Particulars:

Length: 70.8 m

Breadth: 11.4 m

Depth: 5.7 m

Draft: 4.4 m

Deadweight-Displacement Co-efficient: 0.7

Deadweight: 2000 tons

Displacement: 2660 tons

Material Factor, k: taking steel yield stress as 235MPa

$k = 1$

Web Frame Spacing: 1.8 m

Frame Spacing: 0.6 m = 600mm[1] Ship Construction by DJ Eyer

Bottom Shell Plating

C_0 = Wave Co-efficient = $\frac{L}{25} + 4.1 \times CR_W$ **=6.932**

C_{RW} = 1, for Unlimited Service Range

C_L = Length Co-efficient = $\sqrt{\frac{L}{90}}$ **=.887**

f = Probability Factor = **0.6**

p_0 = Basic external dynamic load = $2.1(C_B+0.7) \times c_0 \times C_L \times f$ = **11.62 kN/m²**

p_B = Load on ship bottom = $2.6(C_B + 0.7) \times c_0 \times C_L$ = **24 kN/m²**

n_f = tansverse framing= **1**

a = Frame spacing = **0.6**

$t_{B1} = 1.9 \times n_f \times a \sqrt{p_b \times k + t_k}$ = **7.58 mm**

The obtained value of minimum thickness, t_{min} = $(4.5+0.05 \cdot L_{200}) \cdot \sqrt{k}$ **=8.41**

Bottom Plate Thickness= 10 mm

Side Plate Thickness

z= .5 x (Depth-double bottom depth)+ double bottom depth = 3.23

p_s = Load on sides = $10(T - z) + p_0 \times c_f(1 + \frac{z}{T})$ = **31.85 kN/m²**

t_{s1} = Thickness within .4L amidship = $1.9 \times n_f \times a \times \sqrt{p_s \times k} + t_K$ = **8.43 mm**

Minimum Thickness = $T + \frac{C_0}{2}$ =7.9 mm

Side Plate Thickness = 10 mm

Bilge Plate Thickness

Bilge thickness is same as the bottom plate thickness, t_B

i.e, **Bilge thickness =** **10 mm**

Flat Keel Plate

Width of the flat keel, b = 800 + 50 × L = 4340 mm = 4.34 m

t_{FK} = Thickness for the flat keel plate = t_B + 2 = (10 +2)mm = 12 mm

Deck Plate

Table 4.1 Distribution factors for sea loads on ship's shell and weather decks

Range		c_D	c_F [1]
A	$0 \le \frac{x}{L} < 0.2$	$1.2 - \frac{x}{L}$	$1.0 + \frac{5}{C_B} \cdot \left(0.2 - \frac{x}{L}\right)$
M	$0.2 \le \frac{x}{L} < 0.7$	1.0	1.0
F	$0.7 \le \frac{x}{L} < 1.0$	$1.0 + \frac{c}{3} \cdot \left(\frac{x}{L} - 0.7\right)$ $c = 0.15 \cdot L - 10$ $100\ m \le L \le 250\ m$	$1.0 + \frac{20}{C_B} \cdot \left(\frac{x}{L} - 0.7\right)^2$
1	Within the range **A** the ratio x / L need not to be taken less than 0.1 and within the range **F** the ratio x / L need not to be taken greater than 0.93.		

P_D = Load on Weather Decks = $\frac{20 \times T}{(10+z-T)H} \times c_D =$ 1.75 kN/m^2 (For aft)

1.75 kN/m^2 (For amidship)

3.61 kN/m^2 (For forward)

Deck Plate(contd.)

$v_0 = \sqrt{L} = 8.41\ knot$

$$F = .11 \times \frac{V_0}{\sqrt{L}} = 0.11$$

$$m_0 = 1.5 + F = 1.5 + 1.1 = 1.61$$

$$a_v = F \times m$$

$m = m_0 - 5(m_0) \times \frac{x}{L}$ For 0 < x/L < 0.2 =1

$= 1$ For .2 < x/L < 0.7 =1

$= 1 + \frac{m_0 + 1}{.3} \times [\frac{x}{L} - .7]$ For .7 < x/L < 0.1 =3

For 0 < x/L < 0.2

a_v = .11

P_L = 16.65 kN/m^2

Deck Plate(contd.)

For .2 < x/L < 0.7

a_v= .11
P_L = 16.65 kN/m^2
t_{E2}= 4.7 mm

For .7 < x/L < 0.1

a_v= .11
P_L = 16.65 kN/m^2
t_{E2}= 4.7 mm

For .7 < x/L < 0.1

a_v= .33
P_L = 19.9 kN/m^2
t_{E2}= 4.95 mm

$T_{E,MIN}$= (5.5+.02×L) = 6.92 mm

So, the deck plate thickness is taken as 7 mm

Sheerstrake

Width is not to be taken less than= $800 + 5 \times L$ =4.34 m = 5m(app)

Thickness of the sheerstrake = $.5 \times (t_D + t_s)$ =8.5 mm

So, thickness of the sheerstrake taken= 9mm

Bulkheads

Minimum plate thickness= $6 \times \sqrt{f}$

$= 6 \times \sqrt{1}$

$= 6\ mm$

Center Girder

The depth of center girder, h = $350 + 45 \times l$;Where l = B

=863.9 mm

Thickness= $t_m = \frac{h}{h_a} \cdot \left(\frac{h}{100} + 1.0 \right) \cdot \sqrt{k}$ [mm]

Thickness= 9.8mm = 10 mm

Sectional Area of the faceplate of center girder $A_f = 0.7 \cdot \mathbf{L} + 12$ [cm^2]

Therefore, width of the girder= 840 mm

Web frame & Side Stringer

P_S= 31.85 kN/m^2

No cross ties would be used, that is why n_c= 1.

Section Modulus =$0.55.e.l^2.P_s.n_c.k$

Unsupported span, l = 1.8

frame spacing, a = 0.6 m

Section Modulus, W =102.2 cm^3

So the dimension chosen is = 180mm x 26mm x 2mm

Deck Web & Deck Girder

$P_D = 3.61$ kN/m^2

Section Modulus $= c.e.l^2.P_d.K$ = 15.8 cm3 ;c= 0.75 = for girders and beams

So, the dimension chosen is = 102mm x 102mm x 7 mm

Bottom Longitudinals

$C_1 = 0.11$

$L_K = 55.4$ mm

$m_k = 0.94$

$m = 0.814$

$\sigma_{pr} = 230/\ k = 230/1 = 230$

Section Modulus $= \frac{83.3}{\sigma pr} \times m \times a \times l^2 \times P_B{}^{40}$ = 6.65 cm^3

So, the dimension chosen is = 76 mm x 76 mm x 6 mm

Side Longitudinals

$P_s = 31.85$ kN/m^2

Section Modulus, W $= \frac{83.3}{\sigma pr} \times m \times a \times l^2 \times P_S$

= 2.21 cm^3

So, the dimension chosen is = 44mm x 44mm x 5mm

Deck Beam

$P_D = 31.85$ kN/m^2

Section Modulus, W $= c \times a \times l^2 \times k \times P_D = 5.3$ cm^3

So the dimension chosen = 51mm x 51mm x 10mm

Bracket

$$t = c \times \sqrt[3]{\frac{W}{k_1} = t_k}$$

$c = 1.2\ for\ non = flanged\ bracket$

$k_1 = 1$

$t_k = 2$

$W = n \times c \times a \times l^2 \times p \times k$

$P = P_B = 24\ kN/m^2$

$c = .6$ n= .7

$l = 1.8$ $a = .6$

$W = n \times c \times a \times l^2 \times p \times k$

$= 19.59\ cm^3$

$$t = 1 \times \sqrt[3]{\frac{19.59}{1}} + 2$$

$= 4.695\ mm$

= 5 mm

$$The\ arm\ length\ of\ bracket, l = 46.2 \times \sqrt[3]{\frac{W}{k_1} \times \sqrt{k_2}} \times \sqrt{\frac{4.695}{5}}$$

$= 120.68\ mm$

$= 121\ mm$

Floor Plate

The thickness of plate floor = $t_k - 2 \times \sqrt{k}$

= 8 mm

PARTICULARS	DIMENSIONS
MATERIAL FACTOR (K)	1
WEB FRAME SPACING	1.8m
YIELD STRENGTH	235 N/mm^2
BOTTOM SHELL PLATING	10 mm
Sheer Strake	8 mm
Floor Plate	8 mm
SIDE PLATE THICKNESS	10 mm
BILGE THICKNESS	10 mm
FLAT KEEL PLATE	12 mm
DECK PLATE	6 mm
BULKHEAD THICKNESS	6 mm
CENTER GIRDER(WIDTH X HEIGHT X LENGTH)	840 mmx 900 mm x 1000 mm
WEB-FRAME AND SIDE STRINGERS	T-180 x 25 x 5
DECK WEB AND DECK GIRDER	T-100 x 100 x 5
BOTTOM LONGITUDINAL	L- 75 x 75 x 5
SIDE LONGITUDINAL	L- 45 x 45 x 5
DECK BEAM	L- 50 x 50 x 10
DIMENSIONS OF BRACKET	thickness = 5 mm
	Arm Length= 121 mm