

WÄRTSILÄ**Inert Gas****ENERGY
ENVIRONMENT
ECONOMY**

MOSS MULT-INERT™ SYSTEM



Wärtsilä is a market leader in the development, design, manufacture and servicing of advanced inert gas and nitrogen solutions for marine and offshore oil and gas applications.

Our leading-edge, customised solutions ensure high quality and advanced levels of safety for vessels operating in regulated areas. We are certified by ISO 9001:2000, ISO 14001:2004 and OHSAS 18001:2007.

Our strong reputation in inert gas solutions is based on over 50 years experience and unique full-scale R&D facilities located in Moss, Norway. Our references include over 2500 vessels installed with our inert gas equipment.

Performance testing of inert gas systems can be executed in the company's own test hall in Moss, the only facility tailor-made for this purpose in the world today.



Wärtsilä Moss Multi-Inert™ burner/scrubber unit

Wärtsilä Moss Multi-Inert™ systems are vital systems ensuring a high level of safety for use onboard tankers intended to carry both crude oil and refined products, and combine into one compact unit where quality is the number one priority.

The Wärtsilä Moss Multi-Inert™ system can run as an inert gas generator or, when the boilers are in use, as a flue gas system. They are designed based on compact modules, offering important savings in space and installation cost for newbuild and retrofit vessels.

Our most recent developments include automatic regulation based on deck pressure setting. During offloading process, the inert gas production is optimized and only produces the necessary quantum of inert gas to maintain the tank pressure. This system gives cost efficiency by reducing oil consumption, as well as an environmental benefit.

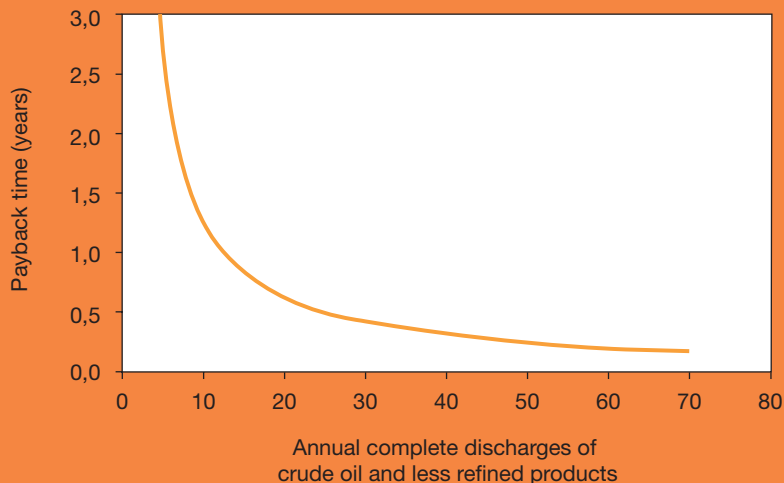
Hamworthy
a Wärtsilä company


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PAYBACK TIME

The payback time for a Mult-Inert™ System compared to a pure Inert Gas Generator based on a 74.000 DWT product/crude oil tanker and a fuel cost of \$850/ton (February 2011) is shown in the graph below.

With 12 complete tank volume discharges of crude oil and less refined products, the payback time is one year.



The product tanker 'M/T Mare Nostrum' is installed with a Wärtsilä Moss Mult-inert™ gas generator system



The product tanker 'M/T Mare Oriens' is installed with a Wärtsilä Moss Mult-inert™ gas generator system

SELECTION OF INERT GAS SYSTEM FOR PRODUCT / COMBINATION TANKERS

A flue gas type inert gas system is normally used on board Crude Oil Tankers where sufficient boiler flue gas is available during cargo discharge.

Wärtsilä Moss do not recommend using only flue gas systems on board Product or Combination Tankers. The main reason is the purity of the inert gas and thus the hazard of cargo contamination.

“The more critical petrochemical cargoes which may be carried by product carriers can be contaminated by flue gas.”

IMO guidelines for Inert gas Systems 1990 Edition, chapter 6.3

The product range for a combination tanker varies from crude oil to the finest refined petrochemicals such as gasoil and jet fuel (white products). Quality control of white petroleum products consists of visual and gravimetric measurement; for example aviation jet fuel must comply with ASTM D1655-10, Standard Specification for Aviation Turbine Fuels: “Fuels containing visual particulate or with particulate levels greater than 1.0 mg/l (corresponding to 1,25 ppm for jet fuel) will require additional handling procedures, such as extended settling and/or filtration.”

Flue gas generated from boilers contains residual components that may discolour a white cargo. Normal particulate residue after sea water scrubbing of flue gas is 1-2% of particles bigger than 1 µm. Particles of this size will settle and hence mix with the product. This is not acceptable for many of the sensitive products. Additionally, sub-micron particles can also contribute to discolouring by aggregating on the cargo surface.

Low SO₂ content is very important in order to reduce possible contamination of sophisticated cargoes. For a flue gas plant using boiler gas with typical SO₂ content 3000 ppm, the SO₂ content in the inert gas will be reduced to approx. 100 ppm after the scrubber. Burning distillate fuel in an inert gas generator provides inert gas with max 1 ppm SO₂ content.

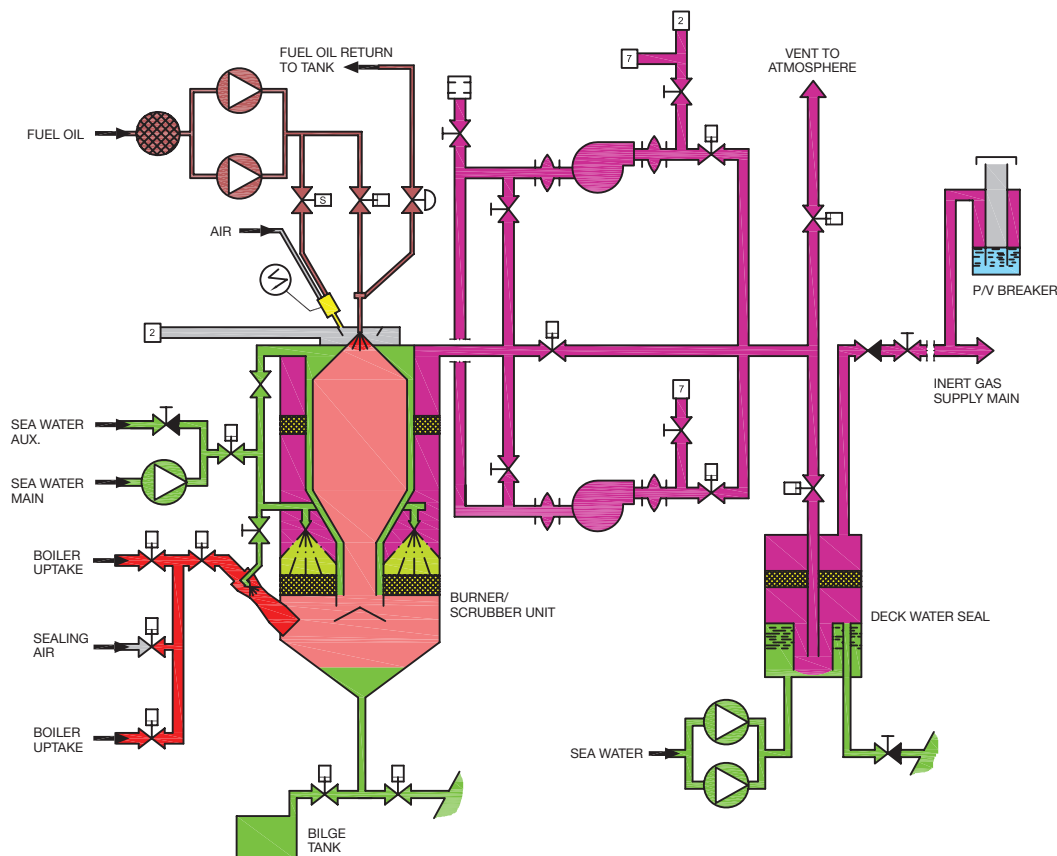
Wärtsilä Moss Inert gas generator is designed for optimal combustion based on a high turbulent burner, and thus producing a higher quality inert gas compared to a boiler. Typical SO₂ level is max. 1 ppm, and the inert gas is soot free.

For tankers intended to carry both crude oil and refined products, we strongly recommend using our Mult-Inert™ System.

This system is a combined flue gas and inert gas generator.

When discharging crude oil or less refined petroleum products, our Mult-Inert™ Generator System can be run in flue gas mode as the boilers are run to heat the cargo. This cargo is less sensitive to contamination. When discharging more sensitive cargo, the system can be switched to inert gas generator mode burning marine fuel.

GENERATOR/FLUE GAS VERSION



PERFORMANCE DATA FOR GENERATOR MODE

Inert gas consumption at 3% by volume of oxygen (based on marine distillate fuel):

CO = Max. 100 ppm
 NO_x = Max. 150 ppm
 SO₂ = Max. 1 ppm
 CO₂ = Approx. 14%
 N₂ + Ar = Balance

Oxygen content adjustable between 1% - 5% down to approx. 1%.

Fuel:

Marine distillate according to ISO 8217, class DMA, DMZ or DMB or marine residual fuels pre-heated to max. 20 cSt.

Nominal fuel consumption:
 0,075 kg/Nm³ gas.

Nominal sea water consumption:
 0,06 m³/Nm³ gas (sea water temp. 32°C).

Nominal el. power consumption:
 0,015 (0,01 - 0,02) kW/Nm³/h gas (excluding sea water pumps).

PERFORMANCE DATA FOR FLUE GAS MODE

Basic flue gas consumption:

O₂ - content: Approx. 5% by vol.
 CO₂ - content: Approx. 13% by vol.
 SO₂ - content: Approx. 3000 ppm.
 N₂ - content: Balance

Inert gas composition:

O₂ - content: No change
 CO₂ - content: No change
 SO₂ - content: Less than 100 ppm
 N₂ - content: Balance

Efficiency of soot extraction equal to or higher than 99% of particles above 1 micron.

Nominal sea water consumption:
 0,015 m³/Nm³ gas (sea water temp. 32°C).

Nominal el. power consumption:
 0,008 kW/Nm³/h gas (excluding sea water pumps).

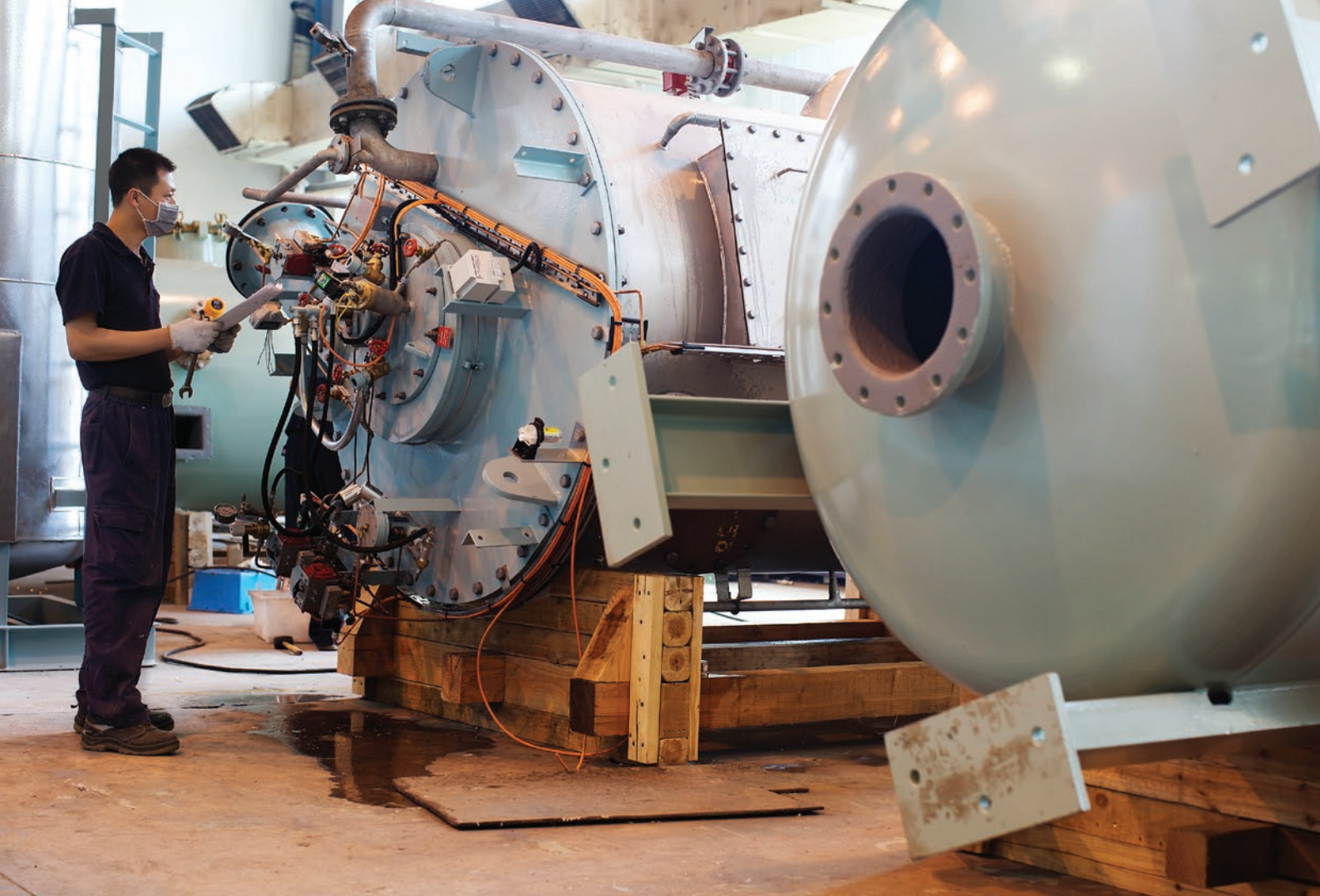
COMMON DATA

Sizes 2000Nm³/h - 20000Nm³/h

Gas outlet temperature:
 Max. 5°C above sea water temperature.

Relative humidity: 100%

Carry over of water droplets:
 Less than 1 g/kg dry gas.



AFTERSALES SERVICE AND SUPPORT

Wärtsilä supports its customers throughout the lifecycle of their installations by optimizing efficiency and performance. We offer expertise, proximity and responsiveness for all customers in the most environmentally sound way and to secure uninterrupted operation.

Our Services & Support solutions range from basic support, installation and commissioning, performance optimization, upgrades, conversions and environmental

solutions to service projects, agreements and product training focusing on overall equipment performance and asset management. Our service department in Moss will also provide anticipated spares on short notice for our full range of inert gas solutions.

We deliver our services through our service stations, workshops and ship repair centres that form our service network in 70 countries worldwide.

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