

# PURIGAS™

Fuel Gas Supply System

# PURIGAS™

PURIGAS™ is the package solution for Fuel Gas Storage and Supply System(FGSS). It is named after S&SYS's Ballast Water Management System, PURIMAR™, means **PUR**e and **IN**telligent **GAS** storage and supply system.

Since FGSS is the most effective solution for IMO's SOx, NOx and GHG emissions restriction, a lot of ship owners consider the FGSS solution although CAPEX and installation space are heavy obstacles to adapt FGSS solution.

To solve this obstacles, PURIGAS™ has been developed from the accumulated technology for LNG related equipment and engineering capability of S&SYS and Samsung Heavy Industries(SHI). Based on S&SYS's proven technology and know-how, PURIGAS™ will provide the most economical solution and the most reliable package system to our valuable customer with low CAPEX & OPEX in any type of engine ME-GI, X-DF and DFDE.



## **“EcoNuri”**

- > The first LNG fuelled ship in Asia
- > Delivered at the end of 2012
- > L.O.A : 38.0m, L.B.P : 34.0m, Breath : 8.0m, Depth : 4.6m, Draft : 2.2m
- > Displacement : 382 TON, Gross Tonnage : Abt. 200 G/T
- > Main engine : Wartsila 9L20DF, 1584kW
- > LNG storage tank : 20m³ X 1EA, IMO Type-C tank, Double shell
- > Tank room located at the end of LNG storage tank with vaporizer

## **Contents**

### **Background of Environmental Issue** 4

- International Maritime Regulations
- IMO strategy on Reduction of GHG
- Emission Performance by Fuel Type

### **Why S&SYS PURIGAS™?** 5

- Proven technology(Reference)
- R&D capability
- Manufacturing & test facilities
- Quality Management System & HSE
- Global network services

### **System Configuration** 6\_7

- Flow diagram for ME-GI engine
- Flow diagram for X-DF engine
- Flow diagram for DFDE for small vessel
- Equipments for PURIGAS™

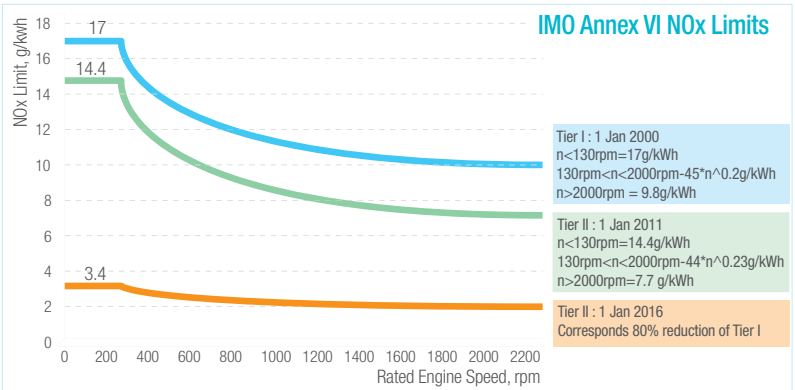
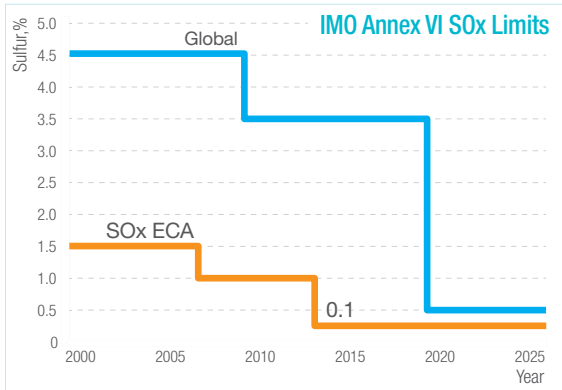
### **System Component** 8\_9

- Bunkering Station
- Type-C LNG Storage Tank
- Cold Box for small sized Tank
- Vaporizer
- Control & Monitoring Mimic

### **PURIGAS™ Global Network** 10

# Background of Environmental Issue

## International Maritime Regulations

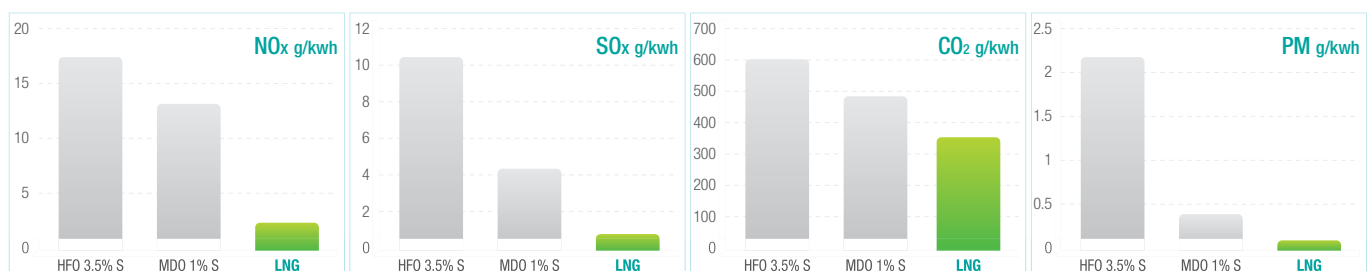


| Area              |   | Come into force | Limit of SOx     | Limit of NOx   |
|-------------------|---|-----------------|------------------|--|
| In ECA (Existing) | • North American ECA, US and Canadian coast             | - 1st Jan. 2015 | 1,000 ppm (0.1%) | Tier III (Aftertreatment-forcing)<br>1st Jan. 2016 ~ |
|                   | • US Caribbean ECA, Puerto Rico & the US Virgin Islands | - 1st Jan. 2015 | 1,000 ppm (0.1%) |  |
|                   | • North American ECA, US and Canadian coast             | - 1st Jan. 2015 | 1,000 ppm (0.1%) |  |
| Global ECA        | • China ECA, including 11 ports                         | - 1st Jan. 2019 | 5,000 ppm (0.5%) | Tier II (Engine-based controls)<br>1st Jan. 2011 ~   |
|                   | • HongKong, all ocean (Local)                           | - 1st Jan. 2019 | 5,000 ppm (0.5%) |  |
|                   | • Australia, Sydney                                     | - 1st Jan. 2020 | 5,000 ppm (0.5%) |  |

## IMO strategy on Reduction of GHG

| LEVEL OF AMBITION  | TIMELINE  |
|--|---|
| <b>Carbon intensity of ships to decline</b><br>- Strengthening of EEDI requirements for new ships<br><b>Carbon intensity of shipping to decline</b><br>- 40% reduction per transport work by 2030 relative to 2008<br>- 70% reduction per transport work by 2050 relative to 2008<br><b>GHG emission from shipping to decline</b><br>- 50% reduction of GHG emissions by 2050 relative to 2008 | <b>Short-term measures : 2018~2023</b><br>- EEDI (Energy Efficiency Design Index) improvement<br>- Speed regulation<br>- Methane slip regulation<br>- VOC regulation<br>- SEEMP improvement (Ship Energy Efficiency Management Plan)<br><b>Mid-term measures : 2023~2050</b><br>- Low carbon/Zero carbon fuels introduction<br>- Operational energy efficiency requirement<br>- Market based measures<br><b>Long-term measures : 2050~</b><br>- Zero carbon /fossil-free fuels for 2050 and later |

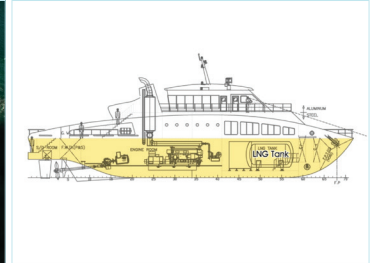
## Emission Performance by Fuel Type



# Why S&SYS PURIGAS™?

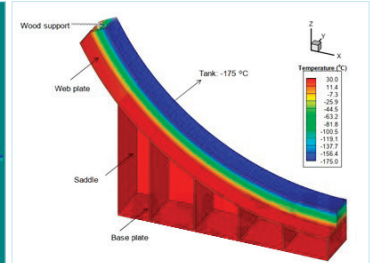
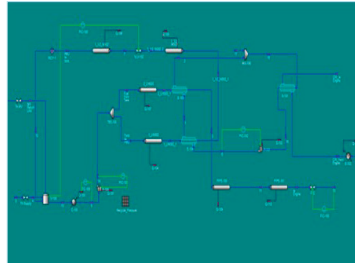
## » Proven technology(Reference)

- Successful delivery of Fuel gas storage and Supply System(FGSS) for Eco-Nuri
- Pre-cooling Mixed Refrigerant tank for Shell Prelude FLNG project
- ME-GI engine test bed in HSD(DOOSAN) engine factory
- FGSS Control system for AET A-Max. Tanker
- AIP(Approval In Principle) for AET A-Max. Tanker FGSS with SHI(Samsung Heavy Industries)



## » R&D capability

- FGSS Skid Structure & Piping with supports design
- FGSS Piping stress analysis
- FGSS Structure analysis
- FGSS Control system design
- Failure mode & effect analysis
- HAZID & HAZOP



## » Manufacturing & test facilities

- Manufacturing factory
- Test facilities
- Training center



## » Quality Management System & HSE

- ISO 9001
- ISO 45001 & 14001

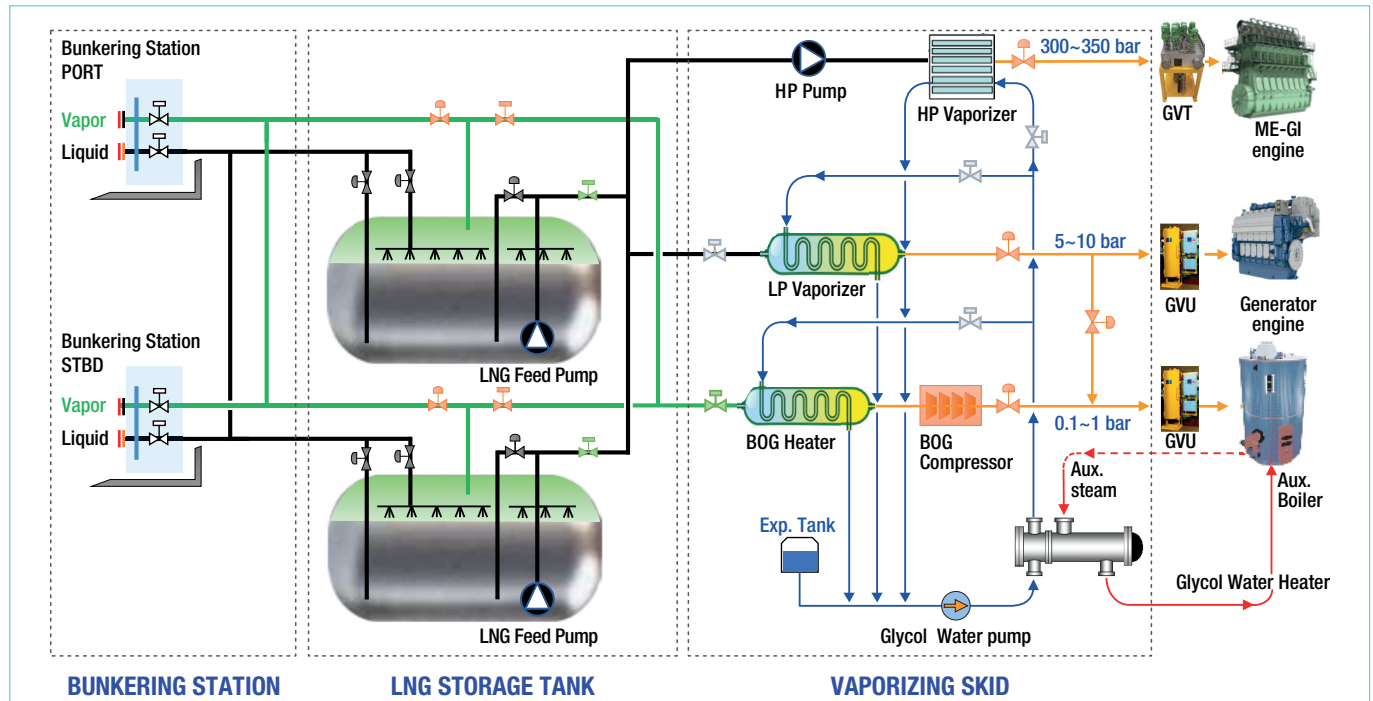


## » Global network services

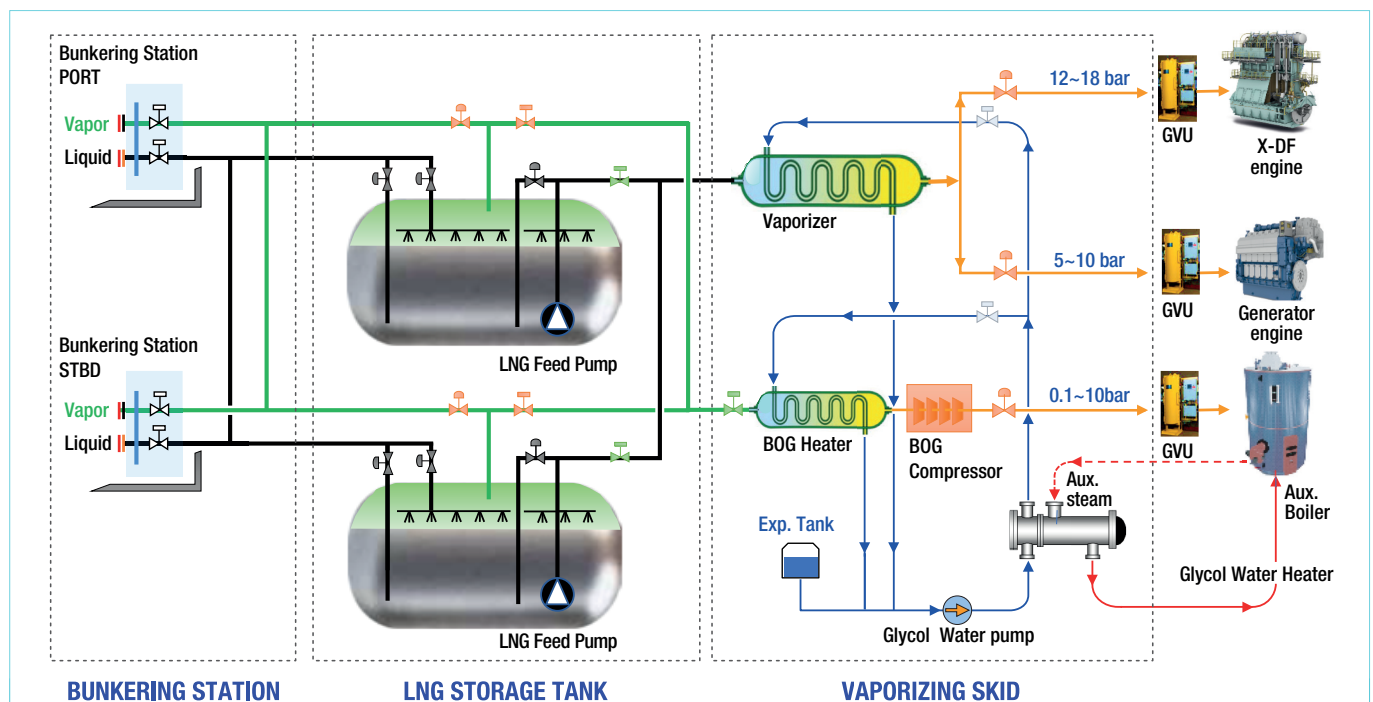
- 19 service agents in 12 countries

# System Configuration

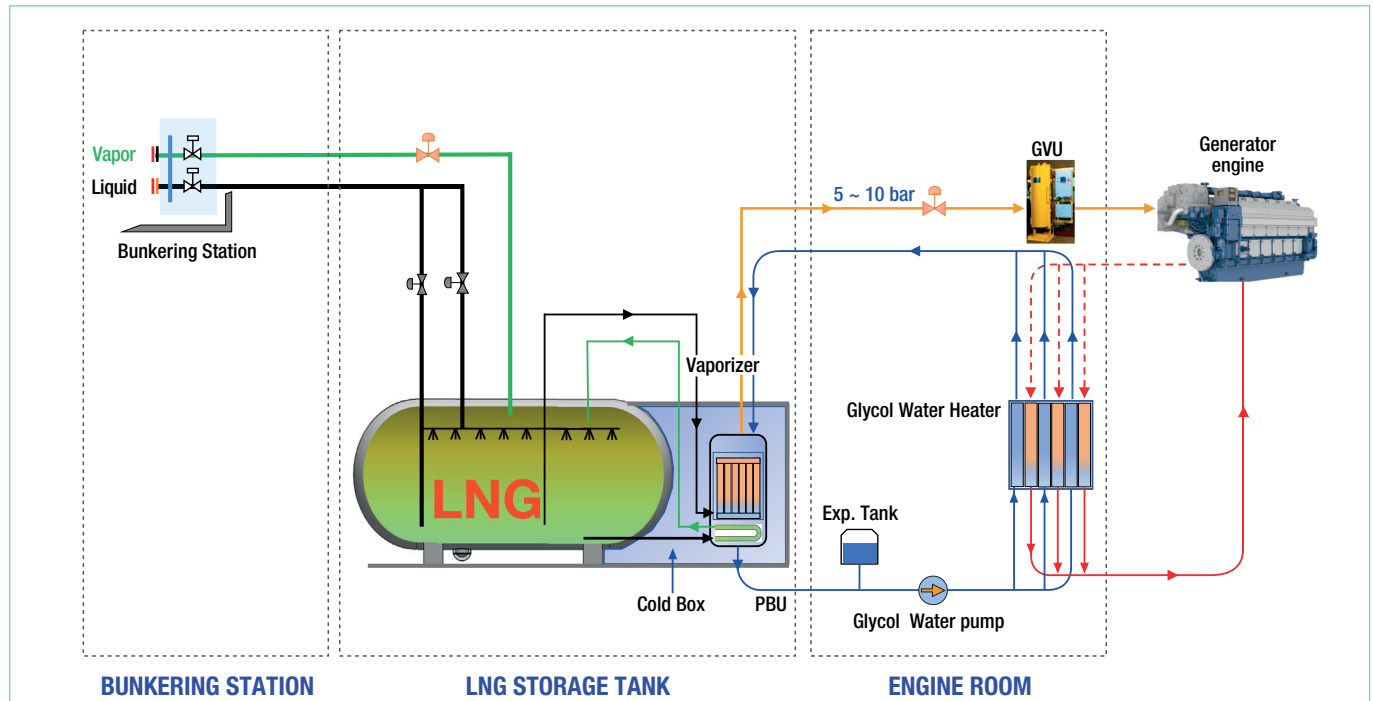
## Flow diagram for ME-GI engine



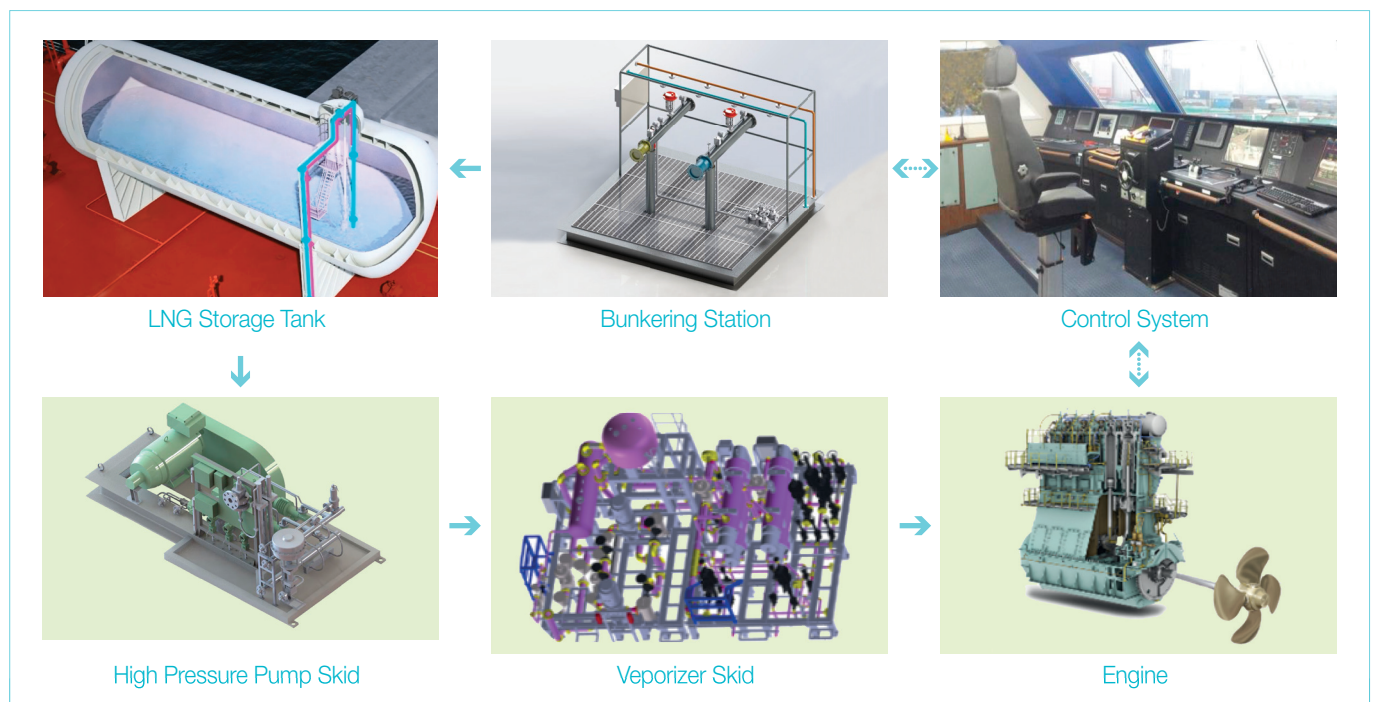
## Flow diagram for X-DF engine



## Flow diagram for DFDE for small vessel



## Equipment for PURIGAS™

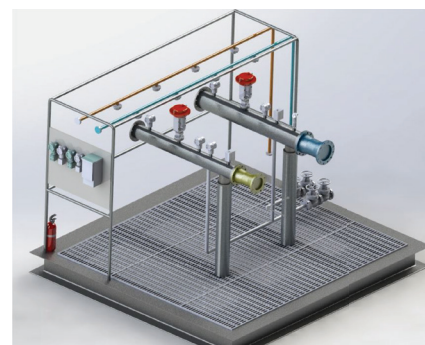


# System Component



## Bunkering Station

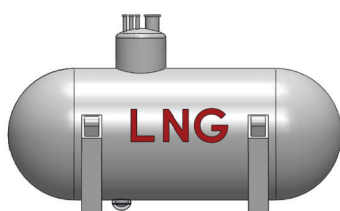
- Quantity : 2 sets(Port & Starboard shipside)
- Liquid Line : 4~8" Pipe  
Vapour Line : 4~6" Pipe
- Dimension(In accordance with SGMF guidance )
  - Distance of manifold flanges inboard from ship's side : 1,100mm
  - Horizontal distance Between Flange centers : 1250 mm
  - Vertical distance Between Flange center & working platform : \*mm(\*depend on ship's specification)
- Bunkering Capacity(In General )
  - Max loading rate with vapor return : 415 m<sup>3</sup>/hr(Based on LNG velocity 6.0 m/sec)
  - \* Design fluid velocity(except of bunkering manifold and vent lines)
    - Liquid line : 10m/sec, in general
    - Vapor line : 35m/sec, in general



## Type-C LNG Storage Tank

### Design specification

- Independent Type-C tank(IMO/IGC)
- Single shell(with PUF) or Double shell(Barrier space with Perlite)
- Vacuum insulation
- Design pressure : 3~9 bar.G
- Working pressure : 1~9 bar.G



Cylindrical type tank



Bi-lobe type tank



Tri-lobe type tank

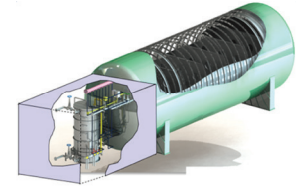
# System Component



## Cold Box for small sized Tank

### Design Specification

- Located at the end of LNG tank
- Vaporizer and valves are installed in Cold box
- Gas & Fire detection(Optional)
- 30 air change / hour with ventilation fan



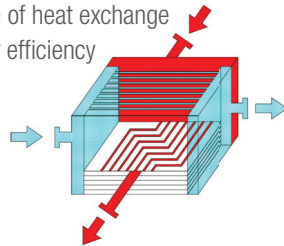
## Vaporizer

### PCHE(Printed Circuit Heat Exchanger)type

- Proper for high pressure
- Diffusion Bonded
- Chemically etched fluid channels

#### Merit

- Minimize area and size of heat exchange
- Maximize heat transfer efficiency

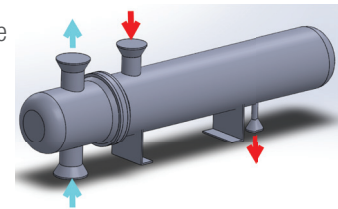


### Shell & Tube Heat Exchanger type

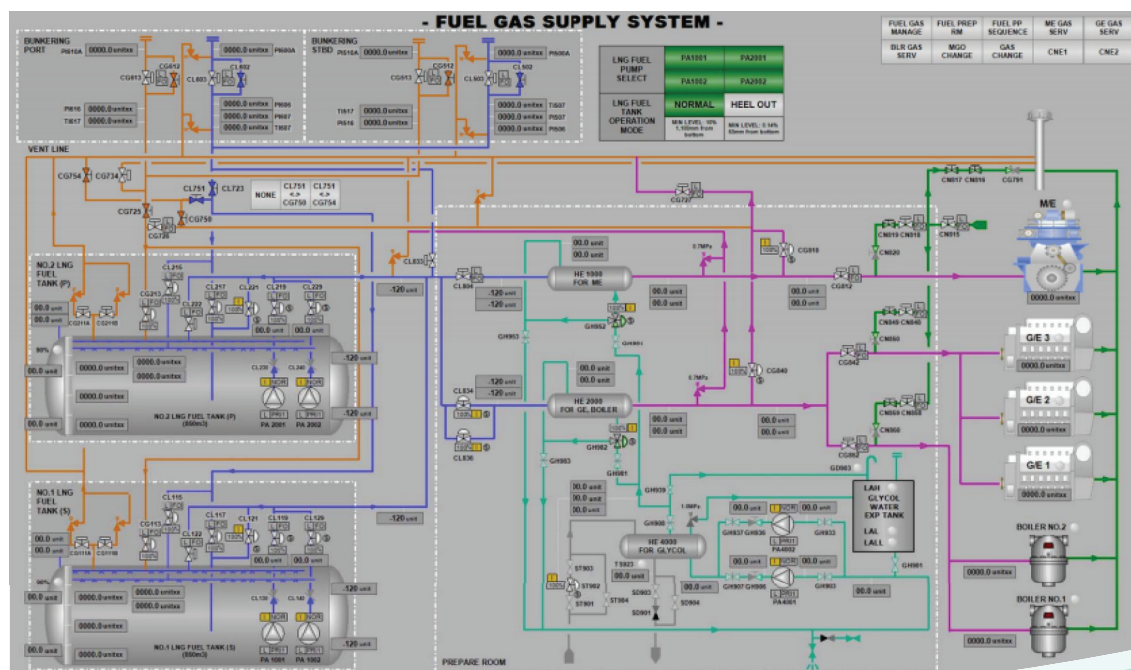
- Proper for low pressure
- Most commonly used

#### Merit

- Low cost
- Easy maintenance



## Control & Monitoring Mimic





| ASIA  |  |                 |                      | OCEANIA       |                         |
|-------|--|-----------------|----------------------|---------------|-------------------------|
| KOREA | S&SYS Co.,Ltd. (HQ)                      | JAPAN           | JRCS Co.,Ltd.        | Australia     | UNION                   |
| KOREA | STK Engineering Co.,Ltd.                 | JAPAN           | Tsuneishi Co.,Ltd.   | SOUTH AMERICA |                         |
| KOREA | JEWON Engineering Co.,Ltd.               | JAPAN           | Union.Co.,Ltd.       | BRAZIL        | METALOCK Brazil Ltd.    |
| KOREA | STA                                      | SINGAPORE       | Treys Ple Ltd.       | BRAZIL        | DZETA Marine & Offshore |
| KOREA | DEX                                      | SINGAPORE       | KTK Group Co.,Ltd.   | EUROPE        |                         |
| CHINA | Seven Seas Electronic Co.,Ltd.(Shanghai) | TAIWAN          | YL Maritime Co.,Ltd. | GERMANY       | Mare systems            |
| CHINA | Seven Seas Electronic Co.,Ltd.(Qingdao)  | CENTRAL AMERICA |                      | ITALY         | MASTER CONTROL          |
| CHINA | Seven Seas Electronic Co.,Ltd.(Dalian)   | MIDDLE EAST     |                      | GREECE        | D.C.S.I Ltd.            |
| CHINA | SAMSUN Marine Technology(HK) Co.,Ltd.    | U.A.E           | MARITRONICS          | TURKEY        | Oceanist                |
| CHINA | Health Lead Development Co.,Ltd.         | U.A.E           | Tensosys             | AFRICA        |                         |
| CHINA | SJE Engineering Co.,Ltd.                 | NORTH AMERICA   |                      | Nigeria       | Radial Circle           |
| CHINA | SSMT                                     | USA             | MarineBCTec(LA)      |               |                         |
| INDIA | Indostan Corporation                     | USA             | MarineBCTec(NJ)      |               |                         |
| JAPAN | Orient Marine Co.,Ltd.                   |                 |                      |               |                         |

\*\* Sales Agency