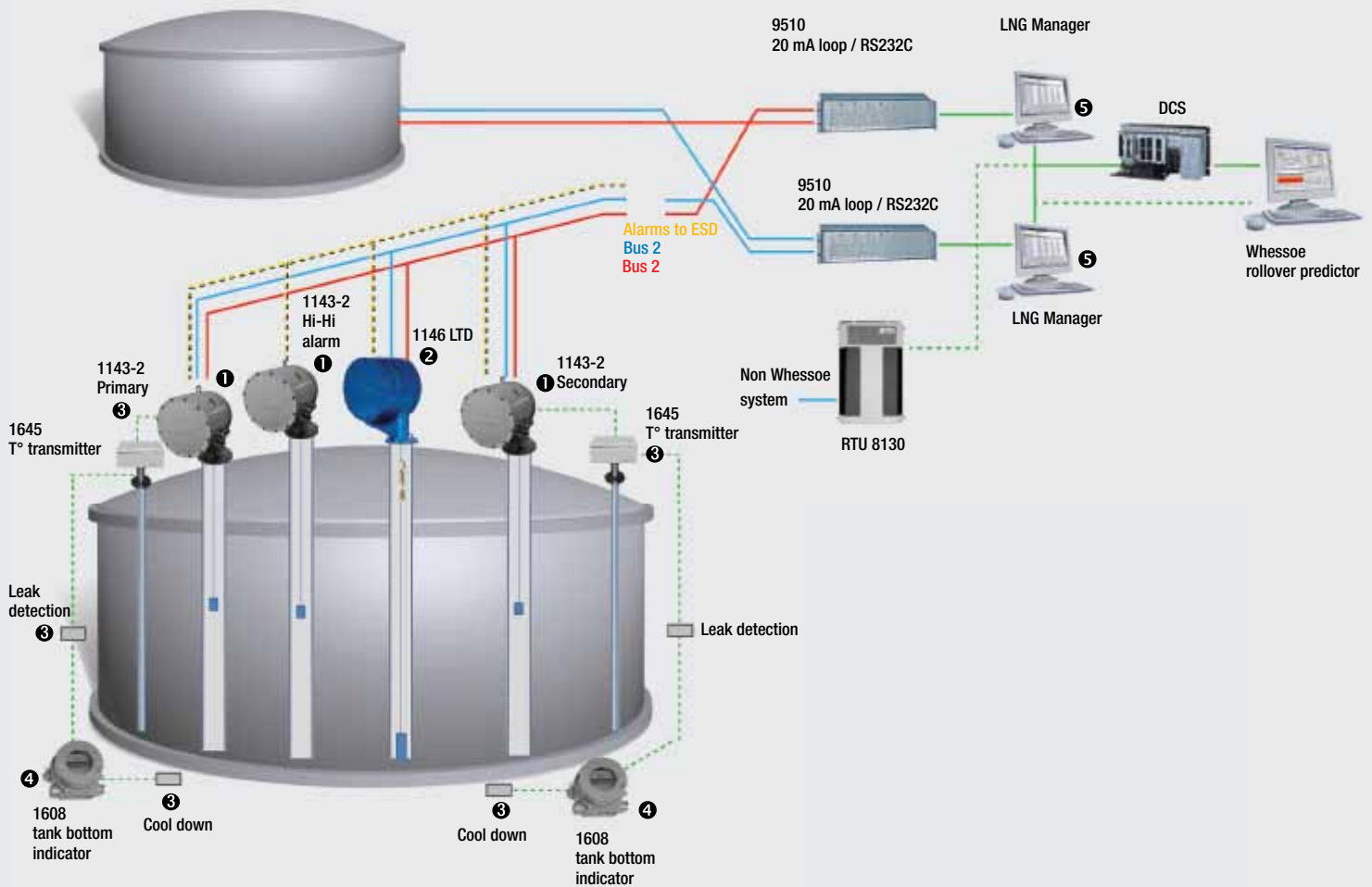


WÄRTSILÄ TANK CONTROL SYSTEMS
LIQUEFIED NATURAL GAS APPLICATION

ENERGY
ENVIRONMENT
ECONOMY



LNG STORAGE TANK TOTAL INSTRUMENTATION SOLUTION



At Wärtsilä we strive constantly to do what is best for you. This includes optimising the lifecycle value of your installations by offering precisely what you need; a promise we can deliver on since we provide the marine industry's most complete portfolio of products, integrated solutions and global services.

By prioritising operational efficiency, environmental excellence, fuel flexibility and 24/7 support, we work with you to find your shorter route to robust growth, greater profitability and regulatory compliance. This is why today, every third vessel in the world has a Wärtsilä solution onboard.

LEADING THE INDUSTRY IN LIQUEFIED GAS STORAGE INSTRUMENTATION AND SAFETY SYSTEMS

Since the earliest days of liquid gas storage, Wärtsilä Tank Control Systems has been at the cutting edge in developing technologies that increase the safety of LNG and LPG storage. In particular, the company's instrumentation and safety systems ensure that all hazardous aspects related to the storage are known and controllable.

In close cooperation with leading gas companies, new technologies have been developed and extensively tested for endurance, accuracy, and reliability in the harsh environments associated with liquid gas storage. Our highly accurate instrumentation, control platforms, and safety shut-off valve systems are installed worldwide to help protect

personnel, the environment, equipment, and the product itself.

If your product is LNG, LPG or ammonia, Wärtsilä Tank Control Systems can provide an application-specific solution for your business needs. Today, the liquid gas industry is driven by the economics of operational scale. In order to apply efficient business management, while adhering to stringent safety regulations, operations personnel must have access to correct information.

Throughout the production cycle, from storage to distribution, the availability of precise data is essential, and it needs to be relayed to the control room in real time. Whether your operation is large or small, our solutions are custom designed to suit your requirements best. They can operate independently, or be interconnected within

1 Model 1143 Mark II Servo Level gauge

Monitors level changes as small as 0.1 mm.

Incorporating a single body concept, it accommodates all electronics, including the main power connection and redundant Modbus communication. The gauge is fully SIL-2 certified and, in a multi-gauge system application, conforms even to SIL-3. The Model 1143 gauge is suitable for custody transfer applications. The gauge has passed seismic testing and is certified to withstand a 12 g acceleration force.



2 Model 1146 LTD gauge

The world's most advanced LTD gauge, this is also based on Wärtsilä Tank Control Systems's unique single body concept. It accommodates all electronics and wiring, and is mounted on a single flange. Travelling at user configurable speeds, it samples 250 data points to construct a detailed and accurate LID profile. Communication is via redundant Modbus. As with all gauges, the LTD also features a local LCD display, showing all process and diagnostics data, while an inspection window is used to verify the sensor's "home" position. The gauge has passed seismic testing and is certified to withstand an 8 g acceleration force.



3 Model 1645 temperature/pressure transmitter

Handles up to 16 RTD's and 3 pressure signals. It is linked to the level gauges for power and the communication of all measured data. With a daisy chain connection of up to 5 units in a local (IS) field-bus, it is capable of handling in-tank temperature masts, as well as leak detection and cool-down elements.



4 Model 1608 Local indicator

Local, tank base indicator.

Model 1608 allows field operators to observe all measured data available on the local (IS) field-bus.

Like the temperature transmitters, it is powered from the level gauge.



5 LNG Manager

All process data can be linked back to our PC-based, redundant, control engineering and configuration platform, the LNG Manager, or alternatively directly linked to the site's DCS.

In instances where the LNG tank gauging instruments are being linked directly to the site's DCS system, configuration and maintenance tasks are handled through a portable PC, known as the LNG System Maintenance Supervisor.



6 EMERSON – RAPTOR 5900S with LNG antenna

High precision radar gauge for cryogenic liquefied gas. It is mounted in a still-pipe which gives a strong echo even under surface boiling conditions. A reference function allows check of measurement also when tank is closed. The gauge has OIML certified custody transfer accuracy. There are no moving parts meaning outstanding measurement reliability.



7 2160 Field Communication Unit

The Rosemount 2160 Field Communication Unit polls data from all 2410 Tank Hubs and, upon request, sends tank data to the host computer in the control room.

The Field Communication Unit communicates with all common host/DCS systems and also other vendor's gauges and control room equipment. Two units can be connected in parallel with one unit working as backup for the other.



a plant-wide system. Our vast experience, research, instrumentation technology, and service support will add value to your business. Our network of sales offices, application specialists, service facilities, and training centres provide local support to customers in key locations worldwide. This provides rapid access to a single point of contact in order to source the most effective solutions – Wärtsilä Tank Control Systems.

TOTAL LIQUEFIED NATURAL GAS STORAGE TANK INSTRUMENTATION SOLUTION

For those highly specialised applications, whereby safety, accuracy, reliability, and repeatability are of prime importance, you need look no further than Wärtsilä Tank Control Systems.

Our total LNG storage tank instrumentation solution comprises the following, fully integrated system components:

- SIL-3 certified servo level gauges
- High/high level alarm gauges
- Product temperature probes
- Fully automatic LTD gauges
- Leak detection and cooling temperature transmitter system
- PC based SCADA package
- Roll-over predictive alarm software
- LNG sampling system.

The entire system communicates via a redundant communication link.

CONTROL PLATFORMS LNG MANAGER

All process data can be linked back to our PC based, redundant, control, engineering and configuration platform, LNG Manager®, and can be directly linked to the site's DCS.

In instances where the LNG tank gauging instruments are being linked directly to the site's DCS system, configuration and maintenance tasks are handled through a portable PC, called LNG System Maintenance Supervisor®.



TANK CONTROL SYSTEMS WÄRTSILÄ WHESSOE ROLLOVER PREDICTOR

Liquefied natural gas (LNG) terminals need to be able to store multiple grades of LNG, and to have sufficient storage capacity available for all of these. Managing storage to ensure availability and to optimise the use of storage capacity is therefore essential.

With the increasing diversification of LNG supply sources, an increase in short-term trade, and a general global trend towards the liberalisation of gas markets, reception terminals need to be able to deal with a greater variety of incoming LNG qualities. Furthermore, with the need to reduce capital and operating costs, the capacity of both existing and new storage tanks must be utilised to their fullest extent.

At the same time, while the LNG is in storage, boil-off will result in a continuous change of its chemical composition. Consequently, storing different grades of LNG in receiving tanks, together with the ongoing

modification of the chemical characteristics, calls for certain proactive measures. In particular, monitoring of the possible development of stratification is needed, and warning must be given in case unstable stratifications that might evolve into a rollover of the layers are detected.

A level temperature density gauge alone is simply not capable of monitoring the stratification evolution. Therefore, in collaboration with GDF Suez, Wärtsilä has developed the Wärtsilä Whessoe Rollover Predictor software. Thanks to the predictor you are able to make the right decisions at the right time, and to manage LNG storages in a safe, timely and optimal way.

The Wärtsilä Whessoe Rollover Predictor provides the user with a watchdog that monitors all the site components which impact and influence the formation and evolution of LNG stratification. The predictor continuously monitors all data and calculates the expected

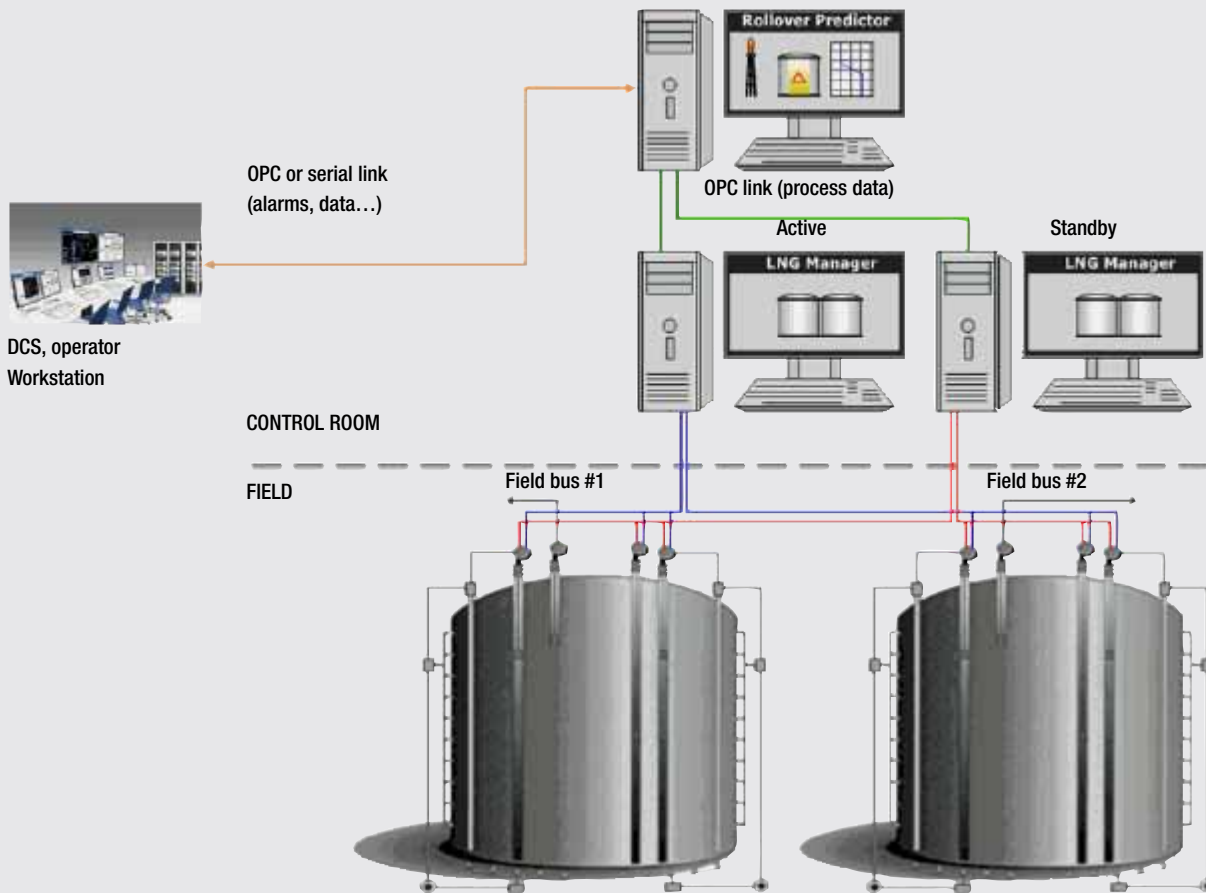
development of stratification, if any.

Should a certain stratification appear likely to evolve into a rollover situation in any of the tanks linked to the same vapour space, the predictor automatically generates an alarm, leaving sufficient time for the operators to take corrective action. As such, the Wärtsilä Whessoe Rollover Predictor meets all requirements of the European SEVESO II directive.

The predictor detects the occurrence of a rollover within the next 30 days (configurable from 1 to 30 days), showing to the operator the:

- Tank where rollover is expected
- Remaining time to rollover
- Predicted boil-off gas level during rollover
- Predicted pressure (rise) during rollover

The Wärtsilä Whessoe Rollover Predictor handles all grades of LNG and calculates their chemical composition in real-time.



AUTOMATION VIEW

- Automation system overview
- Communication status
- LTD status

PLANT VIEW

- Tank overview with alarm information
- Site Safety devices status

LOG FILE VIEW

- Complete log file
- Archive

INTEGRATED SOLUTIONS

As well as LNG rollover prediction software, Wärtsilä Tank Control System provides level, temperature and density measurement, alarm systems, SCADA systems, and data management systems for LNG and LPG terminals. With the extensive product and solutions portfolio Wärtsilä is able to offer full turnkey solutions from engineering, installations on site and commissioning to full lifecycle support solutions including services, spare parts and upgrading solutions.

The Wärtsilä Whessoe Rollover Predictor

- Predicts stratification and rollover phenomena accurately
- Facilitates operations for LNG storage tanks
- Displays tank levels, layer height, average density and temperature per layer
- Indicates plant safety devices status
- Maximises product calorific value
- Generates automatic alarms in case of rollover without any operator intervention
- Reduces operational costs.



PROJECT MANAGEMENT

Wärtsilä Tank Control Systems has a vast experience in project management serving our customers globally.

We have an extensive background on project's customization according to the international standards, local regulations and project's specification.

Our project team is committed to deliver on time, in respect to the technical specification and expected quality by our customers globally.

The unique goal and common objective remains the customer satisfaction.

LIFECYCLE SUPPORT

Our philosophy is to serve customers throughout the lifecycle of their installation. We are available for project conception discussions; we offer advice during the design phase, and we provide support until the operational life is finalized.

We provide OEM spare parts, modernisation and upgrading solutions, technical support, training, and maintenance on site.





FROM SERVICE TO SERVICES

A number of our customers have recognized us as their preferred service supplier to ensure the availability and cost-efficient operation of their installations. They find they get leverage from a variety of benefits by having their entire power system fully serviced by one global supplier.

Wärtsilä Services provides holistic, integrated service for our marine and power plant customers. To serve you better, we are continually broadening our range of solutions by adding products and services that further enhance the value of our one-stop-shop service and expanding our global network. We support your business, in-situ or from our numerous service centers around the globe, regardless of your equipment make.

We provide tailored efficiency solutions throughout the marine propulsion and power

plant product lifecycle in the following services product lines:

- Engine Services
- Propulsion Services
- Boiler Services
- Electrical & Automation Services
- Operations & Management Services
- Training Services
- Environmental Services

We can tackle everything from basic support with parts, manpower and technical support to full service agreements. The work can encompass installation and commissioning, performance optimization, upgrades, conversions, and environmental solutions. Service contracts can extend from parts and manpower all the way to long-term, comprehensive contracts including performance and asset management agreements.

Wherever your installation is located, you will find a Wärtsilä Services center nearby. More than 11,000 dedicated professionals, operating in over 70 countries in 160 locations, are waiting for your call. We are never too far away to help.

This not just service, it is peace of mind – the security of knowing that your installation is covered by the world's most experienced marine and power plant services company: Wärtsilä.

VISIT US AT

[www.wartsila.com/en/gas-systems/
tank-control-systems/whessoe](http://www.wartsila.com/en/gas-systems/tank-control-systems/whessoe)

Wärtsilä is a global leader in complete lifecycle power solutions for the marine and energy markets. By emphasising technological innovation and total efficiency, Wärtsilä maximises the environmental and economic performance of the vessels and power plants of its customers. Wärtsilä is listed on the NASDAQ OMX Helsinki, Finland.

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