

LNG Bunkering



Taking advantage of
field-proven technology



This type of LNG bunkering is developed from existing, field proven systems, applied for many years for hydrocarbons; mainly to be found in north European ports like Rotterdam, Amsterdam, Antwerp and Hamburg

The big advantages of this bunkering vessel mounted arm are:

- The bunkering vessel is used for parallel berthing to allow bunkering of receiving vessels simultaneously with their commercial loading and offloading activities, thus minimizing docking time.
- The same bunker arm can be used to fill the bunker vessel from storage tank on shore. (bi-directional)
- Maximum flexibility and a very wide operational range are needed to ensure a good variety of connection possibilities as the position of bunker connections on commercial vessels are not standardized as oil and LPG/LNG carriers may be (ref. OCIMF). Bunker connections can be found in various places, sometimes only reachable via a hatch in the hull of the ship. For that reason it is impossible to apply a fully hard piped system (similar to a Marine Loading Arm) that can reach all different locations and compensate for important height differences between the bunker vessel and the receiving vessel.



LNG Bunker arm

LNG Bunkering (why?):

- **Ships engine adjustments to LNG**
- **Supply / logistics from source to bunker spot**
- **Prices LNG versus conventional fuels**
- **Emission regulations call for LNG-powered ships**

Nowadays, more and more ships are changing their running energy to LNG, to cope with this recent market demand, Kanon, in collaboration with van Wijk, adapted the existing bunkering system.



This technology allows for a connection range much larger than the conventional fully rigid marine loading arms.

It provides fast connection possibility to low and high receiving ship's manifolds combining the rigidity of hard piping hydraulically driven, with the flexibility of hoses at the ships interface side. Making connection possible to almost all receiving ships. It will save manpower and improve ease of use.

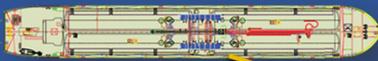
What differs from the older fuel oil and diesel bunkering facilities is the fact that for LNG, an Emergency Release System (ERS/ERC) is an absolute requirement. This system, comprising of two valves that are closing and then separating from each other, serves as a 'dry-break' system preventing uncontrolled spillage in the case where both ships accidentally move too far away from each other.

LNG Bunker arm

No dedicated
wharf necessary

No disruption of
commercial activities

LNG Bunkering Vessel



COMMERCIAL HARBOR

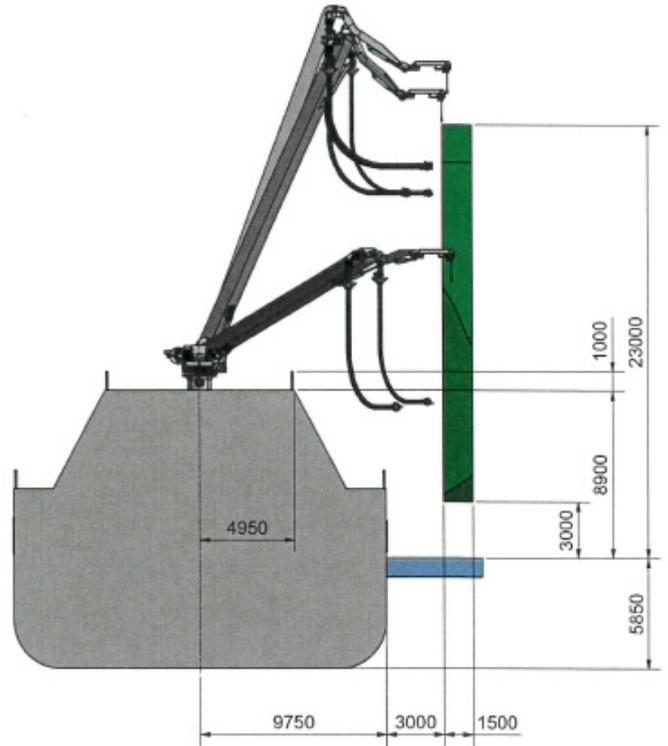
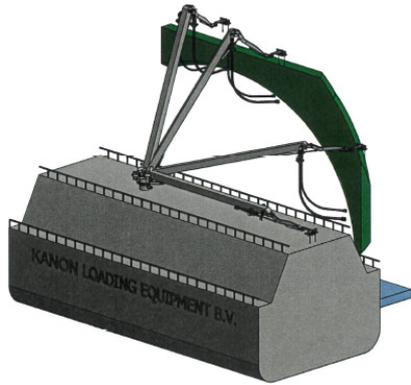
Maybe the most interesting advantage of a bunker boom for LNG, is the possibility to proceed with LNG bunkering without interruption of the receiving vessel's normal activities, as proven in Stockholm for the Viking Grace: for example, a passenger cruise ship can moor at its standard wharf at the harbour, off-load its passengers while bunkering (refuelling) at the same time. No need for it to wait and to sail on to a dedicated LNG bunkering jetty.

This is a non-negligible time/money saving. For normal marine diesel applications, it is already a standard.

Safety being of the essence, Kanon / Van Wijk Boom is executed with an automated Emergency Release System to allow safe disconnection in case either ship would drift away from each other or in case of any other emergency.

This safety system is SIL 2 classified.

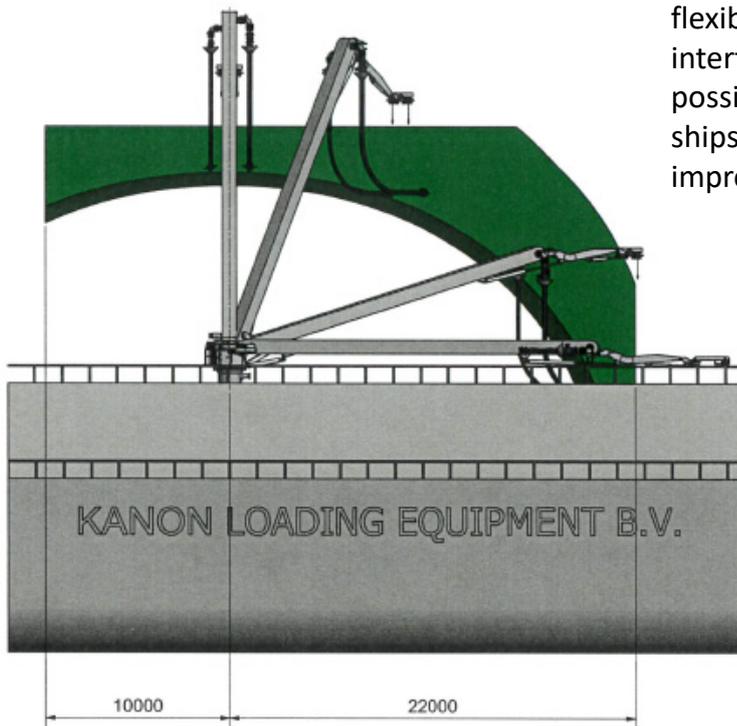
LNG Bunker arm



This technology allows for a connection range much larger than the conventional LNG transfer system.

DIMENSIONS ARE EXAMPLE ONLY

Fast connection is possible to low and high receiving ship's manifolds combining the rigidity of hard piping, hydraulically driven with the flexibility of hoses at the ships interface side. Making connection possible to almost all receiving ships. it will save manpower and improve ease of use.



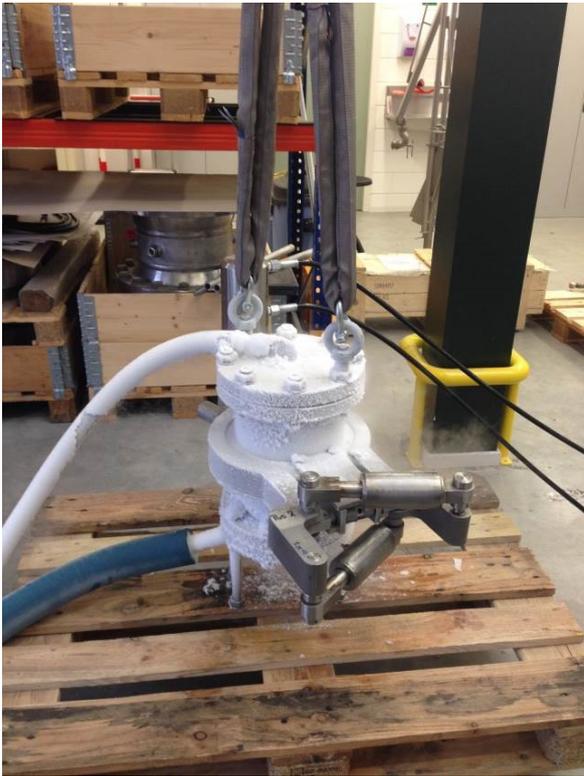
LNG Bunker arm



ERC's: one on the liquid line, the other on the vapour line: they ensure safe release in case either ship would drift away further than the maximum hose length. The system is SIL 2 and provided with a 2oo3 voting principle for ESD2.

LNG Bunker arm

The Dry Break Emergency Release Coupler is hydraulically activated and tested at the LNG operating temperature



HOSES

Multi-LNG White

Applications

Multi-LNG White is especially designed for use with fully refrigerated conveyants down to -196°C such as LNG in rail, railcars, inplant, ship to shore and (LPG)bunker operation.

Certifications

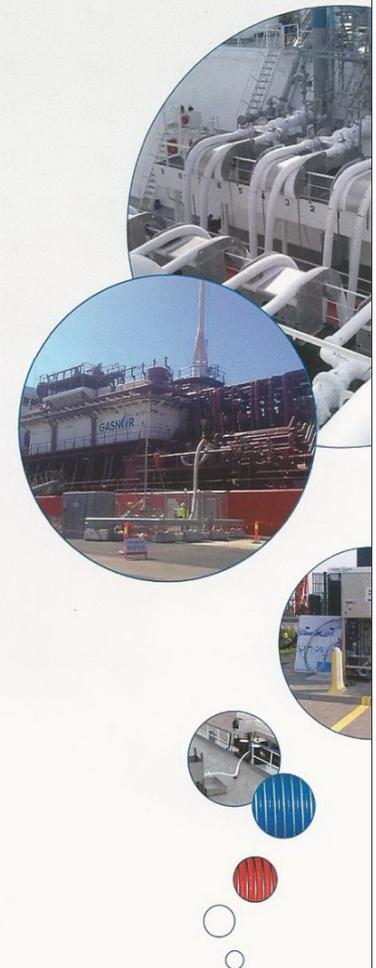
Multi-LNG White hoses are produced and tested according international standards like EN 13766:2010 & IMO IGC code

Construction

Inner wire	Stainless steel 316
Lining	Polyester fabrics and films
Outer cover	Polyamide
Outer wire	Stainless steel 316

Physical properties

Maximum elongation	10% on proof pressure
Electrical resistance	2,5 Ohm p/mtr < 2" 1,0 Ohm p/mtr >= 2"
Maximum twist	10° p/m
Min. burst pressure	5x working pressure (safety fact 5:1)
Max flowrate	on request
Max tensile strength	on request
Pressure losses	on request
Temperature range	-196°C upto +50°C



Certificate no: RET0265639-AC-01
Page 1 of 1



INSPECTION CERTIFICATE

Project: **Activation Cryogenic Safety Break Valve**

Client: **Kanon Loading Equipment**
Edisonweg 27
Zeewolde

Office: **Haren**

Client's Order Number: **R001302**

Date: **27 February 2015**

Order Status: **complete**

Inspection Dates

First: **17 February 2015**

Final: **19 February 2015**

This certificate is issued to the above mentioned Client in order to certify that the undersigned Surveyor to Lloyd's Register Nederland BV did attend their Works at Edisonweg 27 Zeewolde The Netherlands on the above mentioned dates for the purpose of witness the function test of undernoted equipment:

Two (2) Activation Cryogenic Safety Break Valve size 4" and 6"

Procedure : Kanon Procedure and Test Report R001302 issue 1 dated 17-02-2015 (6 pages total)
Test dates : 4" on 17-02-2015 and 6" on 19-02-2015

The break valves were tested by KANON under the conditions as mentioned on page 5 and 6 of the above mentioned procedure, witnessed by undersigned surveyor and found acceptable. A copy of the Procedure and Test Report is held by LR.

Note:

The procedure, with the signed off break tests on page 4, is part of this certificate.



A. COMPAGNE

Senior surveyor to Lloyd's Register Nederland BV

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Form 1123 (2013.12)