"SUPER" INSULATING PERLITE FOR EVACUATED CRYOGENIC SERVICE

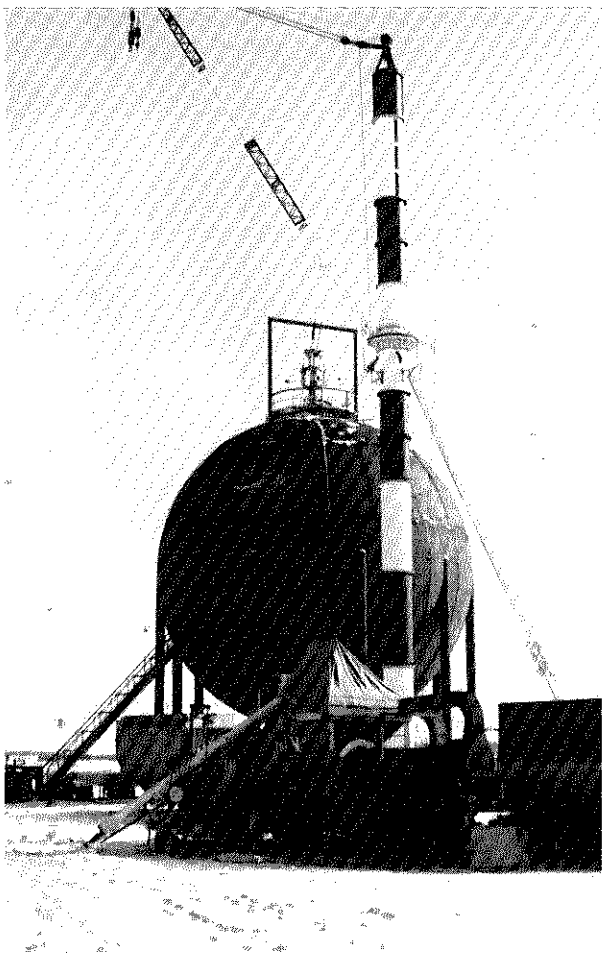
Expanded perlite is used for a wide variety of insulating applications ranging from cryogenic vessels requiring "super" insulation to low temperature and high temperature applications, lightweight perlite insulating concrete, insulating board, insulating plasters, masonry wall insulation and underfloor insulation.

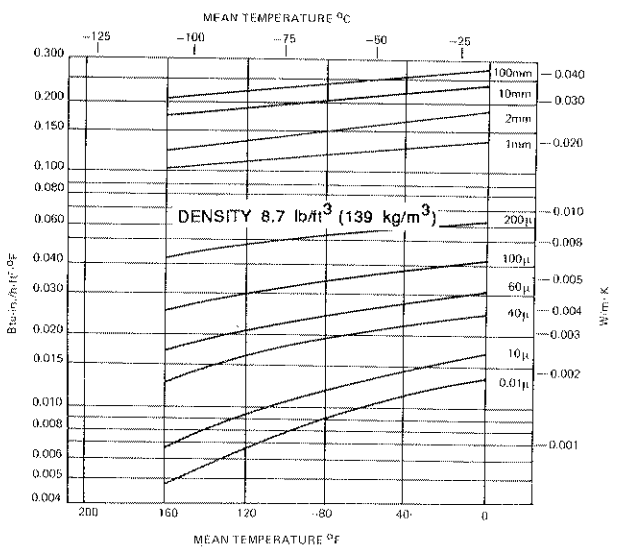
Perlite "Super" Insulation

For cryogenic applications of -150°F (-101°C) and below requiring "super" insulation, evacuated perlite provides a superior insulation with thermal conductivity up to 40 times less than 0.200 Btu·in/h·ft^2·°F (0.029 W/m·K) depending on vacuum and temperature. Usual applications for evacuated perlite insulation are in double walled helium and hydrogen storage spheres. It may also be used for storage of oxygen, nitrogen and LNG when especially low thermal conductivities are desired. In addition to large field erected storage tanks, evacuated perlite is used to insulate smaller shop fabricated vessels designed for the storage of many of the cryogenic gases.

Properties of Perlite Insulation

Perlite insulation suitable for evacuated cryogenic service exhibits low thermal conductivity throughout a range of temperatures, pressures and densities. The normal recommended density range is 8 to 9-1/2 lb/ft^3 (128 to 152 kg/m^3). The accompanying graph provides data on thermal conductivity for expanded perlite with a density of 8.7 lb/ft^3 (139 kg/m^3) at mean temperatures from 0°F (-18°C) to -160°F (-107°C). Cryogenic temperatures are generally considered to be below -150°F (-101°C). Thermal conductivity of evacuated perlite is many times lower than that of nonevacuated perlite insulation. For example, at a mean temperature of -115°F (-82°C), normal unevacuated cryogenic perlite at 4 lb/ft^3 (64 kg/m^3) would have a thermal conductivity about 22 times as great as evacuated perlite at 8.7 lb/ft^3 (139 kg/m^3) and interstitial pressure of 10 microns.





Effect of interstitial gas pressure and temperature on thermal conductivity of 8.7 lb/ft^3 (139 kg/m^3) expanded, evacuated perlite insulation.

EVACUATED PERLITE CRYOGENIC INSULATION SPECIFICATIONS

Density	8 to 9½ lb/ft^3 (128 to 152 kg/m^3)
Sieve Analysis (U.S. Standard)	Maximum 5% +30 mesh (0.6 mm)*
Thermal Conductivity**	0.0047 Btu·in/h·ft^2·°F$^+$ (0.0007 W/m·K)$^+$

* Tests have shown that the finer the material the better its performance (Within the specified density range).
** Thermal conductivity depends on temperature, density and sieve analysis of expanded perlite and the interstitial pressure.
\+ At -160°F (-107°C), 8.7 lb/ft^3 (139 kg/m^3), 0.01μ (1.33 mPa)

In addition to excellent thermal properties, perlite insulation is relatively low in cost, easy to handle and install, noncombustible and meets fire regulations, reduces insurance rates and does not shrink, swell, warp or slump.

Perlite for evacuated service must be dry. The normal moisture limit is 0.1 percent by weight. Moisture in the perlite greatly increases the pumpdown time necessary to achieve the low vacuum required. As a result, perlite must be fresh and packaged in moisture-proof bags or sealed tank trucks. Perlite bagged in paper sacks should not be used.

Typical Evacuated Perlite Installation

Field installation of perlite "super" insulation for large evacuated cryogenic vessels requires that a vacuum be maintained in the annular space of the vessel being insulated. Expanded perlite is pressurized with nitrogen in a tank truck and drawn into the annular space by a combination of vacuum and pressure. For small vessels, where vacuum transfer is not practical, direct conveying of dry perlite by means other than vacuum, under strictly controlled conditions, produces satisfactory results.

Portable perlite expansion plants complete with dust control equipment and an intermediate two-compartment tank truck are used to expand the perlite on-site and to fill the annular space with evacuated cryogenic grade perlite insulation in a dust-free, moisture-free manner.

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