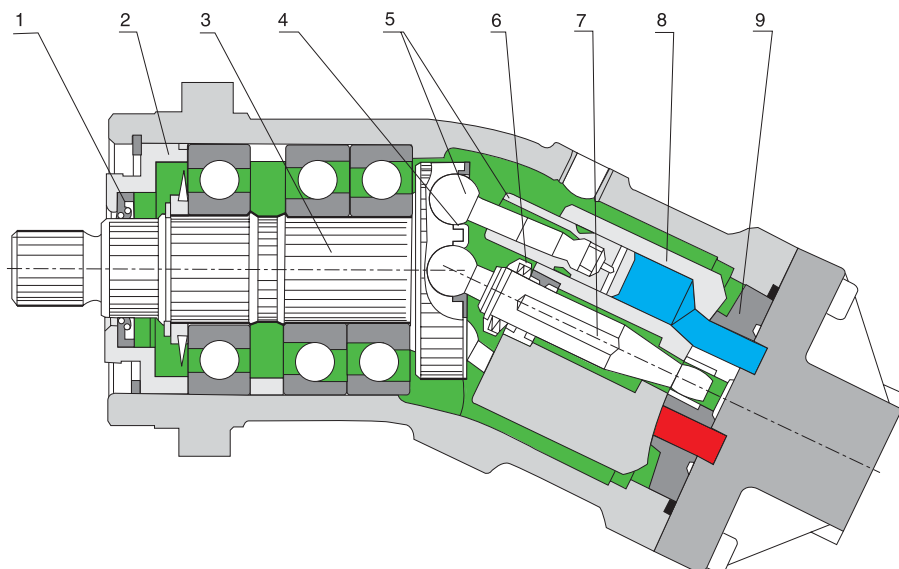


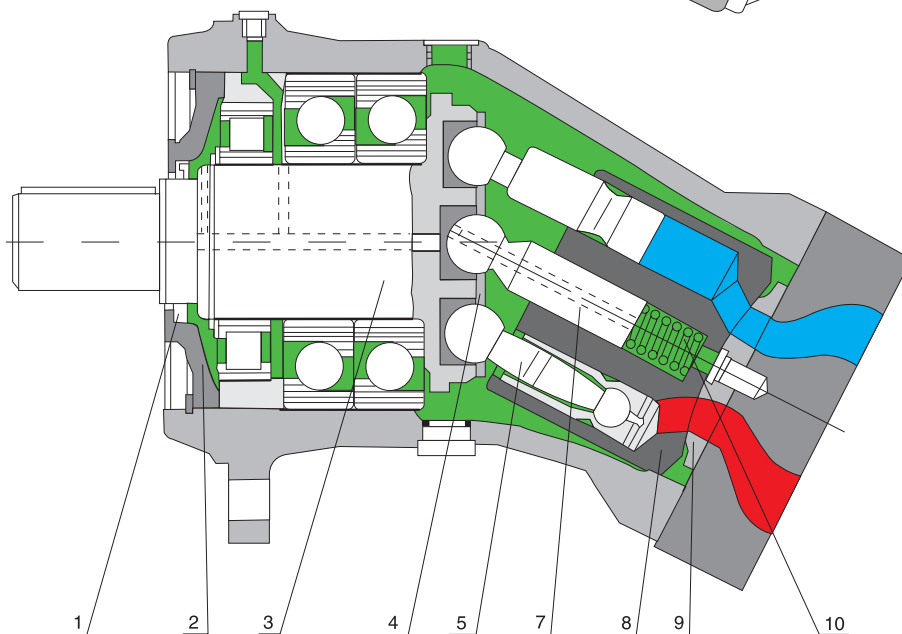
A2F Fixed Displacement Pump / Motor (1~5 Series)

A2F Series 1~4
(Size 10~160) Section



A2F Series 5
(Size 200~500) Section

1. Oil Seal Kit
2. Cover
3. Shaft
4. Retainer Plate
5. Piston, Piston Rod
6. Wash Spring
7. Center Pin
8. Cylinder Block
9. Port Plate
10. Spring



Descriptions

Axial tapered piston unit of bent axis design with fixed displacement for use as either pump or motor in hydrostatic drives, in open or closed circuit system.

When operated as a pump, the flow is proportional to the drive speed and the displacement.

When operated as motor, the output speed is proportional to the flow and inversely proportional to the displacement.

The output torque increases with the pressure drop between the high and low pressure sides.

Features

Self-centering spherical control area allows torque free cylinder bearing.

Low peripheral speed and high efficiency.

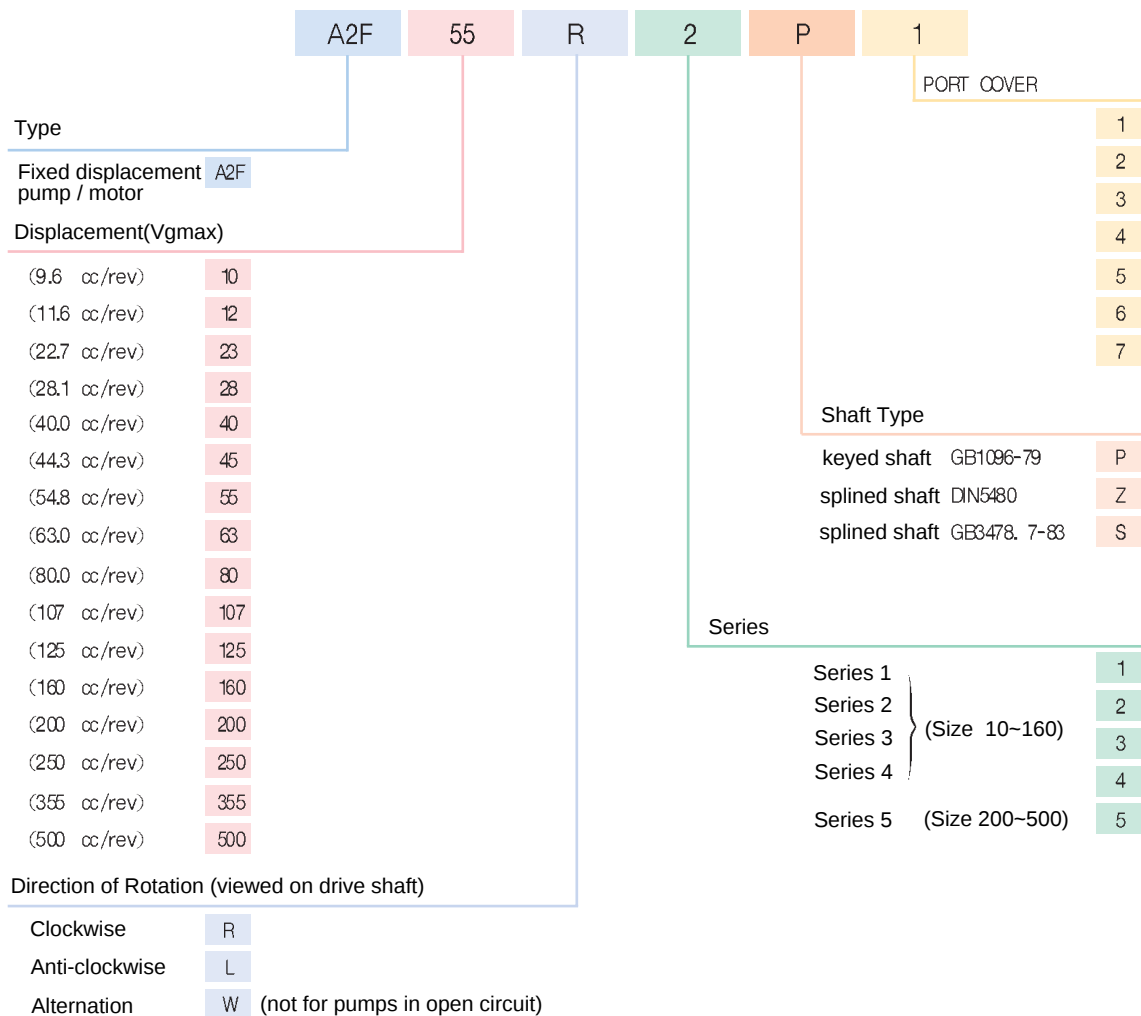
Drive shaft capable of accepting radial loading.

Low noise level.

A2F Series Pump / Motor

A2F Fixed Displacement Pump / Motor (1~5 Series)

Model Code



Series		2/4		2/3		1/2						2		5			
Size		10	12	23	28	40	45	55	63	80	107	125	160	200	250	355	500
Postperculum	1	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●	●
	2				●	●	●	●	●	●	●	●	●	●	●	●	●
	3					●	●	●	●	●	●	●					
	4	●	●	●	●												
	5																
	6						●										
	7								●	●		●					

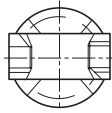
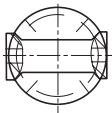
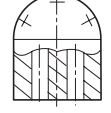
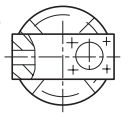
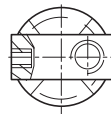
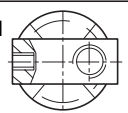
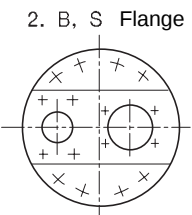
Ordering Example

A2F, 80, R, 2, P, 2

Fixed displacement pump A2F, Size 80, clockwise rotation, series 2, keyed shaft, port plate 2

A2F Fixed Displacement Pump / Motor (1~5 Series)

PORT COVER

Size	10-160	200-500
Used for close system pump / motor	1. A, B Thread 	6. A, B Flange 
	2. A, B Flange 	7. A, B Flange 
Used for open system pump	3. A, B Flange 	5. B, S Thread 
	4. B, S Thread 	2. B, S Flange 

Technical Data

Calculation of Size

- Pump

$$\text{Output Flow } Q = \frac{V_g \cdot N \cdot \eta_v}{1000} \quad (\text{l/min})$$

$$\text{Input Torque } M = \frac{1.59 \cdot V_g \cdot \Delta P}{10 \cdot \eta_m} \quad (\text{n} \cdot \text{m})$$

$$\text{Input Power } P = \frac{M \cdot N}{9549} = \frac{\Delta P \cdot Q}{60 \cdot \eta_t} \quad (\text{kW})$$

- Motor

$$\text{Input Flow } Q = \frac{V_g \cdot N}{1000 \cdot \eta_v} \quad (\text{l/min})$$

$$\text{Output Torque } M = \frac{1.59 \cdot V_g \cdot \Delta P \cdot \eta_m}{10} \quad (\text{n} \cdot \text{m})$$

$$\text{Output Power } P = \frac{M \cdot N}{9549} = \frac{\Delta P \cdot Q \cdot \eta_t}{60} \quad (\text{kW})$$

$$\text{Output Speed } N = \frac{Q \cdot 100 \cdot \eta_t}{V_g} \quad (\text{r/min})$$

V_g : Max geometric displacement [cc/r], M : Torque [N.m], N : Speed [r/min]

η_v : Volumetric efficiency η_m : Mechanical hydraulic efficiency

η_t : Overall efficiency ΔP : Differential pressure

Inlet Operating Pressure

- Pump

Minimum pressure at ports S, A or B :

P_{abs} : 0.08MPa

In close circuits, the pressure must be between 0.2 MPa and 0.6 MPa, depending on pump speed and viscosity of hydraulic fluid.

- Motor

Pressure at ports A or B :

Nominal pressure $P_N=35\text{MPa}$

Peak pressure $P_{max}=40\text{MPa}$

The sum of the pressure at ports A and B must not exceed 70MPa (individual pressure on either side max.40 MPa)

Outlet Operating Pressure

- Pump

Nominal pressure $P_N=35\text{MPa}$

Peak pressure $P_{max}=40\text{MPa}$

- Pressure for Drain

Maximum permissible case pressure (at port T) :

P_{abs} 0.2MPa

Condition of Hydraulic Fluid

- Fluid Recommendation : 40 low-solidifying

- Fluid Temperature Range : -25~80℃

- Viscosity Range : 10~1000 mm²/s (1000 mm²/s : short periods)

- Optimum Operating Viscosity : 16~25 mm²/s

- Filtration of Hydraulic Fluid :

Recommended filtration 10 μm. Coarser filtration of 25 to 40 μm is acceptable, However longer service life is achieved.

Speed Range

No limitation on minimum speed. If high uniformity of rotation is required, N_{min} should not be less than 50 r/min. See next page for maximum speed.

Mounting Position

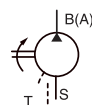
Arbitrarily Choose. The housing must be filled with oil.

Flow Direction

Clockwise

A to B

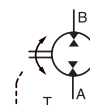
S to B (Open Circuit)



Anti-clockwise

A to B

S to B (Open Circuit)



A, B : Pressure Port (Discharge Port)

T : Drain Port

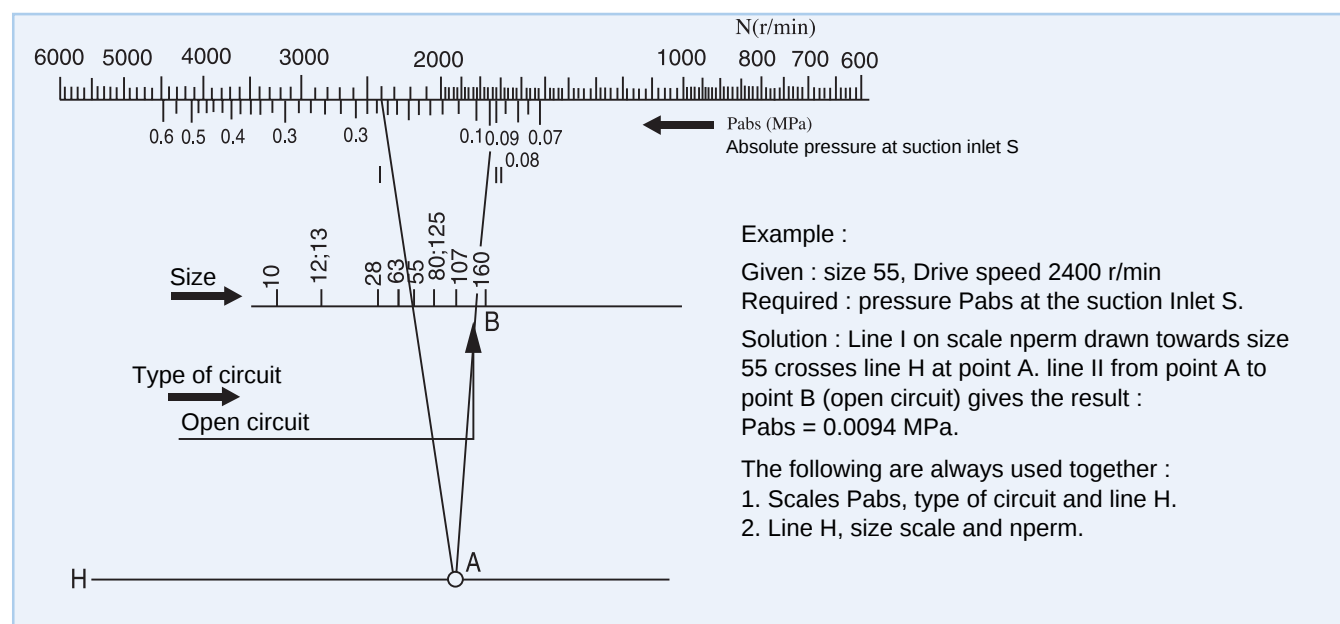
S : Suction Port

A2F Fixed Displacement Pump / Motor (1~5 Series)

Technical Data Theoretical Values, Without Considering η_m and η_v , Values rounded Off.

Size		10	12	23	28	45	55	63	80	107	125	160	200	250	355	500	
Displacement (cc/rev)		9.4	11.6	22.7	28.1	44.3	54.8	63	80	107	125	160	200	250	355	500	
Max. Speed $n_{\max}$ (r/min)	Close Circuit	7500	6000	5600	4750	4500	3750	4000	3350	3000	3150	3650	2500	2500	2240	2000	
	Open Circuit	0.09	4700	3750	3750	2800	2850	2360	2550	2120	1900	2120	1650	1700	1400	1250	1120
	Inlet Pressure (P_{ab} s=MPa)	0.10	5000	4000	4000	3000	3000	2500	2700	2240	2000	2240	1750	1800	1500	1320	1200
		0.15	6000	4900	4900	3600	3650	3000	3300	2750	2450	2750	2100	2180	1850	1650	1500
Max. Flow $Q_{\max}$ (l/min)	Close Circuit	71	70	127	133	199	206	252	268	321	394	424	500	625	795	1000	
	Open Circuit	0.09	43	42	83	76	122	125	156	165	197	257	256	330	340	430	543
	Inlet Pressure (P_{ab} s=MPa)	0.10	46	45	88	82	129	133	165	174	208	272	272	349	364	455	582
		0.15	55	55	108	98	157	159	202	213	254	333	326	423	449	568	728
Max. Power $P_{\max}$ (kW) $\Delta P=35MPa$	Close Circuit	41	41	74	78	116	120	147	156	187	230	247	292	365	464	583	
	Open Circuit	0.09	25	25	48	44	71	73	91	96	115	150	149	192	198	251	317
	Inlet Pressure (P_{ab} s=MPa)	0.10	27	26	51	48	75	78	96	101	121	159	159	204	212	265	340
		0.15	32	32	63	57	92	93	118	124	148	194	190	247	262	331	424
Electric Motor Speed $N=1450$ /min	Flow Close Circuit	13.6	16.8	32.9	40.7	64.2	79.5	91.3	116	155.2	181.2	232	290	363	515	72	
	Q (l/min) Open Circuit	13.2	16.3	31.9	39.5	62.3	77.1	88.6	112.5	150.5	175.8	225	281	352	499	703	
	P (kW) Close Circuit	7.9	9.8	19.2	23.7	37.4	46	53	67.7	90	106	135	169	212	300	423	
	$\Delta P=35MPa$ Open Circuit	7.7	9.5	18.6	23	36.3	45	51.7	66	88	103	131	164	205	291	410	
Torque $M(N \cdot m)$	$\Delta P=10MPa$	15	18	36	44.7	70	87	100	127	170	199	254	318	398	564	795	
	$\Delta P=35MPa$	52	65	126	156	247	305	351	445	595	696	890	1113	1391	1976	2783	
Approx. Weight (kg)		5	5	12	12	23	23	33	33	44	63	63	88	88	138	185	

Notes : 1. These values are valid provided there is a absolute pressure at suction inlet S and when operated on mineral oil.

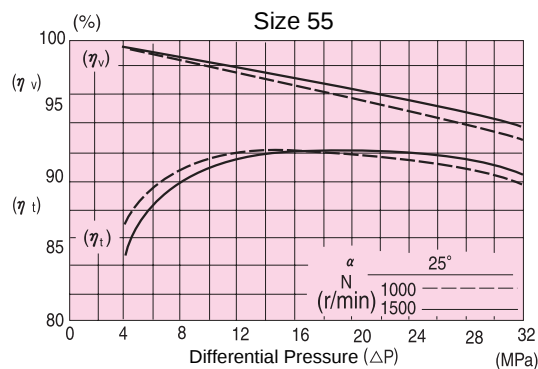
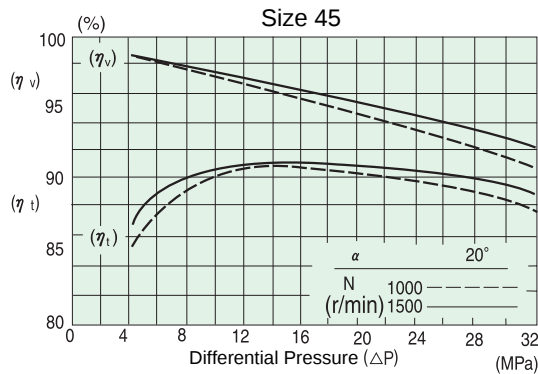
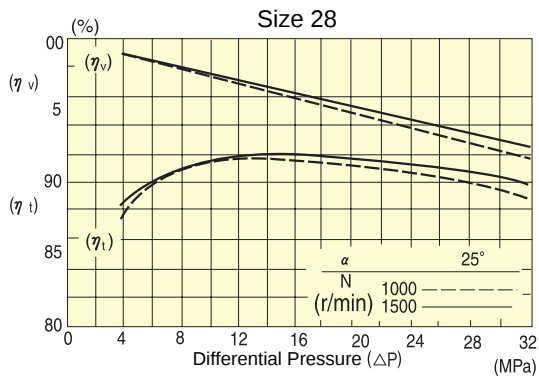
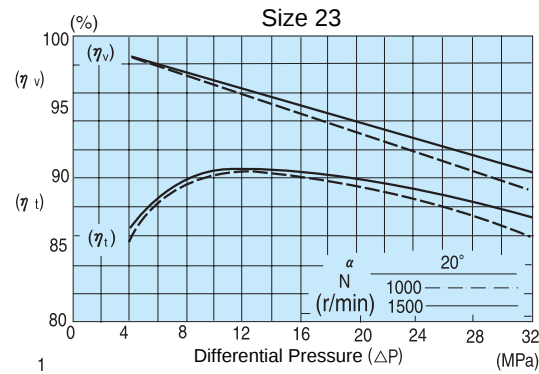


1. Permissible speed N_{perm} can be determined from the nomograph.
 In motor operation the permissible speed for closed circuit system and boosted operation are also valid for open circuit system.
2. When suction pressure $P_{abs} > 0.1MPa$, the permissible speed can be increased in open circuits (Self-suction operation).
 But when suction pressure $P_{abs} < 0.1MPa$, the permissible speed must be reduced.

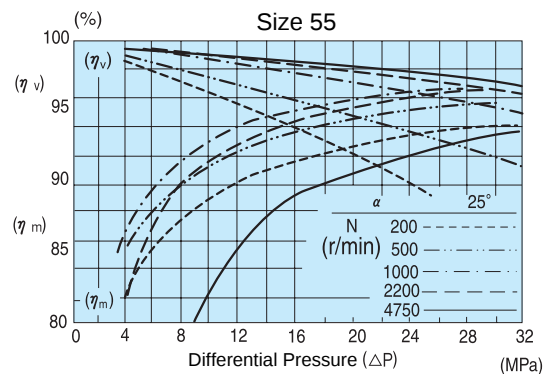
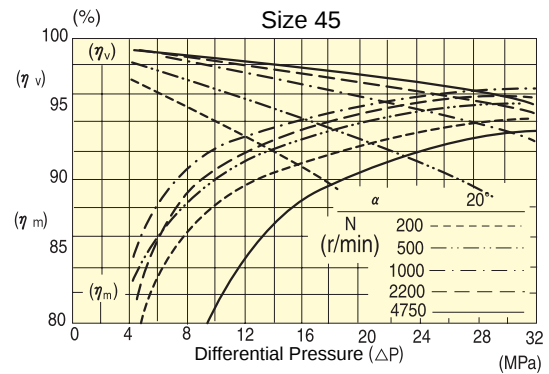
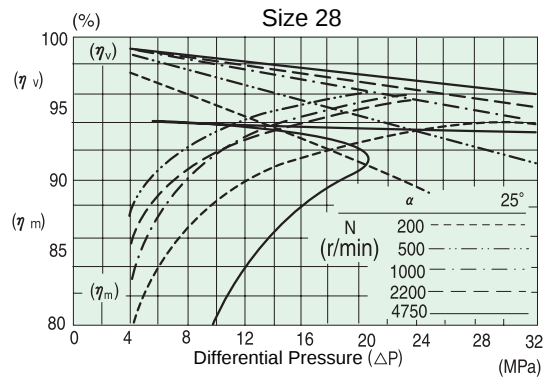
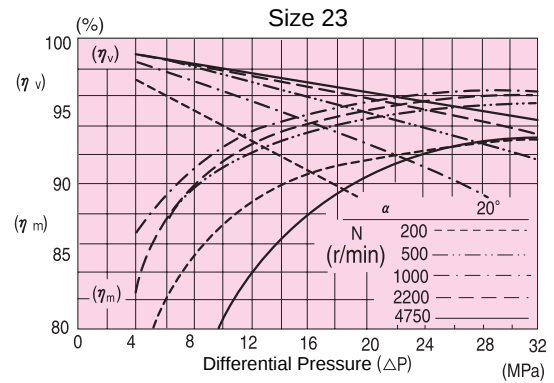
A2F Fixed Displacement Pump / Motor (1~5 Series)

Performance curve of efficiency for differential pressure and rotating speed of pump & motor

PUMP



MOTOR



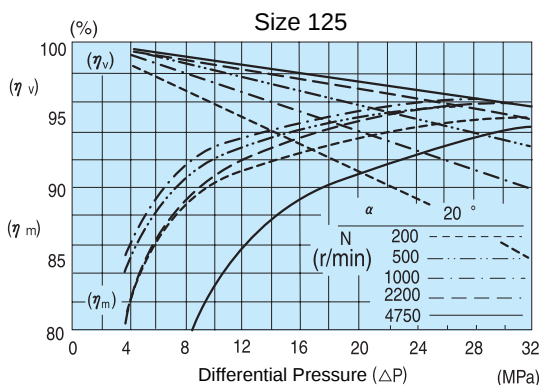
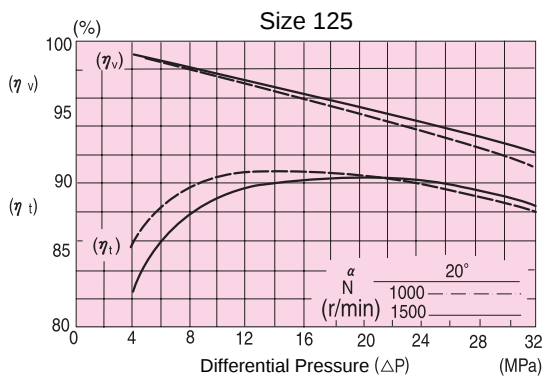
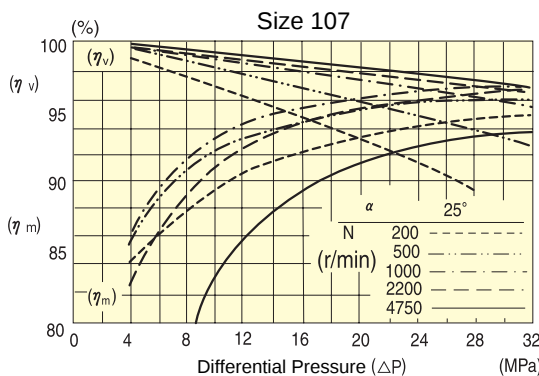
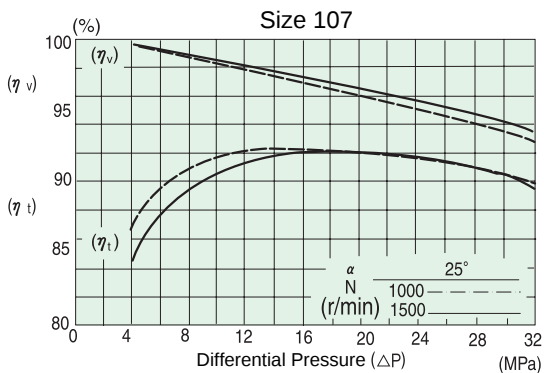
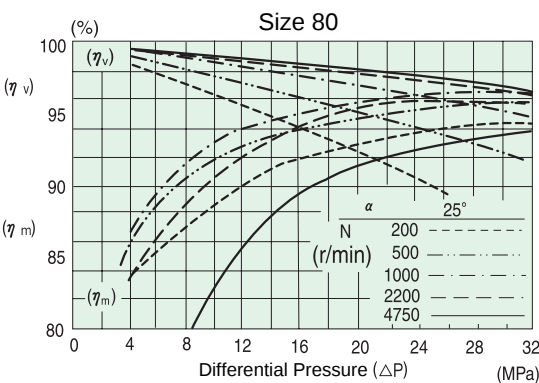
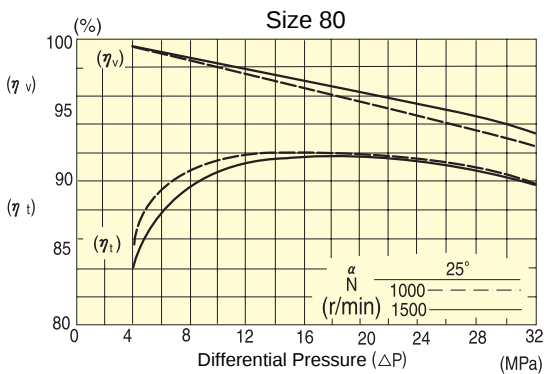
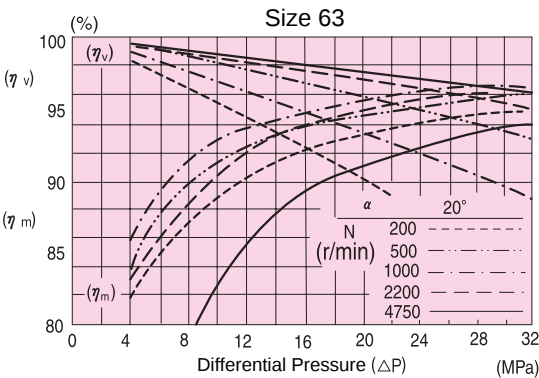
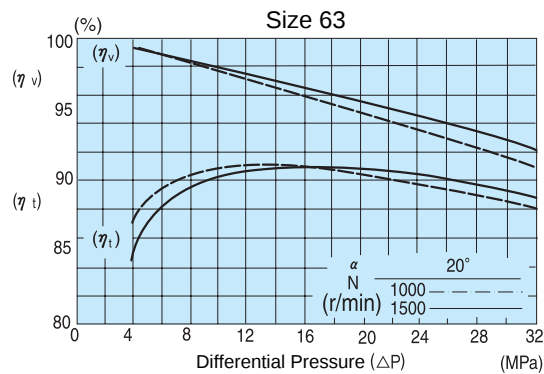
η_v : Volumetric efficiency
 η_m : Mechanical efficiency
 η_t : Overall efficiency

A2F Fixed Displacement Pump / Motor (1~5 Series)

Performance curve of efficiency for differential pressure and rotating speed of pump & motor

PUMP

MOTOR

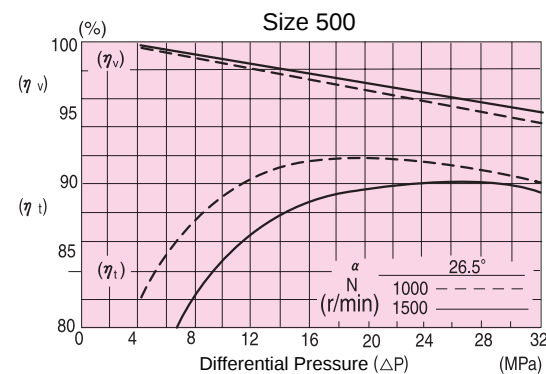
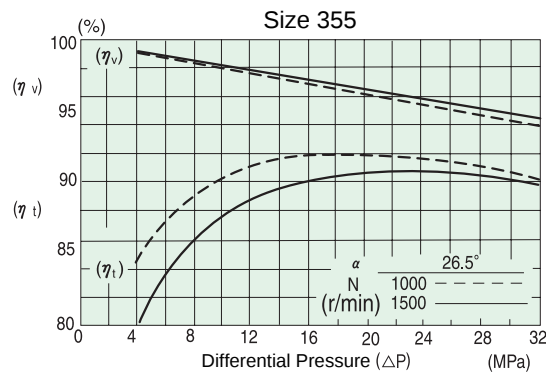
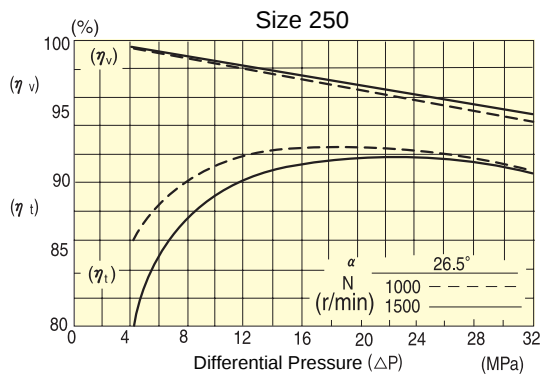
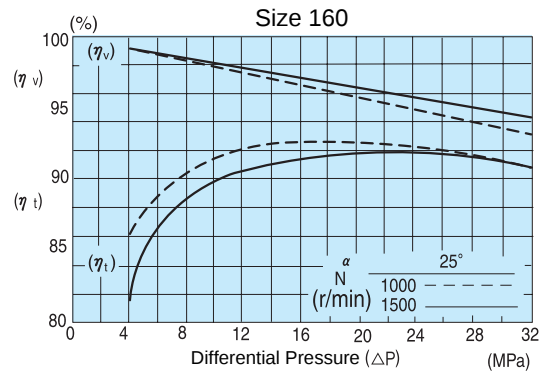


η_v : Volumetric efficiency
 η_m : Mechanical efficiency
 η_t : Overall efficiency

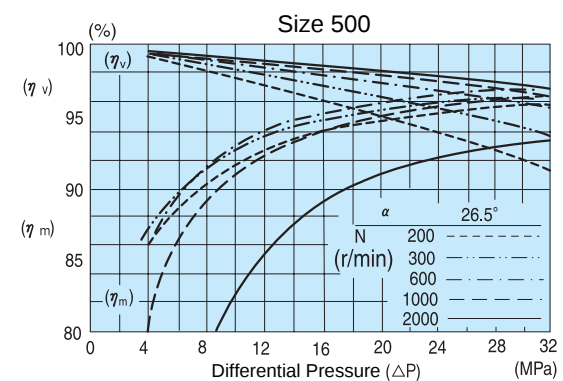
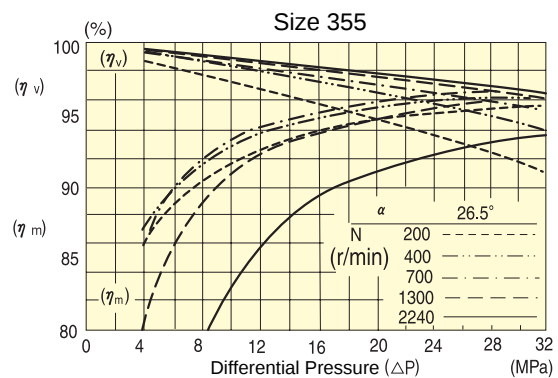
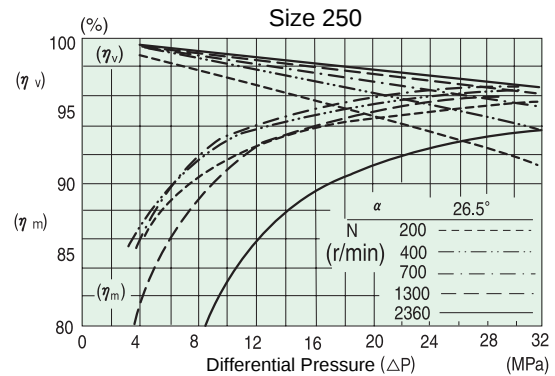
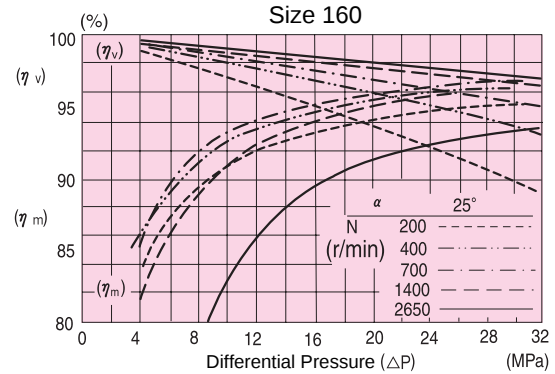
A2F Fixed Displacement Pump / Motor (1~5 Series)

Performance curve of efficiency for differential pressure and rotating speed of pump & motor

PUMP



MOTOR

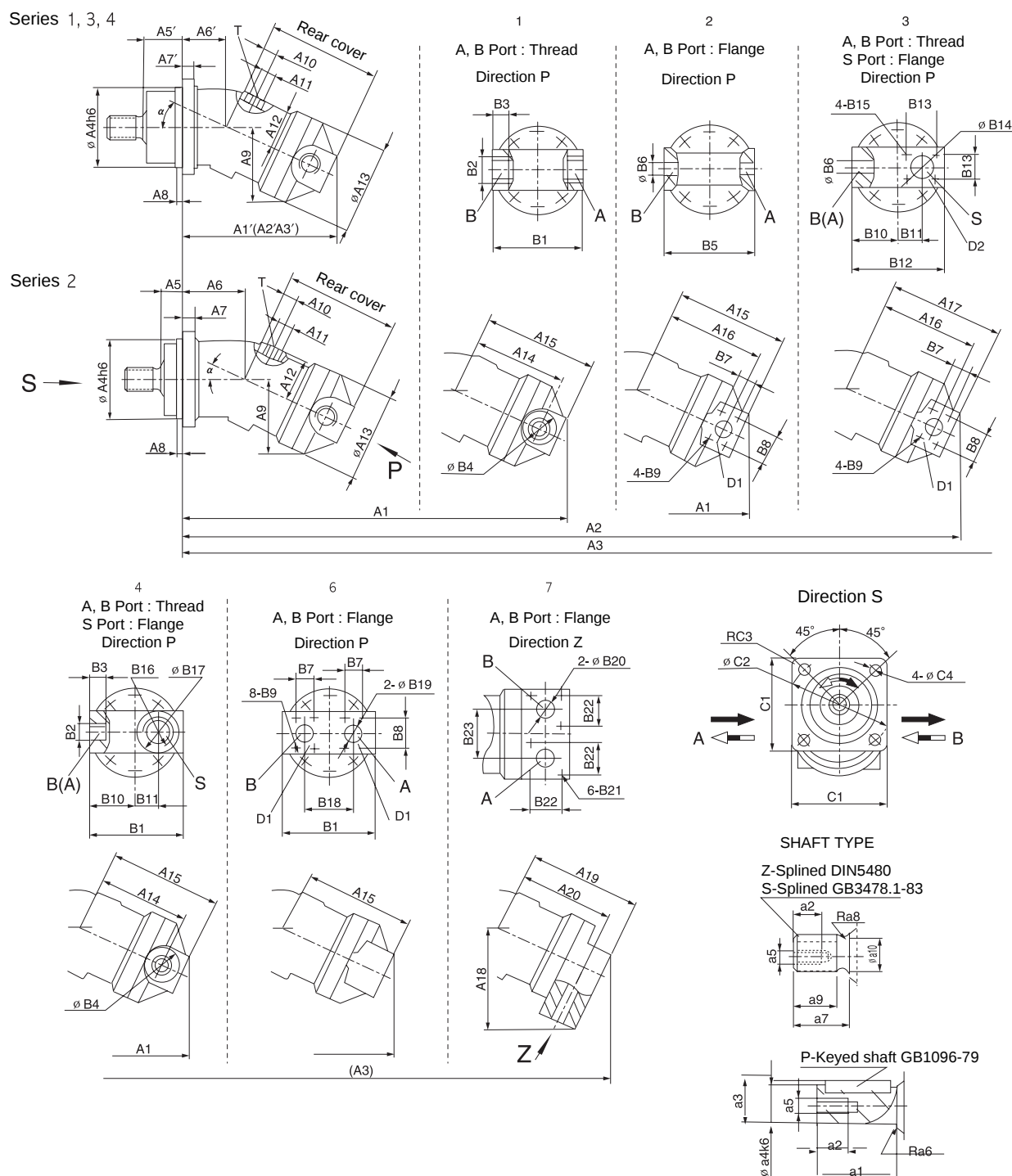


η_v : Volumetric efficiency
 η_m : Mechanical efficiency
 η_t : Overall efficiency

A2F Fixed Displacement Pump / Motor (1~5 Series)

Unit Dimensions Series 1~4 Size 10~160

Rear Cover Type



1. The dimensions of A1, A2, A3 are only valid for series 2. The parallel dimensions of the three above mentioned positions for series 1, 3 and 4 can be calculated according to the follows formulas :
 $A1' - (A6 - A6')$; $A2 - (A6 - A6')$; $A3 - (A6 - A6')$.
2. Besides above mentioned constructsures, we can adjust the design of the present product according to the customers' special needs.

A2F Series Pump / Motor

A2F Fixed Displacement Pump / Motor (1~5 Series)

Unit Dimensions Series 1~4 Size 10~160

Size		Series	Rear cover	A ₁		A ₂		A ₃		A ₄	A ₅	A ₆	A _{5'}	A _{6'}	A ₇	A ₈	A ₉	
α20°	α25°			α20°	α25°	α20°	α25°	α20°	α25°								α20°	α25°
10	12	2,4	1,4	174	172	-	-	-	-	80	20	62	40	42	12.5	8	69	75
23	28	2,3	1,2,4	223	218	-	-	-	-	100	25	75	50	50	16	8	88	95
45	55	1,2	1,2,3,6	292	289	286	284	-	-	125	32	108	63	77	20	10	110	118
63	80	1,2	1,2,3	350	348	345	342	-	-	140	32	137	83	86	23	10	126	140
87	107	1,2	1,2,3,7	360	356	353	348	358	353	160	40	130	80	90	25	12	138	149
125	160	2	1,2,3,7	422	417	417	410	408	420	180	40	156	-	-	28	10	159	173.5

Size		A ₁₀	A ₁₁	A ₁₂	A ₁₃	A ₁₄	A ₁₅	A ₁₆	A ₁₇	A ₁₈		A ₁₉	A ₂₀	B ₁	B ₂	B ₃	B ₄
α20°	α25°									α20°	α25°						
10	12	14	M12×1.5	40	89	90	112	-	-	-	-	-	-	89	M22×1.5	14	34
23	28	25	M16×1.5	50	106	118	145	118	-	-	-	-	-	106	M27×2	16	48
45	55	31.5	M18×1.5	63	132	150	183	151	178	-	-	-	-	132	M33×2	15	53
63	80	36	M18×1.5	77	156	173	213	174	208	-	-	-	-	156	M42×2	15	53
87	107	40	M18×1.5	80	165	190	230	190	225	185	200	230	195	160	M42×2	20	50
125	160	45	M22×1.5	93	195	-	262	212	257	204	220	252	212	195	M48×2	22	70

Size		B ₅	B ₆	B ₇	B ₈	B ₉	Deep	B ₁₀	B ₁₁	B ₁₂	B ₁₃	B ₁₄	B ₁₅	Deep	B ₁₆	Deep	B ₁₇	B ₁₈	B ₁₉	B ₂₀	B ₂₁
α20°	α25°																				
10	12	-	-	-	-	-	-	44.5	18	-	-	-	-	-	M33×2	18	42	-	-	-	-
23	28	120	13	18.2	40.5	M8	15	53	25	-	-	-	-	-	M42×2	20	48	-	-	-	-
45	55	126	19	23.8	50.8	M10	15	53	29	129	48	42	M10	13	-	-	-	67	20	-	-
63	80	150	25	27.8	57.1	M12	15	75	35.5	153	60	53	M12	15	-	-	-	-	-	-	-
87	107	160	25	27.8	57.1	M12	17	80	35.5	162.5	60	53	M12	18	-	-	-	-	-	25	M12
125	160	190	32	31.8	66.7	M14	19	95	42.2	192.5	75	68	M16	20	-	-	-	-	-	30	M12

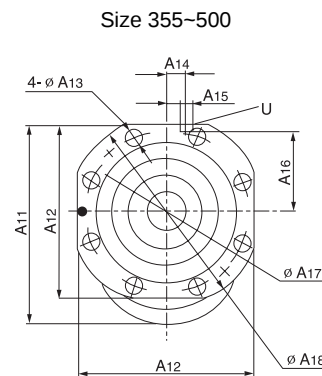
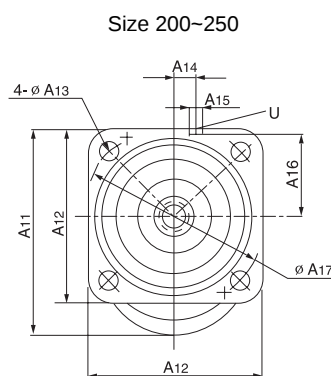
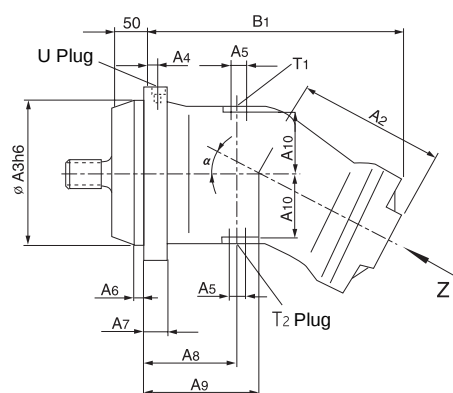
Size		Deep	B ₂₂	B ₂₃	C ₁	C ₂	C ₃	C ₄	a ₁	a ₂	a ₃	a ₄	a ₅	a ₆	a ₇	a ₈	a ₉	a ₁₀	SAE Flange	
α20°	α25°																		D ₁	D ₂
10	12	-	-	-	95	100	10	9	40	16	22.5	20	M6	0.8	34	2	22	16.7	-	-
23	28	-	-	-	118	125	12	11	50	19	27.9	25	M8	0.8	43	1.2	28	21.5	1/2"	-
45	55	-	-	-	150	160	16	13.5	60	28	33	30	M12	1.5	35	1.5	28	25	3/4"	1 3/4"
63	80	-	-	-	165	180	16	13.5	70	28	38	35	M12	1.6	40	1.5	33	30	1"	2"
87	107	25	50	78	190	200	20	17.5	80	28	43	40	M12	1.6	45	2	37.5	35	1"	2"
125	160	25	50	78	210	224	20	17.5	90	36	48.5	45	M16	2.5	50	2.5	43	40	1 1/4"	2 3/4"

Size		Paralled Shaft GB1096-79	Splined Shaft DIN5480	Splined Shaft GB3478.1-83	Weight (kg)
α20°	α25°				
10	12	Key 6×32	W20×1.25×14×9g	-	5
23	28	Key 8×40	W25×1.25×18×9g	-	12
45	55	Key 8×50	W30×2×14×9g	-	23
63	80	Key 10×56	W35×2×16×9g	EXT16Z×2m×30R×5f	33
87	107	Key 12×63	W40×2×18×9g	EXT18Z×2m×30R×5f	44
125	160	Key 14×70	W40×2×21×9g	-	63

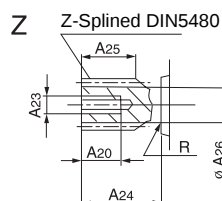
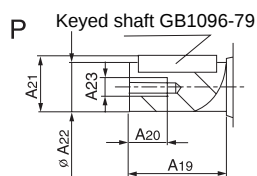
A2F Series Pump / Motor

A2F Fixed Displacement Pump / Motor (1~5 Series)

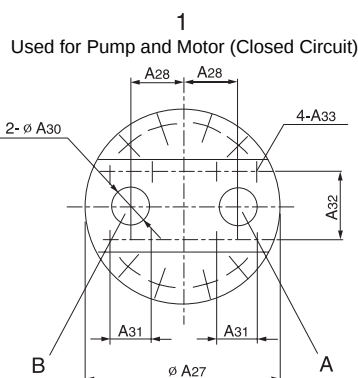
Unit Dimensions Series 5 Size 200~500



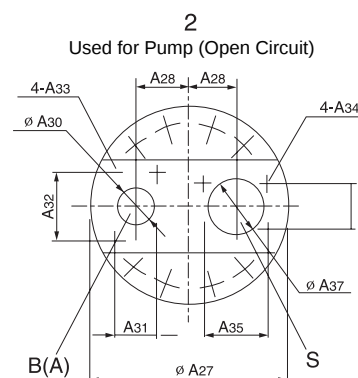
Shaft End



End Plate (Direction Z)



A, B Port : Flange 42MPa (See from A38)
A, B : Discharge (Pressure) port
S : Suction port
T1 : Drain port
T2 : Drain port
U : Clear port (Bearing)



A, B Port : Flange 42MPa (See from A38)
S Port : Flange 42MPa (See from A39)
When rotation with anti-clockwise, the end plate will be rotary 180 degree.
Size 200~355 : 17.5MPa, Size 500 : 14MPa.

Unit Dimensions Series 5 Size 200~500

Size	α	A ₁	A ₂	A ₃	A ₄	A ₅	A ₆	A ₇	A ₈	A ₉	A ₁₀	A ₁₁	A ₁₂	A ₁₃	A ₁₄	A ₁₅
200	21°	368	232	224	13	M22×1.5	9	25	120	134	107	300	252	22	70	M14×1.5
250	26.5°	370	232	224	13	M22×1.5	9	25	120	134	107	314	252	22	70	M14×1.5
355	26.5°	422	260	280	14	M33×2	15	28	142	160	128	380	335	18	35	M14×1.5
500	26.5°	462	283	315	15	M33×2	15	30	155	175	142	420	375	22	35	M18×1.5

Size	A ₁₆	A ₁₇	A ₁₈	A ₁₉	A ₂₀	A ₂₁	A ₂₂	A ₂₃	A ₂₄	A ₂₅	A ₂₆	A ₂₇	A ₂₈	A ₂₉	A ₃₀	A ₃₁	A ₃₂	A ₃₃
200	122	280	/	82	36	53.5	50	M16	58	47	45	216	55	45	32	31.8	66.7	M14
250	122	280	/	82	36	53.5	50	M16	58	47	45	216	55	45	32	31.8	66.7	M14
355	166	320	360	105	42	64	60	M20	82	69	55	245	60	50	40	36.6	79.4	M16
500	180	360	400	105	42	74.5	70	M20	82	67	62.5	270	65	55	40	36.6	79.4	M16

Size										Paralled Shaft	Splined Shaft	Weight (kg)
	A ₃₄	Deep	R	A ₃₅	A ₃₆	A ₃₇	A ₃₈	A ₃₉	GB1096-79	DIN5480		
200	22	M12	18	1.2	88.9	50.8	63	1 1/4"	2 1/2"	Key 14×80	W50×2×24×9g	88
250	22	M12	18	1.2	88.9	50.8	63	1 1/4"	2 1/2"	Key 14×80	W50×2×24×9g	88
355	24	M12	18	1.6	88.9	50.8	63	1 1/4"	2 1/2"	Key 18×100	W60×2×28×9g	138
500	24	M16	24	1.6	106.4	62	75	1 1/4"	3"	Key 20×100	W70×2×22×9g	185