

Hydrogen Ship
Technology Center
Pusan National University

Eco-Friendly Hydrogen Ship R&D Platform

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Pusan National University

Eco-Friendly Hydrogen Ship R&D Platform



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Technology Center
Pusan National University

HSTC

Eco-friendly Hydrogen Ship R&D Platform

Hydrogen Ship R&D Platform

A eco-friendly Hydrogen Ship R&D platform at the Uam Pier Marine Industry Cluster, Busan Port.

It is one of Korea's largest facilities for evaluating the core functions and performance of hydrogen ships, with capabilities at a level comparable to NASA in the field of liquid-hydrogen technologies.

The Eco-friendly Hydrogen Ship R&D Platform is Korea's first dedicated R&D infrastructure specialized for hydrogen ships.



Overview

| Purpose | Operation of a dedicated test and evaluation facility for hydrogen ship core technologies

| Scale | Total site area of 5,000 m², 4 stories above ground

| Location | 2-1, Sinseon-ro, Nam-gu, Busan, Republic of Korea

| Contact | TEL. +82-51-637-2007 FAX. +82-51-980-0788

Establishment of Korea's Largest Hydrogen Ship Performance Evaluation Facilities

State-of-the-Art R&D Infrastructure Specialized for Core Functional Areas

Technical Data Centralization Leveraging a Big Data Command Center

Eco-Friendly Hydrogen-Fueled Ship R&D Platform

Major R&D Infrastructure by Core Hydrogen Ship Technology

For hydrogen ships to function properly, they must fulfill three essential capabilities: storing hydrogen as fuel, utilizing the stored hydrogen for ship propulsion, and managing new forms of onboard energy.

The Hydrogen Ship Technology Center operates dedicated test and evaluation facilities through its R&D platform to support technology development for each of these core functional areas.

The platform is equipped with specialized performance evaluation facilities for hydrogen fuel storage and supply systems, MW-scale hydrogen fuel cell–ESS (energy storage system) systems, and MW-scale electric propulsion systems.

In particular, it realizes integrated testing within a single space based on assumed series and parallel module configurations onboard ships. In addition, for hydrogen fuel storage and supply systems, a dedicated performance test facility has been established for liquid hydrogen (−253°C), which offers the highest storage efficiency.





Hydrogen Ship Core Technologies

Hydrogen Fuel Storage and Supply System

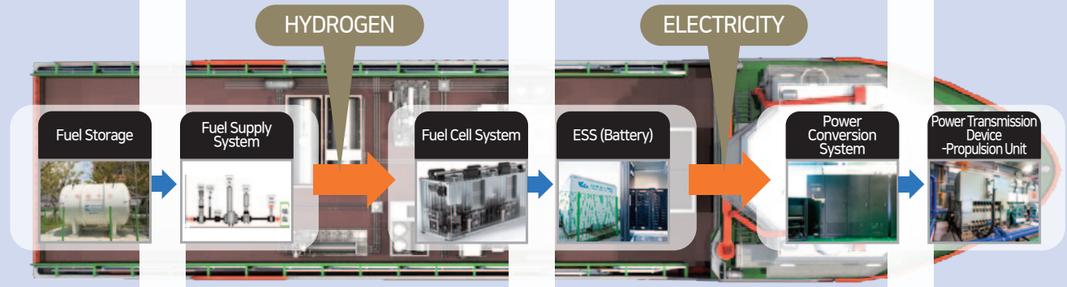
Cryogenic Liquid Hydrogen Storage and Supply Technology

Fuel Cell–ESS System

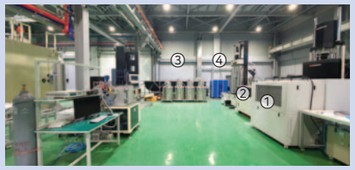
Power Generation and Energy Storage & Management Technology

Electric Propulsion System

Ship Electric Propulsion & Control Technology



Performance Evaluation Facility for Hydrogen Fuel Storage and Supply Systems



① Integrated Steel Structure Test Facility
② Integrated Insulation / Composite Material Test Facility
③ Insulation Performance Test Facility for Insulation / Composite Materials
④ Advanced Measurement Facility for Hydrogen Embrittlement Prevention Design Verification

MW-Scale Hydrogen Fuel Cell–ESS System Performance Evaluation Facility



⑤ Parallel Fuel Cell Performance Evaluation Facility
⑥ MBOP Performance Evaluation Facility
⑦ EBOP Performance Evaluation Facility
⑧ ESS Performance Evaluation Facility

MW-Scale Electric Propulsion System Performance Evaluation Facility



⑨ MW-Scale Load Test Facility
⑩ HILS-Based Integrated Simulation Facility

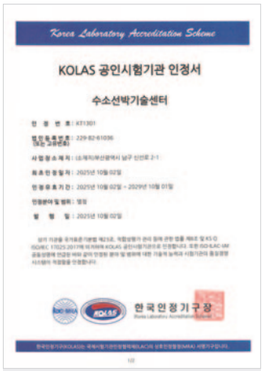
THE HYDROGEN SHIP TECHNOLOGY CENTER IS A **KOLAS-ACCREDITED TESTING INSTITUTE.**

국가공인시험기관
(인정번호:KT1301)

The Hydrogen Ship Technology Center is a KOLAS-accredited testing laboratory recognized for its technical competence and quality management system in accordance with KS Q ISO/IEC 17025.

KOLAS ACCREDITATION SCOPE

01. Mechanical Testing _ 01. 001. Metals and Related Products



Accreditation Certificate


Fatigue Testing Machine (10 tons)


Fatigue Testing Machine (50 tons)

Standard Number	Product and Quality	Standard Title	Test Scope	Business Site	On-Site Testing
ASTM E1450-24	Hydrogen Ship Machinery and Equipment	Standard Test Method for Tension Testing of Structural Alloys in Liquid Helium	Load : 0-490 kN Elongation : 0-99% Reduction of Area : 0-99%	Location	N
KS B 0802:2003		Tensile Test Method for Metallic Materials			

KOLAS TESTING PROCEDURE

Testing Consultation & Application
- Testing inquiry and application
  - Test schedule and availability
- Submission of test request form and required documents (e.g., procedures, drawings, and related documents)

Review of Test Request & Test Method
- Review of the test request
  - Applicable test standards
  - Applicant requirements
  - Testing fees

Testing & Issuance of Test Report
- Conduct testing
- Prepare the test report upon completion of testing
- Issue the official test report



Advancing LH_2 Demonstration and Commercialization through Korea's Regulatory Sandbox

Regulatory Sandbox Project

Development and Performance Verification of Liquid Hydrogen Storage Tanks for Hydrogen-Fueled Ships

Overview

Performance verification of prototype liquid hydrogen storage tanks through demonstration testing for small- and medium-sized hydrogen-fueled ships.







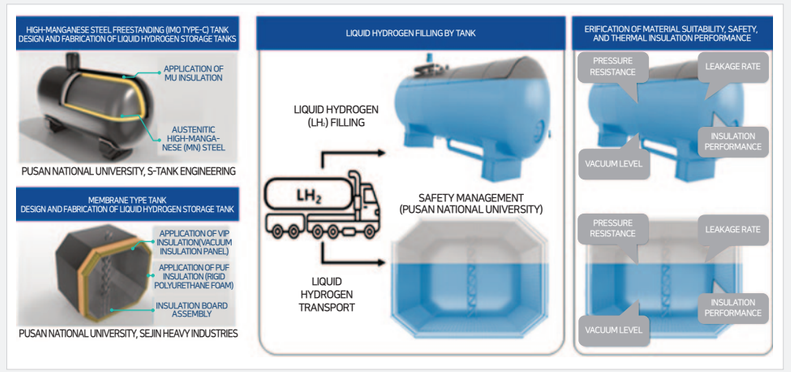
Regulatory Sandbox Project

Thermal Insulation Performance Evaluation Platform for Liquid Hydrogen Cargo Tanks for Hydrogen Transport Ships

Overview

Fabrication of prototype liquid hydrogen cargo tanks of various types and evaluation of their thermal insulation performance to support the development of large-scale liquid hydrogen carriers.





CORE FACILITIES
OF THE ECO-FRIENDLY HYDROGEN SHIP R&D PLATFORM

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HYDROGEN SHIP TECHNOLOGY CENTER

12
Hydrogen Storage & Supply Test Facility



- Integrated Steel Test Facility
- Integrated Insulation / Composite Material Test Facility
- Insulation Performance Test Facility for Insulation / Composite Materials
- Advanced Measurement Facility for Hydrogen Embrittlement Prevention Design Verification

16
MW-Scale Hydrogen Fuel Cell–ESS Test Facility



- Parallel Fuel Cell Performance Test Facility
- MBOP Performance Test Facility
- EBOP Performance Test Facility
- ESS Performance Test Facility

24
MW-Scale Electric Propulsion Test Facility



- MW-Scale Load Test Facility
- HILS-Based Integrated Simulation Facility

Hydrogen Fuel Storage & Supply System

Integrated Steel Test Facility

A test facility for evaluating and analyzing the strength and durability characteristics of steel materials and components used for liquid hydrogen storage and operation under ultra-cryogenic conditions (−253°C or below)

PURPOSE AND FEATURES

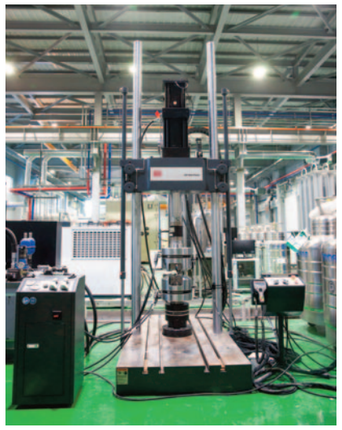
- Evaluation of steel strength and durability under ambient and ultra-cryogenic conditions
- Simulation of various load types, including tensile, compressive, shear, bending, fatigue, static, dynamic and impact loads
- Measurement of diverse parameters: mechanical strength, elongation properties, fatigue life, impact absorption energy, and more
- Support for ultra-cryogenic strength and durability evaluation of hydrogen-charged steels using physical and chemical charging methods

Configuration and Performance



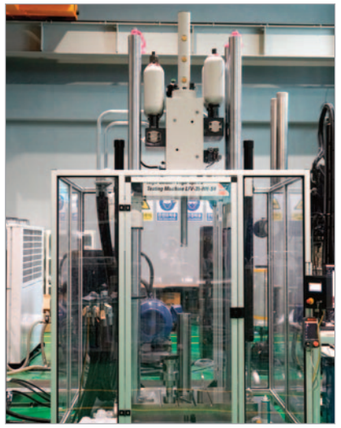
Universal Testing Machine

- Maximum Load : 1,000kN
- Loading Speed : 0.005~1,000mm/min
- Maximum Displacement : 1,500mm
- Operating Temperature : -253~20°C
- Internal Chamber Size : 445mm(D)×980mm(H)



Fatigue Testing Machine

- Maximum Load : 500kN
- Dynamic Performance : ~50Hz
- Actuator Stroke : 250mm
- Operating Temperature : -253~20°C
- Internal Chamber Size : 345mm(D)×780mm(H)



High-Speed Tensile Testing Machinechine

- Maximum Load : 30kN
- Test Speed : 10m/s
- Actuator Stroke : 250mm
- Operating Temperature : -253~20°C
- Internal Chamber Size : 200mm(D)×1,000mm(H)

Application Areas

- Evaluation of strength and durability (including fatigue) of steels and welds for liquid hydrogen tanks and piping

Hydrogen Fuel Storage & Supply System

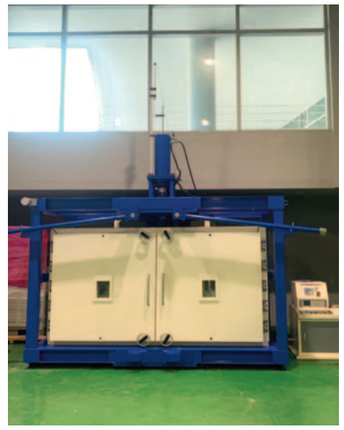
Integrated Insulation / Composite Material Test Facility

A test facility for evaluating the strength and durability of insulation and composite materials for liquid hydrogen under ultra-cryogenic conditions (−253°C or below).

PURPOSE AND FEATURES

- Evaluation of mechanical performance of composite structures and materials under ambient and ultra-cryogenic conditions
- Simulation of various load types, including compressive, shear, bending, fatigue, static, dynamic and impact loads
- Measurement of key parameters: mechanical strength, elongation properties, fatigue life, impact absorption energy, and more
- Evaluation of crack initiation and fracture behavior in non-metallic composite materialsand chemical charging methods

Configuration and Performance



Structural Compression / Bending Testing Machine

- Maximum Load : 1,000kN
- Maximum Displacement : 500mm
- Operating Temperature : -200~100°C
- Internal Chamber Size : 3,200mm(D)×1,200mm(W)×600mm(H)



Fatigue Testing Machine

- Maximum Load : 100kN
- Dynamic Performance : ~50Hz
- Maximum Displacement : 1,434mm
- Operating Temperature : -253~20°C
- Internal Chamber Size : 400mm(D)×530mm(H)



Drop Impact Testing Machine

- Maximum Impact Energy : 1,800J
- Drop Height : Max. 2,100mm
- Operating Temperature : -253~20°C
- Internal Chamber Size : 380mm(D)×380mm(W)×280mm(H)

Application Areas

- Evaluation of strength and durability (including fatigue) of insulation and composite materials for liquid hydrogen tanks and piping

Hydrogen Fuel Storage & Supply System

Insulation Performance Test Facility for Insulation / Composite Materials

A test facility for evaluating the thermal insulation performance of insulation and composite materials for liquid hydrogen under ultra-cryogenic conditions (−253°C or below)

PURPOSE AND FEATURES

- Evaluation of thermal insulation performance of composite structures and materials under ambient and ultra-cryogenic conditions
- Measurement of boil-off rate and heat flux using liquid nitrogen, helium or hydrogen
- Measurement of key parameters: temperature, vacuum level, heat flux, heat flow, fill level, internal pressure, and more
- Real-time data logging over time

Configuration and Performance



Flat Plate and Cylindrical Insulation Performance Measurement Equipment

- Operating Temperature : -269~20°C
- Vacuum Level : 5×10^{-6}~760torr
- Measurements : Temperature / Heat flux / Vacuum / Flow rate
- Cylindrical Specimen Size : 90~260mm(ø)×2,000mm(L)
- Flat Plate Specimen Size : 280~300mm(D)×1~100mm(H)



Material Insulation Performance Measurement Equipment

- Operating Temperature : -269~20°C
- Vacuum Level : 5×10^{-6}~760torr
- Measurements : Temperature / Heat flux / Vacuum / Flow rate
- Specimen Size : 100mm(D)×100mm(W)×100mm(H)
- Using a GM cryocooler



Structural Insulation Performance Measurement Equipment

- Operating Temperature : -253~20°C
- Vacuum Level : 5×10^{-6}~760torr
- Measurements : Temperature / Heat flux / Vacuum / Flow rate / Pressure / Loading rate
- Outer Vessel : 1,062mm(ø), 6mm(T)
- Inner Vessel : 712mm(ø), 6mm(T)

Application Areas

- Evaluation of insulation performance (including holding time) for liquid hydrogen tanks and piping

Hydrogen Fuel Storage & Supply System

Advanced Measurement Facility for Hydrogen Embrittlement Prevention Design Verification

A test facility for evaluating hydrogen embrittlement of materials and equipment for hydrogen storage and operation using physical (high-pressure) and electrochemical charging methods.

PURPOSE AND FEATURES

- Hydrogen permeation testing under high-pressure hydrogen environments
- Material performance evaluation linked to liquid hydrogen test facilities
- Evaluation of hydrogen uptake for embrittlement mitigation designs

Configuration and Performance



High-Pressure Hydrogen Charging Facility

- Gas Pressure : 14~700bar
- Charging Gas : Hydrogen
- Capacity : 6L
- nternal Chamber Size : 150mm(D)×500mm(L)



Electrochemical Hydrogen Charging Facility

- Voltage and Current : 10V, 10A
- 8 channels, 4 probe types
- Working Electrode Size : 62.5mm × 60mm × 12.5mm
- Thermostatic Bath Temperature : 20-80°C



Hydrogen Charging Analysis System

- Maximum Temperature : 1,100°C
- Heating Rate : 100-300°C/h
- Carrier Gas : Helium(99.999%)
- Quartz Tube Size : 20mm(D)
- GC(Gas Chromatography) Analysis

Application Areas

- Hydrogen embrittlement evaluation of steels and welds for liquid and high-pressure hydrogen tanks and piping

HYDROGEN
FUEL CELL
ESS SYSTEM

Hydrogen Fuel Cell–ESS System

Parallel Fuel Cell Performance Evaluation Facility

A test facility for evaluating and analyzing the performance stability and power quality of hydrogen fuel cell stacks under marine conditions, including ship motion and saline environments

PURPOSE AND FEATURES

- Fuel Cell Performance Evaluation (Steady-State / Dynamic Conditions)
- Environmental impact assessment using ship dynamic (6-DOF) simulation
- Fuel cell stability testing under simulated extreme conditions

Configuration and Performance



Fuel and Gas Supply System

- Hydrogen
  - Pressure Control Range : Input 200bar, Output 0.25-10bar
  - Flow Control Range : up to 100m³/hr
- Nitrogen
  - Pressure Control Range : Input 10bar, Output 0.25-10bar
  - Flow Control Range : up to 50m³/hr
- Air
  - Pressure Control Range : Input 8bar, Output 0.25-8bar
  - Flow Control Range : up to 300m³/hr



Dynamic Characteristics Simulation System

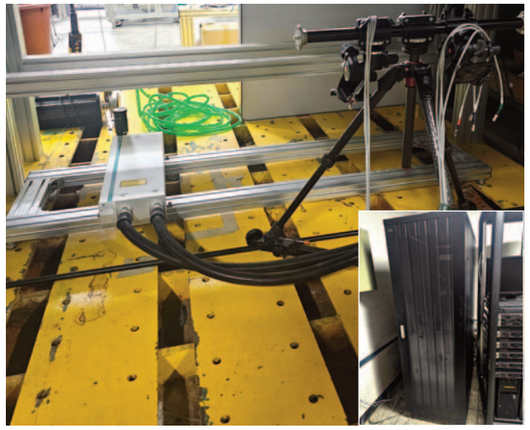
- Maximum Load : 1ton
- Frame Size : 2,000mm × 2,000mm
- Motion Control Type : 6-axis motion control platform

Displacemen	Displacement Value	Velocity
Surge	±850mm	1,400mm/sec
Sway	±850mm	1,200mm/sec
Heave	±500mm	800mm/sec
Roll	±30deg	±30deg/sec
Pitch	±22deg	±30deg/sec
Yaw	±30deg	±40deg/sec



Temperature and Humidity Chamber

- Internal Volume : 10m³
- Internal Dimensions : 2,000mm × 2,000mm × 2,500mm
- Temperature Range : -20 to 150°C
- Humidity Range : 25-98% RH
- Control Resolution : ±0.1°C



Flow Field Evaluation System

- Stereo-type PIV system for flow measurement
- System Configuration :
  Two high-speed CCD cameras (160fps, 2,048 × 2,048px)
  Nd : YAG laser (200mJ)
  Dual-channel frame grabber
  Server cluster for CFD analysis

Application Areas

- Evaluation of fuel cell and power generation safety under simulated ship motion

HYDROGEN
FUEL CELL
ESS SYSTEM

Hydrogen Fuel Cell–ESS System

MBOP Performance Evaluation Facility

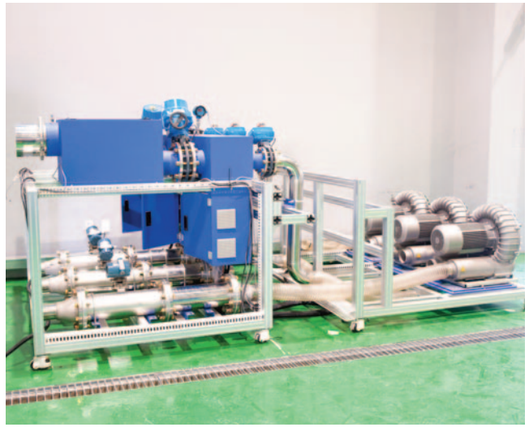
Mechanical Balance of Plant

Test facility for evaluating and analyzing the performance of major equipment under the marine environment and operating conditions (hydrogen and air flow characteristics, humidification and heating) for the fuel supply system of hydrogen fuel cells

PURPOSE AND FEATURES

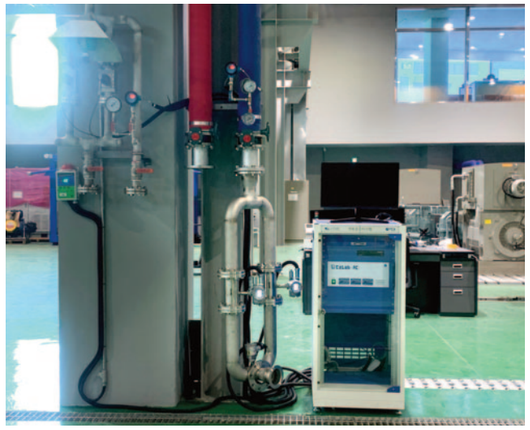
- Performance evaluation of MBOP components, including air supply blowers, filters, and water-cooled fuel cell cooling systems
- Measurement of hydrogen fuel supply and consumption
- Support for marine environment simulation, including salt spray generation and airborne salinity measurement

Configuration and Performance



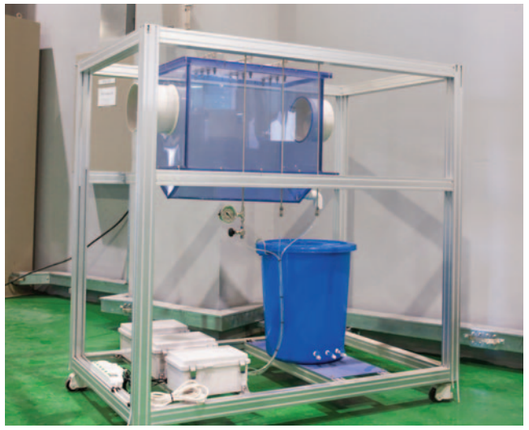
Air Blower and Filter Performance Test System

- Equipment configuration : air blower / flow meter / filter performance tester
- Ambient Temperature & Humidity Measurement : RH 1–95%, T −50 to 50°C
- Air Supply : 3,000Nm³/h, 220mbar
- Flow Measurement Range : 20-3,600Nm³
- Pressure Measurement Range : -1 to 1bar
- Temperature Measurement Range : 0-100°C
- Particle Counter Sizes : 0.3, 0.5, 1, 2, 5, 10μm



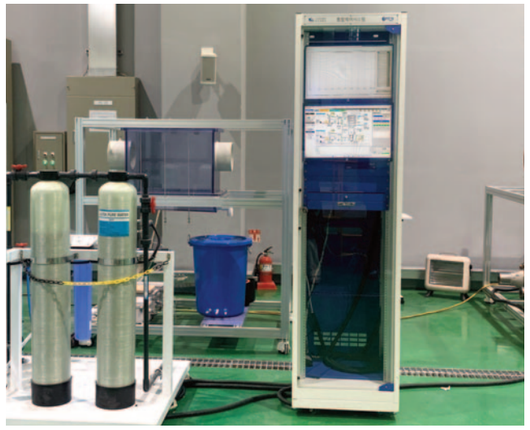
Hydrogen Fuel Supply System

- Equipment configuration : hydrogen pressure regulator / flow meter
- Fuel supply capacity for power generation of 500 kW or higher
- Hydrogen Supply : 600Nm³/h, 2–10bar
- Flow Measurement : 300Nm³ × 2units
- Pressure Measurement Range : 0-20bar
- Temperature Measurement : T-type temperature sensor
- Hydrogen Pressure Regulator Range : 0-250PSI



Salt Spray Simulation System

- Equipment configuration : NaCl spray system / collection chamber / chlorine analyzer
- Supply of NaCl solution into the air using a booster pump
- NaCl Spray : 5% NaCl concentration, 10μm droplet diameter
- Residual Chlorine Measurement Range : 0-10ppm
- pH Measurement Range : 0-14
- Temperature Range : -30 to 130°C
- Resolution : chlorine 0.01ppm, pH 0.01, temperature 0.1°C



Control and Instrumentation System

- Equipment configuration : instrumentation / hydrogen detector / DAQ
- Dedicated operation software for air blower,filter performance, and chlorine measurement
- System Control : pumps, blowers
- Measured Data : flow rate, temperature, pressure
- DAQ Systems : CIMON, Soray System, etc.
- Hydrogen Detector Range : 0-2,000ppm

Application Areas

- Evaluation of H_2 / O_2 supply, heat exchange, stack temperature control, and marine environmental effects

HYDROGEN
FUEL CELL
ESS SYSTEM

Hydrogen Fuel Cell–ESS System

EBOP Performance Evaluation Facility

Mechanical Balance of Plant

A test facility for evaluating and analyzing the performance of power conversion and control system components of hydrogen fuel cells under marine conditions (salt exposure and temperature)

PURPOSE AND FEATURES

- Support for performance testing of large-scale (500kW-class) fuel cells
- Load variation testing using electrical output from the power conversion system
- Evaluation of hydrogen fuel cell operation and control performance

Configuration and Performance



Electronic Load

- Rated Capacity : 100kW (20kW × 5 units)
- Operating Voltage : 0-1,200V
- Operating Current : 4kA (0.8kA × 5 units)
- Operating Modes : CC, CR, CV, CP
- Interface : USB, Ethernet



Transformer

- Rated Capacity : 700kVA
- Primary Side : 3-phase, 4-wire, 380V / 44V
- Secondary Side : 3-phase, 3-wire, 690V
- Rated Frequency : 60Hz
- Winding Configuration : YNd1
- Insulation Class : Class F



Integrated Connection and Grid Load Interface

- 500kW MCCB : Rated current 200A, 4-pole, 5 units, max voltage DC 1,000V
- 100kW MCCB : Rated current 200A, 4-pole, 1 unit, max voltage DC 1,000V
- Integrated MCCB for ESS Test Interface : Rated current 800A, 4-pole, 1 unit, max voltage DC 1,000V

Application Areas

- EBOP unit function, power conversion, controller operation, and continuous operation testing under marine conditions

HYDROGEN
FUEL CELL
ESS SYSTEM

Hydrogen Fuel Cell–ESS System

ESS Performance Evaluation Facility

Energy Storage System

A test facility for evaluating battery charge / discharge efficiency and safety under marine conditions.

PURPOSE AND FEATURES

- Electrochemical analysis and testing of ESS batteries, including AC impedance, voltage, temperature, insulation resistance, and cell voltage/temperature measurements
- Integrated operation and data management linking battery testers, ACIA, DAQ, insulation resistance meters, and BI software
- Integrated connection interface between the ESS battery inspection system and batteries

Configuration and Performance



ESS Battery

- Equipment configuration : Cell / Module / Rack / BPU
- Cell : 16Wh(95%), 1S1P
- Module : 4.54kWh(65V DC), 18S18P
- Rack(11 Modules) : 50kWh×3ea, 18S18P
  - Charge/Discharge Voltage : 620~812V DC
  - Charge/Discharge Current : 34.96A
- BPU(Battery Protection Unit) with Rack BMS



ESS Battery Inspection System

- Equipment configuration :
  AC impedance analyze / DAQ / Battery·BMS Interface
- AC impedance analyzer :
  Impedance Measurement Using FRA
  - Voltage Range : 5~1,000V
  - Current Range : 200μA~1A
  - Frequency Range : 4kHz~0.1Hz
  - Impedance Range : 1MΩ~100Ω



Battery Pack Tester

- Voltage Range : 50-1,000V
- Current Range : 0-500A
- Independent Power: 500kW
- Operating Temperature / Humidity : 10-40°C / 0-85%
- Resolution : 1mV, 1mA
- Accuracy : ≤ 0.1%(Voltage, Current) / ≤ 1%(Power)
- Operating Modes : CC, CP, CC/CV



PCS/PMS

- PCS(Power Conversion System)
  - Capacity : 500kW
  - Voltage / Current / Frequency :
    3-phase, 4-wire, 350 /220V / 760A / 60Hz
  - Operating Modes : charge, discharge, stop, active standby
  - Battery Min/Max Voltage Limits: 550V DC / 850V DC
- PMS(Power Management System)
  - ESS Real-Time Monitoring

Application Areas

- Support for marine environment simulation using temperature rise, and performance evaluation testing of power conversion and energy storage systems

Hydrogen Fuel Cell-Based Electric Propulsion System

MW-Scale Load Test Facility

A large-scale load testing system for supplying power generated by hydrogen fuel cells and energy storage systems to ship propulsion equipment

PURPOSE AND FEATURES

- Motor performance and thermal testing, including output, temperature rise, and temperature distribution
- Propulsion motor load testing under combined environmental conditions
- Performance evaluation of network power devices and shipboard power distribution systems
- Real-sea condition simulation testing using ship operation data

Configuration and Performance



Load Motor System

[Load Motor]
- Load Motor Capacity : 2MW
- Rated Torque : 10,682N·m
- Rated Speed : 1,788RPM
- Input Power Supply : 3-phase, 690V, 60Hz

[Load Inverter]
- DC Link Voltage : 675-1,035V DC
- Rated Current : 2,540A
- Maximum Current : 3,505A



Test Motor System

[Test Motor]
- Load Motor Capacity : 1.5MW
- Rated Torque : 8,043N·m
- Rated Speed : 1,781RPM
- Input Power Supply : 3-phase, 690V, 60Hz

[Test Inverter]
- DC Link Voltage : 675-1,035V DC
- Rated Current : 1,620A
- Maximum Current : 2,251A



Power Source Emulator

- Power Supply Capacity : 1.0 MW(500kW × 2)
- Rated Output Voltage : 1,000V
- Rated Output Current : 1,000A
- Current Accuracy : within ±0.1%
- Motor Propulsion Capacity : (Motor) 1.2MW (Dynamometer) 2MW

Application Areas

- Performance and Safety Evaluation of MW-Scale Hydrogen Fuel Electric Propulsion Systems and Equipment

Hydrogen Fuel Cell-Based Electric Propulsion System

HILS-Based Integrated Simulation Facility

Hardware In the Loop Simulation

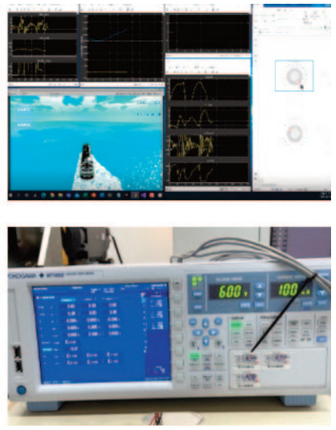
A process facility that integrates real hardware with a simulation environment to test and verify the performance and operation of hydrogen fuel cell electric propulsion systems

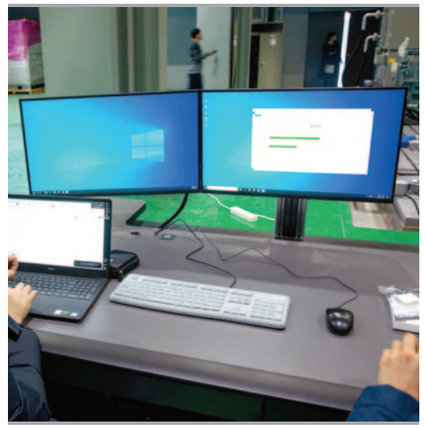
PURPOSE AND FEATURES

- Provision of system stability and equipment performance evaluation under virtual operating scenarios
- Support for power system simulation testing in near-real operating environments
- Implementation of scaled-down models for large-capacity power systems

Configuration and Performance







Dynamometer Control System and UI

- Real-Time Target PC Software : Simulink Real-Time(MathWorks)
- Host PC Software : APROL R/O/E Standard Package(B&R Automation)
- Real-Time Performance Evaluation of Hydrogen Fuel Cell-ESS-Based Electric Propulsion Systems : Comparison and assessment of real-time simulation results with actual data

Application Areas

- Performance verification and fault scenario simulation of hydrogen fuel cell electric systems
- Evaluation and optimization of hydrogen fuel cell system components, including dynamic testing of protective relays, distributed power control and protection devices, and power quality monitoring systems for electric ships



HYDROGEN SHIP TECHNOLOGY CENTER
HSTC

A specialized eco-friendly ship research institute leading global hydrogen ship initiatives and accelerating demonstration of core technology development.

Global Industry-Academia -Research Network

Domestic Public Institutions

Korean Register (KR)
Korea Gas Safety Corporation (KGS)
Korea Hydro & Nuclear Power Co., Ltd. (KHNP)
Korea Maritime Cooperation Center (KMCC)
Busan Shipbuilding & Marine Equipment Cooperative (BUSAN MARINE)
Busan Techno Park (BTP)
Gyeongnam Technopark (GNTP)
Ulsan Technopark (UTP)

Domestic Companies

Samsung Heavy Industries Co., Ltd.	MACRON Co., Ltd.
Hanwha Ocean Co., Ltd.	Samwoo MCPC Co., Ltd.
HD Korea Shipbuilding & Offshore Engineering Co., Ltd.	Daechang Solution Co., Ltd.
Hyundai Motor Company	Mobena Co., Ltd.
Samsung C&T Corporation	Korea Ship Technology Co., Ltd.
Doosan Enerbility Co., Ltd.	Parity Co., Ltd.
Doosan H2 Innovation Co., Ltd.	Jungwoo E&E Co., Ltd.
POSCO	Seojin Instec Co., Ltd.
Hyundai Steel Company	Hantec Co., Ltd.
PANASIA Co., Ltd.	Shinil Ace Co., Ltd.
HJ Shipbuilding & Construction Co., Ltd.	Surim Tech Co., Ltd.
DongSung Finetec Co., Ltd.	Dongbang Ship Machinery Co., Ltd.
Korea Carbon Co., Ltd.	Ilseung Co., Ltd.
Sejin Heavy Industries Co., Ltd.	Daeha Co., Ltd.
Techcross Inc.	Sunbo Industries Co., Ltd.
DongHwa Entec Co., Ltd.	Ablemax Co., Ltd.
Hanla IMS Co., Ltd.	YL Energy Technology Co., Ltd.
Mt.H Control Valve Co., Ltd.	Felix Tech Co., Ltd.
BHI Co., Ltd.	47 Member Companies of the Busan Hydrogen Alliance

Domestic Research Institutes

Korea Institute of Machinery & Materials (KIMM)
Korea Institute of Materials Science (KIMS)
Korea Research Institute of Ships & Ocean Engineering (KRISO)
Research Institute of Medium & Small Shipbuilding (RIMS)
Korea Institute of Industrial Technology (KITECH)
Korea Marine Equipment Research Institute (KOMERI)
Korea Atomic Energy Research Institute (KAERI)
Korea Automotive Technology Institute (KATECH)
Korea Electrotechnology Research Institute (KERI)
Korea Testing Laboratory (KTL)
Korea Testing & Research Institute (KTR)

Overseas Universities/Research Institutes/Organizations

Carnegie Mellon University	Nanyang Technological University
The Pennsylvania State University	Stanford University
Georgia Institute of Technology	Missouri University of Science and Technology
University of Wisconsin-Madison	The University of Texas at Austin
Purdue University	Argonne National Laboratory
Fraunhofer	Yale University
University of Southampton	University of Connecticut
University of Strathclyde, Glasgow	NASA
University of Twente	Colorado School of Mines
Norwegian University of Science and Technology	Harvard Medical School
Technical University of Munich	HyAxiom, A Doosan Company
Paul Scherrer Institute	Lloyd's Register
Peking University	American Bureau of Shipping