BAB IX
KESIMPULAN

Dengan perencanaan kamar mesin untuk kapal *COASTER* 500 *DWT* diatas yang diperhitungkan berdasarkan teori, maka didapat beberapa kesimpulan spesifikasi data – data sebagai berikut:

1. Data-Data Kapal Rancangan

Dimensi ukuran utama Kapal *Coaster 500 DWT* adalah :

Length Over All	(*LOA*)	= 51,80 m
Length Water Line	(*LWL*)	= 46,92 m
Length Between Perpendicular	(*LPP*)	= 46,00 m
Breadth Moulded	(*B mld*)	= 10,40 m
Height Moulded	(*H mld*)	= 4,20 m
Draft Moulded	(*T mld*)	= 2,85 m
Coefficient Block	(*Cb*)	= 0,67
Coefficient Midship	(*Cm*)	= 0,98
Coefficient Waterline	(*Cw*)	= 0,77
Coefficient Prismatic	(*Cp*)	= 0,68
Displacement	(Δ)	= 955,069
Volume Displacement	(∇)	= 931,774 m^3
Speed	(*Vs*)	= 12.00 Knots
LCB from Amidsh		= 1,316
Density	(ρ)	= 1,025 Kg/m^3
		= 104,5 $Kg.s^2/m^4$

A.B.K	=	18 orang
Penumpang :		
Penumpang Eksekutif	=	78 orang
Penumpang Tatami	=	172 orang
Jumlah Penumpang	=	260 orang
Kapasitas ruang muat	=	240 ton

2. MOTOR INDUK KAPAL :

-Merk	: **WARTSILA**
- Type	: **W 4L20**
- Jumlah silinder	: 4
- Bore & Stroke	: 200 x 280 (mm)
- Daya	: 1080 HP (800 KW)
- Putaran Mesin	: 1000 Rpm
- Berat mesin	: 2365 Kg
- Konsumsi bahan bakar (Sfoc)	: 199 g/kWh
- Dimensi *P x L x T*	: 2510 × 1483 × 1800 (mm)

Marine Gear specification

- Merk	: **WUCHAI**
- Model	: **ADVANCE 900 MG**
- Reduction Ratio	: 2,04
- Berat Gear	: 1600 Kg

2. BALING – BALING YANG DIPILIH :

- Tipe baling-baling berada pada	: B4-40
- Diameter baling-baling (D)	: 1.710 m
- *Pitch Ratio propeller* (Ho/D)	: 0.62
- *Developed Blade Ratio* (Fa/F)	: 0.84
- Effisiensi baling-baling (η_p)	: 56.5 %
- Jumlah daun propeller (Z)	: 4

3. SPESIFIKASI GENERATOR SET :

- Merk	: **YANMAR**
- Type	: **4HAL2-TN**
- Jumlah silinder	: 4

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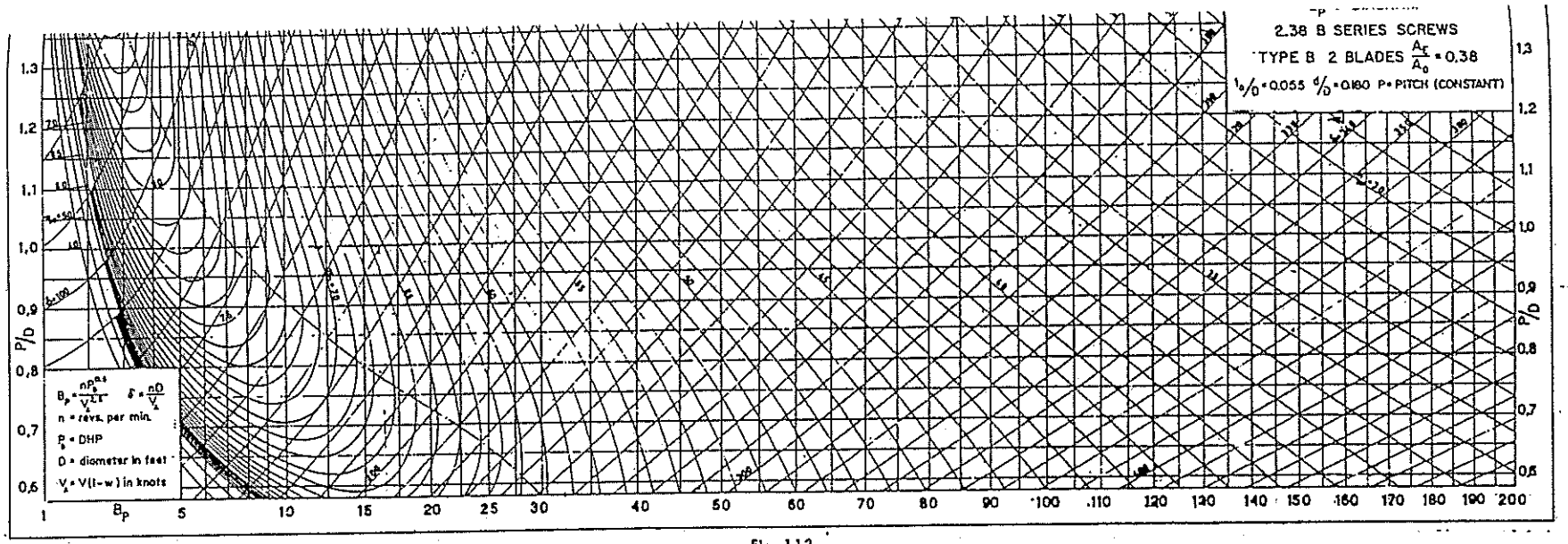


Fig. 113

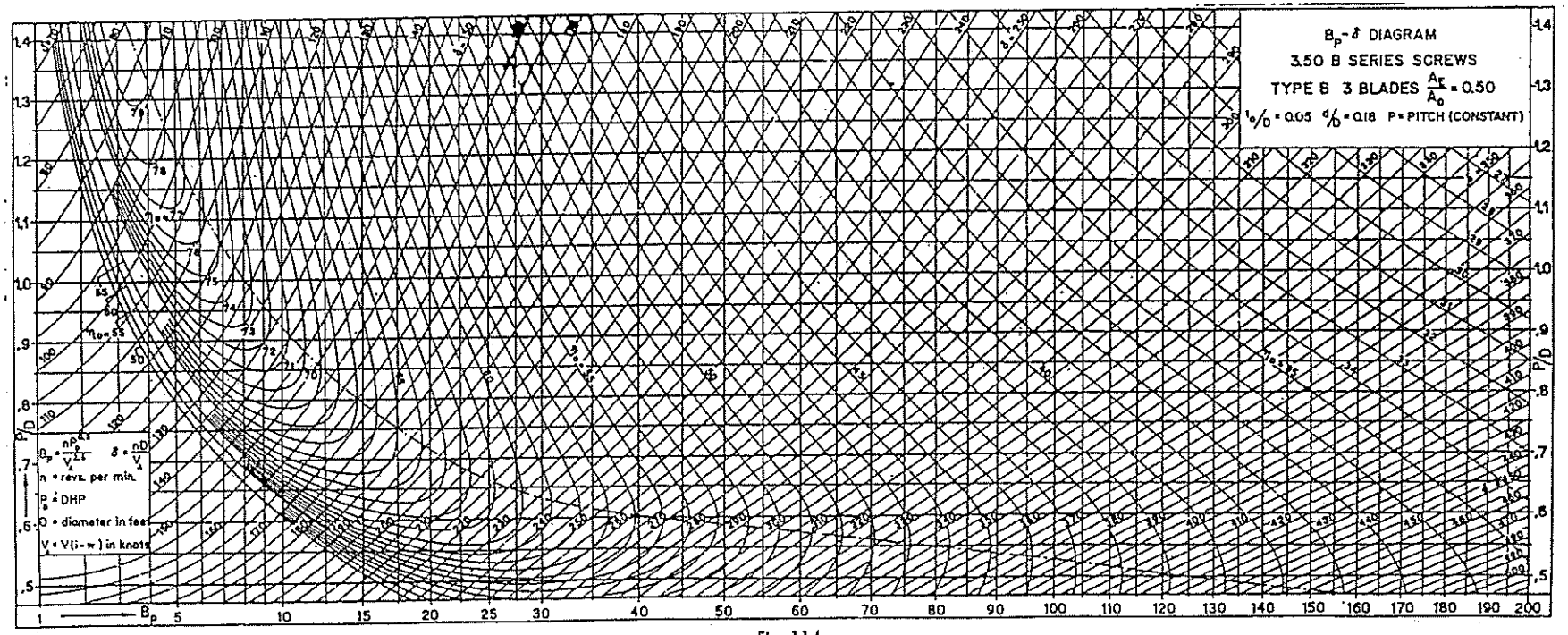


Fig. 114

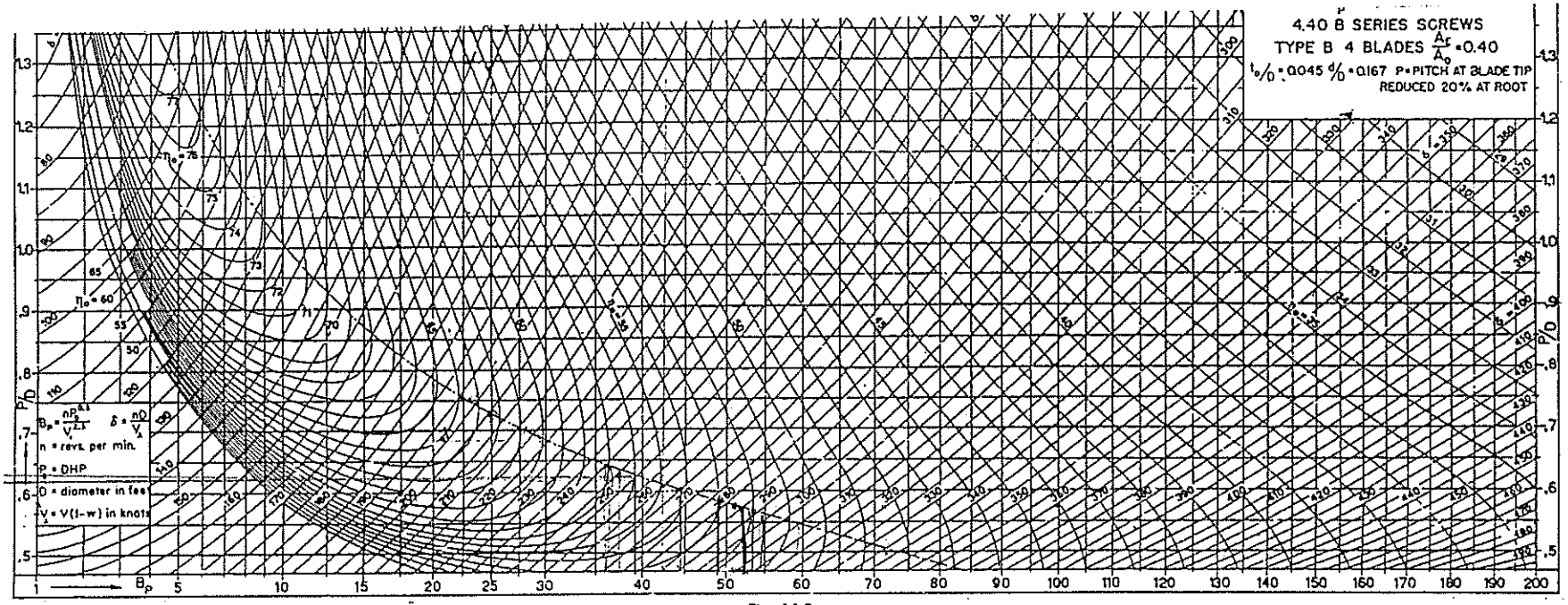
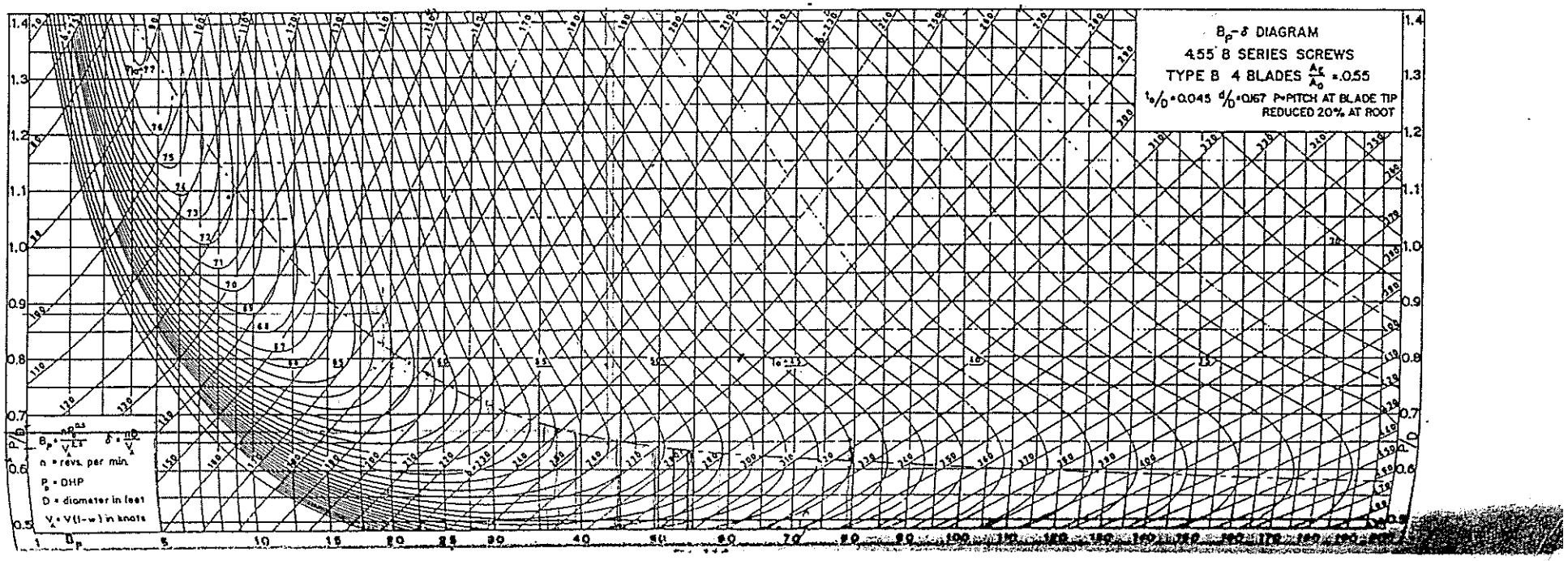

4.40 B SERIES SCREWS
TYPE B 4 BLADES $\frac{A_r}{A_o}$ = 0.40
t_o/D = 0.045 d/D = 0.167 P = PITCH AT BLADE TIP
REDUCED 20% AT ROOT
$B_p = \frac{nP_s^{0.5}}{V_A^{2.5}}$ $\delta = \frac{nD}{V_A}$
n = revs. per min.
P_s = DHP
D = diameter in feet
V_A = V(1-w) in knots
P/D
B_p

Fig. 115


B_p-δ DIAGRAM
4.55 B SERIES SCREWS
TYPE B 4 BLADES $\frac{A_r}{A_o}$ = 0.55
t_o/D = 0.045 d/D = 0.167 P = PITCH AT BLADE TIP
REDUCED 20% AT ROOT
$B_p = \frac{nP_s^{0.5}}{V_A^{2.5}}$ $\delta = \frac{nD}{V_A}$
n = revs. per min.
P_s = DHP
D = diameter in feet
V_A = V(1-w) in knots
P/D
B_p

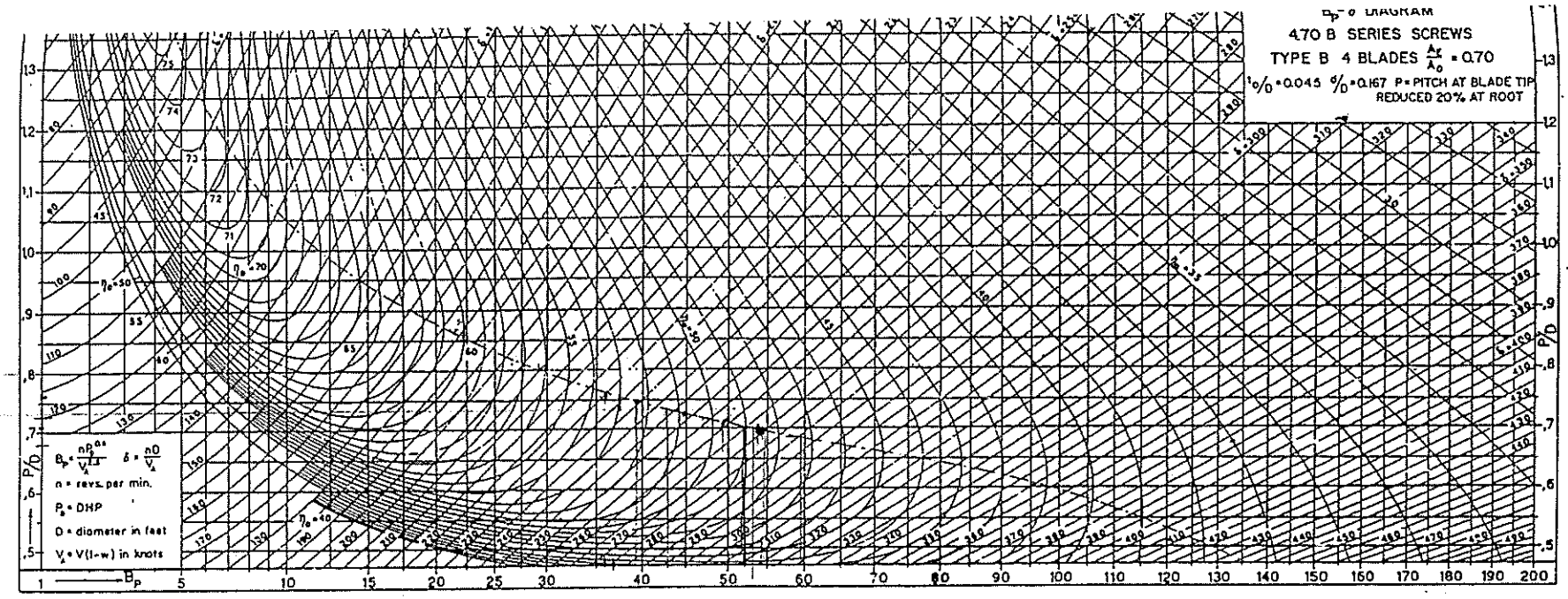


Fig. 117

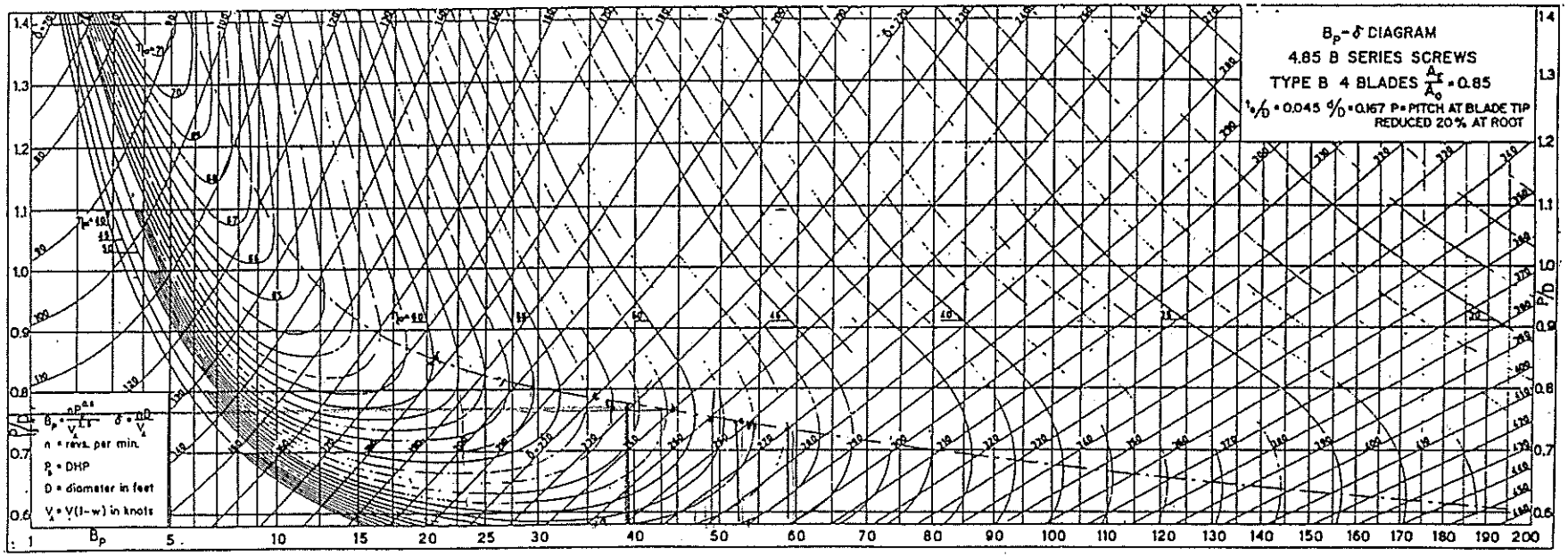


Fig. 118

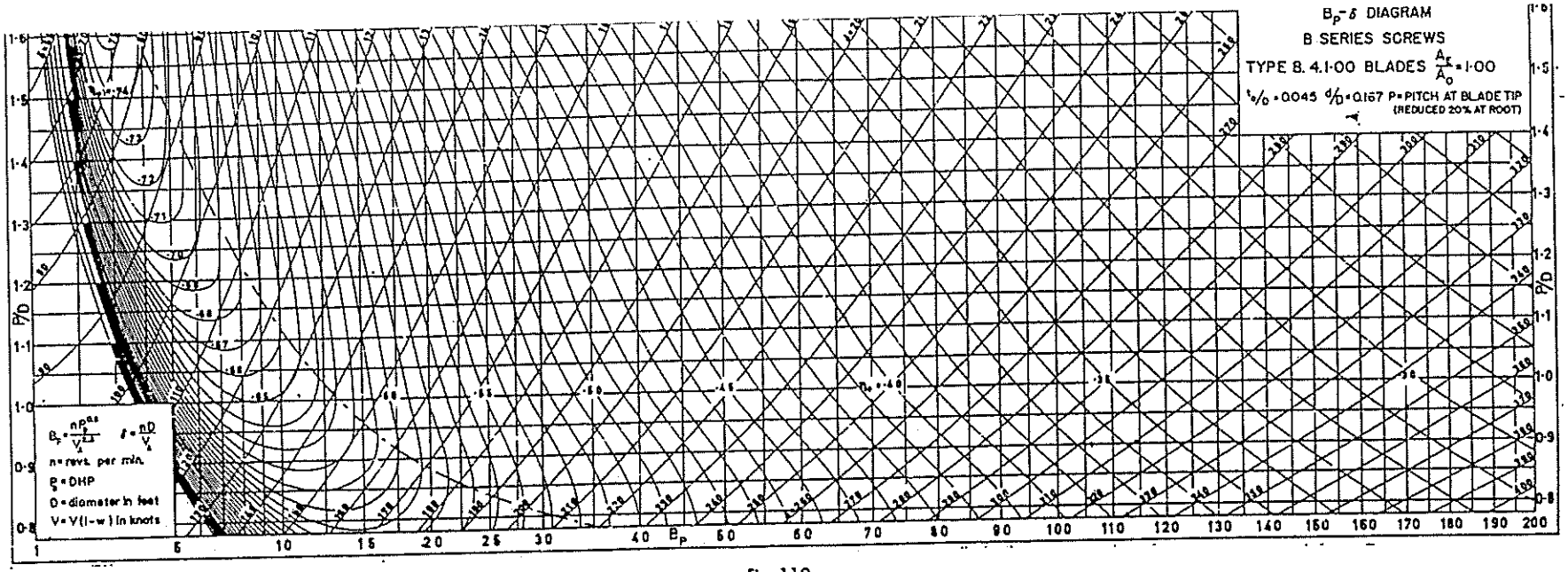
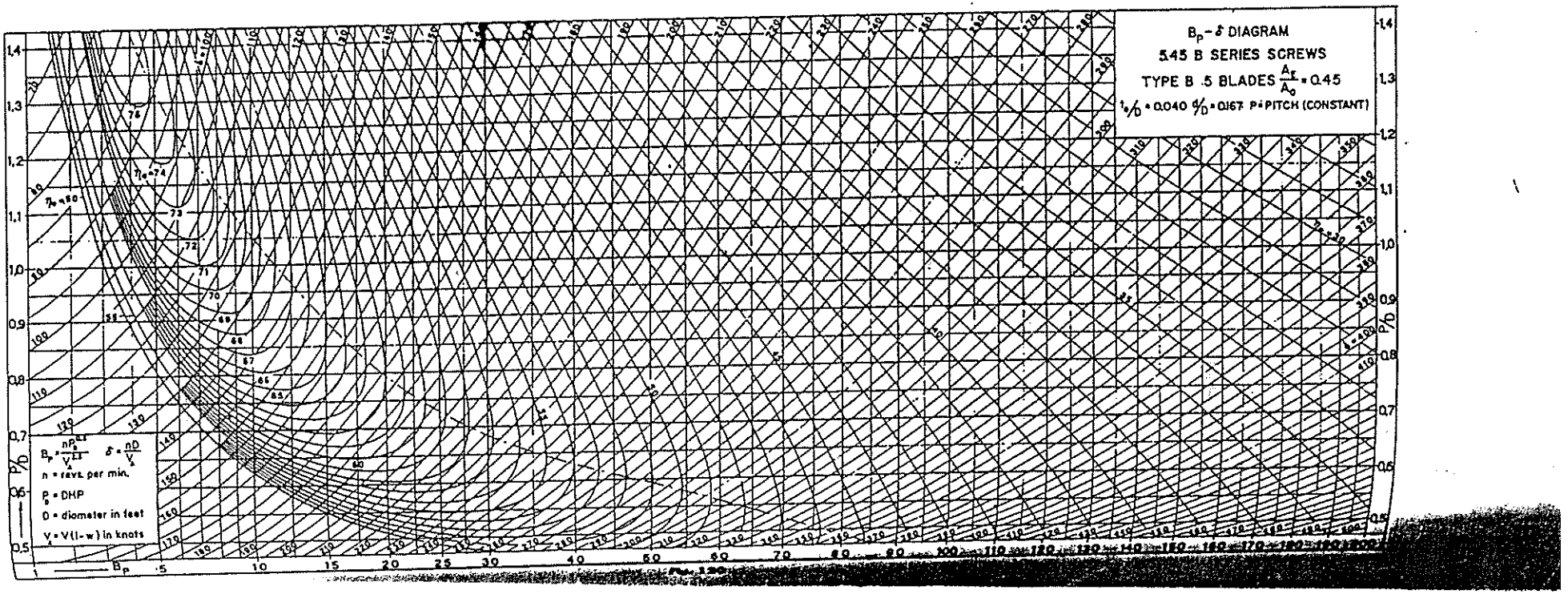

B_p–δ DIAGRAM
B SERIES SCREWS
TYPE B. 4.1-00 BLADES $\frac{A_E}{A_O}$ = 1·00
t/D = 0·045 d/D = 0·167 P = PITCH AT BLADE TIP (REDUCED 20% AT ROOT)
$B_p = \frac{nP_E^{0.5}}{V_A^{2.5}}$ $\delta = \frac{nD}{V_A}$
n = revs. per min.
P_E = DHP
D = diameter in feet
$V_A = V(1-w)$ in knots
B_p
P/D

Fig. 119


B_p–δ DIAGRAM
5·45 B SERIES SCREWS
TYPE B .5 BLADES $\frac{A_E}{A_O}$ = 0·45
t/D = 0·040 d/D = 0·167 P = PITCH (CONSTANT)
$B_p = \frac{nP_E^{0.5}}{V_A^{2.5}}$ $\delta = \frac{nD}{V_A}$
n = revs. per min.
P_E = DHP
D = diameter in feet
$V_A = V(1-w)$ in knots
B_p
P/D

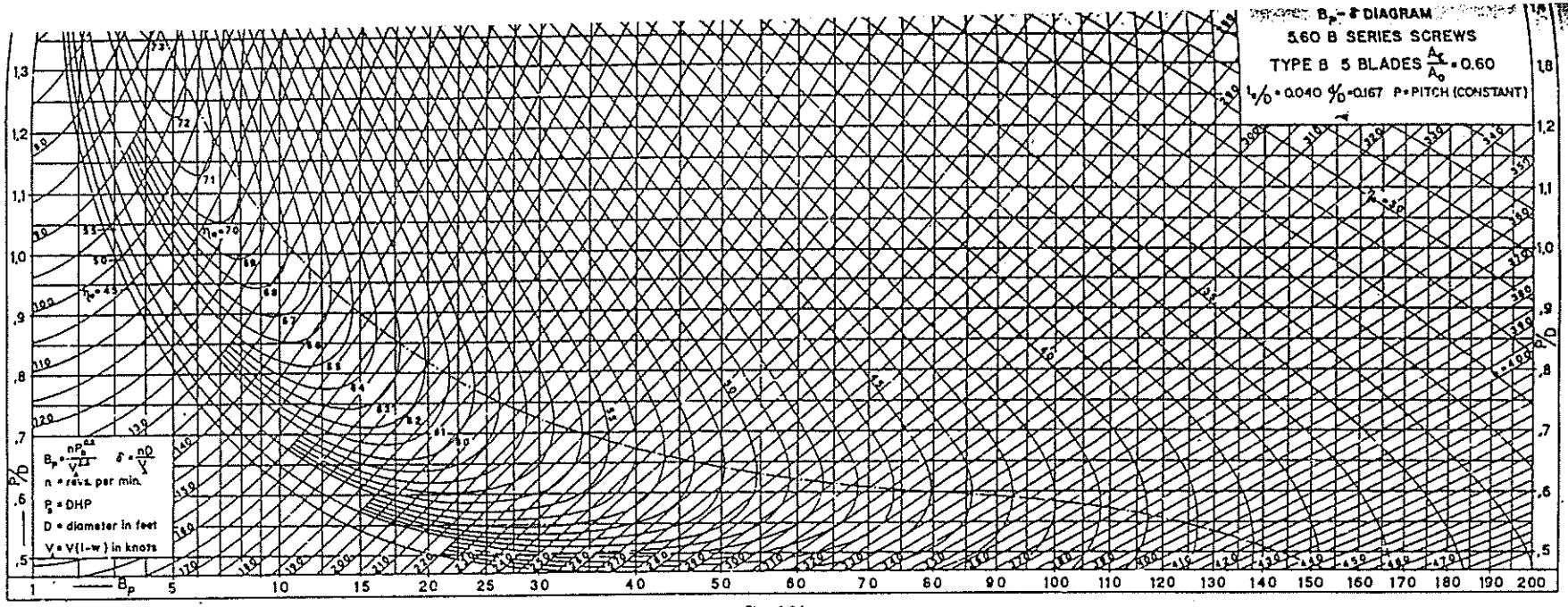


Fig. 121

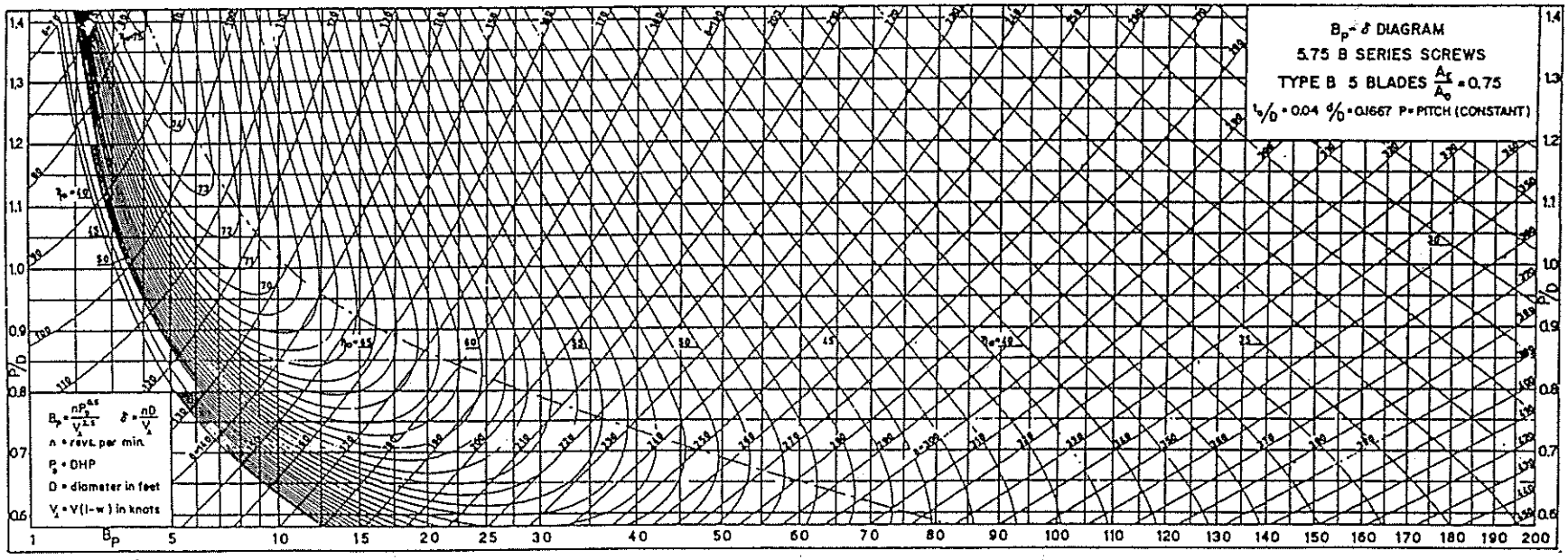


Fig. 122

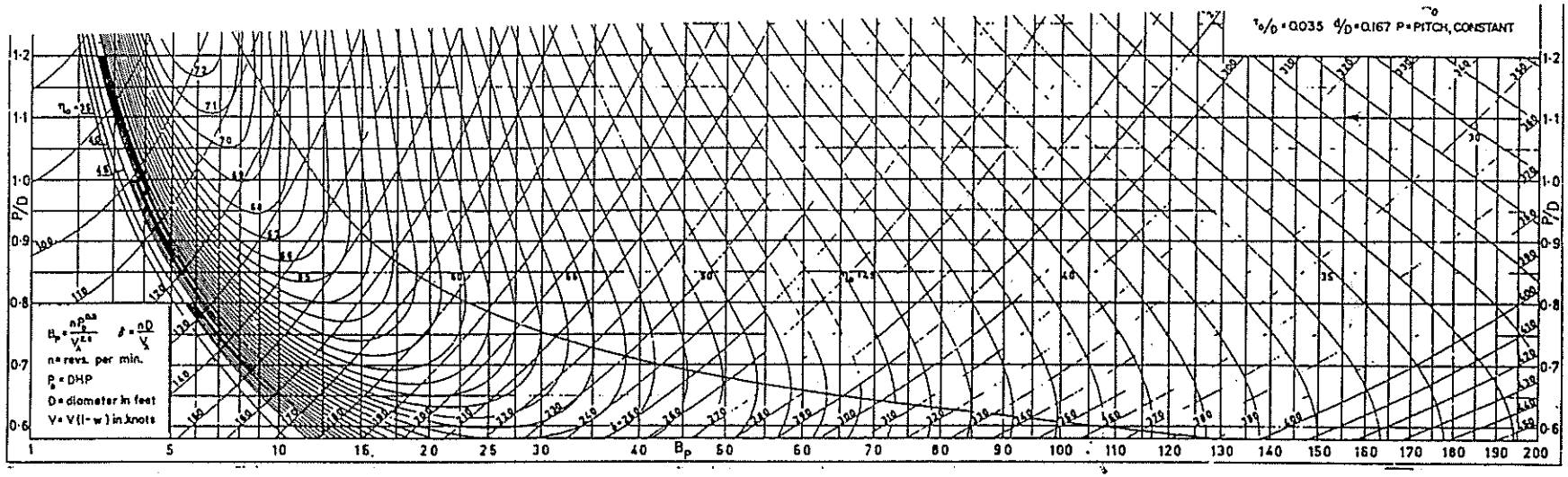


Fig. 123

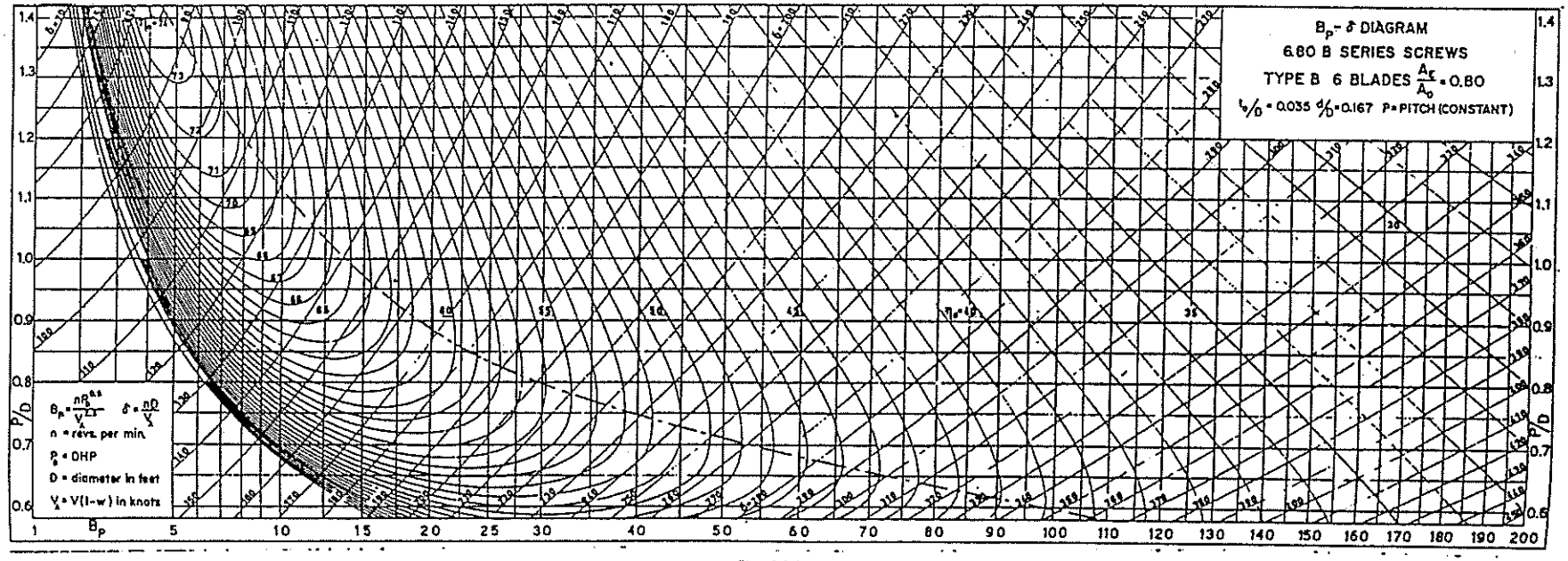


Fig. 124

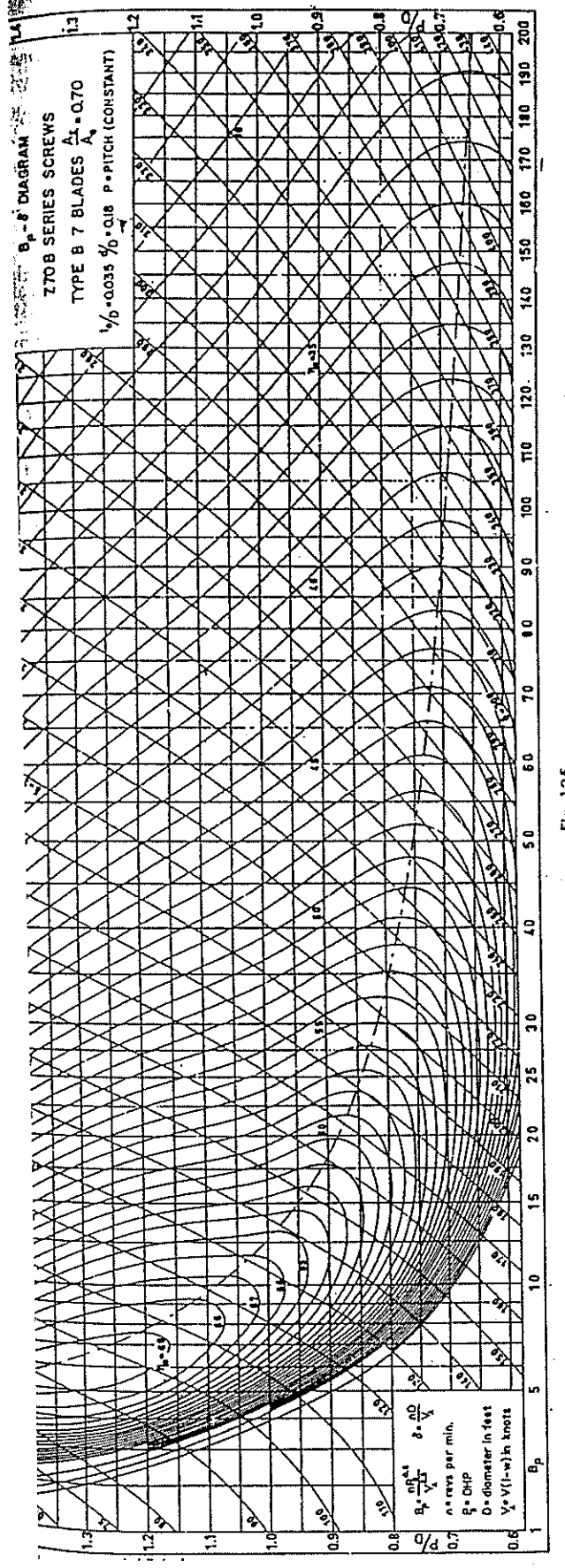


Fig. 125

where

n = revolutions per minute
P_D = delivered horsepower at propeller
V_A = speed of advance, knots
D = propeller diameter, ft

The charts consist of contours of constant propeller efficiency η_0 and of constant advance coefficient δ plotted on a grid of B_P and pitch ratio, P/D, as in Fig. 113.

The model results used to construct the charts are based upon experiments in fresh water and allowance for this must be made in the design calculations.

The information required for making a propeller design from these charts may be summarized as follows:

1 Principal dimensions, proportions and form coefficients for ship, to estimate wake and thrust-deduction factors and other propulsion information.

2 ehp from model tests or estimated from other available data, using information under 1.

3 Engine power and rated rpm.

4 Speed of ship.

5 Any restrictions, such as a limit on the maximum diameter of the propeller.

The dhp at the propeller can be estimated from equation (73)

$$P_D = \frac{P_E(1 + x)}{\eta_D}$$

where the quasi-propulsive coefficient η_D can be taken from such published data as Series 60, from the trial results of a similar ship or, in many cases, from experiments run with a model of the ship in question with a stock propeller of approximately the correct diameter and pitch. The estimated value will later be checked in the course of the design.

For a new ship in trial condition, ehp may be estimated either from specific model tests or by series data, in either case with the addition of a suitable model-ship correlation allowance C_A. This latter will depend on a number of factors such as the method of shell construction, quality of paint surface, time out of dock and size of ship (Section 20). For normal standard estimates, using the ATTC coefficients, it is still the agreed procedure for all published work to assume that $C_A = +0.0004$. In commercial work, clients may require estimates involving other values of C_A which they have derived from an analysis of the performance of their own ships. Otherwise the value of +0.0004 is used.

The ehp must also be increased to include the resistance of any appendages not fitted during model tests, such as bilge keels or bossings.

It is desirable in general to design the propeller to suit the expected average service conditions rather than those on trial, which are unlikely to be repeated. The service allowance should be chosen upon the basis of the average weather conditions on the ocean routes on which the ship is expected to trade. The North Atlantic, for example, makes more exacting demands in this respect than most oceans. In the absence of any such special

1. Main Data and Outputs

The Wärtsilä 20 is a 4-stroke, non-reversible, turbocharged and intercooled diesel engine with direct injection of fuel.

Cylinder bore	200 mm
Stroke	280 mm
Piston displacement	8.8 l/cyl
Number of valves	2 inlet valves and 2 exhaust valves
Cylinder configuration	4, 6, 8, 9, in-line
Direction of rotation	Clockwise, counterclockwise on request
Speed	900, 1000 rpm
Mean piston speed	8.4, 9.3 m/s

1 Maximum continuous output

Table 1.1 Rating table for Wärtsilä 20

Cylinder configuration	Main engines		Generating sets			
	1000 rpm		900 rpm / 60 Hz		1000 rpm / 50 Hz	
	kW	bhp	Engine [kW]	Generator [kVA]	Engine [kW]	Generator [kVA]
W 4L20	800	1080	740	880	800	950
W 6L20	1200	1630	1110	1320	1200	1420
W 8L20	1600	2170	1480	1760	1600	1900
W 9L20	1800	2440	1665	1980	1800	2140

The mean effective pressure p_e can be calculated as follows:

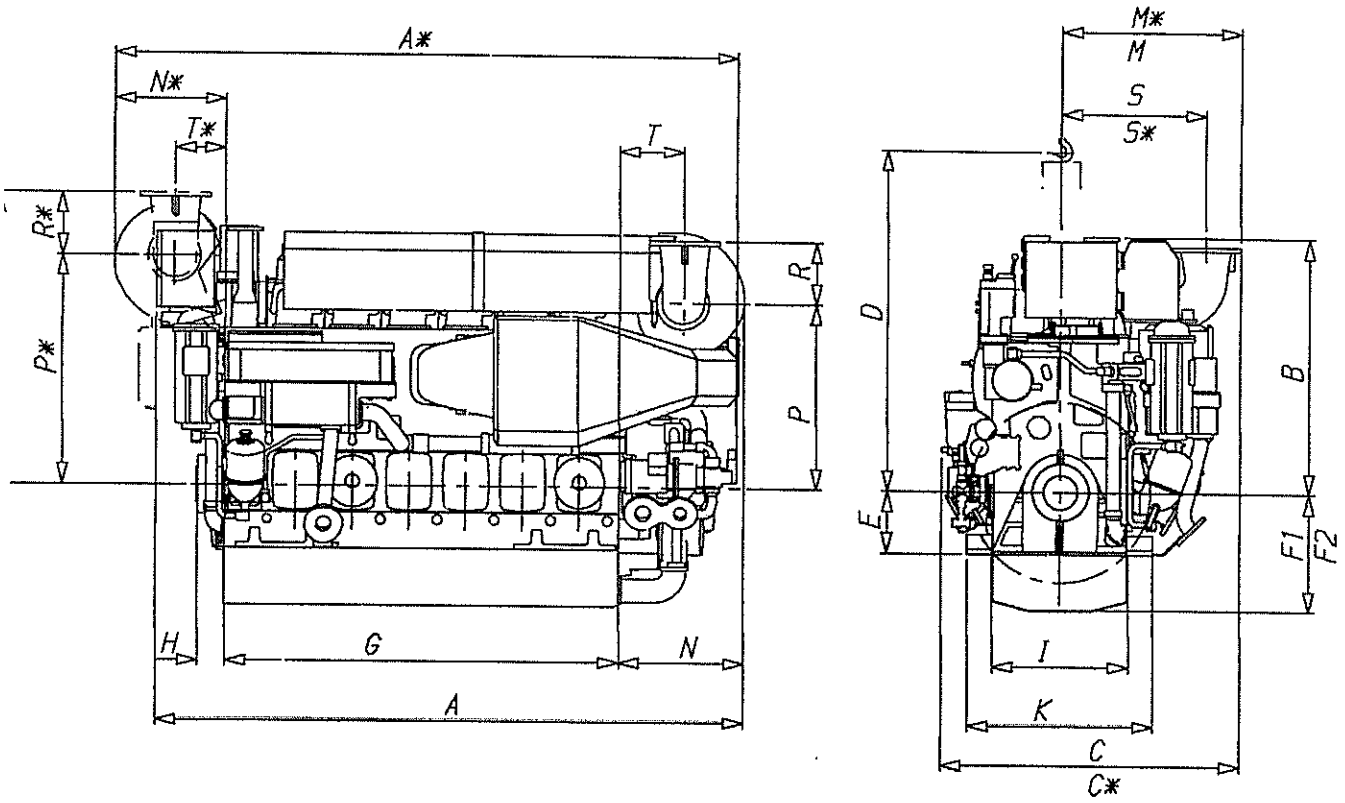
$$P_e = \frac{P \times c \times 1.2 \times 10^9}{D^2 \times L \times n \times \pi}$$

where:

P_e = Mean effective pressure [bar]
P = Output per cylinder [kW]
n = Engine speed [r/min]
D = Cylinder diameter [mm]
L = Length of piston stroke [mm]
c = Operating cycle (4)

.4 Dimensions and weights

gure 1.1 Main engines (3V92E0068c)



gine	A*	A	B*	B	C*	C	D	E	F1	F2	G	H	I	K
4L20		2510		1348		1483	1800	325	725	725	1480	155	718	980
6L20	3292	3108	1528	1348	1580	1579	1800	325	624	824	2080	155	718	980
8L20	4011	3783	1614	1465	1756	1713	1800	325	624	824	2680	155	718	980
9L20	4299	4076	1614	1449	1756	1713	1800	325	624	824	2980	155	718	980

or dry sump and F2 for deep wet sump

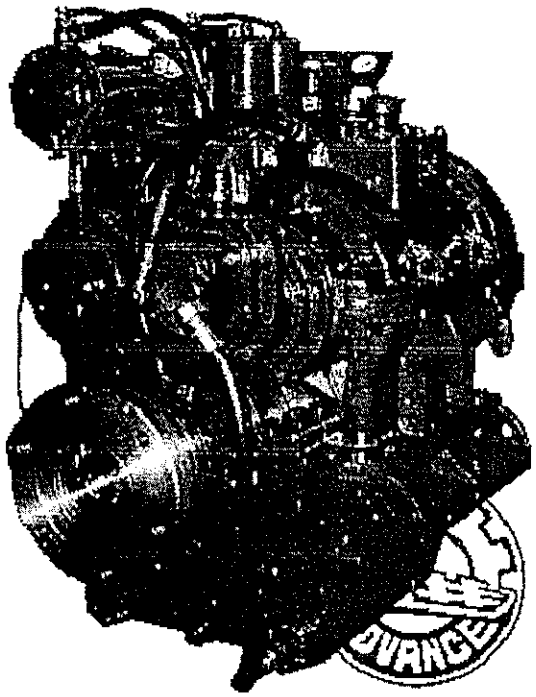
ine	M*	M	N*	N	P*	P	R*	R	S*	S	T*	T	Weight
L20		854		665		920		248		694		349	7.2
L20	951	950	589	663	1200	971	328	328	762	763	266	343	9.3
L20	1127	1084	708	738	1224	1000	390	390	907	863	329	339	11.0
L20	1127	1084	696	731	1224	1000	390	390	907	863	329	339	11.6

bocharger at flywheel end
ensions in mm. Weight in tons.

Technical Data

1 Wärtsilä 4L20

Wärtsilä 4L20		ME IMO Tier 2	AE/DE IMO Tier 2	AE/DE IMO Tier 2	ME IMO Tier 2	AE/DE IMO Tier 2	AE/DE IMO Tier 2
Cylinder output	kW	200	185	200	200	185	200
Engine speed	RPM	1000	900	1000	1000	900	1000
Engine output	kW	800	740	800	800	740	800
Mean effective pressure	MPa	2.73	2.8	2.73	2.73	2.8	2.73
Combustion air system (Note 1)							
Flow at 100% load	kg/s	1.55	1.37	1.49	1.5	1.38	1.5
Temperature at turbocharger intake, max.	°C	45	45	45	45	45	45
Temperature after air cooler (TE601)	°C	50...70	50...70	50...70	50...70	50...70	50...70
Exhaust gas system (Note 2)							
Flow at 100% load	kg/s	1.55	1.42	1.55	1.55	1.42	1.55
Flow at 85% load	kg/s	1.39	1.31	1.43	1.39	1.31	1.43
Flow at 75% load	kg/s	1.2	1.16	1.28	1.2	1.16	1.28
Flow at 50% load	kg/s	0.8	0.81	0.9	0.8	0.81	0.9
Temperature after turbocharger, 100% load (TE517)	°C	370	370	370	370	370	370
Temperature after turbocharger, 85% load (TE517)	°C	340	335	335	340	335	335
Temperature after turbocharger, 75% load (TE517)	°C	350	335	335	350	335	335
Temperature after turbocharger, 50% load (TE517)	°C	385	355	355	385	355	355
Backpressure, max.	kPa	4.0	4.0	4.0	5.0	5.0	5.0
Calculated pipe diameter for 35 m/s	mm	320	306	320	320	306	320
Heat balance (Note 3)							
Jacket water, HT-circuit	kW	175	166	175	175	166	175
Charge air, LT-circuit	kW	275	251	275	275	251	275
Lubricating oil, LT-circuit	kW	130	122	130	130	122	130
Radiation	kW	33	32	33	33	32	33
Fuel system (Note 4)							
Pressure before injection pumps (PT101)	kPa	700±50	700±50	700±50	700±50	700±50	700±50
Engine driven pump capacity (MDF only)	m³/h	0.87	0.78	0.87	0.87	0.78	0.87
Fuel flow to engine (without engine driven pump), approx.	m³/h	0.69	0.64	0.7	0.69	0.64	0.7
HFO viscosity before engine	cSt	16... 24	16... 24	16... 24	16... 24	16... 24	16... 24
Max. HFO temperature before engine (TE101)	°C	140	140	140	140	140	140
MDF viscosity, min.	cSt	1.8	1.8	1.8	1.8	1.8	1.8
Max. MDF temperature before engine (TE101)	°C	45	45	45	45	45	45
Fuel consumption at 100% load	g/kWh	197	198	199	197	198	199
Fuel consumption at 85% load	g/kWh	194	195	196	194	195	196
Fuel consumption at 75% load	g/kWh	194	196	197	194	196	197
Fuel consumption at 50% load	g/kWh	196	203	204	196	203	204
Clean leak fuel quantity, MDF at 100% load	kg/h	3.3	3.1	3.3	3.3	3.1	3.3
Clean leak fuel quantity, HFO at 100% load	kg/h	0.7	0.6	0.7	0.7	0.6	0.7
Lubricating oil system							
Pressure before bearings, nom. (PT201)	kPa	450	450	450	450	450	450
Suction ability main pump, including pipe loss, max.	kPa	20	20	20	20	20	20
Priming pressure, nom. (PT201)	kPa	80	80	80	80	80	80
Suction ability priming pump, including pipe loss, max.	kPa	20	20	20	20	20	20
Temperature before bearings, nom. (TE201)	°C	66	66	66	66	66	66
Temperature after engine, approx.	°C	78	78	78	78	78	78
Pump capacity (main), engine driven	m³/h	34	24	27	34	24	27
Pump capacity (main), stand-by	m³/h	21	21	21	21	21	21
Priming pump capacity, 50Hz/60Hz	m³/h	8.6 / 10.5	8.6 / 10.5	8.6 / 10.5	8.6 / 10.5	8.6 / 10.5	8.6 / 10.5
Oil volume, wet sump, nom.	m³	0.27	0.27	0.27	0.27	0.27	0.27
Oil volume in separate system oil tank	m³	1.1	1.0	1.1	1.1	1.0	1.1
Filter fineness, nom.	microns	25	25	25	25	25	25
Oil consumption at 100% load, max.	g/kWh	0.5	0.5	0.5	0.5	0.5	0.5
Crankcase ventilation backpressure, max.	kPa	0.3	0.3	0.3	0.3	0.3	0.3
Oil volume in speed governor	liters	1.4...2.2	1.4...2.2	1.4...2.2	1.4...2.2	1.4...2.2	1.4...2.2
Cooling water system							
High temperature cooling water system							



commodity description:

900 MARINE GEARBOX MAX.1440HP at 1600RPM

Engine Speed:1000~1800RPM

Ratio	1.46	2.04	2.47	3.00	3.60	4.08	4.63	4.95
Rate(hp/rpm)	0.90	0.90	0.90	0.90	0.75	0.66	0.58	0.55

L*W*H : 1115*850*1310mm Net Weight : 1600Kg

Options/Comments : Electrical remote control ;Flexible connection

Centre distance : Input and output coaxality

Engine : 12V190DC;M200...

Friction Losses in Pipe Fittings
Resistance Coefficient K (use in formula $hf = Kv^2/2g$)

Fitting		LD	Nominal Pipe Size											
			½	¾	1	1¼	1½	2	2½-3	4	6	8-10	12-16	18-24
			K Value											
Angle Valve		55	1.48	1.38	1.27	1.21	1.16	1.05	0.99	0.94	0.83	0.77	0.72	0.66
Angle Valve		150	4.05	3.75	3.45	3.30	3.15	2.85	2.70	2.55	2.25	2.10	1.95	1.80
Ball Valve		3	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05	0.05	0.04	0.04	0.04
Butterfly Valve								0.86	0.81	0.77	0.68	0.63	0.35	0.30
Gate Valve		8	0.22	0.20	0.18	0.18	0.15	0.15	0.14	0.14	0.12	0.11	0.10	0.10
Globe Valve		340	9.2	8.5	7.8	7.5	7.1	6.5	6.1	5.8	5.1	4.8	4.4	4.1
Plug Valve Branch Flow		90	2.43	2.25	2.07	1.98	1.89	1.71	1.62	1.53	1.35	1.26	1.17	1.08
Plug Valve Straightaway		18	0.48	0.45	0.41	0.40	0.38	0.34	0.32	0.31	0.27	0.25	0.23	0.22
Plug Valve 3-Way Thru-Flow		30	0.81	0.75	0.69	0.66	0.63	0.57	0.54	0.51	0.45	0.42	0.39	0.36
Standard Elbow	90°	30	0.81	0.75	0.69	0.66	0.63	0.57	0.54	0.51	0.45	0.42	0.39	0.36
	45°	16	0.43	0.40	0.37	0.35	0.34	0.30	0.29	0.27	0.24	0.22	0.21	0.19
	long radius 90°	16	0.43	0.40	0.37	0.35	0.34	0.30	0.29	0.27	0.24	0.22	0.21	0.19
Close Return Bend		50	1.35	1.25	1.15	1.10	1.05	0.95	0.90	0.85	0.75	0.70	0.65	0.60
Standard Tee	Thru-Flow	20	0.54	0.50	0.46	0.44	0.42	0.38	0.36	0.34	0.30	0.28	0.26	0.24
	Thru-	60	1.62	1.50	1.38	1.32	1.26	1.14	1.08	1.02	0.90	0.84	0.78	0.72
90 Bends, Pipe Bends, Flanged Elbows, Butt-Welded Elbows	r/d=1	20	0.54	0.50	0.46	0.44	0.42	0.38	0.36	0.34	0.30	0.28	0.26	0.24
	r/d=2	12	0.32	0.30	0.28	0.26	0.25	0.23	0.22	0.20	0.18	0.17	0.16	0.14
	r/d=3	12	0.32	0.30	0.28	0.26	0.25	0.23	0.22	0.20	0.18	0.17	0.16	0.14
	r/d=4	14	0.38	0.35	0.32	0.31	0.29	0.27	0.25	0.24	0.21	0.20	0.18	0.17
	r/d=6	17	0.46	0.43	0.39	0.37	0.36	0.32	0.31	0.29	0.26	0.24	0.22	0.20
	r/d=8	24	0.65	0.60	0.55	0.53	0.50	0.46	0.43	0.41	0.36	0.34	0.31	0.29
	r/d=10	30	0.81	0.75	0.69	0.66	0.63	0.57	0.54	0.51	0.45	0.42	0.39	0.36
	r/d=12	34	0.92	0.85	0.78	0.75	0.71	0.65	0.61	0.58	0.51	0.48	0.44	0.41
	r/d=14	38	1.03	0.95	0.87	0.84	0.80	0.72	0.68	0.65	0.57	0.53	0.49	0.46
	r/d=16	42	1.13	1.05	0.97	0.92	0.88	0.80	0.76	0.71	0.63	0.59	0.55	0.50
	r/d=18	45	1.24	1.15	1.06	1.01	0.97	0.87	0.83	0.78	0.69	0.64	0.60	0.55

Friction Loss of Water in Pipe Fittings in Terms of Equivalent Length - Feet of Straight Pipe

Nominal pipe size	Actual inside diameter inches d	Friction factor f	Gate valve - full open	90° elbow	Long radius 90° or 45° std elbow	Std tee - thru flow	Std tee - branch flow	Close return bend	Swing check valve - full open	Angle valve - full open	Globe valve - full valve	Butter-fly valve	90°Welding elbow		Mitre bend	
													r/d =	r/d =	45°	90°
½	.622	.027	.41	1.55	.83	1.04	3.11	2.59	5.18	7.78	17.6					
¾	.824	.025	.55	2.06	1.10	1.37	4.12	3.43	6.86	10.3	23.3					
1	1.049	.023	.70	2.62	1.40	1.75	5.25	4.37	8.74	13.1	29.7					
1¼	1.380	.022	.92	3.45	1.84	2.30	6.90	5.75	11.5	17.3	39.1					
1½	1.610	.021	1.07	4.03	2.15	2.68	8.05	6.71	13.4	20.1	45.6					
2	2.067	.019	1.38	5.17	2.76	3.45	10.3	8.61	17.2	25.8	58.6	7.75	3.45	2.07	2.58	10.3
2½	2.469	018	1.65	6.17	3.29	4.12	12.3	10.3	20.6	30.9	70.0	9.26	4.12	2.47	3.08	12.3
3	3.068	.018	2.04	7.67	4.09	5.11	15.3	12.8	25.5	38.4	86.9	11.5	5.11	3.07	3.84	15.3
4	4.026	.017	2.68	10.1	5.37	6.71	20.1	16.8	33.6	50.3	114	15.1	6.71	4.03	5.03	20.1
5	5.047	.016	3.36	12.6	6.73	8.41	25.2	21.0	42.1	63.1	143	18.9	8.41	5.05	6.31	25.2
6	6.065	.015	4.04	15.2	8.09	10.1	30.3	25.3	50.5	75.8	172	22.7	10.1	6.07	7.58	30.3
8	7.981	.014	5.32	20.0	10.6	13.3	39.9	33.3	33.3	99.8	226	29.9	13.3	7.98	9.98	39.9
10	10.02	.014	6.68	25.1	13.4	16.7	50.1	41.8	41.8	125	284	29.2	16.7	10.0	12.5	50.1
12	11.938	.013	7.96	29.8	15.9	19.9	59.7	49.7	49.7	149	338	34.8	19.9	11.9	14.9	59.7
14	13.124	.013	8.75	32.8	17.5	21.8	65.6	54.7	54.7	164	372	38.3	21.8	13.1	16.4	65.6
16	15.00	.013	10.0	37.5	20.0	25.0	75.0	62.5	62.5	188	425	31.3	25.0	15.0	18.8	75.0
18	16.876	.012	16.9	42.2	22.5	28.1	84.4	70.3	70.3	210	478	35.2	28.1	16.9	21.1	84.4
20	18.814	.012	12.5	47.0	25.1	31.4	94.1	78.4	78.4	235	533	39.2	31.4	18.8	23.5	94.1
24	22.628	0.12	15.1	56.6	30.2	37.7	113	94.3	94.3	283	641	47.1	37.7	22.6	28.3	113
30	28	.011	18.7	70	37.3	46.7	140	117					46.7	28	35	140
36	34	.011	22.7	85	45.3	56.7	170	142					56.7	34	43	170
42	40	.010	26.7	100	53.3	66.7	200	167					66.7	40	50	200
48	46	.010	30.7	115	61.3	76.7	230	192					76.7	46	58	230
L/D			8	30	16	20	60	50	½ to 6 = 100 24 to 48 =50	150	340		20	12	15	60

Pipe Entrance	Inward Projecting	0.78
Pipe Entrance Flush	Sharp-Edged	0.50
	r/d=0.02	0.28
	r/d=0.04	0.24
	r/d=0.06	0.15
	r/d=0.10	0.09
	r/d=0.14	0.04

The K values given below are for making estimates of friction loss in cases not covered in the previous tables.

Type of Fitting	K Value
Disk or Wobble Meter	3.4 - 10
Rotary Meter (Star or Cog-Wheel Piston)	10
Reciprocating Piston Meter	15
Turbine Wheel (Double-Flow) Meter	5 - 7.5
Bends w/Corrugated Inner Radius	1.3 - 1.6 times value for smooth bend

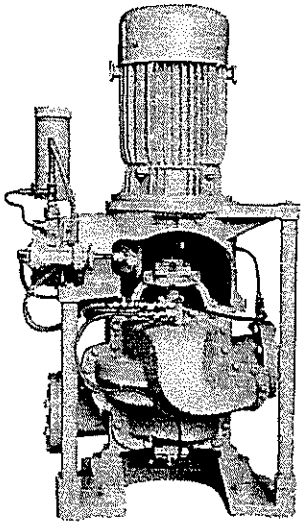
Example: Determine L (friction loss in pipe fittings in terms of equivalent length in feet of straight pipe).
Assume a 6" angle valve for Schedule 40 pipe size.
Select the appropriate K value for such and select D and f for Schedule 40 pipe from the table below where K is the pipe diameter in feet.

Pipe Size Inches Sch. 40	D feet	f	Pipe Size Inches Sch. 40	D feet	f	Pipe Size Inches Sch. 40	D feet	f	Pipe Size Inches Sch. 40	D feet	f
½	0.0518	0.027	2½	0.2058	0.018	10	0.8350	0.014	24	1.8857	0.012
¾	0.0687	0.025	3	0.2557	0.018	12	0.9948	0.013	30	2.3333	0.011
1	0.0874	0.023	4	0.3355	0.017	14	1.0937	0.013	36	2.833	0.011
1¼	0.1150	0.022	5	0.4206	0.016	16	1.250	0.013	42	3.3333	0.010
1½	0.1342	0.021	6	0.5054	0.015	18	1.4063	0.012	48	3.8333	0.010
2	0.1723	0.019	8	0.6651	0.014	20	1.5678	0.012			

Mitre Bends	a=0°	2	0.05	0.05	0.05	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.03	0.02
	a=15°	4	0.11	0.10	0.09	0.09	0.08	0.08	0.07	0.07	0.06	0.06	0.05	0.05
	a=30°	8	0.22	0.20	0.18	0.18	0.17	0.15	0.14	0.14	0.12	0.11	0.10	0.10
	a=45°	15	0.41	0.38	0.35	0.33	0.32	0.29	0.27	0.26	0.23	0.21	0.20	0.18
	a=60°	25	0.68	0.63	0.58	0.55	0.53	0.48	0.45	0.43	0.38	0.35	0.33	0.30
	a=75°	40	1.09	1.00	0.92	0.88	0.84	0.76	0.72	0.68	0.60	0.56	0.52	0.48
	a=90°	60	1.62	1.50	1.38	1.32	1.26	1.14	1.08	1.02	0.90	0.84	0.78	0.72
Note: Fittings are standard with full openings.														

Fitting	L/D	Minimum Velocity for Full Disc Lift		Nominal Pipe Size											
		General ft/sec	Water ft/sec	½	¾	1	1¼	1½	2	2½-3	4	6	8-10	12-16	18-24
				K Value											
Swing Check Valve	100	$35\sqrt{v}$	4.40	2.70	2.50	2.30	2.20	2.10	1.90	1.80	1.70	1.50	1.40	1.30	1.20
	50	$48\sqrt{v}$	6.06	1.40	1.30	1.20	1.10	1.10	1.00	0.90	0.90	0.75	0.70	0.65	0.60
Lift Check Valve	600	$40\sqrt{v}$	5.06	16.2	15.0	13.08	13.2	12.6	11.4	10.8	10.2	9.0	8.4	7.8	7.2
	55	$140\sqrt{v}$	17.7	1.50	1.40	1.30	1.20	1.20	1.10	1.00	0.94	0.83	0.77	0.72	0.66
Tilting Disc Check Valve	5	$80\sqrt{v}$	10.13						0.76	0.72	0.68	0.60	0.56	0.39	0.24
	15	$30\sqrt{v}$	3.80						2.30	2.20	2.00	1.80	1.70	1.20	0.72
Foot Valve with Strainer Poppet Disc	420	$15\sqrt{v}$	1.90	11.3	10.5	9.70	9.30	8.80	8.00	7.60	7.10	6.30	5.90	5.50	5.0
Foot Valve with Strainer Hinged Disc	75	$35\sqrt{v}$	4.43	2.00	1.90	1.70	1.70	1.70	1.40	1.40	1.30	1.10	1.10	1.00	0.90

Fitting	Description	All Pipe Sizes
		K Value
Pipe Exit	Projecting Sharp-Edged Rounded	1.00



CENTRIFUGAL PUMP

VS

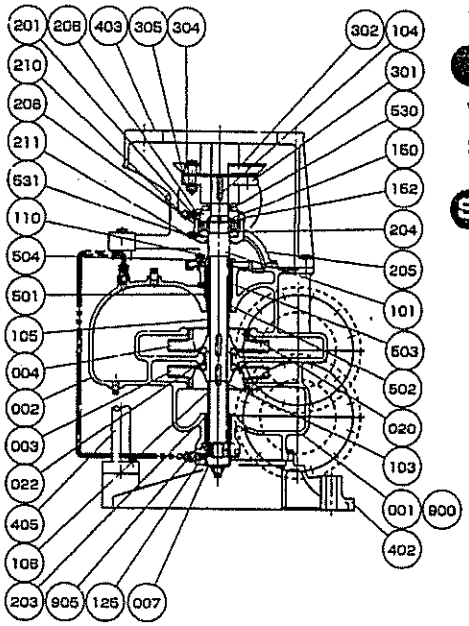
Application

Fire & G.S. Pump
Bilge & Ballast Pump

Feature

Vertical Two-stage Single-suction
Split-casing Type

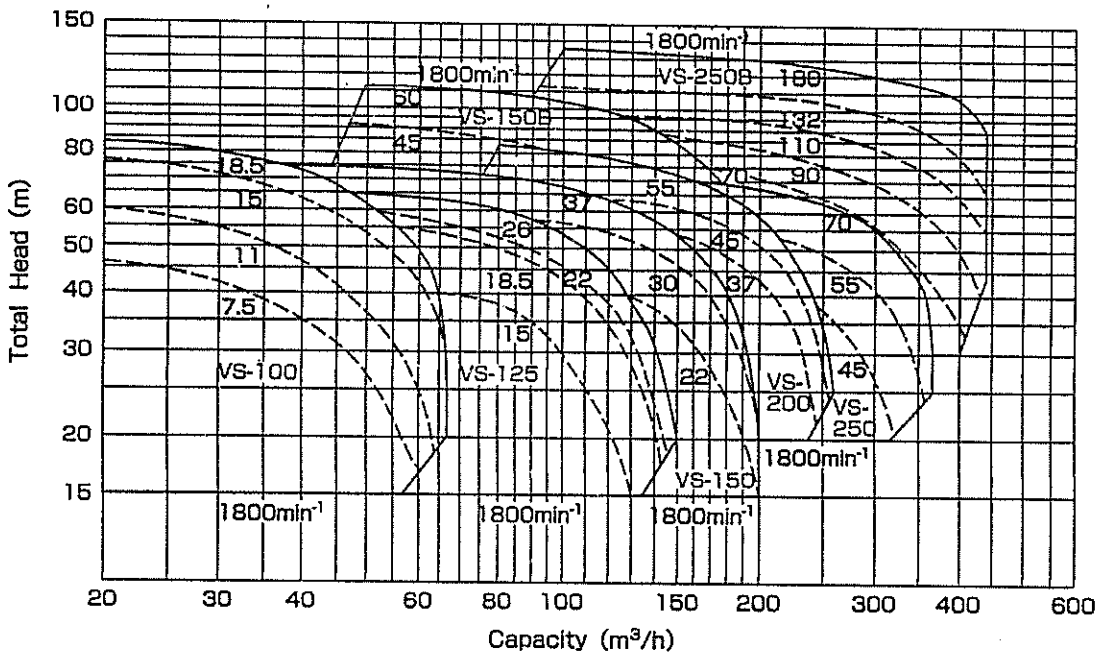
Structure & Material



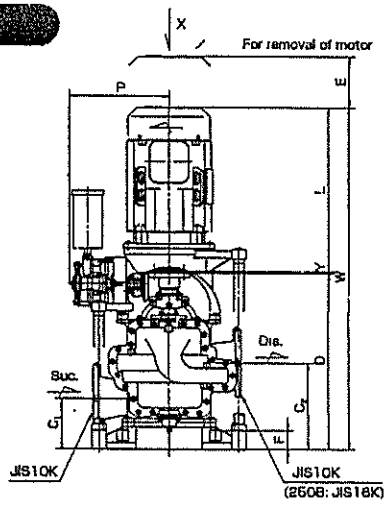
Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
001	CASING	1	BRONZE	CAC402	CAST IRON	FC200
002	CASING COVER	1	BRONZE	CAC402	CAST IRON	FC200
003	IMPELLER	1	PHOSPHOR BRONZE	CAC502A	PHOSPHOR BRONZE	CAC502A
004	IMPELLER	1	PHOSPHOR BRONZE	CAC502A	PHOSPHOR BRONZE	CAC502A
007	BOTTOM COVER	1	BRONZE	CAC402	CAST IRON	FC200
020	CASING RING	2	BRONZE	CAC402	BRONZE	CAC402
022	STAGE BUSH	1	BRONZE	CAC402	BRONZE	CAC402
101	SHAFT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
103	KEY	2	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
104	KEY	1	CARBON STEEL	S45C	CARBON STEEL	S45C
105	SLEEVE	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
108	SLEEVE	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
110	O-RING	1	RUBBER	NBR	RUBBER	NBR
125	SLEEVE NUT	2	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
150	BEARING NUT	1	MILD STEEL	SS400	MILD STEEL	SS400
152	BEARING WASHER	1	MILD STEEL	SS400	MILD STEEL	SS400
201	BALL BEARING	1	BEARING STEEL	SUJ2	BEARING STEEL	SUJ2
203	BOTTOM METAL	1	LEAD BRONZE	–	LEAD BRONZE	–
204	BEARING SPACER	1	MILD STEEL	SS400	MILD STEEL	SS400
205	BEARING HOUSING	1	CAST IRON	FC200	CAST IRON	FC200

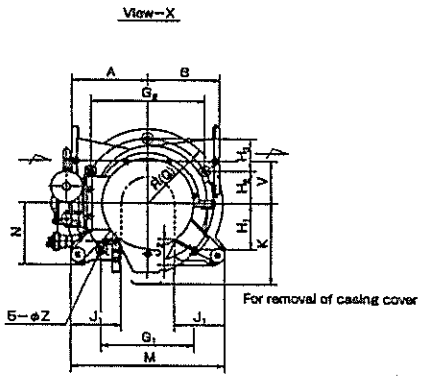
Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
206	HOUSING COVER	1	CAST IRON	FC200	CAST IRON	FC200
208	BEARING COVER	1	CAST IRON	FC200	CAST IRON	FC200
210	GREASE NIPPLE	1	BRASS	C3602	BRASS	C3602
211	GREASE FITTING	1	BRASS	C3602	BRASS	C3602
301	COUPLING	1	CAST IRON	FC200	CAST IRON	FC200
302	COUPLING	1	CAST IRON	FC200	CAST IRON	FC200
304	COUPLING RING	8	RUBBER	NBR	RUBBER	NBR
305	COUPLING BOLT & NUT	8	MILD STEEL	SS400	MILD STEEL	SS400
402	PUMP BED	1	CAST IRON	FC200	CAST IRON	FC200
403	MOTOR FRAME	1	CAST IRON	FC200	CAST IRON	FC200
405	SUPPORT	2	STEEL GAS PIPE	SGP	STEEL GAS PIPE	SGP
501	GLAND PACKING	5	CARBONIZED FIBER	–	CARBONIZED FIBER	–
502	NECK BUSH	1	BRONZE	CAC402	BRONZE	CAC402
503	LANTERN RING	1	BRONZE	CAC402	BRONZE	CAC402
504	GLAND	1	BRONZE	CAC402	BRONZE	CAC402
530	OIL SEAL	1	RUBBER	NBR	RUBBER	NBR
531	OIL SEAL	1	RUBBER	NBR	RUBBER	NBR
900	GASKET	1	PAPER	–	PAPER	–
905	GASKET	1	RUBBER	NBR	RUBBER	NBR

Performance



Dimension

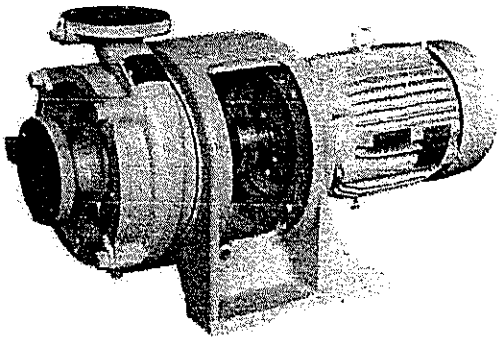




Model No.	Motor		Bore		Dimension (mm)																						
	kW	min⁻¹	Suc.	Dis.	A	B	C1	C2	D	E	F	G1	G2	H1	H2	H3	J1	J2	K	L	M	N	P	Q	V	W	Y	Z
VS-100	7.5	1800	100	100	300	270	220	380	846	150	80	368	460	164	130	130	175	80	450	480	580	240	485	310	170	829	3	24
	11									200										595						944		
	15																			635						984		
	18.5																			685						1034		
VS-125	15	1800	125	125	290	320	262	442	960	200	90	353	433	177	125	125	180	105	540	635	630	255	485	300	175	1698	3	26
	18.5																			685						1648		
	22																											
	28																			725						1689	4	
VS-150	22	1800	150	150	370	350	245	428	876	200	80	424	520	212	150	150	215	120	630	685	750	303	485	360	210	1564	3	28
	30																			725						1605	4	
	37									250										800						1680		
VS-150B	45	1800	150	150	350	330	262	442	972	250	80	424	520	212	150	150	215	120	630	800	750	303	485	360	200	1776	4	28
	60																			1050						2026		
VS-200	37	1800	200	200	370	350	245	428	876	250	90	424	520	212	150	150	215	120	630	800	750	303	485	360	210	1680	4	28
	45																											
	55																			950						1830		
VS-250	45	1800	200	200	400	430	280	552	956	250	90	424	520	212	150	150	215	120	670	800	750	303	485	360	210	1759	4	28
	55																			950						1909		
	70																			1050						2009		
VS-250B	70	1800	250	250	430	430	280	490	1086	250	30	452	554	226	160	160	245	106	800	1050	750	303	540	365	330	2148	4	28
	90																											
	110																			1210						2309		
	132																			1290						2389		
	180																			1668						2565		

CENTRIFUGAL PUMP

TMC



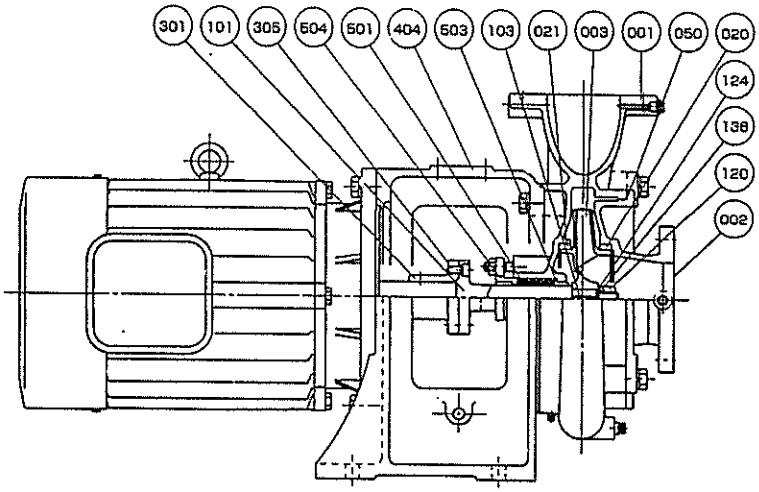
Application

Cooling Fresh Water
Cooling Sea Water
Sea Water Service

Feature

Horizontal Single-stage Single-suction
Closed Coupling Type

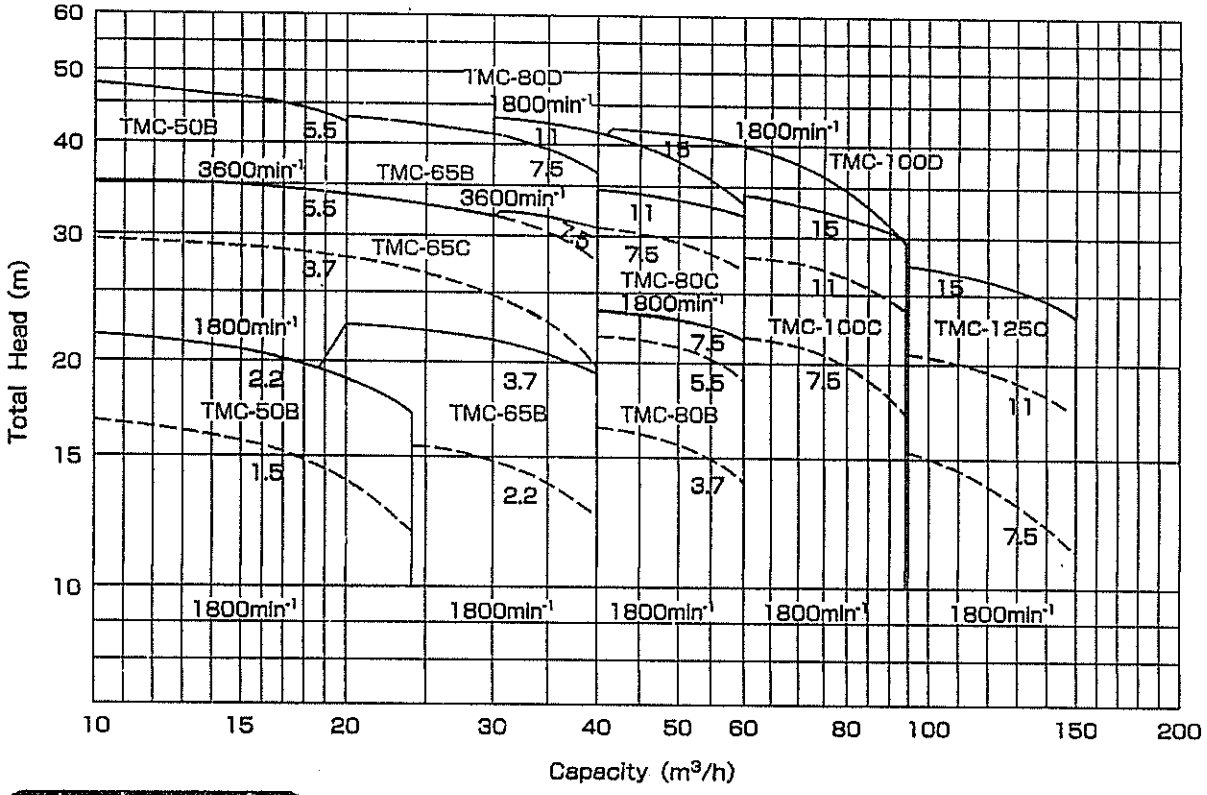
Structure & Material



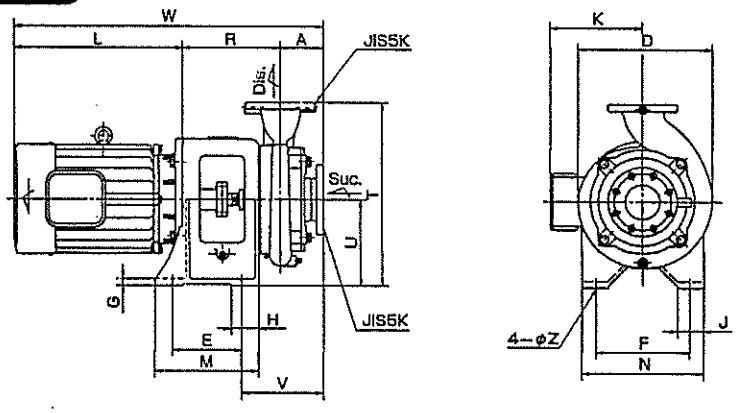
Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
001	CASING	1	BRONZE	CAC402	CAST IRON	FC200
002	CASING COVER	1	BRONZE	CAC402	CAST IRON	FC200
003	IMPELLER	1	PHOSPHOR BRONZE	CAC502A	PHOSPHOR BRONZE	CAC502A
020	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
021	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
050	O-RING	1	RUBBER	NBR	RUBBER	NBR
101	SHAFT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
103	IMPELLER KEY	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
120	IMPELLER NUT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304

Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
124	IMPELLER WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
136	SPRING WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
301	COUPLING	1	MILD STEEL	SS400	MILD STEEL	SS400
305	COUPLING BOLT	4	Cr-Mo STEEL	SCM435	Cr-Mo STEEL	SCM435
404	FRAME	1	CAST IRON	FC200	CAST IRON	FC200
501	GLAND PACKING	4	CARBONIZED FIBER	—	CARBONIZED FIBER	—
503	LANTERN RING	1	BRONZE	CAC402	BRONZE	CAC402
504	GLAND	1	BRONZE	CAC402	BRONZE	CAC402

Performance



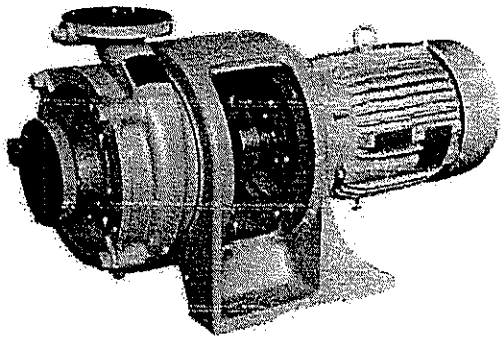
Dimension



Model No.	Motor kW	Motor min⁻¹	Bore Suc.	Bore Dis.	Dimension (mm) A	D	E	F	G	H	J	K	L	M	N	R	T	U	V	W	Z
TMC-50B	1.5	1800	50	50	100	285	160	220	16	80	65	195	300	250	280	216	370	190	205	615	15
	2.2						180		18			205	330	280		226				655	
	5.5	3600					200	270				265	400	300	330	246	390	210		745	
TMC-65B	2.2	1800	65	65	100	285	180	220	18	80	65	205	330	280	280	227	390	190	207	657	15
	3.7											215	355							682	
	7.5	3600					200	270				265	400	300	330	247	410	210		747	
TMC-65C	3.7	1800	65	65	100	335	180	220	18	80	65	215	355	280	280	227	415	190	207	682	15
	5.5						200	270				265	400	300	330	247	435	210		747	
	7.5																				
TMC-80B	3.7	1800	80	80	100	325	180	220	18	80	65	215	355	280	280	232	415	190	212	687	16
	5.5						200	270				265	400	300	330	252	435	210		762	
	7.5																				
TMC-80C	7.5	1800	80	80	100	365	200	270	18	80	75	265	400	300	350	252	500	250	212	752	19
	11								20			285	485			282				887	
TMC-80D	11	1800	80	80	125	405	200	270	20	80	75	285	485	300	350	280	530	250	245	900	19
TMC-100C	7.5	1800	100	100	125	385	200	270	18	80	75	265	400	300	350	253	530	250	238	778	19
	11								20			285	485			283				893	
	15												525							933	
TMC-100D	15	1800	100	100	125	405	200	270	20	80	75	285	525	300	350	280	565	250	245	940	19
TMC-125C	7.5	1800	125	125	140	420	200	270	18	80	75	265	400	300	350	285	530	250	265	805	19
	11								20			285	485			295				920	
	15												525							960	

CENTRIFUGAL PUMP

TMC



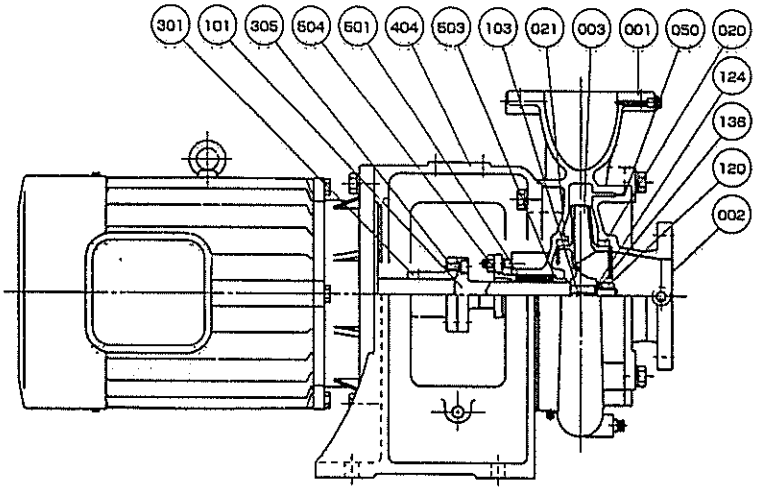
Application

Cooling Fresh Water
Cooling Sea Water
Sea Water Service

Feature

Horizontal Single-stage Single-suction
Closed Coupling Type

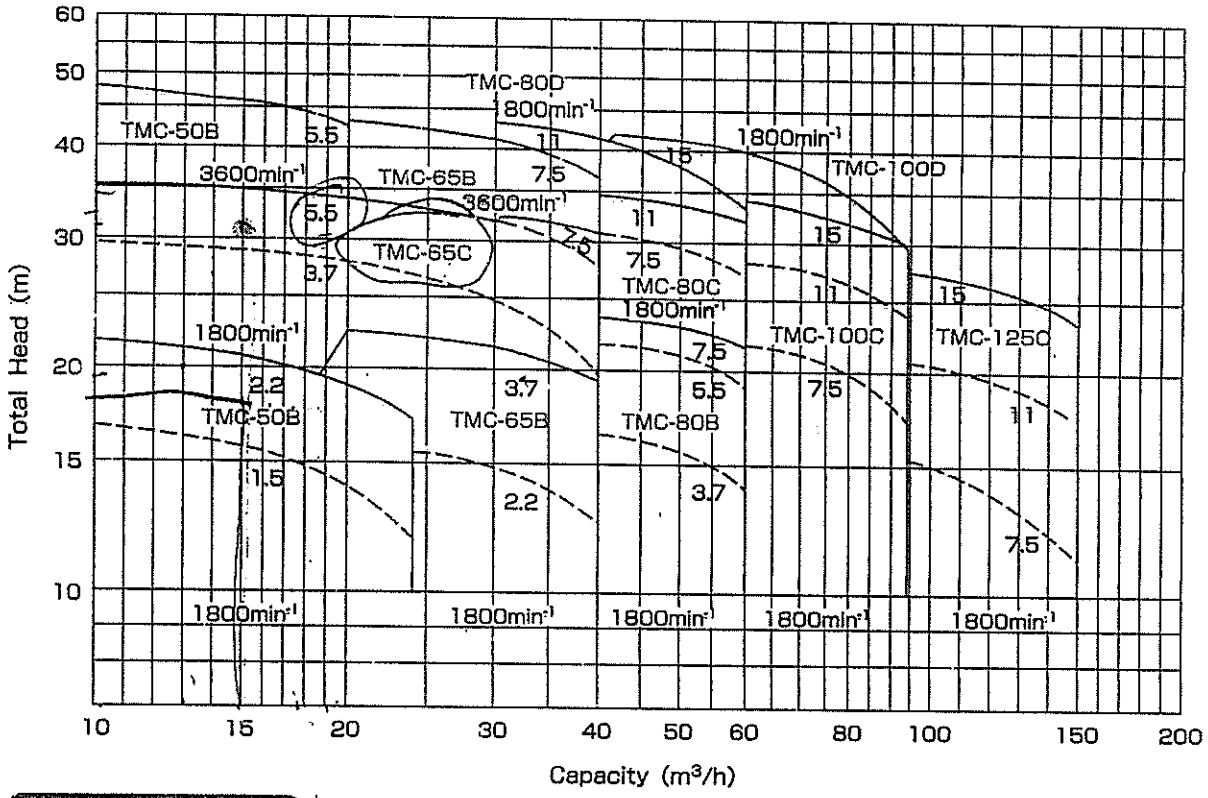
Structure & Material



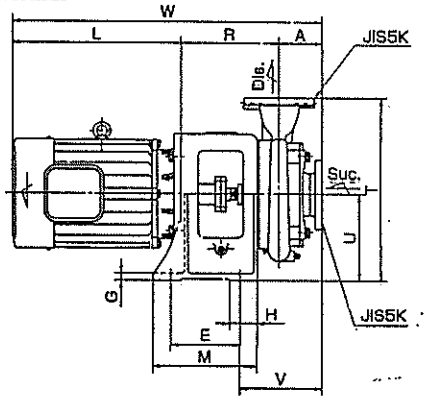
Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
001	CASING	1	BRONZE	CAC402	CAST IRON	FC200
002	CASING COVER	1	BRONZE	CAC402	CAST IRON	FC200
003	IMPELLER	1	PHOSPHOR BRONZE	CAC502A	PHOSPHOR BRONZE	CAC502A
020	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
021	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
050	O-RING	1	RUBBER	NBR	RUBBER	NBR
101	SHAFT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
103	IMPELLER KEY	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
120	IMPELLER NUT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304

Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
124	IMPELLER WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
136	SPRING WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
301	COUPLING	1	MILD STEEL	SS400	MILD STEEL	SS400
305	COUPLING BOLT	4	Cr-Mo STEEL	SCM435	Cr-Mo STEEL	SCM435
404	FRAME	1	CAST IRON	FC200	CAST IRON	FC200
501	GLAND PACKING	4	CARBONIZED FIBER	–	CARBONIZED FIBER	–
503	LANTERN RING	1	BRONZE	CAC402	BRONZE	CAC402
504	GLAND	1	BRONZE	CAC402	BRONZE	CAC402

Performance



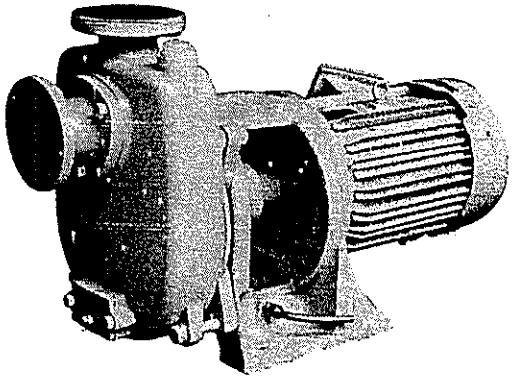
Dimension



Model No.	Motor kW	Motor min⁻¹	Bore Suc.	Bore Dis.	A	D	E	F	G	H	J	K	L	M	N	R	T	U	V	W	Z
TMC-50B	1.5	1800	50	50	100	265	160	220	16	80	65	195	300	250	280	215	370	190	205	615	15
	2.2						180		18			205	330	280		225				655	
	5.5	3600					200	270				265	400	300	330	245	390	210		745	
TMC-65B	2.2	1800	65	65	100	285	180	220	18	80	65	205	330	280	280	227	380	190	207	657	15
	3.7											215	355							682	
	7.5	3600					200	270				265	400	300	330	247	410	210		747	
TMC-65C	3.7	1800	65	65	100	335	180	220	18	80	65	215	355	280	280	227	415	190	207	682	15
	5.5						200	270				265	400	300	330	247	435	210		747	
	7.5																				
TMC-80B	3.7	1800	80	80	100	325	180	220	18	80	65	215	355	280	280	232	415	190	212	687	15
	5.5						200	270				265	400	300	330	252	435	210		762	
	7.5																				
TMC-80C	7.5	1800	80	80	100	385	200	270	18	80	75	265	400	300	350	262	500	250	212	752	19
	11								20			285	485			282				867	
TMC-80D	11	1800	80	80	125	405	200	270	20	80	75	285	485	300	350	290	530	250	245	900	19
TMC-100C	7.5	1800	100	100	125	385	200	270	18	80	75	265	400	300	350	253	530	250	238	778	19
	11								20			285	485			283				893	
	15												525							933	
TMC-100D	15	1800	100	100	125	405	200	270	20	80	75	285	525	300	350	290	565	250	245	940	19
TMC-125C	7.5	1800	125	125	140	420	200	270	18	80	75	265	400	300	350	265	630	250	265	805	19
	11								20			285	485			286				920	
	15												525							980	

CENTRIFUGAL PUMP

TMS



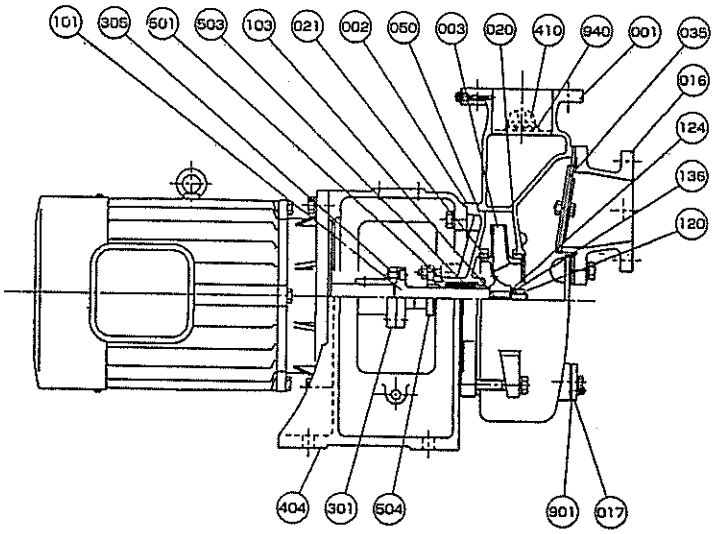
Application

Fire & G.S. Pump
Bilge & Ballast Pump

Feature

Horizontal Single-stage Single-suction
Self-priming Closed Coupling Type

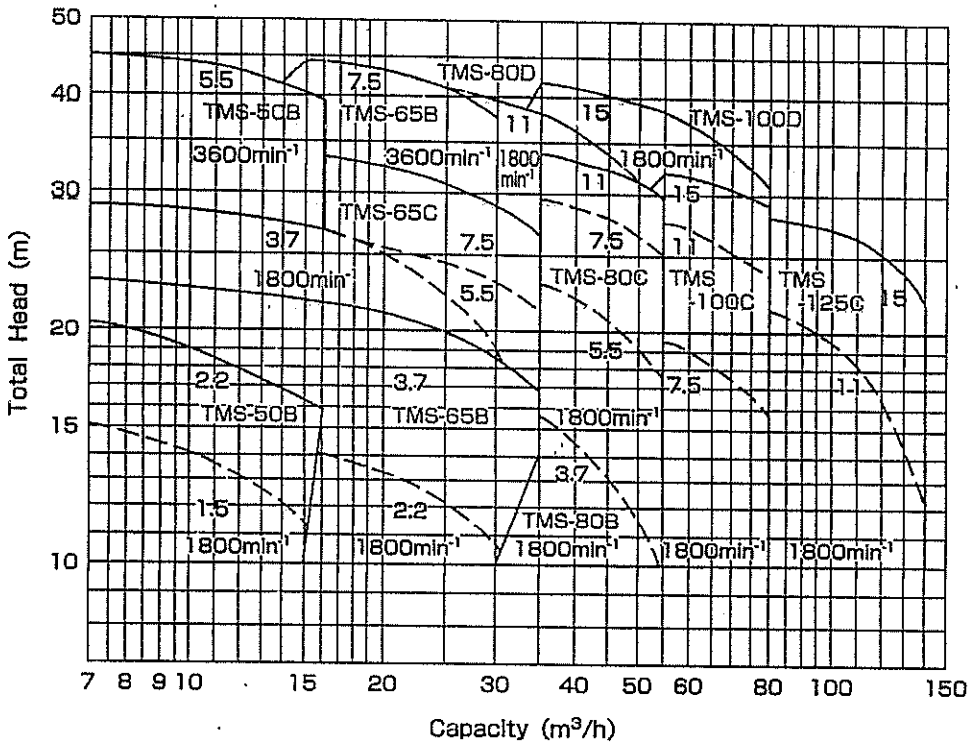
Structure & Material



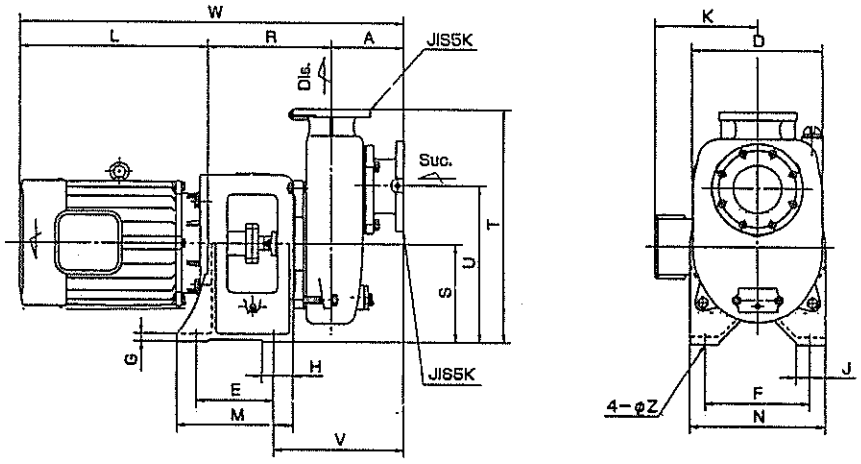
Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
001	CASING	1	BRONZE	CAC402	CAST IRON	FC200
002	CASING COVER	1	BRONZE	CAC402	CAST IRON	FC200
003	IMPELLER	1	PHOSPHOR BRONZE	CAC502A	PHOSPHOR BRONZE	CAC502A
016	SUCTION COVER	1	BRONZE	FC200	CAST IRON	FC200
017	DRAIN COVER	1	BRONZE	FC200	CAST IRON	FC200
020	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
021	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
035	CHECK VALVE	1	RUBBER /BRONZE	NBR /CAC402	RUBBER /BRONZE	NBR /CAC402
050	O-RING	1	RUBBER	NBR	RUBBER	NBR
101	SHAFT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
103	IMPELLER KEY	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
120	IMPELLER NUT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304

Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
124	IMPELLER WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
136	SPRING WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
301	COUPLING	1	MILD STEEL	SS400	MILD STEEL	SS400
305	COUPLING BOLT	4	Cr-Mo STEEL	SCM435	Cr-Mo STEEL	SCM435
404	PUMP FRAME	1	CAST IRON	FC200	CAST IRON	FC200
410	PRIMING CAP	1	BRONZE	CAC402	BRONZE	CAC402
501	GLAND PACKING	4	CARBONIZED FIBER	–	CARBONIZED FIBER	–
503	LANTERN RING	1	BRONZE	CAC402	BRONZE	CAC402
504	GLAND	1	BRONZE	CAC402	BRONZE	CAC402
901	GASKET	1	RUBBER	NBR	RUBBER	NBR
940	GASKET	1	RUBBER	NBR	RUBBER	NBR

Performance



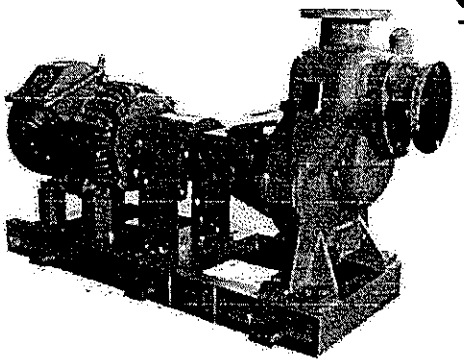
Dimension



Model No.	Motor kW	Motor min⁻¹	Bore Suc.	Bore Dis.	A	D	E	E	G	H	J	K	L	M	N	B	S	T	U	V	W	Z
TMS-50B	1.5	1800	50	50	150	270	160	220	15	80	65	195	300	250	280	240	190	455	315	280	690	15
	2.2						180		18			205	330	280		250					730	
	5.5	3600					200	270				265	400	300	330	270	210	475	335		820	
TMS-65B	2.2	1800	65	65	150	275	180	220	18	80	65	205	330	280	280	260	190	455	315	290	740	15
	3.7											215	355								765	
	7.5	3600					200	270				265	400	300	330	280	210	475	335		830	
TMS-65C	3.7	1800	65	65	150	325	180	220	18	80	65	215	355	280	280	260	190	480	330	290	765	15
	5.5						200	270				265	400	300	330	280	210	500	350		830	
	7.5																					
TMS-80B	3.7	1800	80	80	165	305	180	220	18	80	65	215	355	280	280	270	190	480	315	315	780	15
TMS-80C	5.5	1800	80	80	165	340	200	270	18	80	75	265	400	300	350	290	250	600	400	315	855	19
	7.5																					
	11								20			285	485			320					970	
TMS-80D	11	1800	80	80	185	480	200	270	20	80	75	285	485	300	350	335	250	625	425	330	985	19
TMS-100C	7.5	1800	100	100	185	340	200	270	18	80	75	265	400	300	350	290	250	600	400	335	875	19
	11								20			285	485			320					990	
	15												525								1030	
TMS-100D	15	1800	100	100	185	480	200	270	20	80	75	285	525	300	350	335	250	625	425	330	1025	19
TMS-125C	11	1800	125	125	210	365	200	270	20	80	75	285	485	300	350	335	250	625	425	376	1030	19
	15												525								1070	

CENTRIFUGAL PUMP

EHS



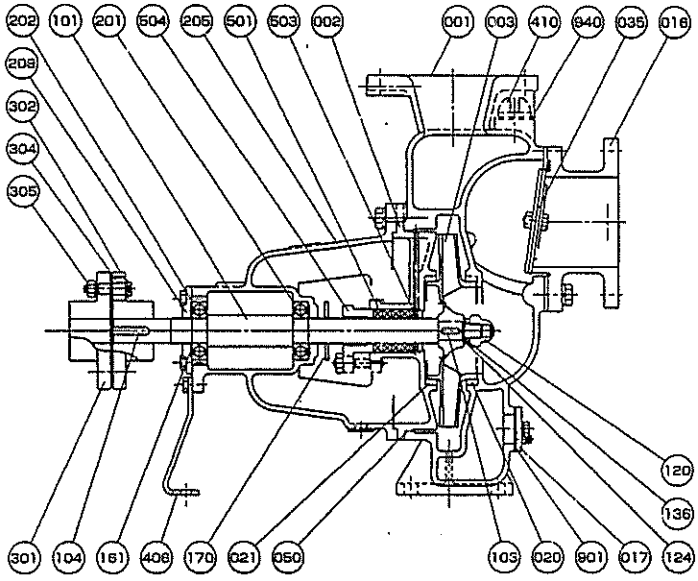
Application

Fire & G.S. Pump
Bilge & Ballast Pump

Feature

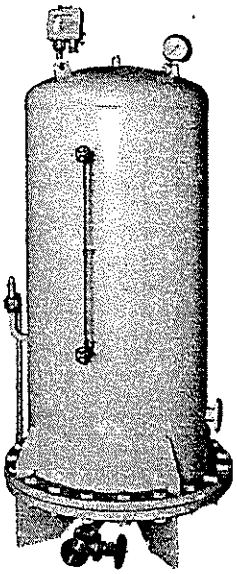
Horizontal Single-stage Single-suction
Self-priming Type

Structure & Material



Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
001	CASING	1	BRONZE	CAC402	CAST IRON	FC200
002	CASING COVER	1	BRONZE	CAC402	CAST IRON	FC200
003	IMPELLER	1	PHOSPHOR BRONZE	CAC502A	PHOSPHOR BRONZE	CAC502A
016	SUCTION COVER	1	BRONZE	CAC402	CAST IRON	FC200
017	DRAIN COVER	1	BRONZE	CAC402	CAST IRON	FC200
020	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
021	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
035	CHECK VALVE	1	RUBBER /BRONZE	NBR /CAC402	RUBBER /BRONZE	NBR /CAC402
050	O-RING	1	RUBBER	NBR	RUBBER	NBR
101	SHAFT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
103	KEY	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
104	KEY	1	CARBON STEEL	S45C	CARBON STEEL	S45C
120	IMPELLER NUT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
124	IMPELLER WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
136	SPRING WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
161	RETAINING RING	1	SPRING STEEL	SUP6	SPRING STEEL	SUP6

Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
170	FLINGER	1	RUBBER	NBR	RUBBER	NBR
201	BALL BEARING	1	BEARING STEEL	SUJ2	BEARING STEEL	SUJ2
202	BALL BEARING	1	BEARING STEEL	SUJ2	BEARING STEEL	SUJ2
205	BEARING HOUSING	1	CAST IRON	FC200	CAST IRON	FC200
209	BEARING COVER	1	CAST IRON	FC200	CAST IRON	FC200
301	COUPLING	1	CAST IRON	FC200	CAST IRON	FC200
302	COUPLING	1	CAST IRON	FC200	CAST IRON	FC200
304	COUPLING RING	8	RUBBER	NBR	RUBBER	NBR
305	COUPLING BOLT&NUT	8	MILD STEEL	SS400	MILD STEEL	SS400
406	SUPPORT	1	MILD STEEL	SS400	MILD STEEL	SS400
410	PRIMING CAP	1	BRONZE	CAC402	BRONZE	CAC402
501	GLAND PACKING	4	CARBONIZED FIBER	–	CARBONIZED FIBER	–
503	LANTERN RING	1	BRONZE	CAC402	BRONZE	CAC402
504	GLAND	1	BRONZE	CAC402	BRONZE	CAC402
901	GASKET	1	RUBBER	NBR	RUBBER	NBR
940	GASKET	1	RUBBER	NBR	RUBBER	NBR



PRESSURE TANK UNIT

VPT

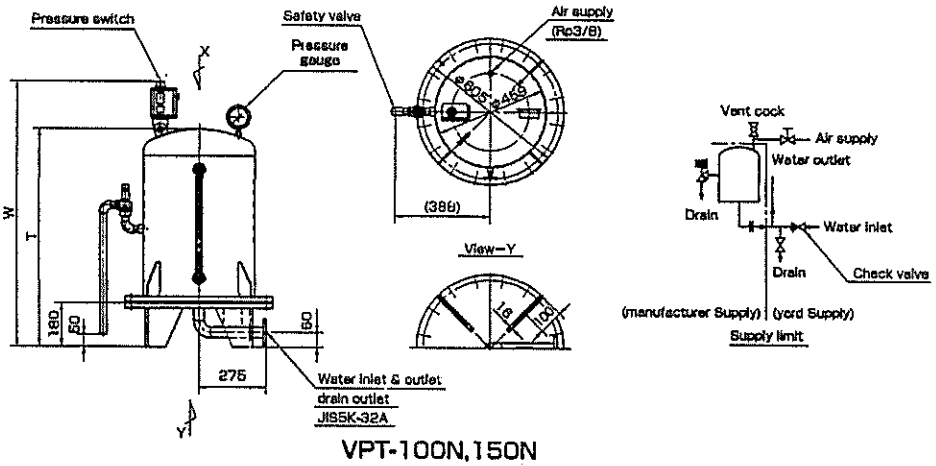
Application

Fresh Water
Sanitary Water
Drinking Water

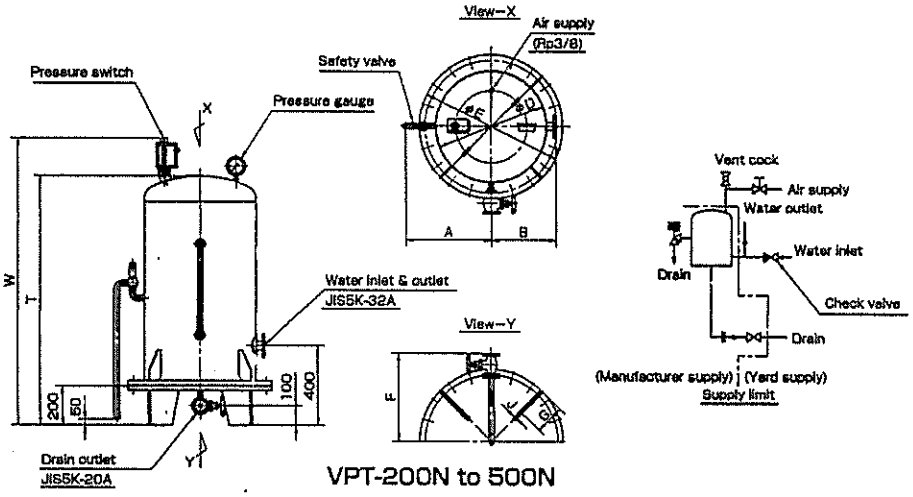
Feature

F.W. & Sanitary

Dimension



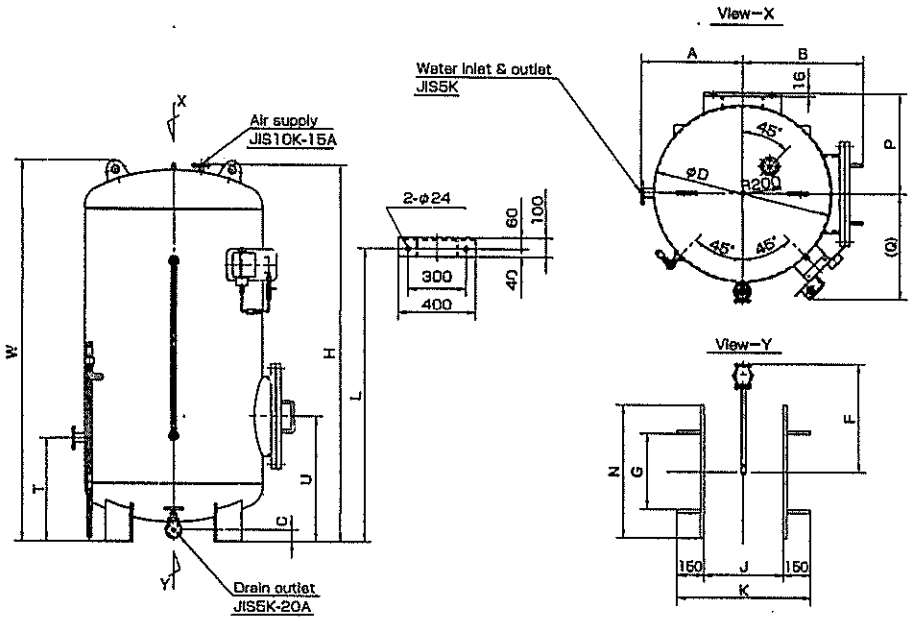
VPT-100N,150N



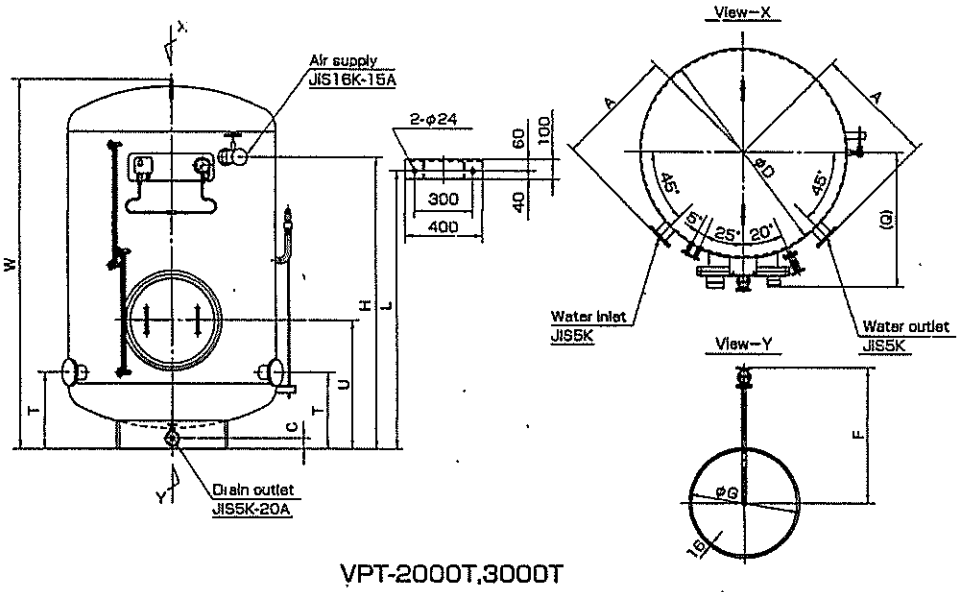
VPT-200N to 500N

Model No.	Tank Volume (L)	Dimension (mm)								
		A	B	D	E	F	G	J	T	W
VPT-100N	100	–	–	–	–	–	–	–	900	1093
VPT-150N	150	–	–	–	–	–	–	–	1207	1400
VPT-200N	200	440	325	559	720	440	150	16	1248	1435
VPT-300N	300	465	350	609	770	460	150	16	1555	1738
VPT-400N	400	515	400	709	875	520	200	19	1560	1753
VPT-500N	500	515	400	709	875	520	200	19	1760	1953

Dimension

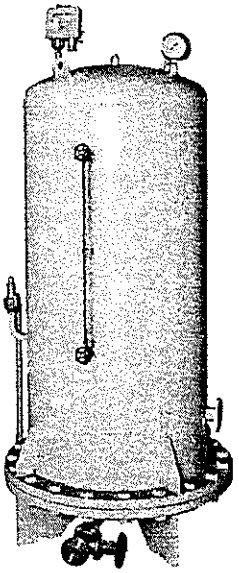


VPT-1000T,1500T



VPT-2000T,3000T

Model No.	Bore		Tank Volume (L)	Dimension (mm)															
	In	Out		A	B	C	D	F	G	H	J	K	L	N	P	Q	T	U	W
VPT-1000T	40		1000	520	630	60	912	560	400	1950	400	700	1519	700	520	710	536	650	1980
VPT-1500T	50		1500	650	720	100	1112	660	350	2030	500	800	1550	700	620	750	550	800	2060
VPT-2000T	65	65	2000	700	–	60	1218	800	650	1700	–	–	1600	–	–	782	450	750	2170
VPT-3000T	80	80	3000	850	–	60	1518	910	878	1800	–	–	1600	–	–	880	650	800	2308



PRESSURE TANK UNIT

VPT

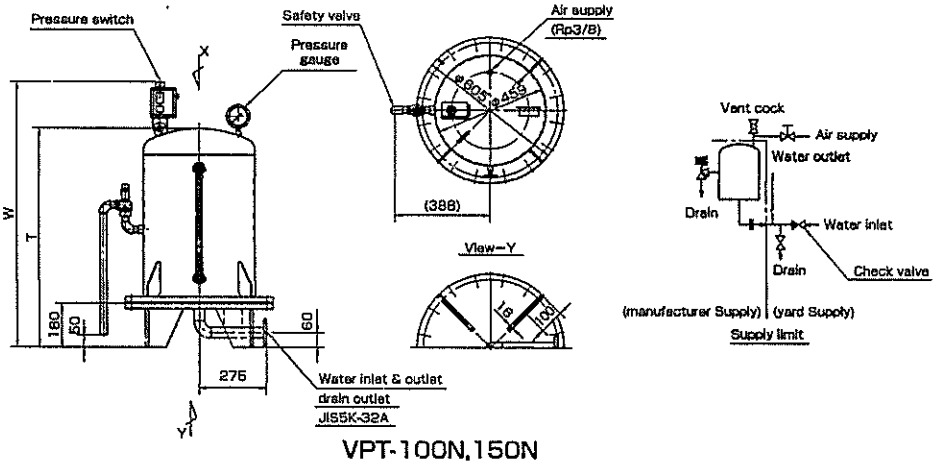
Application

Fresh Water
Sanitary Water
Drinking Water

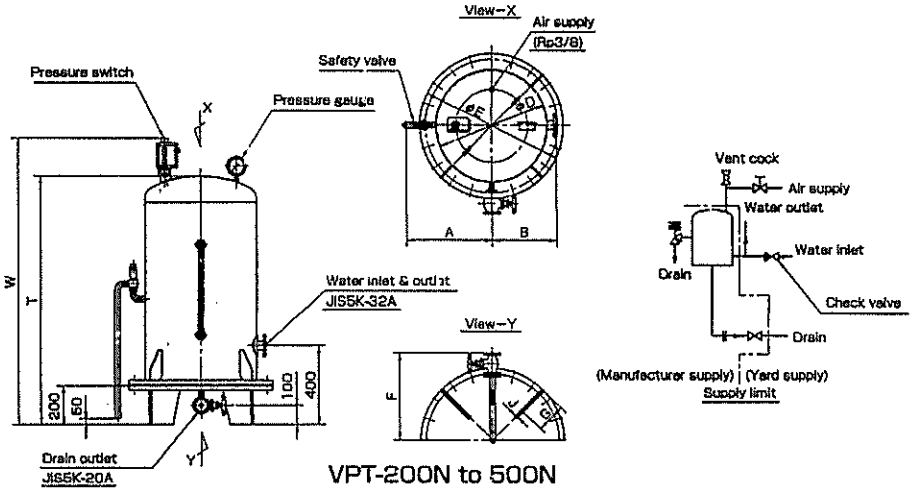
Feature

F.W. & Sanitary

Dimension



VPT-100N,150N



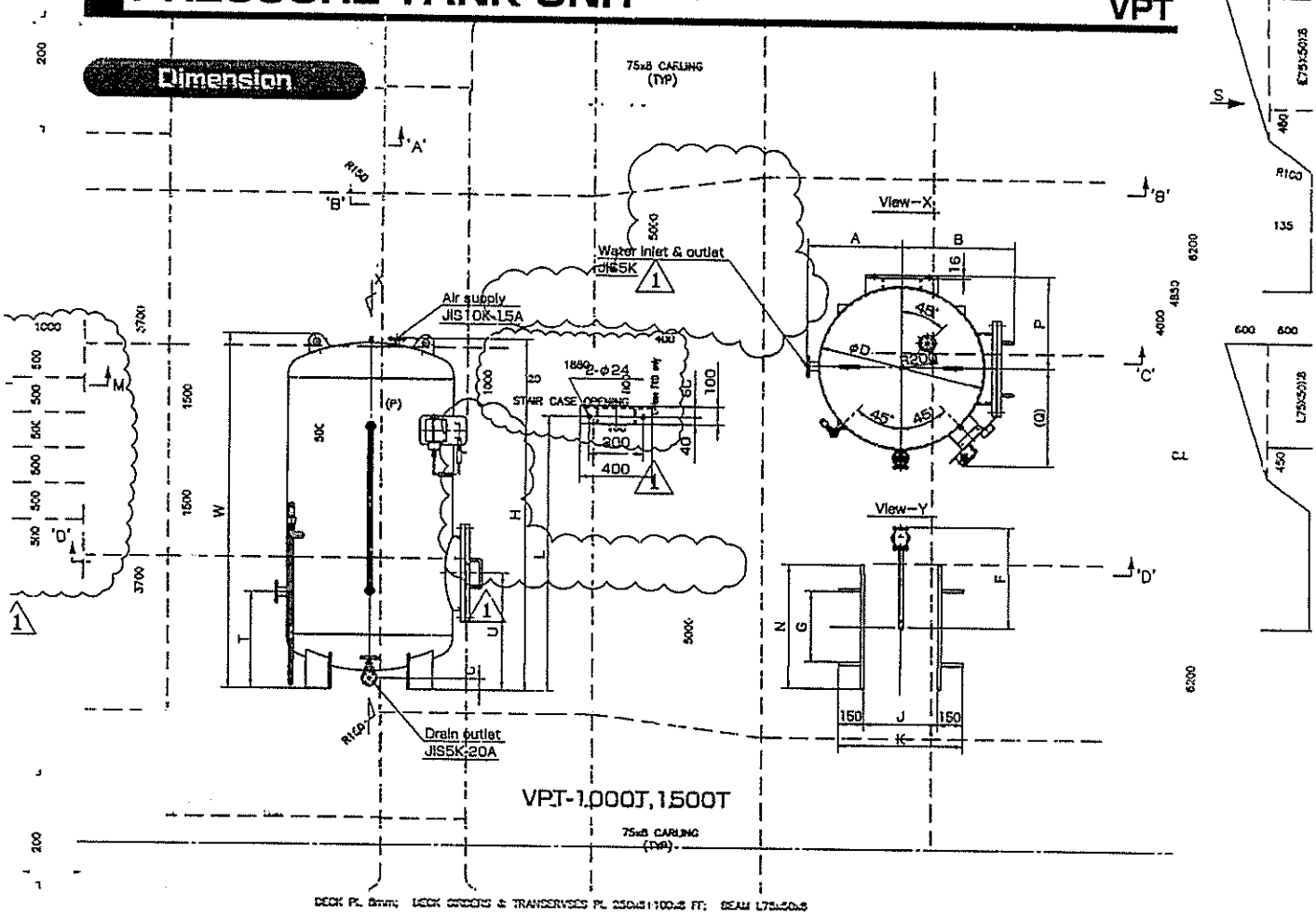
VPT-200N to 500N

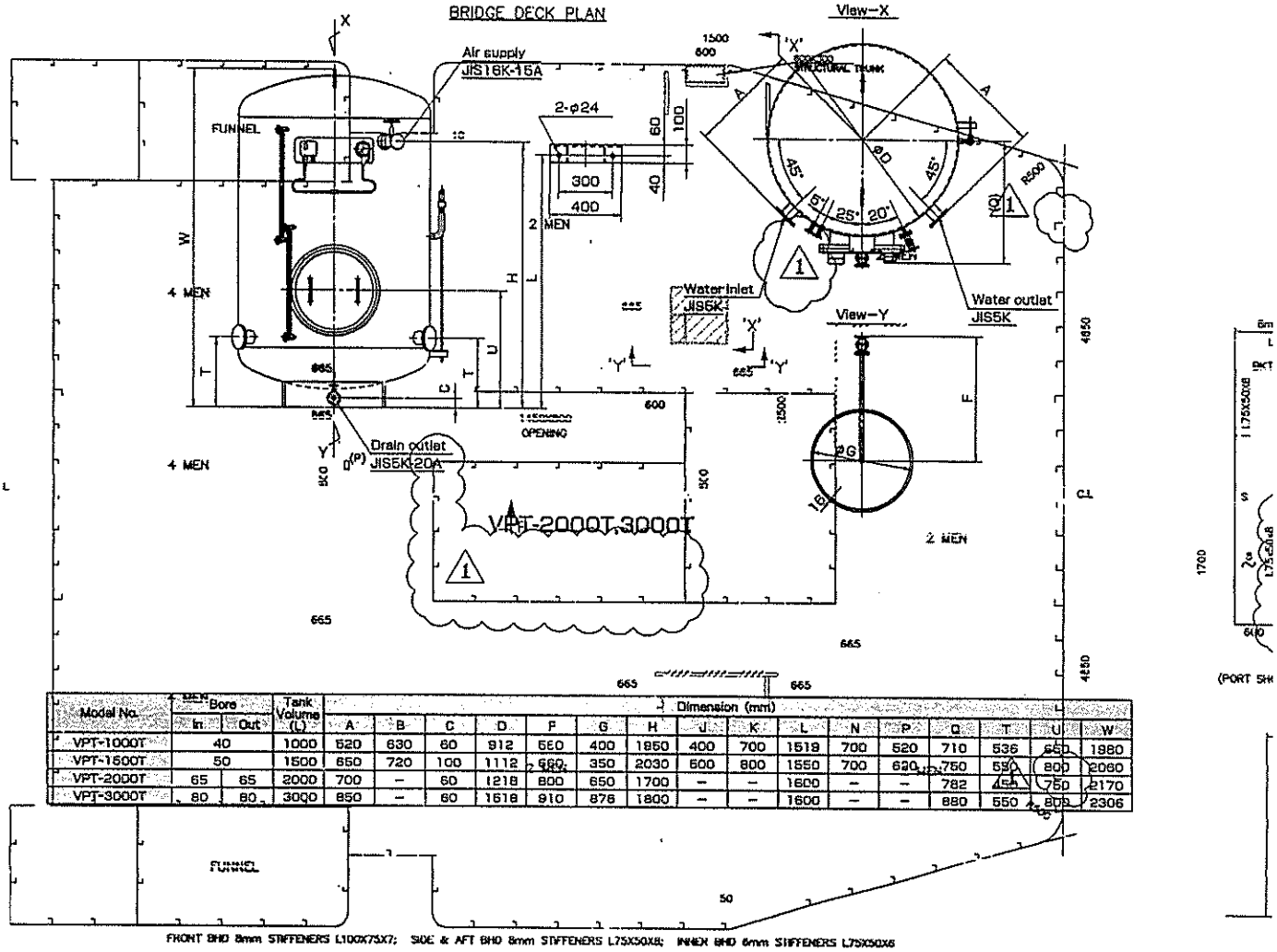
Model No.	Tank Volume (L)	Dimension (mm)								
		A	B	D	E	F	G	J	T	W
VPT-100N	100	–	–	–	–	–	–	–	900	1093
VPT-150N	150	–	–	–	–	–	–	–	1207	1400
VPT-200N	200	440	325	559	720	440	150	16	1248	1435
VPT-300N	300	465	350	609	770	460	150	16	1555	1738
VPT-400N	400	515	400	709	875	520	200	19	1560	1753
VPT-500N	500	515	400	709	875	520	200	19	1760	1953

PRESSURE TANK UNIT

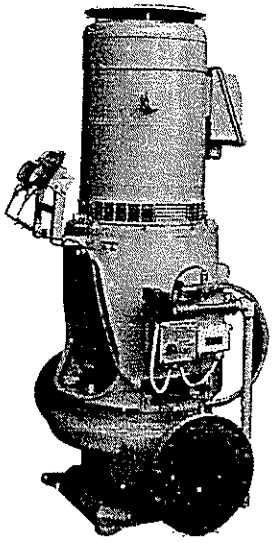
VPT

Dimension





Model No.	Bore In.	Bore Out	Tank Volume (L)	A	B	C	D	F	G	H	J	K	L	N	P	Q	T	U	W
VPT-1000T	40		1000	520	630	60	912	660	400	1950	400	700	1519	700	520	710	536	650	1980
VPT-1500T	50		1500	650	720	100	1112	660	350	2030	600	800	1550	700	620	750	550	800	2060
VPT-2000T	65	65	2000	700	–	60	1218	800	650	1700	–	–	1600	–	–	782	550	750	2170
VPT-3000T	80	80	3000	850	–	60	1618	910	876	1800	–	–	1600	–	–	880	550	805	2306



CENTRIFUGAL PUMP

ESC-D

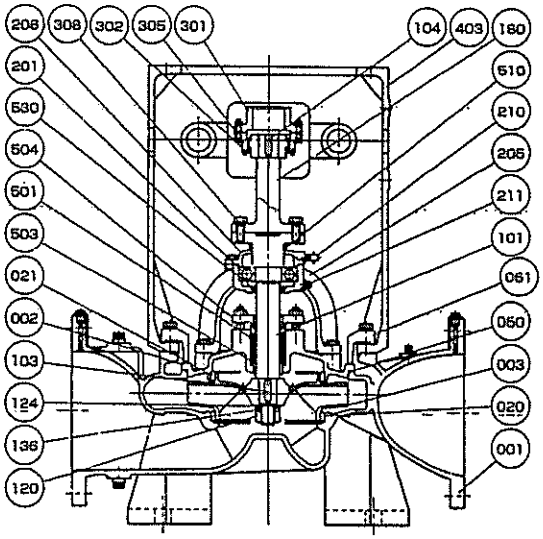
Application

Fire & G.S. Pump
Bilge & Ballast Pump

Feature

Vertical Single-stage Single-suction
Spacer Coupling Type

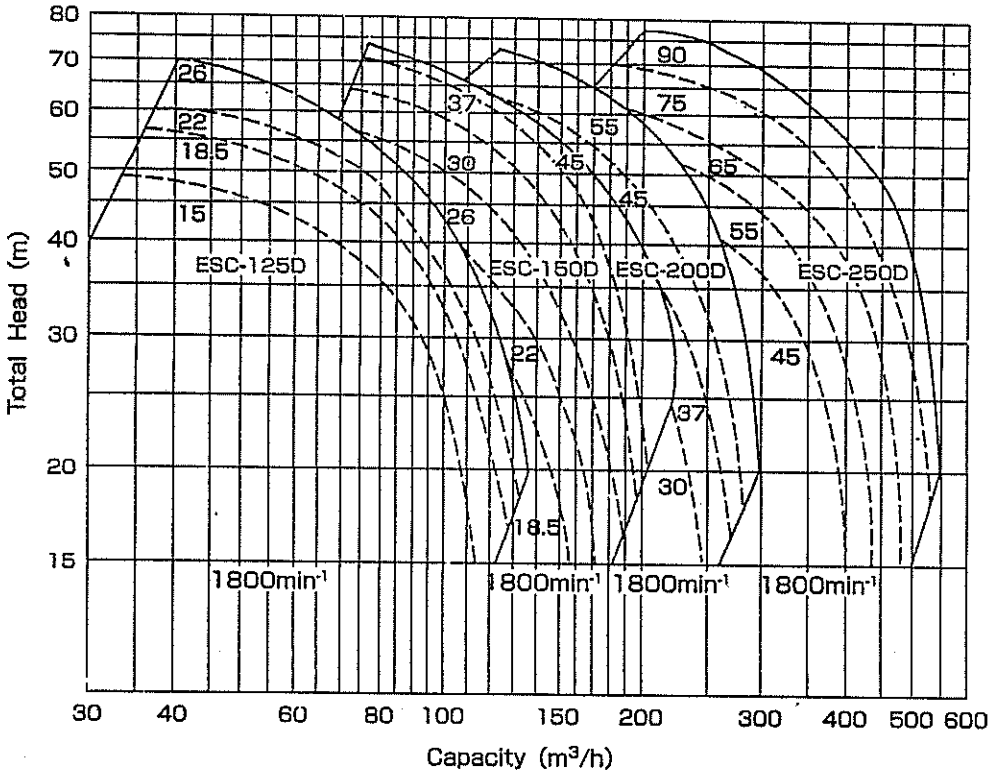
Structure & Material



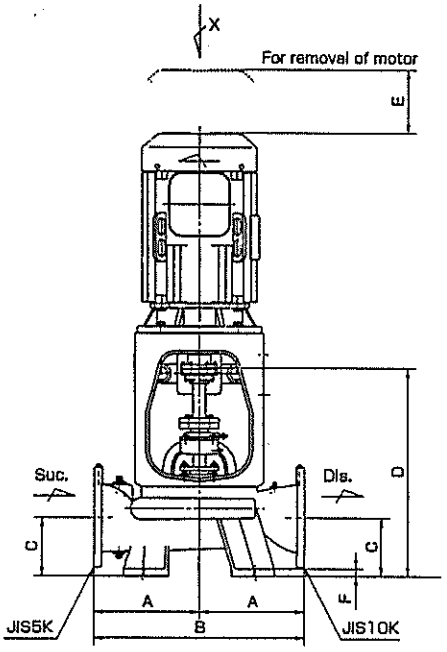
Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
001	CASING	1	BRONZE	CAC402	CAST IRON	FC200
002	CASING COVER	1	BRONZE	CAC402	CAST IRON	FC200
069	IMPELLER	1	PHOSPHOR BRONZE	CAC502A	PHOSPHOR BRONZE	CAC502A
020	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
021	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
050	O-RING	1	RUBBER	NBR	RUBBER	NBR
061	FIXING PLATE	8	MILD STEEL	SS400	MILD STEEL	SS400
101	SHAFT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
103	KEY	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
104	KEY	1	CARBON STEEL	S45C	CARBON STEEL	S45C
120	IMPELLER NUT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
124	IMPELLER WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
136	SPRING WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
180	COUPLING SPACER	1	CARBON STEEL	S45C	CARBON STEEL	S45C
201	BALL BEARING	1	BEARING STEEL	SUJ2	BEARING STEEL	SUJ2

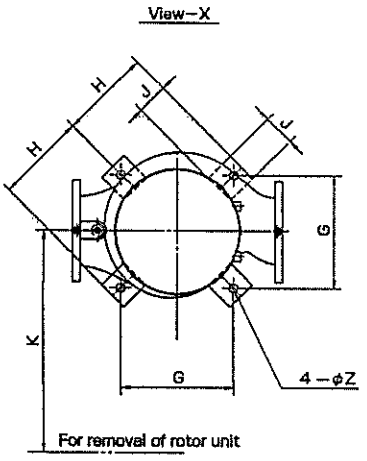
Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
205	BEARING HOUSING	1	CAST IRON	FC200	CAST IRON	FC200
208	BEARING COVER	1	CAST IRON	FC200	CAST IRON	FC200
210	GREASE NIPPLE	1	BRASS	C3802	BRASS	C3802
211	GREASE FITTING	1	BRASS	C3602	BRASS	C3602
301	COUPLING	1	CARBON STEEL	S45C	CARBON STEEL	S45C
302	COUPLING	1	CARBON STEEL	S45C	CARBON STEEL	S45C
305	COUPLING BOLT & NUT	6	Cr-Mo STEEL	SCM435	Cr-Mo STEEL	SCM435
308	BOLT	8	Cr-Mo STEEL	SCM435	Cr-Mo STEEL	SCM435
403	FRAME	1	CAST IRON	FC200	CAST IRON	FC200
501	GLAND PACKING	4	CARBONIZED FIBER	–	CARBONIZED FIBER	–
503	LANTERN RING	1	BRONZE	CAC402	BRONZE	CAC402
504	GLAND	1	BRONZE	CAC402	BRONZE	CAC402
510	V-RING	1	RUBBER	NBR	RUBBER	NBR
530	OIL SEAL	1	RUBBER	NBR	RUBBER	NBR

Performance



Dimension

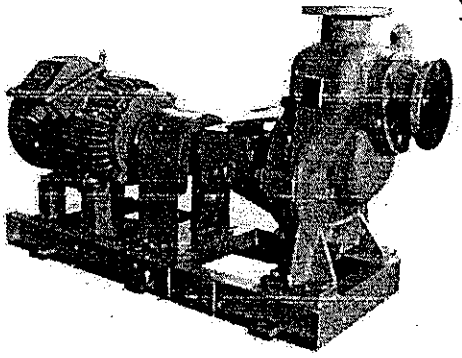




Model No.	Bore		Dimension (mm)										
	Suc.	Dis.	A	B	C	D	E	F	G	H	J	K	Z
ESC-125D	125	100	345	690	180	737	200	25	360	290	100	800	28
ESC-150D	150	125	345	690	180	740	250	25	360	290	100	800	28
ESC-200D	200	150	365	730	180	750	250	25	360	290	100	800	28
ESC-250D	250	200	460	920	230	831	250	25	480	380	100	800	28

CENTRIFUGAL PUMP

EHS



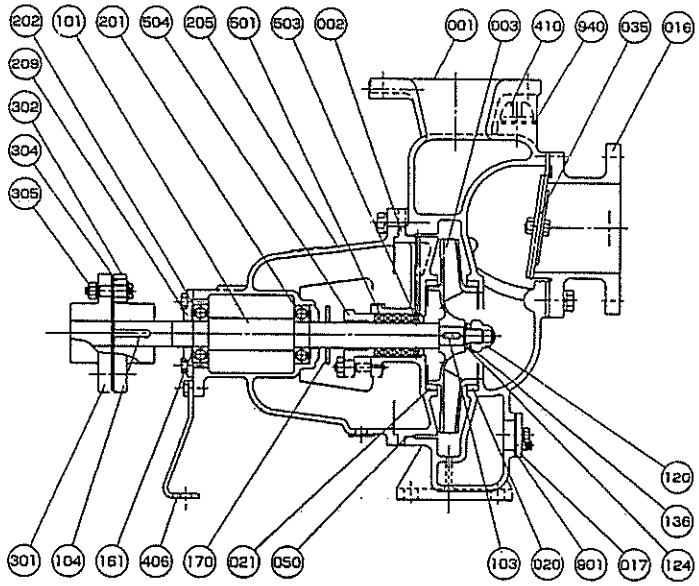
Application

Fire & G.S. Pump
Bilge & Ballast Pump

Feature

Horizontal Single-stage Single-suction
Self-priming Type

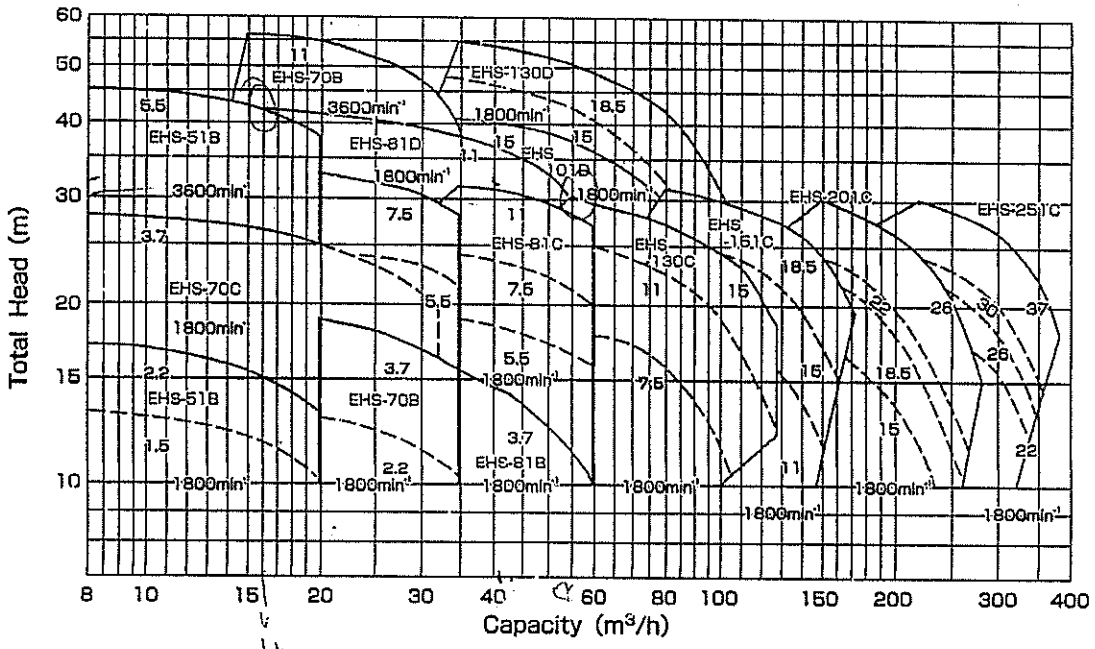
Structure & Material



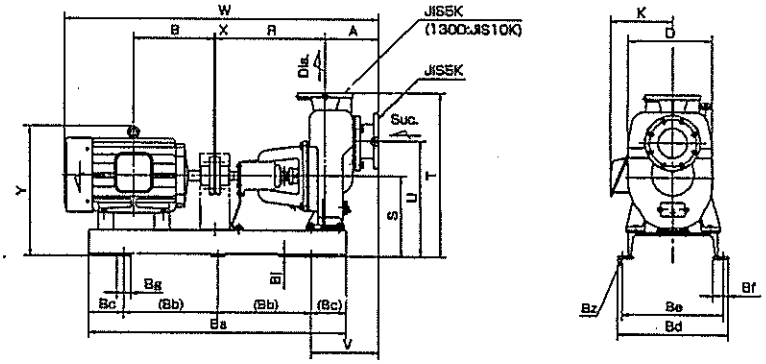
Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
001	CASING	1	BRONZE	CAC402	CAST IRON	FC200
002	CASING COVER	1	BRONZE	CAC402	CAST IRON	FC200
003	IMPELLER	1	PHOSPHOR BRONZE	CAC502A	PHOSPHOR BRONZE	CAC502A
016	SUCTION COVER	1	BRONZE	CAC402	CAST IRON	FC200
017	DRAIN COVER	1	BRONZE	CAC402	CAST IRON	FC200
020	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
021	CASING RING	1	BRONZE	CAC402	BRONZE	CAC402
035	CHECK VALVE	1	RUBBER /BRONZE	NBR /CAC402	RUBBER /BRONZE	NBR /CAC402
050	O-RING	1	RUBBER	NBR	RUBBER	NBR
101	SHAFT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
103	KEY	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
104	KEY	1	CARBON STEEL	S45C	CARBON STEEL	S45C
120	IMPELLER NUT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
124	IMPELLER WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
136	SPRING WASHER	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
161	RETAINING RING	1	SPRING STEEL	SUP6	SPRING STEEL	SUP6

Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
170	FLINGER	1	RUBBER	NBR	RUBBER	NBR
201	BALL BEARING	1	BEARING STEEL	SUJ2	BEARING STEEL	SUJ2
202	BALL BEARING	1	BEARING STEEL	SUJ2	BEARING STEEL	SUJ2
205	BEARING HOUSING	1	CAST IRON	FC200	CAST IRON	FC200
209	BEARING COVER	1	CAST IRON	FC200	CAST IRON	FC200
301	COUPLING	1	CAST IRON	FC200	CAST IRON	FC200
302	COUPLING	1	CAST IRON	FC200	CAST IRON	FC200
304	COUPLING RING	8	RUBBER	NBR	RUBBER	NBR
305	COUPLING BOLT&NUT	8	MILD STEEL	SS400	MILD STEEL	SS400
406	SUPPORT	1	MILD STEEL	SS400	MILD STEEL	SS400
410	PRIMING CAP	1	BRONZE	CAC402	BRONZE	CAC402
501	GLAND PACKING	4	CARBONIZED FIBER	—	CARBONIZED FIBER	—
503	LANTERN RING	1	BRONZE	CAC402	BRONZE	CAC402
504	GLAND	1	BRONZE	CAC402	BRONZE	CAC402
901	GASKET	1	RUBBER	NBR	RUBBER	NBR
940	GASKET	1	RUBBER	NBR	RUBBER	NBR

Performance

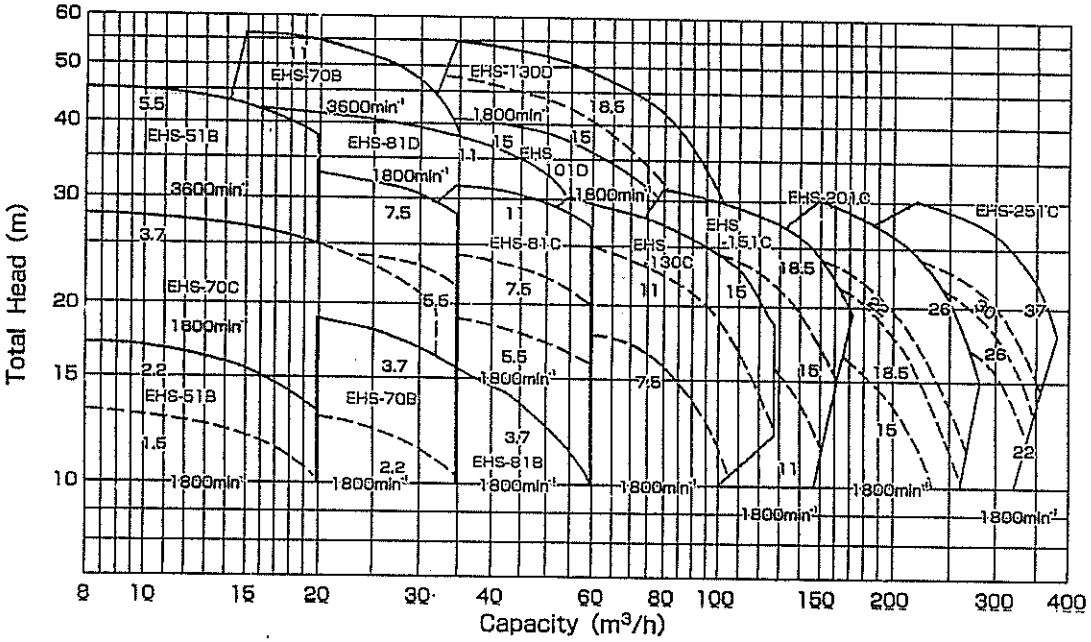


Dimension

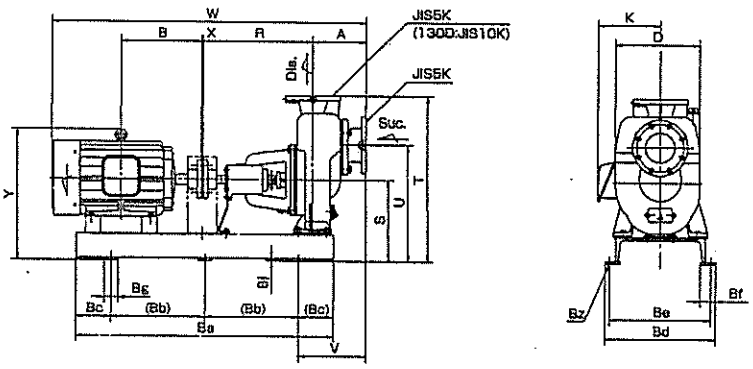


Model No.	Motor kW	Motor min⁻¹	Bore Suc.	Bore Dis.	Dimension (mm) A	B	D	K	R	S	T	U	V	W	X	Y	Ba	Bb	Bc	Bd	Be	Bf	Bg	Bl	Bz
EHS-51B	1.5	1800	50	50	178	188.5	264	188	355	270	538	380	238	867	3	365	700	450	125	325	290	55	50	12	4-φ15
	2.2					193		197						914		375									
	5.5	3600				239		245						990		428	800	500	150			50			
EHS-70B	2.2	1800	65	65	188	193	282	197	355	270	538	380	248	924	3	375	700	450	125	325	290	65	50	12	4-φ15
	3.7					200		212						944		416	800	500	150			50			
	11	3600				323		285						1154		500	1000	700		380	350	65	60		4-φ19
EHS-70C	3.7	1800	65	65	168	200	313	212	355	280	585	430	248	944	3	436	800	500	150	380	350	65	60	12	4-φ15
	5.5					239		245						1000											
	7.5					258							273	1038			900	550	175						4-φ19
EHS-81B	3.7	1800	80	80	230	200	278	212	385	280	585	400	300	986	3	438	800	500	150	390	350	65	60	12	4-φ15
EHS-81C	5.5	1800	80	80	205	239	337	245	470	320	670	470	265	1136	3	478	1000	350	150	470	430	65	60	12	6-φ19
	7.5					258								1171											
	11					323		285						1286		550	1100	400							
EHS-81D	11	1800	80	80	215	323	384	285	470	345	720	520	275	1296	3	575	1100	400	150	470	430	65	60	12	6-φ19
EHS-101D	15	1800	100	100	225	345	400	285	470	370	745	545	285	1348	3	600	1100	400	150	470	430	65	60	12	6-φ19
EHS-130D	7.5	1600	125	125	225	258	358	245	470	345	700	495	285	1191	3	503	1000	350	150	470	430	65	60	12	6-φ19
	11					323		285						1306		575	1100	400							
	15					345								1348											
EHS-130D	15	1800	125	100	280	345	416	285	575	370	770	545	340	1508	3	600	1200	450	150	470	430	65	60	12	6-φ19
	18.5					351.5		330						1520		630									
EHS-151C	11	1800	150	150	285	323	353	285	470	345	720	520	345	1366	3	575	1100	400	150	470	430	65	60	12	6-φ19
	15					345								1408											
	18.5					351.5		330						1420		605									
EHS-201C	15	1800	200	200	325	345	400	285	470	370	810	570	385	1448	3	600	1100	400	150	470	430	65	60	12	6-φ19
	18.5					351.5		330						1460		630									
	22																								
	26					370.5								1498			1200	450							
EHS-251C	22	1800	250	250	335	351.5	500	330	630	430	950	660	385	1530	3	690	1200	450	150	550	500	65	60	25	6-φ19
	26					370.5								1568											
	30																								
	37					425.5		345						1850	4	705	1300	500							

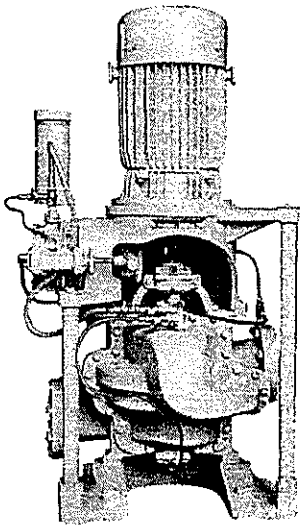
Performance



Dimension



Model No.	Motor		Bore		Dimension (mm)																				
	kW	min⁻¹	Suc.	Dis.	A	B	D	K	R	S	T	U	V	W	X	Y	Ba	Bb	Bc	Bd	Be	Bf	Bg	Bi	Bz
EHS-51B	1.5	1800	50	50	178	168.5	254	188	355	270	538	380	238	867	3	365	700	450	125	325	290	55	60	12	4-φ15
	2.2					193		197						914		375									
	5.5	3600				239		245						990		428	800	500	150			50			
EHS-70B	2.2	1800	65	65	188	193	262	197	355	270	538	380	248	924	3	375	700	450	125	325	290	55	50	12	4-φ15
	3.7					200		212						944		416	800	500	150			50			
	11	3600				323		285						1154		500	1000	700		390	350	65	60		4-φ19
EHS-70C	3.7	1800	65	65	182	200	313	212	355	280	585	430	248	944	3	436	800	500	160	390	350	65	60	12	4-φ15
	5.5					239		245						1000											
	7.5					258							273	1038			900	550	175						4-φ19
EHS-81B	3.7	1800	80	80	230	200	276	212	365	280	585	400	300	986	3	436	800	500	150	390	350	65	60	12	4-φ15
EHS-81C	5.5	1800	80	80	205	239	337	245	470	320	670	470	265	1132	3	478	1000	350	160	470	430	65	60	12	6-φ19
	7.5					258								1171											
	11					323		285						1288		550	1100	400							
EHS-81D	11	1800	80	80	215	323	384	285	470	345	720	520	275	1286	3	575	1100	400	150	470	430	65	60	12	6-φ19
EHS-101D	15	1800	100	100	225	345	400	285	470	370	745	545	285	1348	3	600	1100	400	150	470	430	65	60	12	6-φ19
EHS-130C	7.5	1800	125	125	225	258	358	245	470	345	700	495	285	1181	3	575	1000	350	150	470	430	65	60	12	6-φ19
	11					323		285						1306			1100	400							
	15					345								1348											
EHS-130D	15	1800	125	100	260	345	416	285	575	370	770	545	340	1508	3	600	1200	450	150	470	430	65	60	12	6-φ19
	18.5					351.5		330						1620		630									
EHS-151C	11	1800	150	150	285	323	353	285	470	345	720	520	345	1366	3	575	1100	400	150	470	430	65	60	12	6-φ19
	15					345								1408											
	18.5					351.5		330						1420		605									
EHS-201C	15	1800	200	200	325	345	400	285	470	370	810	570	385	1448	3	600	1100	400	150	470	430	65	60	12	6-φ19
	18.5					351.5		330						1460		630									
	22																								
	26					370.5								1498			1200	450							
EHS-251C	22	1800	250	250	335	351.5	500	330	530	430	980	660	365	1530	3	690	1200	450	150	550	500	65	60	25	6-φ19
	26																								
	30					370.5								1569											
	37					425.5		345						1650	4	705	1300	500							



CENTRIFUGAL PUMP

VS

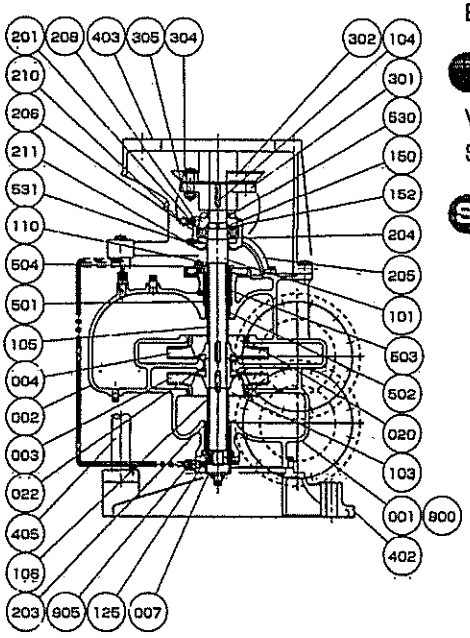
Application

Fire & G.S. Pump
Bilge & Ballast Pump

Feature

Vertical Two-stage Single-suction
Split-casing Type

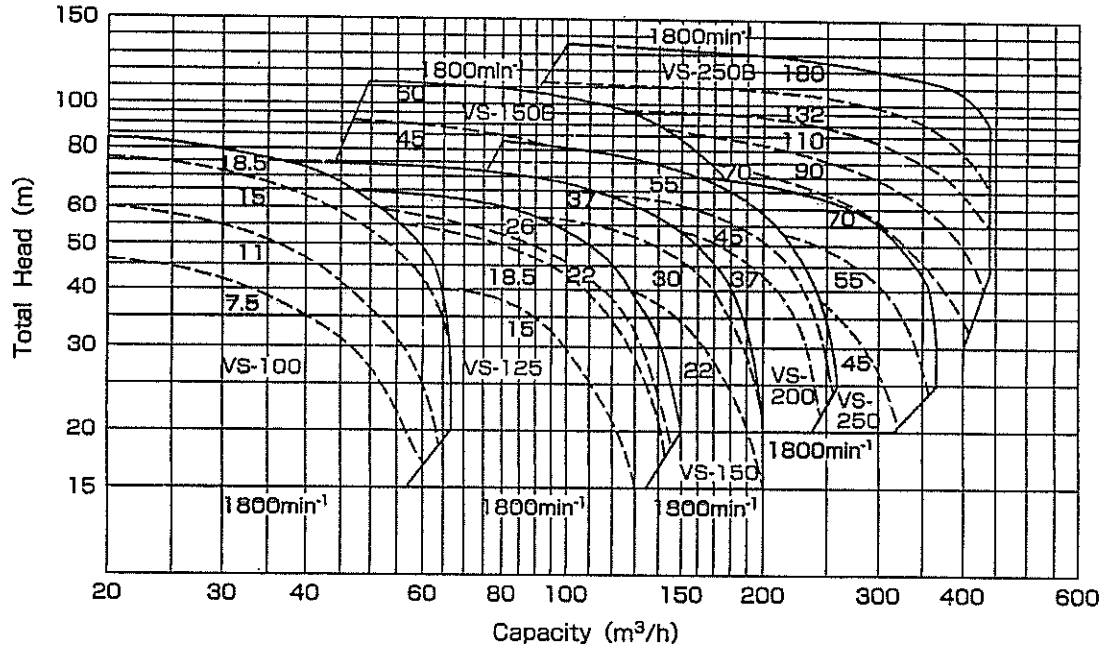
Structure & Material



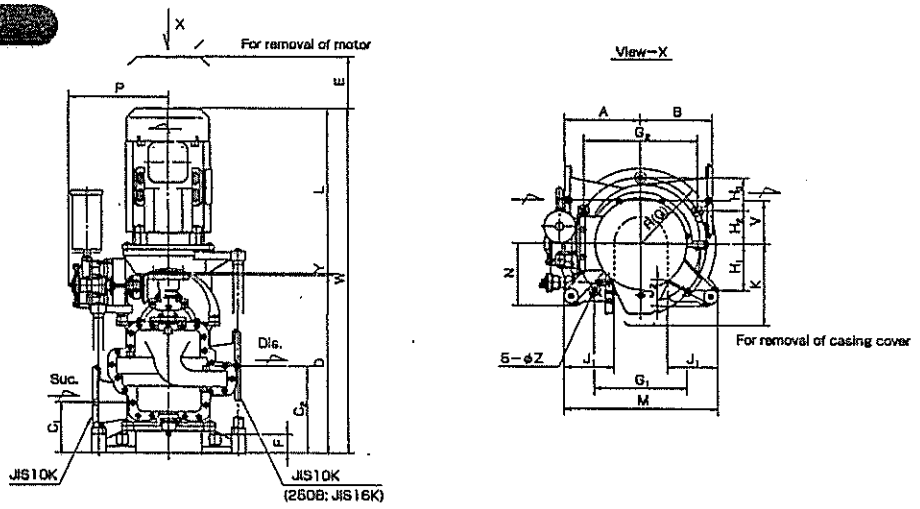
Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
001	CASING	1	BRONZE	CAC402	CAST IRON	FC200
002	CASING COVER	1	BRONZE	CAC402	CAST IRON	FC200
003	IMPELLER	1	PHOSPHOR BRONZE	CAC502A	PHOSPHOR BRONZE	CAC502A
004	IMPELLER	1	PHOSPHOR BRONZE	CAC502A	PHOSPHOR BRONZE	CAC502A
007	BOTTOM COVER	1	BRONZE	CAC402	CAST IRON	FC200
020	CASING RING	2	BRONZE	CAC402	BRONZE	CAC402
022	STAGE BUSH	1	BRONZE	CAC402	BRONZE	CAC402
101	SHAFT	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
103	KEY	2	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
104	KEY	1	CARBON STEEL	S45C	CARBON STEEL	S45C
105	SLEEVE	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
106	SLEEVE	1	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
110	O-RING	1	RUBBER	NBR	RUBBER	NBR
125	SLEEVE NUT	2	STAINLESS STEEL	SUS304	STAINLESS STEEL	SUS304
150	BEARING NUT	1	MILD STEEL	SS400	MILD STEEL	SS400
152	BEARING WASHER	1	MILD STEEL	SS400	MILD STEEL	SS400
201	BALL BEARING	1	BEARING STEEL	SUJ2	BEARING STEEL	SUJ2
203	BOTTOM METAL	1	LEAD BRONZE	—	LEAD BRONZE	—
204	BEARING SPACER	1	MILD STEEL	SS400	MILD STEEL	SS400
205	BEARING HOUSING	1	CAST IRON	FC200	CAST IRON	FC200

Part No.	Name	Req. No.	Sea Water		Fresh Water	
			Material	JIS	Material	JIS
206	HOUSING COVER	1	CAST IRON	FC200	CAST IRON	FC200
208	BEARING COVER	1	CAST IRON	FC200	CAST IRON	FC200
210	GREASE NIPPLE	1	BRASS	C3602	BRASS	C3602
211	GREASE FITTING	1	BRASS	C3602	BRASS	C3602
301	COUPLING	1	CAST IRON	FC200	CAST IRON	FC200
302	COUPLING	1	CAST IRON	FC200	CAST IRON	FC200
304	COUPLING RING	8	RUBBER	NBR	RUBBER	NBR
305	COUPLING BOLT & NUT	8	MILD STEEL	SS400	MILD STEEL	SS400
402	PUMP BED	1	CAST IRON	FC200	CAST IRON	FC200
403	MOTOR FRAME	1	CAST IRON	FC200	CAST IRON	FC200
405	SUPPORT	2	STEEL GAS PIPE	SGP	STEEL GAS PIPE	SGP
501	GLAND PACKING	5	CARBONIZED FIBER	—	CARBONIZED FIBER	—
502	NECK BUSH	1	BRONZE	CAC402	BRONZE	CAC402
503	LANTERN RING	1	BRONZE	CAC402	BRONZE	CAC402
504	GLAND	1	BRONZE	CAC402	BRONZE	CAC402
530	OIL SEAL	1	RUBBER	NBR	RUBBER	NBR
531	OIL SEAL	1	RUBBER	NBR	RUBBER	NBR
900	GASKET	1	PAPER	—	PAPER	—
905	GASKET	1	RUBBER	NBR	RUBBER	NBR

Performance



Dimension



Model No.	Motor kW	Motor min⁻¹	Bore Suc.	Bore Dis.	A	B	C1	C2	D	E	F	G1	G2	H1	H2	H3	J1	J2	K	L	M	N	P	Q	V	W	Y	Z
VS-100	7.5	1800	100	100	300	270	220	360	846	150	80	368	450	184	130	130	175	80	450	480	580	240	485	310	170	829	3	24
	11									200										595						944		
	15																			635						984		
	18.5																			685						1034		
VS-125	15	1800	125	125	290	320	252	442	960	200	90	353	433	177	126	125	180	105	540	635	630	255	485	300	175	1598	3	26
	18.5																			685						1648		
	22																											
	26																			725						1689	4	
VS-150	22	1800	150	150	370	350	245	428	876	200	90	424	520	212	160	160	215	120	630	685	750	303	485	360	210	1564	3	28
	30																			725						1605	4	
	37									250										800						1680		
VS-150B	45	1800	150	150	350	330	262	442	972	250	90	424	520	212	160	150	215	120	630	800	750	303	485	360	200	1776	4	28
	60																			1050						2026		
VS-200	37	1800	200	200	370	350	245	428	876	250	90	424	520	212	160	150	215	120	630	800	750	303	485	360	210	1680	4	28
	45																											
	55																			950						1830		
VS-250	45	1800	200	200	400	430	280	552	955	250	90	424	520	212	150	150	215	120	670	800	750	303	485	360	210	1759	4	28
	55																			950						1908		
	70																			1050						2008		
VS-250B	70	1800	250	250	430	430	280	490	1086	250	80	452	554	226	160	160	245	105	800	1050	750	303	540	365	330	2148	4	28
	90																											
	110																			1210						2309		
	132																			1280						2389		
	180																			1566						2665		

特長 Feature

NHGシリーズは、
一般電動横形低圧・
内装軸受式歯車ポンプです。

NHG series is motor driven horizontal low pressure internal bearing type gear pumps.

■歯　　形：世界にさきがけて考案された、一点連続接触歯車"欠円ギヤー"が標準です。

■Tooth Profile : To be the first in the world to design a one-point-contact-gear called "Segmental Gear" as our standard model.

仕様 Specification

■歯　　形：取扱い油温は、最高80℃です。

■軸　　受：内装軸受式で揚液による自己潤滑方式のため、潤滑性を有する液に適します。

■軸　　封：グランドパッキン式が標準です。ご要望に応じて、メカニカルシール式又はオイルシール式を製作します。

■フランジ：吸込み、吐出し共JIS10Kです。

■軸　　心：ポンプと電動機との軸継手の芯の振れの許容範囲は、回転速度2000～500min⁻¹において、軸継手側面で0.1mm以下、軸継手端面で0.1mm以下です。

■水圧試験：計画仕様圧力の2倍が標準です。最高1.20MPaです。

■吐出し量：吐出し量は、吐出圧力0.60MPa、粘度25.8mm²/sにおける量です。許容吸込圧力範囲は、ポンプ入口において、−0.05～0.20MPaです。

■Temperature : Maximum handling oil temperature is 80℃.

■Bearing : Internal bearing is self-lubricated by pumping liquid which is suitable to serve lubricant fluids.

■Shaft Seal : The conventional gland packing is our standard; however, the mechanical seal type is also available.

■Flange : Both suction and discharge are JIS10K.

■Centering : If connecting the pump with the motor, the standard allowable alignment value at the rate of 2000 to 500min⁻¹at the shaft coupling side surface should be under 0.1mm and at the shaft coupling end surface should be under 0.1mm.

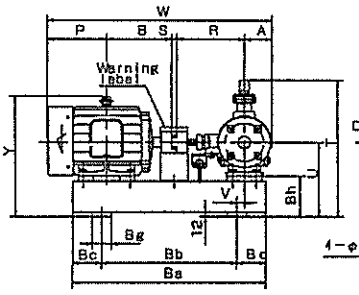
■Hydraulic Test: Twice the value of the designed specification pressure with a maximum value of 1.20MPa.

■Capacity : The following capacity shows at viscosity of 25.8mm²/s with discharge pressure of 0.60MPa.
The allowable suction pressure range is −0.05 to 0.20MPa at the pump suction.

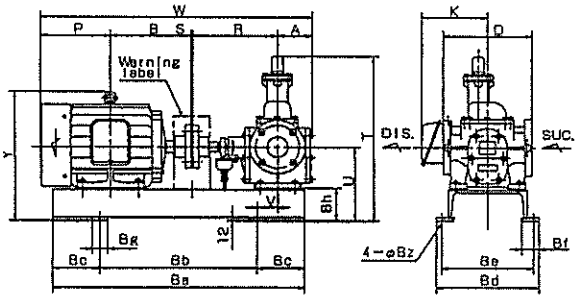
形番 Model No.	口径 Bore (mm) 吸込み×吐出し Suc.×Dis.	吐出し量 Capacity (m³/h) 60Hz 1200min⁻¹	60Hz 1800min⁻¹	50Hz 1000min⁻¹	50Hz 1500min⁻¹
NHG-0.3	32×25	0.3	0.45	0.25	0.37
NHG-0.5		0.5	0.75	0.41	0.62
NHG-1		1	1.5	0.8	1.2
NHG-1.5	40×32	1.5	2.2	1.2	1.8
NHG-2		2	3	1.6	2.5
NHG-2.5	50×40	2.5	3.7	2	3
NHG-3		3	4.5	2.5	3.7
NHG-4	65×50	4	6	3.3	5
NHG-5		5	7.5	4	6
NHG-6		6	9	5	7.5
NHG-7.5	80×65	7.5	11	6	9
NHG-10		10	15	8	12
NHG-12		12	18	10	15
NHG-15		15	22	12	18
NHG-20	100×80	20	30	16	25
NHG-25		25	—	20	30
NHG-30	125×100	30	—	25	—

寸法 Dimension

A



B



形番 Model No.	図 fig.	電動機 Motor (kW) 6P	4P	寸法 Dimension (mm) A	B	D	K	P	R	S	T	U	V	W	Y	Ba	Bb	Bc	Bd	Be	Bf	Bg	Bh	Bz	質量 Weight (kg) ポンプ Pump	台板 Base	電動機 Motor	軸継手 Coupling
NHG-0.3	A	0.4	0.75	80	140	180	145	122	150	13	340	185	15	505	270	500	350	75	275	240	55	50	105	15	8	14	11	AL090
0.5		0.75	1.5		168.5		160	143						555	285												19	CL095
NHG-1		0.4	0.75	85	140	200	145	122	175	13	365	195	20	535	280	500	350	75	275	240	55	50	105	15	12	15	11	AL090
1.5		0.75	1.5		168.5		160	143						585	295										14		19	CL095
2		1.5	2.2		193		165	168.5		18				640	335	600	400	100									17	31	CL100
NHG-2.5		0.75	1.5	90	168.5	200	160	143	180	13	385	210	20	595	310	600	400	100	275	240	55	50	110	15	16	18	19	CL095
3		1.5	2.2		193		165	168.5		18				650	350												31	CL100
NHG-4	B	1.5	2.2	95	193	240	165	168.5	220	3	435	210	35	680	350	600	400	100	275	240	55	50	98	15	22	18	31	A-125
		2.2	3.7		200		175	176						694	370												17	41	
NHG-5		1.5	2.2	95	193	240	165	168.5	220	3	440	210	35	680	350	600	400	100	275	240	55	50	98	15	27	18	31	A-125
6		2.2	3.7		200		175	176						694	370												17	41	
		3.7	5.5		239		190	207.5			470	240		765	415	700	450	125	325	290			128				28	58	A-140
NHG-7.5		2.2	3.7	105	200	250	175	176	250	3	515	240	45	734	400	700	450	125	325	290	55	50	108	15	37	28	41	A-125
10		3.7	5.5		239		190	207.5						805	415												58	A-140
		5.5	7.5		258			226.5						843		800	500	150									32	70	
NHG-12		3.7	5.5	110	239	280	190	207.5	270	3	545	240	45	830	415	700	450	125	325	290	55	50	108	15	47	30	58	A-140
15		5.5	7.5		258			226.5					65	868		800	500	150									31	70	
		7.5	11		323		265	252			575	270	45	958	485	900	550	175	390	350	65	60	138	19		41	105	A-160
NHG-20		5.5	7.5	130	258	320	190	226.5	320	3	630	270	45	938	445	900	550	175	390	350	65	60	110	19	71	40	70	A-160
25		7.5	11		323		265	252					75	1029	485	1000	600	200								42	105	
		11	15		345			274						1072													130	
NHG-30		11	—	145	345	320	265	274	320	3	630	270	75	1087	485	1000	600	200	390	350	65	60	110	19	75	42	130	A-160
		15	—		351.5		290	294.5			660	300	90	1114	550				470	430			140			64	175	A-180

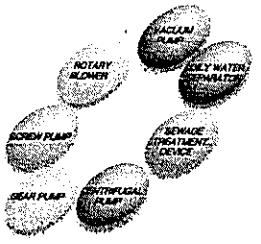
※電動機メーカー及び形番によりW.P.Y.K寸法及び質量が異なります。
Depend on motor manufacturer and model, measurement of W.P.Y. K and weight maybe changed.

大晃機械工業株式会社
TAIKO KIKAI INDUSTRIES CO., LTD.

URL http://www.taiko-kk.com

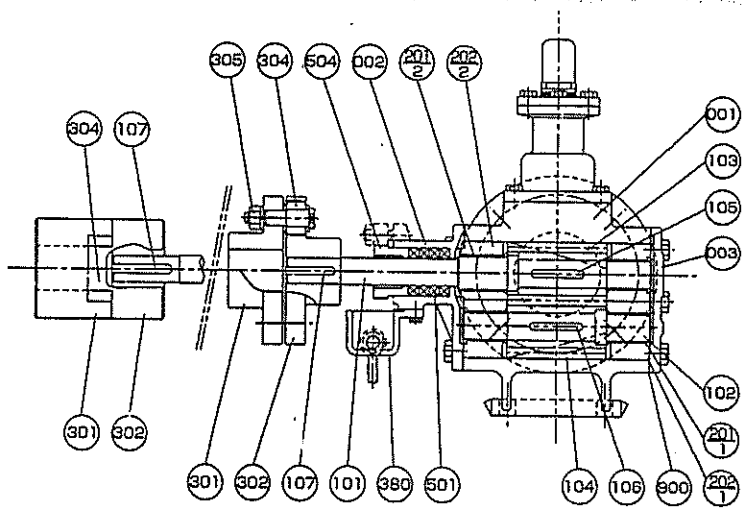
■本 社 ・ 工 場 〒742-1598 山口県熊毛郡田布施町大字下田布施209-1
TEL: (0820) 52-3113~4 FAX: (0820) 53-1001 E-mail: business@taiko-kk.com
■東 京 支 店 〒101-0061 東京都千代田区三崎町3-4-9 水道橋MSビル4階
TEL: (03) 3221-8551 FAX: (03) 3221-8555 E-mail: tokyo-br@taiko-kk.com
■大 阪 支 店 〒541-0048 大阪市中央区瓦町3-4-7 KCビル8階
TEL: (06) 6231-6241 FAX: (06) 6222-3295 E-mail: osaka-br@taiko-kk.com
北京駐在事務所・上海駐在事務所・韓国大晃

■Head Office & Factory 209-1 Shimotabuse, Tabuse-cho, Kumage-gun, Yamaguchi pref. 742-1598 Japan
TEL: 81-820-52-3113~4 FAX: 81-820-53-1001 E-mail: business@taiko-kk.com
■Tokyo Branch 4th floor, Suidobashi MS Building, 3-4-9 Misaki-cho, Chiyoda-ku, Tokyo 101-0061 Japan
TEL: 81-3-3221-8551 FAX: 81-3-3221-8555 E-mail: tokyo-br@taiko-kk.com
■Osaka Branch 8th floor, KC Building, 3-4-7 Kawara-machi, Chuo-ku, Osaka 541-0048 Japan
TEL: 81-6-6231-6241 FAX: 81-6-6222-3295 E-mail: osaka-br@taiko-kk.com
Beijing Office・Shanghai Office・Taiko Korea

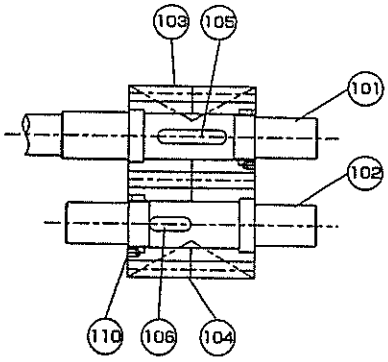


2009/01 MUTSUMI

構造及び材質 Structure and Material



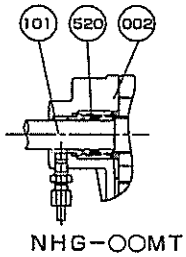
NHG−0.3 to 10



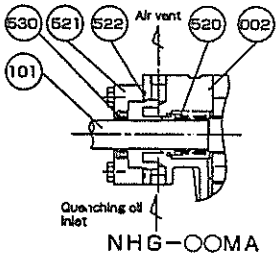
NHG−12 to 30
歯車軸詳細
Detail for Gear Shaft

No.	Name		Material Symbol	Material Name of Material	Q'ty
001	ケーシング	Casing	FC200	Cast iron	1
002	サイドカバー	Side cover	FC200	Cast iron	1
003	サイドカバー	Side cover	FC200	Cast iron	1
101	主動軸	Drive shaft	S45C	Carbon steel	1
102	従動軸	Driven shaft	S45C	Carbon steel	1
103	主動歯車	Drive gear	S45C	Carbon steel	1
104	従動歯車	Driven gear	S45C	Carbon steel	1
105	キー	Key	S45C	Carbon steel	1
106	キー	Key	S45C	Carbon steel	1
107	キー	Key	S45C	Carbon steel	1
110	歯車締付ナット	Gear set ring	S45C	Carbon steel	2
201/1	平軸受	Bearing metal	CAC603	(Lead bronze)	3
201/2			SPCE	Carbon steel sheet	1
202/1	ベアリングハウジング	Bearing housing	FC200	Cast Iron	3
202/2					1
301	軸継手	Coupling	FC200	Cast iron	1
302	軸継手	Coupling	FC200	Cast Iron	1
304	カップリングブッシュ又は軸継手用リング	Coupling bush or coupling ring	NBR	Rubber	—
305	軸継手用ボルト、ナット	Coupling bolt & nut	SS400	Mild steel	—
380	油受皿	Oil pan	FC200	Cast iron	1
501	グランドパッキン	Gland packing	—	Carbonized fiber	4

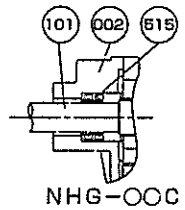
No.	Name		Material Symbol	Material Name of Material	Q'ty
504	グランド	Gland	AC4C-T6	Al-alloy casting	1
515	オイルシール	Oil seal	NBR	Rubber	2
520	メカニカルシール	Mechanical seal	—	SiC & Carbon or Ceramic & Carbon	1
521	メカニカルシールカバー	Seal cover	FC200	Cast Iron	1
522	Oリング	O−Ring	FPM	Rubber	1
530	オイルシール	Oil seal	NBR	Rubber	1
701	逃し弁本体	Safety v. box	FC200	Cast iron	1
702	逃し弁カバー	Safety v. cover	FC200	Cast iron	1
704	逃し弁	Safety valve	CAC402or SUS410	Bronze or Stainless steel	1
706	弁座	Safety v. seat	CAC402	Bronze	1
707	逃し弁ばね	Safety v. spring	SWPA or SUP6	Piano wire or spring steel	1
712	ばね押さえ	Spring carrier	SS400	Mild steel	1
713	調整ねじ	Adjust screw	SS400	Mild steel	1
717	キャップ	Safety v. cap	FC200	Cast Iron	1
718	ロックナット	Lock nut	SS400	Mild steel	1
900	ガスケット	Gasket	—	Paper	2
970	ガスケット	Gasket	—	Paper	1
971	ガスケット	Gasket	—	Paper	1
972	ガスケット	Gasket	PTFE	Teflon	1



NHG−OOMT

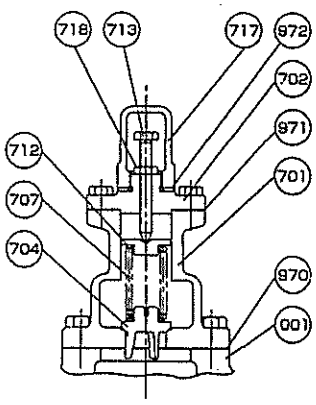


NHG−OOMA

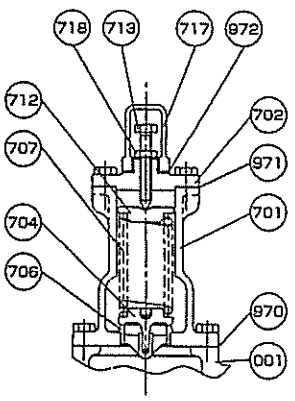


NHG−OOC

軸封詳細
Detail for Seal



NHG−0.3 to 3



NHG−4 to 30

逃し弁詳細
Detail for Safety Valve

L A A L

Engine output
243–669 kW (330–910 PS)

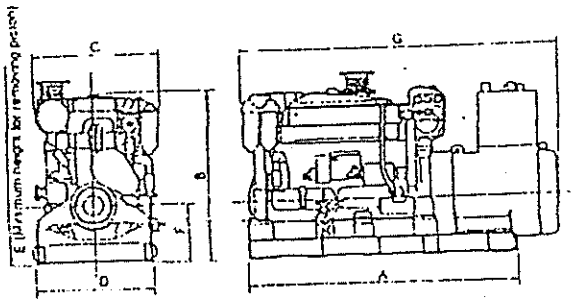
Specifications

Engine model		6LAAL-DTN	6LAAL-UTN			12LAAL-DTN		12LAAL-UTN	
No. of cylinders		6				V12			
Cylinder bore × stroke	mm	148×165				148×165			
Continuous rated output	kW (PS)	243 (330)	265 (360)	309 (420)	353 (480)	530 (720)	618 (840)	574 (780)	669 (910
Engine speed	rpm	1200	1200	1500	1800	1500	1800	1500	180
Generator capacity	kW	220	240	280	320	480	560	520	600
Starting system		Electric starting (Air-motor starting is available.)				Electric starting (Air-motor starting is available.			
Dry weight	kg	1990	2050			3660		3680	

The engine dry weight may differ depending upon the specifications and attached acces

Dimensions (Units: mm)

Depending on the specifications or options that have been chosen, your model may differ slightly from the one in the photograph



Engine model	6LAAL-DTN	6LAAL-UTN		12LAAL-DTN	12LAAL
Engine speed (rpm)	1200	1200	1500 1800	1500 1800	150 180
A	2340	2530	2340	2900	290
B	1469	1469		1610	161
C	1061	1061		1452	145
D	1000	1000		1080	108
E	1414	1414		1315	131
F	489	489		640	64
G	2725	2785	2828	3544	354
Dry weight (engine only)	3383	3740	3820	6420	640

Please confirm all specifications, etc. on the separate delivery specifications sheet

4HAL2/6HAL2

Engine output
72–305 kW (98–414 PS)

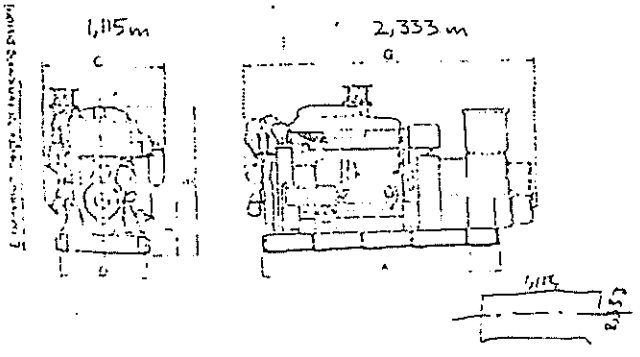
Specifications

Engine model		4HAL2-TN1			4HAL2-TN			6HAL2-N			6HAL2-TN			6HAL2-HTN			6HAL2-DT
No. of cylinders		4						6									
Cylinder bore × stroke	mm	130×165						130×165									
Continuous rated output	kW (PS)	72 (98)	89 (121)	116 (157)	90 (122)	115 (156)	135 (183)	90 (122)	115 (156)	135 (183)	120 (163)	150 (204)	180 (244)	160 (217)	220 (299)	265 (360)	200 (271)	255 (346)
Engine speed	rpm	1200	1500	1800	1200	1500	1800	1200	1500	1800	1200	1500	1800	1200	1500	1800	1200	1500
Generator capacity	kW	64	80	104	80	100	120	80	100	120	104	136	160	144	200	240	180	232
Starting system		Electric starting (Air-motor starting is available.)																
Dry weight	kg	1030			1030			1380			1395			1410			1420

The engine dry weight may differ depending upon the specifications and attached acce

Dimensions (Units: mm)

Depending on the specifications or options that have been chosen, your model may differ slightly from the one in the photograph



Engine model	4HAL2-TN1		4HAL2-TN		6HAL2-N		6HAL2-TN		6HAL2-HTN		6HAL2
Engine speed (rpm)	1200	1500 1800	1200	1500 1800	1200	1500 1800	1200	1500 1800	1200	1500 1800	1200
A	1600		1600		1970		1970	2050	2150		21
B	1206		1206		1285		1351		1351		13
C	1013		1013		1115		1115		1115		11
D	800		800		800		800		800		8
E	1233		1233		1300		1300		1300		12
F	450		450		455		455		455		4
G	2021	2021	2047	2047	2339	2339	2414	2414	2525	2525	2682
Dry weight (engine only)	1750	1810	1810	1870	2130	2190	2230	2290	2630	2690	2750

社は、1924年に電動油圧舵取機の製作に取り組んで以来、世界各国の船主、造船
こ信頼を得て、1万7,000台を超える各種船舶に納入を重ねてきました。従来型舵取
性では世界最高水準にありますが、新シリーズの舵取機は、さらに造船所における
)、信頼性、耐久性のさらなる向上と小型化をコンセプトに開発しました。

years has passed since Kawasaki Heavy Industries, Ltd., began to
ro-hydraulic steering gears in 1924. During this period our products have
ition among shipbuilders not only in Japan but also in many countries of the
e supplied more than 17,000 units of steering gears. Reliability and durability
l series are of the world first class level. Furthermore, the new series are
ve more excellent reliability and durability, and more downsizing in addition
on at the shipyard.

特長 | Features

イアウト変更、安全弁の構造変更な
削減、配管取付作業の不要化、安全
間を短縮しています。

性

(Pa)と、長寿命の油圧ポンプ採用
を持たせています。

、ポンプユニットの配置変更、電
によって、据付スペースを小さくし

1. **Simple installation**
   Modification of pump unit arrangement, safety valve construction, etc. contribute to smaller foundation, deleting the piping work, and saving the required time to confirm the safety valve operation.
2. **High reliability and durability**
   High durability is achieved to apply higher pressure type (max. pressure: 49 MPa) and longer life type hydraulic pump.
3. **Light and compact constitution**
   Higher pressure design, material improvement, modification of pump unit arrangement and electric motor type, etc. contribute to smaller installation space.

型式表示 | Ordering Code

RV 2 1 - 027 - H

- ダ形 / n 2 Cylinders type
- (ポンプ台数) / pump units
- 常用動力ポンプユニット数
  - 1 : 1台
  - 2 : 2台 (−H 型にのみ適用可能)
  - Number of power pump units for normal use
  - 1 : 1 set
  - 2 : 2 sets (available for −H type only)
- 定格トルク (35度時) / Approx. rated torque (at 35°)
  - 003-30 kN·m (3.1 t·m)
  - 004-46 kN·m (4.7 t·m)
  - 005-57 kN·m (5.8 t·m)
  - 007-75 kN·m (7.7 t·m)
  - 009-90 kN·m (9.2 t·m)
  - 010-105 kN·m (10.7 t·m)
  - 013-130 kN·m (13.3 t·m)
  - 017-170 kN·m (17.3 t·m)
  - 022-220 kN·m (22.4 t·m)
  - 027-270 kN·m (27.6 t·m)
- 無し : 標準 / −H : 油圧ロック検出装置付
  - blank: standard
  - −H: with hyd. lock detector

た舵取機は、規則要求によりハイドロ
ではつぎのいずれかで対応しています。
1) 2台同時に運転できないようにする。
不具合に警報を発するようにする。

According to the Rule requirements, two (2) power pumps equipped type steering gear to be provided with any countermeasure of the followings to avoid the hydraulic locking.
1. Starter for electric motor to be provided ... simultaneously operate two(2) power pump units, or.
2. Steering gear to be provided with the ... alarm to be given in case of a failure.

motor Hidrolyc

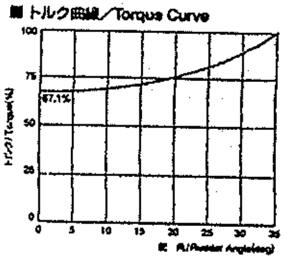
要目表 | Particulars

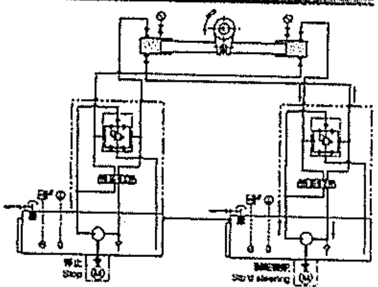
型式 Type			RV∗1-003	RV∗1-004	RV∗1-005	RV∗1-007	RV∗1-009	RV∗1-010	RV∗1-013	RV∗1-017	RV∗1-022	RV∗1-027	RV22-010	RV22-013	RV22-017	RV22-022	RV22-027
			RV11 and RV21 Type										RV22 Type				
最高使用圧力時トルク Torque at max. working pressure		kN·m	30	46	57	75	90	105	130	170	220	270	105	130	170	220	270
		t·m	3.1	4.7	5.8	7.7	9.2	10.7	13.3	17.3	22.4	27.5	10.7	13.3	17.3	22.4	27.8
最大舵角 Rudder turning angle		deg.	70										70				
転舵速度 Rudder turning speed		deg/s	70/15		65/28								65/28				
舵柄半径 Normal radius of tiller arm		mm	210		260			295		375			295		375		
ラム径 Ram diameter		mm	100		125			140		180			140		180		
最高使用圧力 Max. working pressure		MPa	14.0	22.0	14.0	18.0	22.0	18.0	22.0	14.0	18.0	22.0	18.0	22.0	14.0	18.0	22.0
安全弁設定圧力 Safety valve set pressure		MPa	17.5	27.5	17.5	22.5	27.5	22.5	27.5	17.5	22.5	27.5	22.5	27.5	17.5	22.5	27.5
電動機 Motor	出力/Output	kW	2.2	3.7	2.2	2.2	3.7	3.7	3.7	5.5	5.5	7.5	2.2	2.2	2.2	3.7	3.7
	回転数/Speed	min⁻¹	1,750										1,750				

注) ∗には"1"または"2"が入ります。 Note) The mark "∗" indicates "1" or "2".

油圧回路 | Hydraulic Circuit

■ トルク曲線/Torque Curve





油圧ポンプ・電動機 | Hydraulic Pumps & Electric Motor

■ 油圧ポンプ/Hydraulic Pumps

型式/Type			LVP017
構造 Structure			斜軸形ピストンポンプ Bent axis type axial piston pump
圧力 Pressure	定格/rated	MPa	34.3
	最高/max.	MPa	49.0
定格回転数 Rated speed		min⁻¹	1,800
質量 Mass		kg	12

■ 電動機/Electric Motor

項目/Item		仕様/Specifications
電源 Power supply		AC440V-60Hz-3φ
構造 Structure		全閉外扇横フランジ形 Totally enclosed, fan cooled, horizontal, flange mounted type
軸形状 Shaft end type		キー付き With key
極数 No. of pole		4
回転数 Speed	min⁻¹	1,800 (同期/Synchronous)
回転方向 Direction of rotation		左回転 (軸端より見て) Counter clockwise (viewed from shaft end)
ベアリング形番 Bearing type		72 or 73 (片側/One side)
定格 Rated		100%連続/Cont. 230%-30s
始動トルク Starting torque		≧230%

6LAAL

igine output
13–669 kW (330–910 PS)

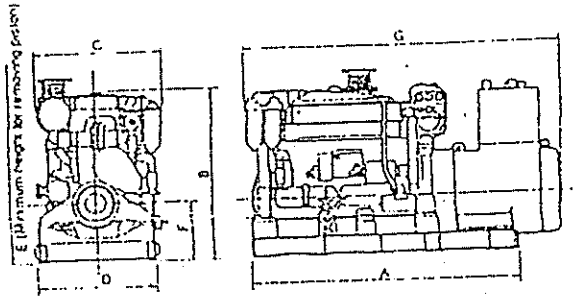
ecifications

Engine model		6LAAL-DTN	6LAAL-UTN			12LAAL-DTN		12LAAL-UTN	
cylinders		6				V12			
er bore × stroke	mm	148×165				148×165			
uous rated output	kW (PS)	243 (330)	265 (360)	309 (420)	353 (480)	530 (720)	618 (840)	574 (780)	669 (910
speed	rpm	1200	1200	1500	1800	1500	1800	1500	1800
tor capacity	kW	220	240	280	320	480	560	520	600
g system		Electric starting (Air-motor starting is available.)				Electric starting (Air-motor starting is available.			
ight	kg	1990	2050			3660		3680	

The engine dry weight may differ depending upon the specifications and attached acces

nensions (Units: mm)

Depending on the specifications or options that have been chosen, your model may differ slightly from the one in the photograph



Engine model	6LAAL-DTN	6LAAL-UTN		12LAAL-DTN	12LAAL
Engine speed (rpm)	1200	1200	1500 1800	1500 1800	150 180
A	2348	2530	2340	2900	290
B	1469	1469		1610	161
C	1061	1061		1452	145
D	1000	1000		1030	103
E	1414	1414		1315	131
F	489	489		640	64
G	2725	2785	2628	3544	354
Dry weight of generating equipment (kg)	3350	3710	3620	6400	640

onfirm all specifications, etc. on the separate delivery specifications sheet

4HAL2/6HAL2

igine output
2–305 kW (98–414 PS)

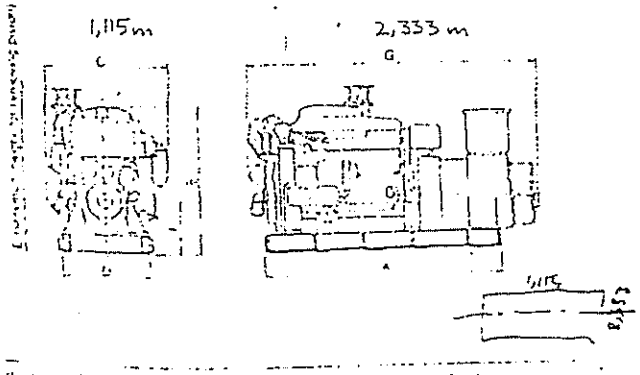
ecifications

Engine model		4HAL2-TN1			4HAL2-TN			6HAL2-N			6HAL2-TN			6HAL2-HTN			6HAL2-DT
cylinders		4						6									
ler bore × stroke	mm	130×165						130×165									
uous rated output	kW (PS)	72 (98)	89 (121)	116 (157)	90 (122)	115 (156)	135 (183)	90 (122)	115 (156)	135 (183)	120 (163)	150 (204)	180 (244)	160 (217)	220 (299)	265 (360)	200 (271)	255 (346)
e speed	rpm	1200	1500	1800	1200	1500	1800	1200	1500	1800	1200	1500	1800	1200	1500	1800	1200	1500
ator capacity	kW	64	80	104	80	100	120	80	100	120	104	136	160	144	200	240	180	232
ng system		Electric starting (Air-motor starting is available.)																
eight	kg	1030			1030			1380			1395			1410			1420

The engine dry weight may differ depending upon the specifications and attached acce

nensions (Units: mm)

Depending on the specifications or options that have been chosen, your model may differ slightly from the one in the photograp



Engine model	4HAL2-TN1		4HAL2-TN		6HAL2-N		6HAL2-TN		6HAL2-HTN		6HAL2
Engine speed (rpm)	1200	1500 1800	1200	1500 1800	1200	1500 1800	1200	1500 1800	1200	1500 1800	1200
A	1600		1600		1970		1970	2050	2150		21
B	1206		1206		1285		1351		1351		13
C	1013		1013		1115		1115		1115		11
D	600		600		800		800		800		8
E	1233		1233		1269		1269		1269		12
F	450		450		485		485		485		4
G	2021	2054	2021	2047	2337	2413	2484	2552	2529	2593	2642
Dry weight of generating equipment (kg)	1750	1620	1810	1520	2180	2190	2290	2340	2630	2680	2750