

# LINEX-BOG Series

Marine Ready Boil-Off Gas (BOG) Subcoolers  
and Reliquefiers

Product Information

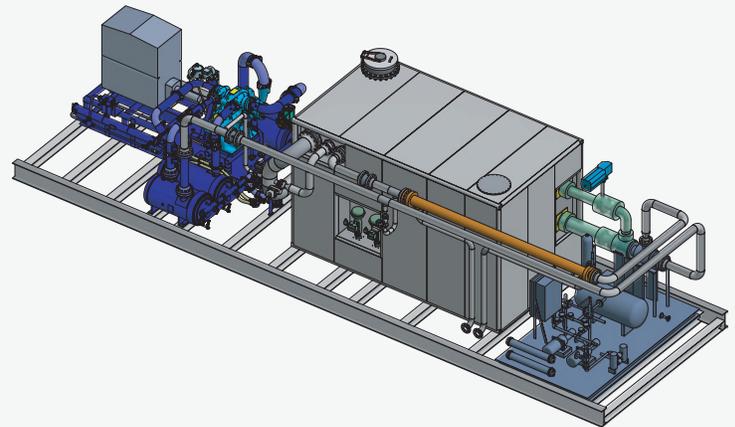


### Marine Class Certified BOG Subcooling and Reliquefaction Systems

Nikkiso Cosmodyne's LINEX-BOG subcooling and reliquefaction system provides tank pressure management by subcooling LNG or by reliquefying excess boil-off gas. The system utilizes robust, industry standard components that can be customized to a client's specific ship requirements. Our typical size packages range from 250 kg/h to 3,300 kg/h.

Nikkiso Cosmodyne's BOG subcooling and reliquefaction system builds on over 60 years of cryogenic experience, with over 450 installations worldwide. Our experience includes air separation and natural gas liquefaction facilities and plants built to operate on aircraft carriers.

Nikkiso Cosmodyne is part of the Nikkiso group of companies already providing cryogenic equipment to the marine LNG fueling and cargo industry.



### Experience

Nikkiso companies have several hundred years of combined experience in engineering highly complicated cryogenic systems for off-shore and on-shore applications.

Our skids are built in our wholly owned marine certified fabrication centers including centers in the United States and South Korea.

### Benefits & Features

- Automatic load & unload included in controls to maintain tank pressure
- Local & remote push button start/stop
- Robust industry standard machinery

### Cosmodyne Competence for LNG Supply Chain

	Dual Fuel Vessels (DF)	LNG Gas Carrier (LNGGC)	FSRU	LPGC, Ammonia, Hydrogen, e-Fuels, MCH
FGSS with Recondenser and Subcooler	●	●	●	●
BOG Reliquefaction Systems	●	●	●	●
Submerged Cryogenic Pumps	●	●	●	●
Cryogenic Heat Exchangers	●	●	●	●
Regasification Systems			●	
Recondensers / Subcoolers			●	
BOG Compressors	●	●	●	●
Controls Package	●	●	●	●
Maintenance Package	●	●	●	●

One Nikkiso company to handle all of the above requirements with a single point guarantee!

## Performance Specifications

### LINEX-BOG

Model	8	14	25	35
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#### Expected Performance

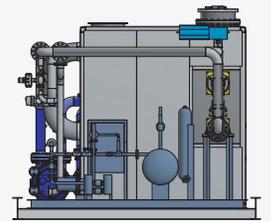
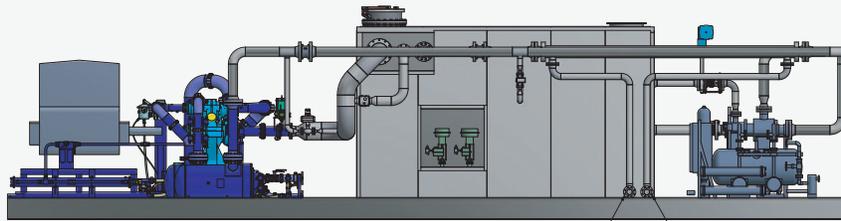
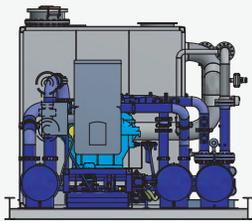
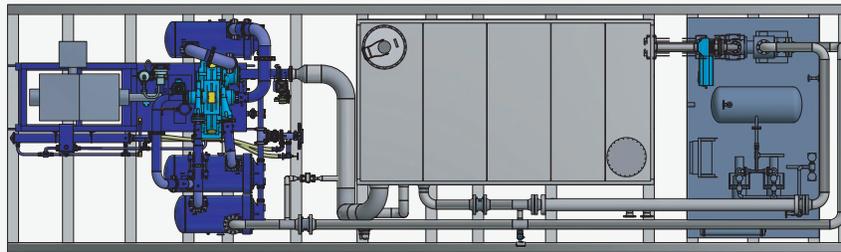
Subcooling Capacity (max)	TPH	0.7	1.4	2.5	3.5
Total Electric Power (excluding cooling water)	kW	675	1168	2174	2870

#### Expected Flows

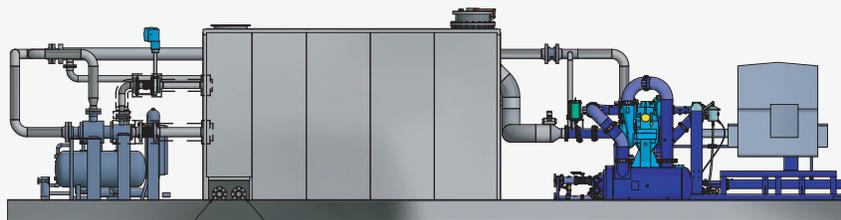
LNG Subcooling Flow	m <sup>3</sup> /hr	24	45	81	112
Min. Subcooling Temp.	K	96	96	96	96
Cooling Water Flow	m <sup>3</sup> /hr	107	185	340	455

#### NOTES:

1. Cooling water temperature: 36 °C
2. BOG latent heat: 465 kJ/kg

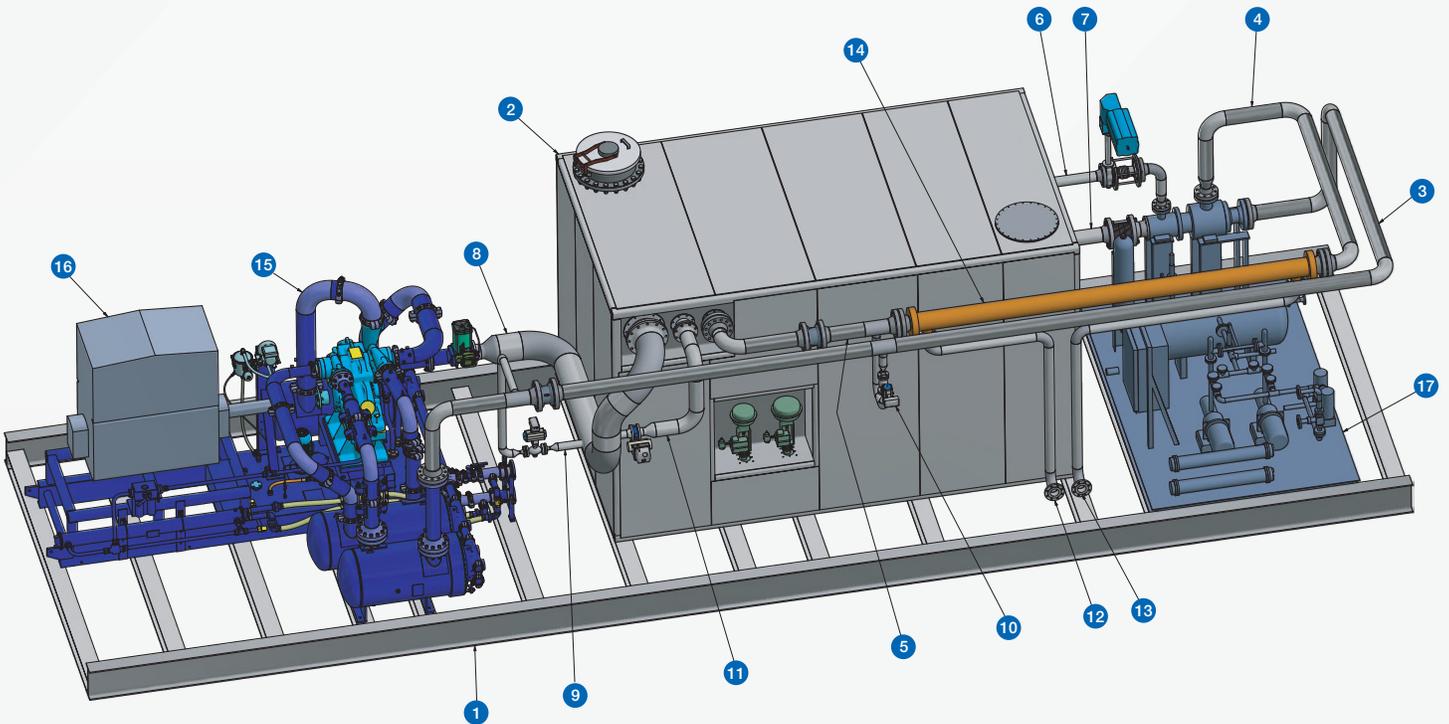


COOLING WATER INLET      COOLING WATER OUTLET



LNG INLET      LNG OUTLET

- 1 Frame
- 2 Cold box module
- 3 Compressor discharge
- 4 Booster discharge
- 5 Booster aftercooler outlet
- 6 Turboexpander inlet
- 7 Turboexpander outlet
- 8 Compressor suction
- 9 Compressor bypass
- 10 Booster bypass
- 11 Gas from separator to recycle
- 12 Cooling water inlet
- 13 Cooling water outlet
- 14 Booster aftercooler
- 15 Recycle compressor
- 16 Recycle compressor motor
- 17 Turboexpander skid



## Standards

Nikkiso Cosmodyne's Linex-BOG subcooling and reliquefaction system is designed to meet all major maritime class society requirements. At minimum, design is in compliance with the following codes:

- IGC and IGF;
- ASME's Boiler and Pressure Vessel;
- DNV Pt.5 Ch.7 "Liquefied Gas Tankers" – DNV Maritime Code;
- DNV Pt.4 Ch.6 "Piping Systems" – DNV Maritime Code;
- ABS Part 3 Hull Construction and Equipment;
- ABS Part 4 Vessel Systems and Machinery.

Additionally,

- All major equipment sourced from marine class approved providers with marine class approved designs;
- Fabrication completed in Nikkiso's own marine class approved shops or 3rd party fabricators in the US and South Korea (e.g., welding, weld nondestructive examination, testing);
- Eliminating additional testing of cryogenic metallic material;
- Full material traceability in accordance with ISO/EN 10204 3.1 and ISO/EN 10204 3.2 material certificate standards;
- Independent FMEA report, etc.;
- All electrical equipment is at minimum in accordance with maritime recognized IECEx Zone 2 requirements (identical to Class 1 Division 2 requirements).

Our Approval-in-Principle Certifications from DNV Maritime and ABS confirm Cosmodyne's design compliance to the above listed rules.





### APPROVAL IN PRINCIPLE

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**Particulars of Product**

Designer: **NIKKISO COSMODYNE**

Product: **Boil-Off-Gas Handling Plant for LNG**

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**This is to verify:**

That the design and arrangement of proposed system for pressure and temperature control in cargo tanks of LNG carriers will comply with respect to applicable rules and regulations and is capable to meet goals stated in IGC Code Chapter 7 and can be used onboard of vessels and installations classed by DNV.

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**Basis for Approval**

The documentation submitted for approval specified in approval letter Ref. M-SA-E/ILCHEN/P35297-J-9 "Nikkiso Cosmodyne LLC Gas Carrier Excellence Center, ID P35297, Re-Nikkiso Cosmodyne - Boil-off-Gas System", dated 2021-10-26, which has been assessed with respect to applicable paragraphs of following Rules and Regulations:

- DNV Rules Pt.5 Ch.7 "Liquefied Gas Tankers" July 2021 editions
- DNV Rules Pt.4 Ch.6 "Piping systems" July 2021 edition
- 2016 IGC Code (Resolution MSC.370(93)) as amended off July 2021

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**Conditions and Assumptions for Approval**

The AIP (approval in Principle) has been issued with conditions and assumption given in Class letter for ID P35297, "AIP (Approval in Principle) Boil-Off-Gas handling System from Nikkiso Cosmodyne", dated 2021-10-27.

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Place: Havik, Norway) Date: 2021-10-27



for DNV

*Monika Johannessen*

Monika Johannessen  
Head of Department

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Form code: APR 311      Revision: 2021-03      www.dnv.com      Page 1 of 1

## Quality Policy

In accordance with its Vision, Mission and Quality Policy, Nikkiso Clean Energy & Industrial Gases is committed to a continuous improvement of Customer satisfaction by focusing its entire organization on Safety of systems and products, Customer Service, Operational Excellence, Technology Leadership and Quality.

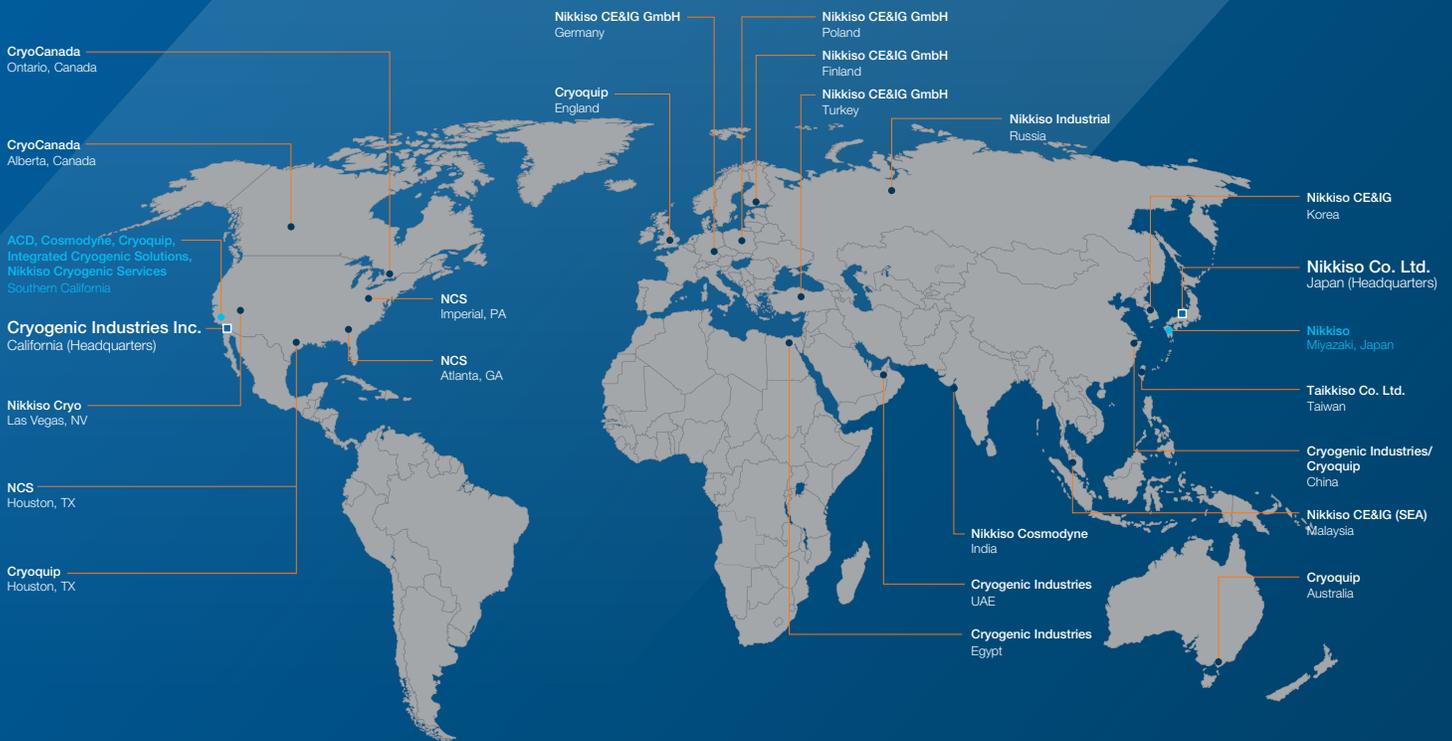
## About Nikkiso

Nikkiso Clean Energy & Industrial Gases group combines over 100 years of maturity in innovating cryogenic equipment for our global customers.

Today, five functional units of the organization such as Cryogenic Pumps, Cryogenic Process and Heat Exchanger Systems, Cryogenic Services and Integrated Cryogenic Solutions provide increased engineering and systems solutions for market development in various markets including marine class qualified solutions.

### Global Presence and Service

With a highly experienced international team, and presence on six continents, especially nearby major shipyards, Nikkiso is capable of providing fast services and responses whenever needed.



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