NU-CALGON

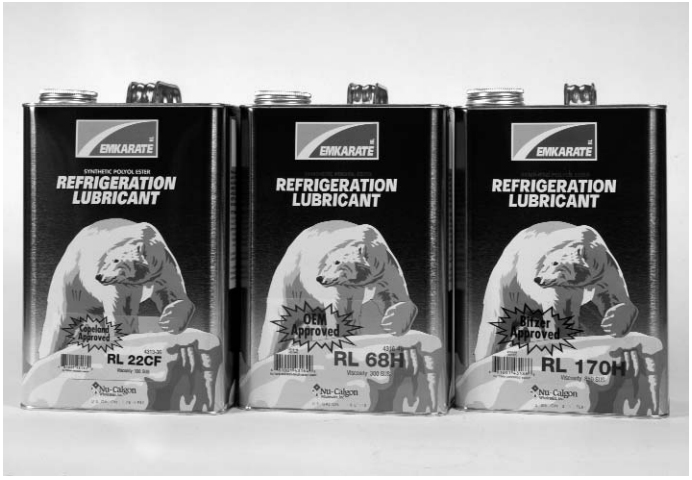
PRODUCT BULLETIN

NUMBER 3-68

REFRIGERATION OILS

EMKARATE® RL LUBRICANTS

- **Fully formulated polyol ester lubricant**
- **OEM-approved, including Copeland approved RL22CF**
- **For CFC, HCFC and HFC applications**
- **Compatible with mineral oils, alkylbenzenes and PAG's**



DESCRIPTION

Uniqema has developed a range of polyol ester refrigeration lubricants within its EMKARATE RL line. They are designed specifically for use with HFC refrigerants, and they have been developed to meet the performance demands of the refrigeration industry. This superior performance has been achieved with basefluids that are specifically formulated to deliver optimum performance with minimal additive levels.

APPLICATION

The requirements of today's refrigeration and air conditioning compressor lubricants are complex. They must be compatible and miscible with the HFC refrigerants, and they must be compatible and miscible with CFC's and HCFC's as well as mineral oil and alkylbenzene oil. Polyol ester lubricants meet these needs, and the EMKARATE RL line of polyol esters is the preferred choice.

Uniqema has developed their polyolester lubricants by drawing on extensive experience and expertise in refrigerant and lubricant technology. Working in close collaboration with compressor and system manufacturers, they have developed OEM-approved POE lubricants covering a wide viscosity range from 7 cSt (35-40 SUS) to 220 cSt (1100 SUS) to suit most refrigeration applications.

These lubricants meet the highest quality standards. Their higher viscosity index is an indication that their effective viscosity will not change drastically with the wide swings in temperature seen by most typical refrigeration and air conditioning systems. This means that energy consumption will be minimized at low temperatures and lubrication will be maximized at elevated temperatures. 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 the preferred choice for servicing and retrofitting existing equipment as well as for OEM charging.

CRITICAL ISSUES

Additives vs Non-Additives. An increasing trend is the preference to specify lubricants that do not contain additives. In the majority of cases, additives should not be needed with properly formulated base lubricants. Experiences such as decreased lubricant stability, sludge formation, and component deposits, are concerns related to the use of additives. At the same time, additives can provide the advantage of improved lubricity, and in certain particularly demanding applications may be necessary.

Miscibility. Since some lubricant will travel with the refrigerant in any air conditioning or refrigeration system, it is imperative that they be fully miscible and soluble with one another…at all temperatures that the system will experience. This insures good oil return and lubricity to the compressor, and no blockage or loss of heat transfer in the evaporator. In traditional systems, the CFC or HCFC refrigerant is miscible and soluble with the mineral or alkylbenzene oil. On the other hand, if these oils and an HFC refrigerant are mixed, they are mutually immiscible and essentially insoluble. They will separate into two distinct phases in the evaporator and the oil will coat the inside of the tubes, resulting in a loss of heat transfer and potentially a lack of lubrication in the compressor.

HFC refrigerants and POE lubricants are fully miscible and have high mutual solubility. As a result, POE lubricants are the proper choice when using HFC refrigerants.

Blending Different POE Brands. Compressor manufacturers often approve several lubricants for use in a particular compressor application. Part of the process of approving them is the understanding that the approved oils may end up being blended with each other in a system. The blending of approved oils is most acceptable. When in doubt, consult the compressor manufacturer.

There are two main types of POE oils currently approved for use in refrigeration compressor applications: unaddivated POE's and formulated POE's which may contain up to 3% additives.

When two unaddivated lubricants are mixed, the performance of the resulting blend is between the performance of the separate lubricants. So long as the lubricants are approved, the resulting mixture should be suitable. However, when a non-additized lubricant is blended with an additized lubricant, some decrease in the performance of the additive may be seen since the additive dose rate of the formulated lubricant will be diluted by the unaddivated lubricant. This can be especially problematic for formulated oils containing foaming agents as these agents tend to be very dose-rate sensitive. Care should be taken and the OEM consulted for advice.

Moisture. Hygroscopicity is the term used to describe a lubricant's affinity for moisture, and POE's are known to be hygroscopic. They absorb water more quickly than mineral or alkylbenzene oils from the surrounding environment. For this reason, care should be exercised during the servicing of equipment charged with or about to be charged with a polyol ester. Should a system come to contain high levels of moisture, problems can occur including the hydrolysis or breakdown of the POE.

At the same time, if acceptable packaging and good service procedures are used and care is exercised in the handling of the oil, moisture should not be a problem. If the container of the POE is metal and it is tightly sealed after each use, no serious ingress of moisture should occur to unused oil. In addition, the use of the appropriate driers and proper service practices will result in the effective control and removal of moisture. In fact, since HFC's effectively compete with the POE for any moisture present (i.e. water moves from the oil to the refrigerant), the moisture will be more easily removed from the refrigerant by the driers.

TYPICAL PROPERTIES

Property & Procedure	RL22H	RL22CF	RL32H	RL68H	RL68HP	RL100H	RL170H	RL220H
Viscosity @ 40°C (cSt), ASTM D-445	18.9	32.0	33.7	72.3	72.3	100	170	230
Viscosity @ 100°C (cSt), ASTM D-445	4.2	5.6	5.9	9.8	9.8	12.0	17.0	19.5
Typical SUS Viscosity @ 100°F	100	150	150	300	300	500	850	1100
Viscosity Index, ASTM D-2270	120	121	110	120	120	120	108	100
Pour Point (°C), ASTM D-97	-52	-46	-46	-39	-39	-20	-25	-15
Density @ 20°C (g/ml), ASTM D-1298	0.995	0.973	0.977	0.977	0.976	0.970	0.968	0.976
Flash Point (COC) (°C), ASTM D-92	240	250	270	270	260	230	290	280
Acid Value (mgKOH/g), ASTM D-974 modified	0.01	<0.07	0.02	<0.02	<0.02	<0.05	<0.02	<0.02
Water Content (ppm), ASTM E 1064-85	<50	<50	<50	<50	<50	<50	<50	<50
Refractive Index @ 28°C	1.4519	1.4546	1.4530	1.4557	1.4566	1.4574	1.4590	1.4580

Viscosity Designations: CF = Copeland Formulation; H = High Solubility; N = Special for McQuay; HP = Special for Carrier Internally Geared Chillers

Rapid Retrofit . . . . . do it on one call

Retrofit existing low and medium temperature CFC or HCFC systems to one of the long term HFC refrigerants in one service call using the ICI patented Rapid Retrofit Procedure.

- **Use on low temp & medium temp systems**
- **Use of POE is minimized as compared to the "3-4 flush" process**
- **Completed in one service call, in 4 hours or less**
- **Do single compressor up to multi-compressor rack systems**

SPECIFIC INSTRUCTIONS

1. Run defrost cycle on all evaporators in order to maximize the movement (return) of mineral oil to the compressor.
2. Turn refrigeration off and isolate the compressor. Remove refrigerant from compressor via accessible ports using appropriate methods and recovery equipment. Remaining portion of CFC refrigerant will stay in the rest of the system.
3. This "down-time" where compressor is open to atmosphere will provide for the warming of the oil in the compressor and facilitate its subsequent draining.
4. Drain mineral oil from compressor. Where possible, drain any oil remaining in other system components such as receivers, accumulators and separators. It is recommended that this step not be rushed; taking adequate time will allow for full warming and a subsequently more complete draining of the mineral oil from the compressor. This is important, particularly on medium temp systems that may not have hot gas defrost nor electric defrost or warming.
5. Replace with equal volume (equal to what was removed) of approved EMKARATE RL lubricant. Charge with appropriate equipment (sealed refrigeration oil pumps, etc.) and procedures.
6. Change filter driers.
7. Using same hand pump (Robinair, Thermal Engineering, etc.), add an additional volume of the EMKARATE RL lubricant (equal to 1/2 of what was just charged to the compressor(s) to the system's liquid line after the condenser, and after the receiver, if there is one.
8. Continue using the pump to adequately push this additional lubricant into the system.
9. If there are multiple evaporators, be sure that all automatic defrosts are disengaged.
10. Re-charge the portion of CFC that was removed from the compressor in step two. Again, use appropriate methods and equipment.
11. Re-energize or start system, remembering that you have approximately 50% extra lubricant in the system. This additional lubricant will enable the system to be "scoured" or more efficiently cleaned of remaining mineral oil.
12. Monitor the compressor crankcase oil level, and drain crankcase as necessary to maintain proper oil levels. In about 15-30 minutes, most of the extra lubricant, including much of the remaining mineral oil, will have been drained from the system.
13. After 30-40 minutes, run defrost cycle(s) again to maximize oil return in the compressor(s).
14. De-energize or turn off the system and sample the oil from the compressor crankcase; if there are multiple compressors, take a sample from each.
15. Using your Nu-Calgon Refractometer (P/N 4815-0), test the sample(s) for residual mineral oil content. For this first test, you should not expect the residual mineral oil to automatically have reached the target of ≤5%. If you're sampling more than one compressor, take an average of the test results.
16. Isolate compressor once again, and recover CFC in compressor, again using appropriate procedures.
17. Drain lubricant from compressor, and charge with an equal volume of the same EMKARATE RL lubricant.
18. Change filter driers.
19. Re-charge the portion of CFC that was removed from the compressor in step two. Again, use appropriate methods and equipment.
20. Re-energize or start system, and run to achieve full circulation of lubricant/refrigeration mixture.
21. Sample oil and test with refractometer.

    a) If mineral oil residual is below 5%, and it should be, turn system off and recover CFC appropriately. Charge system with selected HFC refrigerant.

    b) If mineral oil residual is still above 5%, and this would by very unusual, repeat Steps 15-18 and retest.

CURRENT APPROVAL STATUS WITH HFC REFRIGERANTS

COMPRESSOR MANUFACTURER	TYPE OF MODEL	APPROVED LUBRICANT
APV BAKER (J & E HALL)	HALLSCREW	RL 100H
BITZER	SCREW	RL 170H
BLISSFIELD	RECIPROCATING (OPEN DRIVE)	RL 68H
BOCK	RECIPROCATING	RL 22H, 32H, 46H, 68H, 100H
CARRIER (CAES, TRANSICOLD)	RECIPROCATING O6DR FOR MARINE CONTAINERS CENTRIFUGAL CHILLERS (17EA, 17DA) EXTERNALLY GEARED CHILLERS (17EX, 17FA, 17MPS) INTERNALLY GEARED CHILLERS (17EX, 17FA, 19EA, 19EB, 19FA, 19XL, 19XT, 19EX, 19XR, 19XRT)	RL 22H RL 32H RL 68H RL 68HP
CARRIER/CARLYLE	RECIPROCATING (05G, 05K, 06D, 06E, 06CC C3) SCREW (05T & 06T)	RL 68H RL 100H
COPELAND	SEMI AND HERMETIC RECIPROCATING AND GLACIAL SCROLLS	RL 32CF, RL 32-3MA RL 22CF
DORIN	SEMI HERMETIC RECIPROCATING (“K” SERIES)	RL 22H
DUNHAM BUSH	RECIPROCATING (D-B METIC & D-LINE) SCREW (VERTICAL)	RL 32H, 68H RL 68H
MANEUROP	PERFORMER SCROLLS, LTZ & MTZ RECIPS	RL 32H
MCQUAY INTERNATIONAL	CENTRIFUGAL (100 & 126) CENTRIFUGAL (050, 063, 079, 087) SCREW (COMMERCIAL ITEM NUMBER AA5063472) SCREW (FRAME 2 AND FRAME 4 MODELS)	RL 32H RL 32H RL 68H RL 68HP
ROYCE	RECIPROCATING (FULL LINE)	RL 32H
SABROE	RECIPROCATING & SCREW	RL 32H, 46H, 68H, 100H, 150S, 220H
SRM	TWIN SCREW	RL 150S
TECUMSEH	RECIPROCATING	RL 32H
THERMOKING	RECIPROCATING (FOR CONTAINERS)	RL 32H
TRANE	SCREW SCROLL	RL 68H RL 32HB
USA MILITARY	NSN 9150-01-387-4469 NSN 9150-01-410-8972 NSN 9150-01-443-9390 NSN 9150-01-443-9396 NSN 9150-01-435-1899	RL 68H RL 68H RL 46H RL 46H RL 68H
VATANU-COOL ROTARYVANE	ORBITAL VANE ROTARY (OVR)	RL 220H

This approval list should be used as a guide only. Uniqema recommends that users confirm with the original equipment manufacturer (OEM) which EMKARATE™ RL grade is qualified for use with a particular combination of compressor model, refrigerant and application. OEM’s advice should always be taken. Only use approved lubricants.

On systems calling for RL32S or RL68S substitute RL32H or RL68H, respectively.

NU-CALGON PART NUMBERS

	RL22H	RL22CF	RL32H	RL32HB	RL46H	RL68H	RL68HP	RL100H	RL170H	RL220H
Quarts	–	4313-34	4314-44	–	–	4316-44	–	–	–	–
Gallons	4313-46	4313-36	4314-46	–	4315-46	4316-46	4316-76	4317-46	4318-26	4318-56
5-Gallon	4313-45	4313-35	4314-45	4314-65	4315-45	4316-45	4316-75	–	4318-25	4318-55
Drums*	4313-41	4313-31	4314-41	–	–	4316-41	4316-71	–	–	–

*Drums are 53-gallon.

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