COMPACT RELIQ

REVOLUTIONARY PRODUCT BASED ON PROVEN TECHNOLOGY
GROWING LNG BUSINESS REQUIRES MORE FLEXIBLE SOLUTIONS

- It will be a boost in new built of large LNG carriers.
- Reliquefaction systems has become a standard feature on large LNG Carriers
- With the changing LNG supply chain new sizes and type of vessels enter the market
- LNG becoming a common accepted fuel, increasing the use of Small Scale LNG Carriers
- Retrofit market requires compact solutions that fits well on existing ships.
- Compact Reliq is attractive to Bunkering operations due to proper BOG reliquefaction
- Being the pioneer in BOG reliquefaction Wärtsilä has continued to develop with the market
PROPER BOG RELIQUEFACTION – CONTROLLING TANK PRESSURE IN THE MOST FLEXIBLE AND ENERGY EFFICIENT

- A portion of the BOG may be utilized as fuel for the ship engine
- Excess BOG is liquefied and sold together with the LNG in the cargo.
- Keeping cargo cool to increase holding time

The LNG in the cargo- or storage tank is at its boiling point and will produce boil off gas (BOG) which is reliquefied and returned to the storage tank.
LONG TIME EXPERIENCE AND PROVEN TRACK RECORD NOW TRANSLATED IN A COMPACT, RELIABLE MODULE

CR 1 700
Capacity – 1600 – 1800 kW
WÄRTSILÄ INTRODUCES COMPACT RELIQ

- **BASED ON BRAYTON TECHNOLOGY** proven technology in a vast amount of industrial applications

- **SMART MARINE READY with OPERIM** instrumented for remote operations, health monitoring and online operational supports. The system will be delivered with Wärtsilä OPERIM health program

- **LOW MAINTENANCE:** Minimal maintenance between docking – No scheduled maintenance on rotating equipment. Magnetic bearings - no oil change. Only few moving parts - Low maintenance cost during docking every fifth year.

- **COMMERCIAL GRADE NITROGEN AS REFRIGERANTS:** Easy obtainable refrigerant and provides safe operation

- **DYNAMIC SIMULATION** The system is design verified and parameter tuned by dynamic simulator.

<table>
<thead>
<tr>
<th>Model</th>
<th>CR 850</th>
<th>CR 1700</th>
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<tbody>
<tr>
<td>Capacity (kW)</td>
<td>800 - 900</td>
<td>1600 – 1800</td>
</tr>
<tr>
<td>Efficiency kW/kg LNG</td>
<td>Better than 0.95</td>
<td>Better than 0.95</td>
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WÄRTSILÄ INTRODUCES COMPACT RELIQ:

- **MODULARISED COMPACT DESIGN:** All equipment on one single skid unit including compander, drive motor, heat exchangers, valves control, instrumentation, panel.

- **EXCELLENT TURNDOWN:** Turndown to near 0% with rapid capacity changes.

- **INTEGRATED MAGNETIC BEARING COMPRESSOR** Centrifugal with compressors and expander on a single shaft. Hermetically sealed with low voltage integrated motor. Industry leader in robust and compact compressor solutions has signed an agreement with Wärtsilä.

- **HEAT EXCHANGERS:** Main heat exchanger is a plate fin type. Other heat exchangers are standard plate type.

- **FLEXIBLE SHIP OPERABILITY:** Wärtsilä BOG reliequefaction systems provides full BOG reliequefaction with low temperatures tanks in both laden and ballast voyage. The ship can run at any speed and still have reliequefaction.

- **EASY INSTALLATION – PLUG AND PLAY:** Minimal amount of interface connection points - cooling water, electricity and gas in/out, small footprint.

- **INTERFACE WITH SHIP PMS:** Wärtsilä has a unique position with the extended port folio to help customers fully integrate the reliequefaction system into the PMS to provide optimal ship operation.
THE BEST JUST MADE MORE COMPACT

<table>
<thead>
<tr>
<th>Model</th>
<th>CR 850</th>
<th>CR 1 700</th>
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<tbody>
<tr>
<td>Length</td>
<td>10 000</td>
<td>11 000</td>
</tr>
<tr>
<td>Width</td>
<td>4 500</td>
<td>5 500</td>
</tr>
<tr>
<td>Height</td>
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<td>4 500</td>
</tr>
<tr>
<td>Weight</td>
<td>50</td>
<td>70</td>
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Dimensions: mm
Weight: ton
**What is OPERIM®**

Operational Performance Improvement & Monitoring

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**Data Collection Capabilities**

- **Digitally enabling Wärtsilä products:**
  - Data Acquisition: Data collection capabilities from multiple sources
  - Data Management, Modelling and Validation
  - Online Visualisation: Dynamic dashboards, process visualisation, account management

**Operim Cloud Service**

- **Analysis using Wärtsilä’s unique competence:**
  - Digital Twin: Mathematical representation of the Process models
    - Virtual Instrumentation: Calculation of derived properties
    - Performance Insights: Efficiency calculations: Analysing the plant performance
    - Smart Notifications, (Human based, Partial automation)

**Smart Services**

- **Value Added Services**
  - Performance optimization: ensure the asset operates at its optimal point.
  - Asset health monitoring: preventive notifications and anomaly detection.
  - Remote support: faster and more comprehensive support