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Company Introduction

PanasiaEM Co., Ltd. is a subsidiary of Panasia Co., Ltd., specializing in the engineering and manufacturing of key equipment required before and after the combustion of marine fuels, with the goal of reducing greenhouse gas emissions.

The company is continuously engaged in research and development with the aim of localizing and globalizing core equipment to meet the growing demand for LNG-fueled vessels. Additionally, PanasiaEM Co., Ltd., independently produces liquefaction systems and high-performance solvents for capturing and storing of CO_2 emissions from conventional fueled ships.

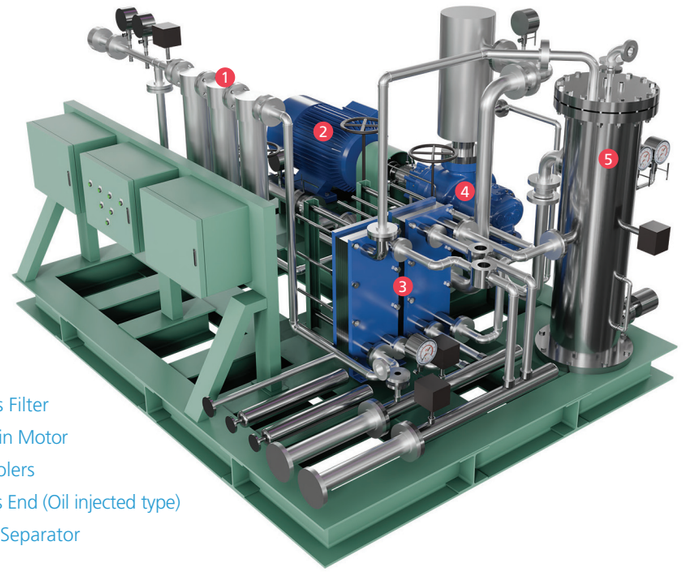
Based on the synergy with the Panasia Group, PanasiaEM Co., Ltd. proposes integrated technical solutions that can respond to various marine fuels, and strives to become the optimal partner for achieving the short-, mid-, and long-term greenhouse gas reduction achievement in the shipping industry.

PRODUCT

- LNG BOG (Boil Off Gas) Compressor System
- LNG Fuel Supply Pump
- CO_2 Liquefaction System

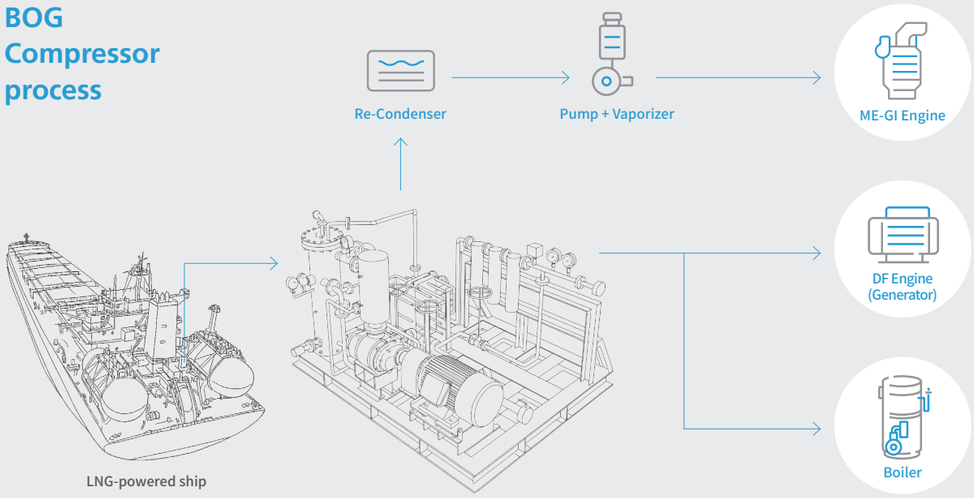
LNG BOG (Boil Off Gas) Compressor System

BOG (Boil-Off Gas) is the vapor generated naturally from LNG (Liquefied Natural Gas) stored in tanks. A BOG compressor is a critical device that safely manages this gas, ensuring the safety of the vessel and enabling efficient use of the gas as fuel.



1. Gas Filter
2. Main Motor
3. Coolers
4. Gas End (Oil injected type)
5. Oil Separator

BOG Compressor process



Specification

Type	Oil injected screw type
Fluid	CH_4, N_2, CO_2, etc.
Capacity	Max. 5500Nm^3/hr
Suction Pressure	In accordance with customer requirements
Suction Temperature	-50 ~ +50°C
Discharge Pressure	Max. 60 barg
Discharge Temperature	Max. 100°C

Line-up

Category	Unit	PC13	PC14	PC21	PC22	PC30
Power range	kW	30 ~ 75	37 ~ 110	75 ~ 200	90 ~ 250	132 ~ 400
	hp	40 ~ 100	50 ~ 150	100 ~ 270	120 ~ 330	180 ~ 550
Inlet flow range	m^3/min	3 ~ 8	4 ~ 13	7 ~ 20	9 ~ 22	17 ~ 50
	cfm	105 ~ 280	140 ~ 460	250 ~ 700	315 ~ 775	600 ~ 1760
Male rotor speed range	rpm	1500 ~ 6600	1300 ~ 6500	1000 ~ 5000	900 ~ 3900	700 ~ 3400
Max allowable working pressure	barg	20	20	20	20	20
	psig	290	290	290	290	290

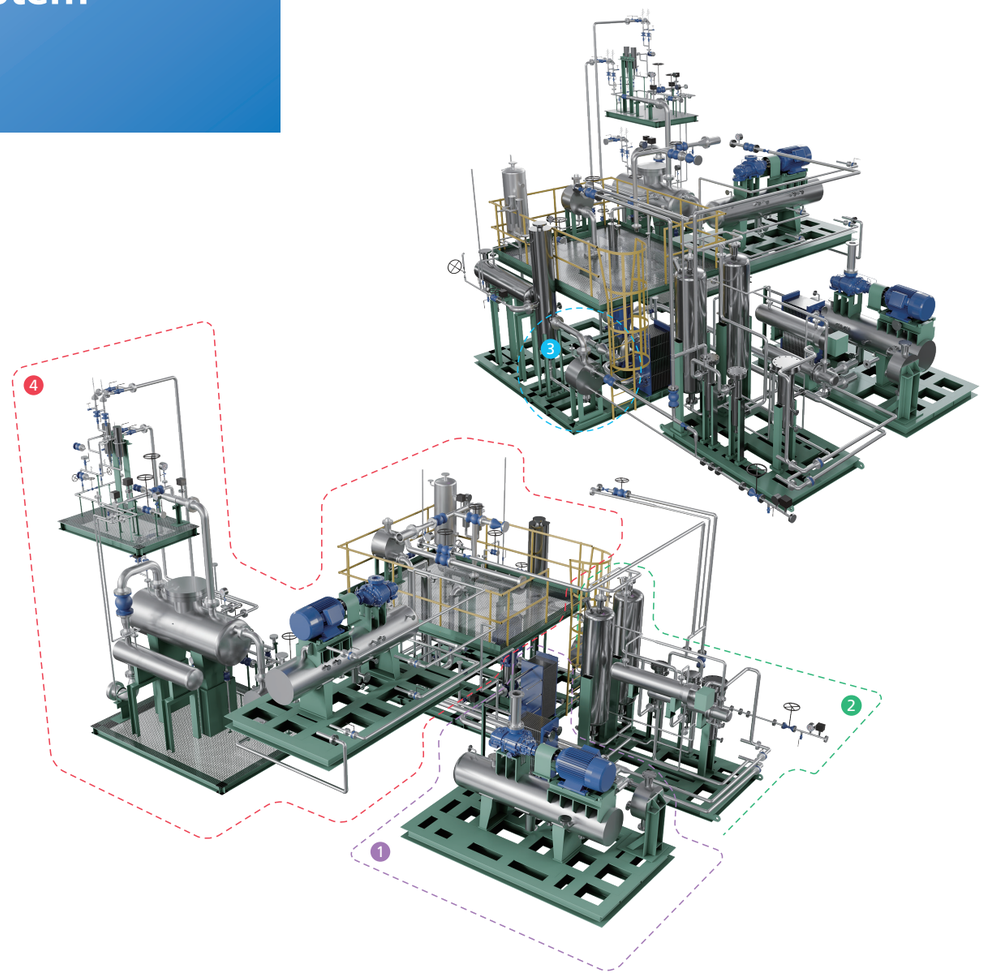
- **High efficiency rotor design :** Tip speed max.15m/s
- **Control type :** Dual (Recycle + VFD)
- **Oil system :** Lube Oil cooler, filter, separator all integrated

Product Overview

- **Application :** LNG carrier, BOG fuel gas supply, fully integrated skid, FGSS optimized design
- **Target gas :** CH_4 90% + N_2 10% (other BOG compositions adaptable)
- **Performance :** High-efficiency rotors & compact low-speed design ensure energy saving and long lifetime
- **Reliability & Safety :** Hermetically sealed system with high-performance bearings, hydraulic axial force compensation, and low oil carryover (<0.01 mg/m^3)
- **Maintenance :** Easy replacement of bearings & seals, minimizing downtime
- **Control :** Local control with VFD for flexible load operation and FGSS integration

CO_2 Liquefaction System

This system efficiently liquefies CO_2 captured by the onboard carbon capture system (OCCS) and safely stores it in ISO tanks or C-type tanks, enabling its use across various applications.



1 CO_2 Compressor

- Compresses gaseous CO_2 to high pressure, creating conditions suitable for liquefaction.
- During compression, both the pressure and temperature of CO_2 increase. Thus, it works in conjunction with downstream equipment (cooler, condenser) to induce liquefaction.

2 Dryer

- Removes moisture and impurities contained in CO_2 gas.
- Moisture can cause ice formation or corrosion inside pipelines, valves, and heat exchangers. Thus, it is an essential pretreatment unit.

3 Condenser

- Cools compressed CO_2 and condenses it from the gaseous liquid state.
- Creates high-pressure, low-temperature conditions to improve liquefaction efficiency, making it suitable for storage and transportation as liquid CO_2.

4 Refrigerant System

- Removes heat generated during the compression and condensation processes to maintain CO_2 under desired temperature conditions.
- Operates together with the condenser to enhance liquefaction efficiency and ensure system stability.

Line-up

CO_2 Liquefaction Capacity	ton/hr	1	2	3	4	5	6	7	8	9	10
Power Consumption	kW	227	476	680	952	1133	1428	1586	1904	2040	2380
CO_2 Liquefaction Condition	℃	-46 ~ 18									
	barg	7 ~ 20									
CO_2 Booster Compressor	ton/hr	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0
Gas Dryer	ppmv	<30									
Condensate System											
Cooling Water	m^3/hr	102	203	305	406	508	609	711	812	914	1016
Sea Water	m^3/hr	57	114	171	227	284	341	398	455	512	569
Pre Cooler	kcal/hr	11262	22525	33787	45050	56312	67574	78837	90085	101346	112606
Liquid Separator	m^3	0.3	0.7	0.9	1.2	1.6	2.0	2.4	2.7	3.0	3.3
CO_2 Separator	m^3	0.2	0.4	0.6	0.8	1.0	1.3	1.4	1.6	1.8	2.0
CO_2 Condenser	kcal/hr	89695	179390	269084	358779	448474	538169	627863	717559	807254	896949
Refrigerant System											
Refrigerant Compressor	ton/hr	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0
Refrigerant Receiver	m^3	0.1	0.2	0.2	0.3	0.4	0.5	0.5	0.6	0.9	0.9
Refrigerant Separator	m^3	0.4	0.8	1.2	1.5	2.1	2.4	2.8	3.2	3.6	4.0
F.W Booster Pump	ton/hr	98	197	295	394	492	590	689	787	885	984

Key advantages

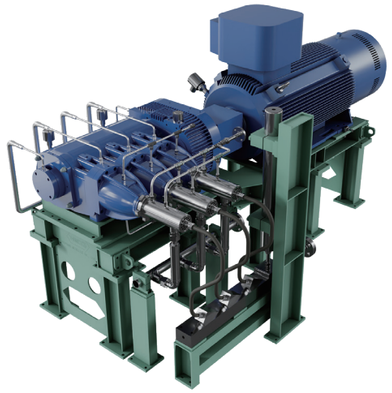
Liquefied CO_2 can be used in a wide range of applications.

In the OCCS Mongla project, PANASIA utilized liquefied CO_2 for e-methanol production.

Application	Dry ice	Agriculture	Underground Storage	CO_2 welding	E-methanol	Beverage
CO_2 Purity (mol-%)	99.50%	99.50%	99.81%	99.90%	**99.90%**	99.95%

LNG Fuel Supply Pump

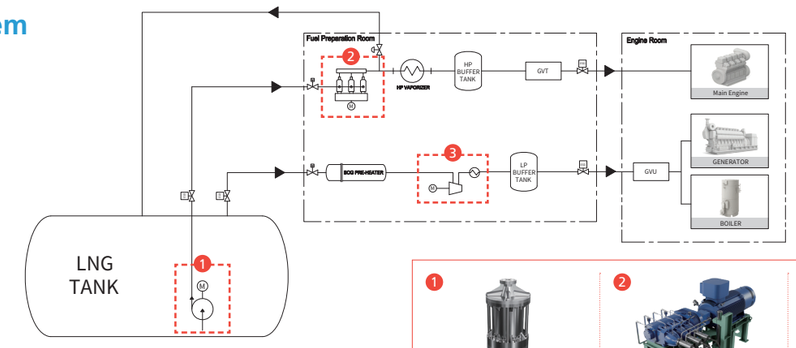
The LNG Fuel Supply Pump is a key device that transfers LNG from the storage tank to the ship's engine or fuel processing system, providing stable pressure and flow to ensure fuel efficiency and operational safety.

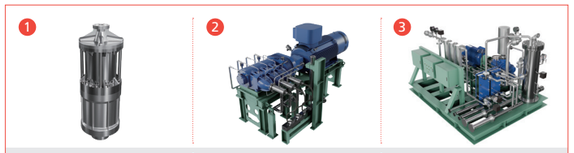


LNG Fuel Supply Pump (HP)

LNG Fuel Supply Pump (LP)

System Flow





LNG Fuel Supply Pump (LP) | LNG Fuel Supply Pump (HP) | BOG Compressor

Key advantages

1. High-Efficiency performance design

- Optimized impeller and internal structure based on CFD analysis
- Reduced heat buildup enhances pump and motor efficiency
- Low NPSH requirement ensures stable suction even at low liquid levels

2. Mechanical design optimization

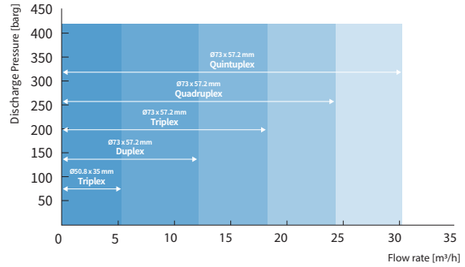
HP pump
- Compact skid-friendly design enables installation in confined spaces
- Low vibration and noise design ensures stable onboard operation
- Compliant with API 674, applicable for both onshore and offshore use
- Discharge line includes pulsation damper to reduce pressure fluctuations

LP pump
- Precisely aligned discharge column improves bearing and motor stability
- High durability and long service life under harsh marine conditions
- Designed in accordance with API 610, suitable for cryogenic LNG service

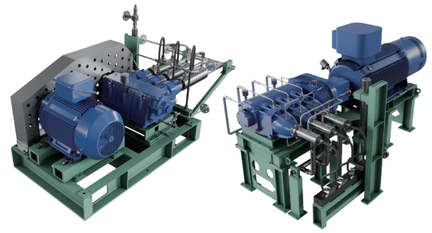
Panasia EM

LNG Fuel Supply Pump (HP)

Performance Curve



Type approval



Belt pulley type | Gear type

Specification

Type	Unit	Reciprocating
Capacity	m^3/h	1.5 ~ 30
Design pressure (Suction)	barg	10
Design pressure (Discharge)	**barg**	**420**
Design density	kg/m^3	450
Liquid temperature	°C	-163
Power (motor)	kW	35 - 475

Line-up

Model	Max. Flow Rate [m^3/hr]	Max. Operating Passure [barg]
PEH-L05N	5	325 or 380
PEH-L10N	10	
PEH-L15N	15	
PEH-L20N	20	
PEH-L25N	25	
PEH-L30N	30	

LNG Fuel Supply Pump (LP)

Application

Use where product loss is not acceptable
- Fuel gas supply system
- Liquid storage transfer

Specification

Type	Unit	Centrifugal multi-stage submerged
Capacity	m^3/h	1 ~ 36
Total head	mlc	15 ~ 450
Liquid temperature	°C	-163
Discharge bore	mm	-
Power (motor)	kW	5 ~ 95
NPSHr	m	0.15 ~ 1.5
Differential pressure	bar	20
Design pressure	barg	30
Speed range	rpm	1,200 ~ 7,200

Type approval

Line-up

Model	Max. Flow Rate [m^3/hr]	Max. Operating Passure [barg]
PEL-L20N	224	20
PEL-L30N	36	

Pilot Test

PANASIA A/S Service

PANASIA Group Global Network

47 Global Service Networks in 37 Countries

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