MEC-E1004 Principles of Naval Architecture

Scantling

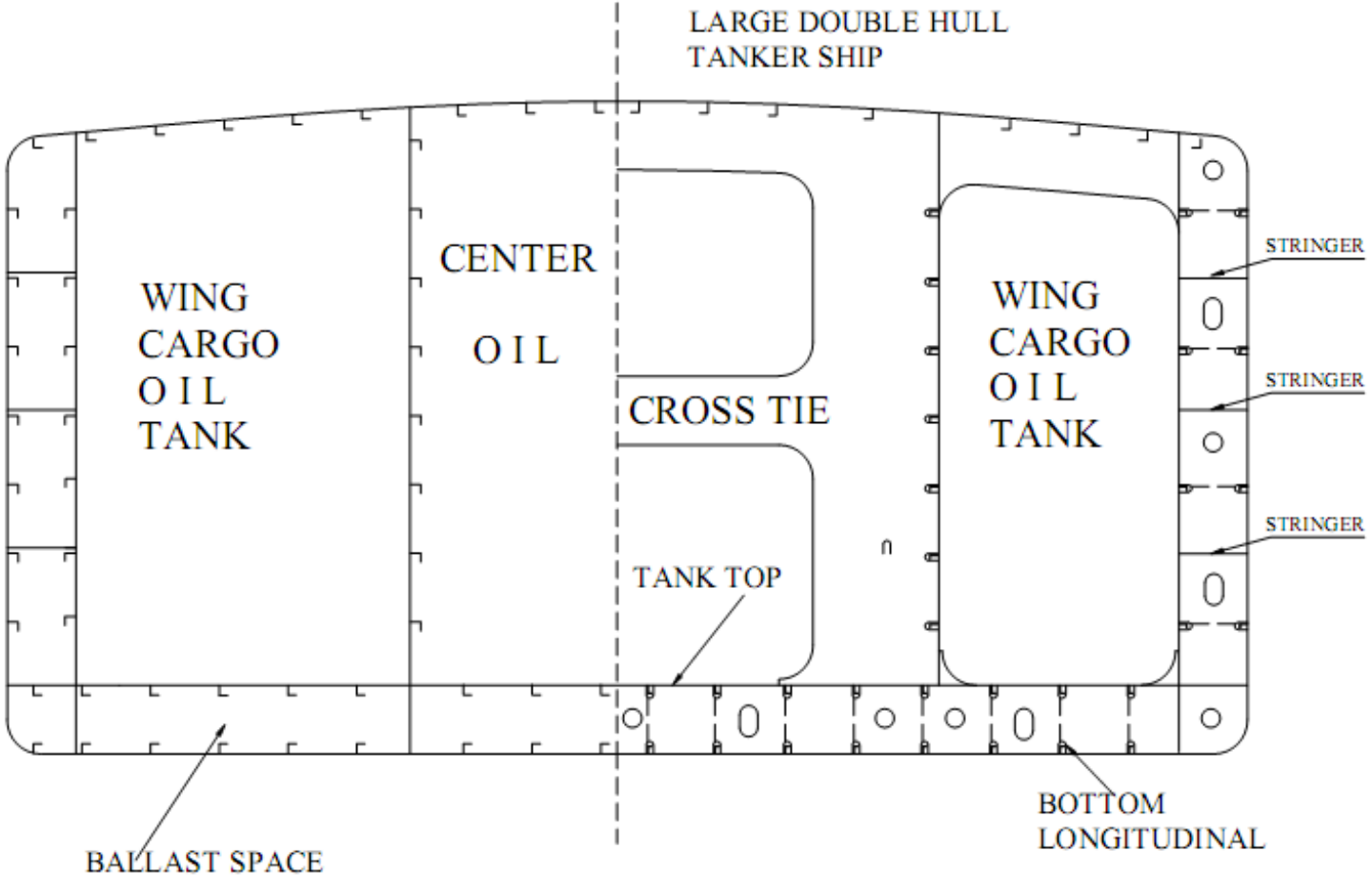
Aalto University
School of Engineering

Scantlings in Class Society Rules

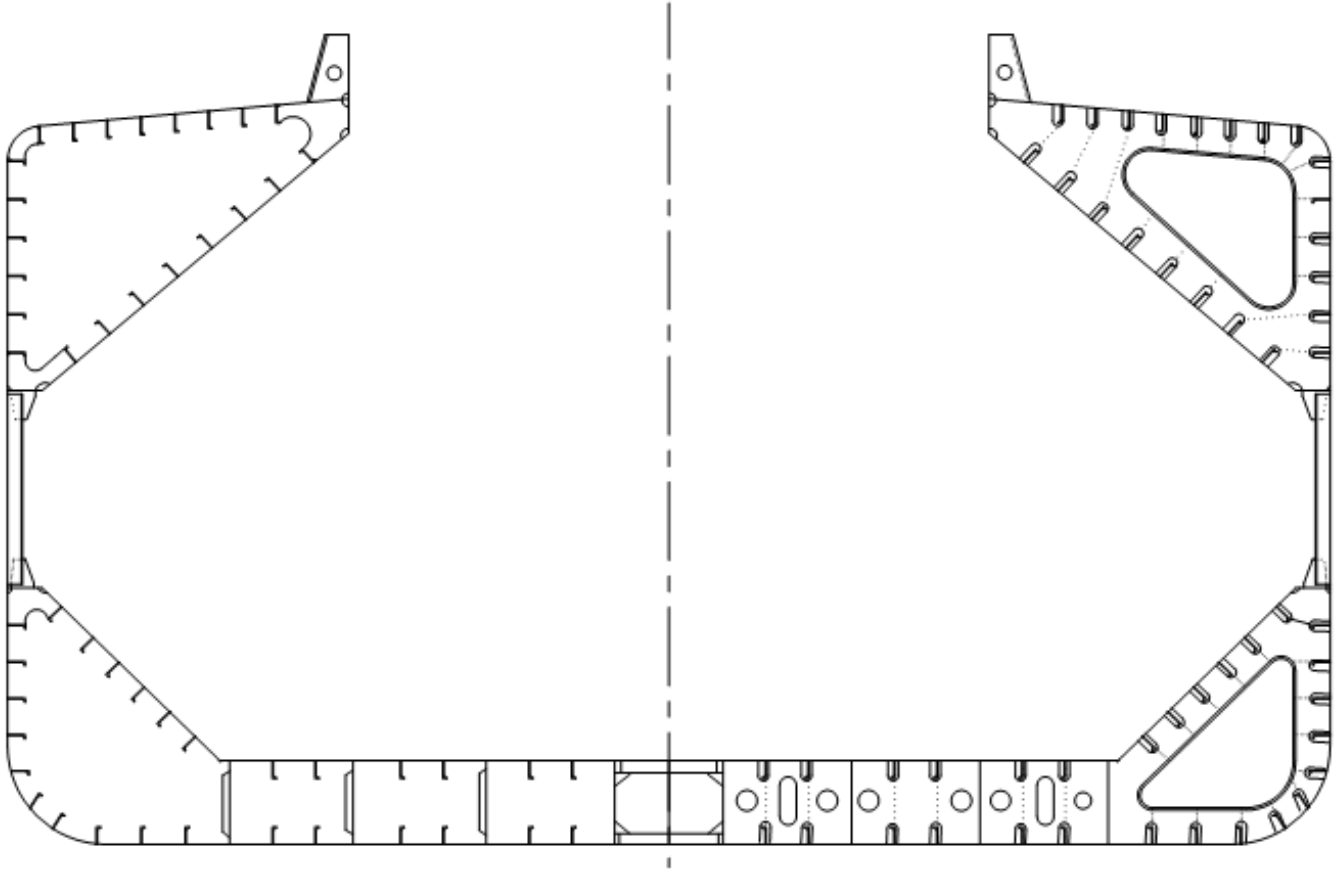
- Scantling should be obtained based on the rules of the corresponding potential classification society.
- Here DNVGL rules “Hull Structural Design, Ships with Length 100 meters and above” is used only as an example.
- Before calculating scantling you should have the ship main particulars, subdivisions and the shape of the amidship section including frame spacing and web frame spacing.

DNVGL rules “Hull Structural Design, Ships with Length 100 meters and above”
http://rules.dnvgl.com/docs/pdf/dnv/rulesship/2016-01/ts301.pdf

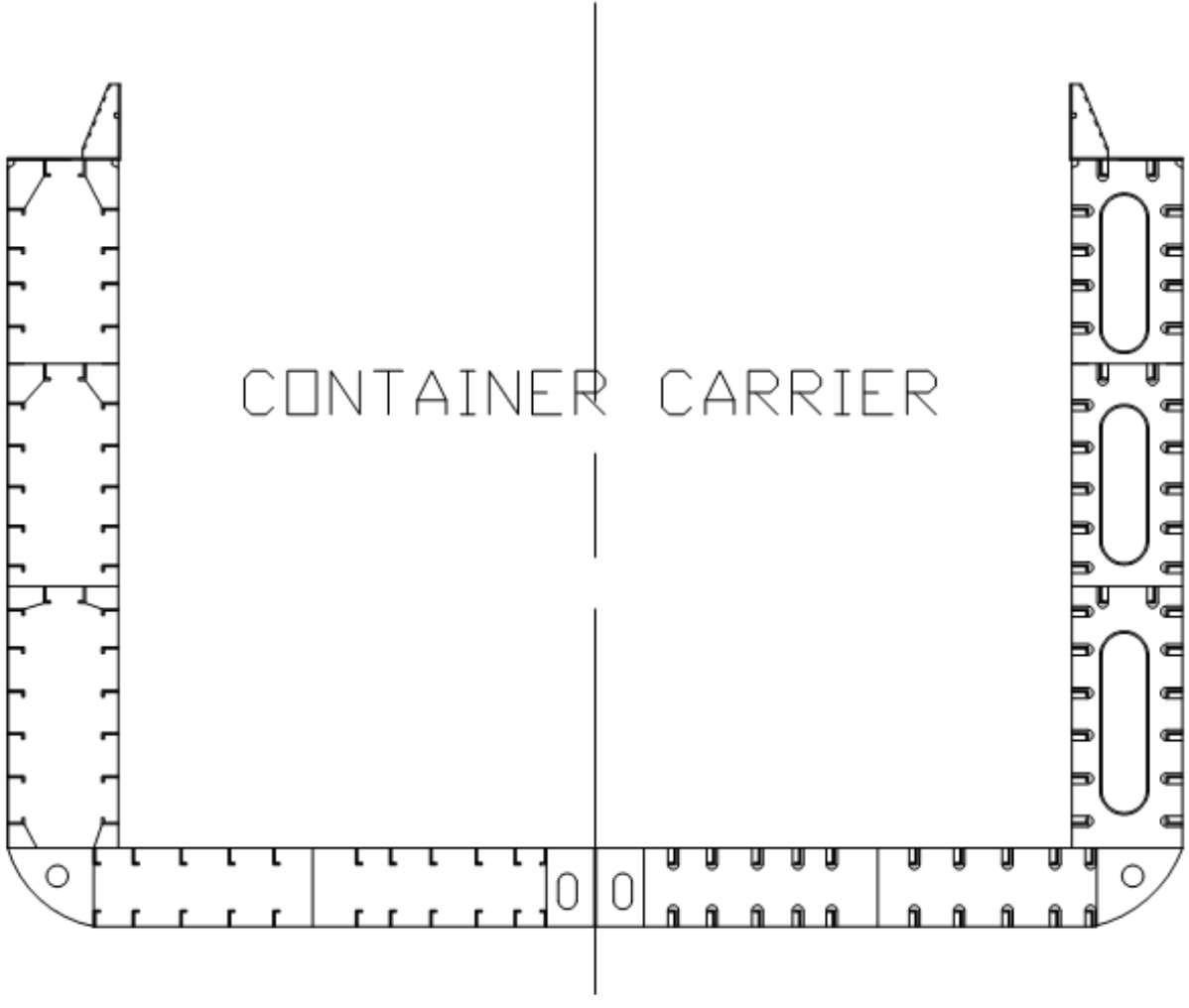
Amidships section of an Oil tanker



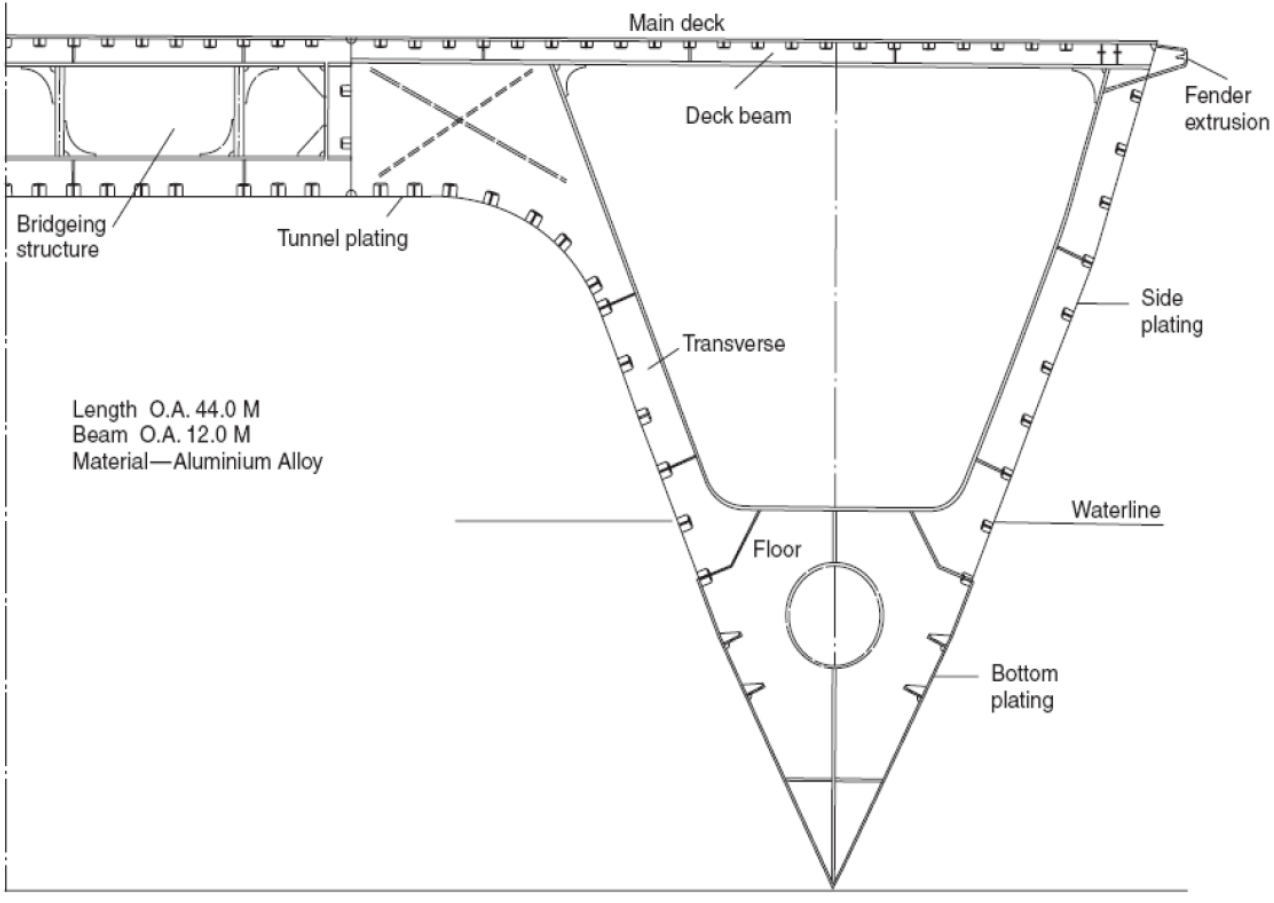
Amidship section of a Bulk carrier



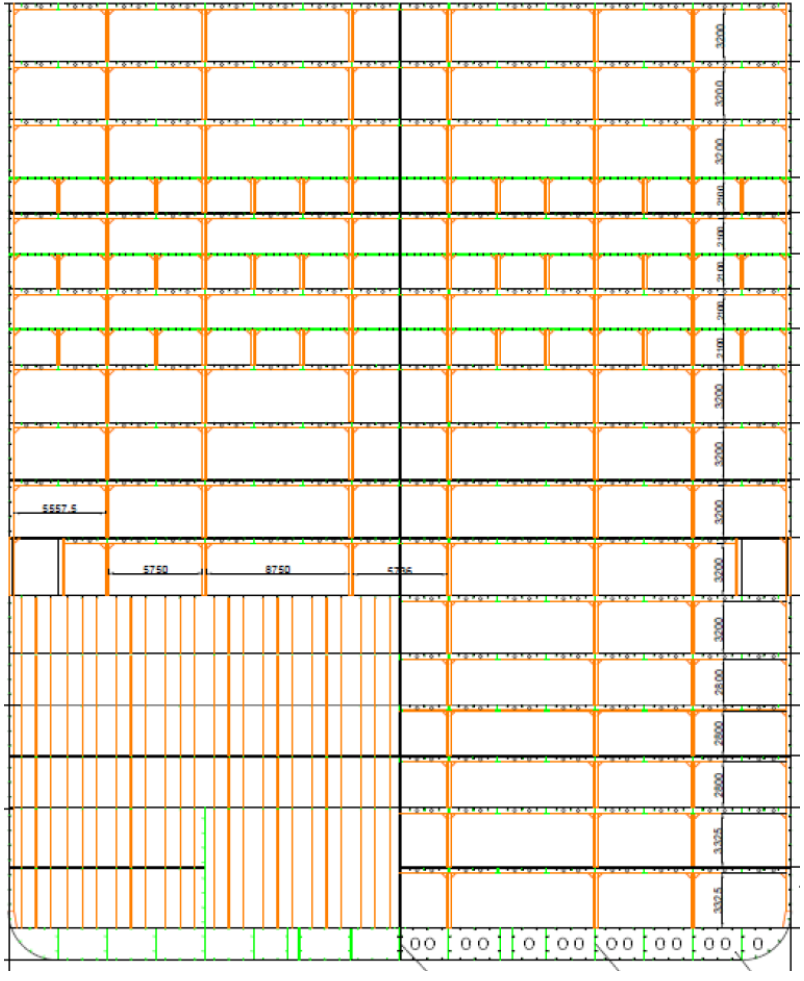
Amidships section of a container ship



Amidships section of a catamaran



Amidships section of a cruise ship



Material

- Go to the material section in the corresponding rules and define the hull structural material (Section 2 In DNVGL Rules)

Plating and stiffeners

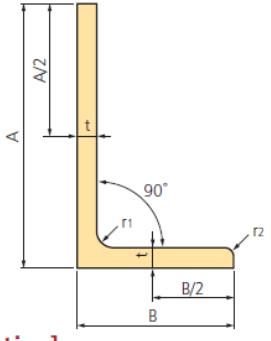
- **Define the min thickness of the plates and the stiffeners and girder section modulus (sec 6 in DNVGL)**

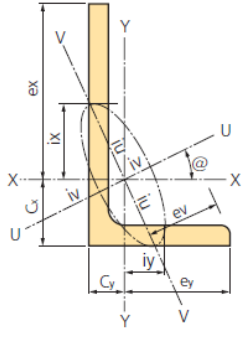
Stiffeners and girder selection

- **Minimum thickness of side shell, deck plate, keel plate, bilge plate etc. can be calculated from the rules**
- **Rules give the minimum section modulus of the stiffeners and girders**
  - ✓ For stiffeners, you can select the appropriate angles from the shipbuilding steel suppliers' catalogue (available on the internet)
  - ✓ For girders, you can use the excel file (Section Modulus calculator) to get the shape of the girder that gives the minimum required section modulus.

Stiffeners and girder selection

- Stiffener selection from the shipbuilding steel suppliers' catalogue





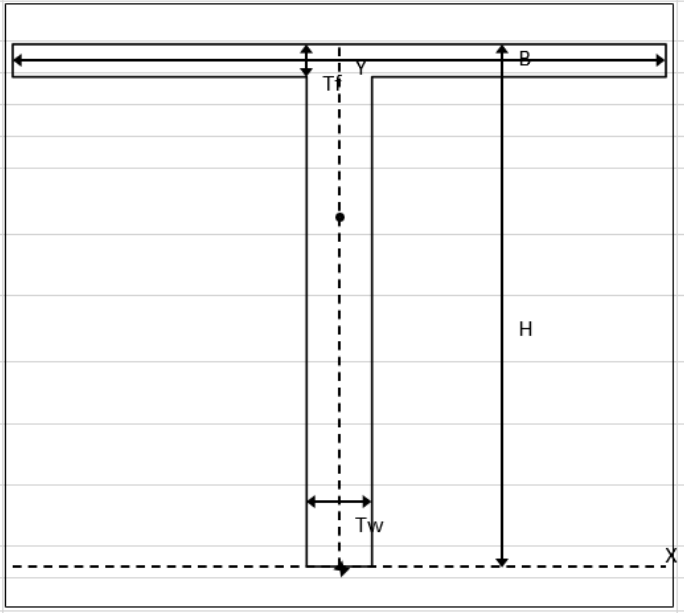
[Product shapes, dimensions and sectional properties]

Dimension (mm)				Sectional area (cm²)	Unit mass (kg/m)	Position of center of gravity (cm)		Geometrical moment of inertia (cm⁴)				Radius of gyration of area (cm)				tan α	Modulus of section (cm³)	
A	t	r1	r2			Cx	Cy	Ix	Iy	max. Iu	min. Iv	ix	iy	max. iu	min. iv		Zx	Zy
100×75	7	10	5	11.87	9.32	3.06	1.83	118	56.9	144	30.8	3.15	2.19	3.49	1.61	0.548	17.0	10.0
	10	10	7	16.50	13.0	3.17	1.94	159	76.1	194	41.3	3.11	2.15	3.43	1.58	0.543	23.3	13.7
125×75	7	10	5	13.62	10.7	4.10	1.64	219	60.4	243	36.4	4.0						26.1	10.3
	10	10	7	19.00	14.9	4.22	1.75	299	80.8	330	49.0	3.96	2.06	4.17	1.61	0.357	36.1	14.1
150×90	9	12	6	20.94	16.4	4.95	1.99	485	133	537	80.4	4.81	2.52	5.06	1.96	0.361	48.2	19.0
	12	12	8.5	27.36	21.5	5.07	2.10	619	167	685	102	4.76	2.47	5.00	1.93	0.357	62.3	24.3

Stiffeners and girder selection

- Girder definition based on the excel sheet

		Index	Section Type		
		28	T section		
Dimensions		Property	Formula		Value
B	10	A	=B*Tf+Tw*H-Tw*Tf		12.500
H	8	Xc		0	0.000
Tw	1	Yc	=H-(Tw*H^2+B*Tf^2-Tw*Tf^2)/(2*A)		5.350
Tf	0.5	Ix	=B*H^3/3-(B-Tw)*(H-Tf)^3/3		441.042
		Iy	=(B^3*Tf+(H-Tf)*Tw^3)/12		42.292
		Ixc	=Ix - A*Yc^2		83.260
		Iyc	=Iy		42.292
		J		0	0.000



Thank you

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