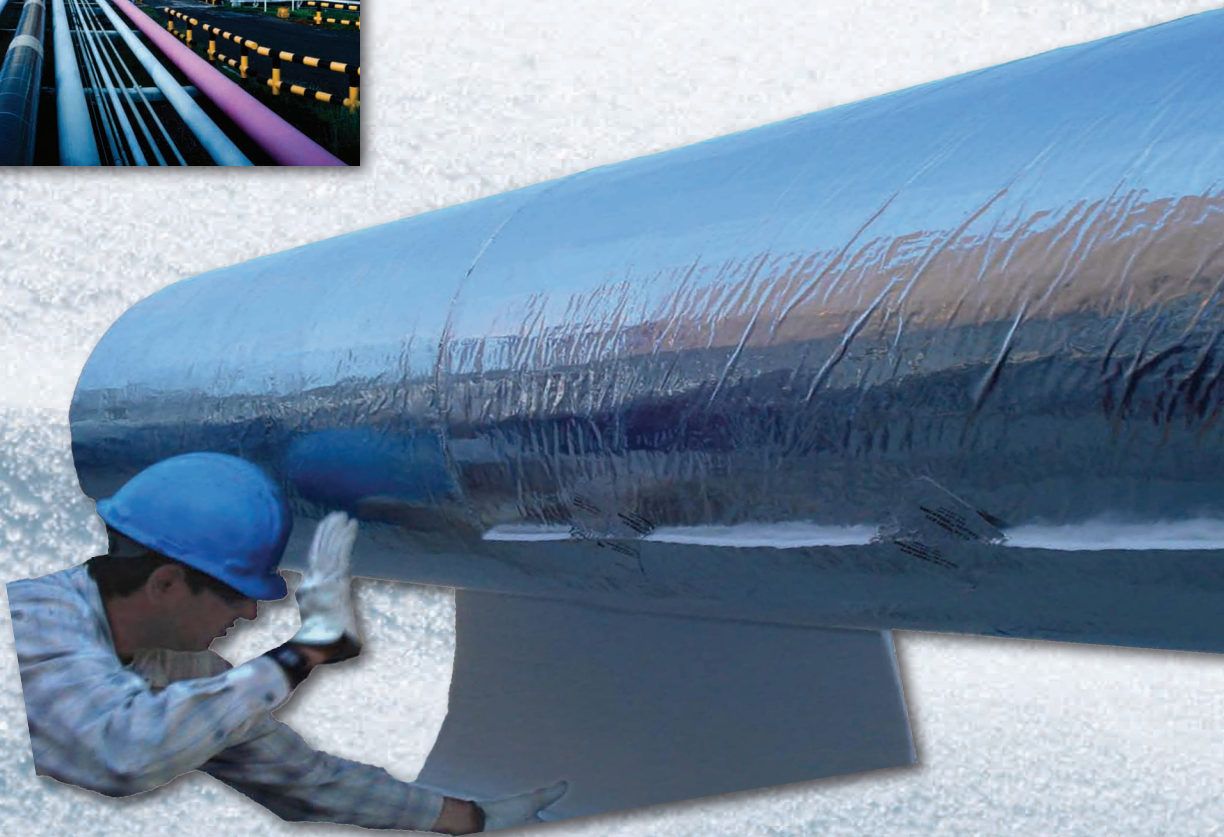


Cryogel[®] Z

Flexible Industrial Insulation With Integral Vapor Barrier for Sub-Ambient and Cryogenic Applications

-460°F (-270°C) to 195°F (90°C)



aspen | aerogels[®]

www.aerogel.com

Cryogel[®] Z

aspens aerogels

Flexible Insulation for Cold Work

Cryogel[®] Z has the lowest *k*-value of any cryogenic insulation material in the world, reducing thicknesses by 50% - 75%. Cryogel[®] Z's flexible blanket form, with a factory-applied, integral vapor barrier, is both faster to install and more durable once in service, resulting in lower-cost, higher-performing designs.

Applications Sub-ambient piping and equipment, cryogenic storage and transport, industrial gases, LNG import/export pipelines and process areas, chilled water systems



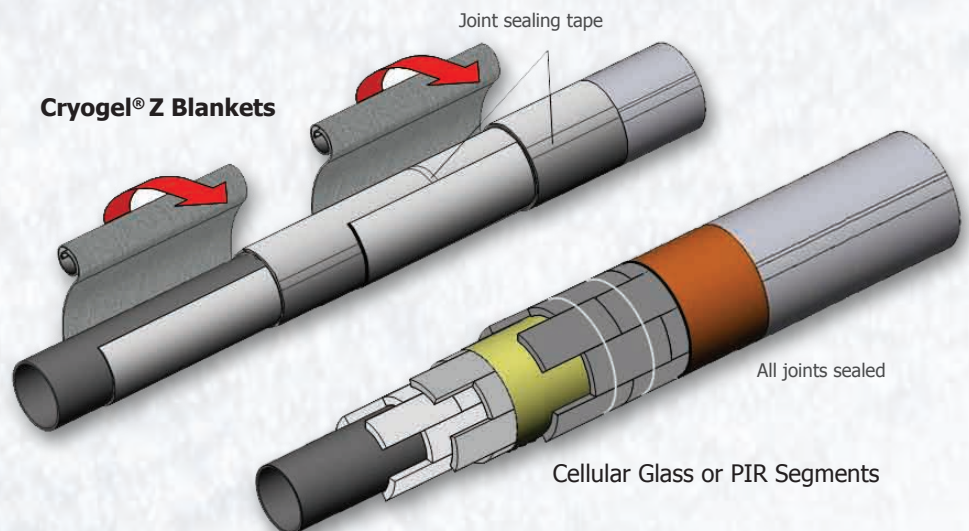
Service Temperature Range -460°F (-270°C) to 195°F (90°C)

Thermal Performance Cryogel[®] Z has the lowest thermal conductivity of any material used for cryogenic service. It is therefore much thinner compared to other cold insulation materials. Cryogel[®] Z's minimal thickness results in a smaller surface area and reduced heat gain compared to other insulation materials. This heat gain "safety factor" improves process control, reduces boiloff, and saves energy. Also, Cryogel[®] Z does not have blowing agents that diffuse out over time, so its thermal performance remains constant.

Moisture and Vapor Resistance Permeability to water and water vapor are critical to any insulation system operating at cryogenic temperatures. Cryogel[®] Z uses a factory-applied mylar vapor barrier to achieve a zero-perm system.

Structural Integrity Cryogel[®] Z is well-suited for sub-ambient and cryogenic applications. Under these severe conditions, it remains totally flexible and resists thermal shock. This is unlike rigid, cellular insulation materials, which experience contraction, thermal shock, damaged structure, freeze-thaw crack propagation, and degraded insulation performance under the same conditions.

Dimensional Stability Cryogel[®] Z insulation has a coefficient of thermal expansion similar to that of stainless steel, so there is minimal differential movement of the insulation system. Its low contraction rate and flexible wrap application eliminate the need for costly and labor intensive expansion/contraction joints required by traditional rigid insulation systems.



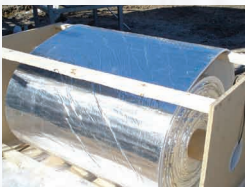
In addition to reducing labor, Cryogel[®] Z blankets minimize sensitivity to workmanship.



Cryogel® Z Insulation System Advantages

- Thinness creates more space in and around pipe racks and equipment.
- Thinness can decrease the overall size of a production facility, resulting in major material reductions and cost savings.
- Thinness results in volume and freight savings, decreased accessory materials, minimal site storage, and simplified logistics.
- Unique flexible form and wrap application makes installation faster, easier, and less costly. Rigid insulation systems require numerous segments that must be effectively sealed.
- Will not break during shipment.
- Competitive with other insulation systems on an installed basis due to decreased material requirements, logistics improvements, reduced installation time, and shorter construction schedules.

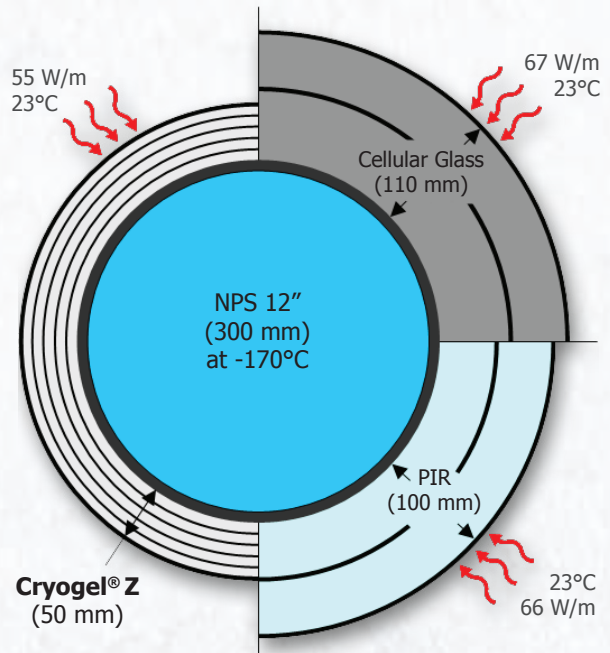
Cryogel® Z Offers Easy Installation, Improved Logistics



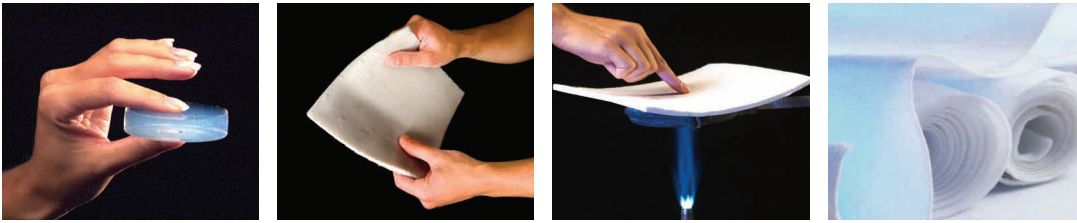
Cryogel® Z insulation rolls delivered, cut to size, and installed.



Cryogel® Z elbows can be stored in the hundreds.



All three designs meet the same condensation control criteria.



Aerogel: A New Way to Think About Industrial Insulation

Aerogels have been in existence for more than 80 years. They consist of lightweight silica solids derived from a gel in which the liquid component has been replaced with gas. The silica solids, which are poor conductors, consist of very small, three-dimensional, intertwined clusters that comprise only 3% of the volume. Conduction through the solid is therefore very low. The remaining 97% of the volume is composed of air in extremely small nanopores. The air has little room to move, inhibiting both convection and gas-phase conduction.

These characteristics make aerogel the world's lowest density solid and most effective thermal insulator. The outstanding thermal properties of aerogels have been studied for decades, but Aspen Aerogels® has developed a technically and economically viable form of aerogel for industrial insulation uses. Our unique process integrates aerogel into a carrier to create flexible, resilient, durable aerogel blankets with superior insulating properties.

Environmentally friendly: Strict environmental regulations and increased awareness have led to the requirement for environmentally friendly insulation materials for use in industry. Aerogels pose no chemical threat to the environment. They are silica based, which is essentially sand. Cryogel® Z and Pyrogel® XT contain no respirable fibers and do not require blowing agents, so they are free of CFCs and HCFCs. These products can be safely disposed and, since the installed

volume is considerably less than competing materials, there is less waste going to landfills.

Fire resistant: Cryogel® Z and Pyrogel® XT offer excellent resistance to flame spread and smoke emission. In actual hydrocarbon fires, they protect piping and equipment longer, which provides additional time to respond to a catastrophic event.

Light weight: Cryogel® Z and Pyrogel® XT are lighter than other insulation materials. This enables them to be easily and safely handled on the job site. They can be installed in longer lengths than traditional insulations, which improves installation rates. Their light weight also reduces overall loading of the pipe and equipment support structure.

Durable: Cryogel® Z and Pyrogel® XT are flexible materials that deform under compression. They have excellent bounce-back properties, even when exposed to compression forces of hundreds of psi, and they can resist high impact loads with no damage and no compromise in performance. This is unlike rigid insulation which, although stiff, is friable and susceptible to cracking. This creates thermal short circuits and paths for moisture intrusion. Rigid insulations also are at risk of breakage during shipping and installation.

Hydrophobic: Cryogel® Z and Pyrogel® XT are extremely hydrophobic and therefore have outstanding resistance to moisture.

Aerogel Insulation Materials Have the Lowest K-Values of Any Industrial Insulation

