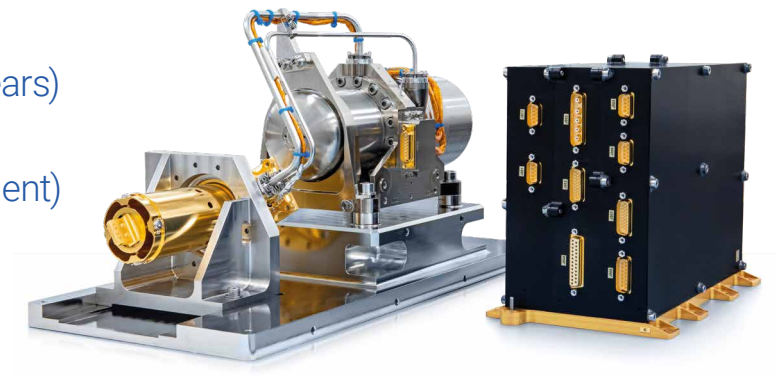
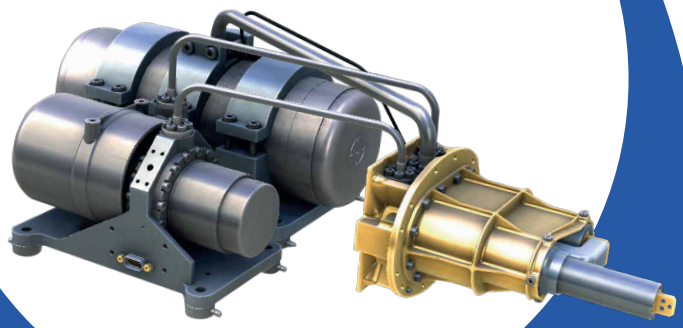
Air Liquide

Active cryo cooling for space applications

Turnkey solutions from 10 K to 200 K

- ✓ High reliability
- ✓ Longlife without maintenance (up to 20 years)
- ✓ Very low level of induced vibration (compatible with optical stability requirement)
- ✓ Enabling satellite agility through orientation independant operation
- ✓ Easy to integrate on your payload
- ✓ Mass/power effective





Capitalizing on its cryogenic engineering capabilities and extensive experience on space specific requirements, Air Liquide has developed a range of coolers based on Pulse Tube technology.

These Pulse Tube coolers operate with no moving parts in the cold finger **which represents a major technological improvement compared to Stirling coolers.** Even at higher temperatures (>100 K) it is a valuable alternative to passive cooling, thanks to its compactness, low mass and orientation independant operation. **All our coolers and systems are fully compatible with space constraints.** This innovative cryo cooling solution can be integrated into scientific, earth observation, astronomy and meteorology satellites.

Air Liquide offers both standard and customized **turnkey solutions to meet your specific needs** and supports you throughout the different phases of your project:

- From feasibility studies to space qualified flight models...
- From power bus to focal plane...
- Products are available as standard off the shelves or can be customized to user needs.

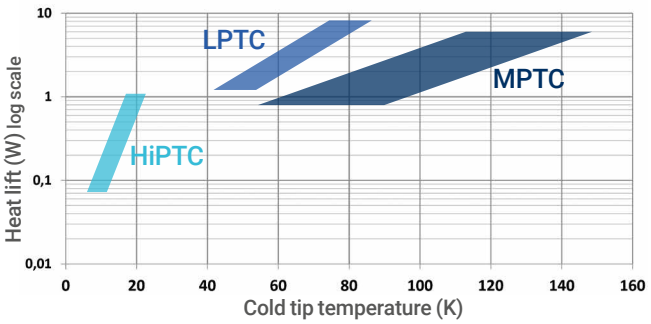
Applications

- Earth Observation
- Meteorology
- Astronomy
- Sciences...

Operating range

(Operating point can be optimized to meet your specific needs)

Air Liquide cryocooler family typical characteristics



	Max. input power *(w/o electronics)*	Mass *(w/o electronics)*	Temperature range	Heat lift range
MPTC *(Miniature Pulse Tube Cooler)*	50 W	3.8 kg	80 - 150 K	1 - 5 W
LPTC *(Large Pulse Tube Cooler)*	160 W	7.3 kg	50 - 80 K	2 - 8 W
HiPTC *(Heat intercepted Pulse Tube Cooler)*	300 W	18 kg	80 - 100 K (St. 1) 10 - 20 K (St. 2)	1 - 3 W (St. 1) 0.05 - 1 W (St. 2)

Key references

- Air Liquide was selected by Thales Alenia Space to supply integrated solutions to cool Focal Plane Arrays around 50-60 K in the frame of the Meteosat Third Generation (MTG) program.
- The Air Liquide LPTC cooler was also selected by Thales Alenia Space for one of its program.
- Airbus Defense and Space and the CNES selected the pulse tube cryocooler of Air Liquide advanced Technologies to handle the cooling of the new generation Infrared Atmospheric Sounding Interferometer (IASI-NG).

Air Liquide is an historical partner in the space adventure for more than 50 years, bringing the space community its pioneering spirit, its innovation capacity, its expertise and its technical excellence.

The compressor, component of the Air Liquide cryo cooling solution, is supplied by Thales Cryogenics B.V. The LPTC is developed by Air Liquide under CEA Licence.

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