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# New possibilities of LNG Bunkering System in Unitest low speed engine room simulator W-Xpert RT-flex50DF electronically controlled

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The LNG Fuel Gas Supply System (FGSS) consists of two LNG Tanks of 315 m<sup>3</sup> capacity located on open deck. The LNG system supply gas at pressure 16 bar to the main engine RTFlex50DF, developing 5.850 kW at 100% Maximum Continuous Rating (MCR). The fuel gas handling system and the auxiliary equipment is designed and constructed to receive and store liquefied natural gas to process fuel gas in required quantity, pressure and temperature to the consumers.





## **Inerting, Gas-Freeing, Drying**

During normal operation only the bunker lines have to be inerted. The required nitrogen is provided by the Nitrogen system installed on the ship or via external source.

Inerting and gas-freeing of the complete system including the LNG tanks are not considered as normal operations. This will only be necessary for preparing repair, maintenance work or dry docking. In this case Nitrogen from an external source should be provided.

## **Purging with NG and Cooling down**

Purging with NG and cooling down of LNG tank and fuel gas system are not considered as normal operation. Purging and cooling down have to be done upon the first commissioning and after maintenance work (gas free ship). Required vapour could be taken from shore. Cooling down will take place afterwards with a small amount of liquid from shore.



## Bunkering

The system is designed to complete bunkering of the fuel gas tank in about 4 hours with vapour return. In order to manage the vapour in case of no vapour return the tank pressure is stabilized by spraying liquid into the tank vapour phase via top loading line.

The installation allows the preparation of loading system prior to bunkering (e.g. cool-down of lines). While on bunker station is in operation, the station on the other side of the ship stays inerted and segregated by double-block valves.

Fuel gas supply to engines

Fuel gas is supplied to the GUV by LNG pumps via  
LNG vaporizer and heater.







## BOG handling

The handling of boil-off gas (BOG) for this fuel gas system is based on pressure build-up in the LNG tanks and fuel gas consumption. No reliquefaction system is installed. During operation continuous liquid or vapour flow is taken from fuel gas, depending on required engine load.

In case of no or low fuel consumption the BOG is kept inside the tanks and the pressure will rise.





## Unloading

Unloading of LNG from the tank without providing the gas to the engines is not planned as normal operation. Emergency unloading by tank pressurization or pumps is foreseen.

## Warming up and gas-freeing

Warming up and gas freeing of the system would only be required in case of repair and maintenance work. During normal operation warming up and gas freeing would not be necessary for the fuel gas system including tank.

Only bunker lines and the gas supply lines between GVU and engines have to be gas free when disconnected.



## Basic system design concept

The LNG FGSS is designed for gas fueled engine. LNG is stored in two independent type “C” tanks. The tanks are of horizontal cylindrical shell with ellipse heads. Double-shell with vacuum + perlite insulation is adopted as the tanks’ main insulation method. The tanks are supported by saddle support and they are installed on open deck. Bunkering stations are provided on ship’s both sides. One set of main control cabinet with a monitor and one marine type computer for remote control and indication is provided in the console of engine control room. Two sets of LNG booster/spray pumps supply gas fuel to main engine. One pump can complete the entire fuel gas supplying task and the other one is for backup. The pumps can be used as key equipment for emergency transferring LNG from one tank to another. The pumps are driven by frequency converter and regulating the pressure around 16 bar according to the pressure transmitters at the LNG buffer tank.

Two sets of LNG vaporizers and heaters are installed for vaporizing and heating LNG. It also is arranged for redundancy.





## LNG storage tank

It is designed for installation on open deck according to IGC-Code with double stainless steel wall vacuum insulation structure. The tank is composed of a double wall structure of cold resistant materials (stainless steel inner & outer wall). A blow out disc is installed in the outer tank for safety protection. The LNG tank is installed on the foundation. The tank connection space is arranged at the after end of the LNG tank.







## Process room

An independent process room with maintenance door is installed close to tank connection space. The process room is made of stainless steel, containing LNG pumps, vaporizers/heaters, water/glycol unit, piping, valve, monitoring instruments and etc. The process room is supported by epoxy to protect cryogenic damage to carbon steel ship hull structures in case of LNG liquid leakage. The tank connection space and process room are connected by two stainless steel expansion joints. The above expansion joint is used for electrical cables gallery, instrument air piping & CO<sub>2</sub> piping the other expansion joint is used for cryogenic pipes gallery. A ventilation fan is running continuously to achieve 30 times air changes per hour.





## **Piping and insulation**

All cryogenic and high piping have been surrounded enough thickness insulation so that improving the temperature preservation result of the piping. It also avoid people to touch the piping to make himself injured.

## **Main control panel**

One main control station for remote indication of operating and alarms is provided in the engine control room. The main control station equipped distributed control systems (DCS) for operation and indication. The main control station is supplied in ECR for indication and operation of the fuel gas supplying system. The marine computer also is installed in ECR for display the conditions of fuel gas supplying system. All alarms and signals are sent to vessel's AMS via Ethernet so that the condition of fuel gas supplying system can be monitored in bridge via AMS monitor in bridge console. The ESD shut down push button have been provided in all necessary places (LOCAL, Fire fighting control room, ECR CCR and W/H) according to relevant rules and regulation and manufacturer's standards.



The main control station includes bunkering control function. At this location tank pressure and tank level can be monitored. Overfill alarm and automatic shutdown also can be indicated at this location.

The following related to the fuel gas supplying systems are remotely controlled and / or monitored via the main control station from the ECR:

- Control of LNG fuel gas bunkering
- Control of LNG fuel gas supplying
- Level / temperature / pressure indication and alarm for LNG storage tanks
- Temperature indication and alarm of TCS and process room
- Control of emergency shutdown system
- W / G Pump local/remote start and stop operation
- LNG PUMP local/remote start and stop operation
- Air blower local / remote start and stop operation
- ESD Valve manually and automatic operation









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The Low Speed Engine Room Simulator W-Xpert RT-flex50DF has been based on modern, electronically controlled solutions, being presently used in medium-sized engine rooms (one two-stroke type main engine with fixed pitch propeller). The Main Engine is dual fuel type that means it can be supply with fuel or LNG.

The simulator introduces 3D model of the Engine Room, based on the real equipment. In order to create the impression of working in the real environment, it provides 3D sound which can be listened on 2, 4 or more speakers.



This simulator is designated for training students of maritime academies as well as for different types of marine vocational training centres. The simulator has universal features and may be used both for training merchant and navy fleet crew.

The main purpose of the simulator is the practical preparation of the trainee for engine room operation, and more particularly:

- familiarization with the basic engine room installation (compressed air system, fresh and sea water cooling system, lubricating and fuel oil system etc.);
- acknowledgment with main engines and auxiliary equipment operating procedures;
- propulsion system manoeuvring.



The software allows for the simulation of opening/closing of basic valves and auxiliary equipment operation in engine room installations. The software also generates the main engine room's sound.

The installation of the simulator's software is simple, it is performed by the user and does not require any manufacturer's installation services.

The software also enables to set up engine room resources and load or save setups.

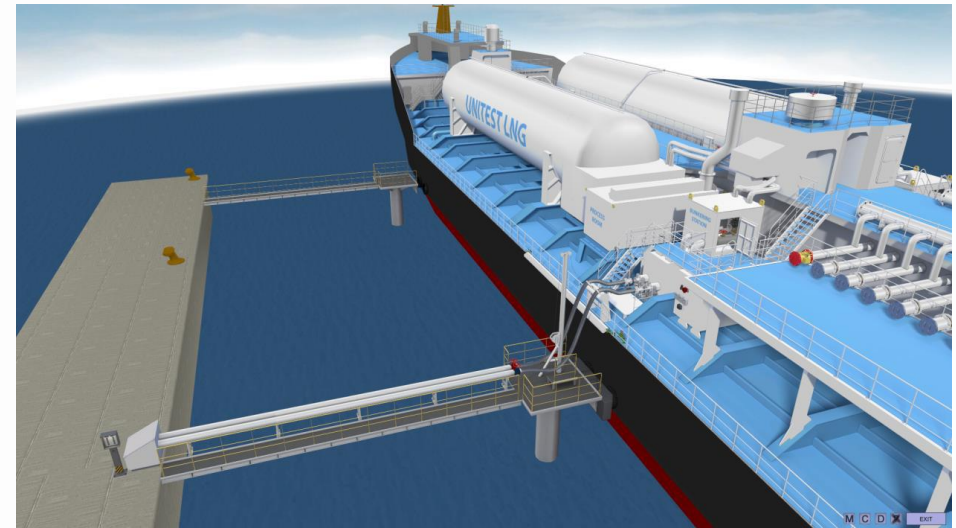
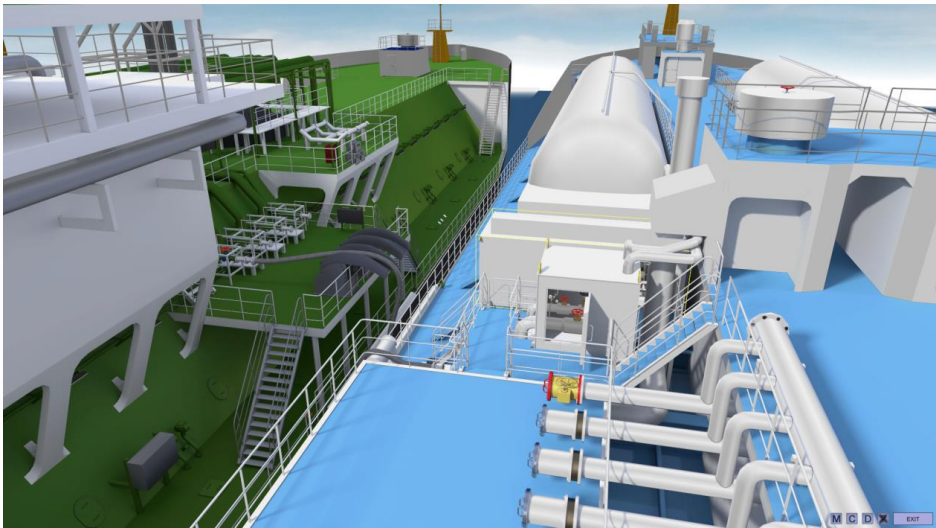
The simulator software's language version is English.

The simulator has been developed in compliance with:

- STCW Code: Section A-1/12 and Section B-1/12.
- ISM Code: Section 6 and Section 8.



Bunkering stations are provided on ship's both sides. One set of main control cabinet with a monitor and one marine type computer for remote control and indication is provided in the console of engine control room. The bunkering station is equipped with a stainless steel drip tray, which collects any spillage and drains it to the main deck. The ship, in way of the bunkering station is provided with a water curtain from the deck and down the ship's side with water supplied from the fire and wash deck main. The deck fire main must always be available and the manifold water curtain in operation when undertaking any cargo operation.

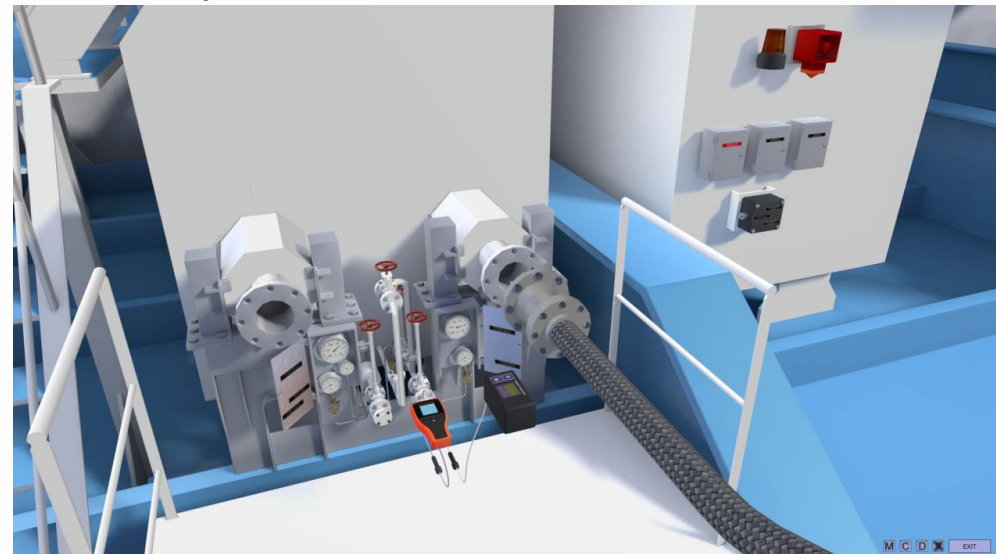






Additionally, fire hoses must be laid out to bunkering station to deal with any small leakages which may develop at valves and flanges. Permanent drip trays are fitted underneath the items most likely to cause problems and portable drip trays are available for any other requirements. In the event of a spillage or leakage, water spray should be directed at the spillage to disperse and evaporate the liquid and to protect the steelwork. The leak must be stopped, suspending bunkering operations if necessary. In the event of a major leakage or spillage, the bunkering operations must be stopped immediately, the general alarm sounded and the emergency deck water spray system put into operation. The simulator enables to practice following bunkering procedures:

- LNG bunkering from shore,
- LNG bunkering from ship,
- LNG bunkering from truck.





## **LNG Safety System**

The safety system consist safety relevant signals like:

- Overpressure monitoring system for Engine Room
- Gas detection
- Fire detection
- Emergency Shut Down (ESD / FGES) System

### **Emergency shut down (ESD/FGES) system**

The ESD/FGES System is executed by an safety plc. It contains a Ship to shore link system and several ESD/FGES pushbuttons.

### **Ship to shore link ESD/FGES system**

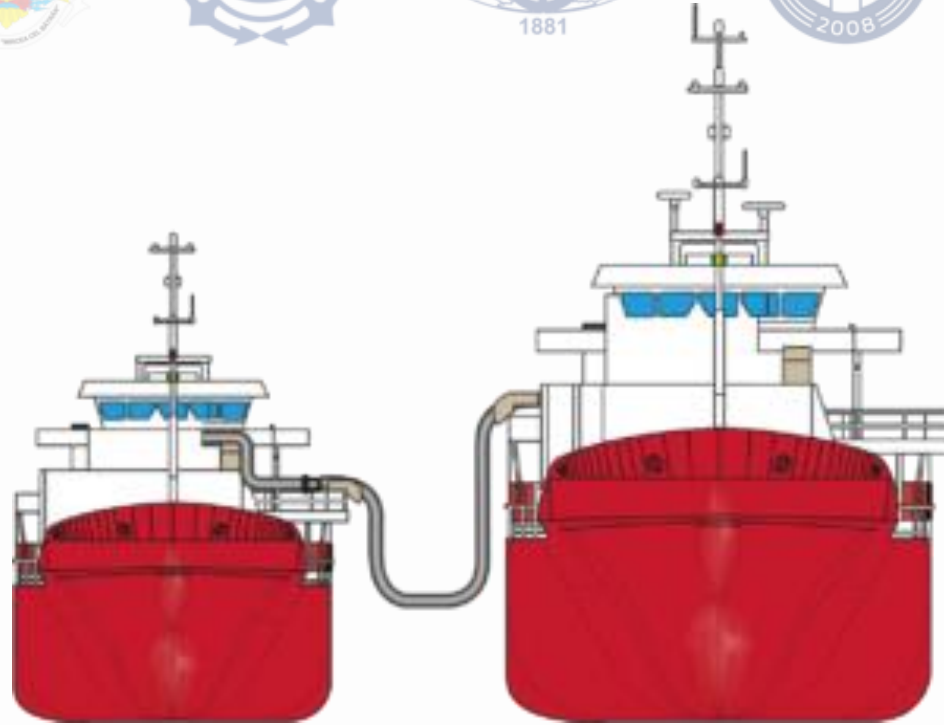
The ship ESD/FGES system is linked with a junction box on starboard and on portside  
The ship to shore link cable or ESD/FGES pendant link can be plugged into one of the junction boxes. The connected ship-shore link shuts down the shore side when an ESD/FGES occurs on the ship side. Vice versa the ship side shuts down if an ESD/FGES occurs at shore side. With the ESD/FGES pendant the shore operator can shut down the ships gas plant from shore side.



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# Thank you for attention