Honeywell
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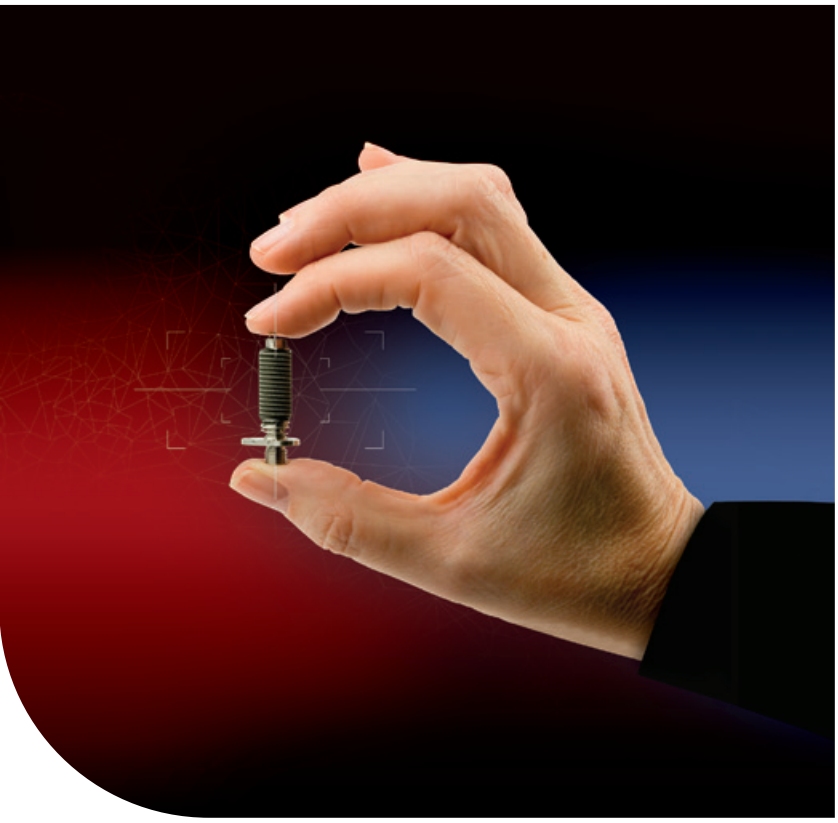
Cryogenic Technologies



# CRYOGENIC & STORED ENERGY TECHNOLOGIES

Cryogenic Cooling

# Cryogenic Cooling

Honeywell Cryogenic coolers are highly efficient, dependable, proven performance solutions that meet customer's specific performance requirements.

Honeywell is a leader in Joule-Thomson cooling and more recent Stirling cycle cryocooler technologies, affirming the company as a premier provider in the supply of equipment for demanding and often harsh environments of defence and space applications.

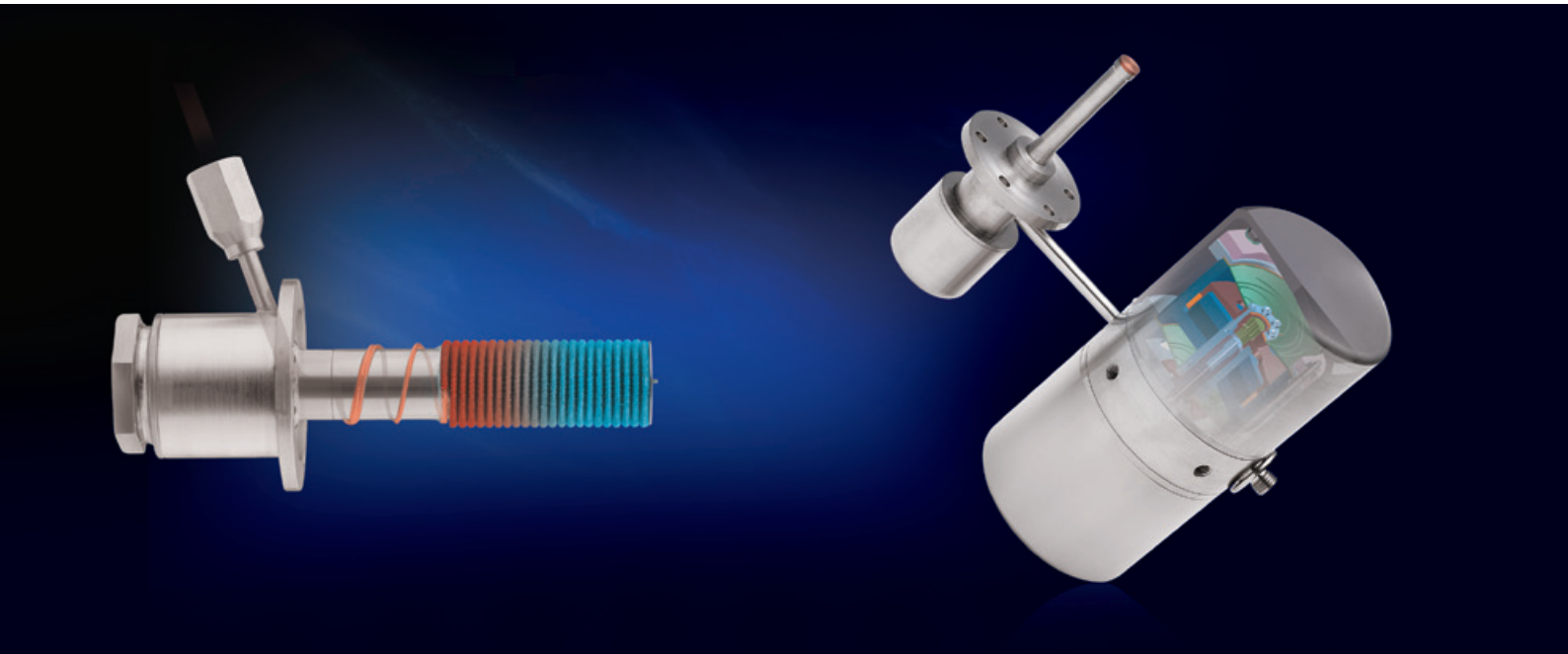
## Joule-Thomson Cryogenic Cooler and Stored Energy (Gas Management) Systems

- For missile and targeting systems utilising cooler IR seeker technology
- Bespoke solutions to meet demanding performance specifications
- Honeywell's fixed orifice, dual flow and demand flow Joule-Thompson coolers accompanied by a wide range of stored energy systems, typically charged between 3-15Kpsi and capacity ranging from 0.02ltr – 2.4ltr
- Provides total gas management systems with market leading quality and performance. The pressure vessels can be 'sealed for life' (>25 years integrity) for extended storage
- We do this by drawing on +80 years of experience and evolution of >100 designs.

## Joule-Thomson Cryocoolers

- Used for cooling tactical infra-red seekers
- Expands high-pressure gas through a small orifice to produce cryogenic temperatures
- Usually single event; short duration
- Able to withstand extreme G and shock loads and MIL Std. requirements
- Very long term storage yet able to cool to 100K (-173°C) in seconds
- Temperatures as low as 65K (-208°C) are typical for missile applications
- Bespoke designs to meet system requirements
  - Temperature - level and stability
  - Cool down time
  - Gas - type and volume
  - Mission duration
  - Cost and weight.

Joule-Thomsom cryocooler



## Stored Energy (Gas Management) Systems

- Storage
  - Variety of gases - air, argon, nitrogen
  - Safety - burst pressures up to 30,000 psi
  - Typically sealed for life, single shot
  - Re-chargeable - typically >5,000 cycles
  - Critical material selection
  - High purity and leak tightness
  - Bullet and fire safety
- Gas Distribution
  - Complex pipe work
  - Control and safety valves
  - Quick disconnect
  - Fire safety discharge
  - Super cleanliness.

## Stirling Cycle Cryocoolers and Cryocompressors

- For Defence and Space cryogenic applications
- High speed imaging and sensing infrared detectors (focal plane arrays), sensor systems and high-resolution cameras
- Flight qualified and/or extended operation, electrically powered cryocooling or cryocompressors.

## Honeywell Delivers

- The Stirling Cycle to convert electrical energy to cryogenic cooling
- Typical cooling power of 0.25 to 5 Watts at 80K
- Cryogenic temperatures in the range 75 to 130K (-200°C to -140°C)
- Maintenance free with expected life of over 10 years – constant use
- Efficiency and performance throughout operational life
- Dual opposed pistons driven by linear motors minimise vibration and noise
- Moving elements mounted in flexure bearings utilising true clearance seals.

## Heritage

- Greater than 60 units shipped for space applications
- As demonstrated by 16 cryocompressors on satellite systems currently in orbit with a culmination of 100 years continuous orbital operation
- Greater than 140,000 hrs over 19 years running achieved on durability test demonstrator with no degradation in performance.

Pure air bottle and quick relaese valve

Gas bottle system

Cryocompessor

## Defence & Space

Providing the power to protect and the technology to perform, Honeywell Aerospace innovations are helping transform the combat environment by boosting operational capabilities and providing unrivalled accuracy to support soldiers, vehicles and aircraft and enhance fleet safety.  Our products offer superior efficiency and performance to lower fuel consumption and maintenance expenditures, while increasing the productivity and lifespan of critical assets.

## Honeywell Aerospace

Honeywell Aerospace innovates and integrates thousands of products and services to advance and easily deliver safe, efficient, productive and comfortable experiences worldwide.

For more information on Honeywell Aerospace, visit us online at **aerospace.honeywell.com**

**Learn More**

To learn more about Honeywell Cryogenic Technologies, please visit: **aerospace.honeywell.com/cryogenic-cooling**

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All estimates on performance, operational benefits and cost savings provided within this document are based on Honeywell data.

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