

## DAFTAR PUSTAKA

- Andi Haris Muhammad, dkk. 2019. *Desain Konfigurasi Sistem Propulsi Hybrid Terhadap Pengurangan Konsumsi BBM Kapal Penangkap Ikan 30 GT*. Universitas Hasanuddin. Makassar
- Andi Haris Muhammad, dkk. 2019. *Pengaruh Sudut Kemiringan dan Jarak antar Daun Kemudi Terhadap Kinerja Manuvering KMP. Bontoharu*. Universitas Hasanuddin. Makassar
- Andi Haris Muhammad, dkk. 2001. *A Design Study Into The Hull And Propulsion System Matching Of 'Minajaya' Fishing Vessel With Chine and Round Bilge Hull Form*. Institut Teknologi Sepuluh November. Surabaya
- Armin Letafat, dkk. 2020. *An Efficient and Cost Effective Power Scheduling In Zero Emission Ferry Ship*. Hindawi. Iran
- Baharuddin. 2016. *Perancangan Simulasi Kontrol Otomatis Distribusi Bahan Bakar Tangki Harian Pada KM. Madani Nusantara*. Universitas Hasanuddin. Makassar
- Bas Kwasiieckyj. 2013. *Efficiency analysis and design methodology Of Hybrid Propulsion Systems*. Delft University Of Technology. Netherlands
- B.R. Höhn, K. Michaelis, A.Wimmer. *Low Loss Gears*. American Gear Manufactures Association

- Carlos A. Reusser, dkk. 2018. *Ship's PTO/PTI Torque Field Oriented Control Scheme with Optimization Strategy, for EEDI Index Improvement*. Institute of Naval Maritime Sciences, Universidad Austral de Chile. Valdivia. Chile
- Eleftherios Dedes. *Hybrid Systems for Diesel Powered Ships*. University of Southampton, United Kingdom.
- Ganding Sitepu, dkk. 2012. *Optimalisasi Perancangan Kapal Penyebrangan di Kawasan Timur Indonesia*. Universitas Hasanuddin. Makassar
- G.Kuiper. 1992. *The Wageningen Propeller Series*. MARIN
- Habibi dan Nurhadi. 2016. *Analisa Pemilihan Propeller tipe B-Series Pada Kapal Feri Ro-Ro 600 GT Dengan Menggunakan Aplikasi Matchpro*. Institut Teknologi Sepuluh November. Surabaya
- Hangga, dkk. 2016. *Perencanaan Sistem Propulsi Hybrid Untuk Kapal Fast Patrol Boat 60 M*. Institut Teknologi Sepuluh November. Surabaya
- Ingeteam. *PTI/PTO Hybrid Electrical drive*. 2016
- Muhammad Badruz Zaman. 2004. *Analisa Penggunaan Power take Off (PTO) Sebagai Pembangkit Daya Listrik Pada Kapal Container MV. Jatiwangi Palwo Buwono 400*. Institut Teknologi Sepuluh November. Surabaya
- Muhammad Khooban, dkk. 2020. *A New Intelligent Hybrid Control Approach For DC/AC Counters In Zero Emission Ferry Ship*. Hindawi. Iran
- Oregonstate. *Battery Bank Sizing Procedures*. 11 Februari 2021

PT. ASDP Indonesia Ferry (Persero). 2019. *Ship Particular*. Indonesia

R.D Geertsma, dkk. 2017. *Design and Control Of Hybrid Power and Propulsion System For Smart Ship*. Delft University Of Technology. Netherlands

## LAMPIRAN

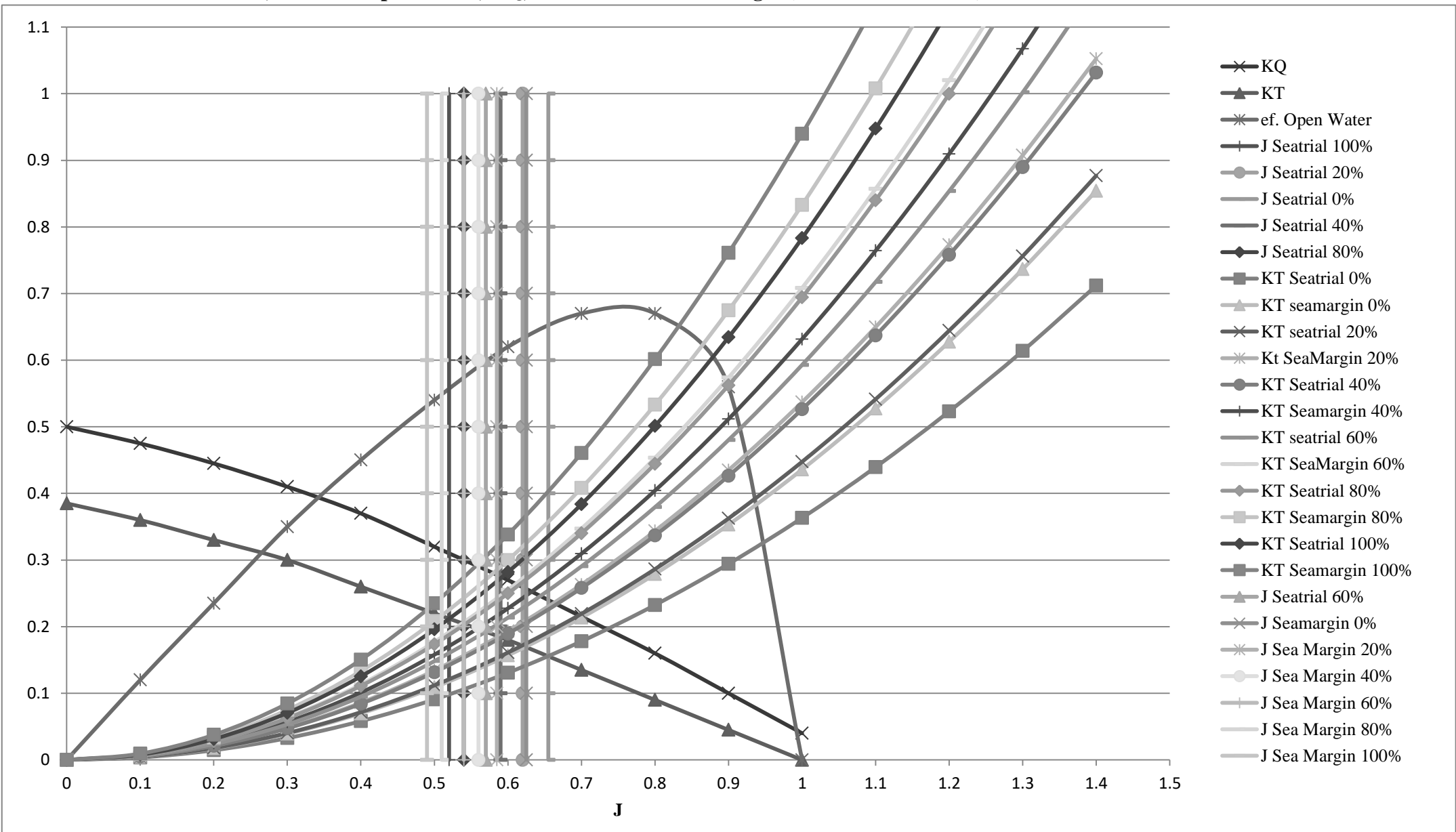
- Tabel nilai kurva open water B4-55, P/D 0,9

J	KT	10KQ	$\eta$
0	0.385	0.5	0
0.1	0.36	0.475	0.12
0.2	0.33	0.445	0.235
0.3	0.3	0.41	0.35
0.4	0.26	0.37	0.45
0.5	0.22	0.32	0.54
0.6	0.18	0.27	0.62
0.7	0.135	0.215	0.67
0.8	0.09	0.16	0.67
0.9	0.045	0.1	0.56
1	0	0.04	0

- **Tabel KT Sea Trial dan KT Sea Margin**

0%		20%		40%		60%		80%		100%	
Sea Trial	Sea Margin	Sea Trial	Sea Margin	Sea Trial	Sea Margin	Sea Trial	Sea Margin	Sea Trial	Sea Margin	Sea Trial	Sea Margin
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
0.01	0.02	0.02	0.02	0.02	0.03	0.02	0.03	0.03	0.03	0.03	0.03
0.03	0.04	0.04	0.05	0.05	0.06	0.05	0.06	0.06	0.07	0.06	0.07
0.06	0.07	0.07	0.09	0.08	0.10	0.09	0.11	0.11	0.13	0.10	0.13
0.09	0.11	0.11	0.13	0.13	0.16	0.15	0.18	0.17	0.21	0.16	0.20
0.13	0.16	0.16	0.19	0.19	0.23	0.21	0.26	0.25	0.30	0.23	0.28
0.18	0.21	0.22	0.26	0.26	0.31	0.29	0.35	0.34	0.41	0.32	0.38
0.23	0.28	0.29	0.34	0.34	0.40	0.38	0.45	0.44	0.53	0.42	0.50
0.29	0.35	0.36	0.43	0.43	0.51	0.48	0.57	0.56	0.67	0.53	0.63
0.36	0.44	0.45	0.54	0.53	0.63	0.59	0.71	0.69	0.83	0.65	0.78
0.44	0.53	0.54	0.65	0.64	0.76	0.72	0.86	0.84	1.01	0.79	0.95
0.52	0.63	0.64	0.77	0.76	0.91	0.85	1.02	1.00	1.20	0.94	1.13
0.61	0.74	0.76	0.91	0.89	1.07	1.00	1.20	1.17	1.41	1.10	1.32
0.71	0.85	0.88	1.05	1.03	1.24	1.16	1.39	1.36	1.63	1.28	1.53

• **Grafik J, Efisiensi Open Water, KQ, KT seatrial dan seamargin (muatan 0% - 100%)**



- **Tabel Resistan dan Daya kapal dari kecepatan 9 knot – 13 knot**
- **Muatan 100%**

No.	Sp. (Kn)	Fr No. LWL	Fr No. Vol	Resist (KN)	Pow (KW)	RT/2 (KN)	Pow/2 (KW)
1	9	0.212	0.45	61.88908	358.18307	30.94454	179.091535
2	9.1	0.214	0.455	63.26361	370.20635	31.631805	185.103175
3	9.2	0.216	0.46	64.6693	382.59074	32.33465	191.29537
4	9.3	0.219	0.465	66.10754	395.35063	33.05377	197.675315
5	9.4	0.221	0.47	67.57982	408.50125	33.78991	204.250625
6	9.5	0.223	0.475	69.08718	422.05548	34.54359	211.02774
7	9.6	0.226	0.48	70.62973	436.02089	35.314865	218.010445
8	9.7	0.228	0.485	72.20646	450.39783	36.10323	225.198915
9	9.8	0.23	0.49	73.81524	465.17952	36.90762	232.58976
10	9.9	0.233	0.495	75.45328	480.35447	37.72664	240.177235
11	10	0.235	0.5	77.11793	495.91115	38.558965	247.955575
12	10.1	0.237	0.505	78.80753	511.84394	39.403765	255.92197
13	10.2	0.24	0.51	80.52225	528.15888	40.261125	264.07944
14	10.3	0.242	0.515	82.26468	544.8778	41.13234	272.4389
15	10.4	0.244	0.52	84.03985	562.03982	42.019925	281.01991
16	10.5	0.247	0.525	85.85498	579.69998	42.92749	289.84999
17	10.6	0.249	0.53	87.71877	597.92526	43.859385	298.96263
18	10.7	0.251	0.535	89.64048	616.78877	44.82024	308.394385
19	10.8	0.254	0.54	91.62891	636.36278	45.814455	318.18139
20	10.9	0.256	0.545	93.69131	656.71103	46.845655	328.355515
21	11	0.259	0.55	95.83236	677.88087	47.91618	338.940435
22	11.1	0.261	0.555	98.05324	699.89583	49.02662	349.947915
23	11.2	0.263	0.56	100.35087	722.74925	50.175435	361.374625
24	11.3	0.266	0.565	102.71763	746.40048	51.358815	373.20024
25	11.4	0.268	0.57	105.14146	770.77453	52.57073	385.387265
26	11.5	0.27	0.575	107.6067	795.76647	53.80335	397.883235
27	11.6	0.273	0.58	110.09543	821.25073	55.047715	410.625365
28	11.7	0.275	0.585	112.58943	847.09469	56.294715	423.547345
29	11.8	0.277	0.59	115.07227	873.17475	57.536135	436.587375
30	11.9	0.28	0.595	117.53137	899.39245	58.765685	449.696225
31	12	0.282	0.6	119.95957	925.68801	59.979785	462.844005
32	12.1	0.284	0.605	122.35609	952.04936	61.178045	476.02468
33	12.2	0.287	0.61	124.72671	978.51566	62.363355	489.25783
34	12.3	0.289	0.615	127.08325	1005.17559	63.541625	502.587795
35	12.4	0.291	0.62	129.44268	1032.16155	64.72134	516.080775
36	12.5	0.294	0.625	131.82581	1059.6415	65.912905	529.82075
37	12.6	0.296	0.63	134.2561	1087.81003	67.12805	543.905015

38	12.7	0.298	0.635	136.75851	1116.88014	68.379255	558.44007
39	12.8	0.301	0.64	139.35862	1147.07626	69.67931	573.53813
40	12.9	0.303	0.645	142.08195	1178.62896	71.040975	589.31448
41	13	0.306	0.65	144.9535	1211.77102	72.47675	605.88551

- **Muatan 80%**

No.	Sp. (Kn)	Fr No. LWL	Fr No. Vol	Resist (KN)	Pow (KW)	RT/2	Pow/2
1	9	0.212	0.459	61.04888	353.3204	30.52444	176.6602
2	9.1	0.214	0.465	62.39397	365.11735	31.196985	182.55868
3	9.2	0.216	0.47	63.76859	377.26205	31.884295	188.63103
4	9.3	0.219	0.475	65.17395	389.76739	32.586975	194.8837
5	9.4	0.221	0.48	66.61133	402.647	33.305665	201.3235
6	9.5	0.223	0.485	68.08159	415.91235	34.040795	207.95618
7	9.6	0.226	0.49	69.58477	429.56999	34.792385	214.785
8	9.7	0.228	0.495	71.11984	443.61987	35.55992	221.80994
9	9.8	0.23	0.5	72.68477	458.05537	36.342385	229.02769
10	9.9	0.233	0.505	74.27695	472.86566	37.138475	236.43283
11	10	0.235	0.51	75.8939	488.03994	37.94695	244.01997
12	10.1	0.237	0.516	77.53405	503.5729	38.767025	251.78645
13	10.2	0.24	0.521	79.19755	519.46994	39.598775	259.73497
14	10.3	0.242	0.526	80.88671	535.75089	40.443355	267.87545
15	10.4	0.244	0.531	82.60611	552.45132	41.303055	276.22566
16	10.5	0.247	0.536	84.36228	569.62116	42.18114	284.81058
17	10.6	0.249	0.541	86.16307	587.32102	43.081535	293.66051
18	10.7	0.251	0.546	88.01683	605.61691	44.008415	302.80846
19	10.8	0.254	0.551	89.93143	624.5738	44.965715	312.2869
20	10.9	0.256	0.556	91.91334	644.24869	45.95667	322.12435
21	11	0.259	0.562	93.96666	664.68358	46.98333	332.34179
22	11.1	0.261	0.567	96.09228	685.89869	48.04614	342.94935
23	11.2	0.263	0.572	98.2873	707.88695	49.14365	353.94348
24	11.3	0.266	0.577	100.54466	730.61056	50.27233	365.30528
25	11.4	0.268	0.582	102.85337	754.0009	51.426685	377.00045
26	11.5	0.27	0.587	105.19919	777.96261	52.599595	388.98131
27	11.6	0.273	0.592	107.56593	802.38205	53.782965	401.19103
28	11.7	0.275	0.597	109.93716	827.13969	54.96858	413.56985
29	11.8	0.277	0.602	112.29814	852.12451	56.14907	426.06226
30	11.9	0.28	0.607	114.63763	877.24851	57.318815	438.62426
31	12	0.282	0.613	116.9493	902.45876	58.47465	451.22938
32	12.1	0.284	0.618	119.23257	927.74534	59.616285	463.87267



33	12.2	0.287	0.623	121.49275	953.14435	60.746375	476.57218
34	12.3	0.289	0.628	123.74055	978.73615	61.870275	489.36808
35	12.4	0.291	0.633	125.99123	1004.64004	62.995615	502.32002
36	12.5	0.294	0.638	128.26348	1031.00678	64.13174	515.50339
37	12.6	0.296	0.643	130.57828	1058.01049	65.28914	529.00525
38	12.7	0.298	0.648	132.95789	1085.84126	66.478945	542.92063
39	12.8	0.301	0.653	135.42508	1114.69884	67.71254	557.34942
40	12.9	0.303	0.658	138.00246	1144.78795	69.00123	572.39398
41	13	0.306	0.664	140.71217	1176.31468	70.356085	588.15734

- **Muatan 60%**

No.	Sp. (Kn)	Fr No. LWL	Fr No. Vol	Resist (KN)	Pow (KW)	RT/2 (KN)	Pow/2 (KW)
1	9	0.212	0.471	60.28394	348.89331	30.14197	174.44666
2	9.1	0.214	0.476	61.60101	360.47715	30.800505	180.23858
3	9.2	0.216	0.481	62.94603	372.39568	31.473015	186.19784
4	9.3	0.219	0.486	64.31998	384.66026	32.15999	192.33013
5	9.4	0.221	0.492	65.72394	397.28298	32.86197	198.64149
6	9.5	0.223	0.497	67.15862	410.27389	33.57931	205.13695
7	9.6	0.226	0.502	68.62396	423.63857	34.31198	211.81929
8	9.7	0.228	0.507	70.11893	437.37658	35.059465	218.68829
9	9.8	0.23	0.512	71.64163	451.48157	35.820815	225.74079
10	9.9	0.233	0.518	73.18961	465.94338	36.594805	232.97169
11	10	0.235	0.523	74.76057	480.75201	37.380285	240.37601
12	10.1	0.237	0.528	76.35306	495.9025	38.17653	247.95125
13	10.2	0.24	0.533	77.96717	511.39966	38.983585	255.69983
14	10.3	0.242	0.539	79.60498	527.26135	39.80249	263.63068
15	10.4	0.244	0.544	81.27058	543.51957	40.63529	271.75979
16	10.5	0.247	0.549	82.96983	560.21917	41.484915	280.10959
17	10.6	0.249	0.554	84.70973	577.41445	42.354865	288.70723
18	10.7	0.251	0.56	86.49771	595.16432	43.248855	297.58216
19	10.8	0.254	0.565	88.34076	613.52655	44.17038	306.76328
20	10.9	0.256	0.57	90.24453	632.55152	45.122265	316.27576
21	11	0.259	0.575	92.21258	652.27595	46.10629	326.13798
22	11.1	0.261	0.58	94.24556	672.71695	47.12278	336.35848
23	11.2	0.263	0.586	96.3407	693.86716	48.17035	346.93358
24	11.3	0.266	0.591	98.49158	715.69181	49.24579	357.84591
25	11.4	0.268	0.596	100.68825	738.12877	50.344125	369.06439
26	11.5	0.27	0.601	102.91792	761.0923	51.45896	380.54615
27	11.6	0.273	0.607	105.16611	784.48079	52.583055	392.2404

28	11.7	0.275	0.612	107.41821	808.18774	53.709105	404.09387
29	11.8	0.277	0.617	109.66113	832.11471	54.830565	416.05736
30	11.9	0.28	0.622	111.88495	856.18407	55.942475	428.09204
31	12	0.282	0.628	114.08419	880.34965	57.042095	440.17483
32	12.1	0.284	0.633	116.25843	904.6036	58.129215	452.3018
33	12.2	0.287	0.638	118.41249	928.97891	59.206245	464.48946
34	12.3	0.289	0.643	120.55599	953.54768	60.277995	476.77384
35	12.4	0.291	0.648	122.70251	978.41618	61.351255	489.20809
36	12.5	0.294	0.654	124.86861	1003.7182	62.434305	501.85908
37	12.6	0.296	0.659	127.07282	1029.6076	63.53641	514.80378
38	12.7	0.298	0.664	129.33477	1056.2519	64.667385	528.12596
39	12.8	0.301	0.669	131.67442	1083.8268	65.83721	541.91339
40	12.9	0.303	0.675	134.11158	1112.5115	67.05579	556.25574
41	13	0.306	0.68	136.66556	1142.4861	68.33278	571.24305

- **Muatan 40%**

No.	Sp. (Kn)	Fr No. LWL	Fr No. Vol	Resist (KN)	Pow (KW)	RT/2 (KW)	Pow/2 (KW)
1	9	0.212	0.484	59.61631	345.02938	29.808155	172.51469
2	9.1	0.214	0.49	60.90712	356.4166	30.45356	178.2083
3	9.2	0.216	0.495	62.22427	368.1257	31.112135	184.06285
4	9.3	0.219	0.5	63.56857	380.16655	31.784285	190.08328
5	9.4	0.221	0.506	64.94089	392.54964	32.470445	196.27482
6	9.5	0.223	0.511	66.34176	405.28366	33.17088	202.64183
7	9.6	0.226	0.516	67.77104	418.37325	33.88552	209.18663
8	9.7	0.228	0.522	69.22773	431.81761	34.613865	215.90881
9	9.8	0.23	0.527	70.71004	445.61071	35.35502	222.80536
10	9.9	0.233	0.533	72.2157	459.7432	36.10785	229.8716
11	10	0.235	0.538	73.74261	474.20593	36.871305	237.10297
12	10.1	0.237	0.543	75.28942	488.99434	37.64471	244.49717
13	10.2	0.24	0.549	76.85621	504.11268	38.428105	252.05634
14	10.3	0.242	0.554	78.44478	519.57684	39.22239	259.78842
15	10.4	0.244	0.559	80.05877	535.41524	40.029385	267.70762
16	10.5	0.247	0.565	81.70332	551.66762	40.85166	275.83381
17	10.6	0.249	0.57	83.38461	568.38191	41.692305	284.19096
18	10.7	0.251	0.576	85.10913	585.60995	42.554565	292.80498
19	10.8	0.254	0.581	86.88298	603.40228	43.44149	301.70114
20	10.9	0.256	0.586	88.71103	621.80274	44.355515	310.90137
21	11	0.259	0.592	90.59628	640.84287	45.29814	320.42144
22	11.1	0.261	0.597	92.53916	660.53681	46.26958	330.26841

23	11.2	0.263	0.602	94.53708	680.87706	47.26854	340.43853
24	11.3	0.266	0.608	96.58424	701.8321	48.29212	350.91605
25	11.4	0.268	0.613	98.67179	723.34648	49.335895	361.67324
26	11.5	0.27	0.619	100.78842	745.34434	50.39421	372.67217
27	11.6	0.273	0.624	102.92137	767.73623	51.460685	383.86812
28	11.7	0.275	0.629	105.05783	790.42883	52.528915	395.21442
29	11.8	0.277	0.635	107.18639	813.33631	53.593195	406.66816
30	11.9	0.28	0.64	109.29848	836.39145	54.64924	418.19573
31	12	0.282	0.646	111.38939	859.55476	55.694695	429.77738
32	12.1	0.284	0.651	113.45889	882.82045	56.729445	441.41023
33	12.2	0.287	0.656	115.51131	906.2183	57.755655	453.10915
34	12.3	0.289	0.662	117.55512	929.81206	58.77756	464.90603
35	12.4	0.291	0.667	119.60224	953.69498	59.80112	476.84749
36	12.5	0.294	0.672	121.6671	977.98384	60.83355	488.99192
37	12.6	0.296	0.678	123.76582	1002.8125	61.88291	501.40626
38	12.7	0.298	0.683	125.91535	1028.3262	62.957675	514.16309
39	12.8	0.301	0.689	128.13293	1054.6764	64.066465	527.33821
40	12.9	0.303	0.694	130.4356	1082.0176	65.2178	541.00881
41	13	0.306	0.699	132.83985	1110.5043	66.419925	555.25214

- **Muatan 20%**

No.	Sp. (Kn)	Fr No. LWL	Fr No. Vol	Resist (KN)	Pow (KW)	RT/2 (KN)	Pow/2 (KW)
1	9	0.212	0.501	59.11282	342.11545	29.55641	171.05773
2	9.1	0.214	0.506	60.38031	353.33385	30.190155	176.66693
3	9.2	0.216	0.512	61.67257	364.86175	30.836285	182.43088
4	9.3	0.219	0.518	62.99018	376.7075	31.49509	188.35375
5	9.4	0.221	0.523	64.33381	388.88	32.166905	194.44
6	9.5	0.223	0.529	65.70384	401.38656	32.85192	200.69328
7	9.6	0.226	0.534	67.10004	414.2309	33.55002	207.11545
8	9.7	0.228	0.54	68.52144	427.41198	34.26072	213.70599
9	9.8	0.23	0.545	69.96637	440.92418	34.983185	220.46209
10	9.9	0.233	0.551	71.4328	454.75905	35.7164	227.37953
11	10	0.235	0.557	72.9188	468.90839	36.4594	234.4542
12	10.1	0.237	0.562	74.42317	483.36816	37.211585	241.68408
13	10.2	0.24	0.568	75.94594	498.14206	37.97297	249.07103
14	10.3	0.242	0.573	77.48866	513.244	38.74433	256.622
15	10.4	0.244	0.579	79.05448	528.69877	39.52724	264.34939
16	10.5	0.247	0.584	80.64783	544.54089	40.323915	272.27045
17	10.6	0.249	0.59	82.27404	560.81186	41.13702	280.40593

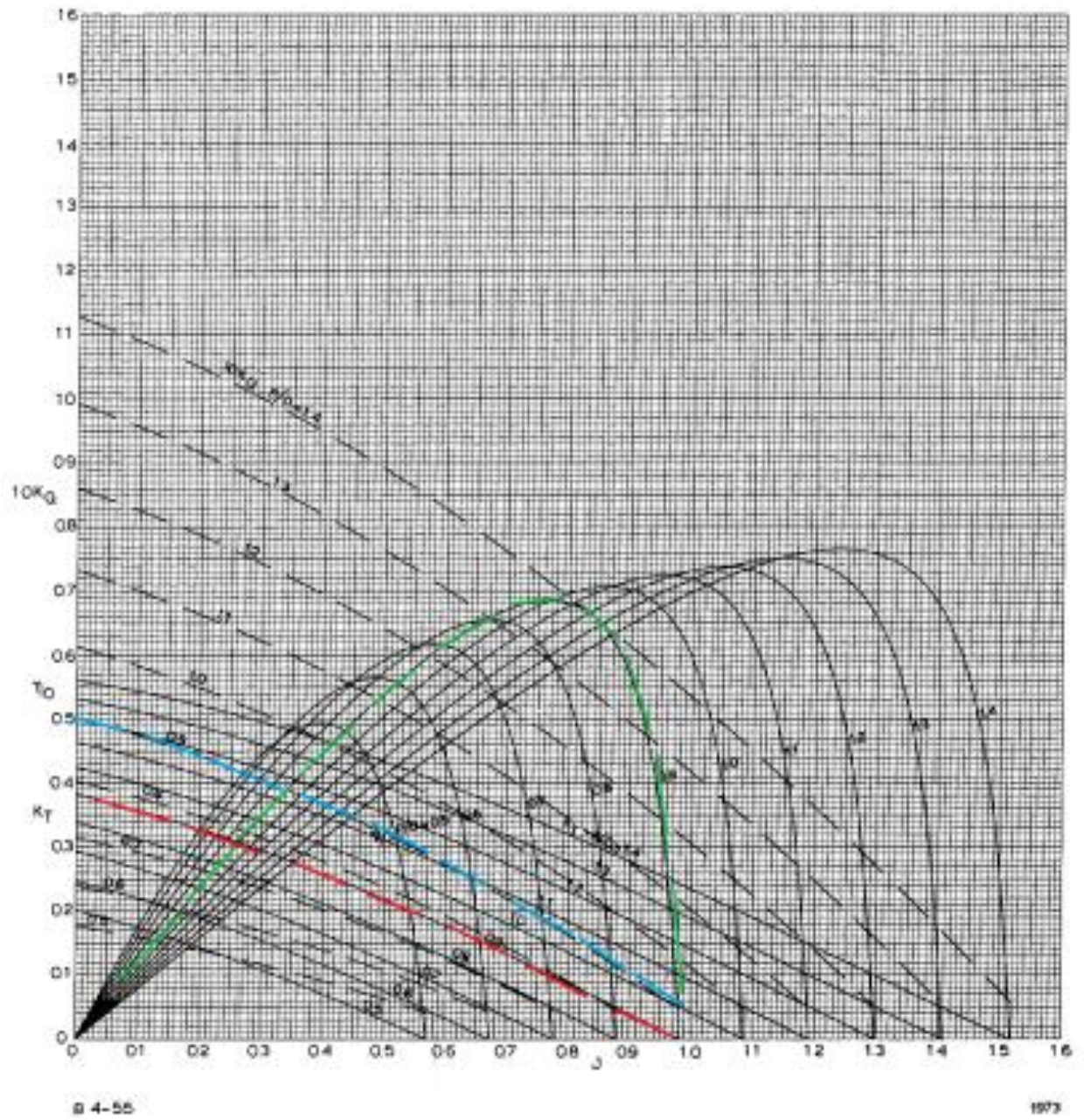
18	10.7	0.251	0.596	83.93867	577.55632	41.969335	288.77816
19	10.8	0.254	0.601	85.64688	594.81758	42.82344	297.40879
20	10.9	0.256	0.607	87.4028	612.6329	43.7014	306.31645
21	11	0.259	0.612	89.20886	631.02877	44.60443	315.51439
22	11.1	0.261	0.618	91.06529	650.01649	45.532645	325.00825
23	11.2	0.263	0.623	92.96973	669.58868	46.484865	334.79434
24	11.3	0.266	0.629	94.91704	689.71733	47.45852	344.85867
25	11.4	0.268	0.634	96.8995	710.35405	48.44975	355.17703
26	11.5	0.27	0.64	98.90729	731.43315	49.453645	365.71658
27	11.6	0.273	0.646	100.92946	752.87769	50.46473	376.43885
28	11.7	0.275	0.651	102.95502	774.6078	51.47751	387.3039
29	11.8	0.277	0.657	104.97425	796.55045	52.487125	398.27523
30	11.9	0.28	0.662	106.97991	818.6489	53.489955	409.32445
31	12	0.282	0.668	108.96808	840.87039	54.48404	420.4352
32	12.1	0.284	0.673	110.93871	863.21102	55.469355	431.60551
33	12.2	0.287	0.679	112.89559	885.6973	56.447795	442.84865
34	12.3	0.289	0.685	114.84606	908.38445	57.42303	454.19223
35	12.4	0.291	0.69	116.8003	931.35258	58.40015	465.67629
36	12.5	0.294	0.696	118.77062	954.70137	59.38531	477.35069
37	12.6	0.296	0.701	120.7707	978.5446	60.38535	489.2723
38	12.7	0.298	0.707	122.81487	1003.0051	61.407435	501.50257
39	12.8	0.301	0.712	124.91762	1028.2108	62.45881	514.10539
40	12.9	0.303	0.718	127.09321	1054.2912	63.546605	527.14559
41	13	0.306	0.724	129.35544	1081.3755	64.67772	540.68777

- **Muatan 0%**

No.	Sp. (Kn)	Fr No. LWL	Fr No. Vol	Resist (KN)	Pow (KW)	RT/2 (KN)	Pow/2 (KW)
1	9	0.212	0.523	53.37318	308.89729	26.68659	154.448645
2	9.1	0.214	0.529	54.5062	318.95968	27.2531	159.47984
3	9.2	0.216	0.534	55.66126	329.29819	27.83063	164.649095
4	9.3	0.219	0.54	56.83874	339.91937	28.41937	169.959685
5	9.4	0.221	0.546	58.03911	350.83028	29.019555	175.41514
6	9.5	0.223	0.552	59.26256	362.03664	29.63128	181.01832
7	9.6	0.226	0.558	60.50882	373.54111	30.25441	186.770555
8	9.7	0.228	0.564	61.77695	385.34229	30.888475	192.671145
9	9.8	0.23	0.569	63.06545	397.43495	31.532725	198.717475
10	9.9	0.233	0.575	64.37251	409.81151	32.186255	204.905755
11	10	0.235	0.581	65.69645	422.4647	32.848225	211.23235
12	10.1	0.237	0.587	67.03622	435.39091	33.51811	217.695455

13	10.2	0.24	0.593	68.39179	448.59312	34.195895	224.29656
14	10.3	0.242	0.598	69.76447	462.083	34.882235	231.0415
15	10.4	0.244	0.604	71.15687	475.88135	35.578435	237.940675
16	10.5	0.247	0.61	72.57273	490.01709	36.286365	245.008545
17	10.6	0.249	0.616	74.01644	504.52481	37.00822	252.262405
18	10.7	0.251	0.622	75.49261	519.44155	37.746305	259.720775
19	10.8	0.254	0.627	77.00548	534.80306	38.50274	267.40153
20	10.9	0.256	0.633	78.55839	550.63977	39.279195	275.319885
21	11	0.259	0.639	80.15325	566.97295	40.076625	283.486475
22	11.1	0.261	0.645	81.79012	583.81107	40.89506	291.905535
23	11.2	0.263	0.651	83.46688	601.14704	41.73344	300.57352
24	11.3	0.266	0.656	85.17914	618.95661	42.58957	309.478305
25	11.4	0.268	0.662	86.92038	637.19881	43.46019	318.599405
26	11.5	0.27	0.668	88.68238	655.81855	44.34119	327.909275
27	11.6	0.273	0.674	90.45603	674.75176	45.228015	337.37588
28	11.7	0.275	0.68	92.23225	693.93237	46.116125	346.966185
29	11.8	0.277	0.686	94.00304	713.30032	47.00152	356.65016
30	11.9	0.28	0.691	95.76252	732.80935	47.88126	366.404675
31	12	0.282	0.697	97.50755	752.43326	48.753775	376.21663
32	12.1	0.284	0.703	99.23821	772.16977	49.619105	386.084885
33	12.2	0.287	0.709	100.95775	792.04158	50.478875	396.02079
34	12.3	0.289	0.715	102.67227	812.0949	51.336135	406.04745
35	12.4	0.291	0.72	104.39023	832.39607	52.195115	416.198035
36	12.5	0.294	0.726	106.12174	853.02717	53.06087	426.513585
37	12.6	0.296	0.732	107.87799	874.0814	53.938995	437.0407
38	12.7	0.298	0.738	109.67066	895.65893	54.83533	447.829465
39	12.8	0.301	0.744	111.51149	917.8635	55.755745	458.93175
40	12.9	0.303	0.749	113.41201	940.79988	56.706005	470.39994
41	13	0.306	0.755	115.38327	964.57206	57.691635	482.28603

- Diagram Wageningen B4-55 dari buku G. Kuiper dengan P/D 0,9



Keterangan :

- Garis intermitten merah adalah garis KT P/D 0.9
- Garis intermitten biru adalah garis 10KQ P/D 0.9
- Garis intermitten hijau adalah garis efisiensi open water P/D 0.9

- Daya EHP, DHP, dan BHP

Muatan (DWT) %	EHP (KW)				
	9	10	11	12	13
0	154.4486	211.2324	283.4865	376.2166	482.286
20	171.0577	234.4542	315.5144	420.4352	540.6878
40	172.5147	237.103	320.4214	429.7774	555.2521
60	174.4467	240.376	326.138	440.1748	571.2431
80	176.6602	244.02	332.3418	451.2294	588.1573
100	179.0915	247.9556	338.9404	462.844	605.8855

- Sea Trial

Muatan (DWT) %	QPC				
	9 Knot	10 Knot	11 Knot	12 Knot	13 Knot
0	0.820507	0.796015	0.796015	0.796015	0.783768
20	0.796015	0.789892	0.783768	0.783768	0.771522
40	0.783768	0.771522	0.759276	0.759276	0.753152
60	0.759276	0.747029	0.734783	0.734783	0.716413
80	0.722536	0.698044	0.698044	0.698044	0.685797
100	0.722536	0.698044	0.685797	0.685797	0.661305

Muatan (DWT) %	DHP (KW)				
	9 Knot	10 Knot	11 Knot	12 Knot	13 Knot
0	188.2355	265.3624	356.1322	472.6252	615.3426
20	214.8927	296.8182	402.5608	536.4279	700.8067
40	220.1093	307.3185	422.0094	566.0361	737.2375
60	229.7541	321.7759	443.8563	599.0543	797.3653
80	244.5001	349.5769	476.1046	646.42	857.6257
100	247.8651	355.215	494.2283	674.8992	916.1974

Muatan (DWT) %	BHP(KW)				
	9 Knot	10 Knot	11 Knot	12 Knot	13 Knot
0	192.0771	270.7779	363.4002	482.2706	627.9006
20	219.2782	302.8757	410.7763	547.3754	715.1089
40	224.6013	313.5903	430.6219	577.5879	752.2831
60	234.4429	328.3428	452.9146	611.2799	813.6381
80	249.4899	356.7112	485.821	659.6122	875.1282
100	252.9235	362.4643	504.3146	688.6726	934.8953

- **Sea Margin**

<b>Muatan (DWT) %</b>	<b>QPC</b>				
	<b>9 Knot</b>	<b>10 Knot</b>	<b>11 Knot</b>	<b>12 Knot</b>	<b>13 Knot</b>
<b>0</b>	0.808261	0.783768	0.783768	0.783768	0.771522
<b>20</b>	0.747029	0.759276	0.747029	0.747029	0.734783
<b>40</b>	0.734783	0.71029	0.71029	0.71029	0.698044
<b>60</b>	0.722536	0.698044	0.698044	0.698044	0.685797
<b>80</b>	0.698044	0.673551	0.661305	0.661305	0.649058
<b>100</b>	0.673551	0.673551	0.661305	0.661305	0.649058

<b>Muatan (DWT) %</b>	<b>DHP (KW)</b>				
	<b>9 Knot</b>	<b>10 Knot</b>	<b>11 Knot</b>	<b>12 Knot</b>	<b>13 Knot</b>
<b>0</b>	191.0876	269.5087	361.6968	480.01	625.1099
<b>20</b>	228.984	308.7867	422.3588	562.8096	735.8471
<b>40</b>	234.7832	333.8115	451.1135	605.0731	795.4404
<b>60</b>	241.4365	344.3567	467.2172	630.5835	832.962
<b>80</b>	253.079	362.2888	502.5548	682.3322	906.1705
<b>100</b>	265.8916	368.1319	512.5331	699.8954	933.4842

<b>Muatan (DWT) %</b>	<b>BHP(KW)</b>				
	<b>9 Knot</b>	<b>10 Knot</b>	<b>11 Knot</b>	<b>12 Knot</b>	<b>13 Knot</b>
<b>0</b>	194.9873	275.0088	369.0783	489.8061	637.8673
<b>20</b>	233.6571	315.0885	430.9784	574.2955	750.8643
<b>40</b>	239.5747	340.624	460.3199	617.4215	811.6739
<b>60</b>	246.3638	351.3844	476.7522	643.4526	849.9612
<b>80</b>	258.2439	369.6825	512.8111	696.2574	924.6638
<b>100</b>	271.318	375.6448	522.9929	714.179	952.5349



- Perhitungan Daya Motor Induk

- » Menghitung Koefisien Propulsi

- a. Hull Efficiency ( $\eta_H$ )

$$(\eta_H) = (1 - t) / (1 - w)$$

Dengan menggunakan diagram pada buku Marine Propellers and Propulsion Hal. 70, maka diperoleh

$$w = 0,5C_b - 0,05$$

$$= 0,31$$

$$t = k \times w$$

$$= 0,155$$

$k$  = koefisien yang besarnya tergantung dari bentuk buritan, tinggi kemudi dan kemudi kapal

= 0,5 ~ 0,7 (untuk kemudi yang stream line dan mempunyai konstruksi

1.816 belahan pada tepat segaris dgn sumbu baling-baling)

= 0,7 ~ 0,9 (untuk kemudi yang stream line biasa)

= 0,9 ~ 1,05 (untuk kapal-kapal kuno yang terdiri dari satu lembar pelat lempeng)

$k$  = 0,5

maka diperoleh,

$$\eta_H = (1 - t) / (1 - w)$$

$$= 1,224638$$

- b. Relative Rotative Efficiency ( $\eta_{rr}$ )

Harga  $\eta_{rr}$  untuk kapl dengan propeller type single screw berkisar 1,0 - 1,1 ( Principal of Naval Architecture hal 152 ) pada perencanaan propeller dan tabung poros propeller diambil harga

$$\eta_{rr} = 1$$

- c. Propeller Open Water Efficiency ( $\eta_o$ )

Harga efisiensi propulsi pada test open water yaitu berkisar antara :

$$\eta_0 = \begin{matrix} 50 - 70 \\ \% \\ 70\% \end{matrix} \quad (\text{berdasarkan muatan dan kecepatan})$$

d. Efisiensi Delivered ( $\eta_D$ )

Harga efisiensi delivered adalah perkalian antara efisiensi lambung kapal, efisiensi propulsi dan efisiensi relatif rotatif ( Practical Ship Hydrodynamic, hal 64 )

$$\eta_D = \begin{matrix} \eta_H \times \eta_0 \\ \times \eta_{rr} \\ 0 \end{matrix}$$

e. Shafting Efficiency ( $\eta_s$ )

Untuk kapal dengan mesin berada dibagian belakang, nilai effisiensinya yaitu : ( basic ship theory vol. II" hal. 403)

$$\eta_s = \begin{matrix} 0,97 - 0,98 \\ 0.98 \end{matrix}$$

d. Propeller Behind Hull Efficiency ( $\eta_b$ ) ( Practical Ship Hydrodynamic, hal 64 )

$$\eta_b = \begin{matrix} \eta_0 \times \eta_{rr} \\ = \end{matrix}$$

e. Koefisien Propulsi ( $\eta_p$ ) ( Practical Ship Hydrodynamic, hal 64 )

$$\eta_p = \begin{matrix} \eta_H \times \eta_{rr} \times \eta_0 \times \eta_s \\ = \end{matrix}$$

» Menghitung Speed Of Advance (  $V_a$  ) principle of naval architecture" hal. 146

$$V_a = \begin{matrix} ( 1 - w ) \times V_s \\ = 3.904296 \quad \text{m/s} \\ = 7.59 \quad \text{knot} \end{matrix}$$

» Daya Dorong Baling-Baling ( Thrust ) principle of naval architecture" hal. 152

$$T = \frac{R}{(1-t)}$$

$$= \frac{56.70532544 \text{ KN}}{113.4107} = 0.5000000000$$

» Menghitung Trust Horse Power (THP) "Harvald Resistance and Propulsion of Ships, hal 133 )

$$THP = T \times V_a$$

$$= 221.3943753 \text{ KW}$$

$$= 296.8946967 \text{ HP}$$

» Menghitung Delivered Horse Power (DHP)

$$DHP = \frac{EHP}{\eta_D}$$

$$= \text{KW}$$

$$= \text{HP}$$

» Menghitung Shaft Horse Power ( SHP )

$$SHP = \frac{DHP}{\eta_s}$$

$$= \text{KW}$$

$$= \text{HP}$$

» Menghitung Power Main Engine ( BHP )

$$BHP_{scr} = \frac{SHP}{0,98}$$

$$= \text{hp}$$

$$= \text{kw}$$

$$BHP_{mcr} = \frac{BHP_{scr}}{0,75}$$

$$= \text{HP}$$

$$\begin{aligned}
 &= \text{KW} \\
 \text{Quasi Propulsif Coeficient (QPC)} & \\
 \text{QPC} &= \eta_0 \times \eta_R \times \eta_H \\
 &= \text{(berdasarkan muatan dan kecepatan)}
 \end{aligned}$$

Untuk kapal jenis general cargo dengan single screw dan mesin berada di belakang maka perhitungan propulsinya adalah :

- » diameter max propeller "tahanan dan propulsi kapal" hal. 137
 
$$\begin{aligned}
 D_p &= \frac{2}{3} T \\
 &= 1.422 \quad \text{m}
 \end{aligned}$$
- » jarak sumbu poros ke lunas (E) "principle of naval architecture vol II" hal. 159
 
$$\begin{aligned}
 E &= 0.045T + 0.5D_p \\
 &= 0.823455 \quad \text{m}
 \end{aligned}$$
- » tinggi air di atas propeller "tahanan dan propulsi kapal" hal. 196
 
$$\begin{aligned}
 h &= (T - E) + 0,0075L_{bp} \\
 &= 2.03142 \quad \text{m}
 \end{aligned}$$
- » Koefisien angka taylor (Bp) "principle of naval architecture" hal 191
 
$$\begin{aligned}
 B_{p1} &= N \times SHP^{1/2} \times V_A^{-5/2} \\
 &=
 \end{aligned}$$

$$K_Q^{1/4} \times J^{-5/4} = 0,1739 \times B_{PI}^{1/2}$$

» Tekanan pada poros propeller "tahanan dan propulsi kapal" hal 196

$$P_O - P_V = \frac{99.60 - (10.05 \times h)}{79.184229} \text{ KN/m}^2$$

» Nilai Ae/Ao ( Rasio luas bentang daun propeller ) "principle of naval architecture" hal. 183

$$Ae/Ao = \frac{\{(1.3 + (0.3 \times Z) \times T) / ((P_O - P_V) \times D_P^2)\} + k}{}$$

dimana :

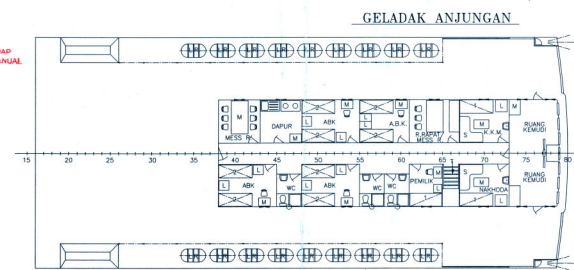
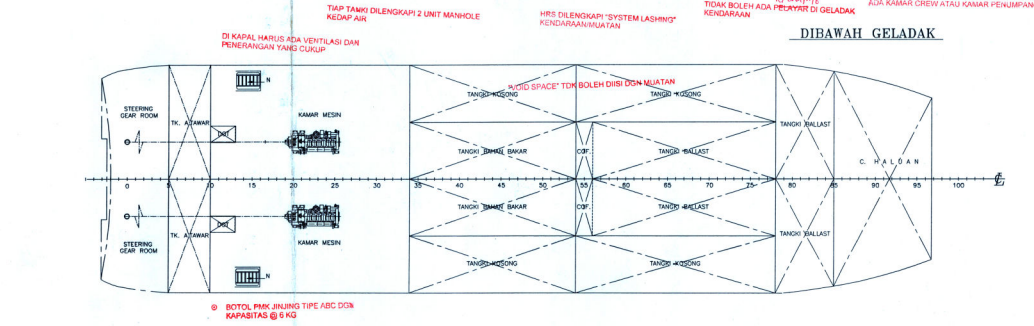
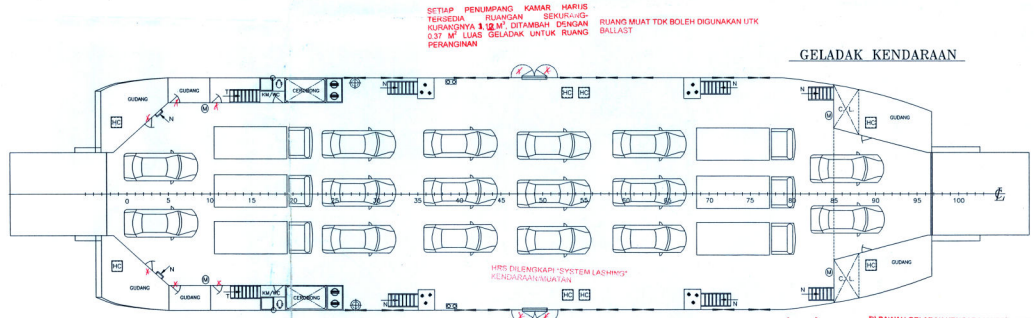
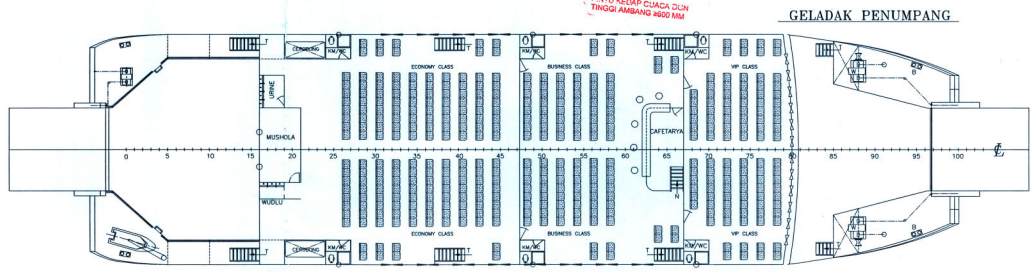
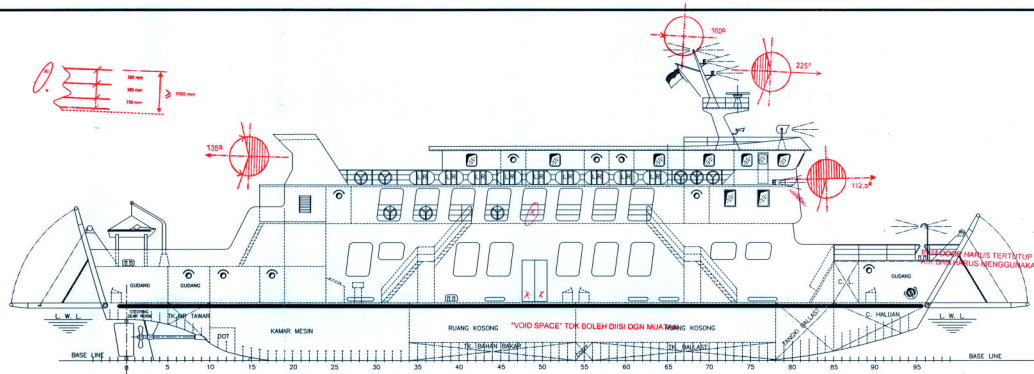
$$k = (0,1 \sim 0,2) \text{ untuk kapal dengan single screw}$$

$$= 0.1$$

sehingga

$$Ae/Ao = 0.55$$





**103/KMP/TPK/X-10  
DIKETAHUI**

A.n. Direktur Jenderal Perhubungan Laut  
Direktori Perhubungan dan Kapal

REKOMENDASI YANG SELAM TERCAHYA  
DALAM GAMBAR (NO. HAKUS, MENGENAI  
KEPENTINGAN DESAIN JENIS KAPAL INI

**11/11/2011**  
M. M. F. ROCHIM, M. S. I.  
Pemeriksa Teknik (P/TP)

**UKURAN UTAMA**

PANJANG SELURUHNYA (LOA)	54.00 M
PANJANG ANTARA GARIS TEGAK (LBP)	47.45 M
LEBAR (B)	14.00 M
TINGGI (H)	3.50 M
SARAT AIR (T)	2.50 M
MESIN UTAMA (ME)	2 x 900 HP
GROSS TONNAGE (GT)	1053 GRT
PENUMPANG	400 ORANG
ABK	16 ORANG
KECEPATAN (V)	12 KNOT
KENDARAAN	6 TRUK 16 SEDAN

**K L A S** BKI: A 100 P "KAPAL PENYEBERANGAN" - SM

**CATATAN:**  
1. KAPAL HARUS DILENGKAPI  
2. KAMAR MESIN  
3. KAPAL HARUS SESUAI COLREG 72  
4. KAMAR MESIN  
- VENTILASI UDARA & PENDINGINAN CIKUP  
- 20 BOTOL PMK JINANG TIPE ABC DUN  
- KAPASITAS @ 6 KG  
5. PERANGKAT RADIO SESUAI PERATURAN  
6. ALAT PEWAGAH PENKEMBARAN SESUAI DENGAN  
PERATURAN

**VERIFIKASI AKHIR KESELESAIAN GAMBAR DAN  
KONDISI FISIK KAPAL HARUS DIPERNSA DATAS  
KAPAL OLAK M DITERIM HUBLA**

MODIFICATION DETAIL/DESCRIPTION		REV :	BY:
<b>PT. ASDP INDONESIA FERRY (Persero)</b>			
<b>GENERAL ARRANGEMENT KMP. BANTOHARU</b>			
DRAWN BY	<i>afis</i>	2-11-2011	
CHECKED BY	<i>hee</i>	3-11-2011	
APPROVED BY			
SCALE	1 : 150	PROJECT No. :	DRAWING No. :

## SHIP PARTICULAR

### I. KAPAL PENYEBERANGAN

- |                          |  |
|--------------------------|--|
| 1. PEMILIK               | ; PT ASDP INDONESIA FERRY (PERSERO)                            |
| 2. NAMA KAPAL            | ; KMP. BONTOHARU   |
| 3. GALANGAN / PEMBUATAN  | ; PT IKI MAKASSAR  |
| 4. TAHUN PEMBUATAN       | ; 2 0 0 3  |
| 5. MATERIAL              | ; BAJA   |
| 6. TYPE KAPAL            | ; PASSENGER SHIP   |
| 7. KALASIFIKASI          | ; B.K.I , Code Klas ; + A.100 (I) P <sup>o</sup> Ferry Ro - Ro |
| 8. KEBANGSAAN ( BENDERA) | ; INDONESIA  |
| 9. NAMA PANGGILAN        | ; Y H K W  |
| 10. N O, I M O           | ; 9210593  |
| 11. TANDA SELAR          | ; 634 / LL.a   |
| 12. GROSS AKTE           | ; 3963 (26 Desember 2005)                                      |

### II. UKURAN UTAMA

- |                                 |                  |
|---------------------------------|------------------|
| 1. PANJANG SELURUHNYA ( L.O.A ) | ; 54,00 Meter    |
| 2. PANJANG GARIS AIR ( L.B.P )  | ; 48,13 Meter    |
| 3. LEBAR BREADTH ( B )          | ; 14,00 Meter    |
| 4. TINGGI CAR DECK              | ; 3,8 Meter      |
| 5. DEPTH ( D )                  | ; 3,50 Meter     |
| 6. SARAT FREE BOARD             | ; 2,5 Meter      |
| 6. G T                          | ; 1124 ,NT : 359 |

### III. KAPASITAS TANGKI

- |                       |                                       |
|-----------------------|---------------------------------------|
| 1. TANGKI BBM         | ; 2 x 30 Ton                          |
| 2. TANGKI AIR TAWAR   | ; 2 x 33,688 Ton                      |
| 3. TANGKI AIR BALLAST | ; DEPAN : 40 Ton<br>BELAKANG : 30 Ton |

### IV. MESIN UTAMA

- |                          |                |
|--------------------------|----------------|
| 1. MERK                  | ; YANMAR       |
| 2. TYPE                  | ; 12 LAA UTE 1 |
| 3. HP                    | ; 1000         |
| 3. JUMLAH MESIN          | ; 2 Unit       |
| 4. KECEPATAN MAKSIMUM    | ; 9 Knots      |
| 5. TAHUN PEMBUATAN MESIN | ; 2002         |
| 6. R P M                 | ; 1850 ✓       |
| 7. JENIS BAHAN BAKAR     | ; HSD          |

### V. MESIN BANTU

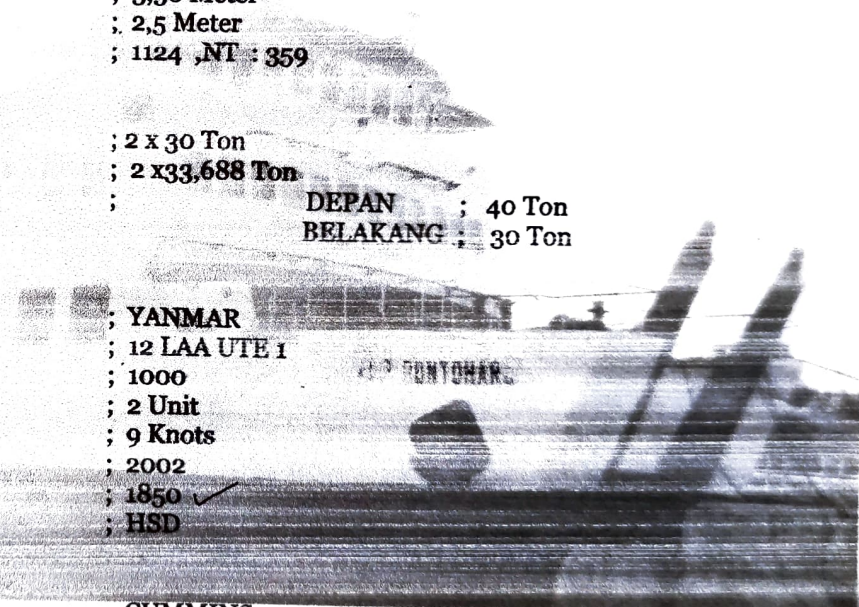
- |                 |                  |
|-----------------|------------------|
| 1. MERK         | ; CUMMINS        |
| 2. TYPE         | ; 6 BT 5,9 D (M) |
| 3. HP           | ; 122 ✓          |
| 4. JUMLAH MESIN | ; 2 Unit         |

### VI. KAPASITAS MUAT

- |                     |             |
|---------------------|-------------|
| 1. JUMLAH PENUMPANG | ; 300 Orang |
| 2. JUMLAH KENDARAAN | ; 22 Unit   |
| 3. JUMLAH ABK       | ; 17 Orang  |

### VII. PINTU RAMPDOR

- |                     |  |
|---------------------|--|
| 1. HALUAN & BURITAN | ; PANJANG = 6 Meter<br>; LEBAR = 4 Meter |
|---------------------|--|

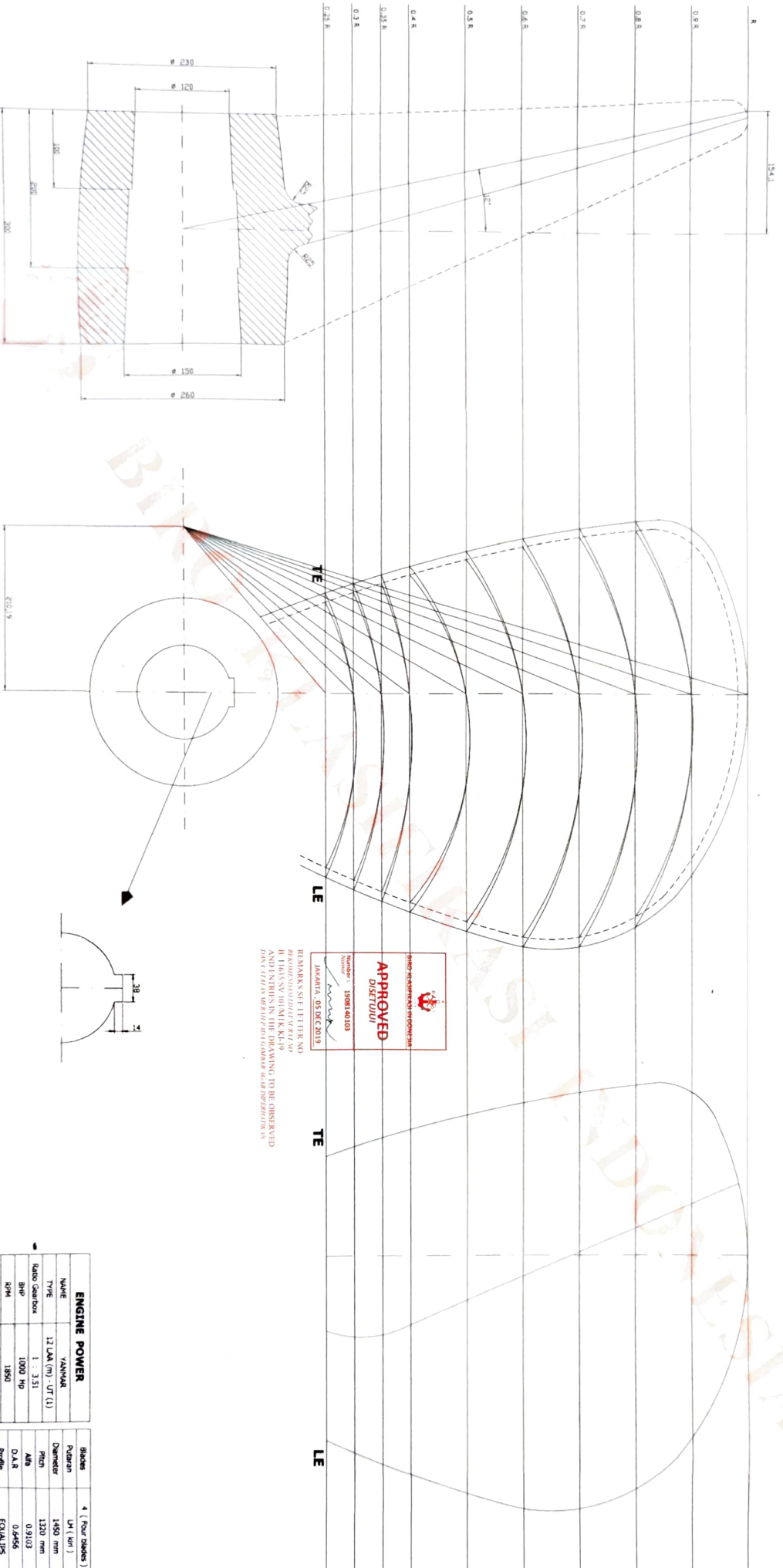




### Side View

### Developed & Projected

### Expanded



BRITISH STANDARDS INSTITUTION  
**APPROVED**  
 DISCREETLY  
 Number: 1080140103  
 Issue: 1  
 JAKARTA, 05 DEC 2019

BRITISH SHEET NO.  
 B166551/101/101/101/101  
 B166551/101/101/101/101  
 AND ENTERS IN THE DRAWING TO BE OBSERVED  
 AND IN THE DRAWING TO BE OBSERVED

R	Radius	TE CH	Pitch	LE CH	Chord	Max Th
0.2 R	145.00	-	-	437.09	468.24	76.00
0.2 R	141.25	128.55	1200.00	232.97	393.41	60.00
0.3 R	217.50	140.44	1200.00	282.82	418.59	64.00
0.3 R	223.75	151.92	1200.00	297.66	443.81	64.00
0.4 R	290.00	164.55	1200.00	281.76	469.02	64.00
0.4 R	296.25	181.46	1200.00	305.13	494.24	64.00
0.5 R	435.00	197.53	1200.00	324.23	521.48	36.00
0.5 R	441.25	210.02	1200.00	324.94	548.79	36.00
0.6 R	580.20	219.83	1200.00	298.93	514.79	26.00
0.6 R	586.45	233.90	1200.00	231.15	444.23	18.00

**ENGINE POWER**

NAME	YANMAR
TYPE	12 LAA (M) UT (1)
Ratio Gearbox	1 : 3.51
BHP	1000 Hp
RPM	1850
RATING	CONTINUOUS

**Blades** 4 (Four blades)  
**Material** LM (Al)  
**Diameter** 1450 mm  
**Pitch** 1320 mm  
**AM** 0.9103  
**O.A.R** 0.6456  
**Profile** EQUALISE  
**Material** Magnesium Bronze (CU)  
**Weight** 300 kg

Designed by: **PT. MARINA TEHNIK ABADI**  
 Foundry: **CV. JAYA LOGAM**  
 Drawn by: **KMP. BONTOHARU**  
 Checked by: **PT. ASDP (PENSERO)**  
 No. Draw: **PROPPELLER DETAIL**  
 Date: **13-11-2019**  
 Scale: **A2**

This drawing and the information contained here in is supplied on the understanding that they are the exclusive property of PT. MARINA TEHNIK ABADI. They must not be used or reproduced in part without permission in writing.

## SHIP PARTICULAR

### I. KAPAL PENYEBERANGAN

- |                          |  |
|--------------------------|--|
| 1. PEMILIK               | ; PT ASDP INDONESIA FERRY (PERSERO)                            |
| 2. NAMA KAPAL            | ; KMP. BANTOHARU   |
| 3. GALANGAN / PEMBUATAN  | ; PT IKI MAKASSAR  |
| 4. TAHUN PEMBUATAN       | ; 2 0 0 3  |
| 5. MATERIAL              | ; BAJA   |
| 6. TYPE KAPAL            | ; PASSENGER SHIP   |
| 7. KALASIFIKASI          | ; B.K.I , Code Klas ; + A.100 (I) P <sup>o</sup> Ferry Ro - Ro |
| 8. KEBANGSAAN ( BENDERA) | ; INDONESIA  |
| 9. NAMA PANGGILAN        | ; Y H K W  |
| 10. N O, I M O           | ; 9210593  |
| 11. TANDA SELAR          | ; 634 / LL.a   |
| 12. GROSS AKTE           | ; 3963 (26 Desember 2005)                                      |

### II. UKURAN UTAMA

- |                                 |                  |
|---------------------------------|------------------|
| 1. PANJANG SELURUHNYA ( L.O.A ) | ; 54,00 Meter    |
| 2. PANJANG GARIS AIR ( L.B.P )  | ; 48,13 Meter    |
| 3. LEBAR BREADTH ( B )          | ; 14,00 Meter    |
| 4. TINGGI CAR DECK              | ; 3,8 Meter      |
| 5. DEPTH ( D )                  | ; 3,50 Meter     |
| 6. SARAT FREE BOARD             | ; 2,5 Meter      |
| 6. G T                          | ; 1124 ,NT : 359 |

### III. KAPASITAS TANGKI

- |                       |                                       |
|-----------------------|---------------------------------------|
| 1. TANGKI BBM         | ; 2 x 30 Ton                          |
| 2. TANGKI AIR TAWAR   | ; 2 x 33,688 Ton                      |
| 3. TANGKI AIR BALLAST | ; DEPAN : 40 Ton<br>BELAKANG : 30 Ton |

### IV. MESIN UTAMA

- |                          |                |
|--------------------------|----------------|
| 1. MERK                  | ; YANMAR       |
| 2. TYPE                  | ; 12 LAA UTE 1 |
| 3. HP                    | ; 1000         |
| 3. JUMLAH MESIN          | ; 2 Unit       |
| 4. KECEPATAN MAKSIMUM    | ; 9 Knots      |
| 5. TAHUN PEMBUATAN MESIN | ; 2002         |
| 6. R P M                 | ; 1850 ✓       |
| 7. JENIS BAHAN BAKAR     | ; HSD          |

### V. MESIN BANTU

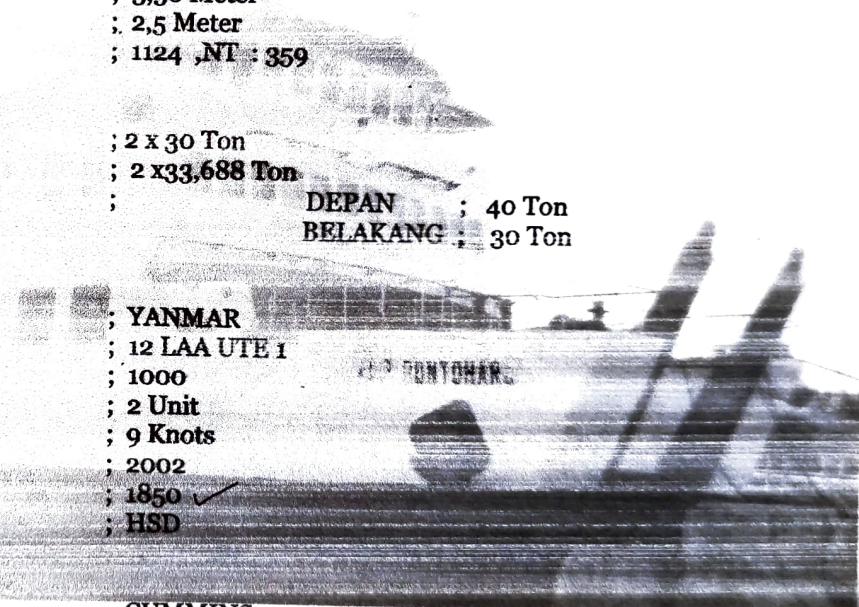
- |                 |                  |
|-----------------|------------------|
| 1. MERK         | ; CUMMINS        |
| 2. TYPE         | ; 6 BT 5,9 D (M) |
| 3. HP           | ; 122 ✓          |
| 4. JUMLAH MESIN | ; 2 Unit         |

### VI. KAPASITAS MUAT

- |                     |             |
|---------------------|-------------|
| 1. JUMLAH PENUMPANG | ; 300 Orang |
| 2. JUMLAH KENDARAAN | ; 22 Unit   |
| 3. JUMLAH ABK       | ; 17 Orang  |

### VII. PINTU RAMPDOR

- |                     |  |
|---------------------|--|
| 1. HALUAN & BURITAN | ; PANJANG = 6 Meter<br>; LEBAR = 4 Meter |
|---------------------|--|





## SAFEPOWER – SPE TT FC 20 – 120kVA (50/60 or 60/50Hz)

3 phase INPUT/3 phase OUTPUT

MODEL	SPE FC20	SPE FC30	SPE FC40	SPE FC50	SPE FC60	SPE FC80	SPE FC100	SPE FC120
Nominal Rating (kVA)	20	30	40	50	60	80	100	120
Topology	ON LINE DOUBLE CONVERSION – VFI-SS-111 WITH INVERTER OUTPUT transformer							
<b>INPUT CHARACTERISTICS</b>								
Voltage (Vac)	380 – 400 – 415 (other voltages on request)							
Phases	3							
Frequency (Hz)	50 or 60Hz							
<b>OUTPUT CHARACTERISTICS</b>								
Nominal Power (kVA)	20	30	40	50	60	80	100	120
Active Power (kW) @0.8pf	16	24	32	40	48	64	80	96
Nominal voltage (Vac)	380 – 400 - 415 + N (other voltages on request)							
Phase	3							
Frequency (Hz)	50 or 60 Hz							
Waveform	SINUSIODAL							
Crest factor	3:1							
THD (linear load)	<2%							
THD (non-linear load)	<5% in accordance with BS EN50091-3							
Voltage regulation	±1% steady state ±5% dynamic. Recovery to within steady state limits within 20msecs							
Voltage symmetry	Balanced load - <1% 100% unbalanced load - <2%							
Overload	125% for 10 minutes. 150% for 60 seconds.							
Frequency regulation	±0.05% internal oscillator							
<b>BATTERIES (if fitted)</b>								
Type	Valve regulated lead acid (VRLA). Vented Lead Acid or NiCad's							
Mounting	Externally mounted on OPEN or CLADDED racks or cubicles							
<b>COMMUNICATION &amp; MANAGEMENT</b>								
Signalling & alarms	Large screen with 4 line, 20 character alphanumeric, multi-coloured status indication and audible alarm							
Emergency stop	Yes							
Communication	Communications interface board with volt-free/RS232/9 Pin 'D' and optical.							
<b>PHYSICAL CHARACTERISTICS</b>								
Dimensions (W x D x H))	550 x 850 x 1100				700 x 860 x 1400		1100 x 800 x 1400	
Weight (kgs)	250	275	300	340	370	550	680	820
Noise	60 - 63							
IP rating	IP21							IP20
<b>ENVIRONMENTAL</b>								
Temperature/Humidity	0 to +40° C/20-80% non-condensing (EXCL Batteries)							
<b>STANDARDS &amp; COMPLIANCE</b>								
EN62040-1 EMC EN62040-2 directives 73/23 – 93/68-2004/108 & EN62040-3								

# Eaton 93PR UPS 25-200 kW

## Technical specifications

General								
UPS output power rating (1.0 p.f.)	25, 50, 75, 100, 125, 150, 175, 200kW							
Efficiency in double conversion mode	> 96%							
Efficiency in Energy Saver System (ESS)	> 99%							
Static bypass rating	200kW							
External paralleling	up to 4 units with HotSync technology							
UPS topology	Double conversion							
UPS degree of protection	IP20							
Acoustic noise at 1 m, in 25 °C ambient temperature	< 70 dBA in double conversion, < 55 dBA in ESS							
Altitude (max)	1000m above sea level at 40 °C. Maximum 2000m with 1% derating per each add. 100 m							
Input								
Rated input voltage	220/380 V, 230/400 V, 240/415 V 50/60 Hz							
Voltage tolerance - Rectifier input	187 to 276 V							
Voltage tolerance - Bypass input	rated voltage -15% / +10%							
Rated input frequency	50 or 60 Hz, user configurable							
Frequency tolerance	40 to 72 Hz							
Input wiring	3 phase + neutral							
Input power factor at 100% load	> 0.99							
Input ITHD	< 3%							
Rated input r.m.s current	25kW	50kW	75kW	100kW	125kW	150kW	175kW	200kW
380V	40 A	80 A	120 A	159 A	199 A	239 A	278 A	318 A
400V	38 A	76 A	114 A	151 A	189 A	227 A	264 A	302 A
415V	37 A	73 A	110 A	146 A	182 A	219 A	255 A	291 A
Soft start capability	Yes							
Internal backfeed protection	Yes							
Output								
Output wiring	3 phase + neutral							
Rated output voltage rating	220/380 V, 230/400 V, 240/415 V, configurable							
Total voltage harmonic distortion	< 1% (100% linear load); < 3% (100% non-linear load)							
Output power factor	1.0							
Permitted load power factor	0.8 lagging to 0.8 leading							
Overload on inverter	10 min 102-110%, 60 sec 111-125%, 10 sec 126-150%, 300 ms > 150%.							
Overload on bypass	Continuous < 125%, 20 ms 100%							
Battery								
Battery type	12V, VRLA							
Charging method	ABM technology or Float							
Temperature compensation	Optional							
Battery nominal voltage (VRLA)	480 V							
Battery quantity	36 to 44 blocks. Default is 40 blocks							
Charge current limit	Default 5A, configurable maximum 25A per UPM							
Battery start capability	Yes							
Communications								
Minislot	3 communication bays							
Network/SNMP interface	Yes, optional							
Serial ports	Built-in host and device USB							
Standard connectivity ports	Mini-slot ports for optional cards, Device USB and Host USB, RS-232 service port, relay output, 5 building alarm inputs and a dedicated EPO							
Accessories								
	MiniSlot connectivity (Web/SNMP, ModBus/Jbus, Relay) External Battery Cabinet(EBC) Parallel Tie Cabinet(PTC) External Maintenance Bypass Switches(EMBS) External Battery Cabinet Breaker(EBCB)							
Compliance with standards								
Safety	IEC 62040-1							
EMC	IEC 62040-2							
Performance	IEC 62040-3							

Due to continuous product improvement programmes, specifications are subject to change without notice.

# Open Set

## 70 - 250 kVA @ 50 Hz /

### Features:

- Cummins water cooled diesel engine
- Oil and fuel filter, lub-oil drain valve fitted
- 50°C Radiator with drain tap for all models except for C100D5 / C90D6
- Mechanical governor on 4B, 6B and 6C
- Electronic governor on 4BTA3.9G3/G4, 6BTA5.9G2, QSB7 and 6CTAA
- Normal duty air filter
- Single bearing alternator class H/H
- Standard voltage 400 v 50 Hz, 480 v 60 Hz
- Exciter / Voltage regulator - Torque Match as std
- PCC1301 control standard
- PCC1302 (PC1.1) for QSB7
- 3-pole circuit breaker
- Fuel tank with flexible fuel hoses fitted
- Fuel tank capacity designed for up to 8 hours operation
- Starting Batteries 12v
- Industrial Silencer
- Steel base frame with anti-vibration mounting



### Options:

- 4-pole circuit breaker
- Other voltage options available

#### Power output 50 Hz

Model Name	kVA		kWe		Engine				Stamford Alternator	Open Set		
	Standby <sup>+</sup>	Prime <sup>+</sup>	Standby <sup>+</sup>	Prime <sup>+</sup>	Type	Cyl Arr	Bore x Stroke mm	Disp (L)		Dimension (L x W x H) mm	Dry Weight (Kg)	Tank (L)
C70 D5	70	63	56	50	4BT3.9G4	4L	102 x 120	3.9	UC224F	1920 x 1050 x 1438	1060	200
C80 D5	80	72	64	58	4BTA3.9G3	4L	102 x 120	3.9	UC224F	1920 x 1050 x 1438	1120	200
C90 D5	90	80	72	64	4BTA3.9G4	4L	102 x 120	3.9	UC224G	1920 x 1050 x 1438	1165	200
C100 D5	100	90	80	72	4BTA3.9G4	4L	102 x 120	3.9	UC274C	1920 x 1050 x 1438	1195	200
C110 D5B	110	100	88	80	6BTA5.9G1 - I	6L	102 x 120	5.9	UC274C	2220 x 1050 x 1577	1280	320
C125 D5	125	113	100	90	6BTA5.9G2 - I	6L	102 x 120	5.9	UC274V	2220 x 1050 x 1577	1280	320
C150 D5*	150	136	120	109	6BTA5.9G2	6L	102 x 120	5.9	UC274E	2220 x 1050 x 1577	1390	320
C150 D5e	150	136	120	109	QSB7G3	6L	107 x 124	6.69	UC274F	2656 x 1000 x 1653	1467	470
C175 D5e	175	158	140	126	QSB7G5	6L	107 x 124	6.69	UC274G	2656 x 1000 x 1653	1598	470
C200 D5e	200	182	160	146	QSB7G5	6L	114 x 135	8.3	UC274J	2656 x 1000 x 1653	1739	470
C200 D5S	204	185	163	148	6CTA8.3G2	6L	114 x 135	8.3	UC274H	2427 x 1000 x 1685	1870	340
C220 D5e	220	200	176	160	QSB7G5	6L	114 x 135	8.3	UC274J	2656 x 1000 x 1653	1739	470
C250 D5*	250	227	200	182	6CTAA8.3G2	6L	114 x 135	8.3	UC274J	2623 x 1020 x 1685	2018	340

#### Power output 60 Hz

Model Name	kVA		kWe		Engine				Stamford Alternator	Open Set		
	Standby <sup>+</sup>	Prime <sup>+</sup>	Standby <sup>+</sup>	Prime <sup>+</sup>	Type	Cyl Arr	Bore x Stroke mm	Disp (L)		Dimension (L x W x H) mm	Dry Weight (Kg)	Tank (L)
C60 D6	75	69	60	55	4BT3.9G4	4L	102 x 120	3.9	UC224E	1920 x 1050 x 1438	1060	200
C70 D6	88	81	70	65	4BTA3.9G3	4L	102 x 120	3.9	UC224F	1920 x 1050 x 1438	1120	200
C80 D6	100	90	80	72	4BTA3.9G4	4L	102 x 120	3.9	UC224G	1920 x 1050 x 1438	1165	200
C90 D6	112.5	100	90	80	4BTA3.9G4	4L	102 x 120	3.9	UC274C	1828 x 630 x 1368	1095	200
C110 D6	138	125	110	100	6BTA5.9G1	6L	102 x 120	5.9	UC274C	2220 x 1050 x 1577	1300	320
C125 D6e	125	113	156	141	QSB7G3	6L	107 x 124	6.69	UC274E	2656 x 1000 x 1653	1546	470
C140 D6*	175	158	140	125	6BTA5.9G2	6L	102 x 120	5.9	UC274E	2220 x 1050 x 1577	1390	320
C150 D6e	188	169	150	135	QSB7G5	6L	107 x 124	6.69	UC274F	2656 x 1000 x 1653	1546	470
C175 D6e	219	200	175	160	QSB7G5	6L	107 x 124	6.69	UC274H	2656 x 1000 x 1653	1544	470
C180 D6	225	206	180	165	6CTA8.3G2	6L	114 x 135	8.3	UC274G	2387 x 1000 x 1685	1870	340
C200 D6e	250	225	200	180	6CTAA8.3G1	6L	114 x 135	8.3	UC274G	2656 x 1100 x 1610	1835	340
C230 D6*	288	256	230	205	6CTAA8.3G2	6L	114 x 135	8.3	UC274J	2623 x 1020 x 1685	2018	340

Specifications may change without notice.

<sup>+</sup>Please refer to pg 15 for ratings definition.  
\*Advantage rating applicable to emergency standby power only.



**KEMENTERIAN PENDIDIKAN DAN KEBUDAYAAN**  
**UNIVERSITAS HASANUDDIN**  
**FAKULTAS TEKNIK**

Jalan Poros Malino Km. 6 Bontomarannu, Gowa, Sulawesi Selatan, 92172  
Telp. (0411) 586015, 586262 Fax. (0411) 586015  
https://eng.unhas.ac.id Email: teknik@unhas.ac.id

**BERITA ACARA UJIAN SARJANA**

Terhadap Mahasiswa

Nama : Agung Setiawan

Stambuk : D33115306

Judul : **Perencanaan Power Take Off Pada Sistem Propulsi Kapal Feri KMP.Bontoharu**

Hari/Tanggal : Rabu, 9 Juni 2021

Waktu : 13.00 wita-selesai

Tempat : Ruang Sidang Teknik Sistem Perkapalan (Daring)

Keputusan Sidang / Catatan : *lulus 86 A*

**PANITIA UJIAN**

No.	Susunan Panitia	Nama	Tanda Tangan
1	Ketua/Anggota	Andi Haris Muhammad, ST.,MT.,Ph.D	1.....
2	Sekretaris/Anggota	Haryanti Rivai, S.T., M.T..Ph.D.	2.....
3	Anggota	Ir. Sherly Klara, M.T.	3.....
4	Anggota	Ir. Zulkifli, M.T.	4.....

Ketua Sidang,

Andi Haris Muhammad, ST.,MT.,Ph.D  
Nip. 19690404 200003 1 002

Gowa ,  
Sekretaris Sidang,

2021

Haryanti Rivai, S.T., M.T..Ph.D.  
Nip. 19790225 200212 2 001