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# Hi-ERS

Hyundai innovative  
Economical Re-liquefaction System



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Hyundai Heavy Industries' Engine & Machinery Division (HHI-EMD) has developed Hi-ERS (Hyundai innovative Economical Re-liquefaction System) that is capable of partially liquefying the boil-off gas (BOG) of LNG carriers by combining the high pressure compressor for ME-GI engines.

Hi-ERS is characterized by simple configuration, robust operation, reliable components, and high safety system satisfying the requirements of customers.

Hi-ERS basically consists of BOG heat exchanger, ▶  
Joule-Thomson valve, and LNG separator.



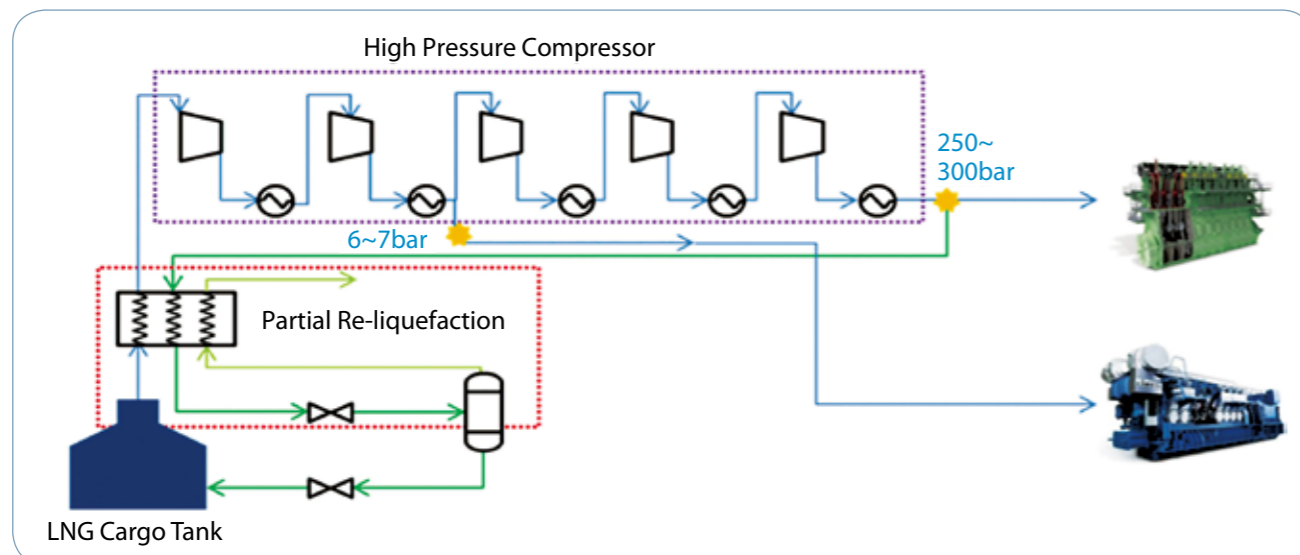
## ■ Process Description

The LNG carrier has cargo tanks which are fully insulated for a slightly sub-cooled condition. Ship motion and heat penetration causes the LNG to heat above its boiling point. For this reason, LNG cargo handling system continuously controls the boil off gas in the LNG cargo tank to prevent overpressure of the LNG cargo tank during transportation. In order to control the LNG cargo tank pressure within acceptable range depending on the design point of the LNG cargo tank, the BOG should be removed and extracted from the LNG cargo tank.

The High Pressure Compressor (HPC) is primary used to control the LNG cargo tank pressure. The HPC with five-stage compressors is installed to compress the BOG from the LNG cargo tanks. The HPC supplies fuel gas to ME-GI engine for the propulsion.

When the flow rate of the BOG is higher than gas demand of the engines, surplus BOG will be sent to Hi-ERS through a control valve which is so called Joule-Thomson valve, and it is then condensed partially. Finally, the condensate is returned to the LNG cargo tanks. If the flow rate of the surplus BOG is higher than the capacity of ERS, a part of the compressed gas can be sent to other consumers such as GCU, DF generator or DF boiler and so on. When the flow rate of BOG is lower than gas demand of the ME-GI engine, LNG fuel gas supply system will be operated to meet the required gas pressure and amount for the ME-GI engine.

## ■ Process flow



For the purpose of the energy recovery for ERS system, the BOG heat exchanger is installed between the cargo tank and the suction of high pressure compressor.

The temperature of the cold BOG from LNG cargo tank will be approximately between  $-120^{\circ}\text{C}$  and  $-90^{\circ}\text{C}$ . The pressure of the compressed BOG is approximately 300bar required by ME-GI engine. The cold BOG from the LNG cargo tanks is sufficient to make the compressed BOG cool down for partial re-liquefaction. The flash gas to be vented from the gas separator which is a part of Hi-ERS is passed through the BOG heat exchanger again and transfers its cold heat to the compressed BOG via the BOG heat exchanger to improve the system efficiency of Hi-ERS, and then finally to be sent to other consumers.

If the compressed BOG in its cold state is expanded through the Joule-Thomson valve to a targeted low pressure, then it can be simultaneously decreased to the condensing temperature of BOG by Joule-Thomson effect.

By using Hi-ERS, simple and economical re-liquefaction of BOG can be achieved.

## ■ Main equipment of Hi-ERS



▲ BOG heat exchanger



▲ Joule-Thomson valve (J-T valve)



▲ LNG separator

## ■ Patent

