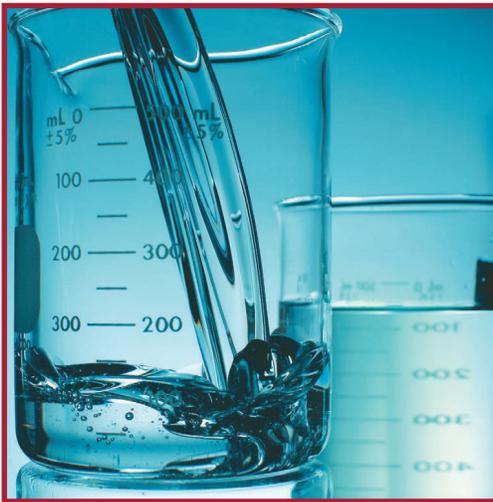


Ammonia Refrigeration Oils

***717-HT, 717-LT, 717-SC, 717-LTSC,
4600-15-SC Ammonia Pump Oil***

*With outstanding stability,
CAMCO® Ammonia Refrigeration Oils
are the clear choice.*



Inside

1 Introduction

CAMCO® Ammonia Refrigeration Oils: Today's premier lubrication choice for ammonia refrigeration applications.

2-3 CAMCO® Ammonia Refrigeration Oils

Features and highlights.

3 The CAMCO® Difference

Why choose CAMCO® Ammonia Refrigeration Oils over other types of oil?

4 About Conventional Refrigeration Oils

Conventional naphthenic oils are a thing of the past.

4 Requirements of Ammonia Refrigeration Systems

A higher quality lubricant is required.

4-5 The Challenges of Ammonia

Lubrication, Life Span, Viscosity Index, Evaporator Efficiency

6 CAMCO® Answers the Challenge

CAMCO® Lubricants engineers know a better way to handle the needs of ammonia refrigeration systems.

6 The Choice Is Clear

Demand superior performance. Choose CAMCO® Ammonia Refrigeration Oils.

Introduction

CAMCO® Ammonia Refrigeration Oils are today's premier fluids specifically designed for use in ammonia systems. These refrigeration oils consistently outperform conventional mineral oils for ammonia refrigeration applications.

CAMCO® Ammonia Refrigeration Oils are recommended for use as a lubricant/coolant in ammonia refrigeration applications. They are especially effective in combating corrosion and promoting long life in rotary screw, reciprocating, and vane ammonia compressors.

For outstanding temperature stability with no sludge forming tendencies, CAMCO® Ammonia Refrigeration Oils are the clear choice.



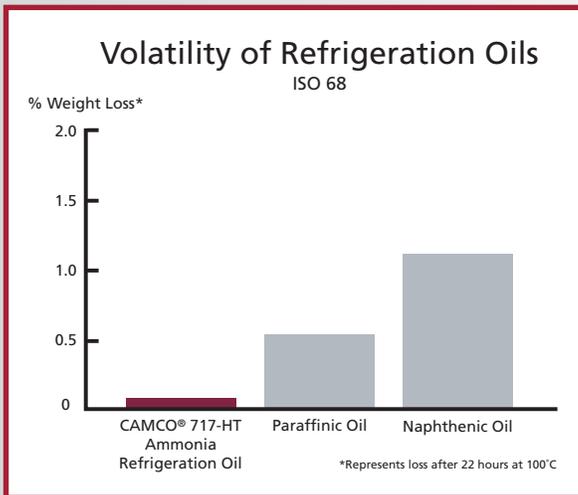


Figure A

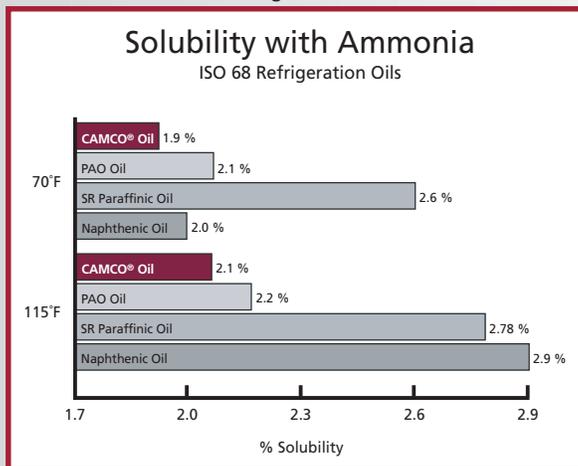


Figure B

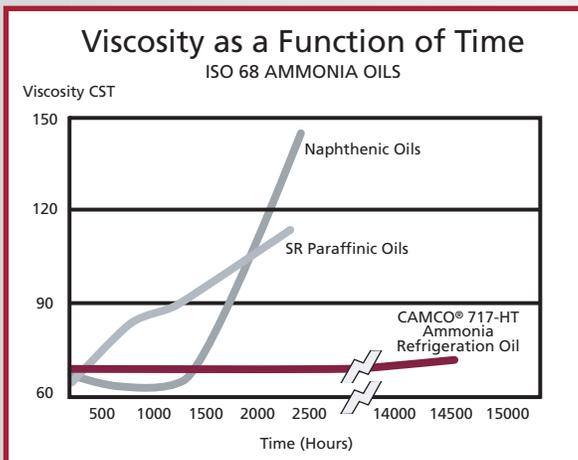


Figure C

CAMCO® Ammonia Refrigeration Oils

Low Volatility

CAMCO® Ammonia Refrigeration Oils are formulated to exceed compressor manufacturers' specifications. Due to their low volatility, oil carryover is reduced 50 percent. High volatility oils increase consumption which leads to carbon and sludge buildup. See Figure A.

Low Ammonia Solubility

CAMCO® Ammonia Refrigeration Oils are selected and blended for minimum mixing of oil in the refrigerant. See Figure B. This reduces the amount of make-up oil, thereby reducing annual oil costs, and reduces the amount of oil downstream from the compressor – oil which must then be removed from the low side of the system.

High Viscosity Index for Thermal Stability

Lubricants will get thicker as the temperature decreases and thinner as the temperature increases. Due to the high viscosity index of the CAMCO Ammonia Refrigeration Oils, the actual viscosity of the lubricant changes less as the temperature increases, thus keeping the viscosity in the proper range of the compressor.

Consistent Viscosity Over Time

Unlike solvent-refined oils, hydrocracked oils have much lower aromatic content, reducing volatility and resulting in less carry-over loss into the system. Light ends of the hydrocracked oil vaporize at much higher temperatures, therefore viscosity increase does not occur, and the oil stays in viscosity grade thousands of hours longer than solvent refined oils. This characteristic extends compressor life and extends the drain interval. CAMCO® 717 series oils are blended from hydrocracked base stocks that do not mix with water to form an emulsion. This increases oil life and high film strength is maintained with low volatility. It can be seen from Figure C that solvent refined mineral oils increase in viscosity in a short period of time.

Low or No Foaming

The low foaming characteristics of CAMCO® Ammonia Refrigeration Oils provide for rapid release of ammonia from the lubricant. Low foaming characteristics allow the lubricant to better perform the tasks of lubrication, cooling and sealing between the rotors on screw compressors and reciprocating compressors.

Oxidation Inhibition

CAMCO® Ammonia Refrigeration Oils have an additive package that enhances the natural protection of the base stocks to prevent rust from forming inside the compressor and other metal parts of the system. Oxidation inhibition is another way that CAMCO® Ammonia Refrigeration Oils protect your investment.

USDA H2 Approved

CAMCO® Ammonia Refrigeration Oils are USDA/NSF approved for use in meat, poultry and other food processing plants where there is no possibility of incidental food.

The CAMCO® Difference

CAMCO® Ammonia Refrigeration Oils meet the stringent demands of industrial ammonia compressors. This is accomplished by using base stocks from a patented two-stage severely hydrotreated refining process. This refining process removes impurities from the base stock along with unsaturated hydrocarbons, creating an exceptionally high quality base oil. Selected additives are then added to the base stock to create superior performance in an ammonia refrigeration oil. These additives include oxidation inhibitors, anti-corrosion protection, and pour point depressants. CAMCO® Ammonia Refrigeration Oils are straight branched hydrocarbons making a closed cell molecular structure, giving them high thermal and oxidative stability for extended drain intervals. The lubricity is also up to twice that of conventional, solvent-refined Group I base stocks, making them superior for use in reciprocating, rotary screw and vane compressors.

CAMCO® 717-HT

An ammonia refrigeration compressor fluid made from a custom blend of chemically inert, highly refined, de-waxed, semi-synthetic lubricant base stock.

CAMCO® 717-LT

A low temperature formulated lubricant, offering the same high quality performance as the 717-HT, with an additive package designed for medium-low temperature applications.

CAMCO® 717-SC

A refrigeration oil with an improved special additive blend to condition seals while the compressor is operating. Seals that have hardened due to overheating may not be helped, but seals that have lost resiliency due to the leaching action of oils on the seal will be restored, and leaks will be stopped or drastically reduced.

CAMCO® 717-LTSC

A low pour point fluid designed for systems operating in the -40°F to -60°F range that require extra low temperature qualities. Also includes a special seal conditioner additive package that restores resiliency to "O" rings and seals to near original condition. As noted, certain seal leaks may not be helped. Contact your CAMCO® distributor for more information.

CAMCO® 4600-15-SC

For use with Cornell recirculating pumps in ammonia and R-22 systems. Features a -97° pour point and a seal conditioner to extend seal life. The seal conditioner replenishes plasticizers and fillers in the seal that are leached out by contact with the lubricant, restoring the resiliency of the seal. Contact your CAMCO® distributor for more information.

Naphthenic refrigeration oils work well with old Freon refrigerants, but they fall significantly short in modern ammonia refrigeration applications.



About Conventional Refrigeration Oils

The standard refrigeration oils for both Freon and ammonia systems were naphthenic oils, chosen because of their natural low pour point, -30° F. Their miscibility in Freon systems was acceptable and in ammonia systems their solubility in the discharge gas was acceptable. However, their low viscosity index, high volatility and high aromatic content resulted in high carry-over. Carbon and sludge buildup impacted compressor performance and maintenance. In lower temperature systems oil was difficult to remove. On newer high speed, high temperature equipment, CAMCO® 717 series lubricants and blended synthetic oils have eliminated these problems. A cleaner, reduced maintenance, extended drain interval lubricant is the result.

Requirements of Ammonia Refrigeration Systems

Modern high speed ammonia compressors require a high quality lubricant and must have the following qualities:

- High film strength for sealing between male and female rotors and between rotor tips and compressor barrel
- Ability to cool the compressor
- Adequate lubrication to reduce wear on reciprocating compressors and maintain adequate viscosity at discharge temperatures for lubrication and sealing on screw compressors

CAMCO® Ammonia Refrigeration Oils are quality lubricants that meet the new, more demanding requirements.



The Challenges of Ammonia

CAMCO® Lubricants understands both the challenges presented by ammonia systems and the shortcomings associated with conventional naphthenic refrigeration oils:

Lubrication

Ammonia does not have Freon's natural lubricating quality. The harsh chemical environment of an ammonia refrigeration system requires an oil that must lubricate, cool and seal.

Life Span

Conventional oils, both naphthenic and solvent-refined paraffin, are short-lived in ammonia compressors; they begin to break down after a short period of time. Viscosity increase occurs after about 1500 hours of operating time.

Viscosity Index

Conventional mineral oils have a low viscosity index, poor thermal stability, and viscosity drops rapidly as discharge temperatures are reached. The viscosity drop may affect bearing wear and the sealing quality of the lubricant. High volatility and high aromatic content increases carry-over and results in carbon and sludge buildup in the compressor.

Ammonia refrigeration oils must possess characteristics for optimum low-temperature performance, not just high temperature durability.

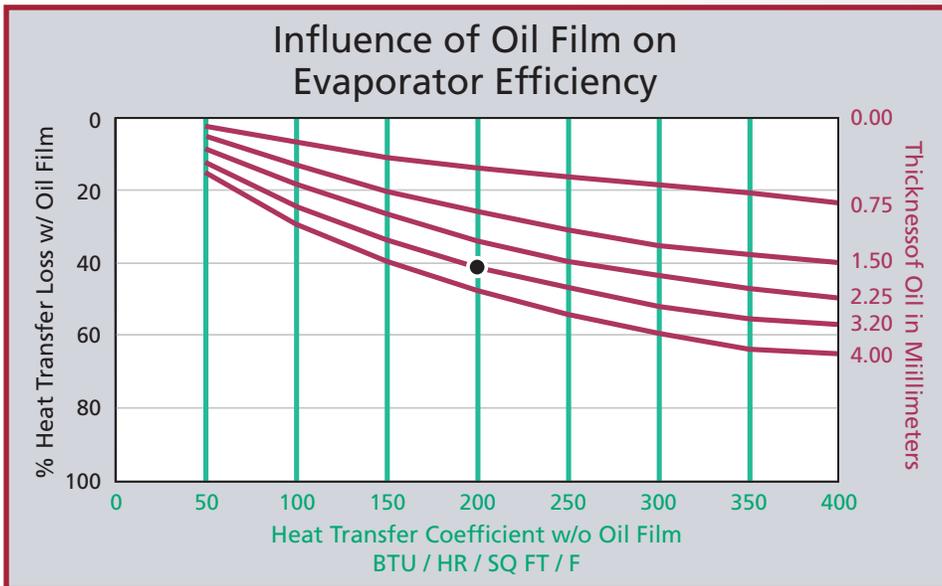


Figure D

Evaporator Efficiency

A high viscosity index lubricant is needed to minimize the amount of oil that migrates into the system. See Figure D shows the effect of oil film on evaporator efficiency. To determine the heat transfer loss on an evaporator coil, find the heat transfer co-efficient of your evaporator at the bottom of the chart. On the right side, select the thickness of the oil in mils on the inside of the evaporator. Where these two lines intersect on the chart is your reference point. Use a straight edge from the reference point to the left margin to determine heat loss for a given thickness of oil in the evaporator. For example, assuming a heat transfer co-efficient of 200 and a 3.20 mil oil film on the evaporator coil, by following the intersection of the green and red lines (marked by a black dot) to the left hand margin, we see that a 40% heat loss will occur.



CAMCO® Answers the Challenge

Engineers at CAMCO® Lubricants believed that a better-suited oil could be formulated for use in ammonia refrigeration applications, and through innovative hydrotreating methods and the incorporation of select additive packages, a clear solution is now available.

CAMCO® Ammonia Refrigeration Oils outshine competitive products in several rigorous industry-standard bench tests. Our quality oils demonstrate excellence in lubrication and anti-wear performance, low volatility, thermal stability and ammonia immiscibility.

The Choice Is Clear

Ammonia refrigeration systems demand the highest quality lubrication oil available. CAMCO® Ammonia Refrigeration Oils are formulated to provide the most efficient, most versatile, and longest lasting lubrication possible for ammonia systems. With hydrotreated base stocks and additive packages selected specifically for the task at hand, CAMCO® Ammonia Refrigeration Oils deliver reliable lubrication and ongoing savings.

Demand superior performance. Choose CAMCO® Ammonia Refrigeration Oils.



*CAMCO® offers:
Less down time,
less oil consumption,
less machine wear,
less headache.*



Specializing in Synthetic and Semi-Synthetic Lubricants for Refrigeration, Food Processing and Industrial Applications

Corporate Office: 1544 134th Avenue NE • Ham Lake, MN 55304
Tel: 763-205-0828 • Fax: 763-432-9295
Email: camcosales@camcolubricants.com • www.camcolubricants.com

To order CAMCO® Ammonia Refrigeration Oils, contact CAMCO® Lubricants or your local distributor. Lubricants for the new non-ozone depleting refrigerants and automotive air conditioner lubricants are also available.