Size125)

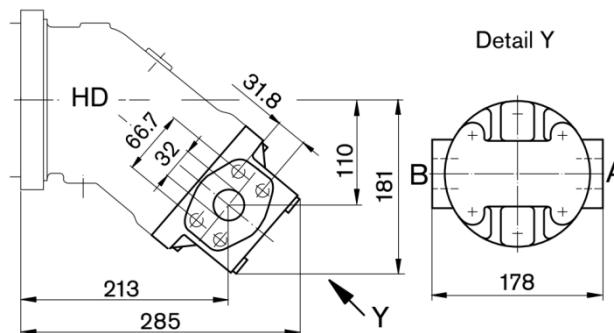


Plate	Ports	Port for	Standard	Size ¹⁾	P _{Max} [bar] ²⁾	State ⁵⁾
01, 10	A, B	Working port Fastening thread	SAE J518 ⁴⁾ DIN 13	1-1/4" M14 x 2 deep 19	450	O
02 Size107	A, B	Working port Fastening thread	SAE J518 ⁴⁾ DIN 13	1" M12 x 1.75 deep 17	450	O
02 Size125	A, B	Working port Fastening thread	SAE J518 ⁴⁾ DIN 13	1-1/4" M14 x 2 deep 19	450	O

Note

1) For the maximum tightening torques the general instructions must be observed.

2) Momentary pressure spikes may occur depending on the application.

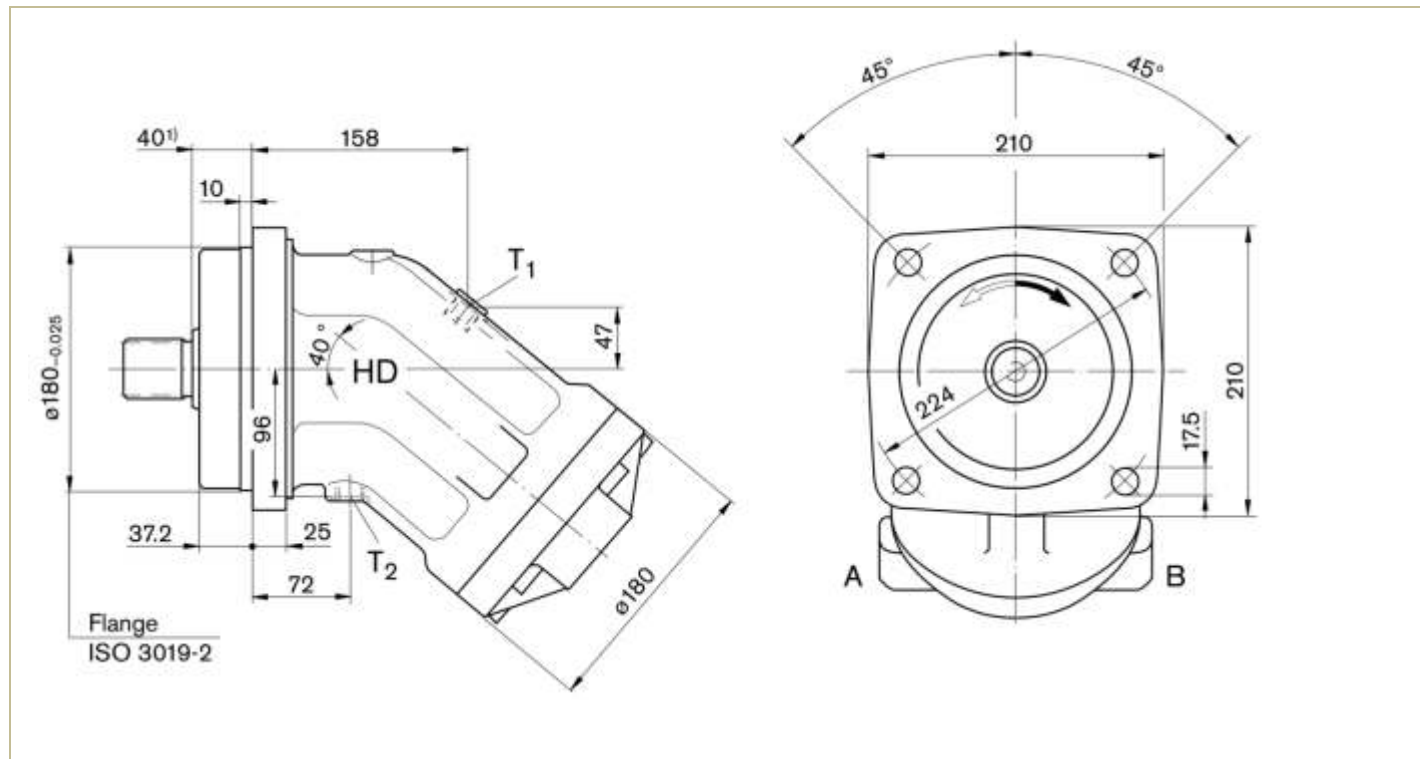
Keep this in mind when selecting measuring devices and fittings.

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

5) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

■ Size 160, 180...Dimensions in mm

Port plate 010... SAE flange ports at rear.



□ Drive shaft

<p>Size 160, 180</p> <p>A Splined shaft DIN 5480 W 50 x 2 x 24 x 9g</p>	<p>■ Size 160</p> <p>Z Splined shaft DIN 5480 W 45 x 2 x 21 x 9g</p>	<p>■ Size 160, 180</p> <p>B Parallel keyed shaft DIN 6885 AS 14 x 9 x 70</p>	<p>■ Size 160</p> <p>P Parallel keyed shaft DIN 6885 AS 14 x 9 x 70</p>
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□ Ports

Ports	Port for	Standard	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁶⁾
A, B	Working port		see port plates	450	
T ₁	Drain port	DIN 3852 ⁵⁾	M22 x 1.5 deep 14	3	X ⁷⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M22 x 1.5 deep 14	3	O ⁷⁾

Note

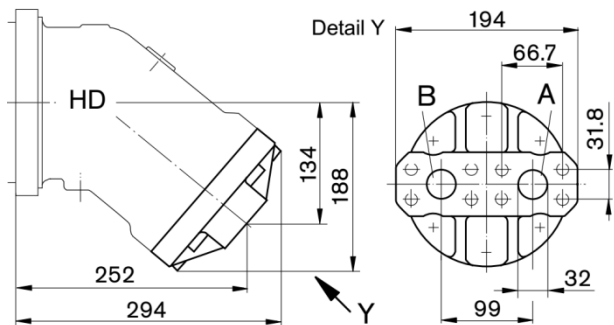
- 1) To shaft colla
- 2) Center bore according to DIN 332 (thread according to DIN 13)
- 3) For the maximum tightening torques the general instructions must be observed.
- 4) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.

- 5) The spot face can be deeper than specified in the appropriate standard
- 7) Depending on the installation position, T₁ or T₂ must be connected
- 8) O = Must be connected (plugged on delivery)
X = plugged (in normal operation)

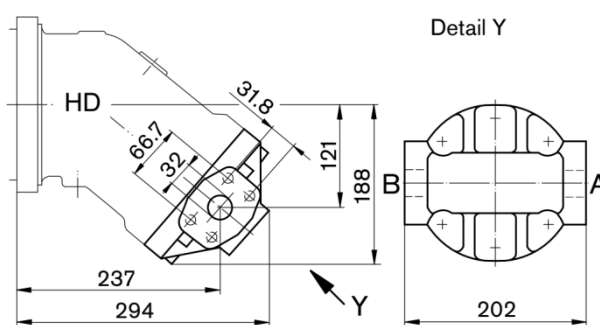
■ Size 160, 180...Dimensions in mm

Location of the service line ports on the port plates

Plate 01...SAE flange ports at rear



■ Plate 02...SAE flange ports at side, opposite



■ Plate 10...SAE flange ports at bottom (same side)

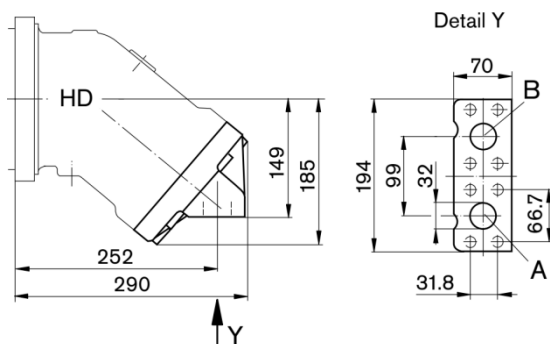


Plate	Ports	Port for	Standard	Size ¹⁾	P _{Max} [bar] ²⁾	State ⁵⁾
01, 02, 10	A, B	Working port Fastening thread	SAE J518 ⁴⁾ DIN 13	1-1/4" M14 x 2 deep 19	450	O

Note

1) For the maximum tightening torques the general instructions must be observed.

2) Momentary pressure spikes may occur depending on the application.

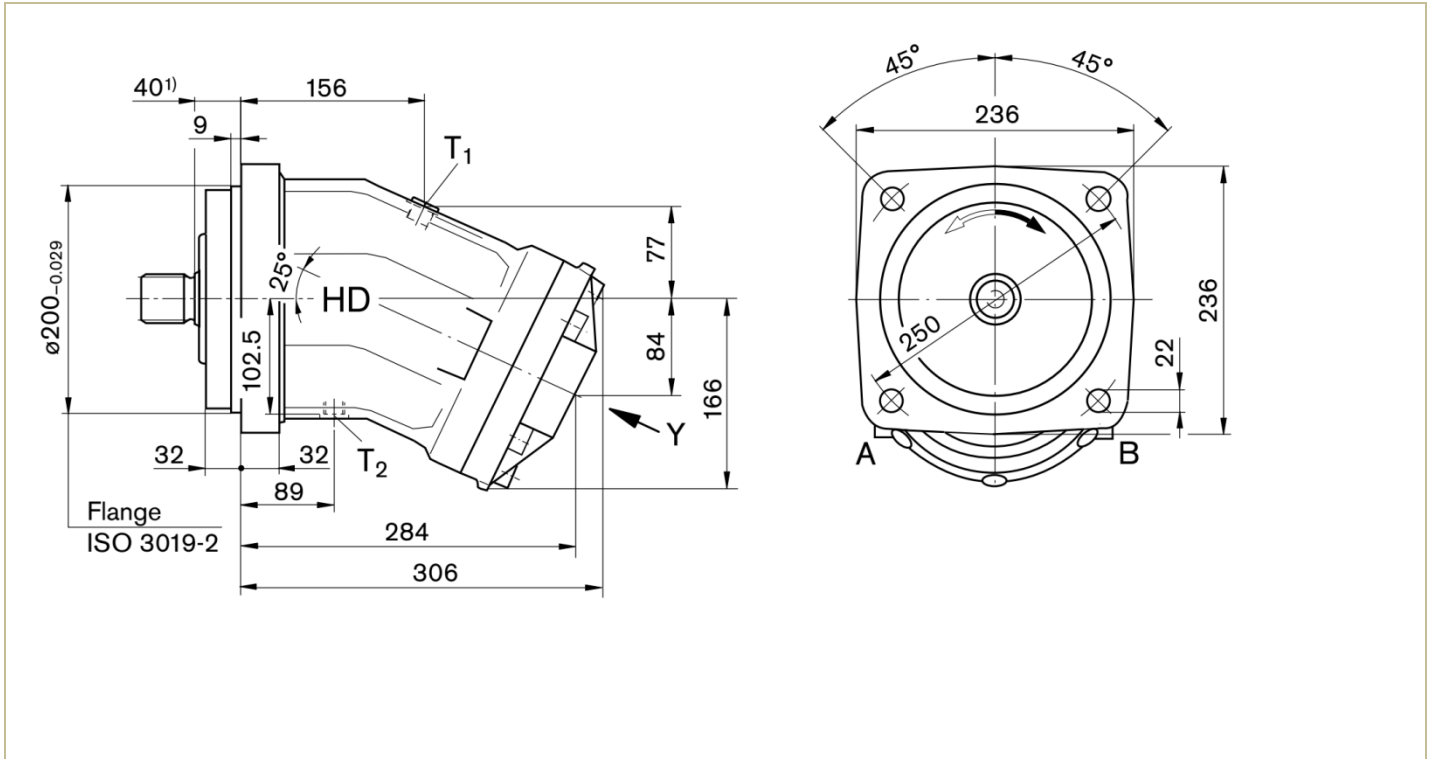
Keep this in mind when selecting measuring devices and fittings.

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

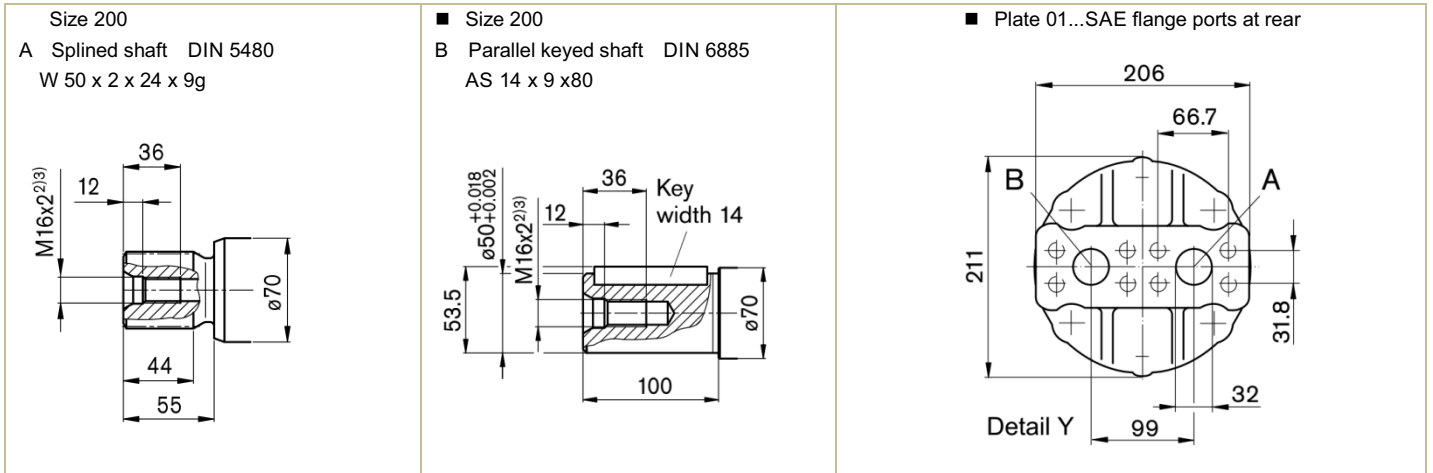
5) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

■ Size 200...Dimensions in mm

Port plate 010... SAE flange ports at rear.



□ Drive shaft



□ Ports

Ports	Port for	Standard	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁸⁾
A, B	Working port Fastening thread	SAE J518 ⁶⁾ DIN 13	1-1/4" M14 x 2 deep 19	450	
T ₁	Drain port	DIN 3852 ⁵⁾	M22 x 1.5 deep 14	3	X ⁷⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M22 x 1.5 deep 14	3	O ⁷⁾

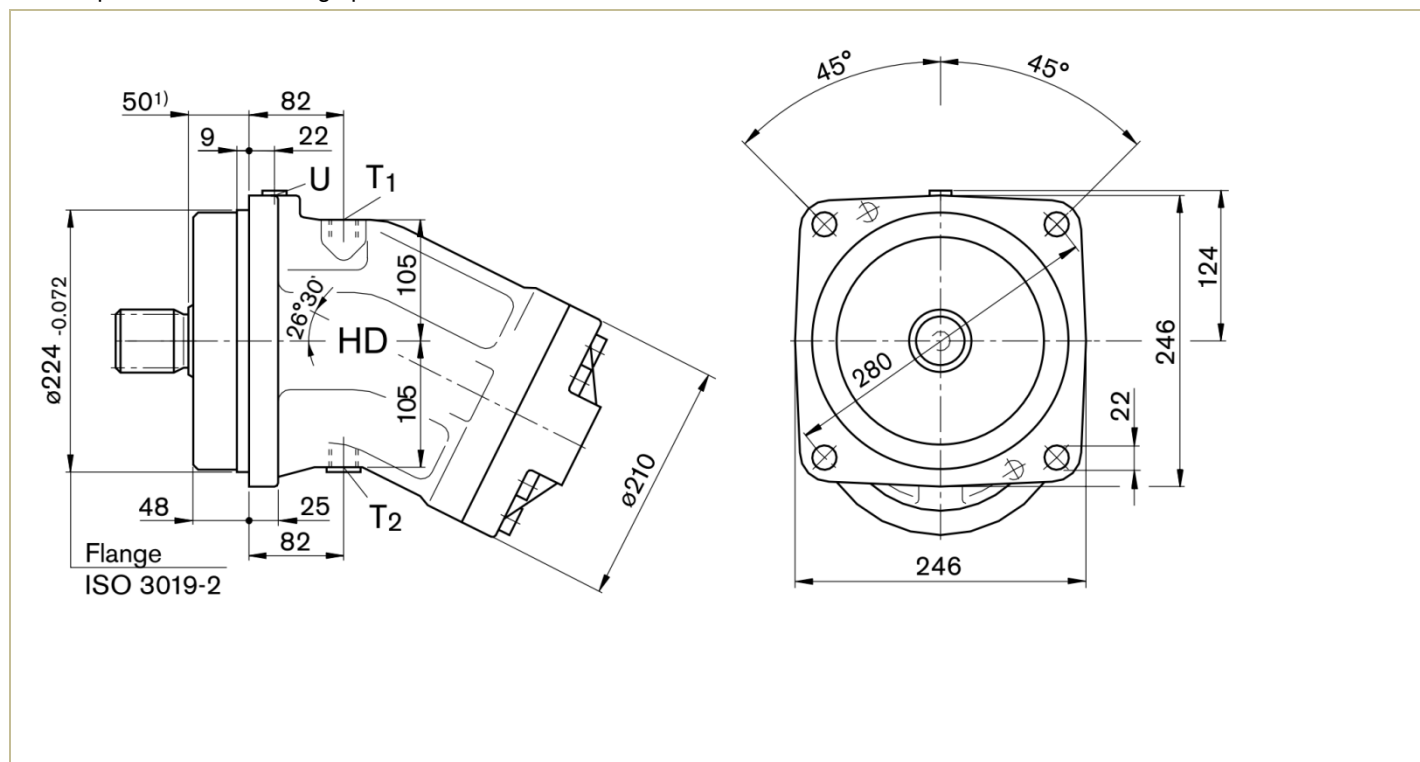
Note

- 1) To shaft collar
- 2) Center bore according to DIN 332 (thread according to DIN 13)
- 3) For the maximum tightening torques the general instructions must be observed.
- 4) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.

- 5) The spot face can be deeper than specified in the appropriate standard
- 6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
- 7) Depending on the installation position, T₁ or T₂ must be connected
- 8) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

■ Size 250...Dimensions in mm

Port plate 010... SAE flange ports at rear.



□ Drive shaft

<p>Size 250 Z Splined shaft DIN 5480 W 50 x 2 x 24 x 9g</p>	<p>■ Size 250 P Parallel keyed shaft DIN 6885 AS 14 x 9 x 80</p>
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□ Ports

Ports	Port for	Standard	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁶⁾
A, B	Working port		see port plates	450	
T ₁	Drain port	DIN 3852 ⁵⁾	M22 x 1.5 deep 14	3	X ⁷⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M22 x 1.5 deep 14	3	O ⁷⁾
U	Bearing flushing port	DIN 3852 ⁵⁾	M14 x 1.5 deep 12	3	X

Note

- | | |
|---|---|
| <p>1) To shaft colla</p> <p>2) Center bore according to DIN 332 (thread according to DIN 13)</p> <p>3) For the maximum tightening torques the general instructions must be observed.</p> <p>4) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.</p> | <p>5) The spot face can be deeper than specified in the appropriate standard</p> <p>7) Depending on the installation position, T₁ or T₂ must be connected</p> <p>8) O = Must be connected (plugged on delivery)
X = plugged (in normal operation)</p> |
|---|---|

■ Size 250...Dimensions in mm

Location of the service line ports on the port plates

Plate 01...SAE flange ports at rear

■ Plate 02...SAE flange ports at side, opposite

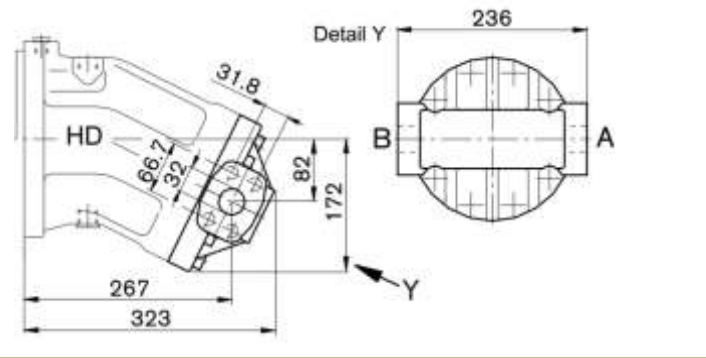
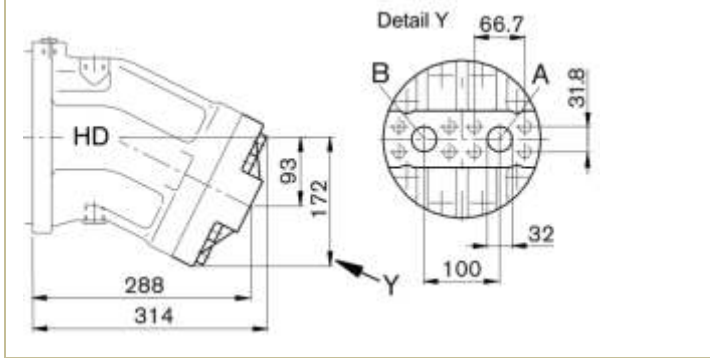


Plate	Ports	Port for	Standard	Size ¹⁾	P _{Max} [bar] ²⁾	State ⁵⁾
01, 02	A, B	Working port Fastening thread	SAE J518 ⁴⁾ DIN 13	1-1/4" M14 x 2 deep 19	400	O

Note

1) For the maximum tightening torques the general instructions must be observed.

2) Momentary pressure spikes may occur depending on the application.

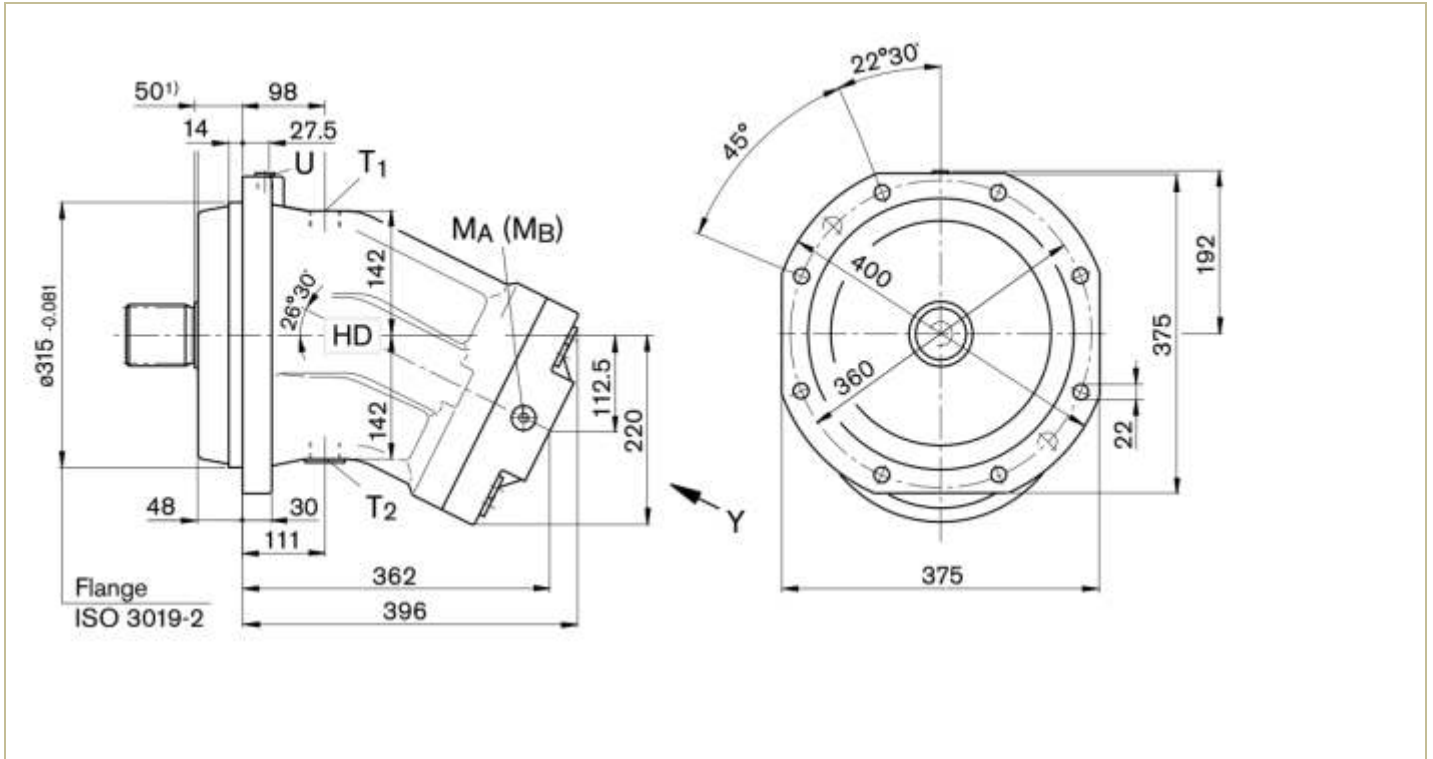
Keep this in mind when selecting measuring devices and fittings.

4) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.

5) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

■ Size 500...Dimensions in mm

Port plate 010... SAE flange ports at rear.



□ Drive shaft

<p>Size 500 Z Splined shaft DIN 5480 W 70 x 3 x 22 x 9g</p>	<p>■ Size 500 P Parallel keyed shaft DIN 6885 AS 20 x 12 x 100</p>	<p>■ Plate 01...SAE flange ports at rear</p>
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□ Ports

Ports	Port for	Standard	Size ³⁾	P _{Max} [bar] ⁴⁾	State ⁸⁾
A, B	Working port Fastening thread	SAE J518 ⁶⁾ DIN 13	1-1/2" M16 x 2 deep 21	450	
T ₁	Drain port	DIN 3852 ⁵⁾	M33 x 2 deep 18	3	X ⁷⁾
T ₂	Drain port	DIN 3852 ⁵⁾	M33 x 2 deep 18	3	O ⁷⁾
U	Bearing flushing port	DIN 3852 ⁵⁾	M18 x 1.5 deep 12	3	X
M _A , M _B	Measuring working pressure	DIN 3852 ⁵⁾	M14 x 1.5 deep 12	400	X

Note

- 1) To shaft colla
- 2) Center bore according to DIN 332 (thread according to DIN 13)
- 3) For the maximum tightening torques the general instructions must be observed.
- 4) Momentary pressure spikes may occur depending on the application.
Keep this in mind when selecting measuring devices and fittings.
- 5) The spot face can be deeper than specified in the appropriate standard
- 6) Only dimensions according to SAE J518, metric fastening thread is a deviation from standard.
- 7) Depending on the installation position, T₁ or T₂ must be connected
- 8) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

Flushing and boost pressure valve

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

- ❑ In an open circuit, it is used only for flushing the housing.
- ❑ In a closed circuit, it ensures a minimum boost pressure level in addition to the case flushing.
- ❑ Hydraulic fluid is directed from the respective low pressure side into the motor housing. This is then fed into the reservoir, together with the case drain fluid. The hydraulic fluid, removed out of the closed circuit must be replaced by cooled hydraulic fluid from the boost pump.
- ❑ With port plate 027, the valve is mounted directly on the fixed motor (sizes 45 to 180, 250); with port plate 017 (sizes 355 and 500) on a plate.

Fixed setting

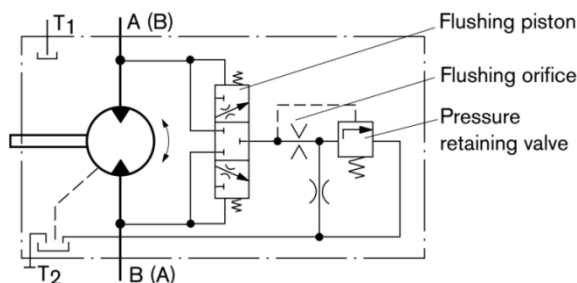
Cracking pressure of pressure retaining valve (observe when setting the primary valve)

Sizes 45 to 500, fixed setting 16 bar

- ❑ Switching pressure of flushing piston ΔP

Sizes 45 to 500 8 ± 1 bar

Schematic



Flushing flow q_v

Orifice (throttles with integrated valve) can be used to set the flushing flows as required.

- ❑ Following parameters are based on

$\Delta P_{ND} = P_{ND} - P_G = 25 \text{ bar}$ and $V = 10 \text{ mm}^2/\text{s}$

- 🌈 P_{ND} = low pressure P_G = case pressure

Standard flushing flows

Flushing and boost pressure valve, mounted

Size	flushing flows q_v l/min	Throttle Φ mm
45	3.5	1.2
107, 125	5	1.8
160, 180	8	2.0
250	10	2.0
355, 500	10	2.5

- ❑ With sizes 45 to 180, orifices can be supplied for flushing flows from 3.5 to 10 l/min. For other flushing flows, please state the required flushing flow when ordering.

- ❑ The flushing flow without orifice is approx. 12 to 14 l at low pressure $\Delta P_{ND} = 25 \text{ bar}$.

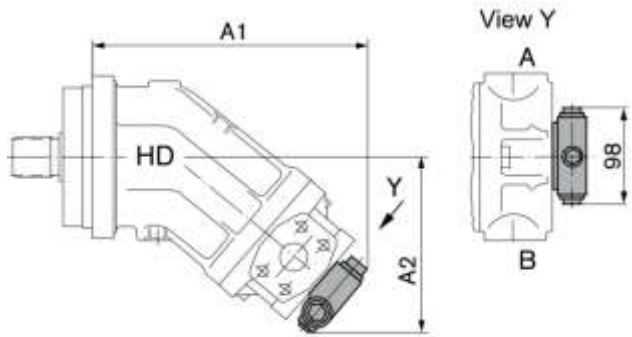
- ❑ Flushing and boost pressure valve, integrated

Size	flushing flows q_v l/min	Throttle Φ mm
56, 63	6	1.5
80, 90	7.3	1.8

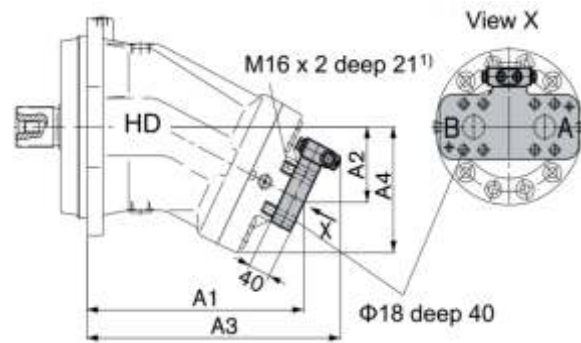
■ Flushing and boost pressure valve

Dimensions in mm

Port plate 027...SAE flange ports at side



□ Port plate 017...SAE flange ports at rear

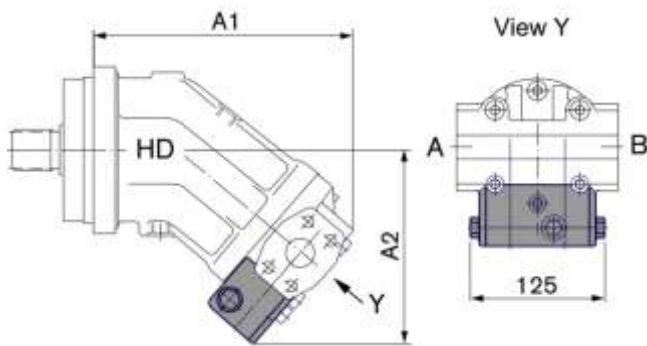


Size	A1	A2		
45	223	151		
107, 125	294	192		
160, 180	315	201		
250	344	172		

Size	A1	A2	A3	A4
355	356	120	421	198
500	397	130	464	220

1) DIN 13, observe the general instructions for the maximum tightening torques

□ Port plate 029...SAE flange ports at side



Size	A1	A2		
56, 63	225	176		
80, 90	257	186.7		

■ Pressure-relief valve

The pressure-relief valves 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.

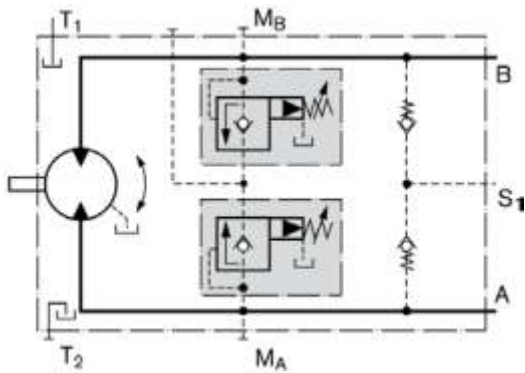
- The pressure-relief valves are only available in combination with port plates 181,191 or 192 (counterbalance valve for mounting to port plate 181)
- Cracking pressure setting range.....50 to 420 bar
- With the version "with pressure boost facility" (192), a higher pressure setting can be realized by applying an external pilot pressure of 25 to 30 bar to port P_{St}

When ordering, please state in plain text

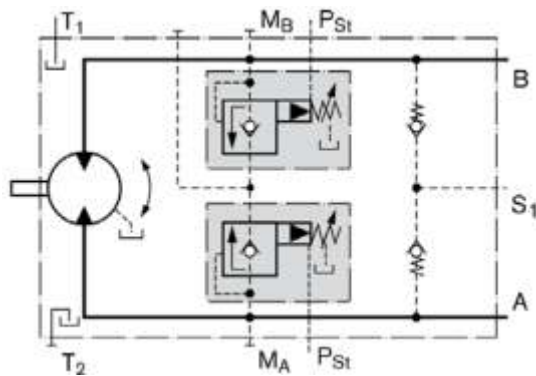
- Cracking pressure of pressure-relief valve
- Cracking pressure with pilot pressure applied to P_{St} (only with version 192)

Schematic

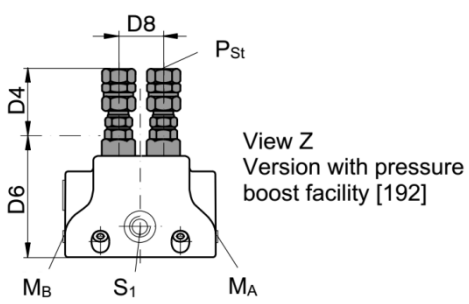
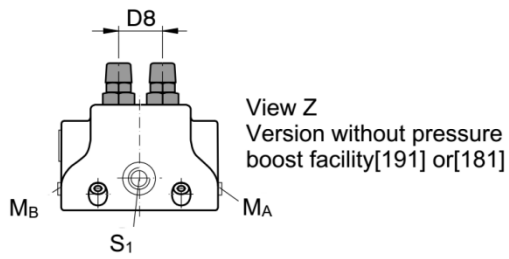
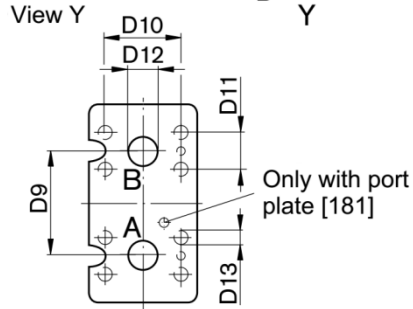
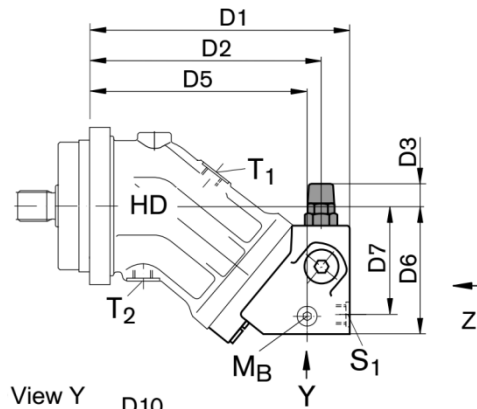
Version without pressure boost facility [191]



Version with pressure boost facility [192]



Dimensions in mm



■ Pressure-relief valve

Dimensions in mm

Size	Code	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13 ²⁾
28, 32	MHDB16	209	186	25	68	174	102	87	36	66	50.8	23.8	Φ19	M10 deep 17
45	MHDB16	222	198	22	65	187	113	98	36	66	50.8	23.8	Φ19	M10 deep 17
56, 63	MHDB22	250	222	19	61	208	124	105	42	75	50.8	23.8	Φ19	M10 deep 13
80, 90	MHDB22	271	243	17.5	59	229	134	114	42	75	57.2	27.8	Φ25	M12 deep 18
107, 125	MHDB32	298	266	10	52	250	149.5	130	53	84	66.7	31.8	Φ32	M14 deep 19
160, 180	MHDB32	332	301	5	47	285	170	149	53	84	66.7	31.8	Φ32	M14 deep 19

Size	Port A,B	S ₁ ¹⁾	M _A , M _B ¹⁾	P _{St} ¹⁾	
28, 32	3/4"	M22 x 1.5 deep 14	M20 x 1.5 deep 14	G1/4"	Assembly instructions for port plate with pressure boost facility "192" The lock nut must be counterheld when installing the hydraulic line at the pst port
45	3/4"	M22 x 1.5 deep 14	M20 x 1.5 deep 14	G1/4"	
56, 63	3/4"	M26 x 1.5 deep 16	M26 x 1.5 deep 16	G1/4"	
80, 90	1"	M26 x 1.5 deep 16	M26 x 1.5 deep 16	G1/4"	
107, 125	1-1/4"	M26 x 1.5 deep 16	M26 x 1.5 deep 16	G1/4"	
160, 180	1-1/4"	M26 x 1.5 deep 16	M30 x 1.5 deep 16	G1/4"	

Ports

Ports	Port for	Standard	Size ¹⁾	P _{Max} [bar] ²⁾	State ³⁾
A, B	Working port	SAE J518	See above	450	O
S ₁	Supply port (only with port plate 191/192)	DIN 3852	See above	5	O
M _A , M _B	Measuring operating pressure port	DIN 3852	See above	450	X
P _{St}	Pilot pressure port (only with port plate 192)	DIN 3852	See above	30	O

Note

- 1) For the maximum tightening torques the general instructions must be observed.
 3) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

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

■ Counterbalance valve BVD and BVE

Travel drive/winch counterbalance valves are designed to reduce the danger of overspeeding and cavitation of axial piston motors in open circuits. Cavitation occurs if the motor speed is greater than it should be for the given input flow while braking, travelling downhill, or lowering a load.

- If the inlet pressure drops, the counterbalance spool throttles the return flow and brakes the motor until the inlet pressure returns to approx. 20 bar
- BVD available for sizes 28 to 180 and BVE available for sizes 107 to 180.
- The counterbalance valve must be ordered additionally. We recommend ordering the counterbalance valve and the motor as a set.

Note

Ordering example

A2FM90/61W-VAB188 + BVD20F27S/41B-V03K16D0400S12

- The counterbalance valve does not replace the mechanical service brake and park brake.
- Observe the detailed notes on the BVD counterbalance valve and BVE counterbalance valve
- For the design of the brake release valve, we must know for the mechanical park brake
- the pressure at the start of opening
- the volume of the counterbalance spool between minimum stroke (brake closed) and maximum stroke (brake released with 21 bar)
- the required closing time for a warm device (oil viscosity approx. 15 mm²/s)

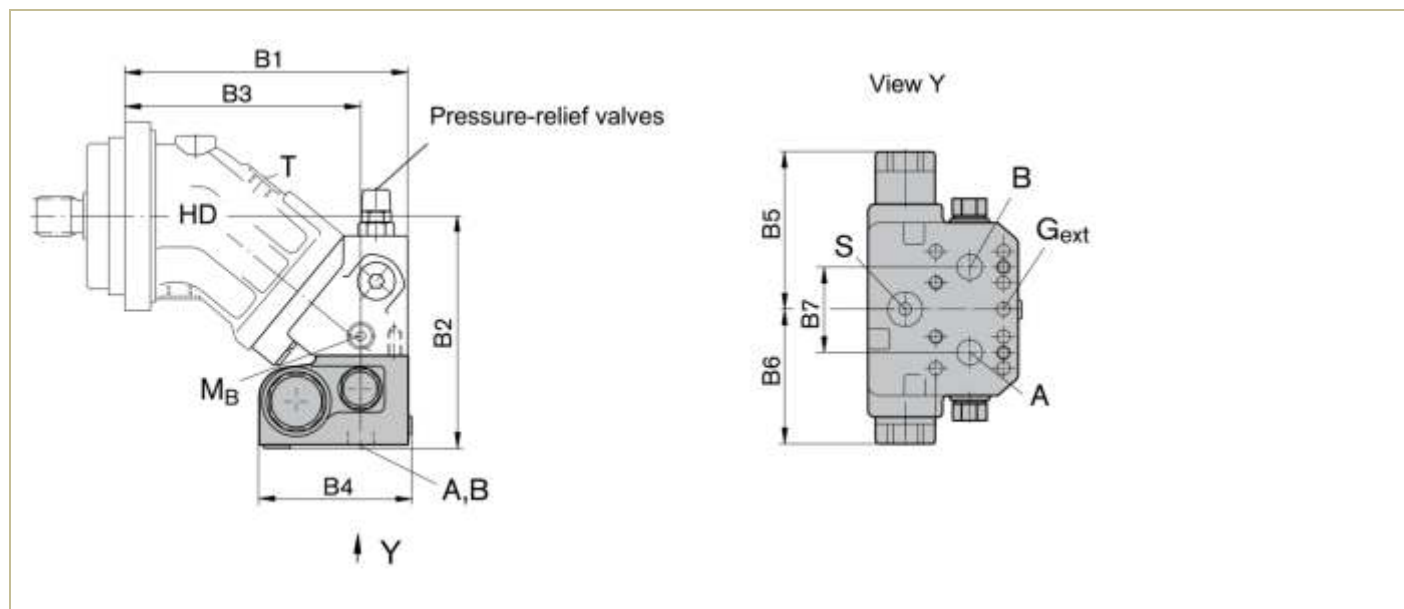
■ Technical Data

Permissible input flow or pressure in operation with DBV and BVD/BVE

Motor HD-A2FM Size	Without valve		Restricted values in operation with DBV				Restricted values in operation with BVD/BVE				
	P _{nom} /P _{max} bar	q _{v max} l/min	DBV size	P _{nom} /P _{max} bar	q _v l/min	Plate Code	BVD/BVE size	P _{nom} /P _{max} bar	q _v l/min	Plate Code	
28	400/450	176	16	350/420	100	181 191, 192	20 BVD	350/420	100	188	
32		201									
45		255									
56		280	22		240	220					
63		315									
80		360									
90		405									
107		427			171						
125		500									
107		427	32		400	181 191, 192	25 BVD/BVE		320		188
125		500									
160		577									
180		648									

Counterbalance valve BVD and BVE

Dimensions in mm



尺寸数据 (mm)

HD-A2FM	Counterbalance valve		Dimensions in mm							
Size	Type	Port A, B	B1	B2	B3	B4(S)	B4(L)	B5	B6	B7
28, 32	BVD20...16	3/4"	209	175	174	142	147	139	98	66
45	BVD20...16	3/4"	222	196	187	142	147	139	98	66
56, 63	BVD20...17	3/4"	250	197	208	142	147	139	98	75
80, 90	BVD20...27	1"	271	207	229	142	147	139	98	75
107, 125	BVD20...28	1"	298	238	251	142	147	139	98	84
107, 125	BVD25...38	1-1/4"	298	239	251	158	163	175	120.5	84
160, 180	BVD25...38	1-1/4"	332	260	285	158	163	175	120.5	84
107, 125	BVE25...38	1-1/4"	298	240	251	167	172	214	137	84
160, 180	BVE25...38	1-1/4"	332	260	285	167	172	214	137	84
250	On request									

Ports

Ports	Port for	Version	Standard	Size ¹⁾	P _{Max} [bar] ²⁾	State ⁴⁾
A, B	Working port		SAE J518	See above	420	O
S	Infeed	BVD20	DIN 3852 ³⁾	M22 x 1.5 deep 14	30	X
		BVD25, BVE25	DIN 3852 ³⁾	M27 x 2 deep 16	30	X
Br	Brake release, reduce high pressure	L	DIN 3852 ³⁾	M12 x 1.5 deep 12.5	30	O
G _{ext}	Brake release, high pressure	S	DIN 3852 ³⁾	M12 x 1.5 deep 12.5	420	X
M _A , M _B	Measuring pressure A, B		ISO 6149 ³⁾	M12 x 1.5 deep 12	420	X

Note

1) For the maximum tightening torques the general instructions must be observed.

3) The spot face can be deeper than specified in the appropriate standard

2) Momentary pressure spikes may occur depending on the application.

4) O = Must be connected (plugged on delivery) X = plugged (in normal operation)

Keep this in mind when selecting measuring devices and fittings.

■ Counterbalance valve BVD and BVE

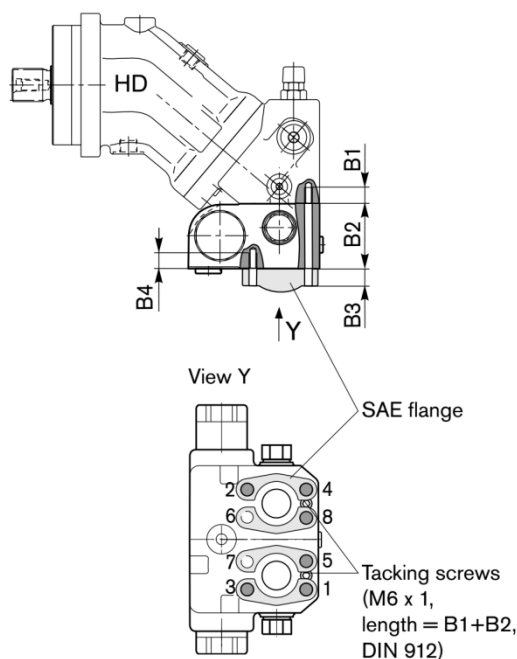
When delivered, the counterbalance valve is mounted to the motor with two tacking screws (transport protection). The tacking screws may not be removed while mounting the service lines. If the counterbalance valve and motor are delivered separately, the counterbalance valve must first be mounted to the motor port plate using the provided tacking screws.

- The counterbalance valve is finally mounted to the motor by screwing on the SAE flange with the following screws
 6 screws (1, 2, 3, 4, 5, 8)..... length B1+B2+B3
 2 screws (6, 7).....length B3+B4

- Tighten the screws in two steps in the specified sequence from 1 to 8 (see following scheme)

In the first step, the screws must be tightened with half the tightening torque, and in the second step with the maximum tightening torque (see following table)

Installation drawing



Thread	Strength class	Tightening torque
M6 x 1 tacking screw	10.9	15.5 Nm
M10 x 1.5	10.9	75 Nm
M12 x 1.75	10.9	130 Nm
M14 x 2	10.9	205 Nm

HD-A2FM Size	28,32	56,63	80,90	107,125	107,125
Port plate	18				17
B1 ¹⁾	M10x1.5 deep 17	M10x1.5 deep 17	M12x1.75 deep 18	M14x2 deep 19	M12x1.75 deep 17
B2	78 ²⁾	68	68	85	68
B3	-	-	-	-	-
B4	M10x1.5 deep 15	M10x1.5 deep 15	M12x1.75 deep 16	M14x2 deep 19	M12x1.75 deep 17

1) Minimum required thread reach 1 xΦthread

2) Including sandwich plate I

Speed sensors

The versions A2FM...U and A2FM...F ("prepared for speed sensor", i.e. without sensor) is equipped with a toothed ring on the rotary group.

- On deliveries "prepared for speed sensor", the port is plugged with a pressure-resistant cover.
- With the DSA or HDD speed sensor mounted a signal proportional to motor speed can be generated.
- The sensors measures the speed and direction of rotation.
- Ordering code, technical data, dimensions and details on the connector, plus safety information about the sensor can be found in the relevant data sheet.

Installation

The sensor is mounted at the specially provided port D as follows
 DAS..... with one mounting bolt
 HDD..... with two mounting bolts

- We recommend ordering the A2FM fixed motor complete with sensor mounted

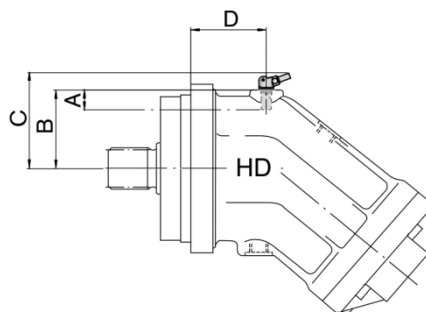
Technical Data

Size	23,28,32	45	56,63	80,90	107,125
Number of teeth	38	45	47	53	59
DSA	A depth ± 0.1	18.4	18.4	18.4	18.4
	B surface	57.9	64.9	69.9	74.9
	C	74.5	81.5	86.5	91.5
	D	54.7	54.3	61.5	72.5

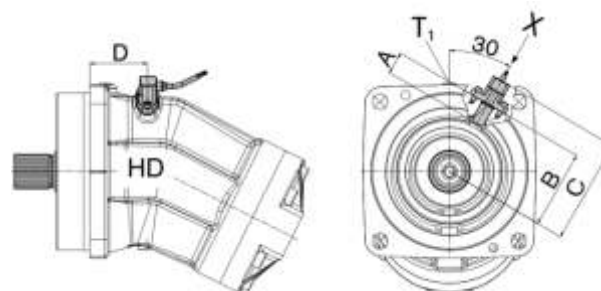
Size	160,180	200	250	355	500
Number of teeth	67	80	78	90	99
HDD	A depth ± 0.1	-	-	32	32
	B surface	-	-	110.5	122.5
	C	-	-	149	161
	D	-	-	82	93
DSA	A depth ± 0.1	18.4	18.4	32	32
	B surface	87.4	100.9	-	-
	C	104	117.5	-	-
	D	86.8	97.5	-	-

Installation drawing

Version "V" ...Sizes 23 to 200 with DSA sensor



Version "H" ...Sizes 250 to 500 with HDD sensor

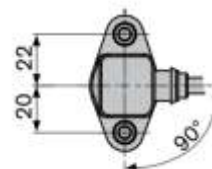


Without HDD sensor
 M6x1 (DIN 13)
 8 deep

With HDD sensor



View X



I

