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REFRIGERANT PROPERTY SUMMARY

ASHRAE No. (Trade Name)	Components (Weight %)	ASHRAE Safety Rating	Glide (°F)	Temperature Lubricants	Comments
Very Low Temperature and Cascade Refrigeration (R-13 and R-503 Type)					
R-23	pure	A1	0	POLYOLESTER	Properties similar to R-13; runs hotter on discharge side.
R-508B SUVA 95	23/116	A1	0	POLYOLESTER	Properties similar to R-503; can be used for both types.
R-403B ISCEON 69L	290/22/218 (5/56/39)	A1	2.5	MINERAL OIL or ALKYL BENZENE	Has been used successfully in 13B1 type equipment.
Low-Medium Temperature Refrigeration (R-502 Type)					
R-22	pure	A1	0	MINERAL OIL or ALKYL BENZENE	Equipment typically uses liquid injection cooling (high dis. T)
R-402A (HP 80)	125/290/22 (60/2/38)	A1	2.5	ALKYL BENZENE OR MO/AB MIX	Retrofit blend; higher discharge pressure than 502.
R-402B (HP 81)	125/290/22 (38/2/60)	A1	2.5	ALKYL BENZENE OR MO/AB MIX	Retrofit blend for ice mach.; higher discharge temp.
R-404A (HP62,FX70)	125/143a/134a (44/52/4)	A1	1.5	POLYOLESTER	HFC blend - long term new or retrofit (oil flush required).
R-408A (FX 10)	125/143a/22 (7/46/47)	A1	1	MINERAL OIL or ALKYL BENZENE	Retrofit blend; slightly higher discharge temp.
R-422A (ISCEON 79)	R125/134a/600a (85.1/11.5/3.4%)	A1	5	MINERAL OIL or ALKYL BENZENE, POE	It can replace R502, R402A/B, R408A, R404A and R507
R-422D (ISCEON MO29)	R125/134a/600a (65.1/31.5/3.4%)	A1	5	MINERAL OIL or ALKYL BENZENE, POE	HFC blend - can replace R22 in low - medium temperature systems.
R-422B (NU-22B)	R125/134a/600a (55/42/3%)	A1	5	MINERAL OIL or ALKYL BENZENE, POE	It can replace R22, R417A and R407C with existing oil in system.
R-507 (AZ 50)	125/143a (50/50)	A1	0	POLYOLESTER	HFC blend, azeotrope, higher discharge pressure.
Low-Medium Temperature Refrigeration (R-12 Type)					
R-22	pure	A1	0	MINERAL OIL or ALKYL BENZENE	New systems (retrofit involves equipment changes).
R-134a	pure	A1	0	POLYOLESTER	HFC - new systems. Retrofit involves oil flushing.
R-401A (MP 39)	22/152a/124 (53/13/34)	A1	8	ALKYL BENZENE OR MO/AB MIX	Retrofit blend; higher glide and discharge pressure/temp.
R-401B (MP 66)	22/152a/124 (61/11/28)	A1	8	ALKYL BENZENE OR MO/AB MIX	Lower temp. retrofit blend (boost to capacity >-20F)
R-409A (FX 56)	22/124/142b (60/25/15)	A1	12	MINERAL OIL or ALKYL BENZENE	Retrofit blend; higher glide and discharge pressure/temp.
Medium-High Temperature Refrigeration (R-12 Type)					
R-414B (HOT SHOT)	22/600a/124/142b (50/1.5/39/9.5)	A1	12	MINERAL OIL or ALKYL BENZENE	"Automotive" type blends which can be used for refrigeration. Typically
R-416A (FRIGC FR12)	134a/124/600 (59/39/2)	A1	2.5	POLYOLESTER	match R-12 in condenser/hot conditions. Loss of capacity occurs at lower evap temps.
Air Conditioning (R-22 Type)					
R-407C (SUVA9000)	32/125/134a (23/25/52)	A1	10	POLYOLESTER	HFC blend; similar properties to R-22, higher glide.
R-410A (AZ 20)	32/125 (50/50)	A1	0.2	POLYOLESTER	HFC blend; higher pressures, new equipment only.
R-417A (ISCEON 59)	125/134a/600a (46.6/50/3.4)	A1	10	MINERAL, POE or ALKYL BENZENE	
High Ambient and Centrifugal Chillers					
R-124	pure	A1	0	MINERAL OIL or ALKYL BENZENE	Similar to R-114 - high ambient air conditioning.
R-123	pure	B1	0	MINERAL OIL or ALKYL BENZENE	Similar to R-11 - low pressure centrifugal chillers

R-12 "REFRIGERATION" RETROFIT BLENDS

R-401A: A blend of R-22, R-152a, and R-124, intended for retrofitting R-12 refrigeration systems. The pressure and system capacity match R-12 when the blend is running in a 10°F to 20°F evaporator, and there is typically an 8°F temperature glide in the evaporator. Applications: direct expansion refrigeration and air conditioning systems designed for R-12 or R-500; good success in any size system, minor adjustment of controls needed. Discharge pressure increases compared to R-12; also slight increase in discharge temperature, however the increases are not as severe as some other retrofit blends. There is a drop in capacity at lower temperatures. R-152a content, an HFC, hurts the miscibility with mineral oil. It is recommended to change some of the oil to alkylbenzene unless the system is small and running at higher evaporator temperatures.

R-401B: Similar to R-401A except higher in R-22 content. This blend has higher capacity at lower temperatures (matches R-12 around -30°F), and also provides a closer match to R-500 at air conditioning temperatures.

R-409A: A blend of R-22, R-142b, and R-124, intended for retrofitting R-12 refrigeration systems. The pressure and system capacity match R-12 when the blend is running in a 10°F to 20°F evaporator, and there is typically 13°F temperature glide in the evaporator. Applications: direct expansion refrigeration and air conditioning systems designed for R-12 or R-500; good success in any size system, minor adjustment of controls needed. Discharge pressure and temperature increases compared to R-12, which may be a problem very hot ambient conditions. Capacity holds well into lower application temperatures (-30°F). R-409A mixes well with mineral oil down to 0°F. As a result it may not be necessary to change oil in systems which do not run colder than 0°F in the evaporator (below that alkylbenzene should replace some mineral oil).



TECHNICAL GUIDELINES

Physical Properties of Refrigerants	R-401A	R-401B	R-409A
Container Size Available (Lbs.)	30, 125	30, 125	30, 125
Composition	R-22/R-152A/R-124	R-22/R-152A/R-124	R-22/124/142b
(Weight %)	(53 / 13 / 34)	(61 / 11 / 28)	(60 / 25 / 15)
Molecular Weight	94.4	92.8	97.43
Boiling Point (1 atm, °F)	-29.9	-32.3	-31.8
Critical Pressure (psia)	669	679.1	680.7
Critical Temperature (°F)	221	218.3	224.4
Critical Density (Lb./Ft. ³)	30.9	31.1	31.7
Liquid Density (70°F, Lb./Ft. ³)	74.61	74.6	76.1
Vapor Density (bp, Lb./Ft. ³)	0.306	0.303	0.313
Heat of Vaporization (bp, BTU/Lb.)	97.5	98.2	94.75
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.3037	0.3027	0.2908
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.1755	0.1725	0.1685
ASHRAE Standard 34 Safety Rating	A1	A1	A1
Temperature Glide (°F)	8	8	13
Pressure/Capacity Match	10°F to 20°F Evap.	-30°F to -20°F Evap.	10°F to 20°F Evap.

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R-12 "AUTOMOTIVE" RETROFIT BLENDS

R-414B: A blend of R-22, R-124 and R-142b with hydrocarbon R-600a (isobutane) added to improve oil miscibility and oil return. This blend was developed to retrofit R-12 refrigeration and automotive air conditioning systems as an improvement to R-406A. The pressure and system capacity match R-12 in 30°F to 45°F evaporators, and the discharge pressure and temperature are slightly lower than other refrigeration retrofit blends. The addition of isobutane to this blend slightly improves mineral oil compatibility, especially for high viscosity oils that are used in auto AC.

R-416A: An R-134a based blend, with R-124 to cut pressure, and hydrocarbon R-600 (butane) to improve oil return. This blend matches R-12 pressures at condenser temperatures, and pressures in the evaporator will need to be a few psi lower than R-12 to maintain proper temperature. There is a low temperature glide. Although the blend does not mix with mineral oils, the addition of hydrocarbon thins the oil

for satisfactory oil return. Systems will experience a loss of capacity, especially at lower temperatures.

General Provisions for Automotive Retrofit Blends: Automotive air conditioning retrofitting is governed by Section 609 of the Clean Air Act. The specific provisions of this section which apply to automotive AC retrofit blends are 1) you can't top off R-12 with a blend, the original charge must be recovered first, 2) new fittings must be installed on the car which are unique and specific to the blend being used, and 3) when using blends that contain R-22 the system must have nylon barrier hoses installed to prevent leakage.

In stationary refrigeration systems running in high ambient temperatures the use of an automotive blend can relieve problems associated with high discharge pressures, however capacity will suffer compared to R-12, especially as evaporator temperatures get lower.



TECHNICAL GUIDELINES

Physical Properties of Refrigerants	R-414B	R-416A
Container Size Available (Lbs.)	25	25, 125
Composition (Weight %)	R-22/600a/124/142b (50 / 39 / 1.5 / 9.5)	R-134a/600/124 (59 / 1.5 / 39.5)
Molecular Weight	101.6	111.9
Boiling Point (1 atm, °F)	-29.9	-10
Critical Pressure (psia)	665.4	582
Critical Temperature (°F)	226.4	227
Critical Density (Lb./Ft. ³)	31.6	32.3
Liquid Density (70°F, Lb./Ft. ³)	76.02	77.68
Vapor Density (bp, Lb./Ft. ³)	0.325	0.354
Heat of Vaporization (bp, BTU/Lb.)	91.5	85.51
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.2913	0.3139
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.1723	0.1949
ASHRAE Standard 34 Safety Rating	A1	A1
Temperature Glide (°F)	13	3
Pressure/Capacity Match	30°F to 40°F Evap.	100 °F Condenser

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R-134a

R-134a: An HFC refrigerant with similar properties to R-12. It has become the new industry standard for automotive air conditioning, refrigerator and freezer appliances, and many other self-contained high and medium temperature refrigeration applications.

Application Temperature Range: R-134a performance suffers at lower evaporator temperatures. In general it is not applied at temperatures below -10°F, and it is not necessarily the most economical overall choice in some other applications. Traditional R-12 type applications have adopted several products as alternatives, including R-134a, R-22, R-404A/R-507, and numerous retrofit blends.

Lubrication: R-134a requires polyolester (POE) lubricants, primarily for their ability to mix with HFC refrigerants. Traditional mineral oils and alkylbenzene do not mix with HFCs and will cause compressor failures. In addition, automotive air conditioning systems may also use polyalkaline glycol (PAG) lubricants (not typically seen in stationary equipment).

Both POEs and PAGs will absorb moisture, and hold onto it, to a much greater extent than traditional lubricants. The moisture will promote reactions in the lubricant as well as the usual problems associated with water (corrosion, acid formation, etc.). The best way to dry a wet HFC system is to use a filter drier – run the system and change the drier – instead of relying on evacuation to clear the water.

Retrofitting Considerations: Equipment built for R-12 will be sized a bit too small compared to equipment built for R-134a. In order to do the same job, an R-134a system will need a larger compressor and larger heat exchangers. As a result, a system that is retrofit from R-12 to R-134a will have lower capacity (run longer) and will probably develop higher head pressures (not enough condenser area). The lubricant will also need to be flushed and replaced with POE.



TECHNICAL GUIDELINES

Physical Properties of Refrigerants	R-134a
Container Size Available (Lbs.)	30, 125 875, 1750, 30 (ACME Fitting)
Molecular Weight	102.3
Boiling Point (1 atm, °F)	-14.9
Critical Pressure (psia)	588.3
Critical Temperature (°F)	213.8
Critical Density (Lb./Ft. ³)	32.04
Liquid Density (70 F, Lb./Ft. ³)	76.21
Vapor Density (bp, Lb./Ft. ³)	0.328
Heat of Vaporization (bp, BTU/Lb.)	93.3
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.3366
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.2021
ASHRAE Standard 34 Safety Rating	A1

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CFC REFRIGERANTS

R-11: Used in large, low pressure centrifugal chillers. This type of chiller provides a very large amount of chilled water for air conditioning purposes (office buildings, hotels, etc.) at the lowest operating cost compared to any other type of air conditioning system.

R-11 centrifugal chillers operate in a vacuum on the low side. Air which leaks into these systems must be purged, and traditionally this meant that some refrigerant would be lost along with the air. New purge technology and better maintenance practices have reduced R-11 losses in these systems.

R-113: Used in commercial and industrial air conditioning and industrial water chillers. It is typically employed in an R-11 centrifugal chiller to generate less capacity to better match load conditions. It is not possible to use solvent grade 113 for refrigeration purposes because of contaminants or additives used for solvents.

R-114: Used in positive pressure centrifugal chillers for air conditioning and industrial process cooling, as well as for air conditioning in very high ambient temperature conditions. Its very good chemical stability makes it useful in highly corrosive applications, such as for shipboard chillers. Good high temperature stability along with lower vapor pressures make it a good choice for high ambient air conditioning, for example in steel mill cranes.

R-13B1: Used in low and medium temperature applications. It has a low compression ratio allowing it to be used in single-stage compressors at quite low evaporating temperatures.

R-12: Widely used in a variety of applications from small hermetic refrigeration systems up through large, positive pressure chillers. It has been the long-time industry standard for automotive air conditioning, high/medium/low temperature refrigeration, and many other commercial and industrial applications.



TECHNICAL GUIDELINES

Physical Properties of Refrigerants	R-11	R-113	R-114
Container Size Available (Lbs.)	100, 200, 650	100, 200, 690	30, 150, 875
Molecular Weight	137.4	187.4	170.9
Boiling Point (1 atm, °F)	74.7	117.7	38.6
Critical Pressure (psia)	639.3	495	472.4
Critical Temperature (°F)	388	417	294.2
Critical Density (Lb./Ft. ³)	34.6	—	36.2
Liquid Density (70°F, Lb./Ft. ³)	92.73	98.26	91.18
Vapor Density (bp, Lb./Ft. ³)	0.365	0.4649	0.489
Heat of Vaporization (bp, BTU/Lb.)	77.9	63.1	53.8
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.2093	0.22	0.2282
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.1444 (Sat.)	0.15	0.1663
ASHRAE Standard 34 Safety Rating	A1	A1	A1

TECHNICAL GUIDELINES

Physical Properties of Refrigerants	R-13B1	R-12
Container Size Available (Lbs.)	5, 10, 28, 90	30, 50, 145, 1000, 2000
Molecular Weight	148.9	120.9
Boiling Point (1 atm, °F)	-72	-21.6
Critical Pressure (psia)	575	600
Critical Temperature (°F)	152.6	233.5
Critical Density (Lb./Ft. ³)	46.5	35.3
Liquid Density (70°F, Lb./Ft. ³)	96.01	82.96
Vapor Density (bp, Lb./Ft. ³)	0.544	0.393
Heat of Vaporization (bp, BTU/Lb.)	51.08	71.2
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.208	0.2324
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.112	0.1455
ASHRAE Standard 34 Safety Rating	A1	A1

HCFC REFRIGERANTS

R-22: The dominant refrigerant in residential and commercial air conditioning and some very large centrifugal chillers for air conditioning and industrial process cooling. It has also been used more in refrigeration since the phaseout of CFCs, both as a pure refrigerant and in blends. R-22 is subject to phaseout in new equipment in 2010 and production ends in 2020.

R-123: Replaced R-11 in low pressure centrifugal chillers. New R-123 equipment has been engineered with the correct materials of construction and sized properly for the intended job. Retrofitting existing R-11 chillers to R-123 may require replacement of seals, gaskets, and other system components to obtain the correct operation conditions and prevent leaks.

The ASHRAE safety rating for R-123 is B1, which indicates that lower levels for personal exposure are allowed in normal daily operation and service conditions. Extra precautions and machinery room requirements must be observed (specific requirements are spelled out in ASHRAE Standard 15, Safety Code for Mechanical Refrigeration).

R-124: Used in refrigeration blends, primarily those used for R-12 type applications. Also used by itself to replace R-114 in chillers or high ambient air conditioning applications, and for sterilant gas formulations.



Physical Properties of Refrigerants	TECHNICAL GUIDELINES		
	R-22	R-123	R-124
Container Size Available (Lbs.)	15, 30, 50, 125, 875, 1750, 30 Returnable	100, 200 (Drums or Cylinders), 650	30, 145
Molecular Weight	86.5	152.9	136.5
Boiling Point (1 atm, °F)	-41.5	82.1	10.34
Critical Pressure (psia)	723.7	531.1	527.1
Critical Temperature (°F)	205.1	362.6	252.45
Critical Density (Lb./Ft. ³)	32.7	34.3	34.57
Liquid Density (70°F, Lb./Ft. ³)	75.27	91.95	85.5
Vapor Density (bp, Lb./Ft. ³)	0.294	0.404	0.419
Heat of Vaporization (bp, BTU/Lb.)	100.5	73.2	70.6
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.2967	0.2329	0.265
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.1573	0.1645 (sat.)	0.1762
ASHRAE Standard 34 Safety Rating	A1	B1	A1

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R-22 AC ALTERNATIVES

R-407C: A blend of R-32, R-125, and R-134a that has very similar properties to R-22 in air conditioning equipment. There is a slight decrease in capacity and efficiency, however R-407C can be used in essentially the same equipment to perform the same job with only minor engineering modifications. New systems built with R-407C must have POE lubricants, and retrofitted R-22 systems would need the residual oil flushed with POE. With the timing of the phaseout of R-22, it is expected that plenty of service refrigerant will be available for existing equipment until it is replaced, and widespread retrofitting of R-22 air conditioners will not be necessary. R-407C has a 10°F temperature glide, which should not pose any operation related problems for a typical system, however there will be leakage/service issues regarding the fractionation potential of the blend.

R-417A: A blend of R-125, R-134a, and R600 (butane) that is intended to replace R-22. It can be used in new R-22 type equipment, or to retrofit existing R-22 air conditioning and refrigeration equipment. There will be a slight loss of capacity upon retrofit, and the lower

suction and head pressures may affect the operation of valves and other expansion devices. Some change in system operation can be expected. The addition of R600 (butane) allows this HFC blend to circulate mineral oil and alkylbenzene lubricants in close-coupled systems. Larger systems with more complicated piping arrangements may require POE lubricants to ensure proper oil return.

R-410A: A blend of R-32 and R-125 which nearly forms an azeotrope, and therefore has extremely low temperature glide and almost no fractionation potential. This blend has about 60% higher pressure than R-22 in air conditioning applications, and therefore should be used only in new equipment specifically designed to handle the pressure. Systems designed for R-410A will have smaller components (heat exchangers, compressor, etc.) to perform the same cooling job compared to R-22. R-410A will require POE lubricants. Retrofitting R-22 equipment with R410A is not recommended under any circumstances.



TECHNICAL GUIDELINES

Physical Properties of Refrigerants	R-407C	R-410A	R-417A
Container Size Available (Lbs.)	25, 115	25, 100	25, 125
Composition (Weight %)	R-32/R-125/R-134a (23 / 25 / 52)	R-32 / R-125 (50 / 50)	R-125/R-134a/R600 (46.6 / 50 / 3.4)
Molecular Weight	86.2	72.6	108.9
Boiling Point (1 atm, °F)	-43.6	-61	-41.8
Critical Pressure (psia)	672.1	691.8	559
Critical Temperature (°F)	187	158.3	194
Critical Density (Lb./Ft. ³)	32	34.5	—
Liquid Density (70°F, Lb./Ft. ³)	72.35	67.74	72.85
Vapor Density (bp, Lb./Ft. ³)	0.289	0.261	0.2447
Heat of Vaporization (bp, BTU/Lb.)	106.7	116.8	89.5
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.3597	0.3948	0.332
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.1987	0.1953	0.2177
ASHRAE Standard 34 Safety Rating	A1	A1	A1
Temperature Glide (°F)	10	0.2	10

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HFC REFRIGERATION BLENDS

R-404A: A blend of R-125, R-143a, and R-134a intended for low and medium temperature refrigeration applications where R-502 was previously used. Most new equipment has been built for R-404A (and R-507 interchangeably). It is also possible to retrofit R-502 systems with R-404A. R-404A has slightly lower pressures than R-507 (from the small amount of R-134a added), and generally both blends have slightly higher pressures than 502. R-404A requires polyolester (POE) lubricant, which is usually charged into new equipment. If retrofitting existing equipment the original oil must be flushed and replaced with POE.

R-507: An azeotropic blend of R-125 and R-143a intended for low and medium temperature refrigeration systems. Similar to R-404A in operation, most new equipment has been rated to use either blend. There will be slightly higher pressures and capacity with R-507 compared to R-404A. Retrofit and lubricant comments are similar to those above.



TECHNICAL GUIDELINES

Physical Properties of Refrigerants	R-404A	R-507
Container Size Available (Lbs.)	24, 100, 875, 1300	25, 100
Composition (Weight %)	R-125/143a/134a (44 / 52 / 4)	R-125/143a (50 / 50)
Molecular Weight	97.6	98.9
Boiling Point (1 atm, °F)	-51.8	-52.8
Critical Pressure (psia)	548.2	539
Critical Temperature (°F)	162.5	159
Critical Density (Lb./Ft. ³)	35.84	30.7
Liquid Density (70°F, Lb./Ft. ³)	66.37	66.65
Vapor Density (bp, Lb./Ft. ³)	0.342	0.349
Heat of Vaporization (bp, BTU/Lb.)	86.1	84.35
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.3600	0.3593
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.2077	0.2064
ASHRAE Standard 34 Safety Rating	A1	A1
Temperature Glide (°F)	1.5	0

R-422 HFC REFRIGERATION BLENDS

R-422 Blends: With increased regulatory pressure on leak repair and recordkeeping for HCFC refrigerants, the R-422 series of refrigerants offer an HFC-based retrofit solution that can be used with existing refrigeration oils. Since no single refrigerant blend can replace R-22 in all applications, the R-422 series offers the best range of choices for retrofitting.

R-422A (ISCEON® M079) is used mainly in low temperature refrigeration systems. It can replace R-502, R-402A/B, R-408A, R-404A, and R-507. With properties that closely match R-404A, many of the newer refrigeration systems can use R-422A directly with very few changes or adjustments to system components. When retrofitting older systems, components (valves, etc.) must be compatible with R-404A in order to use R-422A.

R-422B (One Shot® from ICOR) has been blended to replace R-22 in more moderate temperature applications. It can replace R-22, R-407C, and R-417A. Since R-422B has properties that closely match R-22, most system components will not need to be replaced.

R-422D (ISCEON® M029) has been blended to more closely match R-22 in low to medium temperature refrigeration systems. Existing R-22 system components will not need to be replaced when retrofitting with R-422D.



TECHNICAL GUIDELINES

Physical Properties of Refrigerants	R-422A	R-422B	R-422D
Container Size Available (Lbs.)	20, 100, 120	25, 110	25, 110
Composition (Weight %)	R-125/134a/600a (85.1/ 11.5/3.4)	R-125/134a/600a (55/ 42/3)	R-125/134a/600a (65.1/ 31.5/3.4)
Molecular Weight	113.6	108.5	109.9
Boiling Point (1 atm, °F)	-55.6	-40.5	-45.76
Critical Pressure (psia)	543.7	590.3	566.22
Critical Temperature (°F)	161.2	186.3	175.2
Critical Density (Lb./Ft. ³)	—	—	33.008
Liquid Density (70°F, Lb./Ft. ³)	72.03	73.3	70.87
Vapor Density (bp, Lb./Ft. ³)	0.356	0.2959	—
Heat of Vaporization (bp, BTU/Lb.)	76.8	80.5	81.78
Specific Heat Liquid (70°F, BTU/Lb. °F)	—	—	0.35
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	—	—	0.2
ASHRAE Standard 34 Safety Rating	A1	A1	A1
Temperature Glide (°F)	5	5	5

R-502 RETROFIT BLENDS

R-402A: A blend of R-22 and R-125 with hydrocarbon R-290 (propane) included to improve mineral oil compatibility. This blend is formulated to match R-502 in evaporator temperature ranges and does not significantly increase discharge temperature in R-502 retrofit situations. Discharge pressure, however, can increase from 25 to 40 psi over pressures seen with R-502. Although the propane was added to improve oil circulation, it is still recommended that some mineral oil be removed and replaced with alkylbenzene.

R-402B: Similar components to R-402A but contains more R-22 and less R-125. This lowers the discharge pressure closer to R-502, however the discharge temperature increases compared to R-502. This is a benefit in ice machines, where the blend is primarily used, because it improves harvest times. Although propane will improve oil circulation, it is still recommended that some mineral oil be replaced with alkylbenzene.

R-408A: A blend of R-22 and R-143a and R-125 intended for retrofitting R-502 refrigeration systems. This blend has the closest pressure/temperature match to R-502 across the whole operating range of temperatures. One study suggests higher energy efficiency after retrofit compared to running with R-502. Discharge temperature will increase; however, in most applications this will not impact system performance or long term reliability. In severe duty applications, such as transport refrigeration into hot climates, this blend may not be recommended by the OEM.



Physical Properties of Refrigerants	TECHNICAL GUIDELINES		
	R-402A	R-402B	R-408A
Container Size Available (Lbs.)	27, 110	13	24, 100
Composition (Weight %)	R-125/290/22 (60 / 2 / 38)	R-125/290/22 (38 / 2 / 60)	R-125/143a/22 (7 / 46 / 47)
Molecular Weight	101.55	94.7	87
Boiling Point (1 atm, °F)	-56.5	-52.9	-49.8
Critical Pressure (psia)	600	645	641.6
Critical Temperature (°F)	168	180.7	182
Critical Density (Lb./Ft. ³)	33.8	33.1	30
Liquid Density (70 F, Lb./Ft. ³)	72.61	72.81	66.9
Vapor Density (bp, Lb./Ft. ³)	0.356	0.328	0.303
Heat of Vaporization (bp, BTU/Lb.)	83.58	90.42	96.74
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.3254	0.317	0.3416
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.1811	0.1741	0.1901
ASHRAE Standard 34 Safety Rating	A1	A1	A1
Temperature Glide (°F)	2.5	2.5	1

How can URI help you achieve success?

- Huge Local Inventory
- Broad Product Scope
- Knowledgeable Staff

CFC AZEOTROPES

AZEOTROPE: a mixture of two or more refrigerants in which the liquid and vapor have same composition at equilibrium. In addition, the resulting pressure of the mixture is either higher or lower than the pressure of any of the components. Azeotropes behave like pure component refrigerants because there is no change in boiling temperature or shift in composition during phase change, equipment operation, or leakage.

R-500: Designed to be a "higher capacity" R-12 type refrigerant, R-500 found some use in air conditioning and dehumidifier equipment and in positive pressure centrifugal chillers.

R-502: Developed for use in low temperature refrigeration (the evaporator pressure stays out of vacuum down to -40°F). R-502 offers lower discharge temperature and improved capacity compared to R-22. Commercial refrigeration systems can perform low temperature refrigeration in a single stage with relatively inexpensive compressors.



Physical Properties of Refrigerants	TECHNICAL GUIDELINES	
	R-500	R-502
Container Size Available (Lbs.)	30, 50, 125, 875, 1750	30, 50, 125, 875, 1750
Composition (Weight %)	R-12/R-152a (73.8/26.2)	R-22/R-115 (48.8/51.2)
Molecular Weight	99.3	111.6
Boiling Point (1 atm, °F)	-28.5	-49.5
Critical Pressure (psia)	605.2	582.8
Critical Temperature (°F)	215.8	177.3
Critical Density (Lb./Ft. ³)	30.7	35.5
Liquid Density (70°F, Lb./Ft. ³)	73	77
Vapor Density (bp, Lb./Ft. ³)	0.329	0.388
Heat of Vaporization (bp, BTU/Lb.)	86.4	74.2
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.2782	0.2958
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.1725	0.1641
ASHRAE Standard 34 Safety Rating	A1	A1

VERY LOW TEMPERATURE CFC REFRIGERANTS

Very low temperature refrigeration systems typically operate in two or more stages (cascade type systems). It would be nearly impossible to achieve low temperatures in a single stage with an inexpensive compressor. The traditional cascade system has a low temperature stage which uses the lower boiling point gas, such as R-13 or R-503, and a high stage which typically uses R-12, R-22, or R-502.

The high stage evaporator provides the correct condensation temperature for the low stage so that compressors in both stages can run at "normal" pressures.



Physical Properties of Refrigerants	TECHNICAL GUIDELINES	
	R-13	R-503
Container Size Available (Lbs.)	5, 9, 23, 80	5, 9, 20, 80
Composition (Weight %)	pure	R-23/R-13 (40.1/59.9)
Molecular Weight	104.5	82.25
Boiling Point (1 atm, °F)	-114.3	-125.5
Critical Pressure (psia)	567.8	618.6
Critical Temperature (°F)	84.6	65.2
Critical Density (Lb./Ft. ³)	35.9	34.4
Liquid Density (70°F, Lb./Ft. ³)	72.7	66.3
Vapor Density (bp, Lb./Ft. ³)	0.0432	0.373
Heat of Vaporization (bp, BTU/Lb.)	64.35	77.1
Specific Heat Liquid (70°F, BTU/Lb. °F)	0.2876	0.3774
Specific Heat Vapor (1 atm, 70°F, BTU/Lb. °F)	0.1445	0.1537
ASHRAE Standard 34 Safety Rating	A1	A1

REFRIGERANTS

VERY LOW TEMPERATURE ALTERNATIVES

R-23: Used in very low temperature refrigeration systems, typically on the low stage of a multi-stage system. Has properties similar to R-13 and can be used to replace R-13 in an existing system. R-23 has higher discharge temperatures than R-13, however, and equipment which is not designed to take this into account may suffer related failures. Polyolester (POE) lubricants should be used, and it may still be necessary to charge hydrocarbon oil additives to ensure proper oil return. Check with OEM for specific oil and charging recommendations.

R-508B: A blend of R-23 and R-116 intended for very-low-temperature refrigeration systems, typically the low stage of a multi-stage system. R-508B has properties similar to R-503 and can be used to replace either R-13 or R-503 in an existing system. The discharge temperature does not increase significantly compared to R-23. POE lubricants

should be used, and it may still be necessary to charge hydrocarbon oil additives to ensure proper oil return. Check with OEM for specific oil and charging recommendations.

R-403B: A blend of R-22 and R-218 with hydrocarbon R-290 (propane) added to improve oil return. Though this product was originally developed as a replacement for R-502, it has come to be used as an alternative for R-13B1 in single-stage, low-temperature systems. The evaporator will operate in a vacuum when the low side temperature is below -55°F. When existing R-13B1 systems are retrofit to R-403B the capillary tube must be replaced with a longer/more restrictive size. Similar lubricants can be used for R-403B, with any additives the manufacturer may recommend.



TECHNICAL GUIDELINES

Physical Properties of Refrigerants	R-23	R-508B	R-403B
Container Size Available (Lbs.)	5, 9, 20, 70	10, 20, 70,	30, 125
Composition (Weight %)	pure	R-23/116 (46 / 54)	R-22/290/218 (56 / 5 / 39)
Molecular Weight	70	95.4	103.25
Boiling Point (1 atm, °F)	-115.6	-125.3	-46.8
Critical Pressure (psia)	701.4	556.1	637.7
Critical Temperature (°F)	78.7	53.7	191.6
Critical Density (Lb./Ft. ³)	32.8	35.6	32.6
Liquid Density (20 F, Lb./Ft. ³)	67.46	65.63	72.8 (70F)
Vapor Density (bp, Lb./Ft. ³)	0.29	0.409	0.35
Heat of Vaporization (bp, BTU/Lb.)	102.7	71.4	82.1
Specific Heat Liquid (20°F, BTU/Lb. °F)	0.4162	0.4263	0.313 (70F)
Specific Heat Vapor (20°F, BTU/Lb. °F)	0.1663	0.1701	0.182 (70F)
ASHRAE Standard 34 Safety Rating	A1	A1	A1

HYDROCARBONS FOR VERY LOW TEMPERATURE SYSTEMS

The low stage of a cascade system typically operates below -80°F. At these temperatures, standard refrigeration oils may begin to gum-up and lose their ability to flow around the sytem. Systems that run short periods of time, or cycle through warmer temperatures, may be able to keep the oil returning to the compressor; however, systems that run longer stretches of time at cold temperatures need to add

hydrocarbons to thin the oil and provide consistent oil return. In some cases, the hydrocarbons are used as the low stage refrigerant.

National provides a variety of hydrocarbons in small quantities to be used for addition to very low temperature systems. Larger quantities can be specially ordered.



Part No.	Description	Container Size
004R1150	R-1150 (Ethylene)	4 Oz.
004R170	R-170 (Ethane)	4 Oz.
014R290	R-290 (Propane)	14 Oz.
016R600	R-600 (n-Butane)	16 Oz.
016R600A	R-600a (iso-Butane)	16 Oz.
016RPENTANE	Pentane, Liquid	16 Oz.
3R170	R-170 (Ethane)	3 Lbs.

ANALYTICAL TESTING SERVICE



Refrigerant: Testing to ARI Standard 700 specifications.

Refrigeration Oil: Testing oil quality as indication of system performance.

Halon Testing: Testing to Military/ASTM/Government 1301/1211/1202 specifications.

National Refrigerants, Inc. analytical testing service offers easy-to-use sample kits for:

- Refrigerant
- Refrigeration Oil
- Halon
- Specialty Testing

Sampling Kit features:

- Easy-to-use disposable sample cylinders
- High-pressure sample cylinder rated to 400 psig suitable for most alternative refrigerants and blends
- Instructions included for proper sampling procedures
- All analysis forms and necessary DOT labeling included
- Pre-paid overnight return postage to NRI's analytical laboratory
- All analysis reports are returned with written commentary and recommendations
- Same day results available upon request for additional fee
- Sample cylinders available for very high pressure (VHP) refrigerant

**If you can't find it here, let us know.
United Refrigeration specializes in
locating hard to find parts**

REFRIGERANTS

Testing liquid phase to ARI 700 specifications for fluorocarbon refrigerants for one or more of the following:

- Identification (Infrared Spectroscopy)
- Moisture
- Acidity
- High Boiling Residue/Oil Content
- Particulates/Solids
- Purity (Gas Chromatography)
- Chloride



Part No.	Description	Price
NRIHP	High Pressure Refrigerant Analysis	361.30
NRILP	Low Pressure Refrigerant Analysis	331.20

LUBRICANTS

Testing of lubricant for one or more of the following:

- Identification (Infrared Spectroscopy)
- Moisture
- Appearance
- Acidity
- Viscosity
- Wear Metals
- Residual Mineral Oil (as requested)
- Fluoride, Chloride and Conductivity (as requested, extra cost)



Part No.	Description	Price
NRIOA	Oil Analysis	104.00

NON-CONDENSABLE GAS

Specifications for fluorocarbon refrigerants requires a vapor only sample taken from the source vapor phase.



Part No.	Description	Price
NRINC'	Testing Vapor Phase to ARI 700	192.00

'Not applicable to R11, R113 or R123

HALONS

Testing to Military/ASTM/Government 1302/1211 specifications.

HALONS	
Property	Methodology
Purity	Pack/Cap Col. GC, FID, GC-MS
Other Halocarbons	Pack/Cap Col. GC, FID, GC-MS
Water	KF Coulometric Titration
Halogen Ion	Ag+ Qualitative/Visual
Non-Absorbable Gas	Packed Col. GCT/C Detector
High Boiling Imps. g/100ml	Evaporation/Gravimetric
Suspended Matter with Test for HBI	Visual Observation, Combined
Acidity Titration	Non-Aqueous Extraction/Base
Color	APHA Color Comparison
Free Halogen	Iodimetry/S ₂ O ₂ = Titration

REFRIGERANT RECOVERY



Why is the EZ ONE-SHOT™ Recovery Cylinder different from traditional recovery cylinders?

EZ ONE-SHOT™ cylinders use DOT-39 disposable cylinder technology to provide an inexpensive, lightweight cylinder for use in one-time fill recovery situations.

One-time fill means that once refrigerant has been put into the cylinder and then removed, the cylinder may no longer be used for further recovery operations. It must be scrapped or disposed of properly.

EZ ONE-SHOT™

Recovering refrigerant with an EZ ONE-SHOT™ recovery cylinder is considered the first filling operation. Recovery from several units, one after the other, until the cylinder is full represents one filling operation (for example, a dedicated shop machine).

EZ ONE-SHOT™ recovery cylinders are subject to the same regulations as the "disposable" refrigerant cylinder refrigerant is supplied in. Federal law forbids transportation if REFILLED. Federal law also requires that cylinders be filled and transported in the box provided. Penalty up to \$500,000 fine and 5 years imprisonment (49 U.S.C. 5124).

Applications for the EZ ONE-SHOT™

- Temporary storage receiver (where policy demands a clean cylinder for each job)
- Single recovery job where gas will need to be returned or stored.
 - One job up to 25 lbs.
 - Several smaller jobs at the same site.
 - Burned gas: avoid contamination of your everyday recovery cylinder.
 - Infrequent jobs or products not regularly recovered: won't tie up a standard cylinder.
- Dedicated shop machines.
- Download everyday cylinder to return refrigerant.

There are many situations in which you will still need your traditional recovery cylinders. The EZ ONE-SHOT™ cylinder will complement, but not replace, your current recovery cylinder program.

Applications where EZ ONE-SHOT™ should NOT be used:

- Multiple small jobs at different locations or at different times — back flow prevention valves will not allow additional recovery after the valves have been closed.
- "Everyday" service (can't be filled more than once).



Part No.	Description	Price
DC30	30 Lb. Disposable Reclaim Cylinder	56.00

IDENTIFICATION LABEL



CERTIFICATE OF REMOVAL

Measures 3" x 4". To identify that the refrigerant has been properly removed from a cooling unit, for disposal, in accordance with the 1990 Clean Air Act amendment requirements.



Part No.	Package Qty.	Price
NL1	10	9.56



RECOVERED REFRIGERANT, LARGE

Meets DOT requirements for transporting refrigerants. All recovered refrigerant labels are designated with color code and shipping classification.

- Measures 5" x 10 1/2"



Part No.	Refrigerant	Package Qty.	Price
NL11	R11	5	10.84
NL12	R12	5	10.84
NL123	R123	5	10.84
NL134A	R134A	5	10.84
NL22	R22	5	10.84
NL502	R502	5	10.84

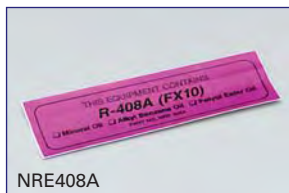


RECOVERED REFRIGERANT, SMALL

- Measures 3" x 4"



Part No.	Refrigerant	Package Qty.	Price
NR11	R11	10	9.66
NR12	R12	10	9.66
NR123	R123	10	9.66
NR134A	R134A	10	9.66
NR22	R22	10	9.66
NR500	R500	10	9.66
NR502	R502	10	9.66



EQUIPMENT CONTENTS IDENTIFICATION

- Measures 2" x 4"



Part No.	Refrigerant	Package Qty.	Price
NRE134A	R134A	5	9.28
NRE23	R23	5	9.28
NRE401A	R401A	5	9.28
NRE401B	R401B	5	9.28
NRE402A	R402A	5	9.28
NRE402B	R402B	5	9.28
NRE404A	R404A	5	9.28
NRE406A	R406A	5	9.28
NRE407A	R407A	5	9.28
NRE407B	R407B	5	9.28
NRE407C	R407C	5	9.28
NRE408A	R408A	5	9.28
NRE409A	R409A	5	9.28
NRE410A	R410A	5	9.02
NRE507	R507	5	9.02



CYLINDER TAG

Measures 4" x 9". Wire tie for fastening to valve collar. For shipping R-12, R-22, R-114, R-500 and R-502.



Part No.	Description	Package Qty.	Price
NRT	Shipping Tag	5	9.52

OIL

MINERAL OIL

- Low wax content
- Chemically and thermally stable
- Low pour point
- Napthenic mineral oil



Part No.	Viscosity	Container Size	Case Qty.*	Price/Ea.
1501Q	150 SUS	1 Qt.	12	11.06
1501G	150 SUS	1 Gal.	6	33.14
1505G	150 SUS	5 Gal.	1	179.92
15055G	150 SUS	55 Gal.	1	1586.03
3001G	300 SUS	1 Gal.	6	34.10
3005G	300 SUS	5 Gal.	1	195.26
30055G	300 SUS	55 Gal.	1	1719.01
5001Q	500 SUS	1 Qt.	12	6.50
5001G	500 SUS	1 Gal.	6	33.60
5005G	500 SUS	5 Gal.	1	184.58
5055G	500 SUS	55 Gal.	1	1780.02

ALKYLBENZENE OIL

High quality synthetic alkylbenzene refrigerant oil. Excellent miscibility and compatibility with all CFC and HCFC refrigerants.

The new AB 200R is approved by Copeland for HCFC retrofit jobs.



Part No.	Viscosity	Container Size	Case Qty.*	Price/Ea.
150AKB1G	150 SUS	1 Gal.	6	49.90
150AKB5G	150 SUS	5 Gal.	1	246.56
150AKB55G	150 SUS	55 Gal.	1	2392.05
200AKB1G	200 SUS	1 Gal.	6	56.04
200AKB5G	200 SUS	5 Gal.	1	301.88
200AKB55G	200 SUS	55 Gal.	1	2972.08
300AKB1G	300 SUS	1 Gal.	6	63.94
300AKB5G	300 SUS	5 Gal.	1	295.80
300AKB55G	300 SUS	55 Gal.	1	2866.07

OIL



POLYOL ESTER OIL

Designed specifically for HFC refrigerants but miscible and compatible with all fluorocarbon refrigerants, mineral and alkylbenzene lubricants. Packaged in metal containers.



Part No.	Viscosity	Container Size	Case Qty.*	Price/Ea.
PE321P	32 (150 SUS)	1 Pt.	12	27.12
PE321Q	32 (150 SUS)	1 Qt.	12	46.26
PE321G	32 (150 SUS)	1 Gal.	6	109.80
PE681P	68 (300 SUS)	1 Pt.	12	27.12
PE681Q	68 (300 SUS)	1 Qt.	12	41.16
PE681G	68 (300 SUS)	1 Gal.	6	114.50
PE1001G	100 (500 SUS)	1 Gal.	6	189.00



CAPELLA MINERAL OIL

- Low wax haze and floc temperature
- Naphthenic oil
- Manufactured by Texaco



Part No.	Viscosity	Container Size	Case Qty.*	Price/Ea.
WF32	Capella B, 32, (150 SUS)	1 Gal.	6	37.00
WF325	Capella B, 32, (150 SUS)	5 Gal.	1	172.54
1TD	Capella D, 68, (300 SUS)	1 Gal.	6	37.00
5TD	Capella D, 68, (300 SUS)	5 Gal.	1	157.00
55TD	Capella D, 68, (300 SUS)	55 Gal.	1	1249.01



MINERAL OIL

Nu-Calgon naphthenic mineral oil is available in three grades: C-3 (150 SUS), C-4 (300 SUS) and C-5 (500 SUS). All viscosities are manufactured by Calumet Lubricant Co. and are approved by Copeland, Trane and other compressor manufacturers.

Nu-Calgon mineral oils combine excellent solubility and stability with good floc and pour points to provide excellent low temperature performance.



Part No.	Viscosity	Container Size	Case Qty.*	Price/Ea.
430307	150 SUS	1 Gal.	6	37.08
430305	150 SUS	5 Gal.	1	182.32
430407	300 SUS	1 Gal.	6	37.08
430405	300 SUS	5 Gal.	1	203.10
430507	500 SUS	1 Gal.	6	40.36



VACUUM PUMP OIL

A quality 200 SUS viscosity oil with a low vapor pressure and high lubricity. Assures high vacuum pump performance.



Part No.	Container Size	Case Qty.*	Price/Ea.
VPO1P	1 Pt.	24	9.10
VPO1Q	1 Qt.	12	13.34
VPO1G	1 Gal.	6	34.22
VPO5G	5 Gal.	1	156.28



Part No.	Container Size	Price
998E02200	1 Qt.	43.40
998E02201	1 Gal.	134.54



OILER

- Zoom telescoping spout
- 12 containers per case
- 4 fluid oz. container



Part No.	Description	Price
D01	Turbine Oiler	2.30
DR1	Rust Buster	4.44

Prices in this catalog are subject to change without notice.



POLYOL ESTER OIL

Designed specifically for use with HFC refrigerants, they have been developed to meet the performance demands of the refrigeration industry.

The lubricants have excellent thermal and

chemical stability, and are compatible with a wide range of elastomers, polymeric materials and other materials of construction. They are fully miscible and compatible with mineral oils and alkylbenzene lubricants as well as with CFCs, HCFs and HFCs.

- Supplied in metal containers



Part No.	Viscosity		Description	Container Size	Price/Ea.
	(SUS) @ 100°F	(cSt) @ 40°C			
431346	100	18.9	ICI Emkarate RL22H	1 Gal.	117.78
431446	150	33.7	ICI Emkarate RL32H	1 Gal.	131.98
431445	150	33.7	ICI Emkarate RL32H	5 Gal.	648.18
431646	300	72.3	ICI Emkarate RL68H	1 Gal.	133.20
431616	—	68	Castrol Icematic E68	1 Gal.	141.40
431645	300	72.3	ICI Emkarate RL68H	5 Gal.	653.16
431706	—	100	Castrol Icematic SW100	1 Gal.	158.62
431826	850	170	ICI Emkarate RL170H	1 Gal.	169.12

MANUFACTURER	TYPE	APPROVED LUBRICANT
APV Baker (J & E Hall)	Hall Screw	RL100H
Bitzer	Screw	RL170H
Blissfield	Reciprocating (Open Drive)	RL68H
Bock	Reciprocating	RL22H, 32H, 46H, 68H, 100H
Carrier	Reciprocating O6DR For Marine Chillers	RL22H
(CAES, Transicold)	Centrifugal Chillers (17EA, 17DA)	RL32H
	Externally Geared Chillers (17EX, 17FA, 17MPS)	RL68H
	Internally Geared Chillers (17EX, 17FA, 19EA, 19EB, 19FA, 19XL, 19XT, 19EX, 19XR, 19XRT)	RL68HP
Carrier/Carlyle	Reciprocating (05G, 05K, 06D, 06E, 06CC C3)	RL68H
	Screw (05T & 06T)	RL100H
Copeland	Semi and Hermetic Reciprocating And Glacial Scrolls	RL32CF, RL32-3MA, RL22CF
Dorin	Semi Hermetic Reciprocating ("K" Series)	RL22H
Dunham Bush	Reciprocating (D-B METIC & D-LINE)	RL32H, 68H
	Screw (Vertical)	RL68H
Maneurop	Performer Scrolls, LTZ & MTZ Recips	RL32H
McQuay International	Centrifugal (100 & 126)	RL32H
	Centrifugal (050, 063, 079, 087)	RL32H
	Screw (Item number AA5063472)	RL68H
	Screw (Frame 2,4 models)	RL68HP
Royce	Reciprocating (FULL LINE)	RL32H
Sabroe	Reciprocating & Screw	RL32H, 46H, 68H, 100H, 150S, 220H
SRM	Twin Screw	RL150S
Tecumseh	Reciprocating	RL32H
Thermoking	Reciprocating (For containers)	RL32H
Trane	Screw	RL68H
	Scroll	RL32HB
US NSN	9150-01-387-4469	RL68H
	9150-01-410-8972	RL68H
	9150-01-443-9390	RL46H
	9150-01-443-9396	RL46H
	9150-01-435-1899	RL68H
Vatanu Cool Rotary Vane	Orbital Vane Rotary (OVR)	RL220H

This approval list should be used as a guide only. Uniquema recommends that users confirm with the OEM which RL grade is qualified for use with a particular application. OEM's advice should always be taken. Use only approved lubricants

	ICI Emkarate										Castrol Icematic						
	RL22H	RL22CF	RL32H	RL32HB	RL46H	RL68H	RL68HP	RL100H	RL170H	RL220H	SW32	SW68	E68	SW100	E100	SW220	SW220HT
Quarts	—	431334	431444	—	—	431644	—	—	—	—	431424	431624	—	—	—	—	—
Gallons	431346	431336	431446	—	431546	431646	431676	431746	431826	431856	431406	431606	431616	431706	—	—	—
5 Gallon	431345	431335	431445	431465	431545	431645	431675	—	431825	431855	431405	431605	431615	—	431705	431805	431806
53 Gallon	431341	431331	431441	—	—	431641	431671	—	—	—	431401	431601	—	—	—	—	—

LUBRICANTS

SPRAY LUBRICANT



MIRACLE 444

Lubricates metal parts with a high quality, all purpose lubricating oil (contains turbine oil). Restores equipment. Repels moisture. Prevents rust and corrosion; "unfreezes" rusted, corroded nuts, bolts, shafts.



Item	Description	Container Size	Price
M444	Miracle 444 Spray Lubricant	12 oz	10.84

COMPRESSOR LUBRICATION



CANVERTER®

A hand-held pump used to remove oil from and add oil to hermetic compressors. Packaged with appropriate tubing.



Part No.	Description	Price
48140	Hand Oil Pump	190.00

CONTAMINATION ANALYSIS



OIL REFRACTOMETER

Used to determine percentage of mineral oil in a refrigeration system during POE changeover. A brix scale, a refractive index, or any list of markings can be used to determine mineral oil percentage.



Part No.	Description	Price
RHB-82	Oil Refractometer	340.50

OIL ADDITIVE



ZEROL ICE

A revolutionary advancement in compressor lubrication technology, when introduced to an air conditioning, refrigeration system, it:

- Enhances the lubricity of all lubricants... mineral, alkylbenzene and POE

- Reduces friction drag resulting in lower energy consumption and longer equipment service life
- Enhances the system oil's hydrodynamic or fluid properties, resulting in improved heat transfer in evaporator
- Is soluble with CFC, HCFC and HFC refrigerants
- Is compatible with system materials such as EPR, EPDM, HNBR, polysulfates, silicones and neoprene

Test results have shown that Zerol Ice can reduce running amperage from 5% to 10%, depending on ambient temperatures. Also, high side and low side pressures were reduced. Of 22 systems operating in 73.3°F temperature, high and low side pressures were reduced an average of 4.8% and 5.8% respectively. And of the 12 systems operating in the cooler ambient, the pressures were reduced 1.2% and 4.4% respectively, again on average.

Another critical benefit of Zerol Ice is its ability to improve heat transfer in the evaporator. It is a given that a film of refrigeration oil will line the surfaces of the evaporator, and this film will restrict heat transfer to a degree. Introduction of Zerol Ice will enhance the hydrodynamic fluid properties of the oil, actually reducing the oil layer on the tubes... and this will result in approximately 5% improvement over mineral oil and approx. 10% improvement over POE oil performance at respective temperatures.

Application: 1 container per 5 Tons R22, Requires Rx11 injector.



Part No.	Description	Price
431250	Zerol Ice, 1 can	108.48
431252	Zerol Ice, 2 cans, Rx11 injector	239.52

United Refrigeration's vast inventory and fast, friendly service can speed you on your way. Our one-stop shopping will enable you to increase your billing hours and reduce your commuting hours.