MAN Cryo

MAN Energy Solutions
Future in the making

Cryogenic solutions for marine and onshore applications

Future in the making

The story of MAN Cryo

MAN Cryo, formerly known as Cryo, joined MAN Energy Solutions in 2016. From our base in Gothenburg, Sweden, we have become one of the world's leading providers of cryogenic engineering solutions. We enable the storage, distribution, and handling of liquefied natural gas (LNG) and liquefied hydrogen (LH_2) at sea and on land.

With more than 60 years' experience at the service of the gas industry, including milestones such as the first LNG-fueled ship in 1999, MAN Cryo has consistently demonstrated its expertise. Our reference projects range from passenger ferries to offshore platform supply vessels, tugboats, bunker barges, and even icebreakers.

MAN Cryo engineers efficient and economical cryogenic equipment for the most demanding applications. Our systems are the perfect complement to MAN dual fuel engines. We offer holistic solutions for environmentally-friendly fuel gas supply systems (FGSS), offshore and onshore bunkering systems, liquefaction systems, regasification systems, and compression systems.

System solutions

Engineering solutions for the energy transition

As well as customized engineering solutions for ships and power plants to run on LNG, hydrogen, and LH_2, we provide all the associated services, such as design, quality assurance, project management, and commissioning. Our products are certified according to ISO 9001, ISO 14001, OHSAS 18001, and ISO 3834-2.

LH_2 gas supply system

MAN Cryo provides a class-approved fuel gas supply system that includes bunkering, LH_2 storage, vaporization, control and safety systems. The system is compatible with both fuel cells and H_2 internal combustion engines. LH_2 is seen as one of the most promising future fuel types. It is produced by wind, water or solar power plants and then used on board vessels, emitting only water and thus supporting the maritime energy transition.

LNG gas supply system

The LNG gas supply system consists of a vacuum-insulated or polyurethane-insulated storage tank, with auxiliary equipment, such as an LNG vaporizer, a pump, and a bunker station. The purpose of the system is to fill, store, and vaporize LNG and LBG, and to supply natural gas to engines on a ship, at the correct temperature, quantity, and pressure. The system is designed for minimum heat loss through leakage to guarantee the maximum holding time. The gas is fed to low pressure or high pressure gas consumers.

Power plants

MAN gas-powered, four-stroke engines are now H_2-ready and can be operated in stationary mode with a hydrogen content of up to 25 % by volume in a gas/fuel mix. This means that, in combination with our modular skid-mounted supply and storage solutions, we can provide gas supply and storage solutions for any type of consumer. Our services include engineering, project management, and commissioning.

Onshore and offshore bunkering systems

With an onshore bunkering system, LNG is transferred to the end customer at the quay, pontoon, or jetty. We offer customized bunkering solutions depending on the application, required transfer rate, and volume.

Onshore liquefied gas applications

We offer complete regasification systems for LNG and LBG with the capability for import, storage, regasification, and supply of gas to consumers. The design is modular and scalable.

Onshore hydrogen applications

Our LH_2 offering includes hydrogen generation from renewable sources with electrolyzers from H-TEC SYSTEMS, compressors for high pressure storage, liquefaction systems, cryogenic storage, LH_2 pump solutions for transfer and supply, and LH_2 ISO container solutions.

Cryogenic solutions

Efficient and economical equipment for the most demanding applications

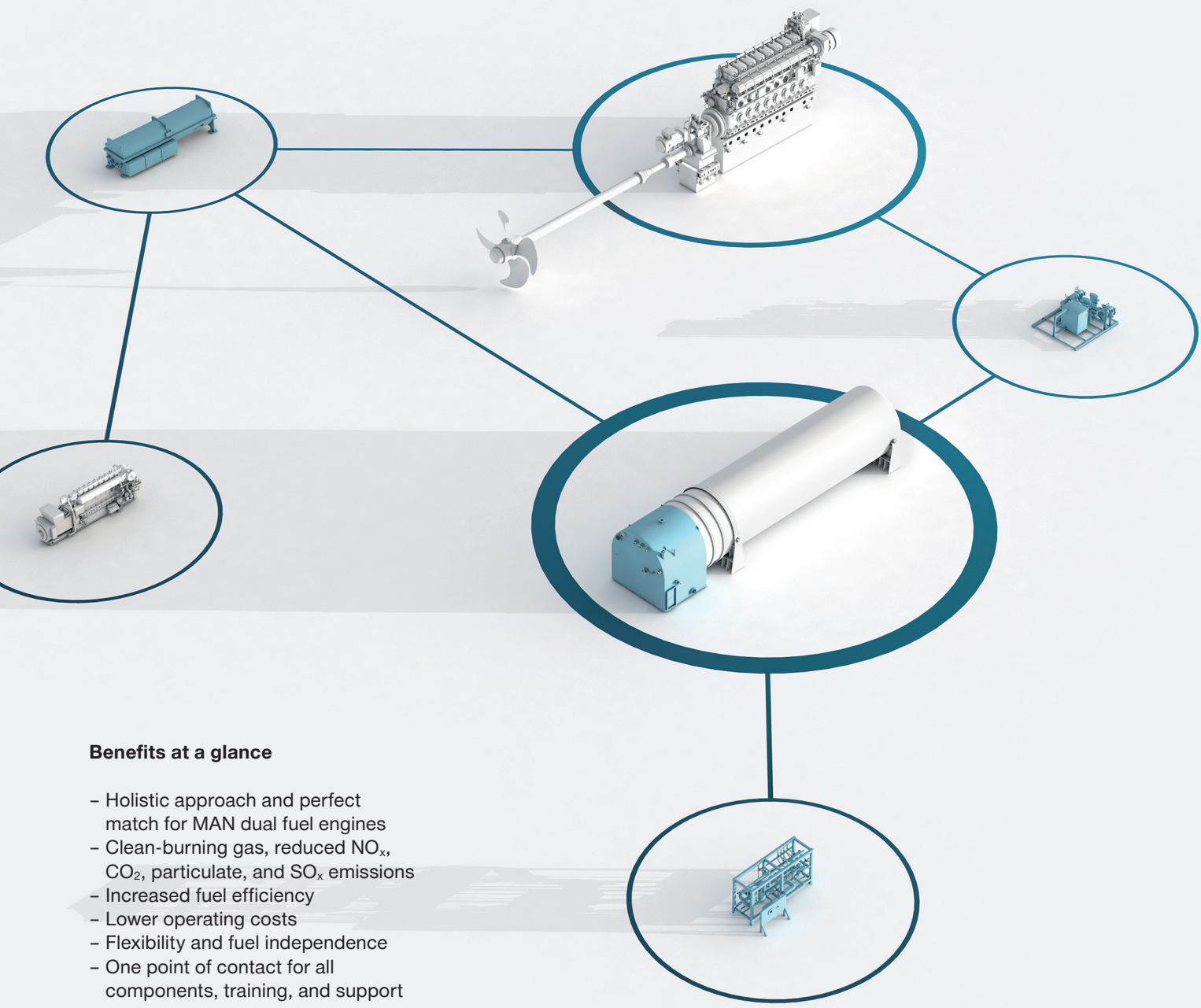
Among its many achievements, MAN Cryo can count the first LNG bunkering vessel in the world and the first LNG terminals in Sweden. Together with MAN's engine and GenSet expertise, we can offer a holistic solution for an extensive range of engines and FGSS.

Fuel gas supply systems

Combining MAN dual fuel engines with our FGSS allows natural gas to be used efficiently. Seamless switchover from gas to diesel operation and vice versa ensures full flexibility in terms of costs and emissions.

As MAN Energy Solutions supplies both the engines and the complete FGSS design, we can work with ship and power plant designers to perfectly integrate comprehensive propulsion solutions, including automation systems for both four-stroke and two-stroke engines.

MAN Cryo has developed a FGSS for liquid hydrogen (LH_2). The design is risk-based, as there are no existing regulations for hydrogen as a marine fuel, but it has been reviewed and approved by several classification societies.



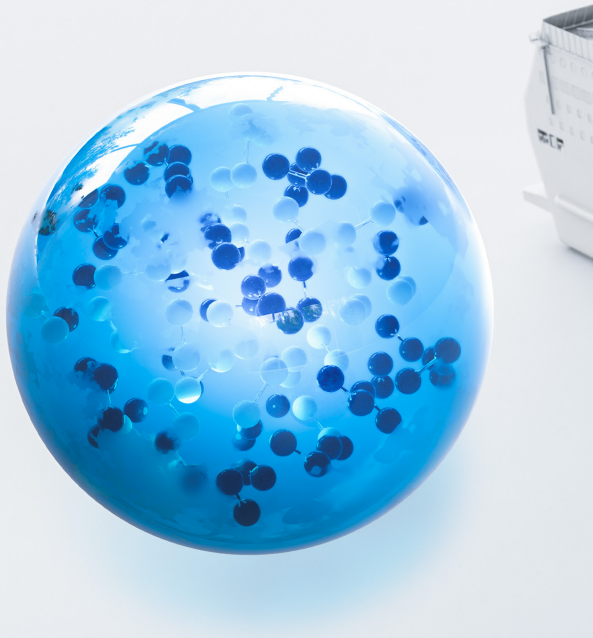
Benefits at a glance

- Holistic approach and perfect match for MAN dual fuel engines
- Clean-burning gas, reduced NO_x, CO_2, particulate, and SO_x emissions
- Increased fuel efficiency
- Lower operating costs
- Flexibility and fuel independence
- One point of contact for all components, training, and support

Suitable engineering applications

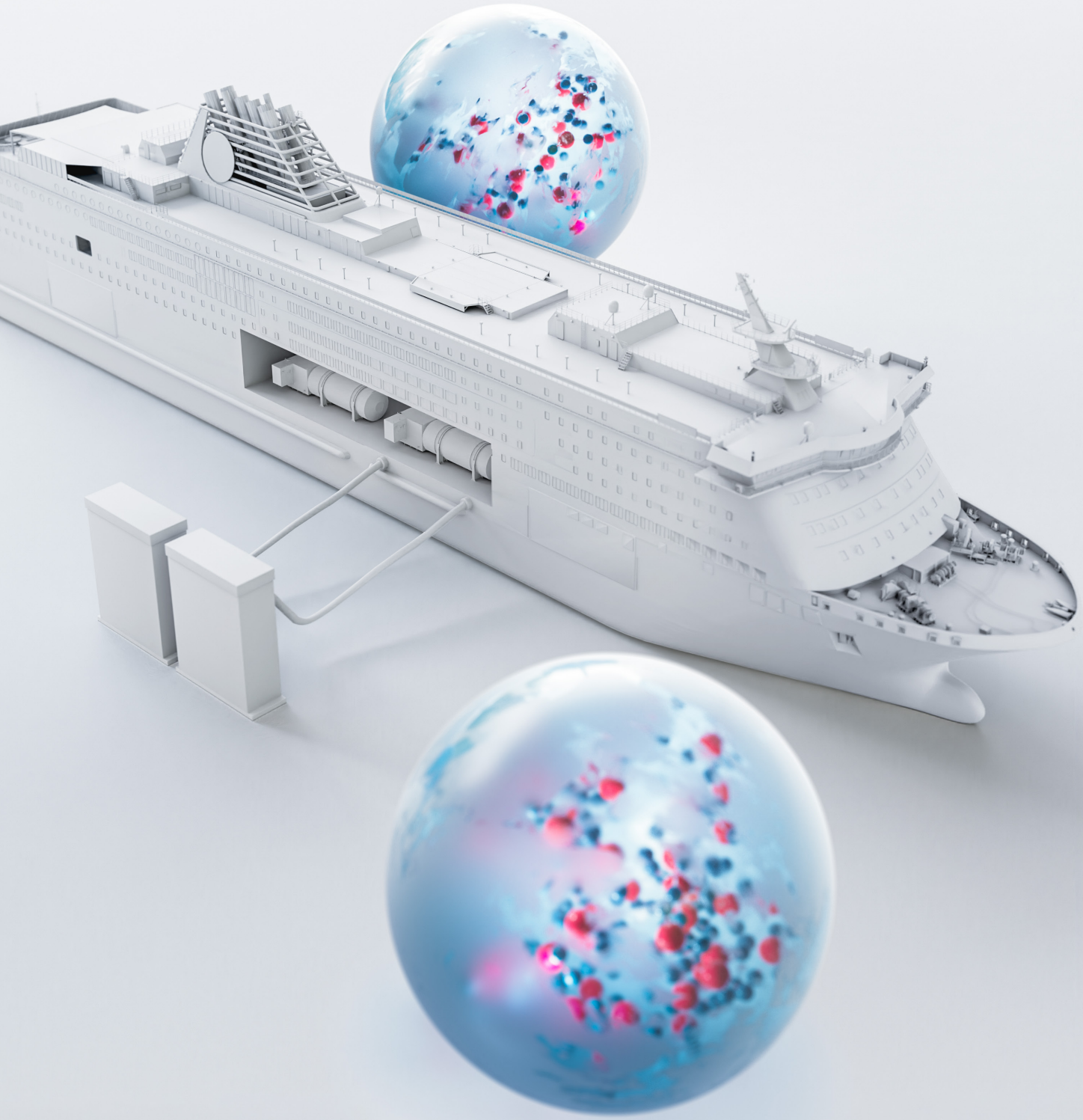
- Liquid hydrogen
- Four-stroke marine
- Two-stroke marine
- Power plants

Fig. 1
Low pressure fuel gas supply system (LP FGSS) based on LNG supply and bunkering systems



Boosting marine applications

Cutting-edge innovations in cryogenic engineering



MAN Cryo supports the maritime energy transition and decarbonization with a range applications for different future fuel types such as liquid hydrogen or methane.

Liquid hydrogen applications

LH_2 FGSS for zero-emission vessels

With a liquid hydrogen FGSS, you can run a zero-emission vessel, since no CO_2 is generated when using hydrogen in either fuel cells or internal combustion engines. In MAN Cryo, you have an engineering partner for bunkering, storage, and regasification.

Certified system

Our liquid hydrogen system has obtained the necessary certification of seaworthiness, and our fail-safe designs are based on the results of risk assessments. As there are no current IMO standards or regulations for LH_2 FGSS, the approval was obtained by analyzing risks together with the classification societies.

The system usually includes:

- Bunker stations
- LH_2 storage tank
- Tank connection space (TCS)
- Vaporizer
- Glycol water system
- Control and safety system
- Nitrogen generator for inert gas

Bunker stations

LH_2 is transported to the storage tank from a truck, bunker terminal, or bunker ship via the bunker station on the ship side. The bunker station is connected to the TCS on the tank via bunker pipes.

Vacuum-insulated C-type tank

The cryogenic LH_2 tank consists of two tanks: The inner vessel, which contains the liquid hydrogen, and the outer vessel, which is regarded as a secondary barrier. The annular space between the inner and outer vessels is vacuum-insulated.

Tank connection space (TCS)

This includes equipment such as the product vaporizer and pressure build-up vaporizer, valves, and instruments for controlling the LH_2 tank and process.

Hydrogen vaporization

LH_2 is evaporated by the dedicated product vaporizer, which can be glycol-heated or water-heated, and supplied to the engine or fuel cell as gas. LH_2 supply to the vaporizer is ensured by the internal pressure of the storage tank. The pressure build-up unit (PBU) guarantees a constant pressure level.

Control and safety system

The LH_2 system is governed by a standalone control system including an operator panel (OP) installed in a cabinet. The control system receives signals from instruments and performs the necessary activities depending on which mode of operation is chosen.

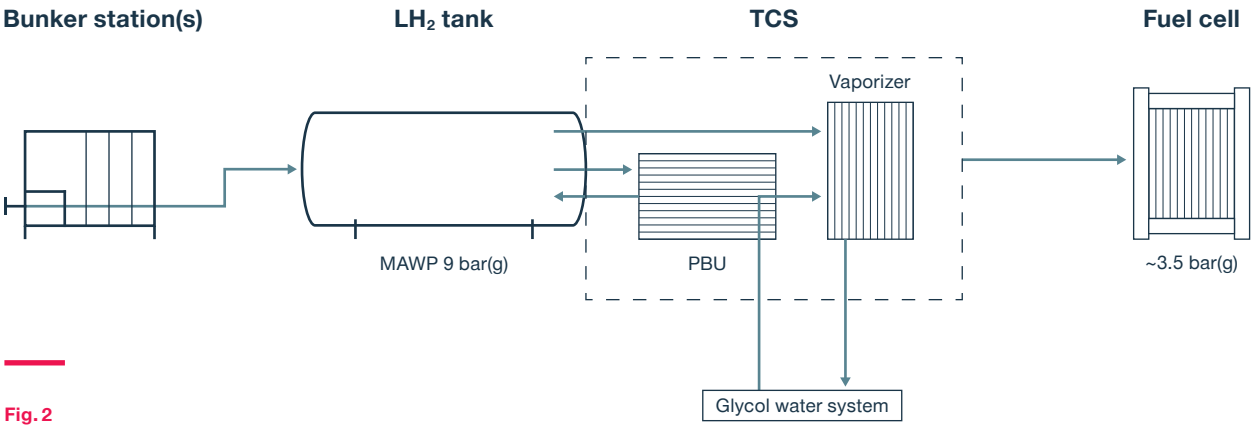


Fig. 2
LH_2 FGSS with PBU

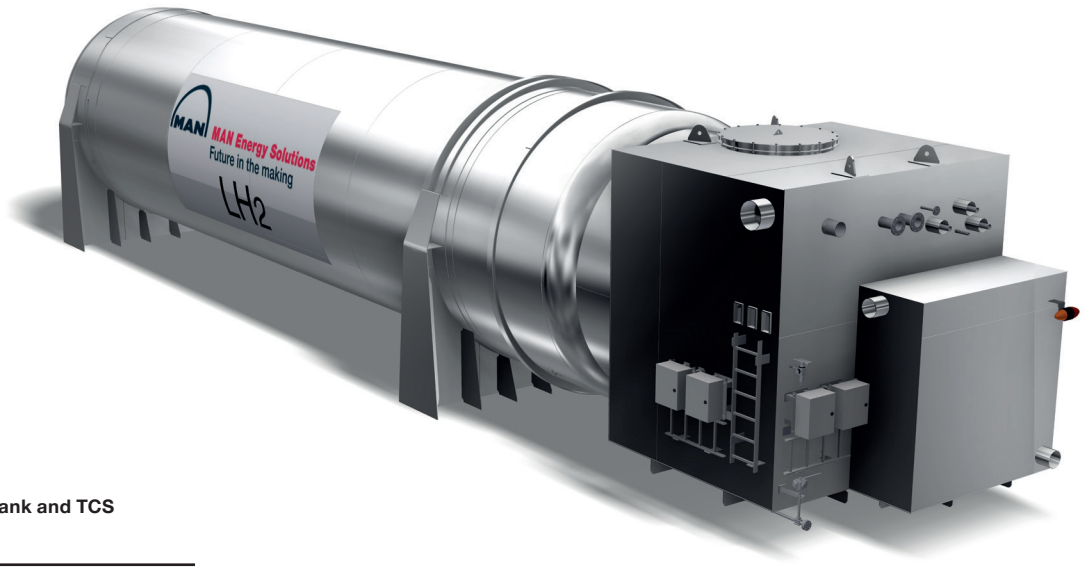


Fig. 3
LH_2 storage tank and TCS

Four-stroke marine applications

Low pressure and high pressure LNG FGSS

MAN Cryo developed the very first FGSS more than 20 years ago. Since then, we have worked with all major classification societies and gathered valuable experience. Our designs now ensure the highest levels of automated system functionality.

Tank pressure and pumps

Gas can be fed to the engines using the tank pressure or with a pump. A low pressure tank (below 6 bar) needs a pump. This generally reduces the weight of the tank and can be more effective for large systems. A high pressure tank (e.g. 9 bar) with a PBU does not require a pump. The advantages include improved reliability and lower maintenance costs, because there is no rotating equipment.

The system usually includes:

- One or more LNG fuel tanks
- Water-heated vaporizer units converting LNG into gas
- PBU units for increasing the tank pressure
- Pumps
- Bunker stations
- Control and safety system
- Piping for bunkering LNG and gas feed lines for supplying natural gas to the engines
- Nitrogen generator for inert gas
- Gas detection system
- Glycol water system

Bunkering LNG in storage tanks

LNG is transported to the storage tanks from a truck, bunker terminal or bunker ship via the bunker station on the ship side. The bunker station is connected to the TCS via bunker pipes.

Vacuum-insulated C-type tank

The cryogenic LNG tank consists of an inner vessel, which contains the liquid LNG, and an outer vessel, which is regarded as a secondary barrier. The annular space between the inner and outer vessels, which is filled with perlite, is vacuum-evacuated. The tank is designed to prevent sloshing when operating in rough conditions and to ensure the maximum holding time.

Tank connection space (TCS)

The TCS includes equipment such as product vaporizers, and pressure build-up vaporizers, valves, and instrument valves for controlling the LNG tank.

LNG vaporization

In order to supply gas to the engines, LNG is evaporated by the dedicated water-heated product vaporizer. The vaporizer unit can deliver gas to engines at the required power and temperature of approximately 10 – 40 °C. The LNG is supplied to the vaporizers by a cryogenic pump or by tank pressure. The PBU guarantees a constant pressure level. We use only the highest quality vaporizers in accordance with European standards.

Control and safety system

The LNG system is governed by a standalone control system including an OP installed in a cabinet. The control system receives signals from instruments and performs the necessary activities depending on which mode of operation is chosen.

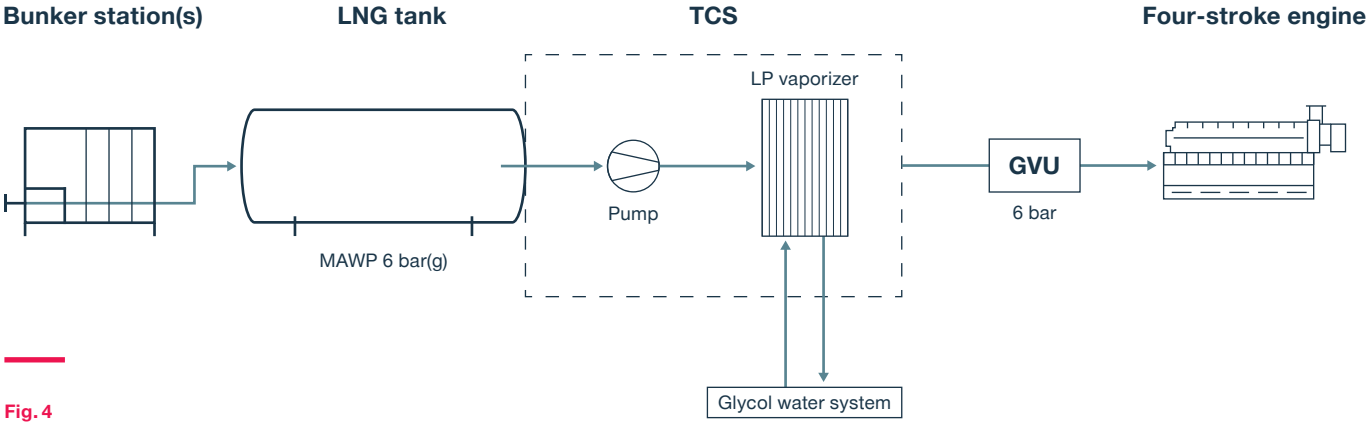


Fig. 4
Four-stroke FGSS with LNG pump

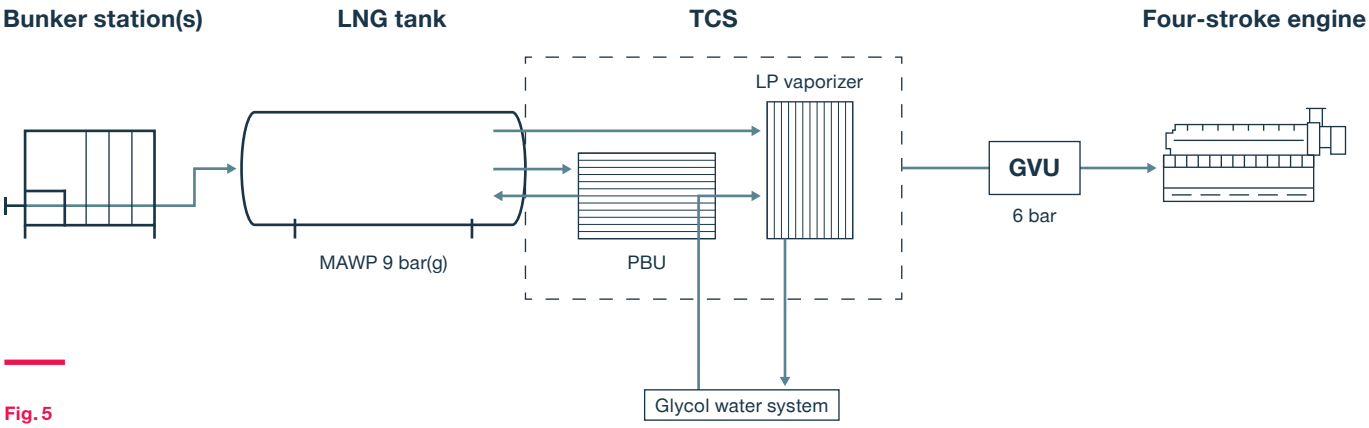


Fig. 5
Four-stroke FGSS with PBU

Two-stroke marine applications

High pressure LNG FGSS

MAN Cryo works with selected partners to provide a complete LNG fuel gas system for MAN B&W ME-GI two-stroke engines. Our systems have been proven in many different types of vessel.

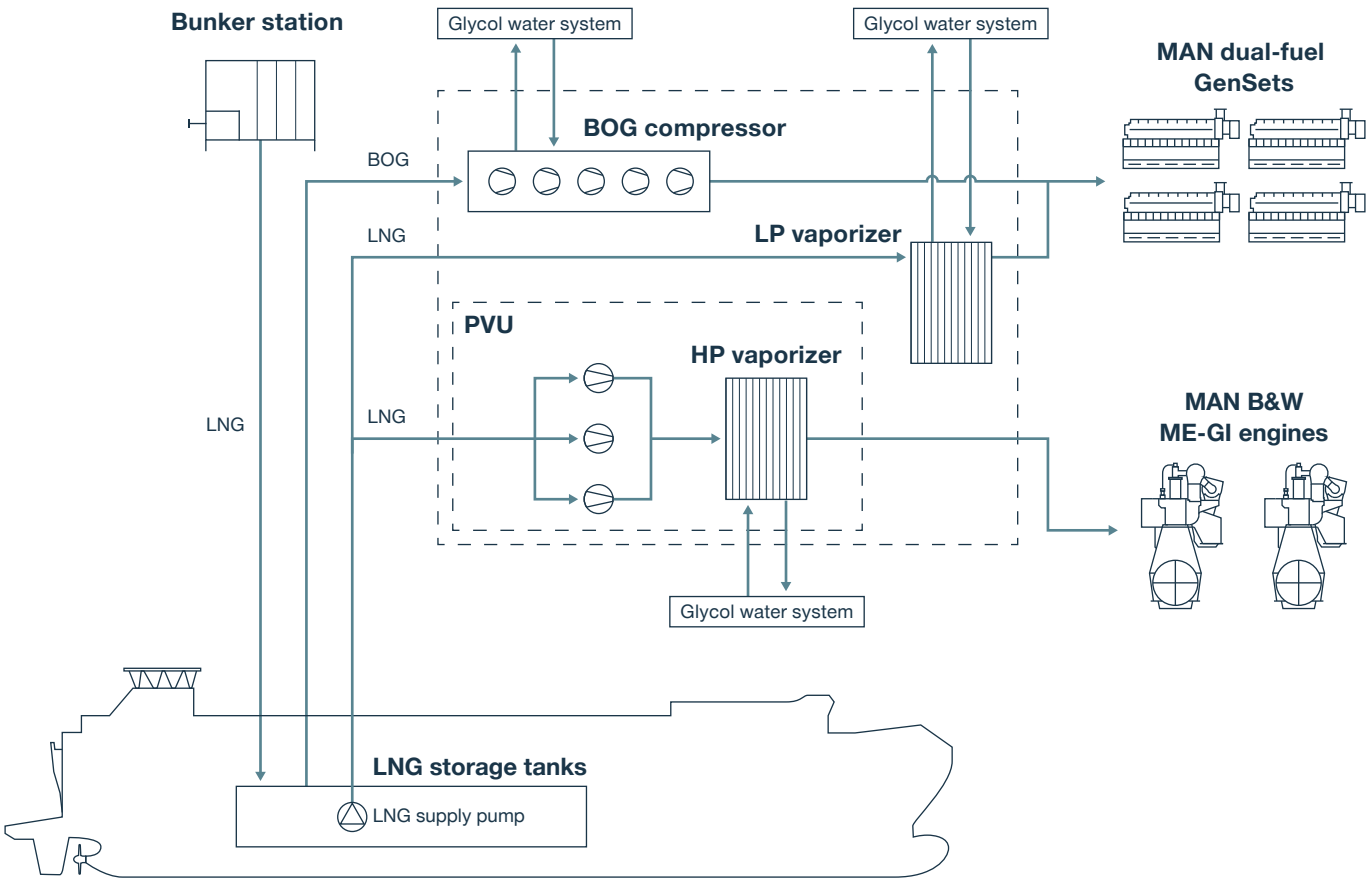


Fig. 6
Example of two-stroke FGSS with pump vaporizer unit, for car carrier application

Fig. 7
Two-stroke dual-fuel MAN B&W ME-GI

FGSS for two-stroke engines

Our solutions include C-type tanks, boil-off gas (BOG) handling systems and compressors, glycol water handling systems, and LNG bunkering. The pump vaporizer unit is designed in-house.

The system usually includes:

- LNG storage tank
- Pump vaporizer unit (PVU)
- Pumps
- Bunker stations
- Control and safety system
- BOG handling system
- Gas detection system
- Inert gas system
- Glycol water system

LNG storage tank

We provide process engineering for a wide range of tank solutions, specifically designed for each project, depending on the ship design and the required storage capacity.

The basic design types are:

- Vacuum-insulated C-type tank
- Polyurethane-insulated C-type tank
- Membrane tank

Each tank design has its own benefits, and we will support you with selecting the best fit for each individual project.

Pump vaporizer unit (PVU)

The MAN PVU supplies LNG at the pressure and temperature required by the MAN B&W ME-GI engine. The PVU receives LNG from a cryogenic centrifugal pump, and subsequently the high pressure (HP) reciprocating pump pressurizes the LNG. The HP pump shown in Fig. 6 has three cylinders actuated by linear hydraulic pistons. The pressurized LNG flows through a compact printed circuit heat exchanger in which it is heated by warm glycol water. An HP filter catches fine particles present in the gas before the gas is directed toward the GVT and the engines.

Pumps

Centrifugal pumps are used to transfer LNG to the customer or consumer. The pump can be placed either directly into the storage tank, submerged into the LNG, or in an insulated container outside of the tank.

Bunker stations

Bunker stations include a fixed valve and piping skid to receive LNG from the shore side or the bunkering ship, and to route the LNG to the storage tank. Bunker stations are standardized regardless of what tank type is selected. All necessary communication links, gas-tight couplings, and monitors can be selected as options.

Control and safety system

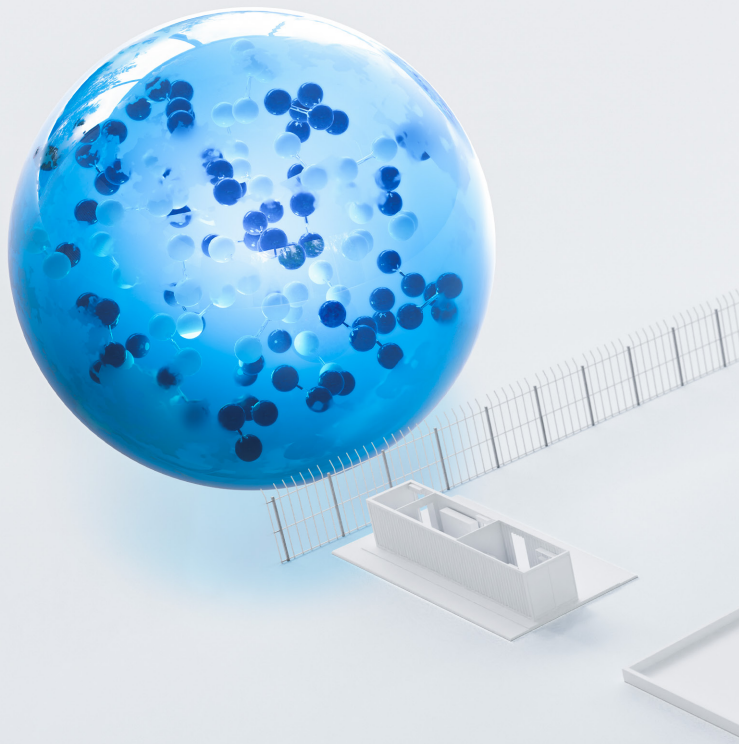
The LNG system is governed by a standalone control system. It includes a PLC and an OP installed in a cabinet. The control system receives signals from instruments and performs the necessary activities depending on which mode of operation is chosen.

Marine references

Accomplishments in shipping

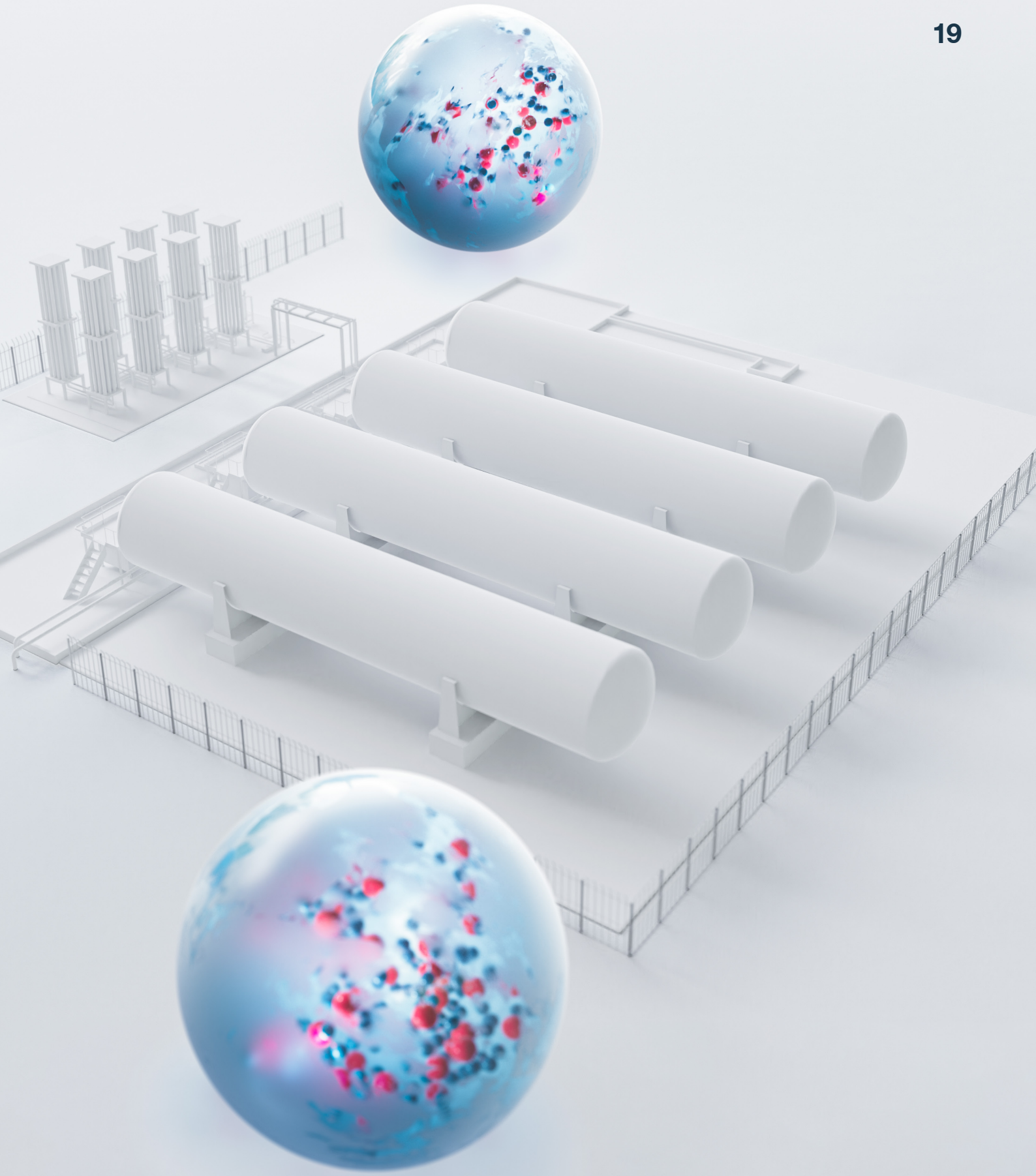
Shipowner	Shipyard	Volume	Classification society	Ship type	Ship name	Remark
MRF	Langsten Slip & Båtbyggeri	30 m³	DNV	Car pax ferry	Gluttra	-
Møkster Shipping	Kleven Verft AS	234 m³	DNV	PSV	Stril Pioneer	-
Eidesvik Offshore	Kleven Verft AS	234 m³	DNV	PSV	Viking Energy	-
Fjord1	Søviknes Verft	2 x 125 m³	DNV	Car pax ferry	Bergensfjord	-
Fjord1	Søviknes Verft	2 x 125 m³	DNV	Car pax ferry	Stavangerfjord	-
Fjord1	Brattvaag Verft	2 x 125 m³	DNV	Car pax ferry	Fanafjord	-
Fjord1	Brattvaag Verft	2 x 125 m³	DNV	Car pax ferry	Raunefjord	-
Fjord1	Søviknes Verft	2 x 125 m³	DNV	Car pax ferry	Mastrafjord	-
Eidesvik Offshore	Westcon NO, West Contractors AS	234 m³	DNV	PSV	Viking Queen	-
Eidesvik Offshore	Westcon NO, West Contractors AS	234 m³	DNV	PSV	Viking Lady	-
Remøy Management/ Kystvakt	Myklebust NO, Myklebust Verft AS	234 m³	DNV	Patrol vessel	Barents Hav	-
Remøy Management/ Kystvakt	Myklebust NO, Myklebust Verft AS	234 m³	DNV	Patrol vessel	Sortland	-
Remøy Management/ Kystvakt	Myklebust NO, Myklebust Verft AS	234 m³	DNV	Patrol vessel	Bergen	-
MRF	Molde/Remontowa	2 x 125 m³	DNV	Car pax ferry	Moldefjord	-
MRF	Molde/Remontowa	2 x 125 m³	DNV	Car pax ferry	Fannefjord	-
MRF	Molde/Remontowa	2 x 125 m³	DNV	Car pax ferry	Romsdalsfjord	-
MRF	Molde/Remontowa	2 x 25 m³	DNV	Car pax ferry	Korsfjord	-
Tide Sjø	Aker Yards Lorient	29 m³	DNV	Car pax ferry	Tidekongen	-
Tide Sjø	Aker Yards Lorient	29 m³	DNV	Car pax ferry	Tidedronningen	-
Tide Sjø	Aker Yards Lorient	29 m³	DNV	Car pax ferry	Tideprinsen	-
DOF	STX Søvik (Aker Yards)	201 m³	DNV	PSV	Skandi Gamma	-
FosenNamsos Sjø	Fiskerstrand BLRT AS	2 x 125 m³	DNV	Car pax ferry	Selbjörnsfjord	-
Fjord1	Fiskerstrand BLRT AS	2 x 125 m³	DNV	Car pax ferry	Boknafjord	-
Eidesvik Offshore	Kleven Verft Ulsteinvik	234 m³	DNV	PSV	Viking Prince	-
Eidesvik Offshore	Kleven Verft Ulsteinvik	234 m³	DNV	PSV	Viking Princess	-
Olympic Shipping	STX Aukra	201 m³	DNV	PSV	Olympic Energy	-
Rem Offshore	Kleven Verft Ulsteinvik	234 m³	DNV	PSV	Rem Leader	-
Island Offshore	STX Brevik	2 x 115 m³	DNV	PSV	Island Crusader	-
Island Offshore	STX Brevik	2 x 115 m³	DNV	PSV	Island Contender	-
Solstad Offshore	STX Langsten	201 m³	DNV	PSV	Normand Arctic	-
Buksér og Berging	Sanmar	86 m³	DNV	Tug	Borgøy	Vertical tanks
Buksér og Berging	Sanmar	86 m³	DNV	Tug	Bokn	Vertical tanks
Eidsvaag AS	Aukra	115 m³	DNV	Fish feed carrier	Eidsvaag Pioner	-
AGA/Sirius	Fiskerstrand	187 m³	DNV/PED	Bunker vessel	Seagas	-
Finnish Border Guard	STX Rauma	230 m³	GL	Patrol vessel	ULV 10 Turva	Vertical tanks
Simon Møkster Shipping	Vard Aukra	201 m³	DNV	PSV	Stril Barents	-
Finnish Transport Agency	Arctech	2 x 400 m³	LR	Icebreaker	Polaris	Vertical tanks
Tallink	Meyer Turku	2 x 300 m³	BV	Car pax ferry	Megastar	-
SeaRoad	Flensburger Schiffbau	-	DNV	RoRo cargo	Searoad Mersey II	Trailer-based tanks
Caronte & Tourist	Sefine	150 m³	RINA	Car pax ferry	ELIO	-
Torghatten	Vard	175 m³	DNV GL	Car pax ferry	Flatöy	-
Torghatten	Tersan	175 m³	DNV GL	Car pax ferry	Huftaröy	-

Shipowner	Shipyard	Volume	Classification society	Ship type	Ship name	Remark
Torghatten	Vard	175 m^3	DNV GL	Car pax ferry	Lysöy	-
Torghatten	Tersan	175 m^3	DNV GL	Car pax ferry	Samnöy	-
Torghatten	Tersan	175 m^3	DNV GL	Car pax ferry	Faeröy	-
Liegruppen	Cemre	352 m^3	DNV GL	Fishing vessel	Libas	-
Nordlaks	Tersan	2 x 143 m^3	DNV GL	Live fish carrier	-	Vertical tanks
Nordlaks	Tersan	2 x 143 m^3	DNV GL	Live fish carrier	-	Vertical tanks
Seaspan	Damen	209 m^3	BV	RoRo cargo	Seaspan Trader	-
Seaspan	Damen	209 m^3	BV	RoRo cargo	Seaspan Transporter	-
TT-Line	Jinling	2 x 500 m^3	DNV GL	Ropax	Nils Holgersson	-
TT-Line	Jinling	2 x 500 m^3	DNV GL	Ropax	Peter Pan	-
Ulvan	Tersan	364 m^3	DNV GL	Multipurpose	Oddrun With	Vertical tanks
Hapag-Lloyd	HRDD	6	DNV GL	Container vessel	Sajir	Retrofit, membrane tank from GTT
Wallenius SOL	CIMC Raffles	2 x 685 m^3	LR	RoRo cargo	Baltic Enabler	-
Wallenius SOL	CIMC Raffles	2 x 685 m^3	LR	RoRo cargo	Bothnia Enabler	-
Not disclosed	Not disclosed	-	LR	Not disclosed	-	LH_2 FGSS
Not disclosed	Royal IHC	-	-	Not disclosed	-	Pre-study LH_2 propulsion
MAN PrimeServ	Not disclosed	-	-	Not disclosed	-	Manufacturing of 8 pcs of PVU 8000
MAN PrimeServ	Not disclosed	-	-	Not disclosed	-	Manufacturing of 6 pcs of PVU 4000
Frontline	GSI	2 x 1,675 m^3	DNV	PCTC	Wolfsburg	-
Frontline	GSI	2 x 1,675 m^3	DNV	PCTC	Emden	-
Frontline	GSI	2 x 1,675 m^3	DNV	PCTC	-	-
Frontline	GSI	2 x 1,675 m^3	DNV	PCTC	-	-
Wallenius	CIMC Raffles	1 x 2,300 m^3	DNV	PCC	-	-
Wallenius	CIMC Raffles	1 x 2,300 m^3	DNV	PCC	-	-
Heerema	-	-	DNV-GL	-	Sleipnir	CCS subsystem for liquefaction. Based on heat transfer from LNG to CO_2



Transforming onshore applications

Proven expertise in cryogenic engineering



MAN Cryo offers all cryogenic solutions needed for power plant and industrial applications. They are modular and scalable to cover outputs from 10 MW to 200 MW.

Power plant and industrial applications

Complete modular designs with regasification systems

Our LNG power plant solutions are standardized but scalable, and cover outputs from 10 MW to 200 MW. We provide extended equipment supply and electrical control, including process design, control and ESD systems, installation verification, and commissioning.

Cryogenic equipment for power generation

MAN Cryo equipment allows you to import and store LNG at the power plant, vaporize LNG into gaseous phase, control gas supply pressure and temperature. Our regasification systems are modular, cost-effective, highly automated and prepared for remote operation.

The system usually includes:

- LNG import
- Pumps
- LNG storage tank
- LNG vaporizer
- Control and safety system

LNG import

The unloading station is used to import LNG from trailer, container or ship to the storage tank. Two hoses are connected to the truck; one for liquid and one for gas. An LNG pump can be part of the unloading station.

Transfer pumps

Pumps are used to transfer LNG to the customer or consumer. The pump can be placed submerged in the storage tank or in an insulated container outside of the storage tank.

LNG storage tank

We offer a wide range of tank solutions, including vacuum-insulated tanks, polyurethane-insulated tanks, and flat-bottom tanks. Each tank design has its own benefits, and we will support you with selecting the best fit for each individual project.

LNG vaporizer

LNG vaporization can be based on engine cooling water or ambient air heating. Using cooling water from engines is optimal with regards to cost, footprint and reduced need for other engine cooling systems. If use of engine cooling water is not possible, ambient air heated vaporizers combined with electrical trim heaters can be used.

Control and safety system

The LNG system is governed by a standalone control system. It includes a PLC and an OP installed in a cabinet. The control and safety system receives signals from instruments and performs the necessary activities depending on which mode of operation is chosen.

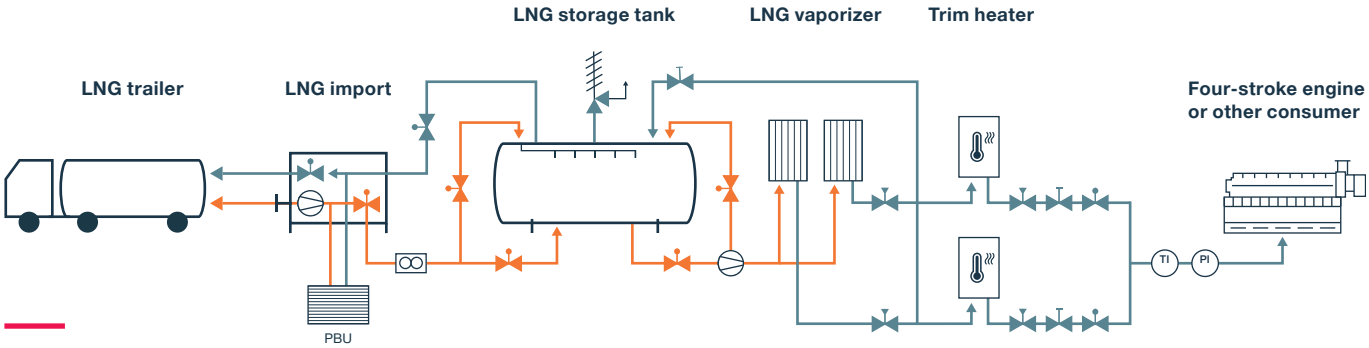


Fig. 8
Process flow diagram with vaporizers heated by ambient air

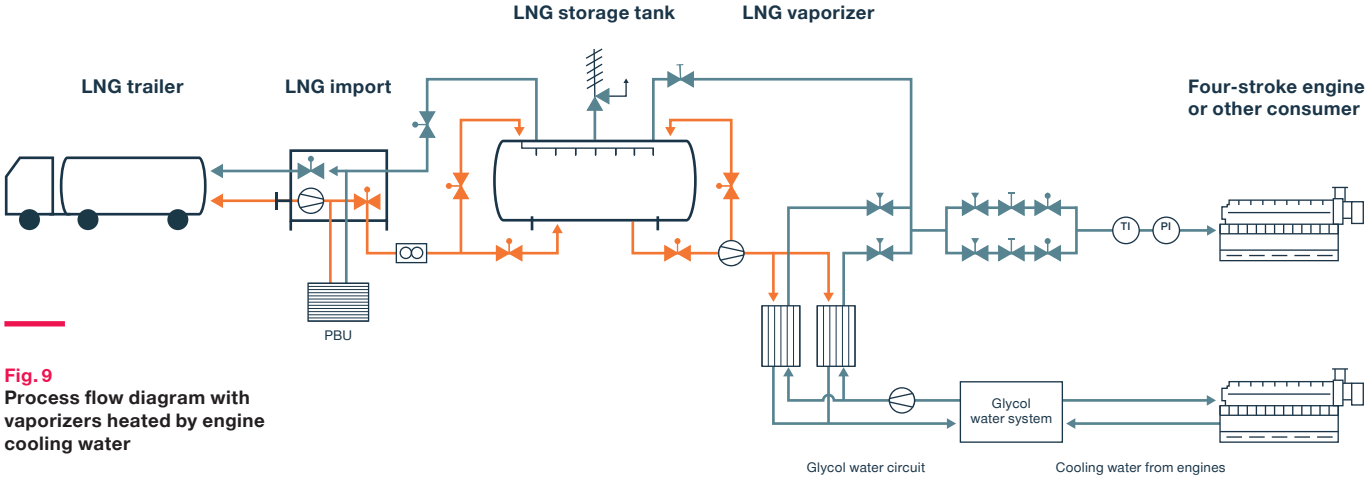


Fig. 9
Process flow diagram with vaporizers heated by engine cooling water

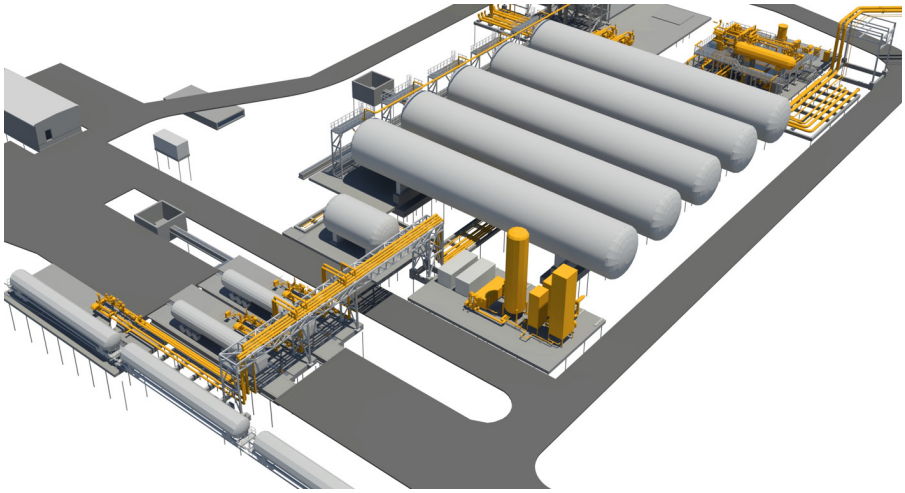


Fig. 10
Import stations and LNG storage tanks

Onshore references

Success stories on land

Client	Country	Storage volume	Plant type	Contract	Year	Remark
Scottish Gas	Scotland	-	Equipment	Equipment	1985	-
Dresser-Rand	Norway	108 m³	Regasification	EPC	1996	Gas turbine test
TLF	Norway	250 m³	Trailer loading	EPC	1997	Located close to air separation plant
AGA Gas	Norway	50 m³	Regasification	EPC	1998	Gas turbine test, mobile unit
Wärtsilä	Finland	50 m³	Regasification	EPC	1998	Extension of existing plant
TVL	Sweden	50 m³	Regasification	EPC	1999	LNG backup for biogas plant
TLF	Norway	250 m³	Trailer loading	EPC	2000	Extension of existing plant
Alstom	Sweden	100 m³	Regasification	EPC	2000	Rebuilt in 2010 with increased capacity
Kungsängsverket	Sweden	50 m³	Regasification	EPC	2001	Backup
Linde Engineering	Norway	1,000 m³	Bunkering/trailer loading	EPC	2003	Storage at liquefaction plant
Linde Engineering	Norway	4 x 175 m³	Regasification	Equipment	2003	LIN backup system at the LNG reliquefaction plant at Melkøya, Statoil plant
YIT	Sweden	50 m³	Regasification	EPC	2004	Backup for biogas
Naturgass Vest	Norway	450 m³	Bunkering	EPC	2004	First ship bunkering
Naturgass Vest	Norway	2 x 250 m³	Regasification	EPC	2004	NG for local heating
Naturgass Vest	Norway	60 m³	Regasification	EPC	2004	NG for local heating
Naturgass Vest	Norway	250 m³	Regasification	EPC	2004	NG for local heating
AGA Gas	Norway	120 m³	Regasification	EPC	2005	Local heating
Stockholm Vatten	Sweden	2 x 50 m³	Regasification/backup	EPC	2006	Backup for biogas
Statoil	Norway	-	Basic engineering	Basic eng.	2007	-
BEWI	Norway	120 m³	Regasification/backup	EPC	2008	-
Gässlösa	Sweden	58 m³	Regasification/backup	EPC	2008	Back up for biogas
Borlänge	Sweden	58 m³	Regasification	EPC	2008	-
AGA Gas	Sweden	108 m³	Equipment	Equipment	2008	Tank for LNG installation
AGA Gas	Sweden	27 m³	Equipment	Equipment	2008	Tank for LNG installation
AGA Gas	Sweden	30 m³	Equipment	EPC	2009	Gas turbine test
Wärtsilä	Finland	22 m³	Regasification	EPC	2009	Engine test
AGA Gas	Sweden	61 m³	Equipment	Equipment	2009	Tank for LNG installation
AGA Gas	Sweden	61 m³	Equipment	Equipment	2009	Tank for LNG installation
AGA Gas	Sweden	61 m³	Equipment	Equipment	2009	Tank for LNG installation
Statoil	Norway	250 m³	Trailer loading	EPC	2009	At Melkøya
Siemens	Sweden	250 m³	Regasification	EPC	2010	Gas turbine test
FordonsGas	Sweden	60 m³	Regasification/fueling	EPC	2010	First truck fueling with LNG
Göteborg Energi	Sweden	125 m³	Trailer loading	EPC	2010	LBG liquefaction (by AL) storage and eq. installation by Cryo
AGA Gas	Sweden	40 m³	Equipment	Equipment	2010	Tank for LNG installation
AGA Gas	Sweden	40 m³	Equipment	Equipment	2010	Tank for LNG installation
Jönköping Energi	Sweden	72 m³	LCNG fueling	EPC	2011	CNG filling of buses
Upplands Lokaltrafik	Sweden	2 x 71 m³	LCNG fueling	EPC	2011	CNG filling of buses, LNG filling
FordonsGas	Sweden	72 m³	Regasification	EPC	2011	Backup for CNG filling of buses
AGA Gas	Sweden	27 m³	Equipment	Equipment	2011	Tank for LNG installation
AGA Gas	Sweden	40 m³	Equipment	Equipment	2011	Tank for LNG installation
Eskilstuna Energi och Miljö	Sweden	108 m³	Regasification/fueling	EPC	2012	CNG filling
Studsvik Nuclear AB	Sweden	61 m³	Regasification	EPC	2012	Local heating
AGA Gas	Sweden	-	Equipment	EPC	2012	Subcooling of recondensed NG
FordonsGas	Sweden	61 m³	Regasification/fueling	EPC	2013	CNG and LNG filling

Client	Country	Storage volume	Plant type	Contract	Year	Remark
AGA Gas	Sweden	250 m^3	Regasification	EPC	2013	Local heating
Bomin Linde	Germany	-	Ship & trailer bunkering	Engineering	2013	Ship and trailer bunkering
Bomin Linde	Germany	-	Ship & trailer bunkering	Engineering	2013	Ship and trailer bunkering
Bomin Linde	Germany	-	Ship & trailer bunkering	Engineering	2013	Ship and trailer bunkering
AGA Gas	Sweden	2 x 250 m^3	Regasification/backup	EPC	2014	Supply to local gas grid
Volvo Trucks	Sweden	0.6 m^3	LCNG fueling	EPC	2014	Test equipment for LNG filling of trucks
Öresundskraft	Sweden	84 m^3	LCNG fueling	EPC	2014	LNG filling of trucks
LKAB	Sweden	150 m^3	Regasification	EPC	2014	NG supply to steel mill
Bomin Linde	Germany	500 m^3	Ship & trailer bunkering	Engineering	2014	Ship and trailer bunkering
Processkontroll	Sweden	12 m^3	Equipment	Equipment	2015	Development
Skangass	Sweden	-	Ship bunkering	EPC	2017	Extension of existing plant with bunkering system
Swedegas	Sweden	-	Ship bunkering	EPC	2017	New installation for LNG bunkering in Gothenburg harbor
AGA Gas	Sweden	-	Ship bunkering	Engineering	2017	Basic design for extension of existing plant with bunkering system
Siemens	Sweden	-	Equipment	Equipment	2018	Additional vaporizer for the existing plant
Forchem	Finland	200 m^3	Regasification	EPC	2018	LNG storage and vaporization plant
MAN PrimeServ	Denmark	-	Test rig for marine equipment	Engineering	2018	Pre-study process evaluation
MAN PrimeServ	Denmark	-	Test rig for marine equipment	EPC	2018	New installation at MAN Cryo in Gothenburg
Terna	Greece	-	Trailer loading system	Equipment	2020	New installation for existing LNG terminal
Svanehöj	Denmark	-	Pump test facility	EPC	2022	Pump performence testing in cryogenic temperature
Essity	Germany	71 m^3	Regasification	Engineering	2022	Supply to local gas grid
Essity	Germany	71 m^3	Regasification	Engineering	2022	Supply to local gas grid
Essity	Germany	2 x 230 m^3	Regasification	Engineering	2022	Supply to local gas grid

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