

COMPANY INTRODUCTION

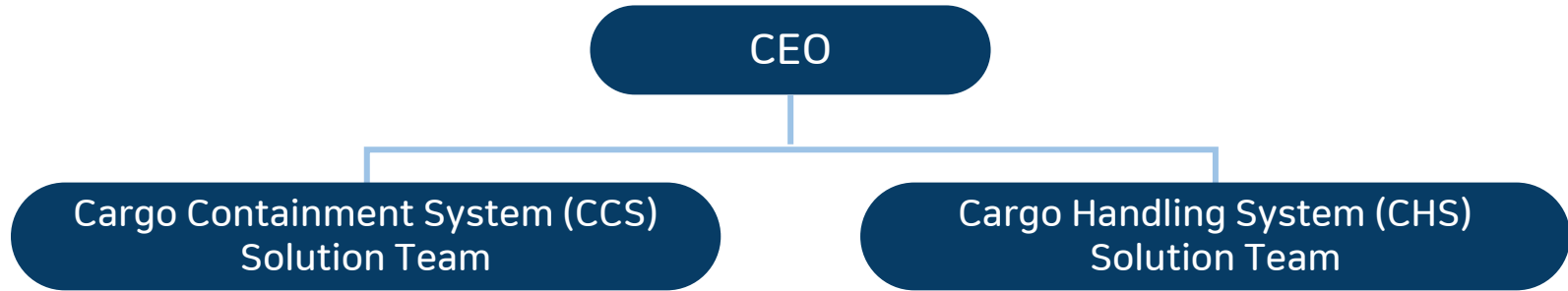


GASPACK
CRYOGENIC SOLUTIONS

- ❖ COMPANY NAME : **GASPACK Co., Ltd.**
- ❖ Established : May 2017
- ❖ Address : A-302, Centum Sky Biz, 97, Centum jungang-ro, Haeundae-gu, Busan, Republic of Korea
- ❖ Business : **Liquefied Gas CCS & CHS Engineering Service**

Cargo Containment System [CCS] ● IMO Type C / IMO Type B / IMO Type A / Membrane System Consulting

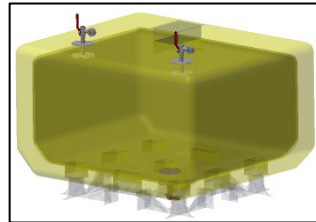
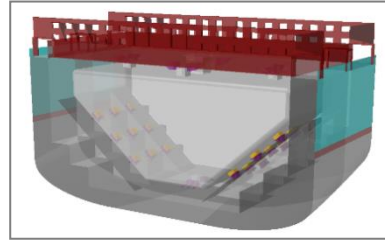
Cargo Handling System [CHS] ● Liquefied Gas Cargo System / Fuel Gas Supply System / Bunkering System / Re-liquefaction System / Re-gasification System



Name	Position	Career
Kwang Seok Kim	CEO	2017 ~ 1995 ~ 2016 GASPACK, CEO DSME R&D Institute, Head of Gas Containment System Part
Youngsik Moon	CTO	2018 ~ 1995 ~ 2017 GASPACK, CHS Solution Team DSME R&D Institute, Head of Gas Handling System Part
Young Bin Kwon	Technical Director	2017 ~ 2013 ~ 2017 2008 ~ 2013 GASPACK, CCS Solution Team Samsung Heavy Industries R&D Center, Senior Engineer DSME R&D Institute, Assistant Engineer
Chang Youl Park	Technical Director	2019 ~ 2017 ~ 2019 2008 ~ 2017 GASPACK, CCS Solution Team LG Electronic R&D Institute, Senior Engineer DSME R&D Institute, Assistant Engineer
Ji Won Kim	Senior Engineer	2020 ~ 2012 ~ 2019 GASPACK, CCS Solution Team Cooperative Company of DSME R&D Institute
Jun-Young Choi	Senior Engineer	2018 ~ GASPACK, CCS Solution Team
Hye-jin Park	Assistant Engineer	2018 ~ GASPACK, CHS Solution Team
Tea Hun Kim	Assistant Engineer	2019 ~ GASPACK, CHS Solution Team

Liquefied Gas CCS & CHS Package Engineering Solution Provider !

Cargo Containment System (CCS)



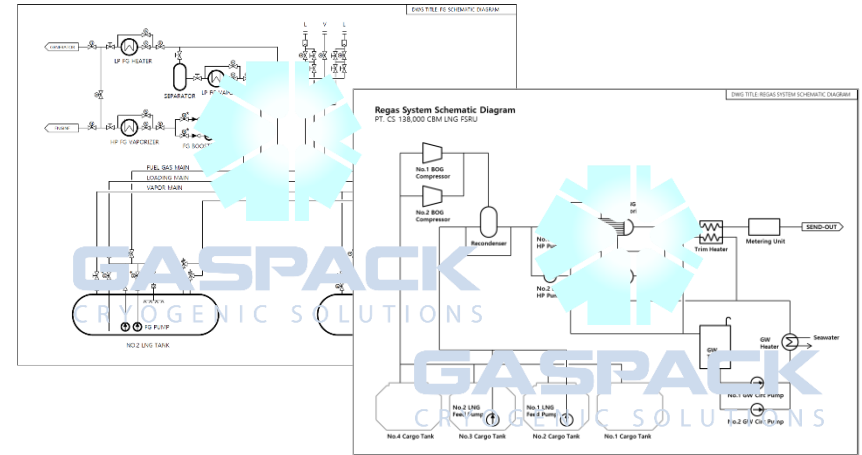
IMO Type A Tank

IMO Type B Tank

IMO Type C Tank

Insulation System

Cargo Handling System (CHS)



Fuel Gas Supply System

Re-gasification System

LNG Bunkering System

Re-liquefaction System

Technical Document List for CCS

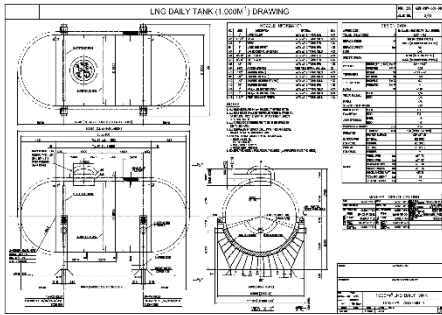
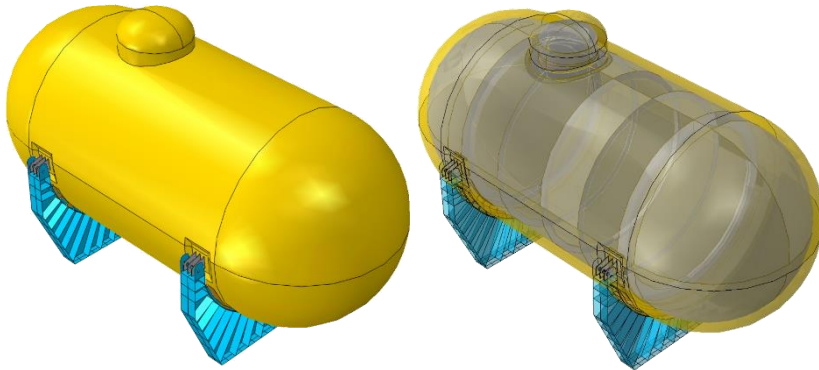
- 1 Cargo Tank Basic Specification
- 2 Cargo Tank Structural Drawing (Basic/Detail) incl. Supports
- 3 Cargo Tank Initial Scantling Calculation
- 4 Cargo Tank Nozzle Strength Calculation
- 5 Cargo Tank Dynamic Liquid Pressure Calculation incl. Sloshing Pressure
- 6 Cargo Tank Material Selection
- 7 Cargo Tank Structural Analysis (Thermal/Yielding/Buckling)
- 8 Cargo Tank Fatigue Analysis (Simplified HCF/LCF)
- 9 Cargo Tank Heat Transfer Analysis
- 10 Cargo Tank General Insulation Data
- 11 Cargo Tank B.O.R & Pressure Build-Up Calculation
- 12 Cargo Tank Loading Limit Curve
- 13 Cargo Tank Lifting Analysis
- 14 Cargo Tank Cool Down Curve
- 15 Cargo Tank Level Calibration Table
- 16 Cargo Tank Installation Plan and Procedure
- 17 Cargo Tank internal piping arrangement
- 18 Thermal & Structural Analysis for Internal Piping and Outfitting of Cargo Tank
- 19 Typical diagram for Cargo Tank

Technical Document List for CHS

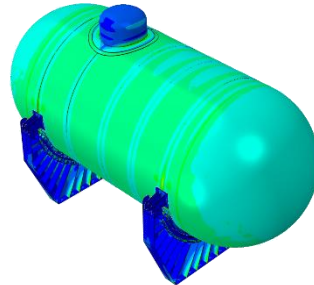
- 1 Process Flow Diagram (PFD) with heat and material balance
- 2 Equipment, valves and line sizing report
- 3 Functional diagram
- 4 Capacity calculation for spray nozzle in LNG tanks
- 5 Capacity calculations for water spray system
- 6 P&ID of LNG system (tank, FGSS, bunkering station, if any)
- 7 Equipment list
- 8 Valve list
- 9 Instrument list
- 10 Cargo operation manual
- 11 Technical assistance during design and construction stage
- 12 Supervision for FAT, installation, gas trial, etc.

❖ [KARADENIZ-MOL] 125K FSRU Conversion Project (Approved by Class BV)

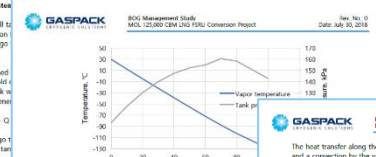
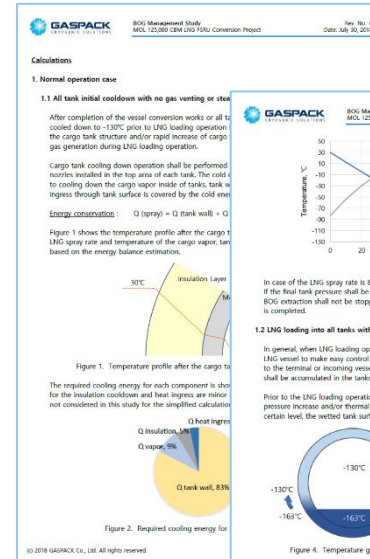
1K LNG Daily Tank Design & Engineering



S. Mises Envelope (max abs) (Avg: 100%)



FSRU B.O.G. Management Study

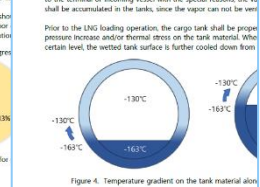


In case of the LNG spray rate is 8 ton/h, the maximum tank pressure (if the heat tank pressure shall be set to lower pressure to prepare BOG extraction shall not be stopped for a certain period, even the is completed).

1.2 LNG loading into all tanks without vapor return

In general, when LNG loading operation is performed with vapor LNG vessel to make easy control the both LNG tank pressure. In case to the terminal or incoming vessel with the special reasons, the vapor shall be accumulated in the tanks, since the vapor can not be vented.

Prior to the LNG loading operation, the cargo tank shall be proper pressure increase and/or thermal stress on the tank material. When certain level of the wetted tank surface is further cooled down from



While the tank material is further cooled down, a corresponding LNG and causes the tank pressure increase. At the same time, a certain to LNG loaded volume shall be displaced. If a enough vapor amount, the tank pressure will be increased and LNG temperature will corresponding to the increased tank pressure.

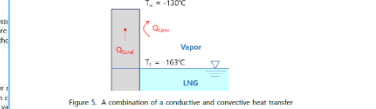
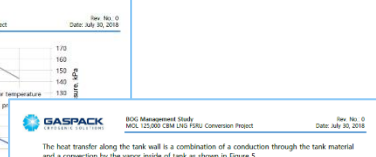
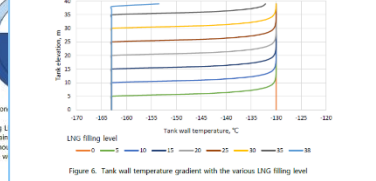


Figure 6 shows the temperature gradient on the tank wall material when the tank is filled up with the cold LNG during the LNG loading operation. For example, if the LNG is filled in 5m level of the tank, the tank wall underneath 5 m of tank elevation will be cooled down from -130°C to -163°C . The tank wall between 5 m and 10 m of the tank elevation will be partly cooled down to a certain temperature as shown in the Figure 6. The upper surface temperature will keep the initial tank temperature of -130°C .



Thus, the following energy conservation can be applied on the estimation of the tank pressure during LNG loading operation.

Energy conservation:

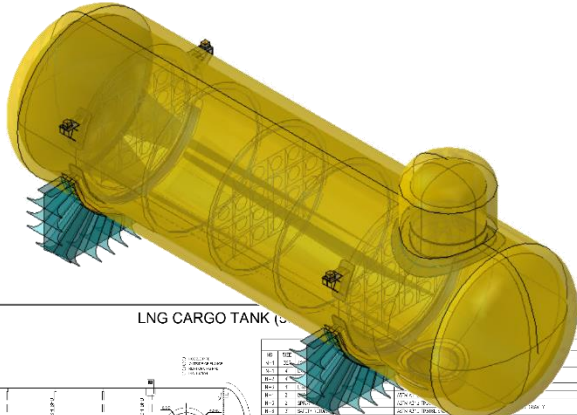
$$Q(\text{BOG accumulated}) + Q(\text{LNG accumulated}) + Q(\text{heat ingress through tank wall}) + Q(\text{heat ingress through loading pipes}) = Q(\text{tank wall further cooldown}) + Q(\text{vapor to be displaced}) + Q(\text{heat ingress through tank wall}) + Q(\text{heat ingress through loading pipes})$$

1K LNG daily tank (125K FSRU)

LNG tank basic & detail design



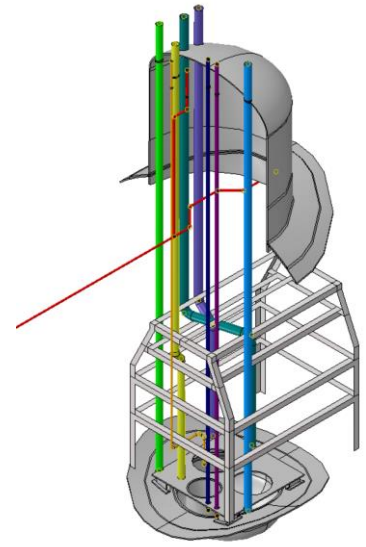
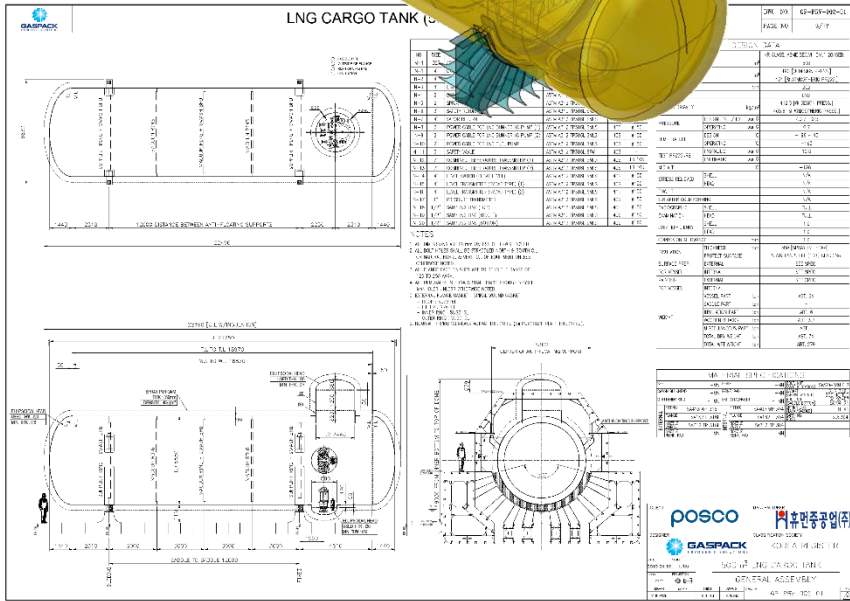
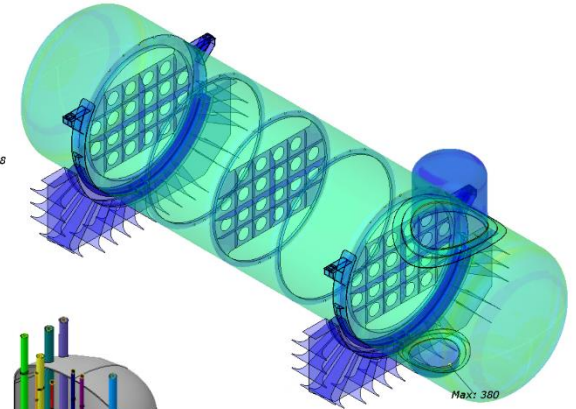
❖ [KRISO] 500m3 LNG Cargo Tank for Bunkering Barge (Approved by Class KR)



S, Mises
Envelope (max abs)
(Avg: 100%)

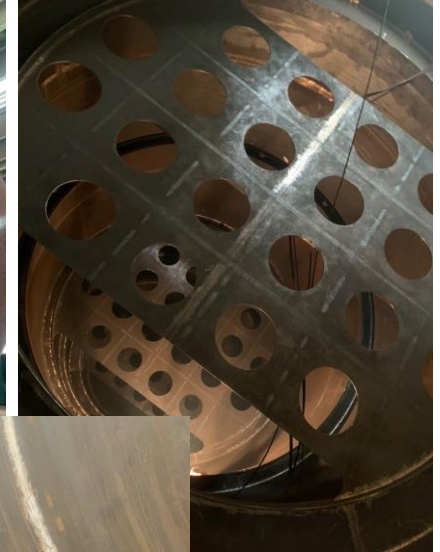
380
348
285
253
222
190
158
127
95
63
32
0

Max: 380
Node: SUPP-1.7668

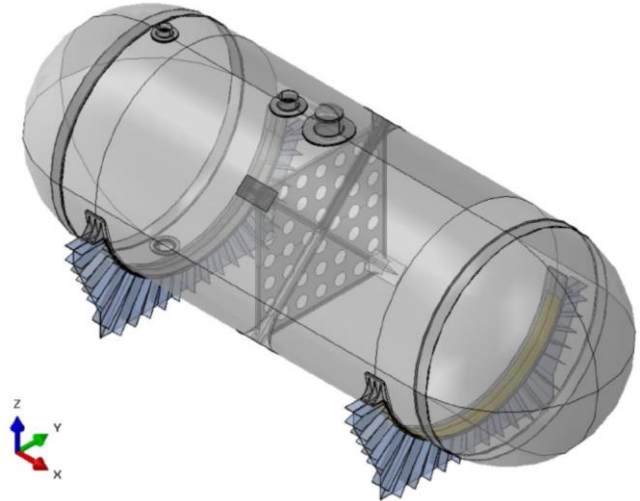
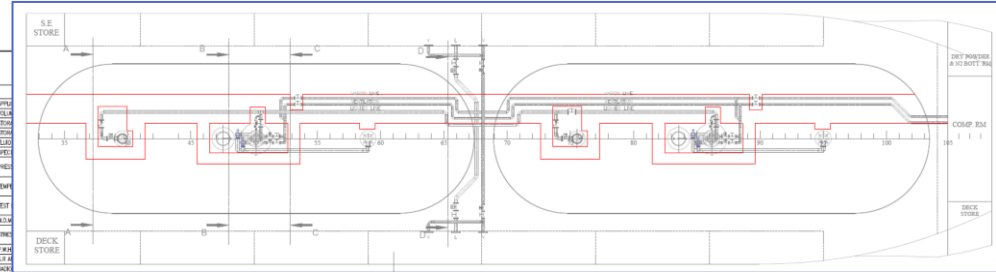
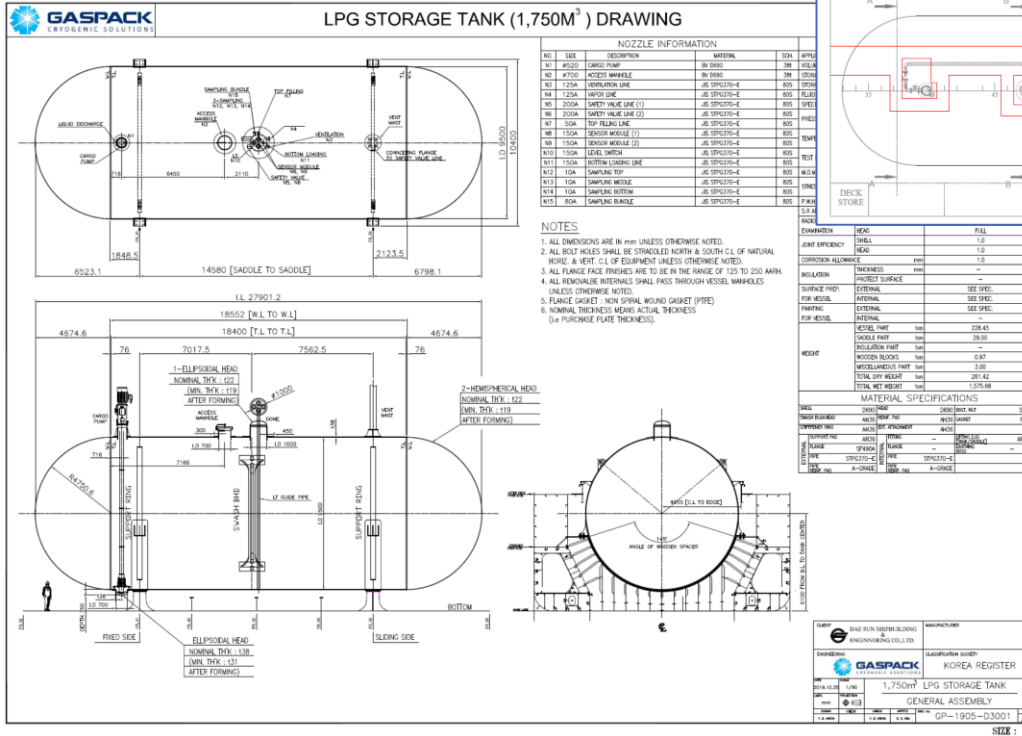


500CBM LNG Cargo Tank (POSCO High Manganese Steel)

CCS Engineering

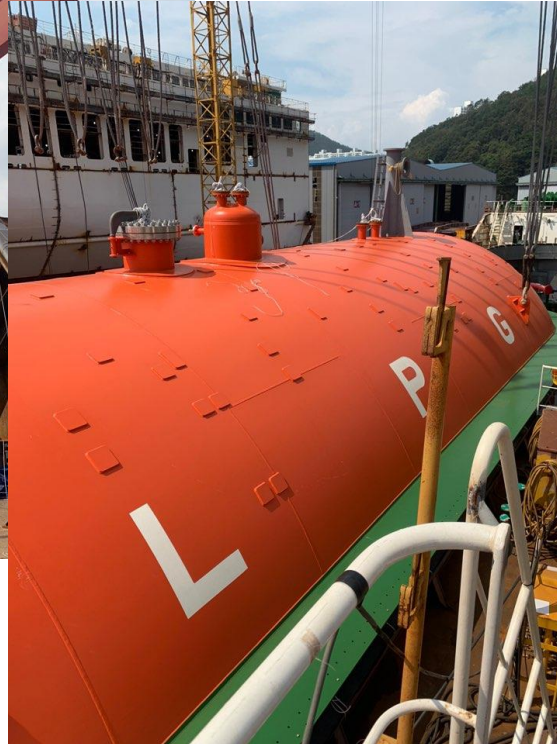


❖ [DAESUN Shipbuilding] 1,750m³ LPG Cargo Tank & Cargo Handling System (Approved by Class KR)



3,500CBM LPGC

CCS & CHS Engineering Package

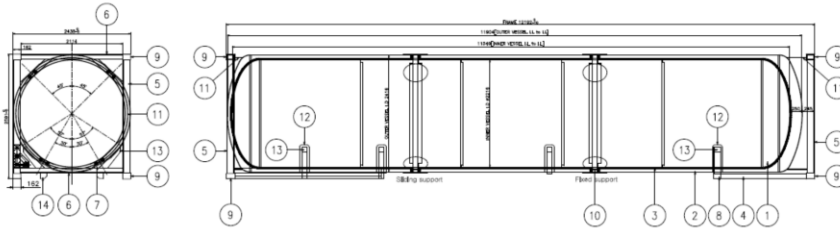
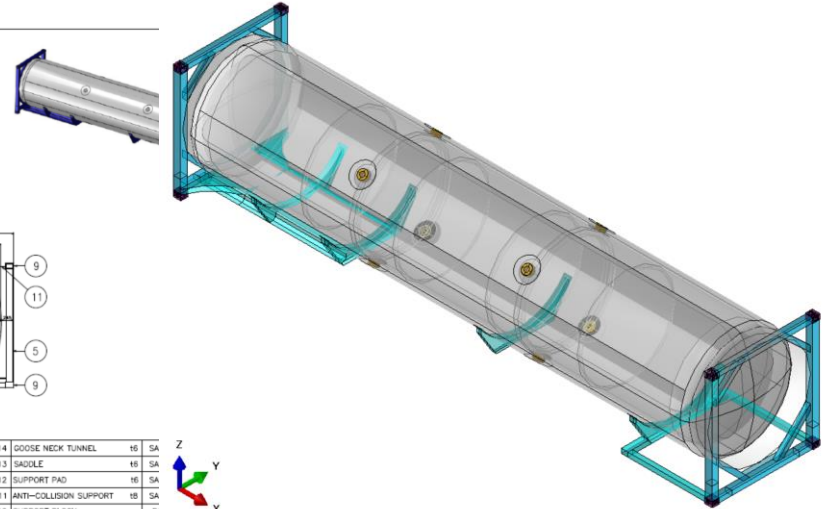


❖ [HHI] LN2 Supply Skid for CCS Mock-Up Test Bed



❖ [Corban Energy Group] 40ft LNG ISO Tank Container (Approved by Class KR)

GENERAL SPECIFICATION			NOTE
CONTAINER TYPE	40 FEET ISO CONTAINER		1. ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE NOTED. 2. FLANGE : ANSI B16.5 150# WN. / MATL : A182-F316L 3. PIPE MATL (INNER/OUTER) : A312-TP304 / A312-TP316L 4. ALL BOLT HOLES SHALL BE STRADDLED NORTH & SOUTH C/L OR NATURAL HORIZ. & VERT. C/L OF EQUIPMENT UNLESS OTHERWISE NOTED. 5. PAINTING SPECIFICATION (OUTER VESSEL) 1) SURFACE PREPARATION (IN. & OUT.) : SSPC-SP-10 2) PAINTING : A) 1st : EPOXY PRIMER (EP 170) 50 MICRON B) 2nd : HIGH BUILD EPOXY PAINT(HE270) 100 MICRON C) 3rd : ACRYLIC/POLYURETHANE PAINT(UG911) 50 MICRON (WHITE) 6. INNER VESSEL IS DESIGNED & CONSTRUCTED BY MANDATORY APPENDIX 44 (COLD STRETCHING).
MODEL	40 FEET ISO CONTAINER		
TYPE	MULTI-LAYER INSULATION WITH HIGH-VACUUM ISO FRAME CRYOGENIC TANK CONTAINER GOOSENECK TYPE		
EXTERNAL DIMENSION	LENGTH	mm 12192±0.5	
	WIDTH	mm 2438±0.5	
WEIGHT	TARE	kg(lb) less than 12,247 (27,200)	
	CAPACITY	kg(lb) less than 17,415 (38,394)	
	MAX. GROSS	kg(lb) less than 29,662 (65,394)	



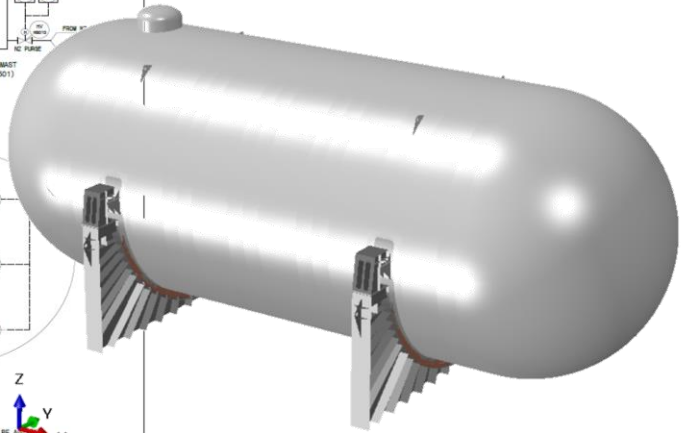
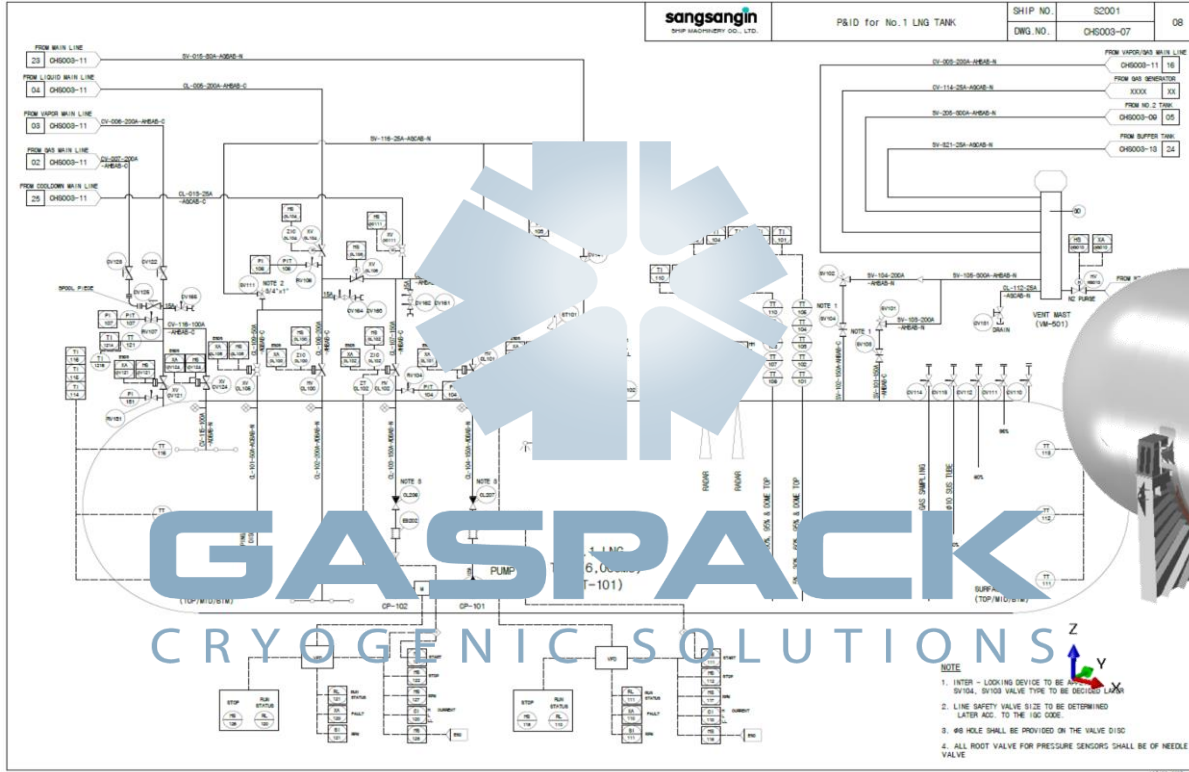
NO.	DESCRIPTION	MATERIAL	QTY	REMARKS	
14	GOOSE NECK TUNNEL	16 SA	8		
13	SADDLE	16 SA	1		
12	SUPPORT PAD	16 SA	4		
11	ANTI-COLLISION SUPPORT	16 SA	4		
10	SUPPORT BLOCK	16	4		
9	CORNER CASTING	SCW480	8	BD1161	
8	SUPPORT FRAME	150X100X6	SRT275	1	SQUARE BEAM
7	DIAGONAL FRAME	100X100X6	SRT275	8	SQUARE BEAM
6	BTM TRANS. FRAME	150X100X9	SRT275	4	SQUARE BEAM
5	VERTICAL FRAME	150X100X9T	SRT275	4	SQUARE BEAM
4	BTM LONG. FRAME	100X100X6T	SRT275	2	SQUARE BEAM
3	INSULATION MATERIAL	MLJ	-		
2	OUTER JACKET	S18/H18	SA516-70	1	TORQ HEAD
1	INNER VESSEL	S18/H18	SA240 304L	1	ELLIP. HEAD

DESIGN DATA			
INNER VESSEL		OUTER JACKET	
VESEL DESIGN CODE	ASME SEC-VI DIV-1 2019 ED (INNER SHELL ONLY)		
TYPE APPROVAL (CLASSIFICATION SOCIETY)	MOG. CSC, ADR/IND. TR. UN. ASME, USDOT, KR		
GROSS VOLUME	m ³ 43.00	N/A	
FLUID	LNG	N/A	
PRESSURE	DESIGN	MPa 0.7	Full Vacuum
	OPERATION	MPa 0.6	Full Vacuum
	HYDRAULIC	MPa 1.218	Full Vacuum
TEST PRESSURE	C.S.	MPa 1.218	Full Vacuum
	LEAK	MPa 0.73	0.025
M.A.W.P.	MPa 0.812(Internal)	Full Vacuum	
FINISH	N/A	N/A	
CORROSION ALLOWANCE	0.0	1.0	
VACUUM DEGREE (ON FABRICATION)	mTorr N/A	1.0	
EVAPORATION RATE	% LNG/DAY	0.21	
HOLDING TIME	days	1110 (to Design Pressure)	
M.D.M.T	-196 °C at 0.812Mpa	N/A	

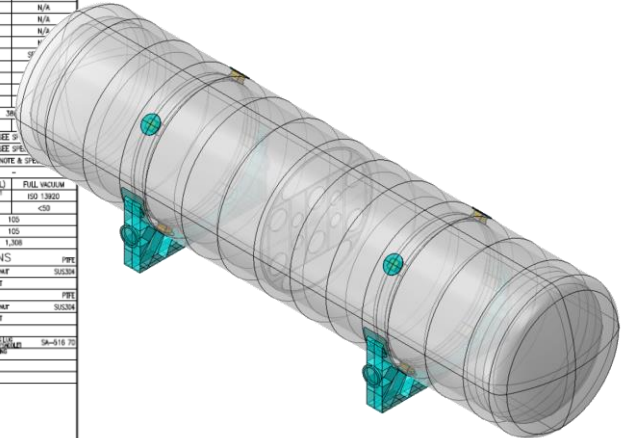
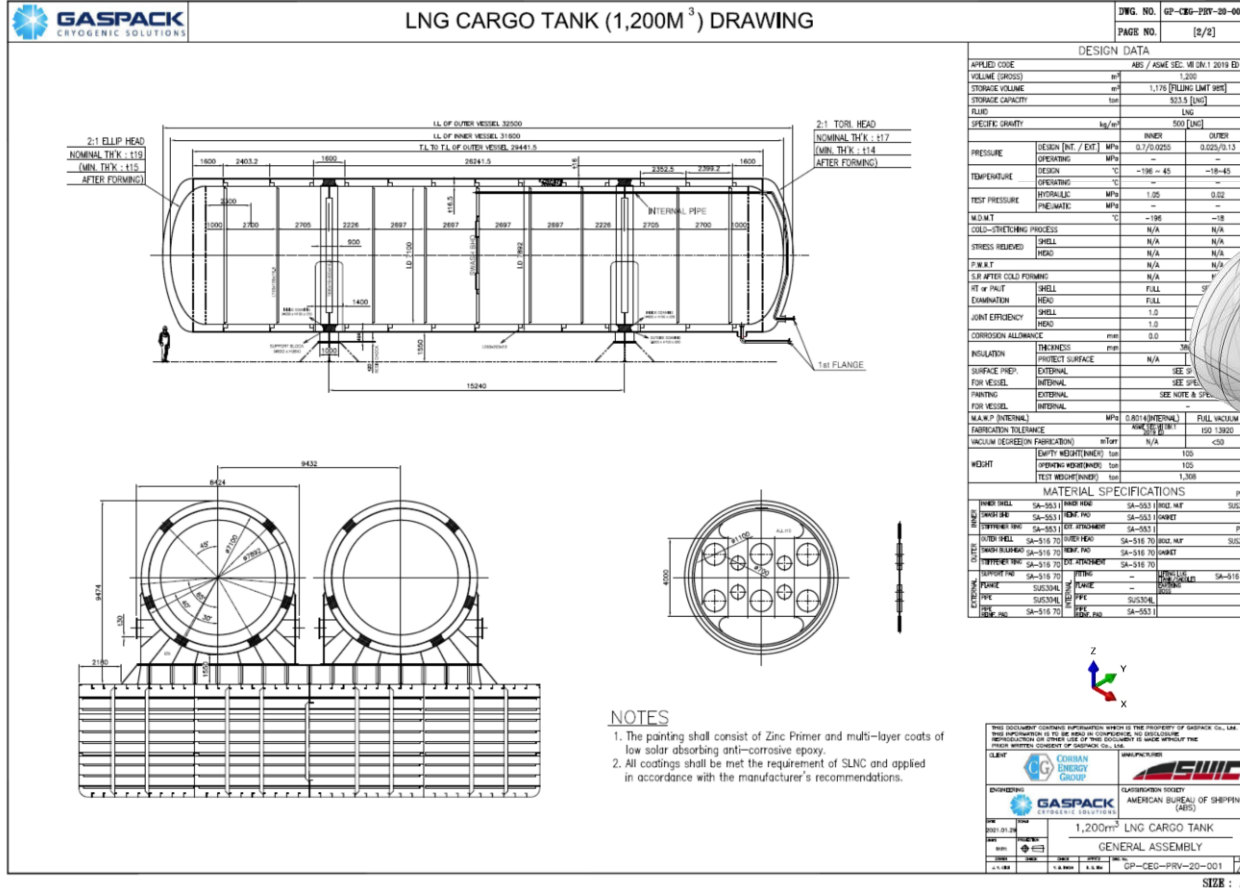
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DESIGNER	APPROVAL
GASPACK	KOREAN REGISTER (KR)
40FT LNG ISO TANK	
GENERAL ASSEMBLY	
GP-ISO-PRV-002-01	



❖ 12K LNG Carrier



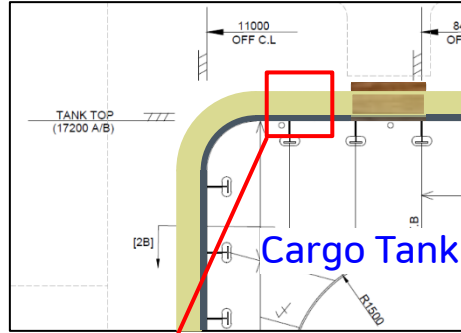
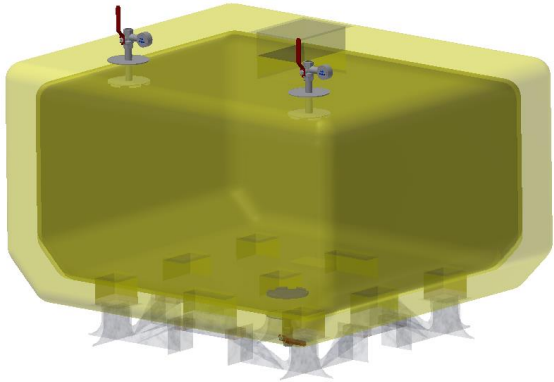
❖ [Corban Energy Group] 1,200 CBM LNG Cargo Tank (Approved by Class ABS)



TRACK RECORD

No.	Project Name	Scope	Client	Delivery
1	9%Ni LNG Fuel Tank (Class AIP)	700m3 9%Ni LNG fuel tank engineering	ANSWER	2018 May
2	125K FSRU conversion	BOG management study report	GAS Entec	2018 Aug
3	GSI 55K OCT (LNG ready ship)	Process basic engineering of FGSS	FESDEC	2018 Nov
4	15K LNG FSU	BOG management study report	GAS Entec	2019 Jan
5	1K LNG daily tank (125K FSRU)	LNG tank basic & detail design	GAS Entec	2019 Feb
6	CCS mock-up test bed	LN2 supply skid	HYUNDAI Heavy Industries	2019 Mar
7	137K FSU conversion	BOG management study report	GAS Entec	2019 Mar
8	Ice abrasion test bed	Test bed design & manufacturing	INHA Univ.	2019 Apr
9	500 m ³ LNG bunkering barge	Hi-Mn LNG tank basic & detail design	POSCO	2019 Apr
10	Costal LNG fueled ship	LNG tank basic & detail design (9% Ni & Hi-Mn)	National Proj.	2019 Apr
11	LNG Fuel Tug Boat (Class AIP)	50m3 bi-lobe H-Mn LNG fuel tank engineering	ANSWER	2019 May
12	DSME welding simulation	Thermo-elastic-plastic simulation	DSME	2019 Dec
13	Samsung LNG test facility	50m3 H-Mn LNG tank basic & detail design	SUNBO / Samsung Heavy Industries	2019 Dec
14	LNG fueled container ship (LNG Ready Ship)	Basic design for 500m3 *2 LNG fuel tank and FGSS	HYUNDAI Mipo Dockyard	2019 Dec
15	3.5K LPG carrier	Cargo tank and handling system basic & detail design	DAESUN Shipbuilding	2020 Dec
16	40 ft LNG ISO tank container	ISO tank engineering	Corban Energy Group	On going
17	12K LNG carrier	Cargo tank and handling system basic & detail design	S*****	On going
18	6.5K LNG carrier	Cargo tank and handling system basic & detail design	S*****	On going
19	1.2K LNG Bunkering Barge	LNG tank basic & detail design	Corban Energy Group	On going

❖ Dual-Purpose Spray Foam Insulation System [DPSI System]



Spray Insulation System

DPSI System is applicable to both **IMO Type B and C**

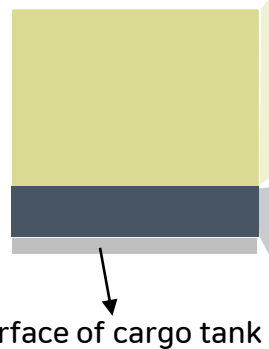
Letter of a patent



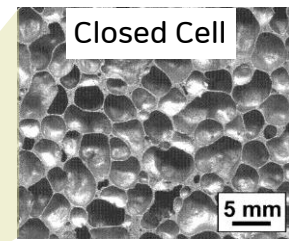
Korea

China

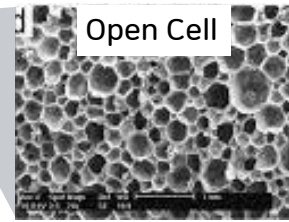
Japan



Surface of cargo tank



- Insulation
- PUF 40kg/m³
- Gas tight



- Ventilation
- Flexible material
- Gas flowable
- Leakage containing
- Relaxation tensile stress of insulation

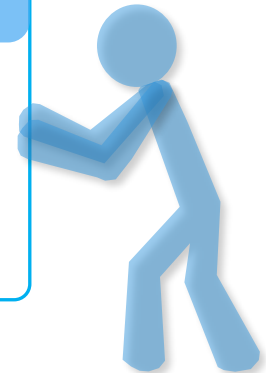
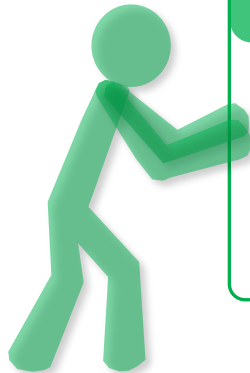


Manufacturing

- Purchasing
- Production
- Total Guaranty / Responsibility

Engineering

- Design & Engineering
- Technical Clarification to Shipyard and Class





GASPACK
CRYOGENIC SOLUTIONS

उत्तम षुनहलर
धन्यवाद
Dėkuji
謝謝
Mulțumesc
ขอบคุณ
Danke
Asante
Bedankt
Terima kasih
Thank you
Gracias
Takk
Merci
Dякуємо
Cảm ơn
Спасибо
고맙습니다
Grazie
Teşekkür ederim
شكرا لك
ありがとう

Website : www.gaspack-cs.com

E-Mail : gaspack.cs@gmail.com

Phone : +82-70-7778-8086

Fax : +82-51-623-8086

H.P. : abausers@gaspack-cs.com (Kwang Seok Kim / CEO)

youngsik.moon@gaspack-cs.com (Youngsik Moon / CTO)