Outline Specification

of a

7,500 m$^3$ LNG Tanker

for

Bunkering and Short Sea
The philosophy:

To create a:
- Multi-purpose tanker suitable to carry LNG for bunkering and short sea distribution;
- Tanker designed for “ship-to-ship” and “ship-to-shore” operations with LNG.
- LNG tanker based on the “pressure-built-up” principle allowing sailing with LNG for a long time without need for re-liquefaction.
- Vessel using “boil-off” of LNG for propulsion, electricity generation and heating.
- Vessel with a flush deck for easy and safe operation during cargo handling.
- Vessel with a low wind profile due to tank concept, flush main deck and no cargo trunk deck.

The focus:

To design and built a vessel with:
- Adapted to Owner’s requirements concerning loading and discharge capacities
- Suitable to operate with a relative small crew
- Using mainly existing and proven technology for cargo containment and cargo handling
- Main engine will be of the “dual-fuel” type running mainly on LNG with fuel oil for ignition and as back-up.

Cargoes:

The vessel is designed for following cargoes:
- Liquefied gasses:
  - LNG
  - Bio-LNG
  - LBG (Liquefied Bio Gas)
Cargo capacity: Cargo capacities and volumes:
- Two (2) independent, insulated cargo tanks
  - Volume: Tank 1: appr. 3,300 m³
  - Temperature: -164 °C
  - MARVS: 4.5 bar g
  - Design: Type C, bi-lobe

Loading - Discharge rates: Cargo loading and discharge rates:
- Maximum loading rate: 1,000 m³/h
- Maximum discharge rate: 1,000 m³/h
- Maximum discharge rate from one tank: 500 m³/h

Speed: Vessel’s speed:
- Speed approx. 13 knots at 90% MCR, 15% sea margin and including 200 kW shaft alternator load.

Fuel consumption: Fuel oil consumption of the main engine:
- Primarily BOG (boil-off gas) and additionally from forced evaporation and heating-up of LNG
- MGO for ignition in DF mode and as back-up

Main particulars: Main dimensions and other particulars:
- Length over all: approx. 120.00 m
- Length p.p.: " 117.00 m
- Breadth moulded: " 17.50 m
- Depth to main deck: " 11.60 m
- Draught design: " 5.60 m
- Deadweight design " 3,600 ton

Tank capacities: Tank capacities in addition to cargo tanks:
- MGO (low sulphur): " 250 m³
- Potable water: " 70 m³
- Ballast water: " 2,000 m³
Classification: Bureau Veritas with notation:

Rules and regulations: All relevant international regulations in accordance with IMO and the Flag State as far as applicable.
- IGC Code
- IGF (interim guide line)
- SOLAS, MARPOL
- SIGTTO, OCIMF,

Main engine: Medium speed diesel engine:
- Type: four-stroke, in-line,
- Make: Wärtsilä, MaK, MAN
- Output: approx. 3,000 kW at 750 rpm
- Fuel type: Dual Fuel (99% NG + 1% MGO)
- NOx: ready for IMO/MARPOL Tier III
- LNG as fuel: according IGC Code Chapter 16

C.P. propeller: A controllable pitch propeller will be installed:
- Diameter: 3,500 mm
- Nozzle: fixed type fitted for higher thrust
- Output: 3,000 kW at approx. 130 rpm.

Reduction gearbox: A reduction gearbox will be installed suitable for:
- Input: 3,000 kW at 750 rpm
- Output CPP: 3,000 kW at approx. 130 rpm
- Output PTO: 800 kW at 1,800 rpm

Auxiliary electric power: Electric power will be supplied as follows:
- Two (2) natural gas fuelled diesel-alternator sets of 468 kVA / 1,200 rpm.
- One (1) marine diesel fuelled harbour/emergency set of 300 kVA / 1,800 rpm.
- One (1) shaft alternator 1,000 kVA / 1,800 rpm
Electric power modes:

Electric power can be used as follows:
- During sailing ships load will be supplied from the shaft alternator.
- During manoeuvring the shaft alternator can supply power to the bow thruster. Ships load can be transferred to one of the diesel alternator sets.
- During cargo operations both diesel alternator sets can supply to all systems.
- In case of failure of the main engine both diesel alternator sets in parallel will supply to the bow thruster as emergency propulsion unit.

Bow thruster:

Electric driven 700 kW bow thruster of steerable type supplying thrust for manoeuvring and acting as emergency “get-me-home” propulsion unit.

Rudder/steering gear:

Following to be fitted:
- Spade-type rudder
- Rotary-vane type steering gear 2x70°

Construction:

Vessel to be constructed according Class:
- Mild steel Grade A
- Where required low temperature grade steels D or E.
- Below the LNG tanks the vessel will be fitted with a single bottom.
- Flush cargo deck

Conservation:

Painting system:
- Underwater: Epoxy and anti-fouling
- Above water: Epoxy
- Ballast tanks: Epoxy

Manifold crane:

One (1) electric-hydraulic, knuckle-boom type, crane:
- Capacity: 1.5 ton SWL at 15 m
- Handling of LNG and vapour hoses
- Handling of fuel oil hoses
- Handling of Yokohama fenders
- Handling of stores and gangways
**Cargo operating modes:**
Following LNG and gas operating modes are possible:
- Loading with vapour return, free flow or forced flow by compressor
- Unloading with and without vapour return
- Cool down of cargo tanks with liquid from shore
- Gassing up with liquid/vapour from shore
- Fuel supply by boil-off gas compression and heating
- Fuel supply by fuel/spray pumps
- Evaporation of cargo residue by hot gas
- Cargo tanks warming up by cargo compressor and heater
- Inerting of cargo tanks and hold spaces
- Purging of cargo piping system with inert gas
- Ventilation of cargo tanks and hold spaces with dry air
- Maintenance of dry air/inert atmosphere in hold space

**Cargo control stations:**
Cargo control for LNG and gas:
- Monitoring and remote control at the wheelhouse cargo control desk.
- Local control stations at the cargo manifold area for valve operation, ESD and communication.
- Calibrated flow meter based on Coriolis Mass Flow will be provided at:
  - liquid loading line
**Cargo installations for LNG:**

Following installations will be provided:

- Two (2) stainless steel or 9% Ni steel, C-type, cargo tanks of “bi-lobes” design, completely insulated and supported on two saddles by the vessel’s structure.
- Tanks provided with upper domes for connections and access, pump wells, internal piping, spray lines, ladders and platforms.
- Tanks provided with level-, temperature- and pressure indicators and necessary relief valves.
- Blow-off mast forward for emergency relief.
- Two (2) electric driven gas compressors for handling of boil-off gas and vapour return.
- One (1) LNG vaporizer to produce fuel gas or for pressure maintenance during unloading.
- One (1) fuel gas heater to heat up the gas to atmospheric temperature before entering the engine room.
- Cooling water/glycol system for cargo equipment.
- Four (4) electric-driven, deep-well, multi-stage, centrifugal LNG pumps of 250 m³/h each, for discharging ashore or to other vessels. Two in each cargo tank.
- Two (2) submerged LNG fuel/spray pumps of approx. 3 m³/h each, one in each cargo tank.
- Cargo piping system will be in stainless steel execution. Piping outside tank will be insulated and protected.
- Emergency Shutdown System (ESD-1)
- Ship-shore interconnection according SIGTTO
- Crossovers at manifold in “L-V-L” arrangement:
  - Two (2) liquid lines: DN 200 ANSI 150
  - One (1) vapour line: DN 150 ANSI 150
  - One (1) nitrogen line: DN 25
- Stainless steel LNG drip trays at manifold with overboard discharge piping.
- Nitrogen/dry air generator of approx. 200 Nm³/h at 8 bar capacity with a 5 m³ buffer tank.
- A deckhouse will be provided near the manifold containing cargo compressors, evaporator, heater and other equipment for handling of LNG, vapour and fuel gas. Electric equipment will be of safe type as far as required.
**Lifesaving appliances:**
According SOLAS and flag state:
- One freefall lifeboat with recovery A-frame
- Rescue boat with davit
- Life rafts, etc. as required

**Fire protection:**
Fire protection, detection and firefighting systems:
- Detection and insulation according SOLAS and Class
- CO₂ in engine room
- Local firefighting systems as required
- Dry chemical powder fire-extinguishing on cargo deck
- Water-spray system on cargo deck, deckhouse front and vessels’ sides along the manifold
- Deck wash- and firefighting system as required

**Gas detection:**
Gas detection according IGC and Class:
- Gas detection in enclosed spaces where required with read-out and alarms.
- Main panel in the wheelhouse.

**Electric installation:**
According classification requirements:
- Power distribution 3x440 Volt / 60 Hz.
- Main switchboard, control panels and cargo switchboard in air-conditioned switchboard room
- Safe type equipment where required on deck

**Automation and control:**
Automation, monitoring and control according:
- Bureau Veritas AUT-UMS

**Accommodation:**
Accommodation according MLC 2006:
- Complement of fourteen (14) in single cabins
- Mess- and dayrooms, galley, office, hospital, provision stores, change room, etc.
- Wheelhouse with cargo control station

**Ventilation and AC:**
Ventilation, heating and AC:
- Accommodation fully air-conditioned according MLC 2006 and ISO standards.
- Ventilation in other spaces as required.
Mooring equipment: Mooring arrangement:
- Suitable for ship-to-ship operations.
- Storage for Yokohama fenders within crane reach.
- Forward two (2) electric windlasses with each one cable lifter, two mooring drums and one warping head.
- On aft deck two (2) electric winches with each two mooring drums and one warping head.
- Winches frequency controlled.

Nautical equipment: Nautical equipment installed:
- According GMDSS for A1, A2 and A3 sailing area
- Radars, radio station, VHF, Inmarsat-C, etc.
- Echo sounder, speed log, gyro compass, autopilot
- GPS, VSAT, ECDIS
- AIS, VDR, EPIRB, etc.
- Other equipment as required for the type and size of vessel and the sailing area.

Engine room systems: Systems in engine room for engines and other duties:
- Fuel supply systems for main- and auxiliary engines for gas and oil.
- Main engine lubricating oil purifier and filters
- Starting- and control air systems
- Bilge system, etc. as required

Cooling water system: A freshwater cooling system based on box-coolers will be installed for:
- Main engine with gearbox and CPP
- Auxiliary engines
- Air-conditioning

Heating system: A thermal oil heating system will be installed for heating of accommodation, potable water systems and engine room systems. System to consist of:
- Exhaust gas economiser in main engine exhaust
- Auxiliary gas/oil fired thermal oil heater
- Necessary heat exchangers, expansion vessels, pumps, etc.
**Ballast water system:** A remote controlled closed loop ballast water system with:
- Two (2) transfer pumps
- Main ring line
- Remote operated valves
- Ballast water treatment plant

**Sanitary installation:** According MLC 2006 and Class:
- Each cabin with a private sanitary unit.
- Sewage plant
- Freshwater evaporator

**OPTIONS:**

**Following options are possible:**
- Ice class
- Stern thruster
- Flap type rudder
- Permanent fresh water ballast system (no BWT and PSPC required)
- Re-liquefaction plant for boil-off gas
- Gas Combustion Unit (GCU) for boil-off gas