Stiffners

	Shell below 15 cm above DWL							
	Bow	Min or Max Required	15% of LWL aft of FP	Min or Max Required	50% of LWL aft of FP	Min or Max Required	85% of LWL aft of FP	Min or Max Required
Effective width, w [cm]	6.3	18.9	24.15	36.45	30.9	40.5	24.15	24.3
Base gap, b [cm]		12.6	12	24.3	12	27	12	16.2
Outer skin thick, [cm]	0.2		0.25		0.35		0.25	
Inner skin thick, [cm]	0.2		0.2		0.25		0.2	
Core thick, [cm]	0.7		0.900		1.500		0.900	
Web height, h [cm]	3	5.990509327	8.750	8.98576399	11.000	11.98102	10.000	10.483391
Crown width, WC [cm]	7	7.188611192	10.000	10.78291679	14.000	14.37722	14.000	14.377222
Flange length, [cm]	3		5.000	12.15	7.000	18.9	5.000	12.15
Flange thick., t1 [cm]	0.2	0.099	0.300	0.28875	0.400	0.363	0.350	0.33
Crown thick., t2 [cm]	0.4		0.600		0.800		0.800	
K =	0.99841822		0.998418221		0.99841822		0.998418	
Spacing, s [m]	0.36		0.400		0.770		0.730	
Design head [m]	2.7917024		1.56252		1.45401167		1.074233	
CF	0.300		1.436		1.747		1.670	
F	0.67		0.25		0.25		0.25	
L between supports, l [m]	0.64		2.100		2.500		2.4	
Neutral axis, dNA [cm]	2.32979275		4.130524037		5.62096738		5.778143	
I_o [cm^4]	21.930681	19.53343639	440.6339664	429.1514363	1304.5161	1297.017	816.0231	803.75184
Section mod., SM [cm^4]	11.131	3.910706056	70.282	26.18471016	165.568	66.4756	136.645	42.910862
Cross section, A [cm^2]	5.200		14.250		25.600		21.700	

Stiffener weight, [Kg] 39.5343185

Keel Bolts

				Position	Offset	Distance
Keel Volume [m^3] =	0.418			0.02	0	18
Keel Weight [N] =	45106.38			0.2	0.028	71
Keel VCG [m] =	1.325			0.375	0.05	115
Steel =>	A	AH32	AH36	0.55	0.067	149
Yield Strength [N/mm^2] =	235	315	335	0.665	0.077	169
Shear Strength [N/mm^2] =			410	0.71	0.08	175
Ult. Tens. Str. [N/mm^2] =	400	470	490	0.755	0.082	179
				0.838	0.083	181
Min. Diameter [mm] =	19.892	for AH36 steel		0.92	0.082	179
Total # of Bolts =	22			1.01	0.075	165
				1.115	0.057	129
				1.25	0	42

Grounding Load:
For L_{WL} = 14 mt GL = 1.92 * Δ

Yacht Full Displacement, Δ [N] =	99493.02
Min. Yield Strength [N/mm^2] =	235
Min. Shear Yield Strength [N/mm^2] =	410

Bolts shear stresses [N/mm^2] = 30.7092 must be < 307.5

Single-Skin Construction Weights Calculations

Below 0.251 m above DWL

Surface	Area, [m^2]	LCG, [m]	VCG, [m]	TCG, [m]	I-roll, [m^4]	I-pitch, [m^4]	I-yaw, [m^4]	Fwd x, [m]	Ave. Thick, [mm]	Weight, [Kg]
Panel 1	0.552	6.065	0.055	0	0.012	0.021	0.019	6.708	6.000	4.897
Panel 2	9.344	3.407	-0.166	0	4.858	11.106	15.276	5.76	7.750	107.080
Panel 3	1.13	1.535	-0.15	0	1.863	0.057	1.842	1.8	9.450	15.790
Panel 4	4.959	0.306	-0.201	0	10.141	1.581	11.342	1.28	10.800	79.194
Panel 5	8.666	-1.575	-0.29	0	13.118	2.981	15.495	-0.6	11.350	145.441
Panel 6	5.359	-3.193	-0.234	0	7.324	0.822	7.856	-2.56	10.850	85.978
Panel 7	4.836	-4.465	-0.147	0	5.437	0.699	5.959	-3.84	10.300	73.654
Panel 8	3.955	-5.732	-0.021	0	3.043	0.532	3.5	-5.12	9.600	56.142
Panel 9	2.066	-6.822	0.098	0	0.909	0.092	0.989	-6.4	8.950	27.342
Reinforced Shell 1	0.816	1.539	-0.424	0	0.166	0.013	0.178	1.8	12.750	15.384
Reinforced Shell 2	2.933	0.342	-0.45	0	0.592	0.831	1.422	1.28	14.400	62.452
Total	44.616	-1.26645	-0.21095							673.3531507

Above 0.251 m above DWL

Surface	Area, [m^2]	LCG, [m]	VCG, [m]	TCG, [m]	I-roll, [m^4]	I-pitch, [m^4]	I-yaw, [m^4]	Fwd x, [m]	Ave. Thick, [mm]	Weight, [Kg]
Panel 1	1.946	6.174	0.844	0	0.248	0.285	0.128	6.708	6.950	19.999
Panel 2	8.748	3.818	0.773	0	9.3	12.132	19.862	5.76	8	103.4834502
Panel 3	1.072	1.541	0.747	0	2.858	0.103	2.789	1.8	8.95	14.18698009
Panel 4	3.753	0.347	0.74	0	12.906	1.369	13.687	1.28	9.6	53.27481327
Panel 5	3.814	-1.579	0.733	0	14.76	1.473	15.655	-0.6	9.65	54.42270711
Panel 6	2.486	-3.2	0.729	0	9.09	0.502	9.219	-2.56	9.500	34.922
Panel 7	2.513	-4.482	0.726	0	8.141	0.509	8.273	-3.84	9.200	34.186
Panel 8	2.582	-5.764	0.719	0	6.554	0.523	6.685	-5.12	8.600	32.834
Panel 9	1.325	-6.733	0.648	0	2.45	0.128	2.383	-6.4	7.250	14.205
Deck Panel 1	1.66	5.234	1.62	0	0.153	0.438	0.589	6.708	4.900	12.028
Deck Panel 2	10.756	2.492	1.791	0	7.678	10.47	17.054	4.5	5.400	85.885
Deck Panel 3	22.118	-1.358	1.903	0	29.919	39.759	65.453	1	5.750	188.055
Cockpit	20.234	-5.031	1.398	0	20.776	22.898	40.563	-3.3	9.300	278.251
Transom	2.896	-7.028	0.957	0	1.795	0.313	1.591		7.250	31.046
Total	85.903	-1.74895	1.274855							956.779

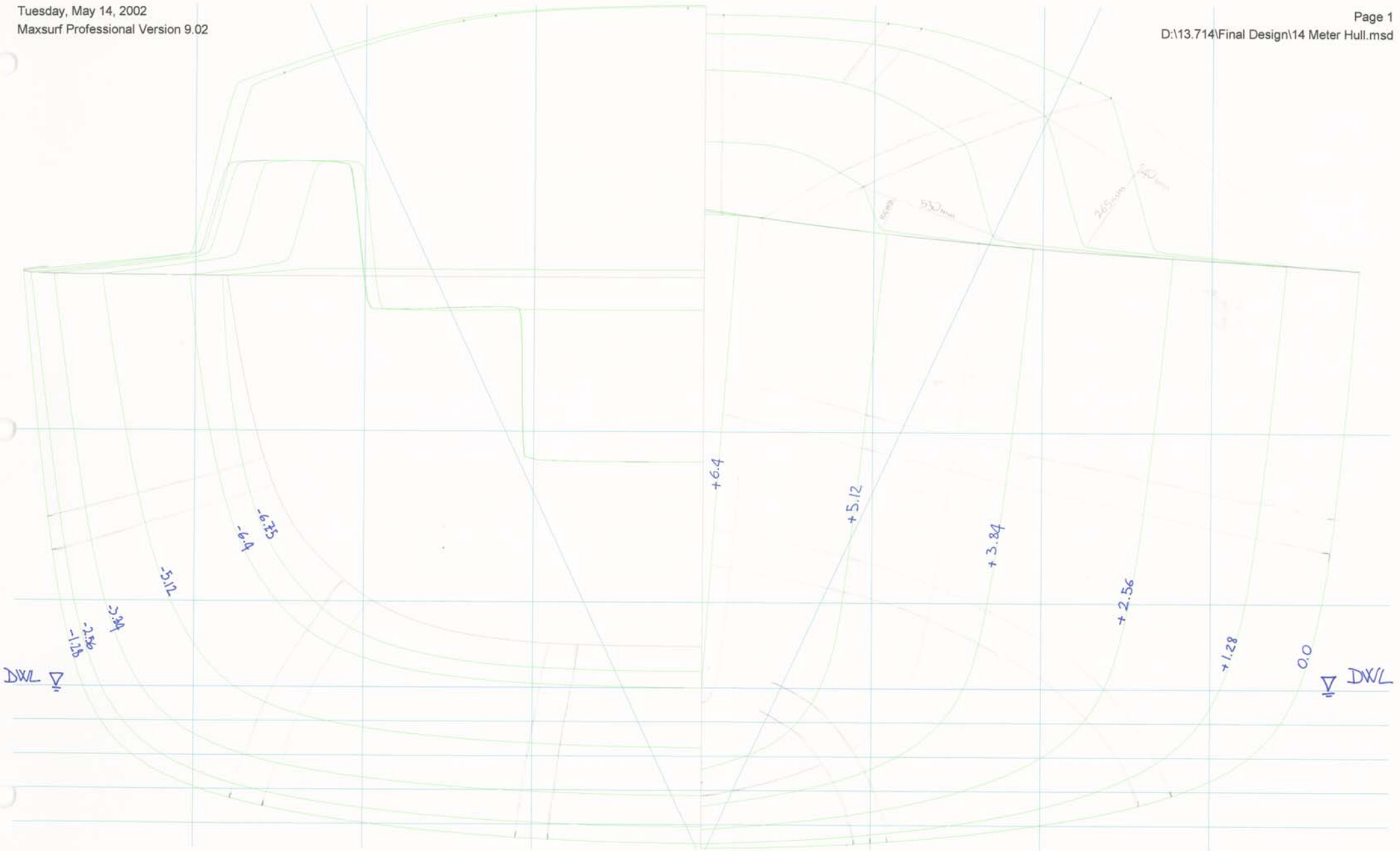
Sandwich Construction Weights Calculations

Below 0.251 m above DWL

Surface	Area, [m^2]	LCG, [m]	VCG, [m]	TCG, [m]	I-roll, [m^4]	I-pitch, [m^4]	I-yaw, [m^4]	Fwd x, [m]	A.S.W., [Kg/m^2]	Weight, [Kg]
Panel 1	0.552	6.065	0.055	0	0.012	0.021	0.019	6.708	6.552	3.617
Panel 2	9.344	3.407	-0.166	0	4.858	11.106	15.276	5.76	7.874	73.572
Panel 3	1.13	1.535	-0.15	0	1.863	0.057	1.842	1.8	9.607	10.856
Panel 4	4.959	0.306	-0.201	0	10.141	1.581	11.342	1.28	10.105	50.108
Panel 5	8.666	-1.575	-0.29	0	13.118	2.981	15.495	-0.6	9.365	81.159
Panel 6	5.359	-3.193	-0.234	0	7.324	0.822	7.856	-2.56	8.868	47.524
Panel 7	4.836	-4.465	-0.147	0	5.437	0.699	5.959	-3.84	8.783	42.475
Panel 8	3.955	-5.732	-0.021	0	3.043	0.532	3.5	-5.12	8.001	31.645
Panel 9	2.066	-6.822	0.098	0	0.909	0.092	0.989	-6.4	7.547	15.591
Reinforced Shell 1	0.816	1.539	-0.424	0	0.166	0.013	0.178	1.8	18.853	15.384
Reinforced Shell 2	2.933	0.342	-0.45	0	0.592	0.831	1.422	1.28	21.293	62.452
Total	44.616	-0.938	-0.226							434.383

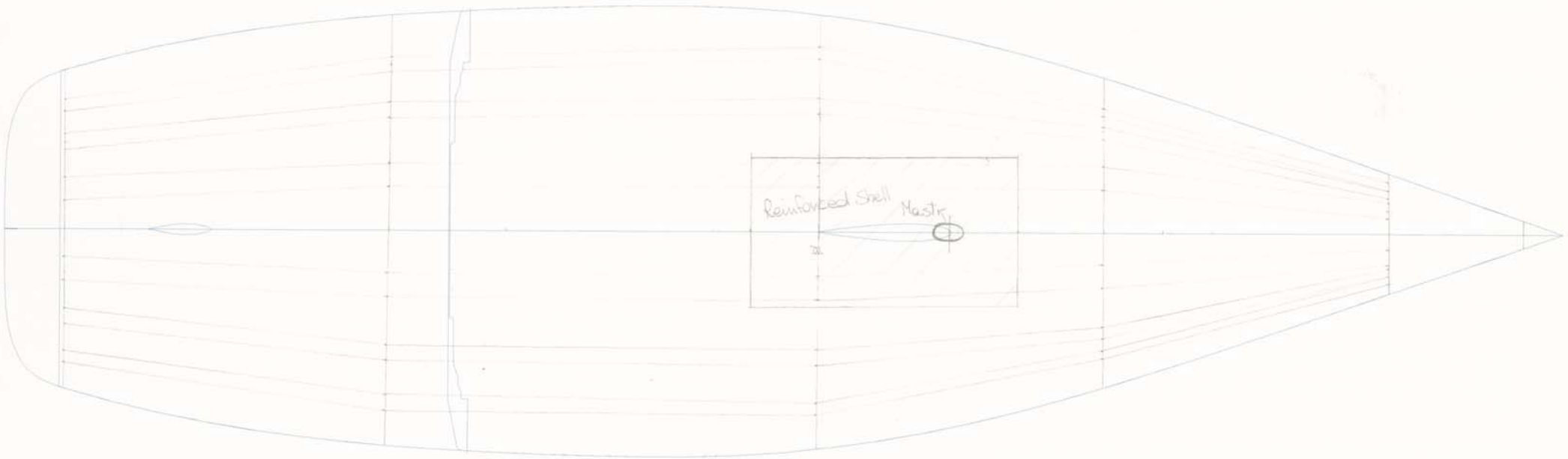
Above 0.251 m above DWL

Surface	Area, [m^2]	LCG, [m]	VCG, [m]	TCG, [m]	I-roll, [m^4]	I-pitch, [m^4]	I-yaw, [m^4]	Fwd x, [m]	A.S.W., [Kg/m^2]	Weight, [Kg]
Panel 1	1.946	6.174	0.844	0	0.248	0.285	0.128	6.708	6.964	13.553
Panel 2	8.748	3.818	0.773	0	9.3	12.132	19.862	5.76	7.377	64.530
Panel 3	1.072	1.541	0.747	0	2.858	0.103	2.789	1.8	7.504	8.044
Panel 4	3.753	0.347	0.74	0	12.906	1.369	13.687	1.28	8.001	30.028
Panel 5	3.814	-1.579	0.733	0	14.76	1.473	15.655	-0.6	8.001	30.517
Panel 6	2.486	-3.2	0.729	0	9.09	0.502	9.219	-2.56	7.589	18.866
Panel 7	2.513	-4.482	0.726	0	8.141	0.509	8.273	-3.84	7.547	18.964
Panel 8	2.582	-5.764	0.719	0	6.554	0.523	6.685	-5.12	7.092	18.311
Panel 9	1.325	-6.733	0.648	0	2.45	0.128	2.383	-6.4	6.637	8.794
Deck Panel 1	1.66	5.234	1.62	0	0.153	0.438	0.589	6.708	6.425	10.665
Deck Panel 2	10.756	2.492	1.791	0	7.678	10.47	17.054	4.5	6.510	70.018
Deck Panel 3	22.118	-1.358	1.903	0	29.919	39.759	65.453	1	6.595	145.861
Cockpit	20.234	-5.031	1.398	0	20.776	22.898	40.563	-3.3	7.589	153.556
Transom	2.896	-7.028	0.957	0	1.795	0.313	1.591		7.250	31.046
Stiffeners		-0.5	0.3	0						276.740
Total	28.239	-1.225	1.007							899.496

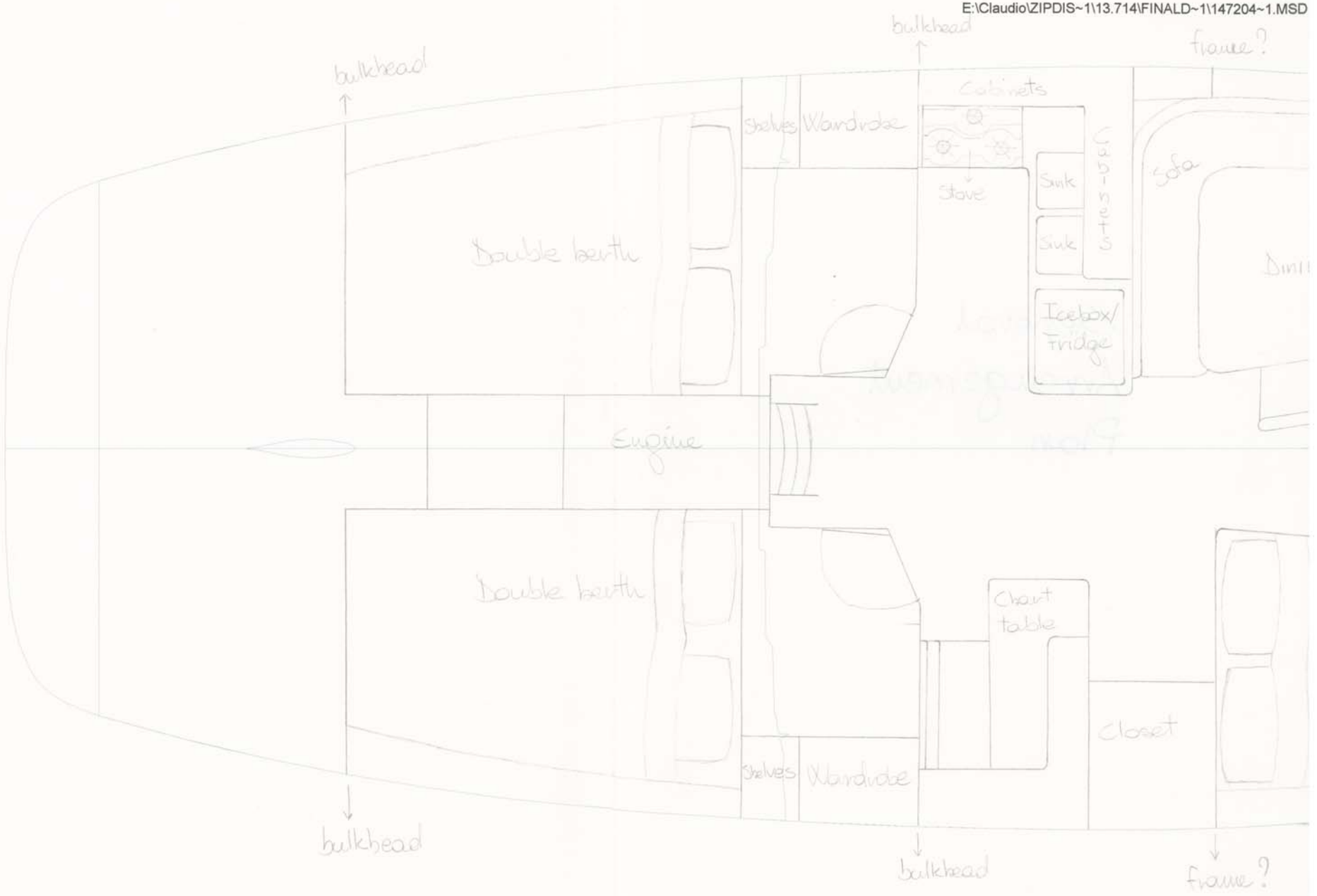


Body Plan View

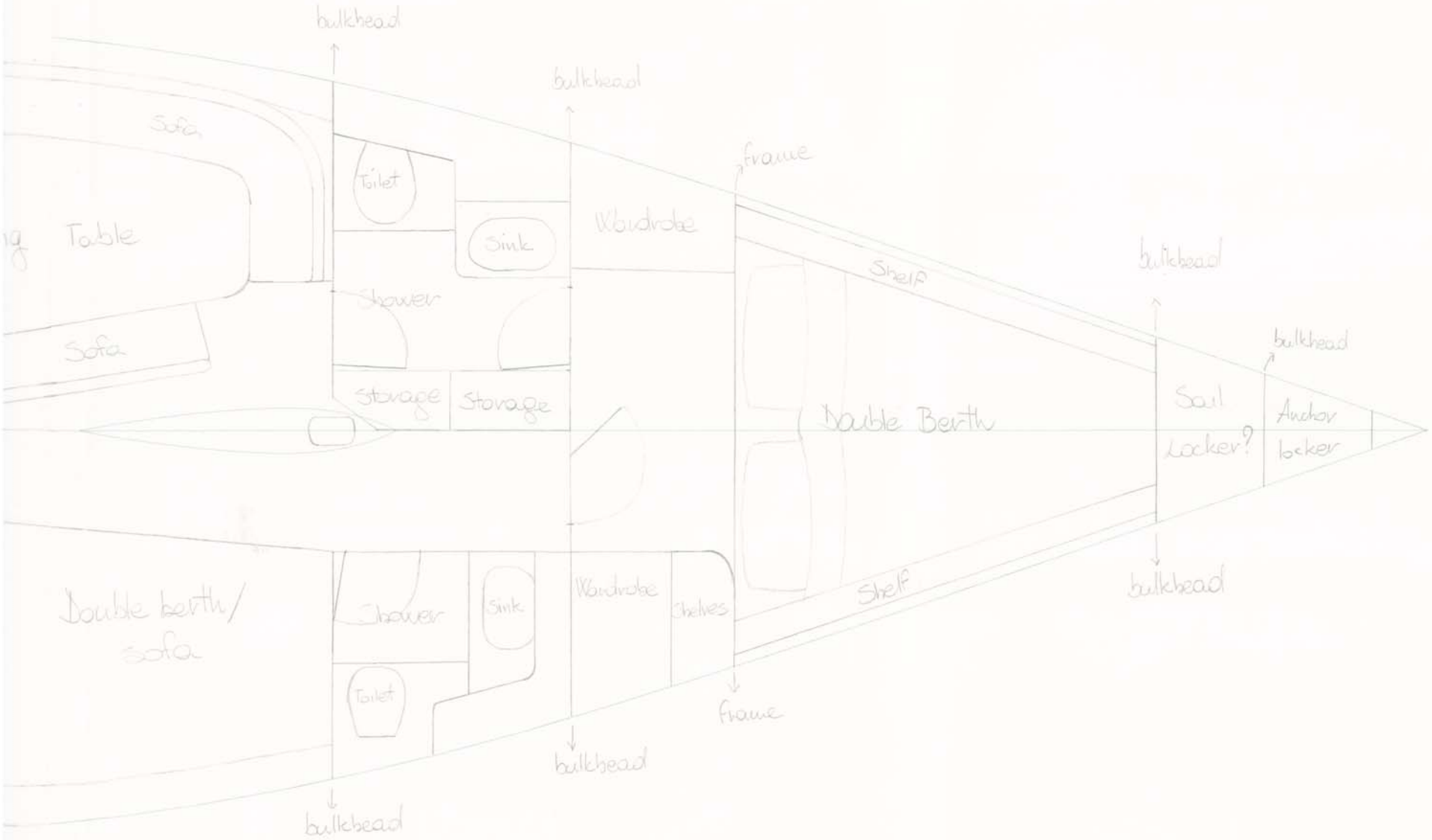
WL : 0.10 + n × 0.150 above DWL
-0.05 × n below DWL



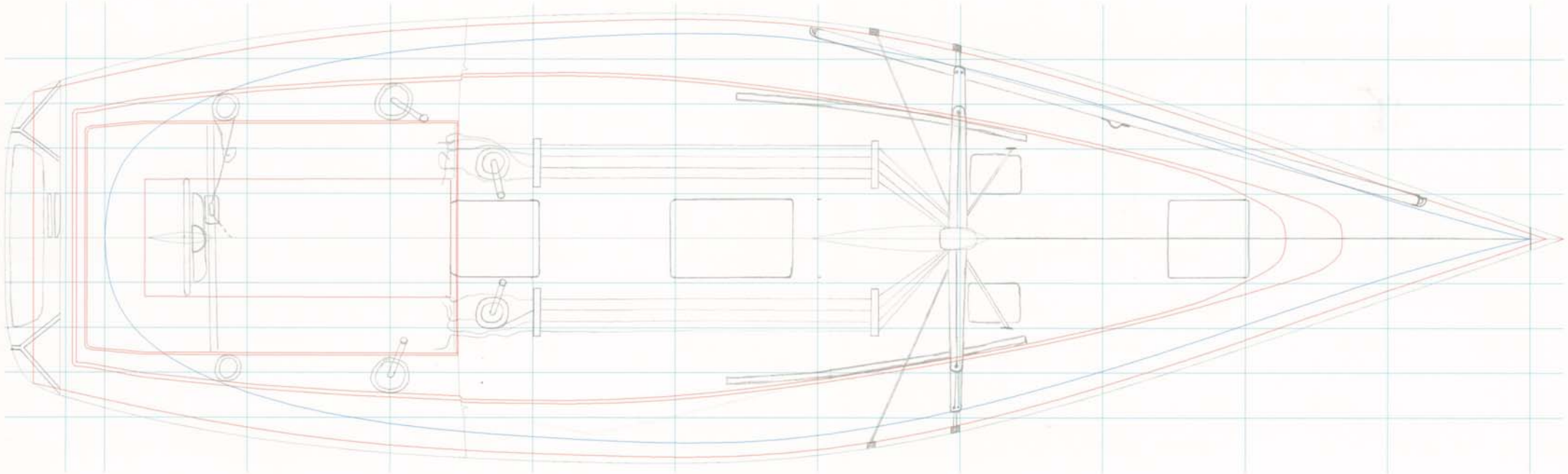
Plan View


bulkhead
bulkhead
frame?
Shelves
Wardrobe
Cabinets
Stove
Sink
Sink
Cabinets
Sofa
Double berth
Icebox/
Fridge
Engine
Double berth
Chart
table
Closet
Shelves
Wardrobe
bulkhead
bulkhead
frame?

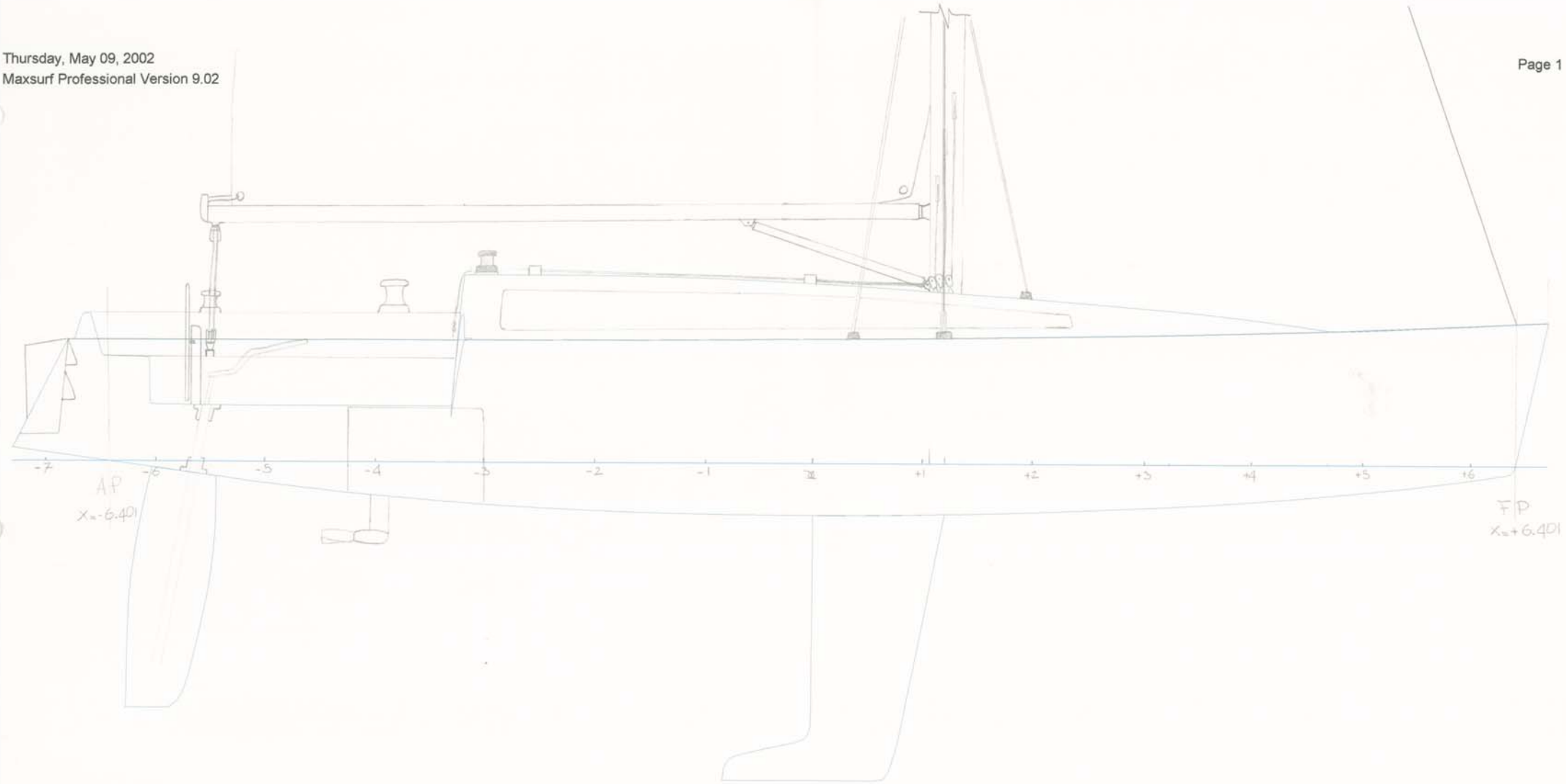
Plan View


bulkhead
bulkhead
frame
bulkhead
bulkhead
Sofa
Toilet
Table
Sink
Wardrobe
Shelf
Shower
Sofa
Storage
Storage
Double Berth
Sail
Locker?
Anchor
locker
Double berth/
sofa
Shower
Sink
Wardrobe
Shelves
Shelf
Toilet
frame
bulkhead
bulkhead
bulkhead

Plan View



Plan View



Profile View

LEWMAR

30ST Two Speed, Self-Tailing Winch

Product Deta

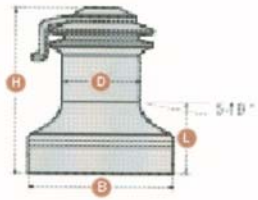
Kg/mm Lb/in

Specifications

Part Number	Finish	Gear Ratio 1st/2nd	Power Ratio 1st/2nd	Weight kg
49030000	Alloy	2:1/4.2:1	13.8:1/29.2:1	4.2
49030001	Chrome	2:1/4.2:1	13.8:1/29.2:1	5.6
49030019	Bronze	2:1/4.2:1	13.8:1/29.2:1	5.6
49030003	All Chrome	2:1/4.2:1	13.8:1/29.2:1	5.8
49030002	All Bronze	2:1/4.2:1	13.8:1/29.2:1	5.8

Dimensions

Drum Diameter D mm	Base Diameter B mm	Height H mm	Line Entry L mm	Line Size mm
74	138	160.5	69	8–12



Mounting Instructions
5 x M6 (1/4 in) c'sk head screws on 113mm (4 7/16 in) PCD. Lewmar recommend that the rope enters onto the drum at an angle of 5° to 10° to the base axis of the winch. To achieve this angle it may be necessary to use a base wedge when installing the winch. The winch must be mounted on an even

44ST Two Speed, Self-Tailing Winch

Product Detail

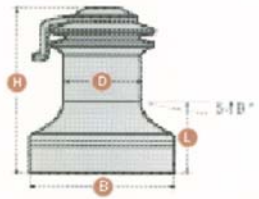
Kg/mm Lb/in

Specifications

Part Number	Finish	Gear Ratio 1st/2nd	Power Ratio 1st/2nd	Weight kg
49044055	Alloy	2.4:1/7.6:1	13.9:1/44.8:1	7.2
49044056	Chrome	2.4:1/7.6:1	13.9:1/44.8:1	9.7
49044057	Bronze	2.4:1/7.6:1	13.9:1/44.8:1	9.7
49044058	Stainless Steel	2.4:1/7.6:1	13.9:1/44.8:1	9.4
49044059	All Chrome	2.4:1/7.6:1	13.9:1/44.8:1	10
49044060	All Bronze	2.4:1/7.6:1	13.9:1/44.8:1	10

Dimensions

Drum Diameter D mm	Base Diameter B mm	Height H mm	Line Entry L mm	Line Size mm
87	168	192	84	8–14



Mounting Instructions
5 x M8 (5/16 in) c'sk head screws on 136mm (5 11/32 in) PCD. Lewmar recommend that the rope enters onto the drum at an angle of 5° to 10° to the base axis of the winch. To achieve this angle it may be necessary to use a base wedge when installing the winch. The winch must be mounted on an even surface.

48ST Two Speed, Self-Tailing Winch

Product Detail

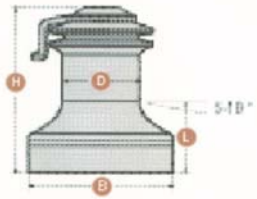
Kg/mm Lb/in

Specifications

Part Number	Finish	Gear Ratio 1st/2nd	Power Ratio 1st/2nd	Weight kg
49048055	Alloy	2.6:1/9:1	13.9:1/48.6:1	8.8
49048056	Chrome	2.6:1/9:1	13.9:1/48.6:1	12.1
49048057	Bronze	2.6:1/9:1	13.9:1/48.6:1	12.1
49048058	Stainless Steel	2.6:1/9:1	13.9:1/48.6:1	11.4
49048059	All Chrome	2.6:1/9:1	13.9:1/48.6:1	12.6
49048060	All Bronze	2.6:1/9:1	13.9:1/48.6:1	12.6

Dimensions

Drum Diameter D mm	Base Diameter B mm	Height H mm	Line Entry L mm	Line Size mm
93	181	208	86	8–14



Mounting Instructions
5 x M8 (5/16 in) c'sk head screws on 150mm (5 29/32 in) PCD. Lewmar recommend that the rope enters onto the drum at an angle of 5° to 10° to the base axis of the winch. To achieve this angle it may be necessary to use a base wedge when installing the winch. The winch must be mounted on an even surface.

Sandwich Construction Weights Calculations				
Item	**LCG, [m]**	**VCG, [m]**	**TCG, [m]**	**Weight, [Kg]**
Hull components below 0.251 above DWL				
Panel 1	6.065	0.055	0	3.62
Panel 2	3.407	-0.166	0	73.57
Panel 3	1.535	-0.150	0	10.86
Panel 4	0.306	-0.201	0	50.11
Panel 5	-1.575	-0.290	0	81.16
Panel 6	-3.193	-0.234	0	47.52
Panel 7	-4.465	-0.147	0	42.47
Panel 8	-5.732	-0.021	0	31.64
Panel 9	-6.822	0.098	0	15.59
Reinforced Shell 1	1.539	-0.424	0	15.38
Reinforced Shell 2	0.342	-0.450	0	62.45
Rudder	-5.814	-6.180	0	99.60
Hull components below 0.251 above DWL				
Panel 1	6.174	0.844	0	13.55
Panel 2	3.818	0.773	0	64.53
Panel 3	1.541	0.747	0	8.04
Panel 4	0.347	0.740	0	30.03
Panel 5	-1.579	0.733	0	30.52
Panel 6	-3.200	0.729	0	18.87
Panel 7	-4.482	0.726	0	18.96
Panel 8	-5.764	0.719	0	18.31
Panel 9	-6.733	0.648	0	8.79
Deck Panel 1	5.234	1.620	0	10.66
Deck Panel 2	2.492	1.791	0	70.02
Deck Panel 3	-1.358	1.903	0	145.86
Cockpit	-5.031	1.398	0	153.56
Transom	-7.028	0.957	0	31.05
Stiffeners	-0.500	0.300	0	276.74
Bulkheads	0.000	0.700	0	180.00
Mast and Rigging				
Mast, unfitted	1.200	10.025	0	164.45
Mast fittings	1.200	10.025	0	16.45
Boom, unfitted	-2.350	2.550	0	46.82
Boom fittings	-2.350	2.550	0	4.68
Headstay	3.950	9.706	0	3.47
Headstay fitting	6.700	1.400	0	5.00
Backstay	-3.050	10.900	0	4.23
Backstay chainplate	-7.200	0.500	0	8.00
Shrouds 1, 2, 3	1.200	13.056	0	3.14
Shrouds 4, 5	1.200	7.450	0	6.09
Upper spreader	1.200	13.550	0	0.48
Lower spreader	1.200	8.050	0	2.00
Shroud chaiplates	1.200	1.300	0	30.00
Mainsail	-0.476	7.885	0	38.99
Jib	3.201	6.400	0	29.04
Spinnakers (180 m^2, 120 m^2, stored)	2.500	0.050	0	87.00
Spinnaker pole	3.950	1.350	0	13.75
Halyards	1.200	10.025	0	20

Deck Hardware				
Jib winches (2)	-3.400	1.400	0	21.34
Halyard winches (2)	-3.000	1.900	0	12.32
Mainsail winches (2)	-5.100	1.400	0	26.62
Spinnaker winches (2)	-4.200	1.400	0	26.62
Jib tracks + cars	0.800	1.250	0	11.22
Main traveler + car	-5.100	1.000	0	2.53
Hatches	-0.800	1.600	0	30
Anchor, chain, rope, windlass	6.300	1.200	0	52.02
Vang	0.600	2.200	0	12
Chandeliers + lifelines	0.000	1.500	0	25
Lines	0.600	1.300	0	80
Machinery				
Engine	-3.84	0.02	0	275
Steering gear	-6.1	0.45	0	100
Plumbing	2	-0.25	0	100
Electrical	-0.5	0.35	0	75
Batteries	0	-0.05	-0.9	70
Stove	-2.18	0.5	1.8	35
Mast step hydraulic pump	1.2	-0.4	0	25
Fuel tank (220 l, empty)	-2.56	-0.25	0	25
Fresh water tank (200 l, empty)	-0.64	-0.25	0	20
Interior				
Berths, cabinets, tables, etc.	-1	0.35	0	400
Crew				
8 people	-4.2	1.1	0	760
Ballast				
Keel	0.461	-1.322	0	4598
Internal Ballast	-1.3	-0.25		1300.00
Total	-0.627400441	-0.171138138		10179.73
LCB position	-0.619			10252