



THE OFFSHORE LOADING SOLUTION

-170°C

-160°C

-150°C



-140°C

-130°C

-120°C

-110°C

-104°C

I n t r o d u c t i o n

A growing global appetite for energy resources has driven the development of the liquid natural gas industry for thirty years.

The discovery of deep water offshore gas reserves and the broadening market in the USA and Asia Pacific are the catalysts for a cost effective supply chain that has evolved to include LNG plants, shuttle tankers and onshore terminals. Vital links in this chain are at the offshore transfer of LNG between fixed plants and floating vessels.

MEETING THE CHALLENGE

Offshore loading situations become complex when both LNG terminal or liquefaction plant and LNG tanker are moving extensively and independently. The transfer system must maintain established high standards in a safety critical industry.

The traditional industry-wide transfer system involves articulated loading arms with swivel joints accommodating motion between terminal dock and tanker. Developing a design to absorb more than the mildest 6 degrees of movement makes this method cost prohibitive.



**FOR HARSHER ENVIRONMENTS,
ALTERNATIVE LOADING SCHEMES MUST BE CONSIDERED**

Large gas reserves off North Western Australia are an incentive to introduce a system that will meet the LNG loading demands during the one-year storm scenarios encountered in the region, preserving the integrity of the LNG supply chain.

Flexible composite hoses are widely used in the offshore transfer of refined oil and cryogenic gases. The development of a hose based system of sufficient capacity to transfer LNG has significant advantages: this is a familiar and proven concept throughout related industries, and the availability of a dedicated LNG hose could encourage competition and so increase cost efficiency.

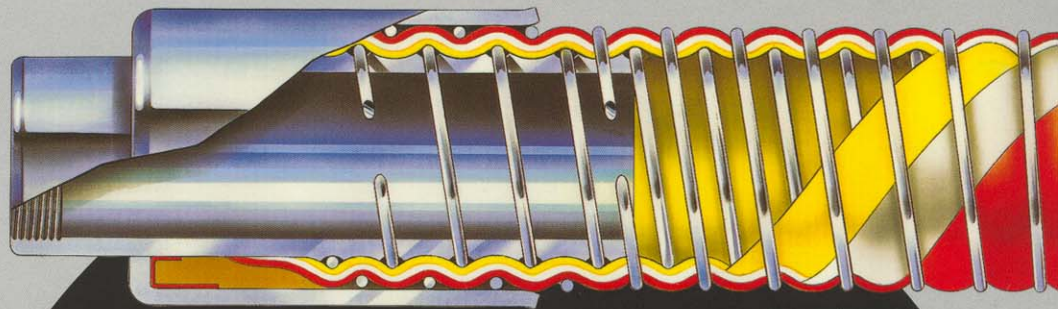


UNEQUALLED SAFETY CRITICAL APPLICATIONS EXPERTISE

Consistent innovation characterises Senior Flexonics' ability to respond to ever changing requirements across a diverse range of industries. Selected by ExxonMobil to conceive and develop a large diameter composite hose for LNG transfer, Senior Flexonics' superbly engineered product results from innovative design, exhaustive prototype testing and a uniquely valuable partnership with customer and test specialists.

Tests simulated service life and included considerations for movement, temperature, pressure and weight, all consistent with expected applications at the specified location. The program was designed to lead to certification for the transfer of LNG offshore and also in onshore terminals, and to ensure that the prototype hose should meet the requirements of the IMO Gas Tanker Code.

FLEXIBILITY AND CAPACITY



The outer stainless steel wire reinforcement provides hoop strength to meet 5 times MAWP. The inner wire offers structural stability, the configuration of both wires establishes the flexible geometry of the hose body and provides compressive sealing force to the film layers.

Polyester fabric layers are selected for axial hose strength, resistance to cryogenic temperatures and the effects of exposure to marine atmosphere.

Twenty Inch Diameter Hose Construction

The material provides both yield strength and service life that exceed requirements and meet low flammability standards.

Proven with contents at temperatures lower than LNG, polymeric film layers line the hose and resist percolation, while also adding to axial strength.

Designed to withstand extreme internal pressures, hose end fittings are secured by stainless steel wire binding to prevent movement, and a wedge feature increases security under increased axial loading.

LNG hose is lagged with polypropylene rope to resist abrasion and aid the already excellent thermal insulation values of composite cryogenic hose.

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AT THE FOREFRONT OF CRYOGENIC HOSE DEVELOPMENT

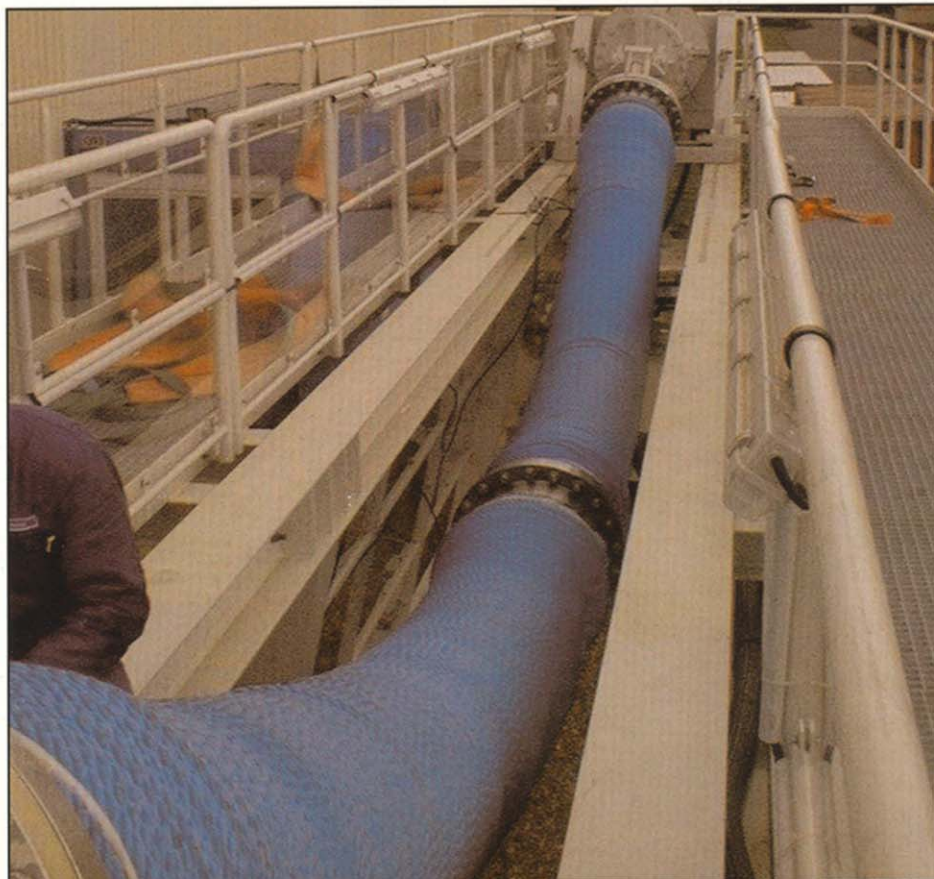
World leader in the manufacture of flexible hose, bellows and expansion joints and associated products, Senior Flexonics renowned quality and reliability is evident in the 12 million feet of flexible hose produced annually.

No other company in the same industry can offer local support around the globe, providing solutions that enable the safe and reliable transfer of liquids or gases, where movement, thermodynamics or pressure demand a vital, flexible link.

DESIGNING A SAFE, RELIABLE AND COST EFFECTIVE SYSTEM

Senior Flexonics Cryoflex composite hose is proven in a variety of cryogenic material transfer applications, including ship to shore, and is supplied in sizes up to 10 inches diameter. Larger diameter hoses have been produced as an uncertified LNG emergency back up system, and Compoflex hose has undergone sea trials in emergency LNG tanker lightening.

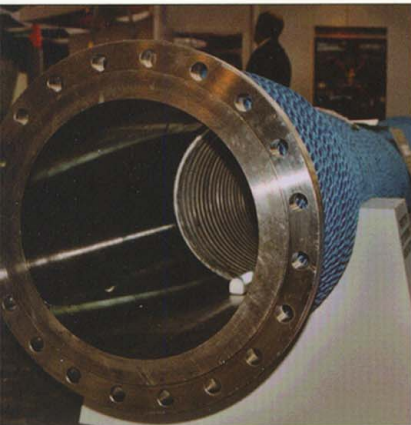
To meet the capacity demanded by a regular LNG loading application, a unique new 20 inch composite hose has been designed, developed and tested.



THE FLEXIBLE HOSE LOADING CONCEPT

- A highly robust and completely reliable system
- Easily adapted to provisional LNG shuttle tanker designs
- Maintains safety standard of current transfer methods and accommodates conventional safety systems
- A flexible hose system is not compromised by weather or environmental conditions
- Inherent long service life reduces maintenance
- Meets the required standard and is fully certified for use throughout the industry
- Comparable loading rates with those currently achieved in onshore terminals
- Highly cost competitive when compared to alternative systems.

A WEALTH OF KNOWLEDGE WORLDWIDE



Flexible hose technology has a vital role in a vast range of industrial processes.

Senior Flexonics products are renowned wherever the application demands reliable, safe operation over a long service life or in arduous conditions.

Adding value to our customers' business is at the heart of Senior Flexonics European Hose Division philosophy. Specialist skills and invaluable experience, together with an in-depth understanding of our customers' needs result in an unbeatable service at the leading edge of our industry.



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