NAUTICUS hull

DNV Rules
Jan 2004
Pt.5 Ch.1 Sec.4

ICE BREAKER (Transv. Stiff.)

Version 10.5 Hull, Sept. 2006

Ship Id: KV Svalbard

Sign:
Time: 17:49
Date: 12.05.29

This spreadsheet calculates plate thicknesses, stiffener- and girder dimensions for transversly stiffened panels in vessels with class notation ICE or POLAR. For POLAR-class vessels also design loads will be presented.

Input for calculation of Class-dependent variables		
Give Class-notation (1-6) :		4
Give 1 if the vessel has Icebreaker-class, 0 else.		1
Input of ship main data - Calculation of design loads		
Give 1 if ship breadth in bow is larger than in midship, 0 els		0
Give ship rule length, [m]	L =	90.800
Give ship breadth, [m]	B =	19.100
Give waterline area coefficient	Cw=	0.835
Give moment of inertia of midship section, [m^4]	Iz =	########
Give ship rule displacement, [t]	Δ =	6530.0
Give design ramming speed, [m/s]	V_{ram} =	3.00
Give bow shape angles [rad] :	α =	1.100
	γ =	0.660
Give 1 if spoon shaped bow, 0 else		1

alpha= 1,07 will be used.

1	ICE-05
2	ICE-10
3	ICE-15
4	POLAR-10
5	POLAR-20
6	POLAR-30

Input of structural data - Calculation of plate, stiffener and girder dimensions

		Plates		Transverse stiffeners								
	F_a	σ_y [MPa]	f_1	σ_y	f_1	s [m]	l [m]	h_w [mm]	β [rad]	c	C_1	I
Stem	1.30	235	1.15	235	1.15	0.40	0.800	0	1.57			0
Bow	1.00	235	1.15	235	1.15	0.40	0.800	0	1.57			0
Bow, Lower	0.67	235	1.15	235	1.15	0.40	0.800	0	1.57			0
Bow, Upper	0.50	235	1.15	235	1.15	0.40	0.800	0	1.57			0
Midship	0.60											
Midship, Lower	0.40											
Midship, Upper	0.30											
Stern	0.80											
Stern, Lower	0.53											
Stern, Upper	0.40											
Bottom	0.25											

	Girders								
	σ_y [MPa]	f_1	S [m]	h_w [mm]	β [rad]	II	k_s	t_k (shell)	t_k (internal)
Stem	235	1.15				2		0.0	0.0
Bow	235	1.15				2		0.0	0.0
Bow, Lower	235	1.15				2		0.0	0.0
Bow, Upper	235	1.15				2		0.0	0.0
Midship								0.5	1.0
Midship, Lower								0.5	1.0
Midship, Upper								0.5	1.0
Stern								0.0	0.0
Stern, Lower								0.0	0.0
Stern, Upper								0.0	0.0
Bottom								1.0	1.5

σ_y = yield stress, [N/mm2]
f_1 = material factor
s = stiffener spacing, [m]
l = stiffener span, [m]
h_w = web height, [mm]
β = angle of web with shell plating, [rad]
F_a = correction factor (calculated)
k_s = shear factor (calculated)

c = factor as given in table C2 of Pt.3 Ch.1 Sec.11 C400
C_1 = arm lenght of bracket, [m]
I : Give 1 if stiffeners are simply supported at both ends, 0 else.
S = Girder span [m]
II : Give 1 if girders are fixed at both ends (default)
2 if girders are continous
3 if girders are simply supported at both ends
t_k = corrosion addition for plate (shell) and web-thickness and area (internal)

Output: Design loads

Design ice compression line load amidship	q	950	kN/m
Design force normal to shell plating in bow area	Poi	30590	kN
Vertical design force resulting from beaching	Pzb	10329	kN
Vertical design force due to head on ramming	Pzr	24490	kN

Output: Dimensions for local strength

NOTE: In the section modules the corrosion addition is NOT accounted for.

			Plates	Transverse stiffeners				Girders	
		p_0	t	A_w	t_w	Z	a_0	A_w	Z
Stem	Rule	9100	47.1	122.1	2.8	687.4	0.0		
	Prop.								
Bow	Rule	7000	41.3	94.0	2.4	528.8	0.0		
	Prop.								
Bow, Lower	Rule	4667	33.8	58.7	2.0	396.5	0.0		
	Prop.								
Bow, Upper	Rule	3500	29.2	44.0	1.7	297.4	0.0		
	Prop.								
Midship	Rule	4200							
	Prop.								
Midship, Lower	Rule	2800							
	Prop.								
Midship, Upper	Rule	2100							
	Prop.								
Stern	Rule	5600							
	Prop.								
Stern, Lower	Rule	3733							
	Prop.								
Stern, Upper	Rule	2800							
	Prop.								
Bottom	Rule	1750							
	Prop.								

p_0 = basic ice pressure, [kN/m2] t = thickness of plates, [mm] A_w = web area, [cm2]
t_w = web thickness, [mm] Z = section modulus, [cm3] a0 = connection area, [cm2]
NB! The web thickness is to be checked against buckling.