LNG FUELED 13K CLASS CHEMICAL TANKER

according to Rules and Regulations for the
Construction and Classification of Ships for the Carrier (LR V)

본 보고서는 대한민국 정부의 "중형선박 설계 경쟁력 강화사업"의 일환으로 작성된 문서입니다.

MANAGER	G.D. OK	CLASS : LR	DATE : 2021. 09. 01	**SCALE**
APPROVED	U.N.KIM	LNG FUELED 13K CLASS CHEMICAL TANKER		NONE
CHECKED	S.M.JUN	**MIDSHIP SECTION RULE SCANTLING REPORT**		**TEAM**
DRAWN	S.J.BAEK			HULL BASIC
TEL.	051) 260 -7811			**REV.** 0
		Lloyd's Register		
		중형선박설계사업단 SHIP DESIGN & ENGINEERING		

Main Dimensions

L, Rule Length	119.80	m
L_{BP}	120.00	m
B, Moulded breadth of ship	21.00	m
D, Moulded depth of ship	11.70	m
T, Moulded draught of ship	8.70	m
C_b	0.78	
DWT, Dead Weight	13068.00	Tonnes

LR V.1 [Application]

Part 4, Chap. 9, Sec. 10.2 [Compartment minimum thickness]

t	**9.04 mm**

LR V.3 [Longitudinal Strength]

Part 3, Chap. 4, Sec. 5.2 [Design Vertical wave bending moments]

Input					m	m			
C_2	f_1	$f_{2\_Sagging}$	Steel	$f_{2\_Hogging}$	L	B	k_L	C_b	C_1
1	1	-1.1	235	1.00	119.80	21.00	1	0.78	8.33

M_{wo}	**371363.58**	**kNm**

Design Vertical Wave Bending				
	$M_{w\_Hogging}$		$M_{w\_Sagging}$	
Value	371639.78	kNm	-408499.94	kNm
abs	371639.78	kNm	408499.94	kNm
max	408499.94			kNm

Bending Moment from T&S	**Ref_DWG**	392400.00	kNm
	T&S_Max Cond.	354484.35	kNm
	10% Margin	389932.79	kNm
	15% Margin	407657.00	kNm

T&S Condition: LD22 (UR-S11_Normal Ballast Condition DEP. - No.6 WBT FULL)

Part 3, Chap. 4, Sec. 5.4 [Minimum Hull Section Modulus]

Z_{min}		Z_{Req}		Ratio(Z_{DECK}/Z_{req})	Ratio(Z_{BOTTOM}/Z_{req})
3.71	m^3	4.57	m^3	1.26	1.68

LR V.3 [Longitudinal Strength]

Part 3, Chap. 4, Sec. 5.5 [Permissible Still Water Bending Moments]

Permissible Still Water Bending (DECK)												
Unit				m^3	m^3			N/mm^2	N/mm^2	N/mm^2		
M_{s_Deck}		$Steel_{\_Deck}$	$Steel_{\_Bot}$	Z_D	Z_B	k_{L_Deck}	k_{L_Bot}	$\sigma_{\_Deck}$	σ_D	σ_B	F_D	F_B
Min.	$= Z_{min} \times \sigma \times 10^3 - M_w$	235	235	5.74	7.69	1	1	175.00	142.17	106.15	0.81	0.61
	241 386.33 kNm	**Section Modulus Results (DECK)**										
Applied Value	**= Actual**		**Actual**	**Rule**	**Status**	**Judge**						
	408 000.00 kNm	**Deck(m^3)**	**5.74**	**4.57**	**125.55%**	**OK**						
Permissible Still Water Bending (BOTTOM)												
Unit				m^3	m^3			N/mm^2	N/mm^2	N/mm^2		
M_{s_Bottom}		$Steel_{\_Deck}$	$Steel_{\_Bot}$	Z_D	Z_B	k_{L_Deck}	k_{L_Bot}	$\sigma_{\_Bot}$	σ_D	σ_B	F_D	F_B
Min.	$= Z_{min} \times \sigma \times 10^3 - M_w$	235	235	5.74	7.69	1	1	175.00	142.17	106.15	0.81	0.61
	241 386.33 kNm	**Section Modulus Results (BOTTOM)**										
Applied Value	**= Actual**		**Actual**	**Rule**	**Status**	**Judge**						
	408 000.00 kNm	**Bottom(m^3)**	**7.69**	**4.57**	**168.16%**	**OK**						

For DECK

For BOTTOM

Part 3, Chap. 4, Sec. 5.8 [Hull Moment of Inertia]

Hull Moment of Inertia	
Unit	m^4
I_{min_1}	16.77
I_{min_2}	13.35

LR V.4 [Hull Envelope Plating]

Part 4, Chap. 9, Sec. 4 [Longitudinally Framed Plate Minimum Thickness]

	J_Results		Input Parameter						
Unit			N/mm^2	N/mm^2	m^3	m^3		mm	m
	J_Deck	J_Bottom	k_{L_Deck}	k_{L_Bottom}	Z_D	Z_B	f_1	s	S
	70.54	83.54	235.00	235.00	5.74	7.69	1.00	690.00	2.3
			1.00	1.00				s_min	669.67

Auto Calculation Parameter												
		N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2	N/mm^2			
k_Deck	k_Bottom	σ_Deck	σ_Bottom	σ_{o_Deck}	σ_{o_Bottom}	σ_{c_Deck}	σ_{c_Bottom}	σ_{Deck}	σ_{Bottom}	F_D	F_B	F_M
1.00	1.00	175.00	175.00	235.00	235.00	142.17	106.15	142.17	106.15	0.81	0.61	0.81
		m^3		m		m	m					
α_Deck	α_Bottom	Z_{min}	C_1	L_1	C_w	h_{T1}	h_{T2}	J_{1_Deck}	J_{2_Deck}	J_{1_Bottom}	J_{2_Bottom}	
1.65	2.21	3.71	8.33	119.8	5.45	11.83	10.44	70.54	72.18	83.11	83.54	
								α<=2	α>2	α<=2	α>2	

Results

Item	Item No.	Value	unit
Upper D/2			
Deck	1	**11.78**	mm
Sheerstrake and gunwale	2	**11.78**	mm
Side shell above mid depth	3,4	**9.97**	mm
Below D/2			
Side shell below mid depth	5,6	**7.56**	mm
Not less than	(a) Mid depth	**9.97**	mm
	(b) upper bilge	**10.20**	mm
Bilge and Bottom shell	7	**10.61**	mm
Bottom shell	8	**10.61**	mm
Keel	9	**12.61**	mm
	Not exceed	25.00	mm

LR V.4 [Hull Envelope Plating]

Part 4, Chap. 1, Sec. 5 [Shell Envelope Plating]

Keel Plating				Bilge Plating				Side Shell Plating						
Keel Breadth	1470.00	mm		**t**	5.15	mm		**Above D/2**	t	10.11	mm			
Thickness	8.26	mm		**Spcaing**	784.37	mm		**Below D/2**	t	10.82	mm	8.88	10.11	10.82

σ_{Bottom}	106.15			R_B	1400	mm					
σ	175.00							σ_D	142.17		
k_L	1							F_M	0.81		
s	690	mm	700					S	2.3	m	
s_1	700							s	690	mm	700
L_1	119.8							s_1	700		
F_B	0.61							F_D	0.81		
h_{T2}	11.43							h_{T1}	11.83	m	
C_w	5.45							h_{T2}	10.44	m	
								f_1	0.92		

C_w = a wave head in metres

= $7{,}71 \times 10^{-2} L\, e^{-0{,}0044\, L}$ where L is not to be taken greater than 227

LR V.7 [Cargo Tank Boundaries]

LR V. 7.3.1 [Cargo Tank Boundaries Plating Minimum

Unit			mm	m	bar	ton/m^3	m	m	m
Input	k_L	K_c	s	l	P_v	ρ	h_1	h_2	h_3
Value	235.00	2	690	2.3	0.25	1.53	11.7	0.76	2.4
Parameter	k	σ_o	f	α_p	α_1	α_2	α_3		
Value	1.00	235.00	0.98	17.96	17.96	0.57	1.23		
t_min	**13.46**	**mm**							

Plating LR V. 7.4 Plating

	\	l	f	k	αp	kc	h1	h2	h3
Trans	1218	10.67	1	1	11.12	2.5	7.11	7.87	9.51
Longi	1218	10.67	1	1	11.15	2.5	7.13	7.89	9.53
	α1	α2	α3	ρ	pv	t min	t re	t ac	Judge
	11.12	5.88	4.88	1.53	0.25	7.5	18.74	21	**OK**
	11.15	5.89	4.89	1.53	0.25	7.5	18.77	21	**OK**

Corrugation LR V. 7.5 Stiffeners and Corrugations

	k	p	αs	h4	h5	h6	α4	α5	α6	le	ρ
Trans	1	1450	8.46	5.34	6.10	7.74	8.46	4.55	3.97	10.67	1.53
Longi	1	1500	8.49	5.35	6.11	7.75	8.49	4.56	3.97	10.67	1.53
	γ	ω1	ω2	dw	b	t p	c	tw	Z re	Z ac	Judge
	1.1	1	1	1080	950	21	1226	21	14433.43182	15407.28	**OK**
	1.1	1	1	1080	1000	21	1190	21	14970.63695	15838.20	**OK**

50tp√k	Judge
1050	**OK**

LR V.8 [Primary Structure]

Part 4, Chap. 9, Sec. 1 [Cargo Tank Boundary Requirements]

$\mathbf{d_{s\_min}}$	1.15 m	double side
$\mathbf{d_{b\_min}}$	1.40 m	double bottom

LR V.8 [Primary Structure]

Part 4, Chap. 9, Sec. 5 [Deck, Side and Bottom Longitudinal Stiffener Calculation]

		Tool(HullScan) Calculation Results				Judgement		Rule Requirement Results			Input Parameter											
	Unit	mm	mm	mm	cm^3			cm^3	cm^3	cm^3	m	m	N/mm^2		mm	m	m	m	m	mm	mm	
Location	Long. No.	Size	t_p	$l_{breadth}$	$Z_{HullScan}$	Percent	Judge	Z_{Rule_Req}	Z_{min_1}	Z_{min_2}	Cal_position(Z)	$h_{Inner\ bottom}$	Min. Yield	k_L	s	l_e	b_1	h	h_0	b_f	b_{f1}	F_s
Upper Deck	0	350x100x12/17	12.0	1080	974	920%	OK	105.83	50.07	105.83	11.70	1.43	235	1	540	2.3	21	0.00	0.40	100.00	6	1.00
	1	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	2	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	3	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	4	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	5	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	6	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	7	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	8	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	9	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	10	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	11	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	12	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	13	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
	14	150x90x12	12.0	1380	229.9	170%	OK	135.22	63.98	135.22	11.70	1.43	235	1	690	2.3	21	0.00	0.40	90.00	6	1.00
Bottom Shell	0	200x12	14.0	1080	166.2	85%	NG	196.52	196.52	194.90	0.00	1.43	235	1	540	2.3	21	11.70	12.10	0.00	6	1.00
	2	250x90x10/15	14.0	1380	507.9	202%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	3	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	4	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	5	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	6	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	7	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	8	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	9	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	10	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	11	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	12	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
	13	250x90x10/15	12.5	1380	503.8	201%	OK	251.11	251.11	249.03	0.00	1.43	235	1	690	2.3	21	11.70	12.10	90.00	5	1.00
Side Shell	14	250x90x10/15	12.5	1320	503.1	205%	OK	245.09	245.09	238.21	1.43	1.43	235	1	660	2.3	21	10.27	10.67	90.00	5	1.02
	15	250x90x10/15	12.5	1320	503.1	195%	OK	258.59	258.59	249.03	2.09	1.43	235	1	690	2.3	21	9.61	10.01	90.00	5	1.03
	17	200x90x9/14	12.5	1380	344.5	133%	OK	259.79	259.79	247.06	3.47	1.43	235	1	690	2.3	21	8.23	8.63	90.00	4.5	1.05
	18	200x90x9/14	12.5	1380	344.5	141%	OK	244.30	244.30	237.69	4.16	1.43	235	1	690	2.3	21	7.54	7.94	90.00	4.5	1.06
	19	200x90x9/14	12.5	1380	344.5	151%	OK	228.47	228.47	228.31	4.85	1.43	235	1	690	2.3	21	6.85	7.25	90.00	4.5	1.07
	20	200x90x9/14	12.5	1380	344.5	157%	OK	218.93	212.31	218.93	5.54	1.43	235	1	690	2.3	21	6.16	6.56	90.00	4.5	1.08
	22	200x90x9/14	12.5	1380	344.5	164%	OK	209.56	195.82	209.56	6.23	1.43	235	1	690	2.3	21	5.47	5.87	90.00	4.5	1.09
	23	200x90x9/14	12.5	1380	344.5	172%	OK	200.18	178.99	200.18	6.92	1.43	235	1	690	2.3	21	4.78	5.18	90.00	4.5	1.10
	24	200x90x9/14	12.5	1380	344.5	181%	OK	190.80	158.77	190.80	7.61	1.43	235	1	690	2.3	21	4.09	4.49	90.00	4.5	1.09
	25	200x90x9/14	12.5	1380	344.5	190%	OK	181.43	138.46	181.43	8.30	1.43	235	1	690	2.3	21	3.40	3.80	90.00	4.5	1.07
	27	150x90x9	12.5	1380	182.1	106%	OK	172.05	118.65	172.05	8.99	1.43	235	1	690	2.3	21	2.71	3.11	90.00	4.5	1.06
	28	150x90x9	12.5	1380	182.1	112%	OK	162.67	99.34	162.67	9.68	1.43	235	1	690	2.3	21	2.02	2.42	90.00	4.5	1.04
Inner Hull	17	250x90x12/16	13.0	1380	554.5	213%	OK	259.79	259.79	247.06	3.47	1.43	235	1	690	2.3	21	8.23	8.63	90.00	6	1.05
	18	250x90x12/16	13.0	1380	554.5	227%	OK	244.30	244.30	237.69	4.16	1.43	235	1	690	2.3	21	7.54	7.94	90.00	6	1.06
	19	250x90x12/16	13.0	1380	554.5	243%	OK	228.47	228.47	228.31	4.85	1.43	235	1	690	2.3	21	6.85	7.25	90.00	6	1.07
	20	250x90x10/15	13.0	1380	554.5	253%	OK	218.93	212.31	218.93	5.54	1.43	235	1	690	2.3	21	6.16	6.56	90.00	5	1.08
	22	250x90x10/15	12.0	1380	551.1	263%	OK	209.56	195.82	209.56	6.23	1.43	235	1	690	2.3	21	5.47	5.87	90.00	5	1.09
	23	200x90x9/14	12.0	1380	343.4	172%	OK	200.18	178.99	200.18	6.92	1.43	235	1	690	2.3	21	4.78	5.18	90.00	4.5	1.10
	24	200x90x9/14	12.0	1380	343.4	180%	OK	190.80	158.77	190.80	7.61	1.43	235	1	690	2.3	21	4.09	4.49	90.00	4.5	1.09
	25	200x90x9/14	10.0	1380	339.1	187%	OK	181.43	138.46	181.43	8.30	1.43	235	1	690	2.3	21	3.40	3.80	90.00	4.5	1.07

	27	150x90x12	10.0	1380	226.2	145%	OK	155.58	85.07	155.58	10.20	1.43	235	1	690	2.3	21	1.50	1.90	90.00	6	1.03
	28	150x90x12	10.0	1380	226.2	152%	OK	148.49	74.87	148.49	10.72	1.43	235	1	690	2.3	21	0.98	1.38	90.00	6	1.02
	29	150x90x12	10.0	1380	226.2	160%	OK	141.38	68.67	141.38	11.25	1.43	235	1	690	2.3	21	0.45	0.85	90.00	6	1.01
Inner Bottom	0	200x12	14.0	1080	166.2	83%	NG	200.53	200.53	194.90	1.43	1.43	235	1	540	2.3	21	10.27	10.67	0.00	6	1.02
	2	250x90x10/15	14.0	1380	507.9	198%	OK	256.23	256.23	249.03	1.43	1.43	235	1	690	2.3	21	10.27	10.67	90.00	5	1.02
	3	250x90x10/15	14.0	1380	507.9	198%	OK	256.23	256.23	249.03	1.43	1.43	235	1	690	2.3	21	10.27	10.67	90.00	5	1.02
	4	250x90x10/15	14.0	1380	507.9	198%	OK	256.23	256.23	249.03	1.43	1.43	235	1	690	2.3	21	10.27	10.67	90.00	5	1.02
	5	250x90x10/15	14.0	1380	507.9	198%	OK	256.23	256.23	249.03	1.43	1.43	235	1	690	2.3	21	10.27	10.67	90.00	5	1.02
	6	250x90x10/15	14.0	1380	507.9	198%	OK	256.23	256.23	249.03	1.43	1.43	235	1	690	2.3	21	10.27	10.67	90.00	5	1.02
	7	250x90x10/15	14.0	1380	507.9	198%	OK	256.23	256.23	249.03	1.43	1.43	235	1	690	2.3	21	10.27	10.67	90.00	5	1.02
	8	250x90x10/15	14.0	1380	507.9	198%	OK	256.23	256.23	249.03	1.43	1.43	235	1	690	2.3	21	10.27	10.67	90.00	5	1.02
	9	250x90x10/15	14.0	1380	507.9	198%	OK	256.23	256.23	249.03	1.43	1.43	235	1	690	2.3	21	10.27	10.67	90.00	5	1.02
	10	250x90x10/15	14.0	1380	507.9	198%	OK	256.23	256.23	249.03	1.43	1.43	235	1	690	2.3	21	10.27	10.67	90.00	5	1.02
	11	250x90x10/15	14.0	1380	507.9	198%	OK	256.23	256.23	249.03	1.43	1.43	235	1	690	2.3	21	10.27	10.67	90.00	5	1.02
Hopper	14	250x90x10/15	14.0	1200	505.8	226%	OK	224.21	224.21	216.55	1.88	1.43	235	1	600	2.3	21	9.82	10.22	90.00	5	1.03
	15	250x90x10/15	14.0	1200	505.8	224%	OK	225.63	225.63	216.55	2.34	1.43	235	1	600	2.3	21	9.36	9.76	90.00	5	1.03

LR V.8 [Primary Structure]

Part 4, Chap. 1, Sec. 6_ Table 1.6.1-(2) [Shell Framing(Longitudinal]

		Tool(HullScan) Calculation Results				Judgement		Rule Requirement Results			Input Parameter												
	Unit	mm	mm	mm	cm^3			cm^3	cm^3	cm^3	m	m	N/mm^2		mm	m			Ton/m^3			mm	mm
Location	Long. No.	Size	t_p	$l_{breadth}$	$Z_{HullScan}$	Percent	Judge	Z_{Rule_Req}	Z(a)	Z(b)	Cal_position(Z)	$h_{inner\ bottom}$	Min. Yield	k_L	s	l_e	F_λ	γ	ρ	ω_1	ω_2	b_f	b_{fl}
Side Shell	14	250x90x10/15	12.5	1320	503.10	172%	OK	292.81	292.81	281.22	1.43	1.43	235	1	660	2.3	1	1.10	1.025	1.00	1.00	90.00	5.00
	15	250x90x10/15	12.5	1320	503.10	179%	OK	281.22	277.56	281.22	2.09	1.43	235	1	660	2.3	1	1.10	1.025	1.00	1.00	90.00	5.00
	17	200x90x9/14	12.5	1380	344.50	117%	OK	294.00	256.36	294.00	3.47	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	18	200x90x9/14	12.5	1380	344.50	117%	OK	294.00	239.20	294.00	4.16	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	19	200x90x9/14	12.5	1380	344.50	117%	OK	294.00	221.87	294.00	4.85	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	20	200x90x9/14	12.5	1380	344.50	117%	OK	294.00	204.37	294.00	5.54	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	22	200x90x9/14	12.5	1380	344.50	117%	OK	294.00	186.71	294.00	6.23	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	23	200x90x9/14	12.5	1380	344.50	117%	OK	294.00	168.88	294.00	6.92	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	24	200x90x9/14	12.5	1380	344.50	117%	OK	294.00	148.59	294.00	7.61	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	25	200x90x9/14	12.5	1380	344.50	117%	OK	294.00	128.36	294.00	8.30	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	27	150x90x9	12.5	1380	182.10	62%	NG	294.00	108.63	294.00	8.99	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	28	150x90x9	12.5	1380	182.10	62%	NG	294.00	89.41	294.00	9.68	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
Inner Hull	17	250x90x12/16	13.0	1380	554.50	189%	OK	294.00	256.36	294.00	3.47	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	6.00
	18	250x90x12/16	13.0	1380	554.50	189%	OK	294.00	239.20	294.00	4.16	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	6.00
	19	250x90x12/16	13.0	1380	554.50	189%	OK	294.00	221.87	294.00	4.85	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	6.00
	20	250x90x10/15	13.0	1380	554.50	189%	OK	294.00	204.37	294.00	5.54	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	5.00
	22	250x90x10/15	12.0	1380	551.10	187%	OK	294.00	186.71	294.00	6.23	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	5.00
	23	200x90x9/14	12.0	1380	343.40	117%	OK	294.00	168.88	294.00	6.92	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	24	200x90x9/14	12.0	1380	343.40	117%	OK	294.00	148.59	294.00	7.61	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	25	200x90x9/14	10.0	1380	339.10	115%	OK	294.00	128.36	294.00	8.30	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	4.50
	27	150x90x12	10.0	1380	226.20	77%	NG	294.00	75.19	294.00	10.20	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	6.00
	28	150x90x12	10.0	1380	226.20	77%	NG	294.00	51.82	294.00	10.72	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	6.00
	29	150x90x12	10.0	1380	226.20	77%	NG	294.00	24.42	294.00	11.25	1.43	235	1	690	2.3	1	1.10	1.025	1.00	1.00	90.00	6.00
Hopper	14	250x90x10/15	14.0	1200	505.80	197%	OK	256.69	256.69	255.65	1.88	1.43	235	1	600	2.3	1	1.10	1.025	1.00	1.00	90.00	5.00
	15	250x90x10/15	14.0	1200	505.80	198%	OK	255.65	247.11	255.65	2.34	1.43	235	1	600	2.3	1	1.10	1.025	1.00	1.00	90.00	5.00

Part 4, Chap. 1, Sec. 6_ Table 1.6.1-(3) [Shell Framing(Longitudinal]

		Tool(HullScan) Calculation Results				Judgement		Rule Requirement Results			Input Parameter												
	Unit	mm	mm	mm	cm^3			cm^3	cm^3	cm^3	m	m	N/mm^2		mm	m	m					mm	mm
Location	Long. No.	Size	t_p	$l_{breadth}$	$Z_{HullScan}$	Percent	Judge	Z_{Rule_Req}	Z(a)	Z(b)	Cal_position(Z)	$h_{inner\ bottom}$	Min. Yield	k_L	s	l_e	l_{e1}	F_λ	γ	ω_1	ω_2	b_f	b_{fl}
Bottom Shell	0	200x12	14.0	1080	166.20	78%	NG	212.94	212.94	116.32	0.00	1.43	235	1	540	2.3	2.5	1	0.05	1.00	1.00	0.00	6.00
	2	250x90x10/15	14.0	1380	507.90	187%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	3	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	4	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	5	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	6	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	7	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	8	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	9	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	10	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	11	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	12	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00
	13	250x90x10/15	12.5	1380	503.80	185%	OK	272.08	272.08	148.64	0.00	1.43	235	1	690	2.3	2.5	1	0.05	1.00	1.00	90.00	5.00

LR V.8 [Primary Structure]

Part 4, Chap. 9, Sec. 6_ Table 9.6.1 [Inner Hull and Longitudinal Oiltight Bulkhead Scantling]

*** Item (1) [Plating thicknesses including corrugations(mm)]**

0.1D from deck	t(a)	6.32 mm	Elsewhere	t(c)	6.32 mm
0.1D from BTM	t(b)	5.13 mm	Minimum	t(d)	6.84 mm

*** Item (2) [stiffener modulus(cm^3)]**

		Tool(HullScan) Calculation Results				Judgement		Rule Requirement Results				Input Parameter					
	Unit	mm	mm	mm	cm^3			cm^3	cm^3	cm^3	cm^3	m	N/mm^2	mm	m	degrees	m
								Verti. Stiffened	Hori. Stiffened								
Location	Long. No.	Size	t_p	$l_{breadth}$	$Z_{HullScan}$	Percent	Judge	Z	Z	Z(i)	Z(ii)	Cal_position(Z)	Steel	s	b_1	α	l_c
Upper Deck	0	350x100x12/17	12.0	1080	974	1215%	OK	80.14	80.97	43.39	80.97	11.7	235.00	540	16.74	49	2.3
	1	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	2	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	3	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	4	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	5	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	6	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	7	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	8	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	9	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	10	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	11	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	12	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	13	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
	14	150x90x12	12.0	1380	229.9	225%	OK	102.40	103.46	55.44	103.46	11.7	235.00	690	16.74	49	2.3
Bottom Shell	0	200x12	14.0	1080	166.2	66%	NG	251.92	252.67	252.67	205.40	0	235.00	540	16.74	49	2.3
	2	250x90x10/15	14.0	1380	507.9	158%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	3	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	4	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	5	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	6	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	7	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	8	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	9	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	10	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	11	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	12	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
	13	250x90x10/15	12.5	1380	503.8	157%	OK	321.90	322.86	322.86	262.45	0	235.00	690	16.74	49	2.3
Side Shell	14	250x90x10/15	12.5	1320	503.1	183%	OK	274.45	275.27	275.27	232.46	1.43	235.00	660	16.74	49	2.3
	15	250x90x10/15	12.5	1320	503.1	186%	OK	270.79	271.59	271.59	234.05	2.09	235.00	690	16.74	49	2.3
	17	200x90x9/14	12.5	1380	344.5	145%	OK	237.04	237.74	237.74	215.30	3.47	235.00	690	16.74	49	2.3
	18	200x90x9/14	12.5	1380	344.5	156%	OK	220.16	220.82	220.82	205.92	4.16	235.00	690	16.74	49	2.3
	19	200x90x9/14	12.5	1380	344.5	169%	OK	203.29	203.89	203.89	196.55	4.85	235.00	690	16.74	49	2.3
	20	200x90x9/14	12.5	1380	344.5	185%	OK	186.41	187.17	186.97	187.17	5.54	235.00	690	16.74	49	2.3

	LNG FUELED 13K CLASS CHEMICAL TANKER											MIDSHIP SECTION RULE SCANTLING REPORT DATE : 2021. 09. 01					
Side Shell	22	200x90x9/14	12.5	1380	344.5	196%	OK	175.98	177.79	170.05	177.79	6.23	235.00	690	16.74	49	2.3
	23	200x90x9/14	12.5	1380	344.5	207%	OK	166.70	168.42	153.12	168.42	6.92	235.00	690	16.74	49	2.3
	24	200x90x9/14	12.5	1380	344.5	219%	OK	157.42	159.04	136.20	159.04	7.61	235.00	690	16.74	49	2.3
	25	200x90x9/14	12.5	1380	344.5	233%	OK	148.14	149.66	119.27	149.66	8.3	235.00	690	16.74	49	2.3
	27	150x90x9	12.5	1380	182.1	131%	OK	138.85	140.29	102.35	140.29	8.99	235.00	690	16.74	49	2.3
	28	150x90x9	12.5	1380	182.1	141%	OK	129.57	130.91	85.42	130.91	9.68	235.00	690	16.74	49	2.3
Inner Hull	17	250x90x12/16	13.0	1380	554.5	234%	OK	237.04	237.74	237.74	215.30	3.47	235.00	690	16.74	49	2.3
	18	250x90x12/16	13.0	1380	554.5	252%	OK	220.16	220.82	220.82	205.92	4.16	235.00	690	16.74	49	2.3
	19	250x90x12/16	13.0	1380	554.5	273%	OK	203.29	203.89	203.89	196.55	4.85	235.00	690	16.74	49	2.3
	20	250x90x10/15	13.0	1380	554.5	297%	OK	186.41	187.17	186.97	187.17	5.54	235.00	690	16.74	49	2.3
	22	250x90x10/15	12.0	1380	551.1	313%	OK	175.98	177.79	170.05	177.79	6.23	235.00	690	16.74	49	2.3
	23	200x90x9/14	12.0	1380	343.4	206%	OK	166.70	168.42	153.12	168.42	6.92	235.00	690	16.74	49	2.3
	24	200x90x9/14	12.0	1380	343.4	218%	OK	157.42	159.04	136.20	159.04	7.61	235.00	690	16.74	49	2.3
	25	200x90x9/14	10.0	1380	339.1	229%	OK	148.14	149.66	119.27	149.66	8.3	235.00	690	16.74	49	2.3
	27	150x90x12	10.0	1380	226.2	185%	OK	122.55	123.82	72.62	123.82	10.202	235.00	690	16.74	49	2.3
	28	150x90x12	10.0	1380	226.2	196%	OK	115.53	116.72	59.81	116.72	10.724	235.00	690	16.74	49	2.3
	29	150x90x12	10.0	1380	226.2	208%	OK	108.50	109.62	52.47	109.62	11.247	235.00	690	16.74	49	2.3
Inner Bottom	0	200x12	14.0	1080	166.2	74%	NG	224.55	225.22	225.22	190.19	1.43	235.00	540	16.74	49	2.3
	2	250x90x10/15	14.0	1380	507.9	177%	OK	286.93	287.78	287.78	243.02	1.43	235.00	690	16.74	49	2.3
	3	250x90x10/15	14.0	1380	507.9	177%	OK	286.93	287.78	287.78	243.02	1.43	235.00	690	16.74	49	2.3
	4	250x90x10/15	14.0	1380	507.9	177%	OK	286.93	287.78	287.78	243.02	1.43	235.00	690	16.74	49	2.3
	5	250x90x10/15	14.0	1380	507.9	177%	OK	286.93	287.78	287.78	243.02	1.43	235.00	690	16.74	49	2.3
	6	250x90x10/15	14.0	1380	507.9	177%	OK	286.93	287.78	287.78	243.02	1.43	235.00	690	16.74	49	2.3
	7	250x90x10/15	14.0	1380	507.9	177%	OK	286.93	287.78	287.78	243.02	1.43	235.00	690	16.74	49	2.3
	8	250x90x10/15	14.0	1380	507.9	177%	OK	286.93	287.78	287.78	243.02	1.43	235.00	690	16.74	49	2.3
	9	250x90x10/15	14.0	1380	507.9	177%	OK	286.93	287.78	287.78	243.02	1.43	235.00	690	16.74	49	2.3
	10	250x90x10/15	14.0	1380	507.9	177%	OK	286.93	287.78	287.78	243.02	1.43	235.00	690	16.74	49	2.3
	11	250x90x10/15	14.0	1380	507.9	177%	OK	286.93	287.78	287.78	243.02	1.43	235.00	690	16.74	49	2.3
Hopper	14	250x90x10/15	14.0	1200	505.8	211%	OK	239.91	240.63	240.63	205.99	1.881	235.00	600	16.74	49	2.3
	15	250x90x10/15	14.0	1200	505.8	220%	OK	230.21	230.90	230.90	200.61	2.337	235.00	600	16.74	49	2.3

Part 4, Chap. 9, Sec. 6.5 [Inner Bottom Minimum Thickness]

P4C9S6.5		Unit	m	m	ton/m^3						
Inner Bottom Min. Thickness		Parameter	h_4	S	ρ	f	(a) Inner Bottom Plating Req		(b) Deeptank Bulkheads Req		P4C1S8.4.1 Minimum INB Plate Thick	
$t_{\text{Inner Bottom Min}}$	**11.62 mm**	Value	7.61	2.3	1.53	0.98	10.44	mm	11.62	mm	10.43	mm

LR V.8 [Primary Structure]

Part 4, Chap. 1, Sec. 8.5 [Floors]

k_L	k	d_{DB}
235.00	1.00	1192.66

	Rule		Actual		Judge
Non-Watertight plate floors Minimum Thickness					
t	9.35	mm	11.00	mm	OK
Watertight plate floors Minimum Thickness					
t	12.54	mm	16.00	mm	OK
Transverse Bracket Minimum Thickness					
t	10.73	mm	11.00	mm	OK

Part 4, Chap. 9, Sec. 9.3 [Girders and Floors in Double Bottom]

	m	m			
k_L	S	S_T	b_T	S_G	k
235.00	2.3	2.30	18.6	2.76	1.00

	Rule		Actual		Judge
(a)	**Center Girder or Duct keel Thickness**				
t	10.54	mm	16.00	mm	OK
(b)	**Floors and side girdersThickness**				
t	9.35	mm	12.00	mm	OK

Part 4, Chap. 10, Sec. 2.8 [Deck Transverses]

	Rule		Actual		Judge
Z	1315.36	cm^3	3062.60	cm^3	OK

Part 4, Chap. 10, Sec. 2.9 [Deck Girders]

	Rule		Actual		Judge
Z	809.14	cm^3	974.00	cm^3	OK