



FGSS
Fuel Gas Supply System



JUNGWOO ENE Co.,Ltd.

Cryogenic Engineering & Equipment



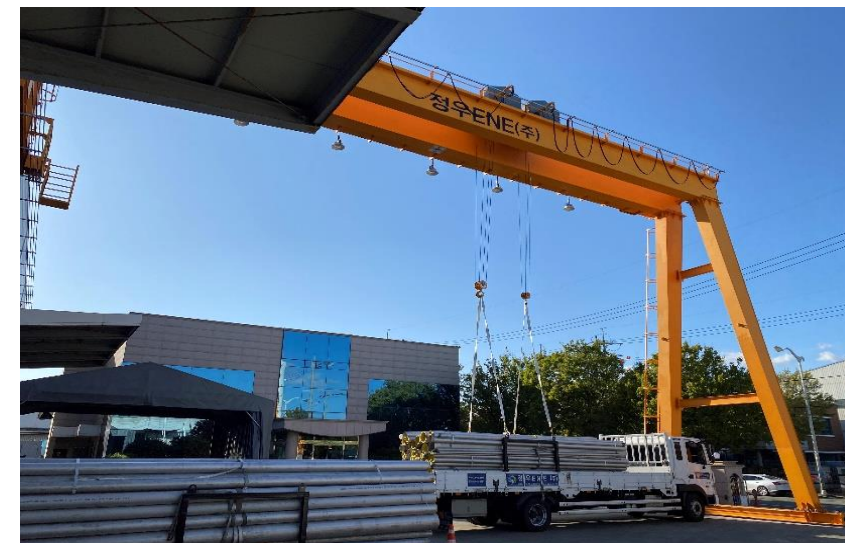
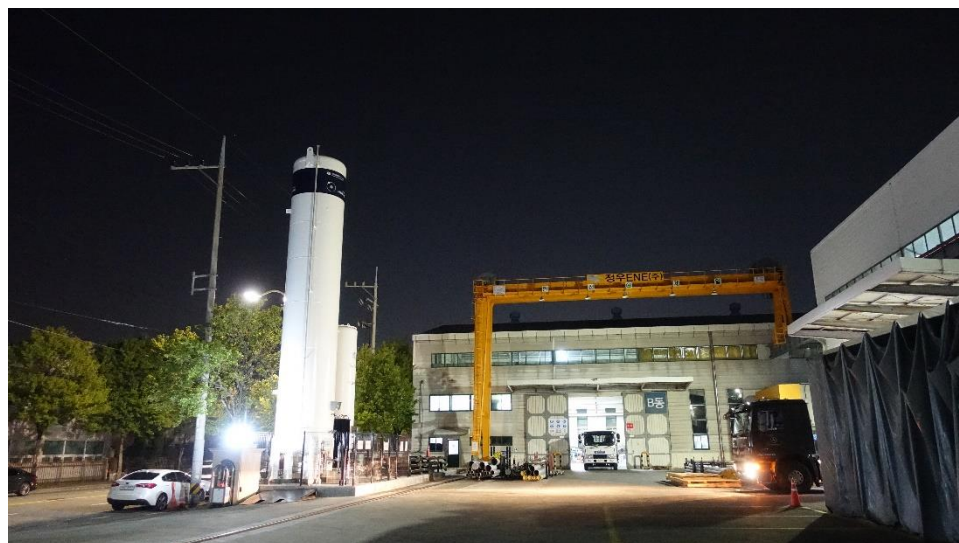
National Core

Technology Retention

Introduction

- **Jungwoo ENE Co., LTD**

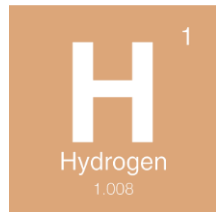
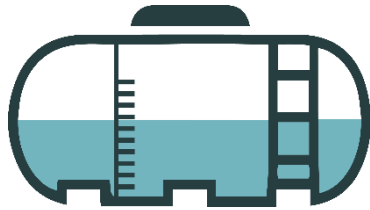
- Head Office, Manufacturing Facility, R&D Center in Busan Metropolitan City
- **National Core Technology Retention awarded**
- LH2 & Cryogenic System Engineering & Manufacturing
- System Integration, Module Build up
- ISO9001/14001/45001
- ASME "U", "S", "PP" STAMP
- CAESAR II Program License





Liquefaction Systems

- Process Engineering & Consulting
- Cryogenic Liquid Storage Tank (C-type)
- Non-BOG Type Cryogenic System Integration



Liquid Hydrogen System

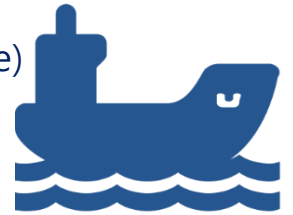
- Hydrogen Generation System
(Natural Gas Reforming, Methanol Reforming)
- LH2 Storage Tank, Cryostat
- H2 Liquefaction System



Cryogenic Systems

Fuel Gas Supply System for LH2 / LNG Fueled Ship

- System Engineering & Design
- LH2 & LNG Process System
- LH2 & LNG Tank (C-Type, Bi-Lobe)
- Vaporizer, Glycol Unit
- G.V.U and Ventilation System
- Booster Pump with Sump Tank



LH2 & LNG Bunkering System

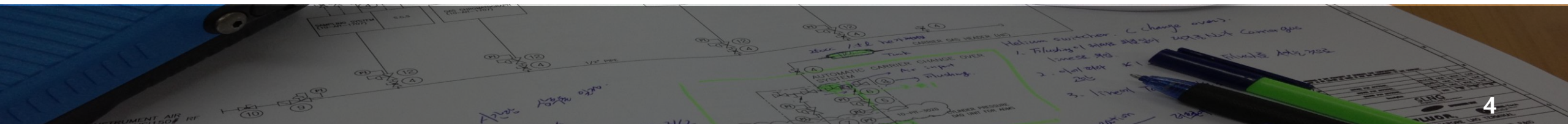
- Process, BOG Handling Process
- Bunkering Unit
- **Vacuum Insulation Pipe**, Double Wall Pipe
(National Core Technology Retention awarded)
- Storage Tank, Special Vessels





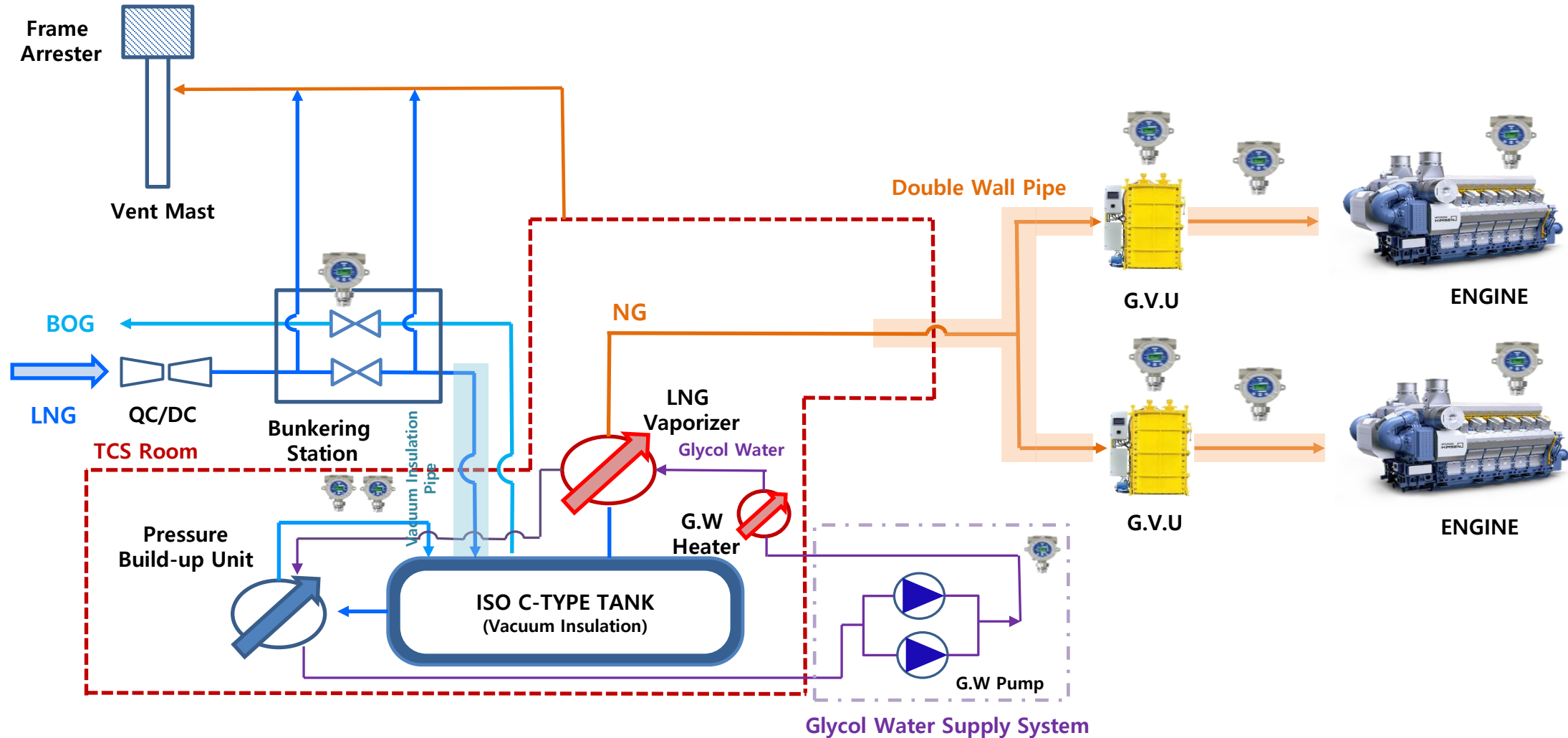
JUNGWOOENE

JUNGWOOENE WORK ABILITY



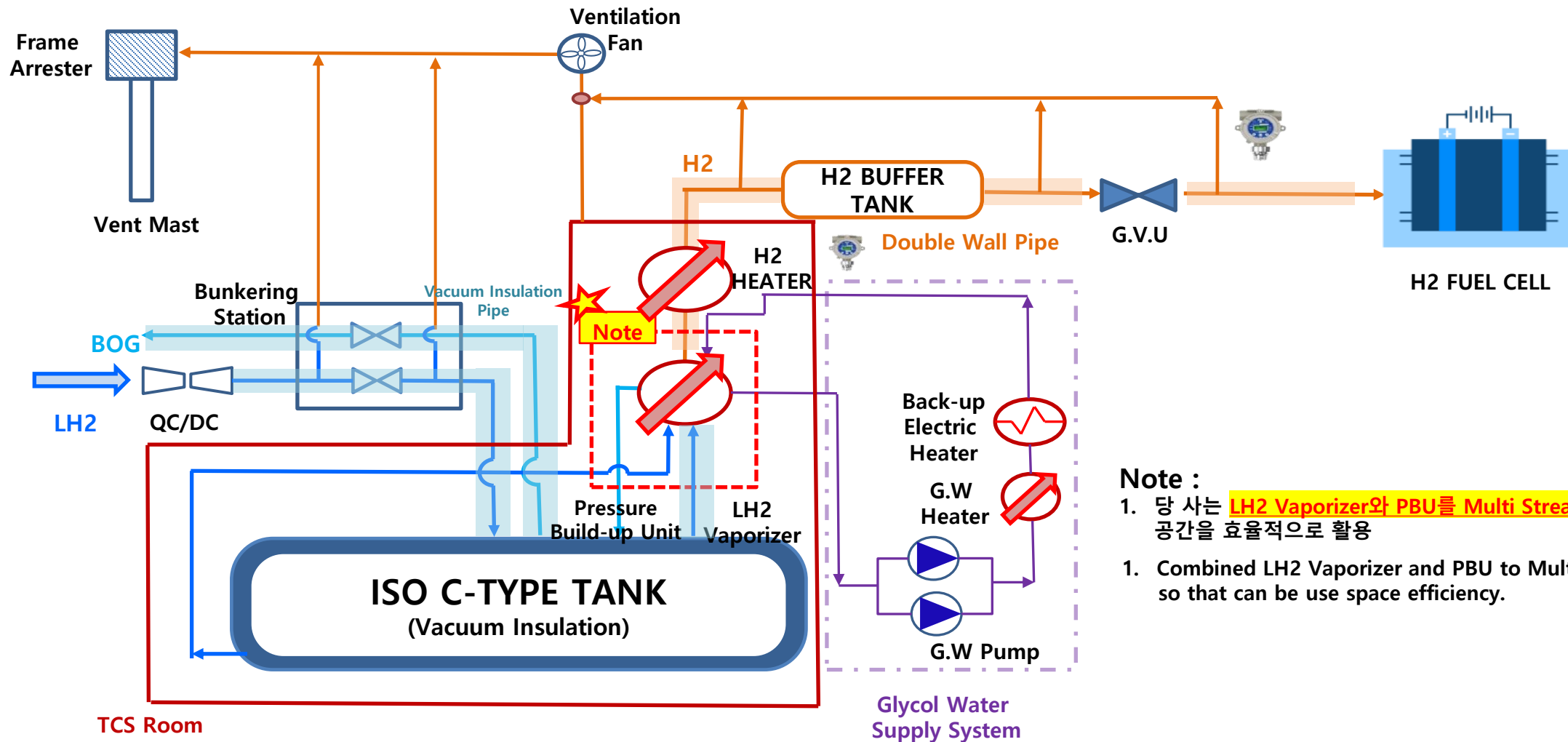


Engineering – LNG FGSS System configuration





Engineering – LH2 FGSS System configuration

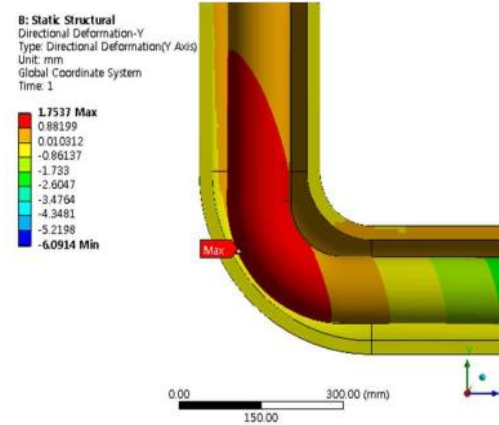
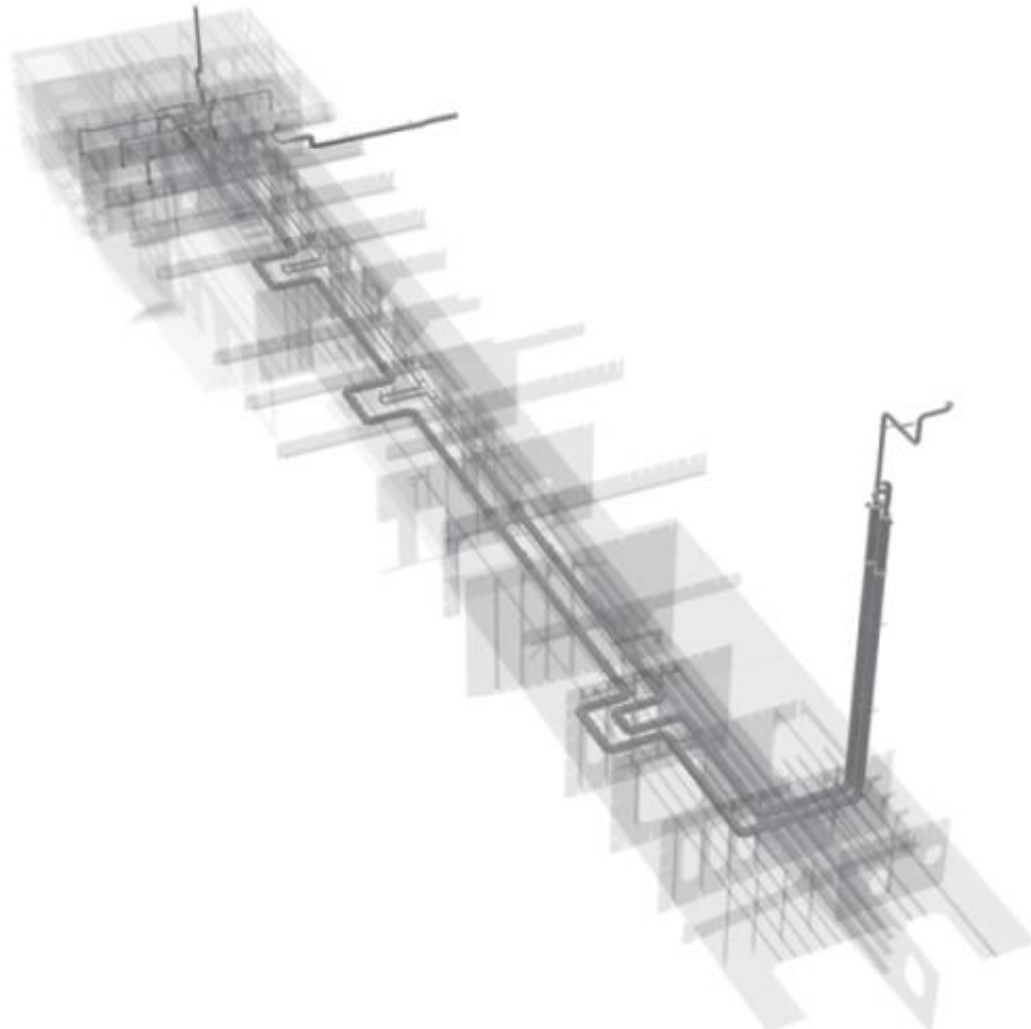


Note :

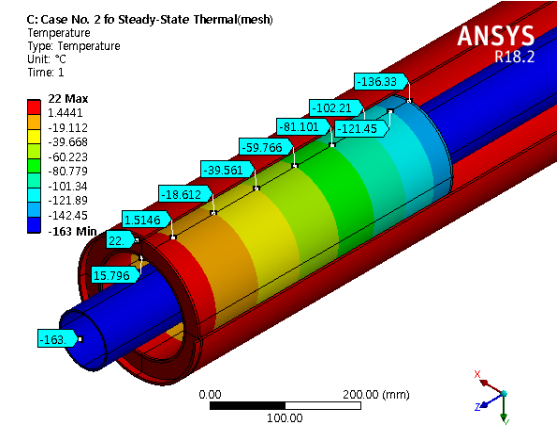
- 1. 당사는 LH2 Vaporizer와 PBU를 Multi Stream으로 구성하여 공간을 효율적으로 활용
- 1. Combined LH2 Vaporizer and PBU to Multi stream vaporizer so that can be use space efficiency.



Engineering - Pipe Analysis



Structure Analysis



Heat Transfer

Ability for product design and analysis

Design : AutoCAD

Analysis : CAESAR II, ANSYS, Compress & Other Programs



Class Approved!!



Engineering – LH2 & LNG C Type Tank

Certificate No. : GCHEM-1279-21

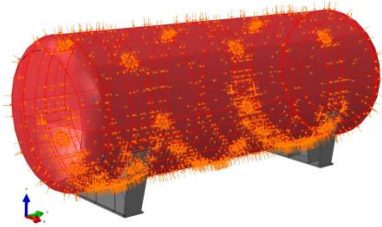


Figure 12 대기압 [1bar] 적용 하중 조건

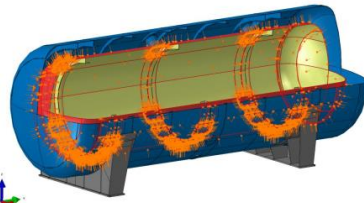


Figure 16 External pressure

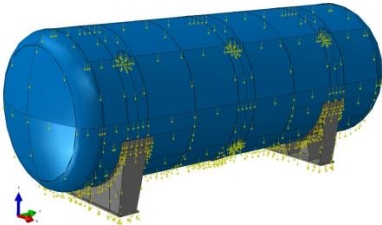


Figure 13 지동 조건

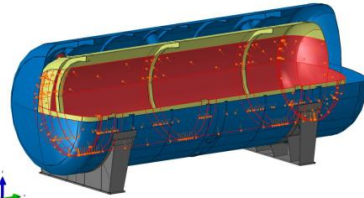


Figure 17 85% filling - LNG Hydrostatic load condition

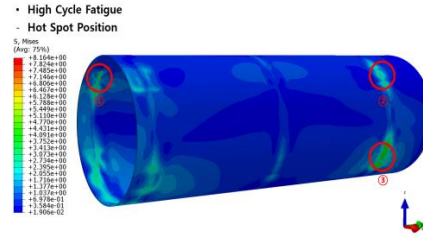


Figure 38 평가속도 조건 시 내조의 주요 응력 contour

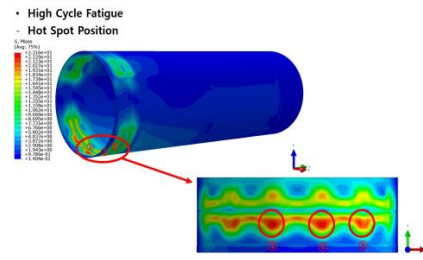


Figure 39 평가속도 조건 시 내조의 주요 응력 contour

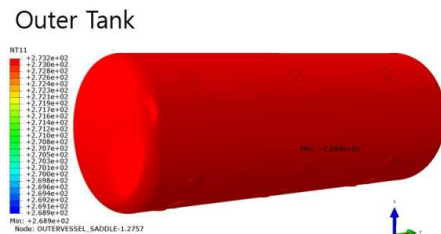


Figure 20 열 분포도 (외조)

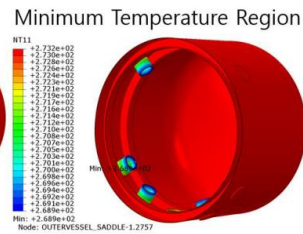


Figure 20 열 분포도 (외조)

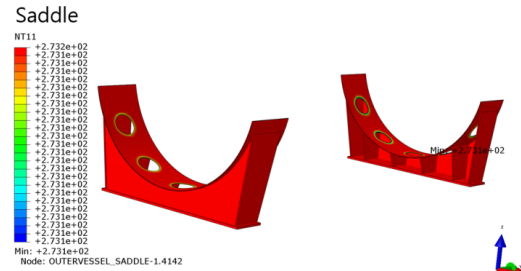


Figure 21 열 분포도 (Saddle)

Certificate for Pressure Vessel



[LNG FUEL TANK]

General Information

Date of Issue	12 August 2021	Date of Commencement	25 March 2021
Work's Order No.	-	Purchase Order No.	-
Place of Inspection	BUSAN, KOREA	Office	Gamcheon Office
Job ID	DOSE116	Quantity/Weight	1 Set(s)
Manufacturer	JUNGWOO ENE Co., Ltd.		
Purchaser	DONGSUNG SHIPBUILDING CO., LTD.		
Intended for	Hull No. DS-116, DONGSUNG SHIPBUILDING CO., LTD.		
Approval Status	MP(GCH33856-BP001), Drawing Approval No. HUC4100-1109-2021(2021.07.09)		

Particulars

Type	IMO Type C, Double Wall
Grade	PV-1
Capacity (m ³)	15.3
Design Pressure (bar)	9.0
Design Temperature (°C)	-163 ~ 35

Testing and Inspection

- Material Test
- Non-destructive Test (PT, MT, RT)
- Hydraulic Test (TP : 13.5 bar)
- Welding Workmanship Test
- Finished Condition Inspection
- Leak Test
- Insulation Material Test

* Three Mill Certificates for Steel Plates certified by DMV GL have been reviewed for transfer of classification. (Mill Certificate No. : 20190211-PI-672-003, 20190906-PI-290-001, 20190329-PI-469-001)

Marking, Serial No. and Remarks

GCHEM 1279
12.08.21
W.T.P. (13.5 bar)



This certificate is signed electronically in accordance with IMO FAL 5/Circ.39/Rev.2. Validation and authentication of the certificate can be confirmed from "http://e-cert.krs.co.kr" by using the tracking No.(M21029190472) and certificate No.(GCHEM-1279-21).



KOREAN REGISTER

1135 HWANG Kyujin

This Certificate is issued to the above client to certify that the undersigned Surveyor did at their request attend the above plant for the purpose of examining and testing the item of material, equipment or any other item covered by this certificate in accordance with the relevant Rules for the Classification of the Ship and found it satisfactory. This Certificate is a representation only that the item of material, equipment or any other item covered by this Certificate has been examined for compliance with the Rule Requirements of this Society. Nothing contained in this Certificate or in any Report issued in contemplation of this Certificate shall be deemed to relieve any customers of this Society or other entity of any warranty expressed or implied.

Processing – LH2 & LNG C

Certificate No : GCH33856-BP001

Approval Certificate for Manufacturing Process [Manufacture of Welded Pressure Vessels]



Initial Approval 29th July, 2021
Manufacturer JUNGWOO ENE Co., Ltd.
 20, Noksansandan 261-ro, 74 beon-gil, Gangseo-gu, Busan, Rep. of Korea
Product Description Manufacture of Welded Class 1 Pressure Vessels



- Approval Condition**
1. Approvals for Drawings, Welding Procedure Specifications and Welder Qualifications are to be maintained separately from the approval.
 2. Materials and Vacuum insulation system used for the tanks shall be certified by the Society.
 3. Elements of insulation systems such as supporting structures and layered insulation installed on inner vessels are to be Type approved.
 4. Individual Product Certification is required.

THIS IS TO CERTIFY that the manufacturing process for the above mentioned product has been approved in accordance with the relevant requirement of this Society's Rules and / or of the recognized standards as

Pt. 5, Ch. 5 Sec. 4 & Ships Using Low-flashpoint Fuels of the Rules for Classification of Steel Ships.

This Certificate is valid until 28th July, 2026
 Issued at Busan, Korea on 29th July, 2021

This certificate is signed electronically in accordance with IMO FAL.5/Circ.39/Rev.2. Validation and authentication of the certificate can be confirmed from "http://e-cert.krs.co.kr" by using the tracking No.(ME21019632740) and certificate No. (GCH33856-BP001).



KOREAN REGISTER

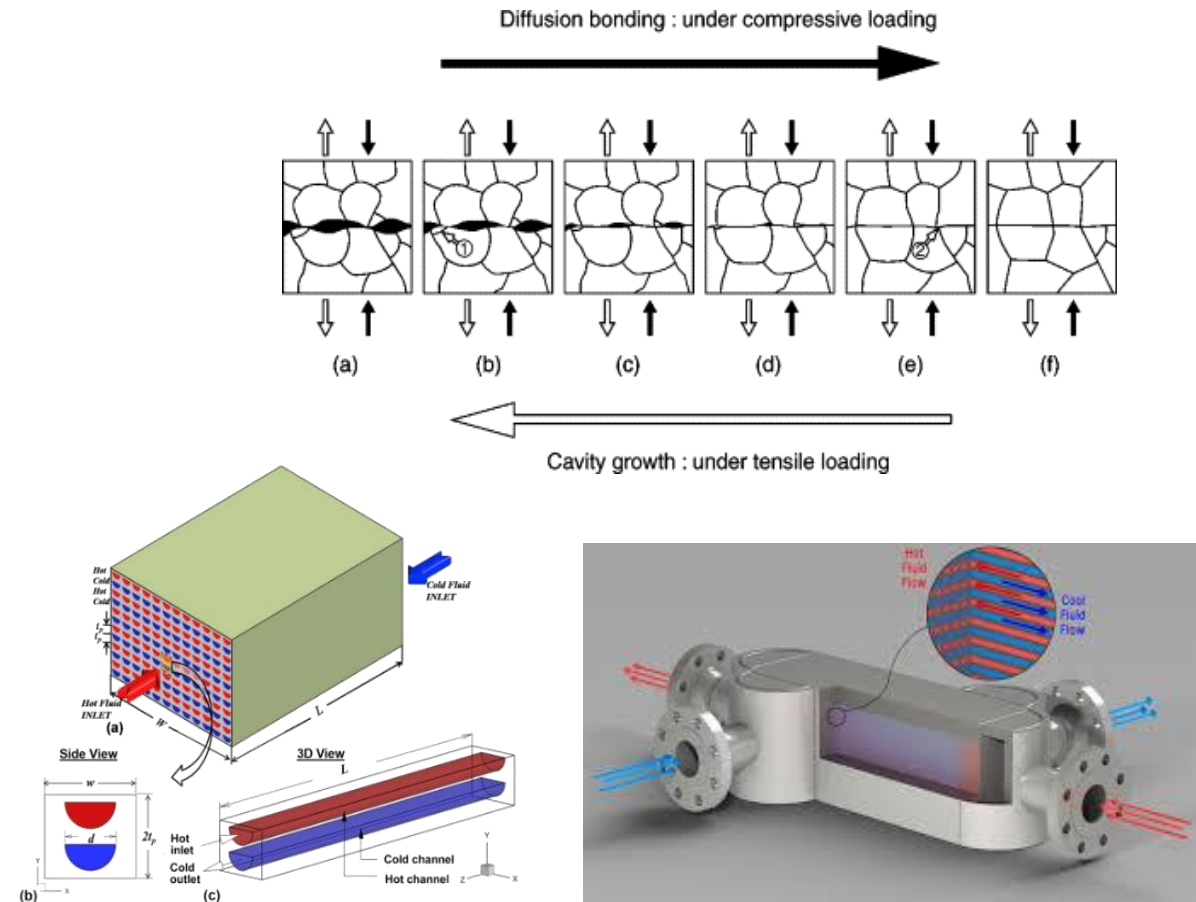
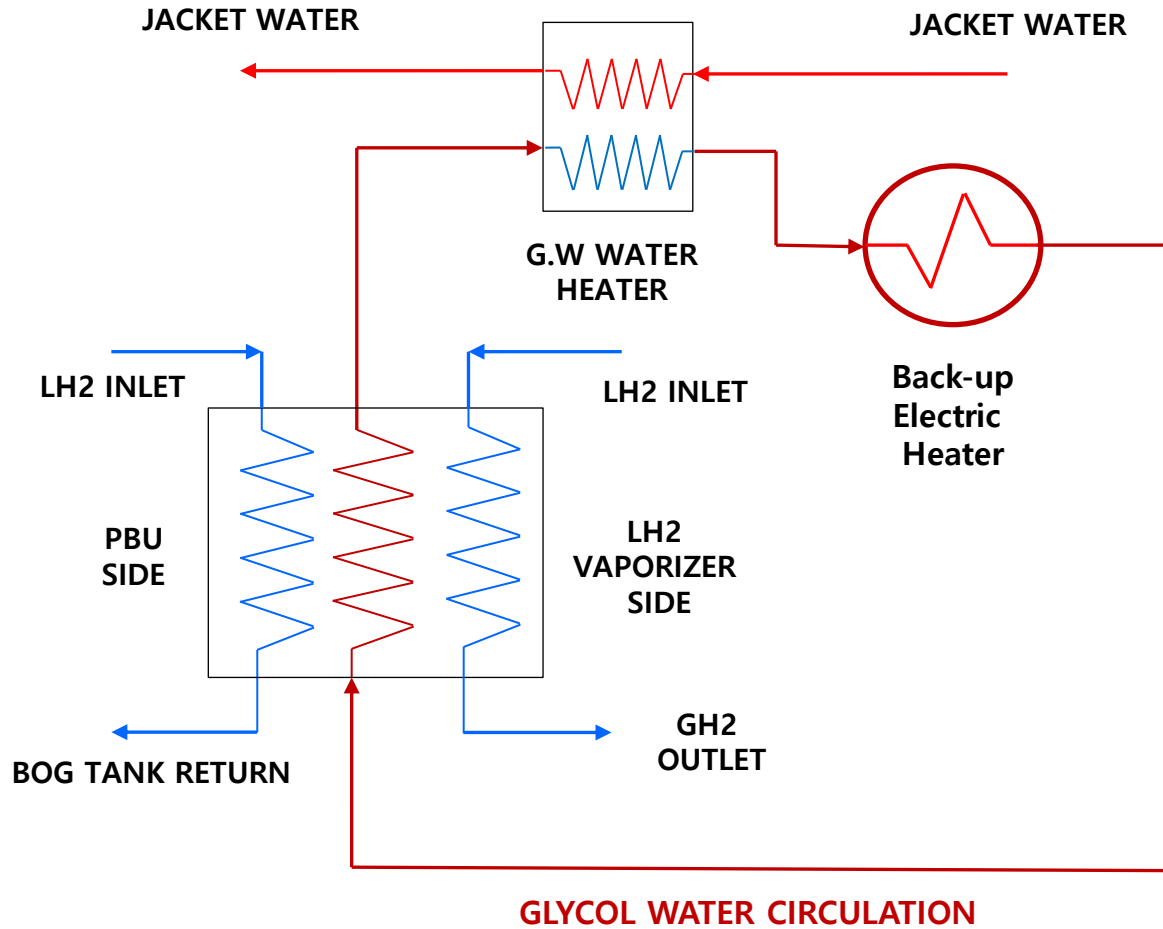
 General Manager of
 Marine & Ocean Equipment Team

Note 1. This certificate will be valid subject to complying with the approval conditions described on the certificate and/or on the Rules of this Society.
 2. This certificate will be invalid from the supply date aforementioned unless the extension or renewal has been granted to the applicant or the manufacturer.
 3. Any significant modification or changes in design or construction to the above product without approval from this Society will render this certificate invalid.
 4. Should the approved rules, regulations or standards be amended during the validity of this certificate, the product is to be re-approved by this Society in accordance with the requirements as amended.





Processing – Multi Stream Heat Exchanger



PRINTED CIRCUIT HEAT EXCHANGER



Processing – Vacuum Insulated Pipes (National Core Technology)



산업통상자원부

수신 정우이앤이(주) 대표이사
(경유)

제목 국가핵심기술 여부 판정 신청에 대한 회신(정우이앤이)

1. 관련 정보 : 정우이앤이(주) '국가핵심기술 여부 사전판정신청' (2018.3.16.)
2. 귀사에서 신청한 국가핵심기술 여부 사전판정에 대해 「산업기술의 유출방지 및 보호에 관한 법률」 제9조 및 시행령 제13조의2의 따라 검토결과를 아래와 같이 알려드립니다.

- 아 래 -

신청자	신청기술	검토 의견
정우이앤이(주)	LNG 연료추진선박 연료공급장치의 진공 단열배관 제조기술	신청기술은 국가핵심기술에 해당

끝.

산업통상자원부



산업기술시장
파 사무관 양재원
협조자

시행 산업기술시장파-642 (2018. 7. 12.) 접수

우 30118 세종특별자치시 한누리대로 402, (어진동, 산업통상자원부) / <http://www.motie.go.kr>

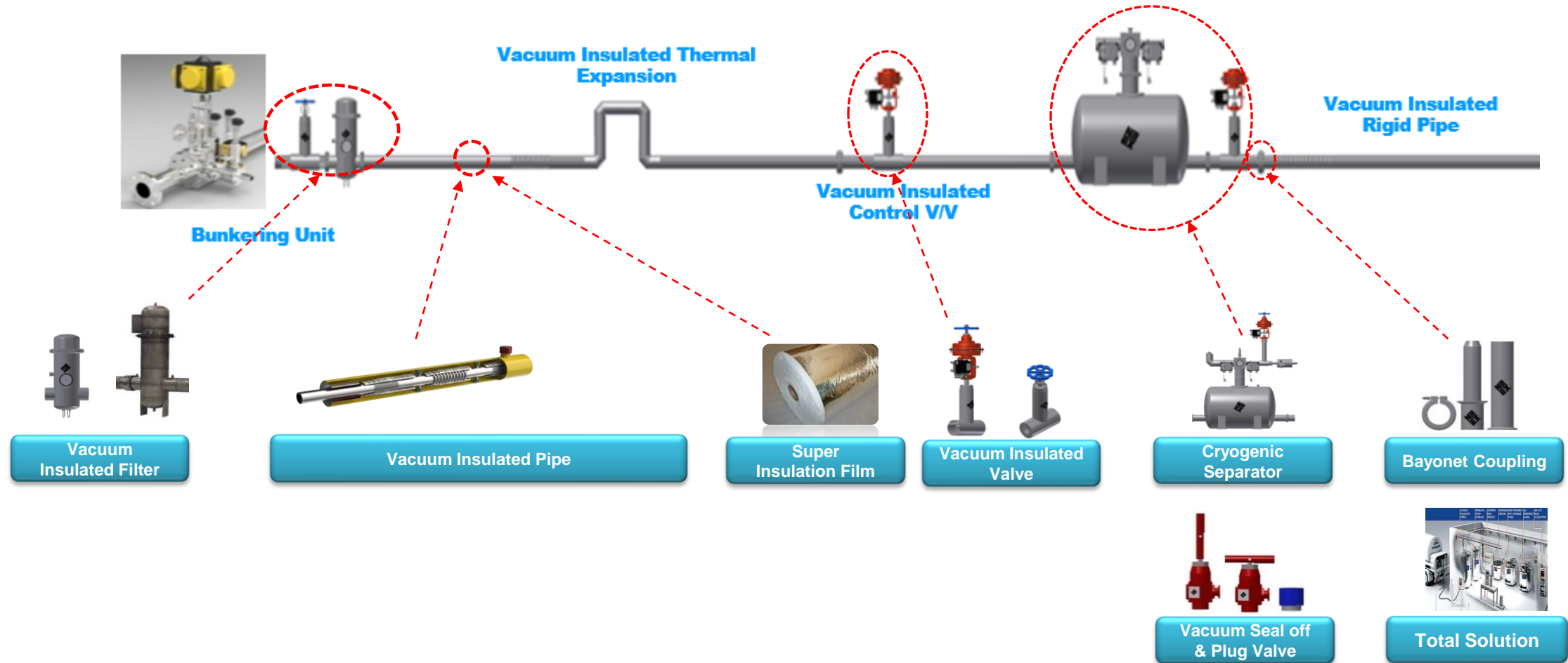
전화번호 044-203-4533 팩스번호 044-203-4745 / yjw0918@korea.kr / 비공개(7)

당사의 진공단열배관은 산업통상자원부에서 지정한 국가핵심기술로서 성능 및 제품의 품질에 우수성을 인정 받아 국내 주요 조선소 및 해외 조선소에 400건이상의 프로젝트를 수행하여 시장 점유율 95% 이상을 가지고 있습니다.

We, Jungwoo ENE has been supplied vacuum insulated pipes to SHI, DSME, HHI in Korea major big 3 shipyard more than 400ship over. It is 95% more market share. And obtained confirmation of 'National Corer Technology Retention' from Korean government 'Ministry of Trade,Industry and Energy'.



Processing – Vacuum Insulated Pipes (National Core Technology)





Processing – Double Wall Pipes



High Pressure Double pipe - ME-GI Engine



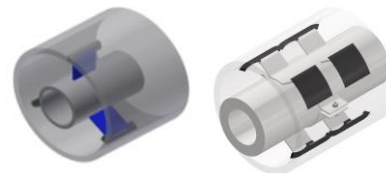
Low Pressure Double pipe - DF Engine, XDF Engine, Gas Engine



Double Wall Pipe



Flexible Support



Fixed Support



Inspection Plug



Double Lip Flange



Processing – Skid Fabrication



TCS SKID



Tank Connection

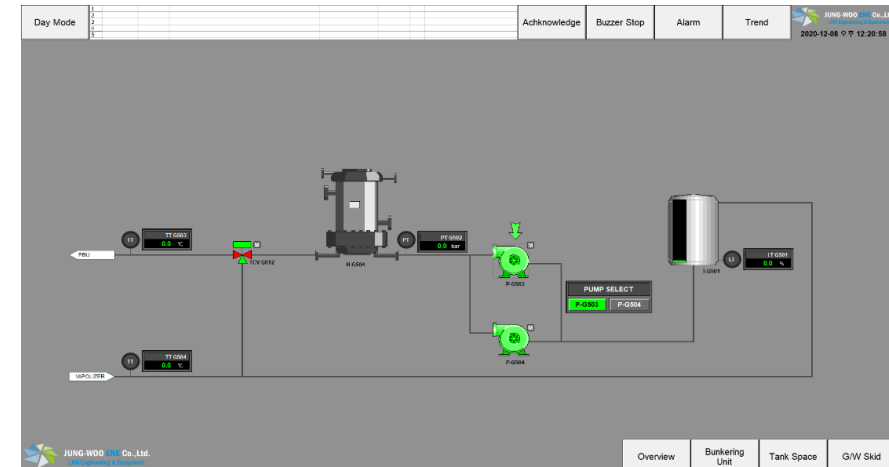
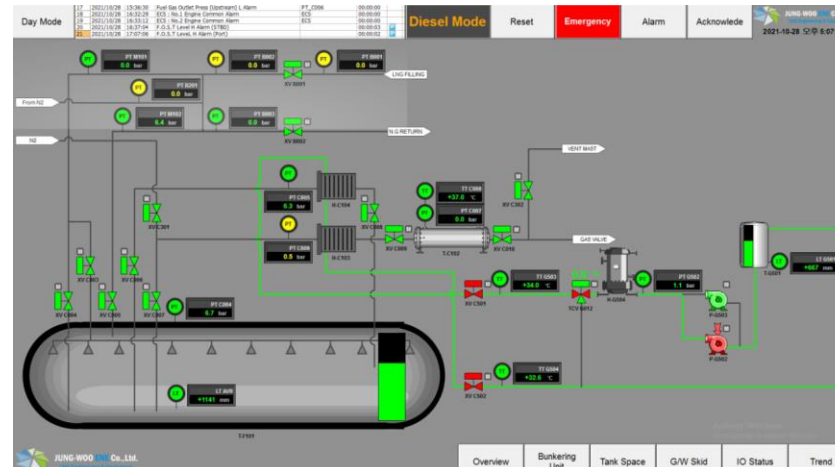
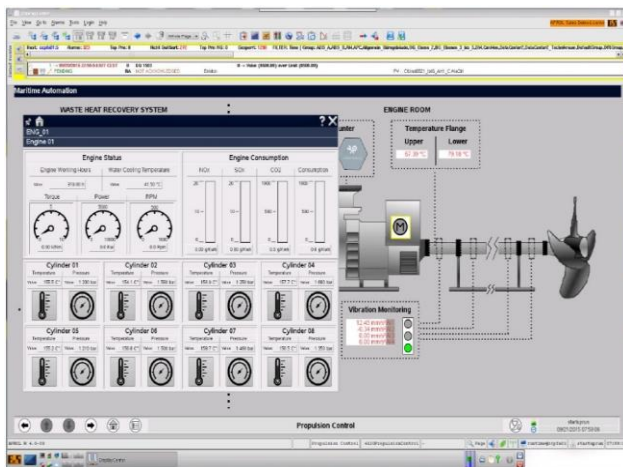
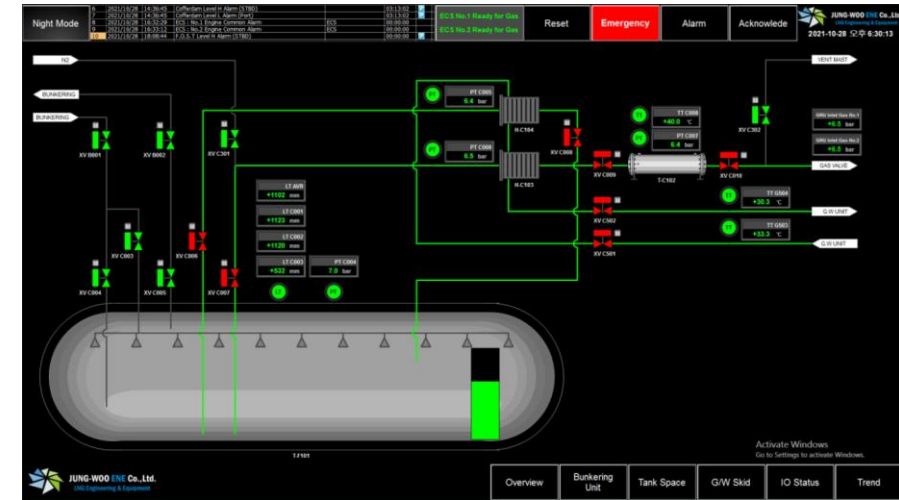


BUNKERING UNIT



Products – Automation Control System

- Alarm Log, Trend Log, Database
- Remote I/O, Communication
- Accessories (Touch screen, Printer, Key-board, Track Ball...etc)
- Monitoring, CCR Control
- HMI



- Exclusive Agency QC/DC & Hose

- TRELLEBORG UK Official Agent in KOREA
- Providing with QC/DC including Class Cert



General								
Coupling Type		Cryo-DC Dry Disconnect Coupling						
Application		Truck loading, rail car loading, bunkering of LNG and other cryogenic gasses						
Nominal Size (Inch)		1	2	2.5	3	4	6	8
Design Temperature	Min (°C)	-196						
	Max (°C)	+70						
Design Pressure	Min (bar)	0	0	0	0	0	0	0
	Max (bar)	25	25	25	25	25	19 Bar @ 38°C	18.4 Bar @ 50°C
Maximum flow at activation (m/hr of LNG @ -163°C)		24	108	140	240	293	750	1500

Type Approval Certificate

[Cryogenic dry-disconnect Coupling]

Initial Approval 14th October, 2021
Manufacturer Trelleborg Westbury Ltd.
 Commerce Business Centre, West Wilts Trading Estate, Westbury, Wiltshire, BA134LS, U.K.
Product Description Type : Cryogenic Dry Disconnect Coupling

" See Appendix 1 "

Approval Condition

" See Appendix 1 "

THIS IS TO CERTIFY that the above-mentioned product has been approved in accordance with the relevant requirement of this Society's Rules and / or of the recognized standards as follows.

Pt 7, Annex 7A-3, Art. 202 of the Rules for the Classification of Steel Ships, EN 12567 : 2000 and ISO 16904 : 2016.

This Certificate is valid until 13th October, 2026
 Issued at Busan, Korea on 14th October, 2021



This certificate is signed electronically in accordance with IMO FAL 5/Circ.39/Rev.2. Validation and authentication of the certificate can be confirmed from "http://e-cert.krs.co.kr" by using the tracking No.(ME21025717727) and certificate No.(LDN43863-PE001).



KOREAN REGISTER

General Manager of Marine & Ocean Equipment Team

Note :
 1. This certificate will be valid subject to complying with the approval conditions described on the certificate and/or on the Rules of this Society.
 2. This certificate will be invalid from the expiry date aforementioned unless the extension or renewal has been granted to the applicant or the manufacturer.
 3. Any significant modifications or changes in design or construction to the above product without approval from this Society will render this certificate invalid.
 4. Should the specified rules, regulations or standards be amended during the validity of this certificate, the product is to be re-approved by this Society or accordance with the requirements as amended.



TYPE APPROVAL CERTIFICATE

Certificate No. : LDN40316-PE001 **Initial Approval** : 1st July, 2019
Product : Emergency Release Coupling for Liquefied Gas Transfer
Manufacturer : KLAW PRODUCTS LIMITED
 Commerce Business Centre, West Wilts Trading Estate, Westbury, Wiltshire, BA13 4LS, United Kingdom
Product Description : Model : 8" NB MKVII Cryogenic Emergency Release Coupling

" See Appendix 1 "

Approval Condition : " See Appendix 1 "

THIS IS TO CERTIFY that the above-mentioned product has been approved in accordance with the relevant requirement of this Society's Rules and / or of the recognized standards as follows and entered in the "List of Approved Manufacturers and Type Approved Equipment".

Ch. 14 of KR Guidance for Floating Liquefied Gas Units, EN 1474-1, 1474-3 and ISO 16904 : 2016.

This Certificate is valid until 30th June, 2024
 Issued at Busan, Korea on 1st July, 2019



This certificate is signed electronically in accordance with IMO FAL 5/Circ.39/Rev.2. Validation and authentication of the certificate can be confirmed from "http://e-cert.krs.co.kr" by using the tracking No (MC19010484946) and certificate No. (LDN40316-PE001).



KOREAN REGISTER OF SHIPPING

General Manager of Marine & Ocean Equipment Team

Note :
 1. This certificate will be valid subject to complying with the approval conditions described on the certificate and/or on the Rules of this Society.
 2. This certificate will be invalid from the expiry date aforementioned unless the extension or renewal has been granted to the applicant or the manufacturer.
 3. Any significant modifications or changes in design or construction to the above product without approval from this Society will render this certificate invalid.
 4. Should the specified rules, regulations or standards be amended during the validity of this certificate, the product is to be re-approved by this Society in accordance with the requirements as amended.



Site Installation





Commissioning & Training



GAS MODE SEA TRIAL

- Alarm signal testing
- Supplying Gas to M/E condition check (Pressure, Temp,,etc)



BUNKERING

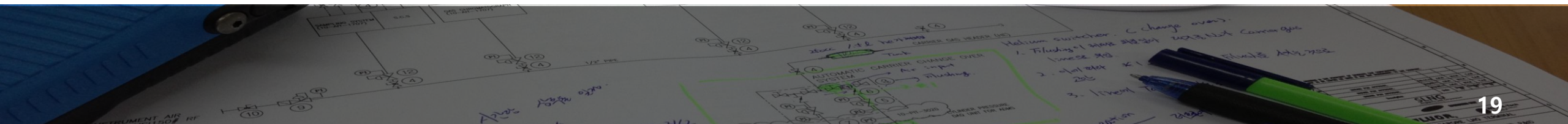
- Gas connection point leak check (QCDC, HOSE)
- N2 Purging & Cooldown
- Tank pressure control





JUNGWOOENE

JUNGWOOENE'S ADVANTAGE





JUNGWOOENE'S ADVANTAGE

1. Most Item Self- Manufacturing for the FGSS

- LNG & LH2 TANK (IMO C Type, Vacuum Insulated)
- Vaporizer (Multi stream, Shell & Tube type), Pressure Build-up Unit, Glycol water heater
- Vacuum Insulated Pipe, Double Wall Pipe
- FEED Engineering, Site Engineer, Simulation & Analyze Engineer
- Certified Welder for all kinds of Class



KOREAN REGISTER OF SHIPPING
Approval List for Welding Procedure Specification

WPS information		Welding techniques			Base metal		Welding material				
No.	Det. No.	WPS No.	Supporting PQR No.	Welding Process	Joint Type (Butt Joint)	Welding Position	Grade	Plate/Pipe Thickness, O.D. Range(mm)	Pipe Size (mm)	Brand name	Maker
1	GQWD-0017-10	JWE-WPS-GT-01	JWE-PQ-GT-01	TIG	Butt pipe	6G-F	ASTMA312 1P304L	3.0	21.0	AHS AS 29 ER316L	HYUNDA WELDING
		0	0					17.2	226.0		
2	GQWD-0018-10	JWE-WPS-GT-02	JWE-PQ-GT-03	TIG	Butt pipe	6G-F	ASTMA790 S31808	3.0	30.2	AHS AS 29 ER309	HYUNDA WELDING
		0	0					11.0	120.0		
3	GQWD-0019-10	JWE-WPS-GT-03	JWE-PQ-GT-04	TIG	Butt pipe	6G-F	ASTMA790 S30705	3.0	34.2	AHS AS 29 ER309	HYUNDA WELDING
		0	0					10.2	95.0		

Remarks: (1) Welding process: SMAW, FCAW, SAW, TIG, CGM, CGM etc.
(2) Welding position: 1G, 2G, 3G-up, 3G-down, 4G for butt of plate / 1G-P, 2G-P, 6G-P, 6G-F for butt of pipe / 1F, 2F, 3F-up, 3F-down, 4F for Fillet Plate / 1F-P, 2F-P, 3F-P, 6F-P for Fillet Pipe
(3) Joint Type: A qualification test performed on a butt weld will also qualify for fillet welding within the thickness ranges specified on butt weld for Fillet welds

THIS IS TO CERTIFY that the above mentioned welding procedure has been approved on the basis of the welding procedure qualification test supervised by the surveyor of Korean Register of Shipping and specified in a welding procedure specification (WPS No.), in accordance with the relevant requirement of the Society's Rules and/or the recognized standard as follows.

Pl. 2, Ch. 2, Sec. 4 of the Rules for Classification, Steel Ships and/or applicable specification

Issued Date / Office : 10 July 2015 / Gwangju Branch Office

1. Welding procedure qualified at a manufacturer are valid for welding in workshops under the same technical and quality management.

2. It is to be the manufacturer's responsibility to establish and document whether a procedure is suitable for the particular application.

- If you wish to make any inquiry for Approval List of WPS, please contact us as follows:
Gwangju Branch Office / Tel: 070-8799-7947-8 Fax: 070-8799-7942

Form AW-03 (2013/02)

KOREAN REGISTER OF SHIPPING
SURVEYOR (Kim Moon-hyung)

http://www.krs.co.kr



JUNGWOOENE'S ADVANTAGE

2. Vacuum Insulated Pipe, Double Wall Pipe

- Obtain 'National Core Technology Retention'
- Many experience in Onshore Plant & Vessel
- 90% more market share in middle-small size costal vessel
- Certified Welder for many kinds of Class



KR WPS



LR WPS



ABS WPS



DNV-GL WPS



BV WPS



RINA WPS



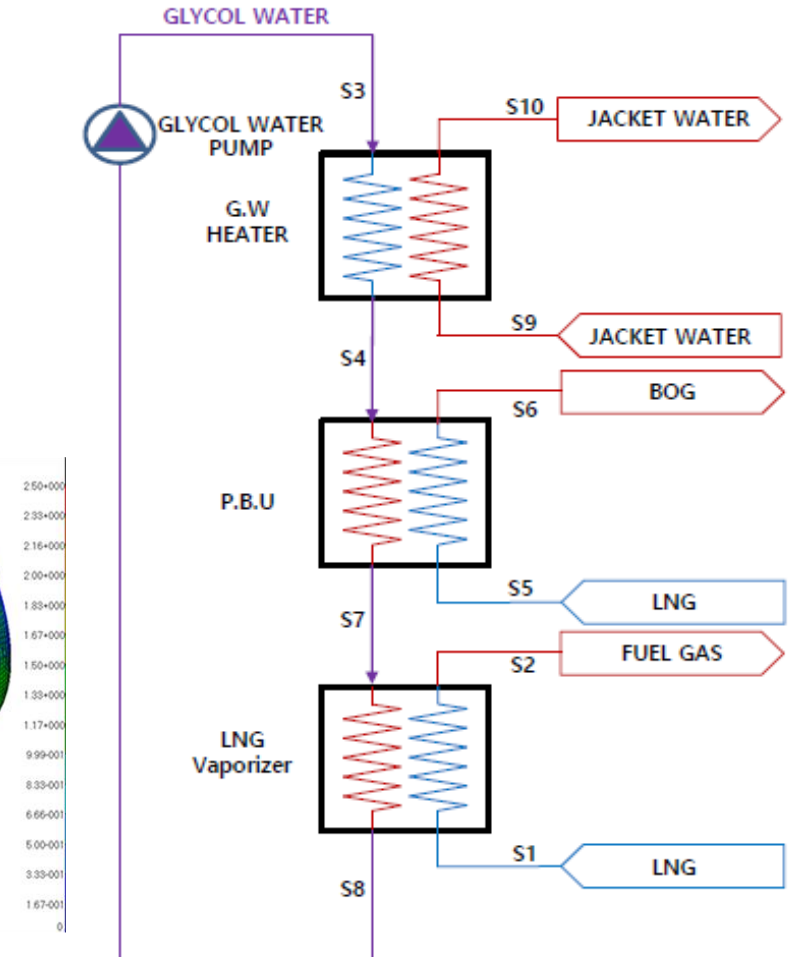
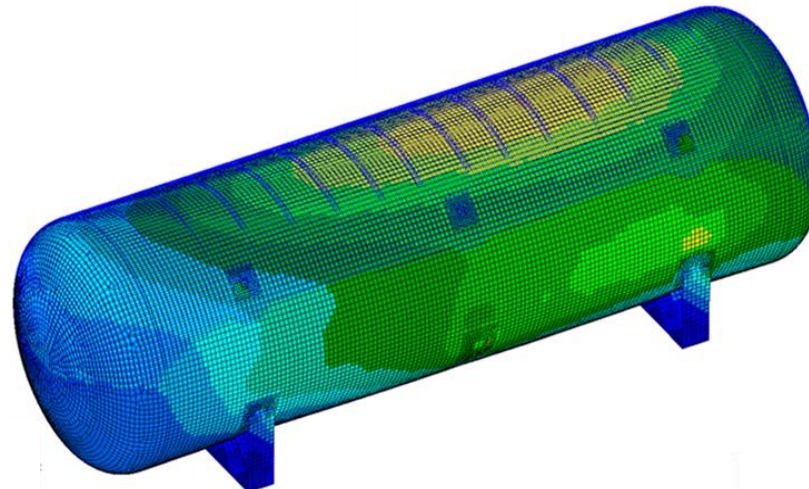
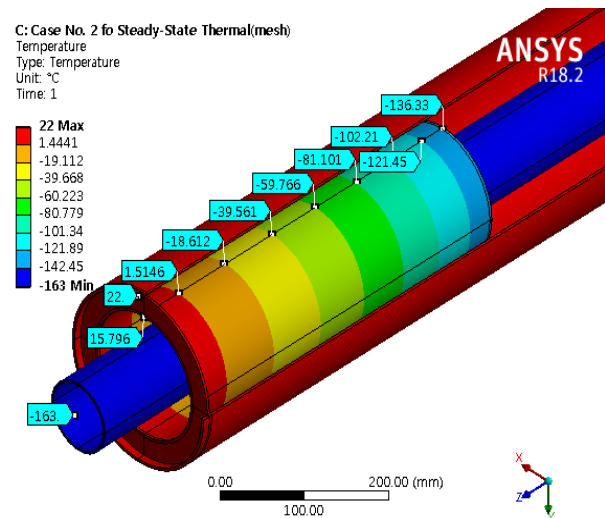
RMRS



JUNGWOOENE'S ADVANTAGE

3. FEED Design and Engineering

- Vacuum Insulated Pipe, Double Wall Pipe, C type Tank, Vaporzier etc..
- Heat & Material Balance calculation
- ULS, Buckling, Heat Transfer, Collision, Boundary condition
- Pipe Stress Analysis





JUNGWOOENE'S ADVANTAGE

4. Supply LNG FGSS for 280ton Class LNG Fueled Coast Cleaning Vessel

- EPCIC Turn-key Contract
- 15m³ IMO C Type LNG Tank Engineering & Fabrication
- Sea trial : Gas Mode 15Hour operation

LNG Storage Tank (KR Approval)



Drawing and Description	Approval
Arrangement of gas fuel tank	Approval (H)
Detail of tank structure including Tank connection space -Welding detail to be included	Approval (H)
Support and staying of gas tank	Approval (H)
Specification of materials in gas tanks	Approval (H)
Arrangement and specification of insulation	Approval (H)
Information on NDT for welds and Strength and tightness testing of tanks	Approval (B)
Specification of welding procedures for gas tanks	Approval (B)
Specification of stress relieving procedure for independent tank (thermal or mechanical)	Approval (B)
Specification of cooling-down procedure for gas tank	Approval (B)
Marking plate for gas tanks	Approval (H)
Other plans and documents deemed necessary by the society	-





Technical Certificates (Onshore/Plant)

[별지 제3호 서식] (앞 쪽)

건설업 등록증

업종 : 가스시설시공업 제1종 등록번호 : 부산감서2017-23-01
 상호 : 정우이앤이(주) 대표자 : 이선해

주된영업소 소재지 : 부산광역시 강서구 녹산산단261로74번길 20 (송정동)
 법인(주인)등록번호 : 180111-0703636

국적또는 소속국가명 : 대한민국 등록일자 : 2017.07.05

위 자는 건설사업기본법 제9조의 규정에 의한 건설업자임을 증명합니다.

부산광역시 강서구청장

변경인원	변경구분	변경내용	지정일 및 기한 (서명 또는 인)

Construction Business Registration Certificate
<Gas Facility Construction & Execution>

[별지 제3호 서식] (앞 쪽)

건설업 등록증

1. 업종 : 기계설비공사업
2. 등록번호 : 부산감서2019-10-07
3. 상호 : 정우이앤이(주)
4. 대표자 : 이선해
5. 주된 영업소 소재지 : 부산광역시 강서구 녹산산단261로74번길 20 (송정동)
6. 법인등록번호(생년월일) : 180111-0703636
7. 국적(소속 국가명) : 대한민국
8. 등록일자 : 2019.07.02

위 자는 건설사업기본법 제9조의 규정에 의한 건설업자임을 증명합니다.

2019년 07월 02일

부산광역시 강서구청장

Construction Business Registration Certificate
<Machinery & Facility Construction>

(앞쪽)

제 2010-3360082-16-5-00008 호

처리부서명	지역경제과
담당자명	강원서
전화번호	970-4475

특정설비 제조 등록증명서

①사업의종류	특정설비		
②상호	정우이앤이(주)		
③사업소 소재지	부산광역시 강서구 녹산산단261로74번길 20 (송정동)		
④성명(대표자)	이선해	⑤생년월일	
⑥용기·냉동기·특정설비	종류	규격	
	특정설비, 특정설비, 특정설비	저장탱크(초저온탱크 포함), 압력용기, 기화장치	

「고압가스 안전관리법」 제5조제1항, 제5조의2제1항 또는 제2항과 같은 법 시행규칙 제6조제1항제3호에 따라 용기(냉동기·특정설비)의 제조등록 또는 제조등록을 마쳤으므로 용기(냉동기·특정설비)제조 등록증명서를 발급합니다.

2017년 06월 09일

부산광역시 강서구청장

2010.07.13. 최초등록

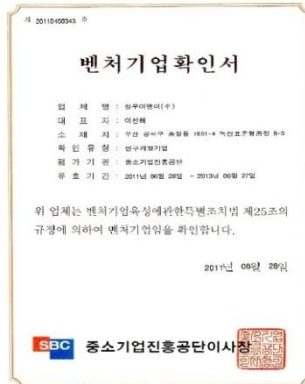
Specific Equipment & Facility
Manufacturing Registration Certificate
<Pressure Vessel / Cryogenic Valve>



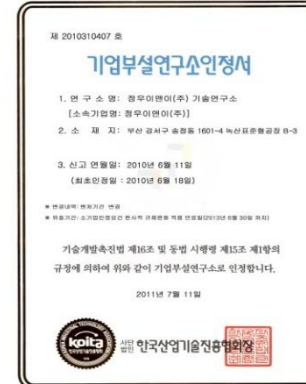
Technical Certificates (Onshore/Plant)



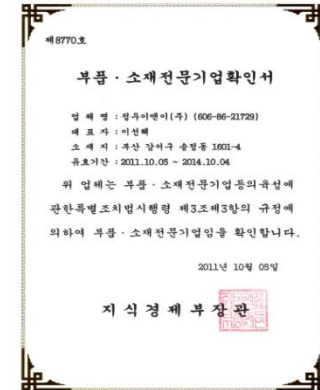
Certificate of INNO-BIZ Business



Certificate of Venture Business



Certificate of R&D Laboratory



Confirmation of Manufacturing Parts & Material Company



ASME "U"



ASME "S"



ASME "PP"



Confirmation of CLEAN WORKPLACE COMPANY



Class Certificates & Quality Certificate (Marine/Offshore)



KR Approval Manufacture of Pressure Vessels



KR Certificate for IMO Type C LNG TANK



KR Design Approval



DSME Quality Certificate



ISO-9001



ISO-14001



ISO-18001



WPS for Class (Marine/Offshore)

KOREAN REGISTER OF SHIPPING
Approval List for Welding Procedure Specification

Manufacturer: JUNGWOO ENE CO., LTD.
Address: 41, Koksamsanri 2st-ro, T4seon-gil, Gangseo-gu, Busan

Applicable Rules / Standard: KR Rule Part 4 - EN ISO 15614
Approved Date: 2014-07-10

No.	WPS Information	Welding Technical	Base Metal	Welding Material
1	2	3	4	5
1	WPS No.: JWE-WPS-GT-01 Supporting PQR No.: JWE-PQ-GT-01 Size: 10, 20, 30-up, 30-down, 40 for butt of plate / 10, 20, 30-up, 30-down, 40 for Filler Pipe	Welding Process: TIG Joint Type: Butt joint Welding Position: 6G-P	Grade: ASTM A312 (TP304L) Pipe Thickness: 3.9, 21.1 Range of thickness: 3.9 ~ 21.1	Steel name: A199 AS 29 ER316L GT-316L(S)
2	WPS No.: JWE-WPS-GT-02 Supporting PQR No.: JWE-PQ-GT-02 Size: 10, 20, 30-up, 30-down, 40 for butt of plate / 10, 20, 30-up, 30-down, 40 for Filler Pipe	Welding Process: TIG Joint Type: Butt joint Welding Position: 6G-P	Grade: ASTM A796 (S31803) Pipe Thickness: 3.9, 30.0 Range of thickness: 3.9 ~ 30.0	Steel name: A199 AS 29 ER2208 GT-2208
3	WPS No.: JWE-WPS-GT-03 Supporting PQR No.: JWE-PQ-GT-03 Size: 10, 20, 30-up, 30-down, 40 for butt of plate / 10, 20, 30-up, 30-down, 40 for Filler Pipe	Welding Process: TIG Joint Type: Butt joint Welding Position: 6G-P	Grade: ASTM A796 (S32760) Pipe Thickness: 3.9, 24.2 Range of thickness: 3.9 ~ 24.2	Steel name: A199 AS 29 ER2384 SMT-2384
4	WPS No.: JWE-WPS-GT-04 Supporting PQR No.: JWE-PQ-GT-04 Size: 10, 20, 30-up, 30-down, 40 for butt of plate / 10, 20, 30-up, 30-down, 40 for Filler Pipe	Welding Process: TIG Joint Type: Butt joint Welding Position: 6G-P	Grade: ASTM A796 (S32760) Pipe Thickness: 10.2, 39.6 Range of thickness: 10.2 ~ 39.6	Steel name: A199 AS 29 ER2384 SMT-2384

Remarks: 1) Welding process: SMAW, FCAW, SAW, TIG, ESAB, GMAW etc.
2) Welding position: 1G, 2G, 3G-up, 3G-down, 4G for butt of plate / 1G, 2G, 3G-up, 3G-down, 4G for Filler Pipe / 1G, 2G, 3G-up, 3G-down, 4G for Filler Pipe

THIS IS TO CERTIFY that the above mentioned welding procedures have been approved on the basis of the welding procedure qualification test supervised by the surveyor of Korean Register of Shipping and specified in a welding procedure specification (WPS No.), in accordance with the relevant requirement of the Society's Rules and/or of the recognized standard as follows:

Pl. 2, Ch. 2, Sec. 4 of the Rules for Classification, Steel Ships and/or applicable specifications
Issued Date / Office : 10 July 2015 / Gangseo Branch Office

1. Welding procedures qualified at a manufacturer are valid for welding in workshops under the same technical and quality management.
2. It is to be the manufacturer's responsibility to establish and document whether a procedure is suitable for the particular application.
3. If you wish to make any enquiry for Approval List of WPSs, please contact us as follows:
Gangseo Branch Office: Tel. 070-8790-7947 ~ 0 Fax: 070-8790-7949

Form A94-03 (2013/02) <http://www.krs.co.kr>

KR WPS

LR
Welding Procedure Specification (WPS)

Company Name: JUNGWOO ENE CO., LTD.
Address: 41, Koksamsanri 2st-ro, T4seon-gil, Gangseo-gu, Busan, Korea

WPS No.: JWE-WPS-GT-01
Supporting PQR No.: JWE-PQ-GT-01

Welding Process: TIG
Joint Type: Butt joint
Welding Position: 6G-P

Grade: ASTM A312 (TP304L)
Pipe Thickness: 3.9, 21.1
Range of thickness: 3.9 ~ 21.1

LR WPS

ABS
JUNGWOO ENE CO., LTD.
41091-4, Songgong-Dong, Gyeongsang-Gu, Daegu, Korea

26 November 2013
Reference: 00136
File Ref: ML-4-7 (2012)
Task No.: 131113106
CR#: 423726

Attn: Mr. Anthony Green, Director of Research

WPS/Welding Procedure Qualification Test Record

Customer:
We have your letter of 6 November 2013 (Doc. No.: JWE-131106-001) submitting the three (3) prints each of the following drawings:

- WPS No.: JWE-WPS-GT-01, Rev. 0 "GTAW - Groove Joint Welding"
PQR No.: JWE-PQR-001 (S04)
- WPS No.: JWE-WPS-GT-02, Rev. 0 "GTAW - Groove Joint Welding"
PQR No.: JWE-PQR-002 (S04)

We have reviewed the results and we are pleased to advise that the procedures are indicated as acceptable provided the production welds in the satisfaction of the preceding Surveyor.
One (1) print each of the above drawings stamped to indicate our review is being returned.
Please note that our review is based on the drawings approved by other classification society.
An invoice to cover our fee for this technical service will be sent to you separately.
Should you need any clarification, please do not hesitate to contact Mr. S. J. Lee at 051-460-4143 or the Underwriter at 051-460-4147. In case of inquiry by phone or reply in document, please indicate our Task No. and the date of this letter.

Very truly yours,
K. M. Wong
Senior Vice President of Engineering
ABS Pacific Division

By: Kosaku Sano
Senior Engineering Specialist
Ship Structures and Structures

© ABS. Human Operations - WIP

ABS WPS

DNV-GL
WELDING PROCEDURE QUALIFICATION TEST

Manufacturer: JUNGWOO ENE CO., LTD.
Address: 41, Koksamsanri 2st-ro, T4seon-gil, Gangseo-gu, Busan, Korea

WPS No.: JWE-WPS-GT-01
Supporting PQR No.: JWE-PQ-GT-01

Welding Process: TIG
Joint Type: Butt joint
Welding Position: 6G-P

Grade: ASTM A312 (TP304L)
Pipe Thickness: 3.9, 21.1
Range of thickness: 3.9 ~ 21.1

Steel name: A199 AS 29 ER316L
GT-316L(S)

DNV GL ASSESSMENT REPORT

DNV GL ASSESSMENT REPORT

DNV GL ASSESSMENT REPORT

DNV-GL WPS

BV
WELDER APPROVAL TEST CERTIFICATE

Company Name: JUNGWOO ENE CO., LTD.
Address: 41, Koksamsanri 2st-ro, T4seon-gil, Gangseo-gu, Busan, Korea

WPS No.: JWE-WPS-GT-01
Supporting PQR No.: JWE-PQ-GT-01

Welding Process: TIG
Joint Type: Butt joint
Welding Position: 6G-P

Grade: ASTM A312 (TP304L)
Pipe Thickness: 3.9, 21.1
Range of thickness: 3.9 ~ 21.1

Steel name: A199 AS 29 ER316L
GT-316L(S)

BV ASSESSMENT REPORT

BV ASSESSMENT REPORT

BV ASSESSMENT REPORT

BV WPS

RINA
WELDING PROCESS APPROVAL CERTIFICATE

Company Name: JUNGWOO ENE CO., LTD.
Address: 41, Koksamsanri 2st-ro, T4seon-gil, Gangseo-gu, Busan, Korea

WPS No.: JWE-WPS-GT-01
Supporting PQR No.: JWE-PQ-GT-01

Welding Process: TIG
Joint Type: Butt joint
Welding Position: 6G-P

Grade: ASTM A312 (TP304L)
Pipe Thickness: 3.9, 21.1
Range of thickness: 3.9 ~ 21.1

Steel name: A199 AS 29 ER316L
GT-316L(S)

RINA ASSESSMENT REPORT

RINA ASSESSMENT REPORT

RINA ASSESSMENT REPORT

RINA WPS

RUSSIAN MARITIME REGISTER OF SHIPPING
JUNGWOO ENE CO., LTD.
41091-4, Songgong-Dong, Gyeongsang-Gu, Daegu, Korea

Our ref.: 296-381-7-197962
Date: 14.08.2010

Year ref.:
Date: 27.07.2010

Subject: Approval for approval of WPS

Dear Sir,
Please be advised that the Welding Procedure Specifications (WPS) with supporting Procedure Qualification Records (PQRs) for welding have been reviewed in compliance with the requirements of RS Rules for the Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships, 2010 with following results:

WPS No.	Rev. No.	PQR No.	Status
JWE-WPS-GT-01	0	JWE-PQ-GT-01(KG)	Approved
JWE-WPS-GT-02	0	JWE-PQ-GT-02(KG)	Approved

Best regards,
Director RMRS LLC in Korea
Andrey Fasilov

Enclosure: A. Denisov
Tel: 010 384 8174

RMRS WPS



Cryogenic Patents of JUNGWOOENE



Pressure vessel included vaporizer and FGSS included this pressure vessel

Regulator for Cryogenic storage tank

Cryogenic storage tank

Vacuum Insulated Pipe

Vaporizer for LNG fueled ship

High pressure pump for gas supply system

Double Wall Pipe



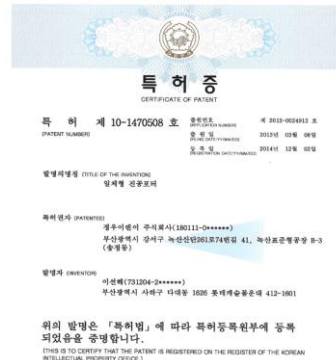
Inspection device of double wall pipe for ship fuel



Fuel Gas Supply System



Multi valve for cryogen liquefied gas



Integral type vacuum port

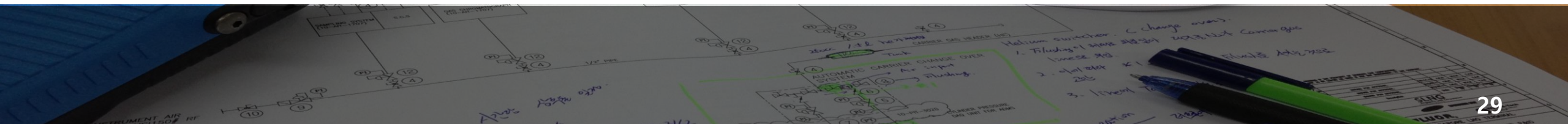


Multi valve for Cryogen liquefied gas (A patent on a now device)



JUNGWOOENE

PROJECT REFERENCE





Reference - LNG FGSS for 280ton Class LNG Fueled Coast Cleaning Vessel

- End User : Yeosu Regional Office of Oceans and Fisheries
- Supply Scope : FGSS, Vacuum Insulated Pipe, LNG Bunkering Station..etc.
- EPCIC Turn-key base Contractor & System Integration



해양수산부
여수지방해양수산청





Reference – Vacuum Insulated Pipe, Double Wall Pipe

- Owner : ULSAN Regional Office of Oceans and Fisheries
- Shipyard : Goryeo Shipbuilding Co., Ltd.
- Items : Vacuum Insulated Pipe & Double Wall Pipe
- Specification : -196°C, 10Bar (Design Temp. & bar)
- Materials : Inner & Outer Pipe SUS 316L
- Insulation : Vacuum Type Insulated
- Contract terms : Included EPC





Reference – Vacuum Insulated Pipe, Double Wall Pipe

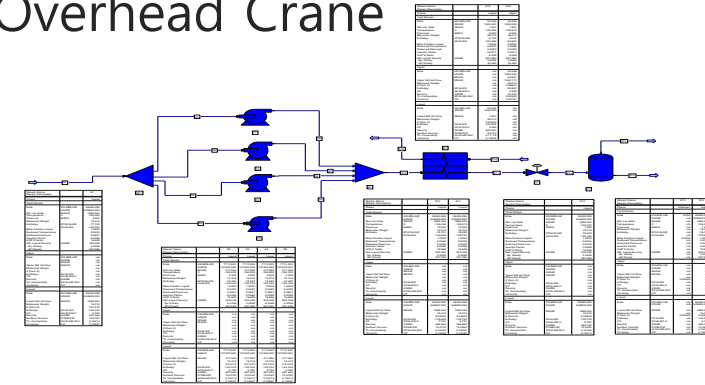
- Owner : KOGAS Shipping
- Shipyard : DH Shipbuilding Co., Ltd.
- Items : Vacuum Insulated Pipe & Double Wall Pipe
- Specification : -196°C, 10Bar (Design Temp. & bar)
- Materials : Inner & Outer Pipe SUS 316L
- Insulation : Vacuum Type Insulated
- Contract terms : Included EPC





LNG Bunkering Equipment Test Facility First Phase Construction

- End User : KOMERI
- Supply Scope : C-type Tank, LNG LP Pump, LNG Transfer System, Overhead Crane
- Process Engineering Review
- EPC Contractor & System Integration





TEST FACILITY FOR LH2 STORAGE AND SUPPLY

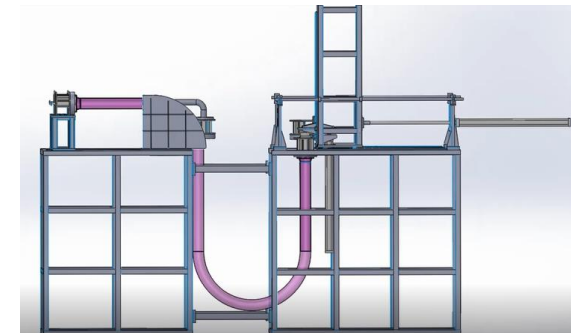
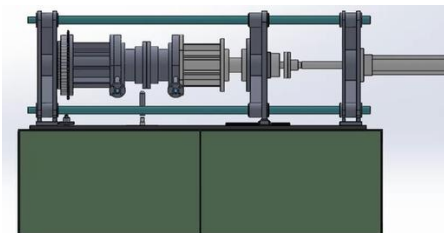
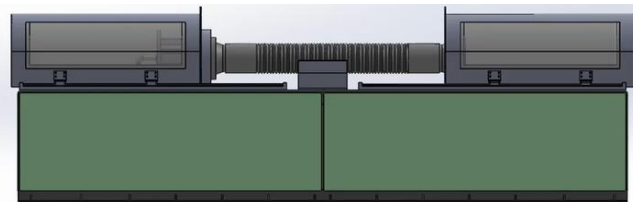
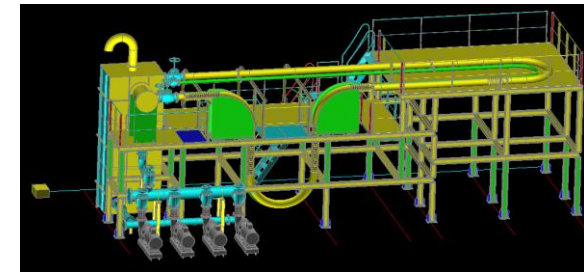
- Owner : Pusan National University Research Institute & Industry Corperation
- Site : Technical Center for Hydrogen Ship
- Items : LH2 Storage and Supply Test Facility
& MW Propulsion Test Facility
- Scope of Supply :
 - > 100ton Universal Test Machine, 50ton Fatigue Test Machine, Cryogenic Chamber, Helium Recovery System, HE & LN2 PIPE Construction
- Contract Terms : EPC Contractor





Reliability Test Facility for LNG Bunkering equipment

- End User : Gyeongnam Technopark
- Supply Scope : Axial stiffness test facility, Fatigue test facility, Minimum bend radius test facility, Ambient flow rate test facility, QC/DC, ERC, Swivel Function test
- Test Sample : LNG Transfer Hose, QC/DC, ERC, Swivel
- EPC Contractor





MOU Agreement with Samsung Heavy Industries

- MOU with SHI for the Development of Hydrogen Fuel System for the ship



Memorandum of Understanding

(양해각서)

Development of

Hydrogen Fuel System for the Ship

(선박용 수소연료시스템 개발)

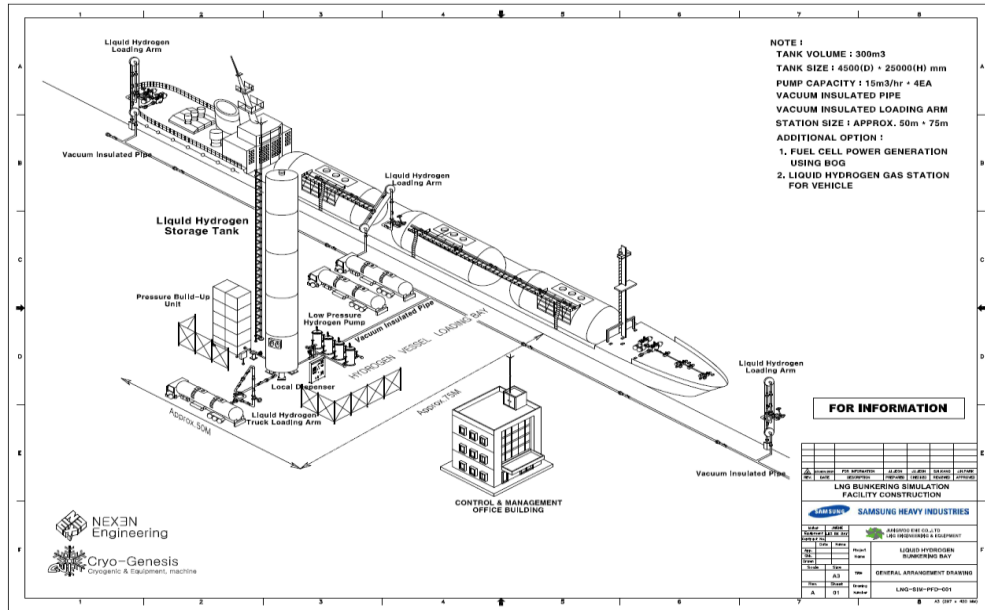
2021년 6월 30일

부산대 수소선박기술센터 [대한민국 부산시 금정구 부산대학로 63 번길 2(장전동) 부산대학교 제 11 공학관, 5층 소재]	이계명 (인) [대한민국 부산시 금정구 부산대학로 63 번길 2(장전동) 부산대학교 제 11 공학관, 5층 소재]
범한퓨얼셀 [대한민국 경남 창원시 마산회원구 자유무역 4길 61 소재]	신현길 본부장 (인) [대한민국 경남 창원시 마산회원구 자유무역 4길 61 소재]
일진 하이솔루션 [대한민국 전북 완주군 봉동읍 완주산단 5로 97-46 소재]	안홍상 대표이사 (인) [대한민국 전북 완주군 봉동읍 완주산단 5로 97-46 소재]
정우 ENE [대한민국 부산시 강서구 녹산산단 261로 74 번길 20 소재]	강성훈 이사 (인) [대한민국 부산시 강서구 녹산산단 261로 74 번길 20 소재]
S&SYS [대한민국 경기도 화성시 동탄순환대로 830, 7층 소재]	배재혁 대표이사 (인) [대한민국 경기도 화성시 동탄순환대로 830, 7층 소재]
광신기계공업 [대한민국 경남 함안군 칠원읍 오곡로 124 소재]	박명철 이사 (인) [대한민국 경남 함안군 칠원읍 오곡로 124 소재]
DNV Korea [대한민국 서울시 서초구 중앙로 586, 4층 소재]	신명섭 본부장 (인) [대한민국 서울시 서초구 중앙로 586, 4층 소재]
삼성중공업 해외사업팀장 [대한민국 경기도 성남시 분당구 판교로 227 번길 23 소재]	김경희 상무 (인) [대한민국 경기도 성남시 분당구 판교로 227 번길 23 소재]



MOU with Samsung Heavy Industries

- MOU with SHI for the Development of Hydrogen Fuel System for the ship





JUNGWOO ENE's NEW FGSS



For the next
Generation
Saving the world
Saving the children



JUNGWOO ENE Co.,Ltd.
Cryogenic Engineering & Equipment

Thank you for your attention



Id : jungwooene



Id : Jungwoo Ene

JungwooENE
sales2@cryogen.co.kr