Air Liquide

Large pulse tube cryocooler

High reliability cryocooler for 50K-80K space applications

- ✓ Lifetime: more than 20 years storage and use
- ✓ Reliability: More than 99% over 7,5 years
- ✓ High performance and excellent temperature stability
- ✓ Low exported vibrations
- ✓ Active vibration cancellation
- ✓ Currently operating in space (TRL9)
- ✓ Qualified on ESA program (ECSS standard)

Large Pulse Tube Cryocooler (LPTC) is a space pulse tube cryocooler aimed at 50K-80K applications. It is widely used for in-space thermal infrared instruments.

This cryocooler is equipping three instruments on board Meteosat Third Generation and METOP Second Generation satellites from EUMETSAT. It was also selected by the French government for Earth observation application. Altogether, 24 LPTC are scheduled to fly and some are already flying for several years.

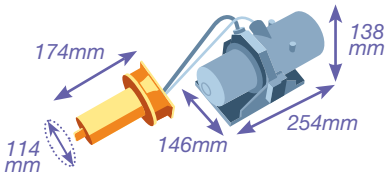
This cryocooler is suitable for any high reliability space application requiring cooling power between 3W at 50K and 7W at 80K, such as Earth observation, space science, space exploration, superconductivity, zero boil off, oxygen liquefaction, CO_2 removal for life support, sample freezing, etc.

Technical data

A large pulse tube cryocooler is composed of a mechanical cooler and control electronics.

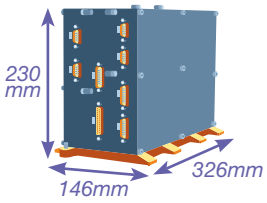
Cooling Mechanical Assembly (CMA)

Mass: 7kg



Cooling control electronics (CCE)

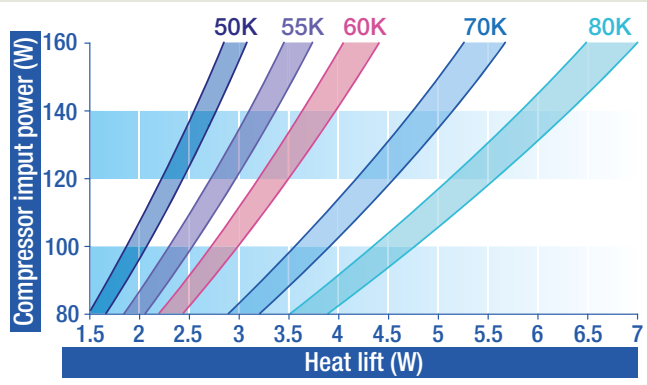
Mass: 5kg



Functionalities and performances

- Temperature regulation: 10mK (1 Sigma) despite reject temperature variations or heat lift excursions,
- Active vibration reduction along compressor piston axis: 100mN RMS,
- Vibration level in transverse axis: 400mN RMS,
- Launch lock to sustain launch vibrations,
- Electrical power rating for the whole system (including electronics): 220W,
- Communication with the instrument: 1553 Bus.

LPTC cryogenic performance (W/W) with reject temperature at 20°C



Sustained environnements

Vibration

- Sine: 25g
- Random: 0.3g²/Hz
- Shock: 316g

Temperatures

- Operating: -20°C → +50°C
- Non operating: -30°C → +60°C

Cleanliness

- ISO 5

Contacts

Air Liquide
Advanced Technologies

2, rue de Clémencière
BP 15 – 38360 Sassenage, France
Phone: +33 4 76 43 62 27
E-mail: gcom.alat@airliquide.com
www.advancedtech.airliquide.com

www.airliquide.com

Air Liquide

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