

Thermonomics[®]

Financial Empowerment
Through Energy Savings

Technical Data
and MSDS



Thermonomics' patented restorative agent has been thoroughly tested by a broad cross-section of commercial industries, independent laboratories, municipalities and government agencies. In nearly ten years of lab tests and field trials, it's proven safe, reliable and effective, garnering recognition from the Department of Energy through the Federal Energy Management Program. To save you the time and expense of recreating these tests, and to answer the questions your operations or engineering folks are likely to ask, we've compiled the key data and test results in this booklet. If you have further questions, or require more detailed information, feel free to contact us at 1-888-870-0003 or tech@thermonomics.net and one of our technicians will be happy to answer your questions.

Test Descriptions and Results

ASHRAE 99: Completed Refrigeration oil description

Refrigeration oils can be described as those that operate with certain values of different refrigerants. Separation, temperatures 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 extensively used test for industrial and process oils.

Parameters: 1.5 maximum

Results: <.05

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.

Parameters: pH 7 –neutral

Results: 6.9

ASHRAE 86 – 1994: Completed Refrigeration oil floc point, °F

The temperature in which waxy materials in lubricating oil separate from 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.

Parameters: -60 °F maximum

Results: -60 °F

ASTM D6304: Completed Water content, ppm

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

Parameters: <50 ppm

Results: 13 ppm

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.

Parameters: 5.0% maximum

Results: <0.5%

ASTM D97: Completed Pour Point, °F

The lowest temperature at which an oil is observed to flow. 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.

Parameters: -40 °F

Results: -70 °F

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 hydrocarbon. The lower aniline point, the greater the solvency.

Parameters: 11 °F

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.

Parameters: 150/160

Results: 156.9

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.

Parameters: <140.9 °F to be flammable

Results: 360 °F



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 Thermonomics: 1.18

ASTM D1384: Completed Corrosion test

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

Parameters: +10 maximum
Results: -3 to -5

ASTM D4052, D70: Completed API gravity @ 600F

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

Parameters: 22.5/25.5
Results: 22.73

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 process) and the incidental scoring that is destructive to sliding surfaces under high loads.

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

EPA 7471: Completed Atomic absorption for mercury

The process of hydrocarbon analysis to determine mercury content.

Parameters: < .20
Results: < .05

EPA 6010: Completed Total metals

Measures the amount of metal particles in lubricants.

Parameters: 1.0 ppm to 100 ppm
Results: all <1.0 ppm

EPA 9020B: Completed Total halogens

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

Results: 364 ppm

ANSI – Compatibility with Hydrocarbons (Group 1, 2, 3): Completed

Results: Compatible

ANSI – Compatibility with Mineral Oils: Completed Results: Compatible

ANSI – Compatibility with Synthetic: Completed Results: Compatible

ANSI – Sealed Compatibility Index: Completed Results: Compatible

Lubricity Evaluation

The Falex Pin and Vee Block Test measures a lubricant's load carrying capacity. It is performed according to ASTM D-3233-73 "Measurement of Extreme Pressure Properties of Fluid Lubricants (Flax Method)." The test employs a steel pin rotated at 290 RPM against two vee blocks that are

immersed in an oil sample through which Freon is bubbled to simulate compressor operating conditions. Load is applied to the pin via the vee blocks until the oil sample fails.

The Falex Corporation offers one of the most modern, fully equipped friction and wear testing laboratories in the world. Falex has more than 50 years of experience in the lubricant testing industry.

SD-1: 100% Refrigerant Oil # 1
Failure @ 300 psi

SD-2: 95% Refrigerant Oil # 1
5% Thermonomics
No failure @4500+ psi

SD-3: 100% Refrigerant Oil # 2
Failure @ 300 psi

SD-4: 95% Refrigerant Oil # 2
5% Thermonomics
No failure @4500+ psi

Seal Compatibility / Degradation Test

Thermonomics ERT's (Efficiency Restorative Technologies) are specifically designed and contain seal life extenders. These proprietary chemicals constantly keep the compressor seals wet without damaging its elasticity and flexibility. (All types of seals used in a/c and refrigeration are compatible.) Seal Degradation: Reduced swelling in Neoprene by 29% and Nitrite by 81% over untreated refrigeration oil. Thermonomics also effectively conditions Viton A, PFE, Buna N, Nylon 66, Hastelloy, Mylar, Polypropylene, and Carpenter 20.



Compatibility tests

Refrigerants

Thermonomics technologies are compatible and effective with the following refrigerants:

Group 1

- R-11 Trichlorofluoromethane
- R-12 Dichlorodifluoromethane
- R-13B Bromotrifluoromethane
- R-22 Chlorodifluoromethane
- R-113 Trichlorotrifluoroemethane
- R-114 Trichlorotetrafluoroemethane
- R-410A 50% Difluoromethane / 50% Pentafluoroethane
- R-502 48.8% Chlorodifluoromethane / 51.2% Chloropentafluoroethane
- R-744 Carbon Dioxide
- R-134A Tetrafluoroethane

Group 2

- R-40 Methyl Chloride
- R-717 Ammonia
- R-764 Sulfur Dioxide

Group 3

- R-290 Propane

Thermonomics technologies include ERT-2000, ERT-2012, and ERT-2022. All ERT technologies are compatible and safe to use for most applications, with the exception of Absorption Chillers. In addition, Thermonomics ERT's can be designed for custom applications where necessary.

Corrosion and Oxidation Protection and Metal Compatibility

Thermonomics ERT's will protect against corrosion and oxidation on the following ferrous and non-ferrous metal commonly used in a/c and refrigeration units:

- Carbon Steel
- Stainless Steel
- Copper
- Zinc
- Aluminum
- Brass
- Cast Aluminum
- Cast Iron
- Silver and Copper alloys

Oxidation

Thermonomics ERT's increased the oil's resistance to oxidation by 78.5%.

Oil Compatibility

Polyol-esters, Alpha-olefins, Poly-alpha olefins, Synthetic oils, Semi-synthetic oils and Mineral oils are all compatible with Thermonomics ERTs. Our research and development department has the ability to evaluate and recommend applications and procedures for compatibility with custom oils.

Thermo-Conductivity

Once Thermonomics ERT's are introduced into the system, the thermo-conductivity factor of the refrigerant and refrigerant/oil combination can increase by 10% to 15%.

Corrosion Tests

(Glass Ware D-1384 @ 120°F weight change, mg.)

Material	Initial	Triplicate Run	Specification
Copper	-6	-5	± 10 max
Brass	-2	-2	± 10 max
Steel	-3	-3	± 10 max
Aluminum	-29	-29	± 30 max

Comparison with refrigerant oil

Property	Refrigerant Oil	Thermonomics mixed with refrigerant oil
Aniline point (D611)	11°F	10°F
Dielectric	27 kV	41 kV
Flash point	340°F	360°F
Karl Fisher	26 ppm	13 ppm
Specific gravity	.963 @ 60°F	.917 @ 60°F
Viscosity @ 100°F in CST	41.8	156.9
Thermal Conductivity (BTU in/h ft. ² °F)	.94	1.18

Extreme Pressure Properties (Four Ball Method) ASTM D 2783

Test Conditions were as follows:

Temperature	75 ± 2 °C
Speed	1760 ± 40RPM
Duration	10 ± 1 sec.
Load	5 ± 0.2 Kgf
Load Wear Index	60.0
Weld Point	295 Kg

Additional Laboratory Results

Disposal: No additional restrains on waste or recyclable or disposal.

Lubricity: Treated samples did not fail at the maximum pressure of 4500 psi, a 1500% increase in lubricity.

Carcinogenicity: Thermonomics ERT's are non-carcinogenic

Seal Compatibility, Index 24 hrs. @ 100 °C IP-278: Passed

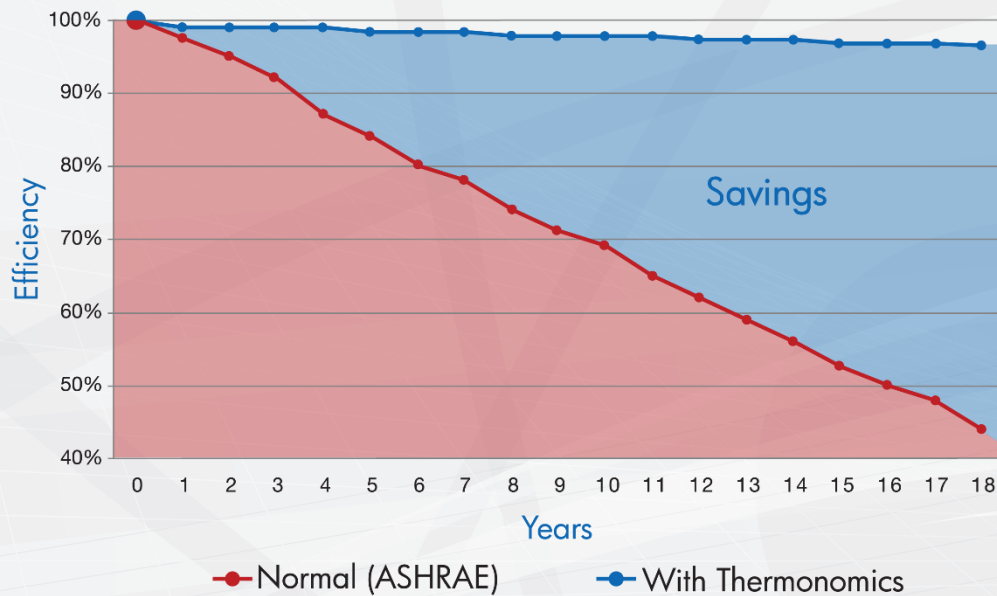
Total Organic Halogens: Passed EPA 9020B.



Inorganics, Metals by Inductively Coupled Plasma, EPA 6010

HW No.	Contaminant	Cas No.	Regulatory/ppm	Thermonomics ERTs/ppm
D004	Arsenic	7440-38-2	5.0	<1.0
005	Barium	7440-39-3	100.0	<1.0
006	Cadmium	7440-43-9	1.0	<1.0
007	Chromium	7440-47-3	5.0	<1.0
008	Lead	7439-92-1	5.0	<1.0
009	Mercury	7439-97-6	0.20	<0.05
010	Selenium	7782-49-2	1.0	<1.0
011	Silver	7440-22-4	5.0	<1.0

Efficiency Loss due to Oil Migration





THERMONOMICS MATERIAL SAFETY DATA SHEET

Effective Date: June 23, 2015

SECTION I – IDENTIFICATION OF PRODUCT

Manufacturer's Name: Thermonomics

Emergency Telephone Number: 1-888-870-0003

Address: 7702 E. Doubletree Ranch Rd, Suite 300, Scottsdale, AZ 85258

Website: www.thermonomics.net

Product Trade Name: Thermonomics

Chemical Trade Name: Polarized Refrigerant Oil Additive

Composition: Enhanced Hydrocarbon Related Proprietary Formulation*

Proprietary Formulation * Trade Secret – As defined and provided for by OSHA Hazard Communication Standard 29 CFR 1910.1200, specific chemical identities may be, and are, withheld.

Component	Chemical Name	% By Weight
Active Ingredients	*See Note	38
Refrigerant Oil	Petroleum Oil (Carrier)	62

SECTION II – HAZARDOUS COMPONENTS OF MIXTURES

The precise composition of this product is proprietary information. A more detailed disclosure will be provided to qualified Medical or Industrial Hygiene personnel as privileged information upon request in case of need for specific treatment.

SECTION III – TYPICAL PHYSICAL DATA

Appearance:	Light Amber	Solubility:	Negligible
Odor:	Slight odor evaporative	Evaporative Rate:	Negligible
Boiling Point:	lbp > 400°F	Specific Gravity:	1.128
Melting/Pour Point:	< 0°F	Physical State:	Liquid
Vapor Pressure:	No data on file	Weight Text:	Mixture

SECTION IV – FIRE AND EXPLOSION DATA

Flash Point:	360°F ASTMD Cleveland Open Cup
Extinguishing Media:	CO ² , dry chemical, foam, water fog
Hazardous Decomposition Products:	Fumes, smoke, carbon monoxide, hydrogen chloride and sulfur oxides may be produced.
Procedures:	For fire involving this material, do not enter any confined space without proper protective equipment including, but not limited to, self-contained breathing apparatus and protective clothing.

EMPTY CONTAINER WARNING

"EMPTY" CONTAINERS RETAIN RESIDUE (LIQUID AND/OR VAPOR) CAN BE DANGEROUS. Do not pressurize, cut, weld, braze, solder, drill, grind or expose container to heat, flame, spark or other source of ignition. They may explode and cause injury or death. Do not try to clean, as residue is difficult to remove. "Empty" drums should be completely drained, properly bunged and promptly returned to a drum reconditioner. All other containers should be disposed of in an environmentally responsible manner consistent and in accordance with all government regulations.



SECTION V – HEALTH HAZARD DATA

HAZARD

HEALTH: 1

FIRE: 1

REACTIVITY: 0

Complex proprietary mixture. Contains no ingredients now known to be hazardous as defined by OSHA CFR 1900.1000 and OSHA CFR 1910.1200

ACGIH Threshold Limit Value:	Exposure guidelines: severely hydrotreated petroleum distillate. Exposure limits: OSHA PEL: 5mg/m ³ (oil mist), ACHIG TLV-TWO: 5mg/m ³ (oil mist), ACHIG TLV-STEEL: 10mg/m ³ (oil mist). All components are listed on the US TSCA inventory. See section VI for emergency and first aid procedures. See section VIII for additional environmental information.
Effects of Overexposure:	Repeated and/or prolonged skin contact may cause mild skin and eye irritation.
Nature of Hazard:	Prolonged or repeated skin contact tends to remove skin oils and can lead to mild reversible irritation and dermatitis. Contact with the eyes may cause reversible eye irritation.
Toxicity Information:	Product has a low order of toxicity.
Potential Health Effects:	Health studies have shown that many petroleum hydrocarbons and synthetic lubricants pose potential human health risks which vary from person to person. As a precaution, exposure to liquids, vapors, mists and fumes should be minimized.
Cancer Information:	Not listed as a carcinogen, IARC, NTP, OSHA.
Health Data:	The toxicity profile would suggest a slight hazard to those chronically exposed to this product. The liver is the probable target organ, should massive systemic poisoning occur.

SECTION VI – EMERGENCY AND FIRST AID PROCEDURES

Eye Contact:	Immediately flush eyes with fresh water for at least fifteen minutes, or until irritation completely subsides. Seek medical attention immediately.
Skin Contact:	Wash exposed area with mild soap and water. Remove soiled clothing and launder before reuse. If irritation persists, seek medical attention.
Ingestion:	Do not induce vomiting. Never give anything by mouth to an unconscious person. Give large quantities of water. Several glasses of milk are preferable, if available. Seek medical attention immediately.
Inhalation:	Move person away from exposure and into well-ventilated area with fresh air. If person is not breathing, begin artificial respiration. Seek medical attention.



SECTION VII – SPECIAL HANDLING AND DISPOSAL

Handling:	Avoid prolonged or repeated breathing of vapors, mist, fumes. Wash hands after handling and wash clothing thoroughly before reuse. Avoid contact with eyes and skin. Do not ingest or inhale. Use in a well-ventilated area. If over exposure occurs, remove person from exposure area into fresh air. If breathing difficulty continues for more than fifteen minutes, seek medical attention and/or use a NOISH/MSHA approved respirator. Wear gloves, safety glasses or splash goggles.
Storage:	Keep container sealed. Store in a cool, dry location below 120°F. Do not store near ignition source or strong solvents or oxidants. Always maintain adequate ventilation.
Spill and leak procedures:	Clean up spills with absorbent clay, vermiculite, diatomaceous earth or other approved absorbent materials. Remove absorbent to approved, closed containers for disposal. Do not allow product access to any water source or sewer.
Disposal:	Always dispose, package, store and transport product in accordance with all local, state and federal regulations.

SECTION VIII – REACTIVITY DATA

Stability:	Stable
Hazardous polymerization:	Not known to polymerize.
Incompatibility:	Components are known to deteriorate when exposed to elevated temperatures or strong alkalis.
Hazardous by-products of decomposition/combustion:	Under fire conditions, hydrogen chloride gas and traces of short-chained hydrocarbons.

SECTION IX – SUPPLEMENTAL INFORMATION

T Shipping Class:	Not Applicable (not classified as a hazardous material under US DOT guidelines) No special shipping considerations beyond continued compliance with storage instructions.
EPA TSCA:	All ingredients listed on the TSCA inventory

The information contained herein relates to the specific material designed and may not be valid for such material when used in conjunction and/or in combination with other materials or in any process. Such information is, to the best of our knowledge and belief, accurate and reliable as of the date compiled and is offered in good faith. The above information is in part based on material safety data sheets provided by the vendors of the raw materials used in this product. We do not offer any warranty against patent infringement. No representation, warranty or guarantee is made as to the reliability, completeness or accuracy of the information. Because the use of the product is outside and beyond our control, no warranty is given, implied or expressed and Thermonomics cannot assume any liability whatsoever for the use of the information contained herein or from any damage resulting from relying on this information or from handling or contact with the above product. To best determine applicability or effect of any law or regulation with respect to this product, counsel should be sought from a legal advisor and/or the appropriate governmental agency.



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Testing Laboratories

Analysts, Inc.

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Intertek Testing Services (ARI) ETL SEMEKO

Professional Services Industries

The AC Research Group AutoResearch Laboratories