

Oil & Marine Hoses Innovation and Safety for Oil & Gas Transfer Systems

Going the Distance Connecting the past to the future

1975

Pioneered the first OCIMF qualified nippleless hose with dual carcass called KLELINE.

1970

1990

1999

Launched REELINE the first large-diameter hose designed specifically to be reeled.

2009

Launched CRYOLINE LNG to exploit remote offshore gas fields through FLNG.

2006

Launched the first TRELLINE submarine hose that meets API Spec 17K.

2001

Developed and introduced the first hose suitable for arctic conditions.

2000

2010

2011

Introduced first GMPHOM 2009 compliant nipple hose with double carcass.

2015

Developed first TRELLINE submarine lines with a 600mm ID that are 2km long.

2016

Introduced first Seawater Suction hose specified to API Spec 17K for FLNG applications.

2017

Supplied suite of solutions to world's first floating LNG Shipto-Shore System.







KNOWLEDGE, EXPERIENCE & EXPERTISE6

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Knowledge Experience & Expertise

About Trelleborg Oil and Marine Hoses

As global operators, you want to maintain the utmost levels of safety while bringing increased flexibility to oil and gas production. Trelleborg Oil & Marine is your partner in delivering high-performing, innovative and qualified solutions to enhance overall efficiency of your assets.

We develop and manufacture the widest range of flexible bonded hose solutions for terminal and offshore oil and gas transfer applications. We offer hoses with both nipple and nippleless technologies, including single, double and dual carcass designs. Our products are applicable for use in submarine, floating or other specific configurations, and are suitable for use in even the harshest of environments.

We create solutions that are tailored to your unique requirements, using expert polymer engineering to seamlessly take your projects from concept, to manufacturing, testing, and installation.

Innovation, Research & Development

Trelleborg's innovative oil hose solutions are the culmination of 40 years' research and development at Trelleborg's renowned testing center in Clermont-Ferrand, France.

Our R&D team gets involved at the earliest possible stage of all projects, cooperating with our customers in defining the most appropriate technical solutions for the targeted application and design life.

Trelleborg's R&D team uses prototypes to undergo rigorous mechanical and chemical testing, as well as hydrodynamic analysis. The results undergo a detailed analysis to determine material behavior laws, establish ageing models for realistic service conditions, and provide a detailed assessment of performance under fatigue.

A consultative approach for customized solutions

Trelleborg understands that when it comes to selecting hoses, one size does not fit all. This is why we place vital importance on taking a consultative approach with customers to ensure the most suitable solution for each project. The following factors are all carefully analyzed:

- Fluid properties
- Standard and specific requirements
- Environmental and operational conditions
- Application and configuration
- Expected or real service life and maintenance program.





World-class manufacturing facility

Based in Clermont Ferrand, France, our manufacturing facility is the headquarters of the Fluid Handling Solutions Business Unit.

The site serves as the location for manufacturing rubber compounds, performing full-scale tests, developing new material and components, assessing ageing hoses and more.

The factory adheres to the highest international quality, safety and environment standards (ISO 9001 / ISO 14001 / API Spec. Q1). Manufacturing operations follow a strict Trelleborg Code of Conduct, and all operations are conducted under the Trelleborg Safety@Work system.

All our hoses are submitted to Factory Acceptance Tests, in accordance with international standards and project requirements. Hoses are only released if they withstand this demanding proof testing session.

Service and lifecycle optimization

Trelleborg performs on-site supervision during installation, inspection, testing for requalification and hose maintenance. This includes on-site repairs to ensure that hoses are not only performing correctly, but meeting the highest standards in safety and quality.

This can even extend to undertaking specific investigation programs. These may include inspections, tests on site or in the factory such as OCIMF and burst tests, or aging analysis such as adhesion tests or elastomer property analysis.

Trelleborg hoses' high quality, performance, durability and resistance ensure minimal maintenance, reducing lifecycle costs with a proven operational lifespan.



Hose Design

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Sec. 4

Nipple Hose Design

SEALINE

This technology consists in nipple flange (1) linked to a hose structure. It is manufactured by using binding steel wires (2) fixed on the nipple flange to block the hose body structure. The structure is made with a fluid resistant inner liner (3), textile layers carcasses (4) and a steel helix reinforcement (5). The design ensures a reliable and high resistant solution by a perfect link and adhesion between the body structure and the nipple flange.

The DOUBLE carcass (6) consists to an additional carcass above the first carcass and a leak detection system (LDS). This design prevents pollution detecting and signalling the failure of the first carcass.





Nippleless Hose Design

KLELINE - REELINE - TRELLINE SWILINE - CRYOLINE LPG - CHEMILINE

This technology consists in compact flange (1) fully embedded in rubber, achieve by a continuous inner liner (2) and integrated gasket (3). The design ensures a perfect sealing solution between conveyed product

and hose structure.

Our technology, called DUAL carcass, is made with two independent carcasses (4) of steel cable layers, which achieve two independent functions:

- Main carcass for resistance to the internal pressure
- Reinforcement carcass for the resistance to loads / stresses and to protect of the main carcass from the external environment.

Hose structure can be reinforced with individual steel rings (5) to increase the resistance and the performance.

A reinforced flange with an integrated bending stiffener (IBS) (6) and connection spool piece can be added to protect against excessive loads or bending in harsh environmental and operational conditions.

Hose in Hose

CRYOLINE LNG

Cryoline LNG is based on hose-in-hose concept that consists of a fieldproven outer rubber marine hose together with an inner LNG composite hose, both structures being separated by an annular insulation volume. (1) The inner hose is best known for its high flexibility and proven

- suitability for LNG transfer;
- (2) The annular space ensures the hose insulation, reducing BOG generation. The hose positive buoyancy is also obtained thanks to the low density of the insulation material.
- (3) Outer protective hose.
- (4) A dedicated insulated connection system enables the attachment of hose in hose in one single operation.

The Integrated Monitoring System (IMS) is embedded in the annular space, ensuring a continuous survey of temperature along the line. The IMS is proved to be a powerful and essential tool for the transfer operation survey.

Cryoline LNG hose is therefore a combination of unrivalled expertise in both composite and rubber-bonded hoses, bringing a high level of safety with the combination of double containment and Integrated Monitoring System.



Inner liner

The material selection for the inner liner of a hose is crucial. The typical function of a liner is to be compatible with the conveyed fluid, ensure the lowest possible permeation rate, exhibiting best mechanical properties and compatibility with operating temperature.

Crude oil, condensate, LPG, LNG, sulfuric acid, paraxylene, ammonia, seawater: each application is specific and requires a particular inner liner material and TRELLEBORG deploys in-house expertise to provide the best suitable compromise ensuring the highest levels of quality.



Outer cover

The outer cover is made with synthetic rubber, especially formulated to be un-sensitive and highly resistant to UV rays from the sunlight, high temperature like exposure to the flair radiation, seawater and external aggresions like abrasions during the operations.

The rubber is made in our factory, its quality and performance insure a perfect protection of the hoses during many years of service. Protection againt abrasion can be increased with additional Polyurethane (PU) layer.







Hose Selection

HOSE SELECTION	SEALINE	KLELINE	REELINE	TRELLINE
Typical floating configuration	ons			
CALM	•	۲		
TANDEM	۲	۲		
SALM	۲	۲		
REEL			۲	
Typical submarine configura	ations			
ALP		۲		
SHIP-TO-SHIP		۲		
SHIP-TO-SHORE	۲	۲		
CBM/MBM	۲	۲		
CHINESE LANTERN	۲	۲		۲
LAZY S	۲	۲		۲
STEEP S	۲	۲		۲
FLOWLINE	•			
RISER				
JUMPER				
REEL				•
DEEP WATER OIL OFFLOADING LINE				0
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CALM Configuration

Reliable Solution

Designed by Trelleborg based on 40 years of knowledge, experience and expertise and manufactured upon the highest quality standards.



Standard design enabling to be operated on new or existing offloading systems.



Prevent the oil spillage with efficient leak detection and double containment.



High strength structure with high performance and fatigue resistance.



Technical features

- For submarine or floating configurations
- GMPHOM 2009 certified
- Nipple flange with helix wire reinforcement
- Single carcass or Double carcass with leak detection system
- Optional reinforcements for end line connections and specific configurations
- High quality inner liner resistant to crude oil, refined products and condensate
- PU outer cover on demand
- Rated pressure up to 21 bar
- Diameter up to 600mm (24")
- Length up to 12.2m (40')





Kleine Premium solution for offshore oil transfer systems



Exclusive consultative approach to supply the optimum solution based on our 40 years of knowledge, experience and expertise.



High fatigue resistance with perfect distribution of loads and stresses. Perfect sealing solution without contact between the fluid and the hose structure and flange, reducing the risk of leak. Up to twice the standard service life without change out. Major OPEX savings compared to standard solutions.

Service Life

Long



Hundreds worldwide projects since 1975 bringing unrivalled field-proven experience.



Technical features

- For submarine, floating or STS (Ship-to-Ship) configurations
- GMPHOM 2009 certified
- Compact nippleless flange
- Light weight structure DUAL Carcass with steel cable layers

• Optional reinforcements with integrated bending stiffener and steel rings embedded in the body structure

- Continuous inner liner and integrated gaskets
- High quality inner liner resistant to Crude oil, refined products and condensate
- Rated pressure up to 25 bar (46 bar for small diameters)
- Diameter up to 600mm (24")
- Length up to 12.2m (40')





Reeine The most effective solution for reel systems

REEL Configuration

Safe & Reliable Solution

High fatigue resistance with perfect distribution of loads and stresses and perfect hose curvature on the drum. Perfect sealing solution without contact

between the fluid and the hose structure and flange, reducing the risk of leak.



50 worldwide projects and more than 80 strings supplied since 1999.



Cost Saving

Long Service Life

From 7 to 10 years without change out with minimized inspection and maintenance leading to OPEX savings up to 50%.



Smooth integration of a Marine Breakaway Coupling (MBC) in the submarine or floating string without risk of activation during reeling/unreeling operations.



Technical features

• For submarine or floating configurations with reel systems

- GMPHOM 2009 certified
- Compact reinforced nippleless flange with integrated bending stiffener
- Light weight structure DUAL Carcass with steel cable layers and steel rings reinforcement
- Continuous inner liner and integrated gaskets
- High quality rubber resistant to Crude oil, refined products and condensate
- Rated pressure up to 25 bar
- Diameter up to 600mm (24")
- Length up to 12.2m (40')





Custom Built Hose

Certified design methodology to create the best performant and resistant hose for your application.



Hydrodynamic analysis (static, dynamic,

extreme) and fatigue analysis to insure

the best performance in all environmen-

tal and operational conditions.



From 10 to 25 years service life without maintenance.



Thousands hoses in service with exclusive technology based on our 40 years of knowledge, experience and expertise.



Fast project execution with simplified and easy transportation in containers, installation with conventional means. Lower installation costs. Significant OPEX/CAPEX savings.



Technical features

- For high demanding submarine configurations
- API Spec 17K certified (ISO 13628-10)
- Compact nippleless reinforced flanges with integrated bending stiffener
- Reinforced structure with steel cable layers and steel rings
- Continuous inner liner and integrated gaskets
- Design pressure up to 100 bar depending on diameter
- Diameter up to 600mm (24"), smooth bore.
- Hose section length up to 12.2m (40')







Gasplication

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Exclusive consultative ap-

proach to supply the optimum

solution resulting of 40 years

of experience in marine hoses

and onshore industrial trans-

fer of LPG.



Ultra low permeation between

the liquid and the hose struc-

ture. High thermal insulation

with limited lost of tempera-

ture. High fatigue resistance

with perfect distribution of

loads and stresses.



Based on our exclusive and unrivalled nippleless technology. Solid and tangible performance with hoses still in service since 2005.



Extended operation with efficient transfer offshore solutions and at least twice service life compared to usual nipple hose with rubber liner.



Technical features

- For submarine of floating configurations
- GMPHOM 2009 certified
- Fully satisfactory to dedicated tests for LPG application
- Compact nippleless flange fully embeded in rubber
- Lightweight structure DUAL Carcass with steel cable layers and steel rings reinforcement
- Optional reinforcements with integrated bending stiffener
- Continuous inner liner and integrated gaskets
- \bullet Specific inner liner resistant to liquid gas up to minus 50 $^\circ\text{C}$ and gas

• Rated pressure up to 21 bar - Up to 100 bar depending on diameter

• Length up to 12.2m (40')



Cryoline LNG Re-think LNG Transfer

Cost Saving

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Capex and Opex savings with this Long life LNG transfer hose designed for a 5-15 year service life with Minmal maintenance costs. Minimal support infrastructure required

Improved Operability

Open up a wide range of marine LNG transfer configurations.

The Cryoline can be stored on a reel, onshore, onboard or even left floating. As a replacement for Marine Loading Arms, this safe double hose provides large flow transfers with low pressure drop. Integrated monitoring allows control room supervision



Significant reduction of engineering, construction, installation and commissioning lead time.

With courtesy of 7 Seas LNG & Power





Hose designed with combination of field proven technologies. High level of safety thanks to the combination of double containment structure and Integrated Monitoring System, preventing from risk of incident.





Technical features

- For submarine, floating or aerial configurations
- EN 1474-2 Type approved

- Dedicated hose in hose design
- Integrated monitoring system
- Operating pressure up to 20 bar
- Diameter from 150mm (6") to 500mm (20")



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The customized solution for seawater intake risers

Custom Built Hose

Certified hose design methodology to create the best performant and resistant hose for your application.

Hydrodynamic analysis (static, dynamic, extreme) and fatigue analysis to insure the best performance in all environmental and operational conditions.

Reliable Solution



Up to 30 years service life without maintenance.



Exclusive system and tools for diverless installation.



Complete solution with hypochlorite injection, hull interface, strainer and installation tools.



Technical features

- For cooling process on FPSO and FLNG
- API Spec 17K or based on our field proven KLELINE hose design
 Compact nippleless flange with integrated bending stiffener for hull connection
- Reinforced structure with steel cable layers and steel rings
- Specific continuous inner liner for extra-long durability against hypochlorite effect
- Diameter up to 1100mm (44")

Chemicals Applications





Exclusive consultative approach to supply the optimum solution based on our 40 years of knowledge, experience and expertise in fluid transfer.



Perfect sealing solution without contact between the fluid and the hose structure and flange. High compatibility with aggressive fluids. High fatigue resistance with perfect distribution of loads and stresses.



Based on Trelleborg exclusive and unrivalled nippleless technology.



Extended operation with efficient transfer solutions.



Technical features

- For all types of configurations (floating, submarine)
- GMPHOM 2009 certified
- Compact nippleless flange
- Light weight structure DUAL Carcass with steel cable layers and steel rings reinforcement
- \bullet Optional reinforcements with integrated bending stiffener
- \bullet Continuous inner liner and integrated gaskets
- Specific inner liner resistant to chemical products and aggresive fluids (acids, xylene, toluene, oil with high aromatic content)
- Rated pressure up to 21 bar
- Diameter up to 300mm (12") Up to 600mm (24") on request
- Length up to 12.2m (40')

Ancillaries



Our wide range of ancillaries provides the means to efficiently handle, store, transport, inspect, test, connect, install, operate and maintain marine hoses. We apply best practices and standards in terms of material quality, welding, non-destructive tests and coating.

- Floating Y-piece or reducer
- Body float
- Marker or Pick-up buoy
- Winker light and marker beacons
- Chain & Shackle
- Wire or synthetic rope
- Spool piece
- Camlock Coupling
- Butterfly Valve
- Gasket

- Bolting
- Caps
- Trolleys
- Lifting beam
- Manual wrench
- Torque wrench
- Test flange
- Vacuum plate
- Hydrostatic pump
- Vacuum pump

Services 8. After-Sales

Trelleborg Oil & Marine is willing to support its customers throughout project execution and is able to offer the following services:

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- On-site commissioning survey
- Inspection and tests for requalification
- Hose maintenance and inspection program
- Cleaning operation
- Bolt tensioning check
- Repair works
- Recommendations on use of lines

Trelleborg Group Leader in Polymer Solutions

Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative engineered solutions accelerate performance for customers in a sustainable way.

Trelleborg **Fluid Handling Solutions**

Trelleborg Fluid Handling Solutions is part of the business area Trelleborg Industrial Solutions. With over 1,200 employees and a head office located in Clermont-Ferrand, France, Trelleborg Fluid Handling Solutions is a leading developer, manufacturer and supplier of low and medium pressure industrial hoses, Oil & Marine hoses, rubber sheeting and matting, expansion joints and flow control solutions based on advanced polymer technology.





Solutions

Trelleborg Offshore & Construction

Trelleborg Wheel Systems

Solutions









Industrial hoses Oil & Marine hoses

Expansion joints Rubber sheeting & matting

Flow control









Trelleborg Solutions Trelleborg Offshore

Protection

www.trelleborg.com/offshore



Trelleborg Marine Systems Terminals Equipment

www.trelleborg.com/marine-systems





Trelleborg is a world leader in engineered polymer solutions that seal, damp and protect critical applications in demanding environments. Its innovative solutions accelerate performance for customers in a sustainable way.

WWW.TRELLEBORG.COM/FLUIDHANDLING

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