

CRYOGENIC THERMAL  
MANAGEMENT TECHNOLOGIES

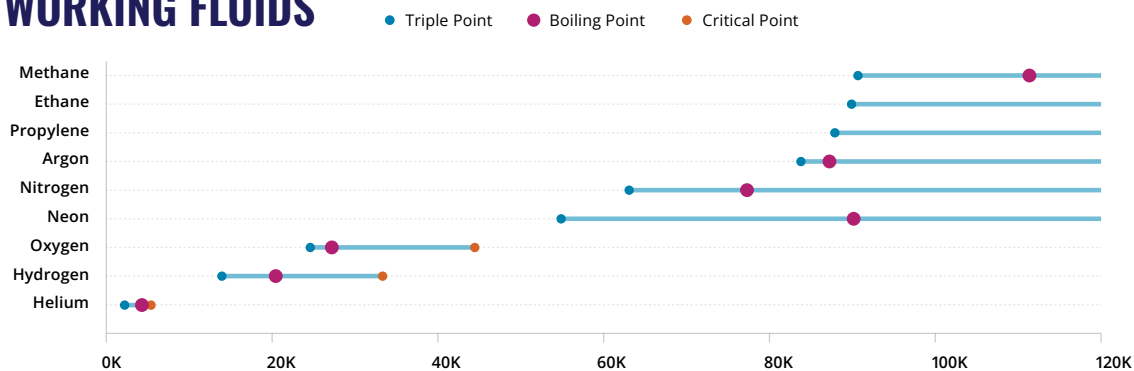
# HIGH-PERFORMANCE HEAT TRANSPORT AT CRYOGENIC TEMPERATURES

Cryogenic heat pipes are specialized thermal management devices that operate below 150K, enabling efficient heat transport where conventional passive cooling is impractical. Typical working fluids include hydrocarbons such as methane, ethane, and propylene; elements such as oxygen and nitrogen; and inert gases such as argon and neon. ACT has pioneered cryogenic heat pipes with custom wick designs that ensure reliable performance across varying heat loads and orientations. These systems are fully passive, vibration-free, and highly reliable, with no moving parts.

CORE CAPABILITIES

- ↳ Operation down to 25K (neon triple point)
- ↳ Passive, capillary-driven heat transport (no mechanical pumps)
- ↳ High effective thermal conductivity
- ↳ Long-distance heat transport with minimal temperature drop
- ↳ Scalable from localized cooling to large-area heat collection systems

## WORKING FLUIDS



## ENVELOPES

Stainless steel and aluminum are common envelope choices for compatibility at low temperatures. However, the use of inert gases opens the opportunity for other envelope materials.

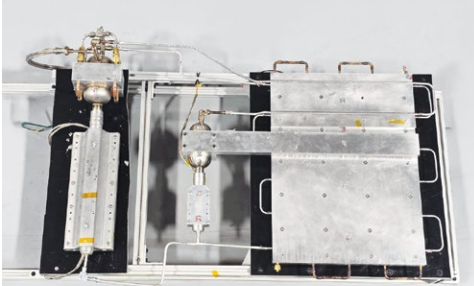
## DESIGN & STRUCTURE

- ↳ Wicked Heat Pipes (Sintered Porous, Screen, and Grooved)
- ↳ Thermosyphons and Loop Thermosyphons
- ↳ Flexible Heat Pipes
- ↳ Loop Heat Pipes
- ↳ Large Area Cooling
- ↳ Thermal Switches
- ↳ Variable Conductance Heat Pipes (VCHPs)

## BI-METALLICS

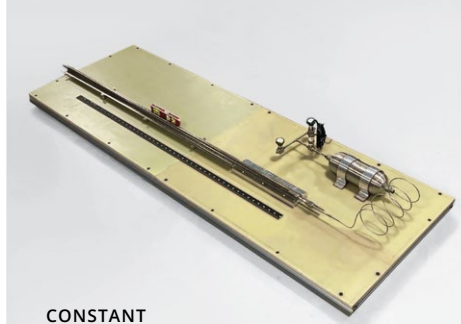
- ACT's R&D team continuously explores bi-metallic and hybrid constructions:
- ↳ Aluminum-copper
  - ↳ Stainless steel-copper
  - ↳ Stainless steel-aluminum

## Hardware Examples



**LOOP HEAT PIPE**

With secondary evaporator for faster start-up at cryogenic temperatures



**CONSTANT CONDUCTANCE HEAT PIPE**

Grooved heat pipe with a pressure relief reservoir



**FLEXIBLE HEAT PIPE**

Heat pipe with bellows integrated with the adiabatic section allowing heat pipe operation bent or straight with proper liquid return and minimized fluid inventory

## APPLICATIONS



Space



Physics Experiments (Detectors & Optics)



Telescopes

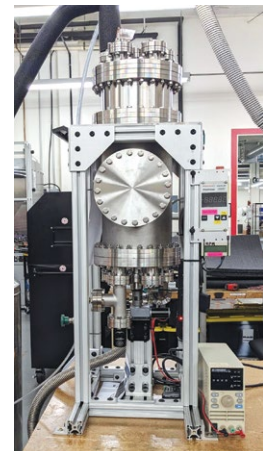


Cryogenic Propellant Storage

### TYPICAL PERFORMANCE METRICS (CONFIGURATION-DEPENDENT)

Operating Temperature Range	25K–150K
Heat Transport Capacity	Up to 1 kW per pipe in the upper temperature range (design-dependent)
Heat Transport Length	Up to several meters
Operating Environments	Planetary atmospheres, including vacuum
Orientation Sensitivity	Application-dependent
Typical Diameter	.25"–1", and customizable
Geometries	Straight, bent, or custom profiles

*Final performance values are established through design trade studies and qualification testing.*



Cryo-vacuum chamber for extreme environment testing

## Build with Confidence

ACT partners with you to deliver high-quality manufacturing for advanced thermal systems.

## TALK TO AN EXPERT

Visit [1-act.com/contact](https://1-act.com/contact) or email us at [info@1-act.com](mailto:info@1-act.com) to discuss your thermal challenge.



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