

Development of a GTT NO96 Membrane-type 170K m³ LNG Carrier with Ice Class 1A

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ABSTRACT

The present paper addresses development of a GTT NO96 membrane type 170K m³ LNG carrier targeted to operate in moderate ice infested seas including Baltic Sea, Sakhalin port of Sea of Okhotsk, Murmansk port of Barents Sea, etc. Critical design issues are covered in detail to meet the requirements coming from the missioned operation conditions comprising low design ambient temperature, harsh wave conditions, stringent environmental protection policies, etc

KEY WORDS: LNG Carrier; GTT-NO96 membrane type; IGC, ICE-IA; Ice strengthening; DNV CSA-2; spectral fatigue analysis; sloshing; Ice Hazards; structural risk analysis; vibration and noise; winterization

INTRODUCTION

A liquefied natural gas (LNG) carrier, using GazTransport & Technigaz (GTT) No96 membrane type with 170K m³ capacity, has been developed to operate in ice infested seas with Ice Class IA. Trading route from Baltic Sea to east coast of North America was utilized to determine design requirements. Basic dimensions are determined considering shallow depth and design specific gravity of LNG as well as to provide sufficient energy absorbing capacity for side wing tank structure.

The target trade routes are characterized by their severe requirements from environment condition, harsh sea condition, and hazards from ice features. Design has been developed through comprehensive study, where investigation was made into critical design issues – winterization and structural soundness against cold operation, sloshing impact pressure, fatigue strength, ice features, etc.

The following technical issues are discussed in the present paper:

- Basic design
- Temperature distribution analysis
- Application of first principles in structural design
- Sloshing
- Slamming
- Structural risk analysis against ice hazards
- Vibration and noise analysis
- Winterization

BASIC DESIGN

General elevation view with ice belt area and conceptual midship

section of the vessel are shown in Figs. 1 and 2. The vessel has a number of special features: The double side is designed to be wider than that of conventional type of vessel to increase side structure capacity against ice loads as well as to meet shallow depth requirement; External shell in the ice belt area is reinforced with thicker plates and the longitudinal stiffeners with increased section modulus are arranged in the half space compared with the other areas. Ice belt strengthening was made to comply with Finnish Maritime Administration (FMA) Regulation. The design was done in the ice class level of ICE-IA; the forebody ice belt zone outside the body tangential line is further reinforced with additional stiffeners compared to the midship area as shown in Figs. 3 and 4.

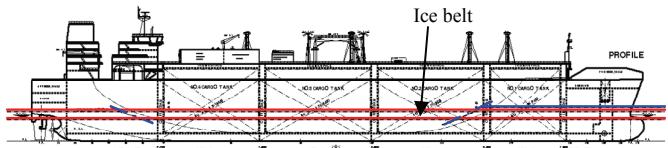


Fig.1 Target Vessel and Ice Belt for Ice Class 1A

Table.1 Principal Dimension

Length O.A.	Approx. 290.0 M
Length B.P.	279.0 M
Breadth	47.0 M
Depth	26.5 M
Draft Design	11.5 M
Scant.	12.5 M

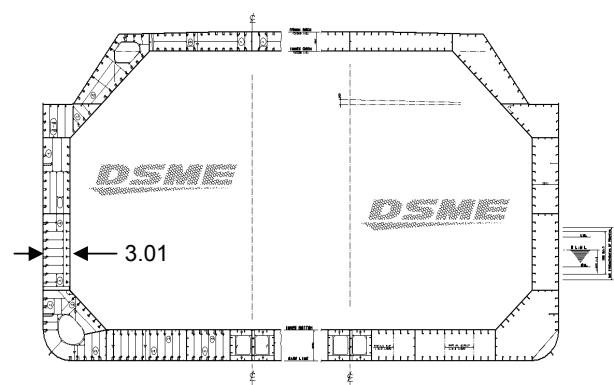


Fig.2 Conceptual Midship Drawing