

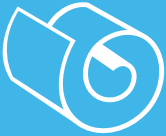
YOUR GUIDE TO CRYOGENIC INSULATION



**RATERMANN
CRYOGENICS**

INDUSTRY INSIGHTS

CRYOGENIC INSULATION HISTORY



IN RECENT YEARS

COMPOSITE OPTION OF COMBINED PAPER AND FOIL



A COMBINATION OF

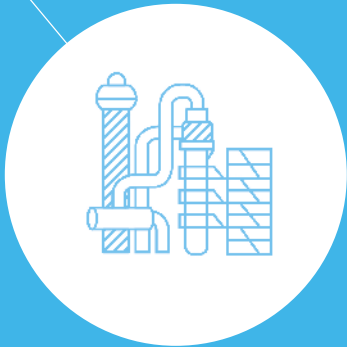
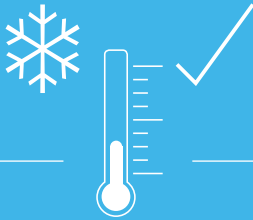
REFLECTIVE FOIL & FIBER GLASS PAPER

CRYOGENIC PAPER AND ALUMINUM FOIL
INSULATION MATERIAL SINCE THE 1950'S

MINIMIZING HEAT FLOW



THROUGH DOUBLE WALLED CRYOGENIC VESSELS



YOUR GUIDE TO CRYOGENIC INSULATION

REVOLUTIONIZING THE WAY YOU WORK

Occasionally in our industry a development occurs which significantly moves the game on. That's exactly what's happened with cryogenic insulation as advances in materials and technologies offer the potential to transform the use and transportation of cryogenic gases. It means we're able to offer high quality, pioneering products that save our customers time and money.

Insulating cryogenic vessels is a tried and tested process. Cryogenic paper and foil is used as the insulating material on double-walled cryogenic vessels. The insulation reduces heat transfer and minimizes liquid and gas losses by having each reflective foil sheet insulated with glass fiber paper, which is low in thermal conductivity. Several layers of paper and

foil are used to line the exterior of an inner vessel and once the space between the inner and outer vessel is sealed, it is evacuated by a vacuum pump to the required pressure.

This process has seen very few developments for well over half a century, that is until now. Here at Ratermann Cryogenics, our team have sourced the best new products from around the globe with significant benefits to our customers. Better quality paper with multi-layer composite options combining paper and foil, vastly improve installation times, reduce gas losses and minimize waste. Similarly, our cryogenic blanket is lightweight, low in density and incredibly easy to handle while giving maximum thermal protection.



In short, our range of cryogenic insulation products provide a smoother, faster and smarter way to improve your bottom line.

The range available includes:

- **CRYOGENIC PAPER**
in widths from 1.6" to 70.9"
- **ALUMINUM FOIL**
in widths from 1.6" to 70.9"
- **COMPOSITE INSULATION**
in up to 5 sets from 2.36" to 70.9"
- **CRYOGENIC BLANKET**
in widths from 35.4" to 70.9" that is 8 times lighter than perlite
- **ANCILLARIES**
that include foil, fabric and tape

WHAT ARE THE KEY BENEFITS?

RATERMANN CRYOGENICS
GREAT SERVICE.
TOP QUALITY LONG-RANGE
PRODUCTS.



We bring extensive knowledge, great service and proven performance levels to the cryogenic insulation market.

When it comes to our products, we make it our business to stay ahead of our game, so that our clients can stay ahead of theirs.

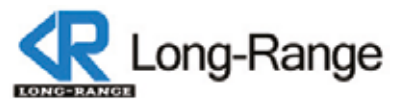
Our trusted partners at Long-Range share a common goal – to offer you quality products with a long service life and a perfect safety record. All this while enhancing your bottom line.

We offer the flexibility to buy in small quantities or in bulk. What's more we can stock your requirements – it means choice, availability and quick turnaround on all your orders. We're here to work with you to find the right solution.

We have listed the major benefits opposite for cryogenic paper, composite insulation and the cryogenic blanket. These benefits all offer you the user a quicker, more simple and enhanced installation helping you have a better product with reduced costs. Try us today.



— IN PARTNERSHIP WITH —



CUSTOMER BENEFITS

No.1

MINIMIZE BULK
PURCHASES

STOCK IN NASHVILLE, TN AND LIVERMORE, CA.

No.2

ONE TYPE OF
INSULATION

SUITABLE FOR ALL APPLICATIONS
INCLUDING OXYGEN.

No.3

ENHANCE YOUR
INSTALLATION

PRODUCTS DESIGNED FOR MAXIMUM
EFFICIENCY IMPROVE YOUR BOTTOM LINE.

CRYOGENIC PAPER

No.4

LOW THERMAL
CONDUCTIVITY

THIN AND LIGHT WITH A STRONG
UNIFORM STRUCTURE.

COMPOSITE INSULATION

No.7

REDUCES
INSTALLATION
TIMES

UP TO FIVE TIMES QUICKER
INSTALL TIMES.

CRYOGENIC BLANKET

No.10

SIMPLIFIES
INSTALLATIONS

AND ENSURES MAXIMUM
THERMAL PROTECTION.

No.5

ZERO
ORGANIC
CONTENT

ALKALI-FREE WITH NO
OUTGASSING PROPERTIES.

No.8

IMPROVES
INSTALLATION
STABILITY

THIS STRENGTHENED OPTION
SIMPLIFIES INSTALLATION.

No.11

EASILY
HANDLED

WITH REDUCED WEIGHT.

No.6

FAST
PUMP TIMES

ENSURED BY THE ENHANCED
LATTICE STRUCTURE.

No.9

MINIMIZES
WASTE

PROVEN STABILITY ALSO
INCREASES PRODUCTIVITY.

No.12

MINIMAL
OUTGASSING

QUICKER INSTALL TIMES.

No.13 — IMPROVES YOUR INSTALLATION & YOUR BOTTOM LINE!

WHICH APPLICATIONS IS IT USED FOR?

OUR CRYOGENIC INSULATION AND RELATED PRODUCTS ARE USED ON DOUBLE-WALLED CRYOGENIC VESSELS ALL OVER THE WORLD.



DEWARS

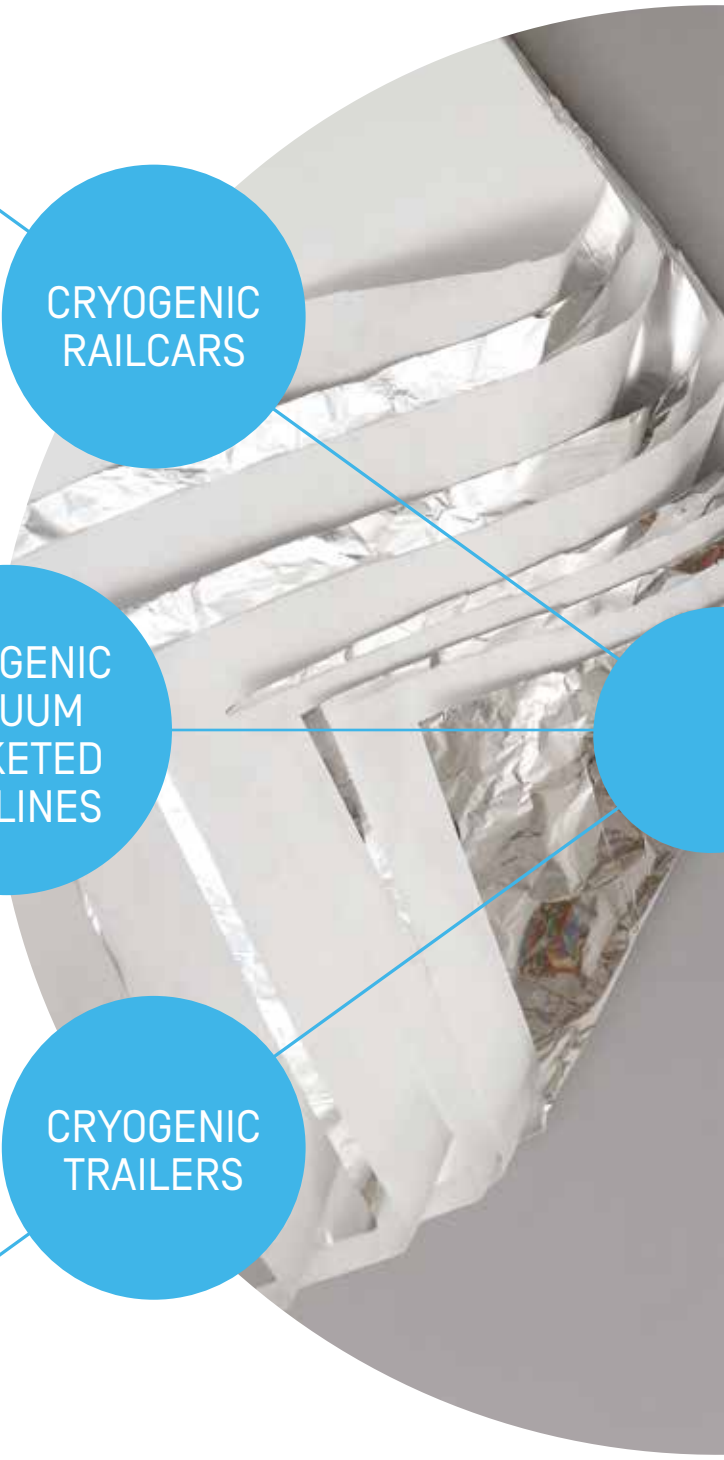
CRYOGENIC
RAILCARS

CRYOGENIC
VACUUM
JACKETED
PIPELINES

CRYOGENIC
TRAILERS

CRYOGENIC
STORAGE
VESSELS

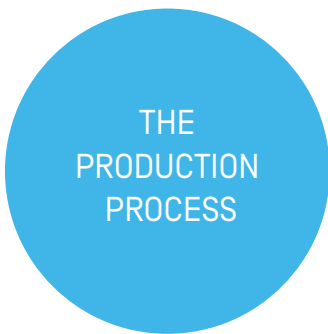
ISO
CONTAINERS



HOW IS IT PRODUCED?



A WORLD CLASS
MANUFACTURING PLANT
PRODUCTION PROCESS.



1



THE RAW MATERIAL IS MADE FROM TOP QUALITY ALKALI-FREE, INORGANIC GLASS FIBER WITH OUTSTANDING FLAME RETARDANT PROPERTIES.

2



THIS RAW MATERIAL IS DELIVERED TO THE PRODUCTION FACILITY PACKED IN SEALED CONTAINERS.



3



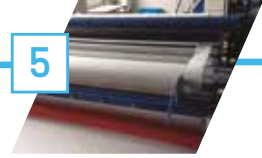
THE PAPER IS PRODUCED IN A "WET, VACUUM AND DRY" PROCESS WHICH ENSURES A CONSISTENT, POROUS STRUCTURE. IT IS THEN FED INTO A FORMING MACHINE WHERE IT IS ROLLED, FORMED AND CUT TO WIDTH USING WATER JETS FOR PRECISION CUTTING.

4



THE PAPER IS CONTINUALLY ROLLED, DRIED AND FED THROUGH THE MACHINE AT CONTROLLED TEMPERATURES TO ENSURE AND DEFINE ITS STRUCTURE AND THICKNESS.

5



AFTER BEING ROLLED TO ITS MAXIMUM LENGTH, THE PAPER CAN BE CUT TO YOUR REQUIRED WIDTHS FROM 1 1/2" TO 71". ALL PAPER ROLLS HAVE SECTIONS OF PAPER FULLY TESTED TO CONFIRM UNIT WEIGHT, THICKNESS, TENSILE STRENGTH, MOISTURE CONTENT AND ORGANIC CONTENT.

6



FOR THE COMPOSITE CRYOGENIC INSULATION, UP TO 5 ROLLS OF PAPER AND 5 ROLLS OF FOIL ARE ROLLED TOGETHER TO GIVE AN ACCURATELY SIZED FINAL PRODUCT. INSTALLATION AT YOUR PREMISES IS MASSIVELY SIMPLIFIED AND INSTALLATION TIME ON THE SHOP FLOOR GREATLY REDUCED.

COMPOSITE



7



AFTER FINISHING, THE CRYOGENIC PAPER OR COMPOSITE INSULATION ARE PACKED IN A VACUUM INTENSIFIED (OR SEALED) PE BAG ON AN EPE EXTERNAL PROTECTION TUBE.

8



TWO SIDE PLATES PROTECT THE CRYOGENIC PAPER OR COMPOSITE INSULATION WHICH IS SUPPLIED IN STRENGTHENED CARTON BOXES AND WOODEN PALLETS.



RATERMANN CRYOGENICS AND OUR MANUFACTURER

RATERMANN CRYOGENICS HAS DEVELOPED A RELATIONSHIP WITH LEADING CRYOGENIC INSULATION MANUFACTURER LONG-RANGE, A PARTNERSHIP CREATED TO HELP OUR CUSTOMERS ACHIEVE THEIR GLOBAL OBJECTIVES.



We already supply complete valve packages and systems to industrial gas cryogenic equipment manufacturers and its users, as well as LNG packages for process plants and shaving stations. The addition of the innovative Long-Range insulation range enables us to extend an already comprehensive package of products to our growing customer base. One supplier for all your valves and accessories means a simpler procurement process and reduced total costs.

Our relationship helps Long-Range take their range to North America and allows Ratermann Cryogenics to develop further its range of quality products. For you it means a smarter way to improve your bottom line.

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THE ADDITION OF THE INNOVATIVE LONG-RANGE INSULATION RANGE ENABLES US TO EXTEND AN ALREADY COMPREHENSIVE PACKAGE OF PRODUCTS TO OUR GROWING CUSTOMER BASE.

Long-Range specialize in insulation solutions for cryogenic equipment and piping systems. Their production facility focuses on the manufacture of cryogenic paper and their unique composite range. By specializing in this area, they are able to make pioneering developments with significant new benefits to our customers - such as reducing installation time, waste and money.

OUR CRYOGENIC INSULATION PRODUCT RANGE

LONG-RANGE CRYOGENIC INSULATION PAPER

The paper is a non-outgassing, inorganic non-woven material manufactured from super fine glass fiber. With a surface that does not absorb gas molecules easily, it minimizes vacuuming times. Furthermore, its enhanced lattice structure ensures that the thermal conductivity coefficient and specific heat flux of the interlay are extremely low when working in cryogenic environments.

The super fine glass fiber paper is made from alkali-free inorganic glass fiber with diameters of between 0.1 to 0.6 μm and glass fiber filaments with diameters between 1 to 3 μm . The exceptional high quality raw material used as the base material ensures the paper has outstanding flame retardant properties.

The Long-Range manufacturing process ensures the finished paper offers an exceptionally efficient thermal barrier against heat transfer in any form of insulated storage containers. Designed to give your equipment a longer operating life at the lowest working cryogenic temperatures, its exceptional stability minimizes vacuum losses on storage or transportation equipment even at liquid hydrogen temperatures.

LONG-RANGE CRYOGENIC COMPOSITE INSULATION

Long-Range manufacture this high quality multi-layer composite option by rolling the aluminum foil together with the inorganic paper in combined layers from one to five pairs. This option is normally used in the 5 times paper and 5 times foil option by most users globally.

The super-fine alkali-free, inorganic glass fiber paper is supplied together with the aluminum foil in thicknesses of .00026" and .00028" as standard. Options of .0003" and .00035" are available.

Made from exceptionally high-quality raw material, it has outstanding flame retardant properties and when combined with the foil, it makes installation up to five times quicker. Suitable for all your cryogenic vessel medium applications this option greatly helps to reduce manufacturing times, clear factory floor space and enhances your bottom line. The multi-layer composite paper and foil will transform the way you install cryogenic insulation.

LONG-RANGE CRYOGENIC INSULATION BLANKET

The Long-Range cryogenic insulation blanket is designed to meet the specific insulation needs of the cryogenic equipment manufacturers and their applications. Made from high quality, super-fine glass fiber bonded together with a melamine resin, it's lightweight, low in density and gives maximum thermal protection with minimal weight.

The product is easy to handle and to cut and shape into internal support struts and legs on vessels. It comes in 1" depths, from 35" to 71" widths (width of 59" width as standard) and 26 1/4" to 82' lengths.

With virtually no outgassing under cryogenic vacuum pressure and cryogenic temperature conditions this material gives faster pump-down times, making your production processes more efficient.

LONG-RANGE CRYOGENIC INSULATION ACCESSORIES

We supply Long-Range accessory products for cryogenic storage and transport equipment manufacturers, such as aluminum foil, aluminum foil tape, fiber glass fabric and fiber glass tape.

LONG-RANGE CRYOGENIC INSULATION PAPER

THE PAPER IS A NON-OUTGASSING, INORGANIC NON-WOVEN MATERIAL MANUFACTURED FROM SUPER FINE GLASS FIBER. WITH A SURFACE THAT DOES NOT ABSORB GAS MOLECULES EASILY, IT MINIMIZES VACUUMING TIMES. FURTHERMORE, ITS ENHANCED LATTICE STRUCTURE ENSURES THAT THE THERMAL CONDUCTIVITY COEFFICIENT AND SPECIFIC HEAT FLUX OF THE INTERLAY ARE EXTREMELY LOW WHEN WORKING IN CRYOGENIC ENVIRONMENTS.



TECHNICAL INFORMATION

Width Range:

1.6" to 71" to your specification (minimum quantities may be required)

Standard Widths:

3 1/2", 36", 51 1/2", 67 1/4", 71"

Temperature Range:

-452°F to 932°F (-269°C to 500°C)

KEY BENEFITS

The Long-Range paper is thin and light. Its highly uniform structure ensures low thermal conductivity:

- Zero organic content with no outgassing.
- Enhanced lattice structure ensures fast pump-down time.
- Proven stability minimizes waste and increases productivity.
- Suitable for all your equipment including oxygen vessels.
- Enhances installation efficiency and improves your bottom line.

APPLICATIONS

Cryogenic Vessels, Cryogenic Tanks, Microbulks, Dewars, Cryogenic Railcars, ISO Tanks, Vacuum Jacketed Pipe, etc.

TECHNICAL REPORTS

The following technical reports are available to give additional detail to support your selection:

- **Test report 20142252:**
Oxygen Compatibility Test
- **Installation Guide**

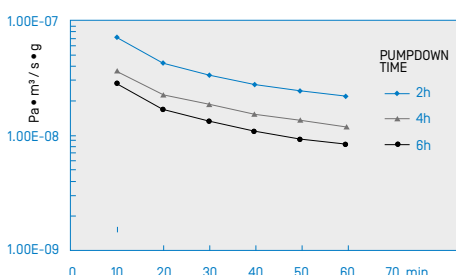
SPECIFICATION

Items	Index (unit)
Thickness	.0024±.0004"
Weight	.044±.0032 OZ/FT ²
Tensile Strength	≥0.03 KN/m
Moisture Content	≤0.5%
Organic Content	≤0.5%
Thermal Conductivity (w/m•k)	≤0.037 w/m•k
Cryogenic Outgassing (Static State 1h)	<1.0x10 ⁻⁸ Pa•m ³ /s•g
Temperature Range	-452°F – 932°F

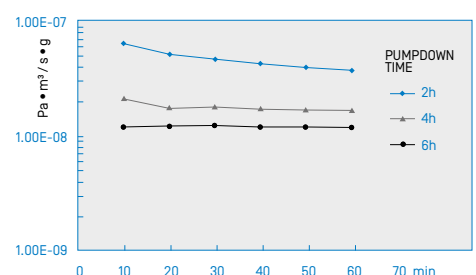
FIBER GLASS OUTGASSING

The 2 graphs show the outgassing at ambient and higher temperatures. The raw materials used together with the manufacturing processes ensure these standards are met.

FIBER GLASS OUTGASSING (TEMPERATURE 73°F)



FIBER GLASS OUTGASSING (TEMPERATURE 248°F)



LONG-RANGE CRYOGENIC COMPOSITE INSULATION

LONG-RANGE MANUFACTURE THIS HIGH QUALITY MULTI-LAYER COMPOSITE OPTION BY ROLLING THE ALUMINUM FOIL TOGETHER WITH THE INORGANIC PAPER IN COMBINED LAYERS FROM ONE TO FIVE PAIRS. THIS OPTION IS NORMALLY USED IN THE 5 TIMES PAPER AND 5 TIMES FOIL OPTION BY MOST USERS GLOBALLY.



TECHNICAL INFORMATION

Width Range:

2.4" to 71" to your specification (minimum quantities may be required)

Standard Widths:

3 1/2", 36", 51 1/2", 67 1/4", 71"

Composite Layers:

(A*+B*) x 1, (A+B) x 2, (A+B) x 3, (A+B) x 5

Temperature Range:

-452°F to 932°F (-269°C to 500°C)

KEY BENEFITS

5x quicker install time:

- The multi-layer, combined option strengthens the insulation materials.
- Drastically reduces the install time and increases your productivity.
- Reduces paper and foil waste.
- Suitable for all your equipment including oxygen vessels.
- Enhances installation efficiency and improves your bottom line.

*A = Aluminum foil & *B = insulation paper

APPLICATIONS

Cryogenic Vessels, Microbulk, Dewars, Cryogenic Railcars, ISO Tanks, Vacuum Jacketed Pipe, etc.

TECHNICAL REPORTS

The following technical reports are available to give additional detail to support your selection:

- **Test report 01S03:** Effective Thermal Conductivity Coefficient Test
- **Test report 04S11:** Material Outgassing Test at High Temperature (120°C)
- **Test report 03S10:** Material Outgassing Test at Normal Atmospheric Temperature
- **Installation Guide**

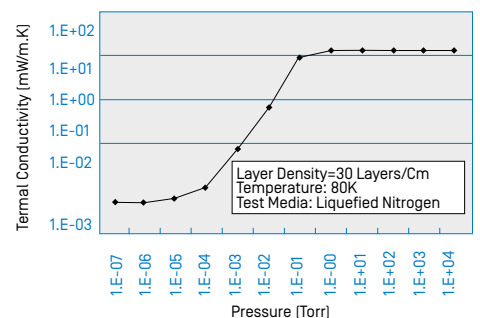
SPECIFICATION

Items	Insulation Material	Aluminum Foil
Thickness	.0024±.0004"	.00025"
Weight	.044±.0032 OZ/FT ²	.056±.0032 OZ/FT ²
Tensile Strength	≥0.03 KN/m	≥0.4 KN/m
Moisture Content	≤0.5%	-
Organic Content	≤0.5%	-
Ensemble Thermal Conductivity	<1.5x10 ⁻⁴ w/m•k	
Cryogenic Out-gassing (Static State 1h)	<1.0x10 ⁻⁸ Pa•m ³ /s•g	
Temperature Range	-452°F – 932°F	

COMBINED PAPER PERFORMANCE

The graph on the right shows the conductivity performance that is achieved by the high level of quality control established throughout the business.

CONDUCTIVITY PERFORMANCE



LONG-RANGE CRYOGENIC INSULATION BLANKET

THE LONG-RANGE CRYOGENIC INSULATION BLANKET IS DESIGNED TO MEET THE SPECIFIC INSULATION NEEDS OF THE CRYOGENIC EQUIPMENT MANUFACTURERS AND THEIR APPLICATIONS. MADE FROM HIGH QUALITY, SUPER-FINE GLASS FIBER BONDED TOGETHER WITH A MELAMINE RESIN, IT'S LIGHTWEIGHT, LOW IN DENSITY AND GIVES MAXIMUM THERMAL PROTECTION WITH MINIMAL WEIGHT.



TECHNICAL INFORMATION

Width Range:

2.4" to 71" to your specification
(minimum quantities may be required)

Standard Width:

71"

Temperature Range:

-450°F to 450°F (-268°C to 232°C)

KEY BENEFITS

- Gives maximum thermal protection with minimal weight.
- Easy to handle and cut into support struts and legs.
- Virtually no outgassing under vacuum pressures and cryogenic temperature conditions.
- Gives faster pump-down times.
- Makes your production processes more efficient and improves your bottom line.

APPLICATIONS

The Insulation Blanket is suitable for any application within the temperature range of -268°C to 232°C.

TECHNICAL REPORTS

The following technical reports are available to give additional detail to support your selection:

- **Test report 05S43:** Material Outgassing Test at Normal Atmospheric Temperature
- **Test report 06S44:** Effective Thermal Effective Conductivity Coefficient Test
- **Material Safety Sheet**

SPECIFICATION

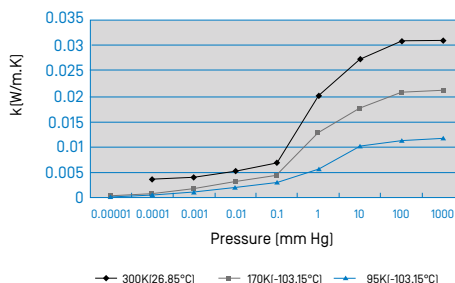
Items	Index (unit)
Thickness	0.98±0.20"
Weight	1.18 – 1.44 OZ/FT ²
Width	35.4" – 71"
Length	26.25' – 82'
Moisture	≤0.5%
Thermal Conductivity (w/m•k)	Refer to chart
Fiber Diameter (mm)	Refer to chart
Temperature Range	-450°F – 450°F

BLANKET PERFORMANCE

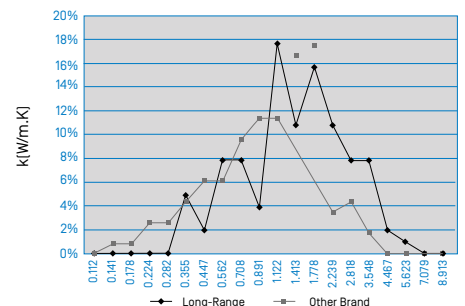
The graphs on the right show the conductivity performance and diameter distribution achieved from the material.

CONDUCTIVITY PERFORMANCE

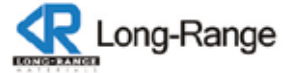
VACUUM CRYOGENIC THERMAL PERFORMANCE



DIAMETER DISTRIBUTION



LONG-RANGE CRYOGENIC INSULATION ACCESSORIES



WE STOCK AND SUPPLY THE FULL RANGE OF CRYOGENIC INSULATION ACCESSORY PRODUCTS FOR YOUR FULL RANGE OF CRYOGENIC EQUIPMENT. THESE INCLUDE ALUMINUM FOIL, ALUMINUM FOIL TAPE, GLASS FIBER FABRIC, GLASS FIBER TAPE, ETC.

CONTACT US TO HAVE YOUR FULL REQUIREMENT HELD IN STOCK TO MEET YOUR DAILY NEEDS.

Call: 844-341-3433

Email: info@ratermann-cryogenics.com



STANDARD SPECIFICATIONS

Property	Thickness (inch)	Width (inch)	Length	Weight (OZ/FT ²)
Aluminum Foil	.00025	1.6" – 71"	10,936 yards	.056±.0032 OZ/FT ²
Aluminum Foil Tape	0.12	.6 / 1 / 2"	180 feet	.0004 oz.
Glass Fiber Fabric	-	41.3"	656 feet	.157/.262 oz.
Glass Fiber Tape	.006	1"	164 / 328 feet	-

ALUMINUM FOIL

- Status 1235-0
- Excellent reflection
- Low emissivity
- No outgassing

ALUMINUM FOIL TAPE

- Water solubility acrylic adhesive
- Flame resistant
- Good sealant
- Long serviceable life indoors and outdoors
- Excellent reflection of both heat and light

FIBER GLASS FABRIC

- Oxygen Compatible
- High strength
- Low thermal conductivity
- Low outgassing
- Meets the needs of fixing, protecting and finishing multi-layer insulation material wrapping

FIBER GLASS TAPE

- Oxygen compatible
- High strength
- Low thermal conductivity
- Low outgassing
- Meets the needs of fixing and finishing multi-layer insulation material wrapping



YOUR GUIDE TO CRYOGENIC INSULATION

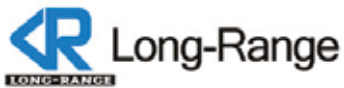
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insulation range please visit —
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Email: info@ratermann-cryogenics.com