



ULTRA LOW OUTGASSING LUBRICANTS

*Next-Generation Lubricants for Cleanroom and Vacuum Applications -
Ultra Low Outgassing, Vacuum Stability, Low Particle Generation*

Nye Lubricants for Cleanroom and Vacuum Applications

Today's vast array of electromechanical devices in semiconductor wafer fabrication, flat panel, solar panel and LCD manufacturing equipment place increasingly challenging demands on their lubricants. Lubricants today must be able to handle higher loads, higher temperatures, extend component operating life, and improve productivity, while eliminating or minimizing airborne molecular contamination or giving off vapors that can fog optics in high-speed inspection systems or even contaminate wafers.

For more than 50 years, Nye has been working with NASA and leaders in the commercial aerospace industry, qualifying lubricants for mission critical components while addressing problems like outgassing, contamination, and starvation. Outgassing reduces the effectiveness of a lubricant and can contaminate nearby components.

Much of this research is now paying off in other industries where Nye is applying this technology to design lubricants for uses in components and sub-assemblies for cleanrooms, laboratories and semiconductor fabrication facilities, both in vacuum and non-vacuum applications.

The Right Lubricant for the Right Application - NyeTorr® 6200 and NyeTorr® 6300

Nye Lubricants offers NyeTorr® 6200 and NyeTorr® 6300, designed to improve the performance and extend the operating life of high-speed bearings, linear guides for motion control, vacuum pumps, and other components used in semicon manufacturing equipment designed for processes such as deposition, ion implantation, etching, photolithography, and wafer measurement and inspection.

Nye tests and certifies the vacuum stability (E-595) of each batch. Other vacuum lubricants list only "typical properties," which do not warrant that vapor pressure on the label matches the actual vapor pressure of the lubricant. And most often, it doesn't.

Additionally, all NyeTorr cleanroom lubricants are subjected to a proprietary "ultrafiltration process" which removes microscopic particulates and homogenizes agglomerated thickeners. All are packaged in ultraclean containers in a Class 100 (ISO Class 5) minienvironment.



NyeLubricants.com

NyeTorr® 6200

A Pennzane® (multiply alkylated cyclopentane “MAC”) based grease thickened with PTFE, NyeTorr® 6200 is manufactured to exhibit very low vapor pressure and excellent wear resistance properties, good for heavily-loaded devices and designs requiring limited or oscillating motion, and is capable of sustained operating temperatures up to 150°C. Pennzane fluid-based lubricants also accept a wide variety of additives and are compatible with many of today’s design materials, making them the right choice for many applications.

Nye was the first to formulate oils and greases from Pennzane synthesized hydrocarbon synthetic fluids and is Shell Global Solutions’ exclusive authorized global distributor of all Pennzane fluids.

| TYPICAL PROPERTIES | Condition (Units) | NyeTorr® 6200 |
|---|-------------------|-------------------------|
| Temperature Range (°C) | | -45 to +150 |
| Vapor Pressure | | |
| | 25°C (torr) | 4.7 x 10 ⁻¹² |
| Knudsen | 100°C (torr) | 3.2 x 10 ⁻⁸ |
| | 150°C (torr) | 2.0 x 10 ⁻⁶ |
| Vacuum Stability - E-595 (24 hrs, 125°C) | | |
| Total Mass Loss | TML (% wt) | 0.069 |
| Volatile Condensable Material | CVCM (% wt) | 0.015 |
| Evaporation Loss | | |
| Nye CTM-1 (24 hrs) | 100°C (% wt) | 0.0 |
| Specific Gravity | 25°C (g/cc) | 1.05 |
| Microscopic Particulate Contamination | | <300/cc, <35µm |
| Penetration | NLGI Grade | 1 |
| Base Oil Viscosity | | |
| | -40°C (cSt) | 76,000 |
| ASTM D-445 | 40°C (cSt) | 106 |
| | 100°C (cSt) | 14 |
| Base Oil Viscosity Index | | 136 |
| Four Ball Wear | | |
| ASTM D-2266 | 20kg (mm) | 0.52 |
| (1hr, 1200 RPM, 75°C) | 40kg (mm) | 0.54 |

APPLICATION GUIDELINES

| | |
|--|---|
| Mechanical Load Limit | Heavy |
| Precision Positioning | Excellent |
| Very Low Starting Torque | Good |
| Torque Variation over Temperature | Moderate |
| Material Compatibility | Excellent for metal on metal. May cause some EPDM seals to swell. |

NyeTorr® 6300

A PTFE thickened, perfluoropolyether (PFPE) grease with very good vapor pressure and the widest temperature range available, from -75°C to 250°C. The inertness of PFPE lubricants makes them compatible with nearly all materials*, but also means low solubility. Additives designed to reduce corrosion or wear are not typically blended into PFPE lubricants.

** PFPE lubricants are generally compatible with metals, but the use of PFPE lubricants in heavily loaded or oscillating metal-on-metal applications or with certain alloys containing aluminum, magnesium, or titanium should be evaluated.*

| TYPICAL PROPERTIES | Condition (Units) | NyeTorr® 6300 |
|---|-------------------|-------------------------|
| Temperature Range (°C) | | -75 to +250 |
| Vapor Pressure | | |
| | 25°C (torr) | 4.5 x 10 ⁻¹² |
| Knudsen | 100°C (torr) | 5.5 x 10 ⁻⁹ |
| | 150°C (torr) | 1.6 x 10 ⁻⁷ |
| Vacuum Stability - E-595 (24 hrs, 125°C) | | |
| Total Mass Loss | TML (% wt) | 0.023 |
| Volatile Condensable Material | CVCM (% wt) | 0.008 |
| Evaporation Loss | | |
| Nye CTM-1 (24 hrs) | 150°C (% wt) | 0 |
| Specific Gravity | 25°C (g/cc) | 1.89 |
| Microscopic Particulate Contamination | | <300/cc, <35µm |
| Penetration | NLGI Grade | 2 |
| Base Oil Viscosity | | |
| | -40°C (cSt) | 5,800 |
| ASTM D-445 | 40°C (cSt) | 187 |
| | 100°C (cSt) | 56 |
| Base Oil Viscosity Index | | 346 |
| Four Ball Wear | | |
| ASTM D-2266 | 20kg (mm) | 0.95 |
| (1hr, 1200 RPM, 75°C) | 40kg (mm) | 1.30 |

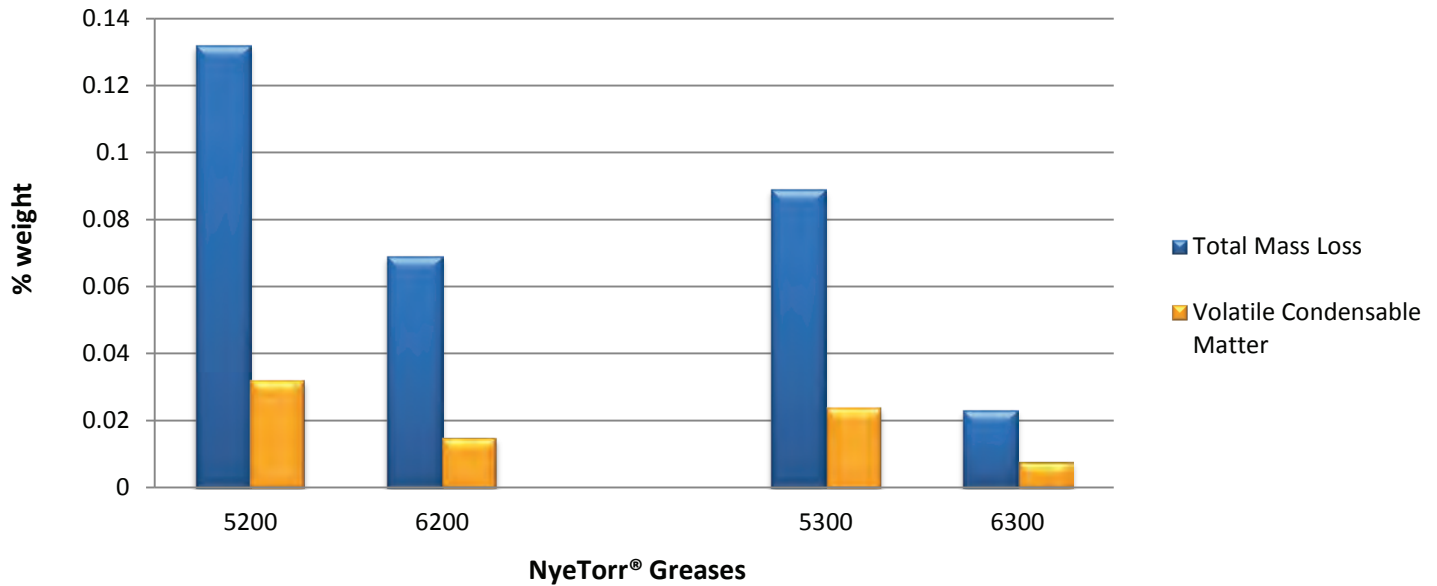
APPLICATION GUIDELINES

| | |
|--|-------------------------------------|
| Mechanical Load Limit | Light to Moderate |
| Precision Positioning | Excellent |
| Very Low Starting Torque | Excellent |
| Torque Variation over Temperature | Very Low |
| Material Compatibility | Excellent for Plastic and Elastomer |

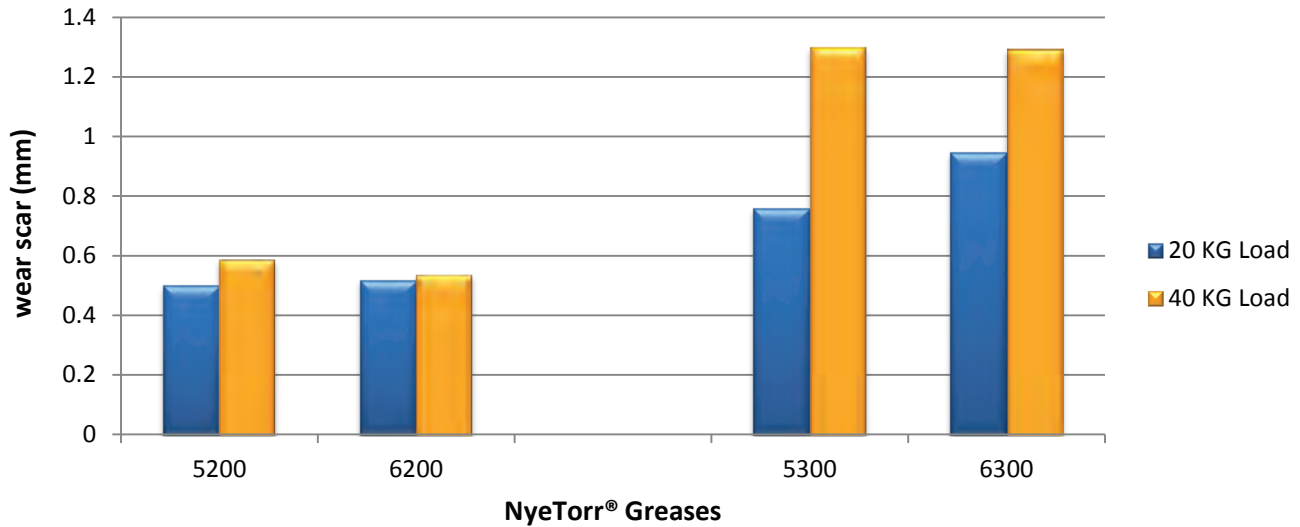


NyeTorr® 6200 and 6300 Comparative Chart

ASTM E-595 Vacuum Stability Test



ASTM D-2266 4-Ball Wear Test



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ISO 9001:2008
ISO 14001:2004
ISO/TS-16949:2009