IHI-SPB Tank System for FLNG

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Outline of SPB Cargo Tank System

Self-supporting, Prismatic-shape IMO type B

Structural concept based on long history and experiences in marine technology

- Robust & Reliable
- Best fit to hull form
- Restricts motions of cargo liquid inside

Hull
Tank
Insulation
Support
Tank and Tank Regions

- Insulation
- Internal Bulkheads
- Around Tank
- Walkway
- Hull
- Tank Support

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Tank Support

- Cargo tank is supported on the bottom by specially reinforced plywood
- Chock constructions are provided on top and bottom of the tank
Tank Insulation

Insulation System:
- Pre-fabricated rigid PUF panels
- Cushion joints

No Thermal Stress

Cushion Joint

Very Low Boil-Off Rate

Best Insulation material
Special insulating support

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Key Factor for FLNG CCS

A) Wide and Flat Upper Deck
B) Any Level Loading without Sloshing
C) High Reliability & Robustness
D) Easy operation, inspection & less maintenance on-site
A) Wide and Flat Upper-deck

- To install topside plant on upper deck

Wide and Flat Upper-deck is essential for FLNG to mount Topside process plant

LPG FPSO with SPB tanks

LNG Carrier with SPB tanks
B) Any Level Loading without Sloshing

- To produce LNG continuously by planned production rate

**Sloshing is:** Resonance of liquid in tank with the vessel motions

- Eliminate sloshing phenomenon itself by providing internal bulkheads in both transverse and longitudinal directions.
- Natural way in marine technology not to generate sloshing by dividing liquid into portions, exactly same approach to:
  - Crude oil tankers
  - LPG tankers
  - Chemical tankers, etc.
C) High Reliability and Robustness

- To operate continuously without dry dock during long life time
- To minimize risks to stop FLNG operation

**SPB designed based on No Leak Concept incorporating as-built conditions of tank**

**Complete fatigue analysis with conservatism**

**Probability of Fatigue Failure**

\[ P << 10^{-6} \]

**Quality verification by 100% X-ray**

**Maximum construction tolerance taken into design**
Operation Records

- No trouble on the SPB tank
- No shutdown of floating terminals since start of their operation
- No delay of LNG transportation even in very harsh route, Alaska – Japan
**D) Easy Operation & Less Maintenance**

-Simple Pressure Control, Independence from Hull-

- To operate continuously without dry dock during long life time
- To minimize risks to stop FLNG operation

- No special pressure controls

  Strong against OUTER and inner pressure

- Free from inner hull damage

  Seawater leakage from ballast tank, if it should occur, can be treated safely and repaired.
Access and Inspection

• Fault, if any, can be found before growing into trouble

SPB Tank

Tanktop

Walkway

Uniform space between hull and tank system

Horizontal girders provide permanent stages for access and/or work scaffolding
SPB Tank Application

Floating Terminal (FPSO)

- LNGC
- FPSO

Land Storage

- Offshore GBS
- LPG FPSO (2005 -)

SPB Technology

- LNG Carrier (1993 -)

Floating Terminal (FSRU)

- Onshore Power Plant
- LNGC
- FSRU

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LNG Fuel Gas Tank for various kinds of vessels

Reduction of;
CO2 emission
NOx, SOx emission

Effective use of ship’s space with any shape of tank by SPB system

Source: Wartsila

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Thank you for your Attention!