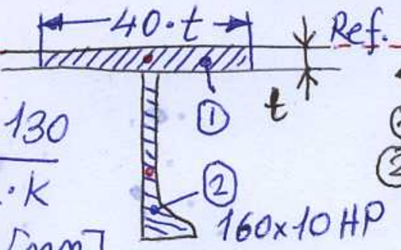
Q1:



For $L=130$

$t=\sqrt{L\cdot k}$

$t=12$ [mm]

i	A_i	y_i	$A_i \times y_i$	I_i	d_i	d_i^2	$A_i \times d_i^2$
①	57,6	0,6	34,56	6,91	2,48	6,16	354,74
②	19,4	10,45	202,73	485	7,38	54,3	1053,3
	$\Sigma_1=77$		$\Sigma_2=237{,}29$	$\Sigma_3=491{,}9$			$\Sigma_4=1408$

$y_{NA}=\Sigma_2/\Sigma_1=3{,}08$ [cm] ; $I_{NA}=\Sigma_3+\Sigma_4=1899{,}9$ [cm⁴] ; $SM=I_{NA}/y_{max}$

$y_{max}=16+1{,2}-3{,}08=14{,}12$ [cm] ; $\boxed{SM=134{,}6\ [cm^3]}$

Q2: WEB Frame Required section modulus (Sect. 10, A 5.3.1)

$W=0{,}55\cdot e\cdot l^2\cdot p\cdot n_c\cdot k\ [cm^3]$

$e=4\cdot a$; $a=L/500+0{,}48=0{,}74$ [m] ; $e=2{,}96$ [m]

$l=D-D/3-1{,}5$; $D=L/11=11{,}82$ [m] ; $l=6{,}38$ [m]

$z=h_{DB}+l/2=1{,}5+6{,}38/2=4{,}69$ [m] $<$ $T=7{,}43$ [m]

$p=p_S=10(T-z)+p_0\cdot c_F\cdot(1+z/T)$ [kN/m²]

$p_0=2{,}1(c_B+0{,}7)\,c_0\cdot c_L\cdot f$ [kN/m²] ; $f=0{,}6$ for (web frames)

$p_0=2{,}1(0{,}7+0{,}7)\cdot 8{,}533\cdot 1{,}0\cdot 0{,}6=15{,}05$ [kN/m²]

$p=p_S=51{,}95$ [kN/m²] ; $n_c=1{,}0$ (no cross ties!) ; $k=1{,}0$

$\boxed{W=3443\ [cm^3]}$

Q3: SHEER STRAKE (section 6, C.3)

The thickness: $t=0{,}5(t_D+t_S)$ or $t=t_S$

The width: $b=800+5\cdot L$

$b=1450$ [mm]

t_D: Deck plating thickness (section 7, A.5)

$t_D=t_{min}=(4{,}5+0{,}05\cdot L)\sqrt{k}$ "or" t_E ; $t_{min}=11$ [mm]

$t_{E1}=1{,}21\cdot a\cdot\sqrt{P_D\cdot k}+t_K$ [mm]

$t_{E2}=1{,}1\cdot a\cdot\sqrt{P_L\cdot k}+t_K$ [mm]

$t_{Emin}=(5{,}5+0{,}02\cdot L)\sqrt{k}$ [mm]

$P_D=p_0\cdot\dfrac{20\cdot T}{(10+z-T)\,H}\,c_D$; $z\cong D=H$

$P_D=21{,}9$ [kN/m²] ; $P_L=P_c(1+a_v)$

$P_L=30(1+0{,}145)=34{,}35$ [kN/m²]

$$\left.\begin{array}{l} t_{E1}=5{,}7\ [mm] \\ t_{E2}=6{,}3\ [mm] \\ t_{Emin}=8{,}1\ [mm] \end{array}\right\} t_E=8{,}1\ [mm] \Rightarrow t_D=t_{min}=11{,}0\ [mm]$$

Also, check for minimum thickness for outer shell (Section 6, B.3.1) $t_{min}=\sqrt{L\cdot k}=11{,}4$ [mm]

Therefore, $\boxed{t_D=11{,}5\ [mm]}$ at least!

$t_S=?$ t_{S1}, t_{S2} or t_{S3}, whichever is greater!

$t_{s1} = 18{,}3 \cdot n_f \cdot a \cdot \sqrt{P_s/\sigma_{pL}} + t_K$ [mm] $n_f = 1{,}0$ (Transverse framing)

$t_{s2} = 1{,}21 \cdot a \sqrt{P \cdot K} + t_K$ [mm] $z = h_{DB} + a/2 = 1{,}87$ [m]

$t_{s3} = 18{,}3 \cdot n_f \cdot a \sqrt{P_{s1}/\sigma_{pL,max}} + t_K$ [mm] $P_s = 86{,}9\,[kN/m^2]$; $P_{s1} = 100{,}2\,[kN/m^2]$

$\sigma_{pL} = 128{,}2\,[N/mm^2]$; $\tau_L = 55/k = 55\,[N/mm^2]$; $\sigma_{LS} = 91{,}2\,[N/mm^2]$

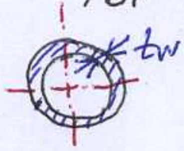
$$\left.\begin{aligned} t_{s1} &= 11{,}15 + 1{,}61 = 12{,}76\,[mm] \\ t_{s2} &= 8{,}35 + 1{,}5 = 9{,}85\,[mm] \\ t_{s3} &= 11{,}97 + 1{,}7 = 13{,}7\,[mm] \end{aligned}\right\} t_s = t_{s3} \Rightarrow \boxed{t_s = 14{,}0\,[mm]}$$

The thickness of the sheerstrake, then, $t = 0{,}5(11{,}5 + 14) = 12{,}75$ [mm]

$\boxed{t = 14\,[mm] \text{ at Least!}}$ $t = t_s = 14\,[mm]$

Q4: PILLAR (the above one!) (Section 10, C.2)

For the given section: $d_a = 100$ [mm] ; $t_W = 6$ [mm] ; $d_i = 88$ [mm]



The pillar load, P_s, may be found from:

$$A_{s\,req} = 10 \cdot \frac{P_s}{\sigma_p} \geq A_s = \pi(d_a^2 - d_i^2)/4 = 17{,}72\,[cm^2]$$

In other words, $P_s \leq 17{,}72 \cdot \sigma_p / 10$ [kN]

$\sigma_p = (\varkappa/S) R_{eH}$; $\varkappa = 1/(\phi + \sqrt{\phi^2 - \lambda_s^2})$; $\lambda_s = \frac{l_s}{i_s \cdot \pi}\sqrt{\frac{R_{eH}}{E}}$

$l_s = D/3 = 3{,}94$ [m] ; $i_s = 0{,}25\sqrt{d_a^2 + d_i^2} = 3{,}33$ [cm] ; $R_{eH} = 235$ [MPa]

$E = 200$ [GPa] $\Rightarrow l_s = 394$ [cm] ; $\lambda_s = 1{,}29 \geq 0{,}2$

$\phi = 0{,}5[1 + n_p(\lambda_s - 0{,}2) + \lambda_s^2]$; $n_p = 0{,}34$ (for tubular section)

$\phi = 1{,}517$; $\varkappa = 0{,}4789$; $S = 2{,}0$ (in general)

$\sigma_p = \frac{\varkappa}{S} R_{eH} = 56{,}27\,[N/mm^2]$ $\boxed{P_s \leq 99{,}7\,[kN]}$

Alternative solution: $P = E \cdot I \cdot (\pi/L)^2$; $L = c \cdot l$

$P = 200\,[GPa] \cdot (\pi(d_a^4 - d_i^4)/64)\,[m^4] \cdot (\pi/1 \cdot l)^2\,[1/m^2] = \boxed{249{,}5\,[kN]}$

Note that no safety factor is included yet!

Consider a safety faktor of "3" as suggested by Teoman ÖZALP, then, $\boxed{P = 83\,[kN]}$ Reasonable!

Q5: BULKHEAD (Plating + Stiffeners) (Section 11, B.2.1)

The thickness $t = c_p \cdot a \cdot \sqrt{p} + t_K$ [mm]

$t_{min} = 6{,}0 \sqrt{f}$ [mm]

$P = 9{,}81 \cdot h$ [kN/m²] ; $l = D/3 = 3{,}94$ [m]

$h = l/2 + 1 = 2{,}97$ [m] ; $p = 29{,}1$ [kN/m²]

For the stiffener, $p = 29{,}1$ [kN/m²], but for the plating, $h = l + 1 = 4{,}94$ [m] $\Rightarrow p = 48{,}5$ [kN/m²]

Assuming that the stiffener spacing is $a = 0{,}74$ [m]

$t = 0{,}9\sqrt{f} \cdot 0{,}74\sqrt{48{,}5} + t_K = 4{,}64 + 1{,}5 = 6{,}14$ [mm]

$t_{min} = 6{,}0\sqrt{f} = 6{,}0$ [mm]

$\Rightarrow \boxed{t_p = 6{,}5 \text{ [mm]}}$ at least!

The required section modulus for stiffeners:

$W = m \cdot c_s \cdot a \cdot l^2 \cdot p$ [cm³]

$m = m_K^2 - m_a^2$; to start with no brackets assumed!

then $m_K = 1$

$m_a = 0{,}204\,(0{,}74/3{,}94)\left[4 - (0{,}74/3{,}94)^2\right] = 0{,}152$

$m = 1^2 - 0{,}152^2 \Rightarrow m = 0{,}977$

One might see the brackets at upper end!

Then, $c_s = 0{,}36 \cdot f = 0{,}36$

$W = 0{,}977 \cdot 0{,}36 \cdot 0{,}74 \cdot 3{,}94^2 \cdot 29{,}1 = 117{,}6$ [cm³]

$\boxed{\text{160 x 9 Bulp section}}$ has 120 [cm³] SM

Alternatively, if both ends bracketed, then $c_s = 0{,}265 f$

$W = 86{,}5$ [cm³] $\boxed{\text{140x9 B.S.}}$