Turbo-Brayton subcooler

for Liquefied Natural Gas (LNG) boil-off reliquefaction

The Air Liquide Turbo-Brayton cooling system is an optimal solution for natural gas reliquefaction. Combining performance, reliability and compactness, it can be integrated on small or large LNG carriers to re-liquefy boil-off gases, but also on bunker barges or vessels and LNG fuelled vessels.

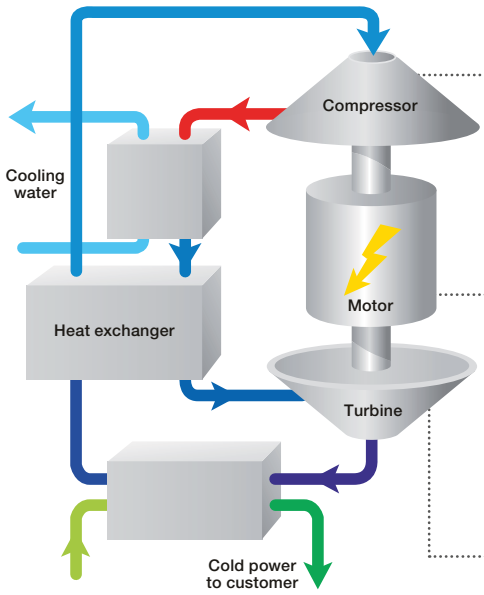
Key benefits of Turbo-Brayton for natural gas reliquefaction

Turbo-Brayton can be installed on both new building and retrofit vessels.

- **Low installation cost and time:** plug and play, compact (low footprint and weight), few utilities (only water and electricity)
- Easy integration thanks to subcooling solution
- High efficiency on all operation range from 0 to 100% turndown
- **Maintenance-free** for 5 years
- **Unmanned operation**
- **Cold power available instantaneously** (less than 5 min) from stand-by mode
- **Oil-free system, vibration-free and utility-free:** no compress air, no oil, no nitrogen or any process gas make-up
- Safe technology: inert process gas, no refill of process gas required, no flammable gas
- High reliability
- Fast and easy integration: **no impact on tank design** (retrofit friendly)

Reverse Turbo-Brayton principle

Air Liquide's innovative reverse Turbo-Brayton process essential innovation concerns the assembly of all active elements on a single shaft.



1 Centrifugal compressor

- High efficiency
- Oil-free

2 High-speed synchronous motor and active magnetic bearings

- Direct drive
- No gear box
- High compacity
- Contact free
- Unsurpassed lifetime

3 Centripetal expander

- More than 50 years experience in the design and manufacture of expanders
- High efficiency

A high efficiency solution

Air Liquide's Turbo-Brayton cooling systems are designed to be both energy efficient and flexible.

- Cryogenic expander power recovery
- Centrifugal compressors and expanders
- Direct drive motors
- Motor's speed adjusts automatically to match the load and operating conditions
- Partial load: electrical consumption is linear with liquefaction production

Off-shore Turbo-Brayton range

Name	Reliquefaction range *(t/h)*	Electrical consumption *(kW)*	Weight *(t)*	Footprint *(L x W x H) (m)*
TBF-175	0 – 0.2 t/h	195	15	9.5 x 1.7 x 3
TBF-350	0 – 0.5 t/h	390	17	11 x 1.7 x 3
TBF-700	0 – 1 t/h	780	30	12 x 3.5 x 3.5
TBF-1050	0 – 1.4 t/h	1,170	40	13.5 x 4.5 x 4
TBF-1225	0 – 1.6 t/h	1,365	42	13.5 x 5 x 4

Expected values given for 36°C cooling water, LNG latent heat: 465 kJ/kg.

Contacts

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A world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 80 countries with approximately 66,000 employees and serves more than 3.6 million customers and patients.