



*Tests conducted under the following
industry standards for **PermaFrost™***

API
ASHRAE
ARI
ASTM
EPA
ANSI
UL

SINCE 1985
Quality Controlled Through Analysis

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10630 Fallstone Rd, Houston, Texas 77099

PO Box 741905, Houston, Texas 77274

TEL: (281) 495-2400

FAX: (281) 495-2410

Client:	Powertron LLC	Requested By:	Mr. Tony Sgarbi
Sample:	10% PermaFrost + 90% Refrigeration Oil	Report Date:	April 18, 2002
Laboratory No:	19695-02 Page 2 of 2	Purchase Order No:	Pending

TEST	RESULTS
Compatibility with Chlorofluoro Hydrocarbons (Group I Refrigerant)	Compatible (No separation)
Compatibility with R-40, R-717, R-764 (Group II Refrigerant)	Compatible (No separation)
Compatibility with R-290 Propane (Group III Refrigerant)	Compatible (No separation)
Compatibility with Mineral Oils	Compatibility with
Compatibility with Synthetic Oils	Compatibility with
Seal Compatibility Index, 24hr @100°C, IP-278	5
Total Organic Halogens (TOX), EPA 9020B, ppm	364.0

Analytical Methods Used:

- 1) Reference: CFR Title 40 Part 261
- 2) Reference: 40 CFR Part 136, Fed Register, Oct 26, 1984, Part III
- 3) Reference: SW-846 Methods for Evaluating Solid Waste No. 1986

TCLP Inorganics, Metals by Inductively Coupled Plasma, EPA 6010

Cold Vapor Atomic Absorption EPA 7471 for Mercury

HW No.	Contaminant	Cas No.	Regulatory/ppm	Result/ppm
D004	Arsenic	7440-38-2	5.0	<1.0
D005	Cadmium	7440-39-3	100.0	<1.0
D006	Barium	7440-43-9	1.0	<1.0
D007	Chromium	7440-47-3	5.0	<1.0
D008	Lead	7440-92-1	5.0	<1.0
D009	Mercury	7440-97-6	0.20	<0.05
D010	Selenium	7440-49-2	1.0	<1.0
D011	Silver	7440-22-4	5.0	<1.0

Prepared By,
Nader M. Sorurbakhsh, P.E.
Laboratory Director

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TEST	RESULTS
Aniline Point, ASTM D 611, °F	11
Dielectric Breakdown Voltage, ASTM D 877, Kv	41
Flash Point, PMCC Closed Cup, ASTM D 93, °F	370
Water Content by Karl Fisher, ASTM D 1744, ppm	10
Viscosity, Kinematics @ 40 °C ASTM D 445, cSt	7.8
Pour Point, ASTM D 97, °F	-70
pH by Glass Electrode, ASTM D 1287	6.18
ASTM Color, ASTM D 1500	<0.5
Specific Gravity, @ 15/15 °C, ASTM D 70	0.9200

Above test were performed according to *ASHRAE* Methods

CORROSION TEST FOR PETROLEUM PRODUCTS IN GLASSWARE D-1384
168 HRS @ 120 °F:

	Initial Run	Duplicate Run	Triplicate Run	Specification
Weight Change, mg				
Copper	-6	-6	-5	+/- 10 max
Brass	-2	-3	-2	+/- 10 max
Steel	-3	-2	-3	+/- 10 max
Aluminum	-29	-28	-29	+/- 30 max

Extreme Pressure Properties of Lubricating Fluid (Four-Ball Method) ASTM D2783:
Test conditions were as following:

Temperature:	75 ⁺ /- 2°C
Speed:	1760 +/- 40 rpm
Duration:	10 +/- 1 sec
Load:	5 +/- 0.2 Kgf

Load Wear Index	60.0
Weld point, kg	295



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STANDARD VALUES

CORROSION TEST FOR PETROLEUM PRODUCTS IN GLASSWARE D-1384

168HRS @ 120 °F

	Initial Run	Duplicate Run	Triplicate Run	Specification
Weight Change, mg				
Copper	-4	-5	-5	+/- 10 max
Brass	-2	-2	-2	+/- 10 max
Steel	-3	-4	-3	+/- 10 max
Aluminum	-27	-29	-28	+/- 30 max

Extreme Pressure Properties of Lubricating Fluid (Four-Ball Method) ASTM D2783 (test to failure)

Standard Refrigerant Oil

Weld Point, kg	Minimum Value	Maximum Value
Four Ball Test ASTM D2783	3	8.5

Average Load Wear Index	Minimum Value	Maximum Value
Four Ball Test ASTM D2783	120	145

Seal Compatibility Index , 24 hr@100°C, IP-278

Test	Min value	Max value
Seal Comp. IP-278	3	8.5

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Client:	Powertron LLC	Requested By:	Mr. Tony Sgarbi
Sample:	PermaFrost	Report Date:	April 18, 2002
Laboratory No:	19695A	Purchase Order No:	Pending

TEST	RESULTS
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Thermal Conductivity of Petroleum Products ASTM D 2717:

Thermal Conductivity @ 90 °F, Btu.in/hr.ft ² °F (Refrigeration Oil Only)	0.94
Thermal Conductivity @ 90 °F, Btu.in/hr.ft ² °F (10% PIX Additive + 90% Refrigeration Oil)	1.18

Respectfully Submitted,
 Nader M. Sorurbakhsh, P.E.
 Laboratory Director



Test Descriptions and Results

→ **UL 984A:** Testing UL classified lubricant for use with compressor motor insulating materials and refrigerants.

UL has developed specifications to classify lubricant used in sealed motor compressors of air conditioning and refrigeration equipment. The UL program covers lubricants and the indicated refrigerants for all insulating materials used in industry-recognized hermetic refrigerant motor-compressors.

→ **ASHRAE 86 - 1994:** Completed Refrigeration oil floc point, °F.

The temperature in which waxy materials in lubricating oil separate from a mixture of oil and refrigerant, giving a cloudy appearance. This test is important in that it evaluates the tendency of refrigeration oils to plug expansion valves or capillaries in refrigeration systems.

Results: - 60°F

→ **ASHRAE 99:** Completed Refrigeration oil description.

Refrigeration oils can be described as those that operate with certain values of different refrigerants. Separation, temperature, and viscosity are a few examples. This test examines these parameters and defines oil as refrigerant compatible.

Results: refrigerant compatible

→ **ASTM D1500:** Completed Color scale

This test is used to compare a range of colors against the colors of other petroleum products. This is the most common test, extensively used for industrial and process oils.

Results: <.05

→ **ASTM D3233:** Completed Extreme pressure additive.

Lubricant additives that prevent metal surfaces from seizing under conditions of extreme pressure. At the high local temperatures associated with metal-to-metal contact, an extreme pressure additive combines chemically with the metal to form a film that prevents the welding of opposing asperities (microscopic projections on metal surfaces resulting from normal surface finishing processes) and the incidental scoring that is destructive to sliding surfaces under high loads.

Results: 2400ft/lbs@1 min before failure. Exceeds standards

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→ **ASTM D665A:** Completed Rust inhibitor.

A type of additive for protecting lubricated metal surfaces against chemical attack by water or other contaminants.

Polar compounds wet the surface preferentially, protecting it with a film of oil.

Results: <0.5%

→ **ASTM D611:** Completed Aniline point, °F.

The lowest temperature at which a specified quantity of aniline (a benzene derivative) is soluble in a specified quantity of petroleum product, i.e. the solvent power of a hydrocarbon. The lower aniline point, the greater the solvency.

Results: 11°F

→ **ASTM D877:** Completed Dielectric breakdown, kV.

The minimum voltage required to produce an electric arc through an oil sample, hence an indication of the insulating (arc preventive) properties of an oil.

Results: 41 kV

→ **ASTM D93:** Completed Flash point, °F.

The lowest temperature at which the vapor of a combustible liquid can be made to ignite momentarily in air. Flash point is an important indicator of the fire and explosion hazards associated with petroleum products.

Results: 370°F

→ **ASTM D1744:** Completed Water content, PPM.

A method used for obtaining a semi-quantitative estimate of the amount of trace water present in a finished lubricant.

Results: 10 PPM

→ **ASTM D445:** Completed Viscosity @ 100°F.

This test measures the fluid's resistance to flow. Liquids change viscosity with temperature, becoming less viscous when heated. High pressures, or load, tend to squeeze the oil out of the bearing, which calls for the greater film strength of a high-viscosity oil.

Results: 7.8

→ **ASTM D97:** Completed Pour point, °F.

The lowest temperature at which oil is observed to flow, when cooled under conditions as defined by ASTM D97. The pour point is 5°F above the temperature at which the oil in a test vessel shows no movement when the container is held horizontally for five seconds.

Results: -70°F.

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→ **ASTM D1287:** Completed Test for pH.

Measures the acidity or alkalinity of an aqueous solution. The pH scale ranges from 0 (very acidic) to 14 (very alkaline), with a pH of 7 indicating a neutral solution equivalent to the pH of distilled water.

Results: 6.18

→ **ASTM D2717:** Completed Thermal conductivity.

Measures the ability to conduct heat. The higher the conductivity, the quicker molecules transfer heat under high temperatures.

Results: Refrigerant oil only - 0.94; with PermaFrost - 1.18

→ **ASTM D1384:** Completed Corrosion test.

The chemical attack on metal or other solid contaminants in a lubricant. Common corrosive contaminants are (1) water, which causes rust, and (2) acids, which may form as oxidation products in deteriorating oil.

Results: -3 to -5

→ **ASTM D4052, D70:** Completed API gravity @ 60°F.

Higher API gravity values translate into lower material density, which would mean a lower specific gravity.

Results: .9200

→ **EPA 6010:** Completed Total metals.

Measures the amount of metal particles in lubricants.

Results: all < 1.0 PPM

→ **EPA 7471:** Atomic absorption for mercury.

The process of hydrocarbon analysis to determine mercury content.

Results: < .05

→ **EPA 9020B:** Total halogens.

The standard for determining the percentage concentration of all halogens in lubricants.

Results: 364

→ **PPMANSI - Compatibility with Hydrocarbons (Group 1, 2, 3):** Completed

Results: Compatible

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→ **ANSI - Compatibility with Mineral Oils: Completed**

Results: Compatible

→ **ANSI - Compatibility with Synthetics: Completed**

Results: Compatible

→ **ANSI - Seal Compatibility Index: Completed**

Results: Compatible

→ **ARI Modified 210/240:** Testing Unitary air conditioning and air source heat pump equipment.

This standard is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors, and users. All procedures are defined by ARI and run under ARI supervision. The tests are independently monitored by ARI field engineers. Because ARI Standard 210 required constant load and humidity control, ARI modified the test to measure heat transfer at the test site and actual location for the HVAC systems.

→ **ARI Modified 550:** Testing Water chilling packages using the vapor compression cycle.

This standard is intended for the guidance of the industry, including manufacturers, engineers, installers, contractors, and users. The standard applies to all vapor compression refrigeration water chilling packages including one or more hermetic or open drive compressors (centrifugal, rotary, screw, scroll, reciprocating, or other types), equipped with either water-cooled, air-cooled, evaporative cooled condensers, or supplied without a condenser.