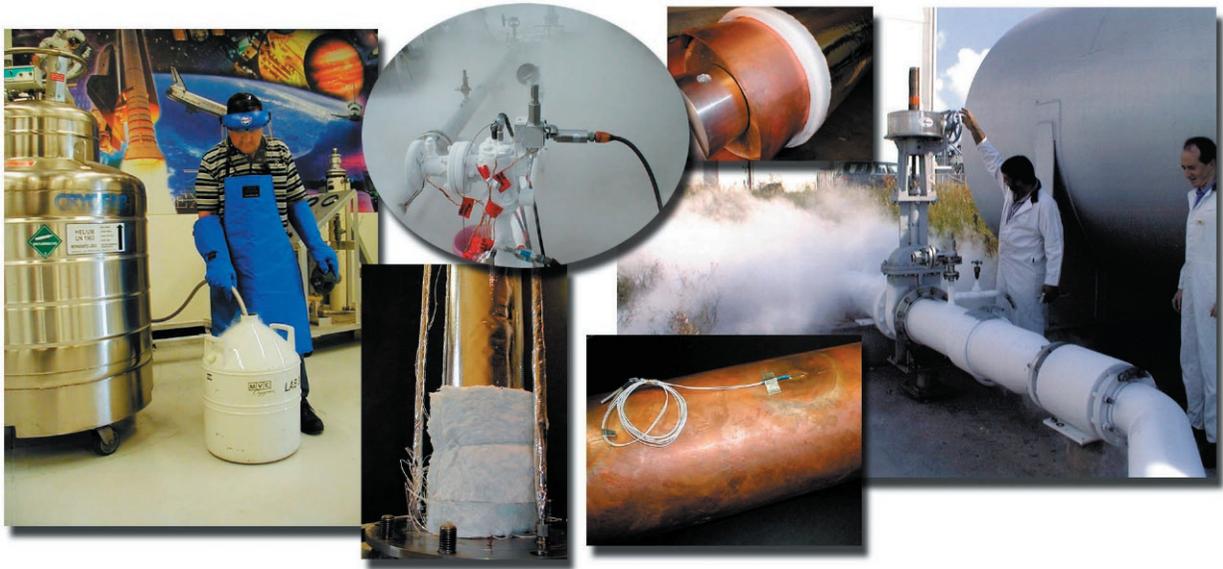


High-Performance Thermal Insulation Test Apparatus With Sleeve (Cryostat 1)

The National Aeronautics and Space Administration (NASA) has developed equipment and methodology for testing insulation materials manufactured in various forms. NASA's High-Performance Thermal Insulation Test Apparatus With Sleeve technology provides for precision quality control in the manufacturing process and yields quantitative and direct thermal performance measurements.

Designed by the Cryogenics Test Laboratory at the John F. Kennedy Space Center (KSC) in Florida, this technology allows manufacturers to fabricate and test cryogenic insulation at their production and/or laboratory facilities. This new methodology and equipment offers precision thermal performance measurement of a variety of different insulation systems under actual use conditions.



Potential Commercial Uses

- Multilayer insulation (MLI) manufacturers and users
- Cryogenic equipment manufacturers and suppliers
- Developers of process piping and storage tanks
- Research facilities

Benefits

- Provides direct, quantitative measurements of apparent thermal conductivity (k-value).
- Eliminates heat leak through ends (heat leak error) by a combination of thermal guard chambers and test sequence methodology.
- Produces long-duration, steady-state measurement of heat flux through insulation test article.
- Provides flexibility of pressure environments from high vacuum to soft vacuum to atmospheric pressure levels.

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- Uses different environments of residual gases
 - Displays complete temperature profile across thickness of insulation test article for detailed performance information
 - Maintains stable cold boundary temperature from top to bottom of sleeve (down to 77 K, -196 °C)
 - Maintains stable warm boundary temperature on outer surface of insulation (up to 373 K, 100 °C)
 - Provides the ability to test continuously rolled insulation materials as well as blanket, loose, and molded product forms
 - Affords relatively quick and simple change-out of test articles

The Technology

The thermal insulation test apparatus is a fluid boil-off calorimeter system. The technology combines method and equipment that together provide reliable, accurate, and repeatable test information in the cryogenic vacuum range of environments. Continuously rolled materials are installed around a cylindrical copper sleeve using a wrapping machine. The sleeve is slid onto the vertical cold mass of the cryostat. The gap between the cold mass and the sleeve is less than 1 millimeter. The cryostat apparatus enables direct measurement of the k-value of the insulation system at any vacuum level between 5×10^{-5} and 760 torr. The system is a convenient top-opening configuration for easy change-out of the test article (all instrumentation fluid feed-throughs are located on the bottom flange plate). Heavy-wall, stainless-steel construction of the internal cold mass provides maximum thermal stability and minimum temperature gradients in the axial direction. Sensors are placed between layers of the insulation to provide complete temperature-thickness profiles. The steady-state measurement of k-value is made when all temperatures (cold mass, sleeve, insulation outer surface, and vacuum chamber) and the boil-off flow are stable. Bulk fill or molded insulation specimens are also handled by this technology.

Options for Commercialization

NASA seeks qualified companies to commercialize the technology High-Performance Thermal Insulation Test Apparatus With Sleeve. This and other technologies are made available by the KSC Technology Commercialization Office through a variety of licensing and partnering agreements. These include patent and copyright licenses, cooperative agreements, and reimbursable and nonreimbursable Space Act Agreements.

Contact

If your company is interested in the technology High-Performance Thermal Insulation Test Apparatus With Sleeve or if you desire additional information, please reference Case Number KSC-12107 and contact:

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Commercialization Checklist

- ✓ Patent pending
 - U.S. Patent
 - Copyrighted
- ✓ Available for licensing
 - Available for no-cost transfer
 - Seeking industry partner for further codevelopment

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