Cryogenic High Vacuum Grease

Introduction

Apiezon N grease is one of the most widely used vacuum greases within the field of cryogenics, where its ability to improve heat transfer and craze-free performance characteristics at low temperatures are especially important. The product is also widely used at ambient temperatures, information on which is in the data sheet "Apiezon L, M & N Greases."

Thermal coupling medium

Apiezon N grease is important for the coupling of cooling systems to superconducting magnets, cryostats, temperature sensors or any system which is required to reach cryogenic temperatures as quickly as possible.

With its ability to fill the micropores of adjoining surfaces, and its resistance to cracking and crazing at low temperatures, Apiezon N grease increases the area of contact and therefore improves thermal coupling across the whole contact area.

The NASA Ames Research Center has shown a significant practical improvement in heat transfer across pressed metallic joints augmented with Apiezon N grease compared to those augmented with Indium. This is despite the thermal conductivity value of Apiezon N grease being less than that for Indium. Data sheet “Apiezon N grease Cryogenic Thermal Conductance” gives further information on this work.

In addition, Apiezon N grease does not suffer from the problem of creep, which is traditionally associated with Indium. It is ideal for applications where thermal cycling occurs, as it has the ability to withstand frequent cycling between temperatures of -273°C and +30°C.

Apiezon N Grease

- Thermal coupling medium
- Sensor mounting medium
- Sample mounting medium
- Cryogenic vacuum seal
- Silicone & halogen free
- Easily removed

Low levels of magnetic susceptibility also make N grease ideal for certain superconductor manufacturing applications.

Easy to apply, the grease provides a simple, efficient and cost effective means of increasing thermal conductivity at liquid helium temperatures and is widely used in the manufacture of all types of cryogenic equipment, including Magnetic Resonance Image (MRI) magnets, cryostats and scientific instruments (including electron microscopes).

Sensor mounting medium

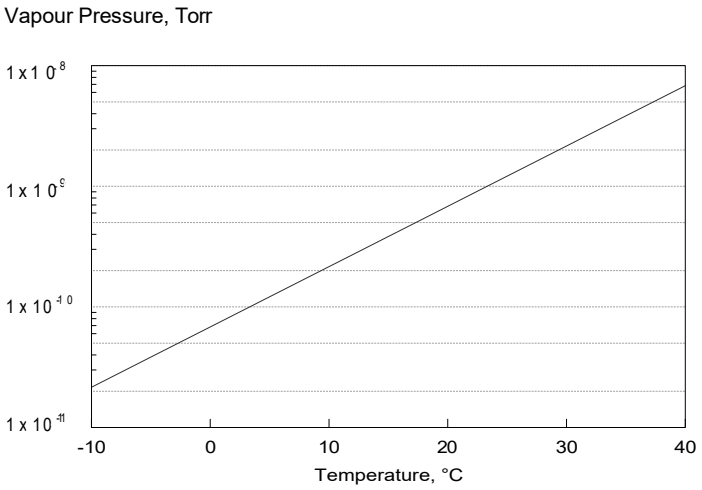
Apiezon N grease is an ideal sensor mount, especially suited for the mounting of sensors within holes. Pliable at room temperature, it solidifies at cryogenic temperatures to ensure the easy mounting and removal of sensors without causing damage.

Sample mounting medium

Important in low temperature testing of semiconductor chips, laser diodes and crystals, etc., Apiezon N grease is used to improve thermal contact between the sample and sample boat or the sample boat and cold finger of a cryostat. This ensures samples are at the lowest possible temperatures and improves test sensitivities.

The grease is luminescent in UV light. For optical testing, cover the grease by the sample or use calibration to account for the emissions caused by the grease.

Vapour pressure over working temperature range



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Cryogenic vacuum seal

Apiezon N grease exhibits extremely low vapour pressures at ambient temperatures. Vapour pressures are further improved by reductions in temperature to the cryogenic region, as demonstrated by extrapolation of the vapour pressure graph overleaf.

Its low temperature resistance to cracking is of particular benefit in vacuum sealing of cryosystems, where N grease can be relied upon to maintain an effective, crack free seal for long periods, even when subject to frequent thermal cycling.

Apiezon N grease is widely used to ensure vacuum or pressure tight seals in, among others, vacuum lines, cold traps, optical ports on electron microscopes, stopcocks, ground glass joints, taps, Schlenk lines and liquid helium hoses. It can also be used to improve cryogenic o-ring seals by filling surface or o-ring imperfections.

Typical Properties

Dropping point - ASTM.D 566	*°C*	50 to 70
	°F	122 to 158
Typical working temperature range	*°C*	-269 to 30
	°F	-452 to 86
Vapour pressure @ 20°C / 68°F, Torr		6×10^{-10}
Relative density @ 20° C / 68°F		0.911
Resistant to radiation		Not recommended
Outgassing characteristics - ASTM .E 595		
TML		<1%
CVCM		<0.1%
Lubricity 4 Ball Test - ASTM .D 2596, kg		150
Coefficient of expansion per °C over 20°C to 30°C		0.00072
Thermal conductivity, W/m°C	*@ 20°C*	0.194
	@ -269°C	0.095
Volume resistivity, V.R., Ω cm		2.0×10^{16}
Permittivity		2.3
Loss tangent		<0.0001
Surface breakdown at flash over, kV		27
Electrical strength, V/mil(0.001")		820

Silicone free

As a hydrocarbon based grease, Apiezon N grease is highly resistant to "creep" or "carry over", a phenomenon associated with silicone-based products. Silicone has a tendency to travel away from the area of application and contaminate adjacent surfaces.

The creep resistance of N grease benefits scientific users as it reduces sample contamination and the risk of interference in analytical techniques such as infra-red and mass spectrometry.

Silicone contamination is of particular concern in surface coating applications such as industrial paint or metal deposition processes, as trace amounts of silicone on surfaces prevent the adherence of paint and poor or incomplete coverage results. In semiconductor manufacture, yields can be severely affected by silicone contamination.

When using silicone-free Apiezon N grease the problems associated with creep and contamination are avoided.

"Gettering" action

Apiezon N grease is manufactured from a unique feedstock containing a high proportion of branched and unsaturated hydrocarbons. These complex structures give N grease a very high molecular weight and consequently strong powers of absorption, particularly for other hydrocarbon molecules.

Strong absorption properties ensure that Apiezon N grease has a powerful "gettering" action, i.e. the power to absorb greasy or chemical impurities on metal and glass surfaces. This is of value in the electronics industry where scrupulous cleanliness is required.

N grease has no contaminating effect on electrical equipment and is easily removed by hydrocarbon solvents, taking with it many trace impurities which are not removed by solvents alone.

Easily removed

Apiezon N grease is easily removed by wiping with a soft clean lint free cloth. Any residues of grease can be washed away with warm soapy water or by using any aromatic hydrocarbon solvent (toluene, xylene). For a more environmentally friendly solvent, we recommend Limonene.

Apiezon hydrocarbon greases are not soluble in alcohols (ethanol, IPA) or ketones (acetone, MEK) so these cannot be used for cleaning.

N grease works when you want it to, but is easily removed when you don't.

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Compatibility

Apiezon N grease is compatible with a wide range of o-ring materials including:-

- Viton
- Silicone
- Nitrile (>30% nitrile content)
- Nylon
- Polyurethane
- Polyethylene
- Polypropylene

Due to its hydrocarbon base N grease is not compatible with:-

- EPDM (ethylene propylene diene M-class rubber)
- EPR (ethylene propylene rubber)
- Butyl rubber
- PVC seals

Shelf life

The shelf life of Apiezon N grease is ten years from date of manufacture, providing the product is in the original unopened packaging and has been stored at ambient (10 to 30°C) temperature.

Industry approvals

Apiezon N grease has gained prestigious approvals from NASA and the US Navy.

Prestigious end users, among others include Siemens Magnet Technology, and Lake Shore Cryotonics, Inc.

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