

R22 Phase Out

→ NOVEMBRE 2009



>> Tecumseh's guidelines

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R22 Phase Out
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R22 Phase Out

Refrigerant R22 is widely used for residential and commercial air conditioning, as well as refrigeration applications. Tecumseh has supplied reciprocating and rotary compressors, along with condensing units with reciprocating and rotary compressors, for the above mentioned applications.

Driven by the 1992 amendment to the Montreal Protocol that calls for the phase-out of HCFCs, refrigerant manufacturers developed HFC alternatives. Original Equipment Manufacturers selected R404A/R507, R407C and R410A to replace R22. They found that system changes were necessary for this conversion and made appropriate design changes to meet application requirements and regulatory demands. **Tecumseh's proposed alternatives are based on tests and measures (performances, lifetesting, measures on application) made by both Tecumseh Product Company and Tecumseh Europe laboratories, as guarantee for an independent position.**

In order to support the service and maintenance of equipment, refrigerant manufacturers introduced HFC blends as a replacement for R22. HFC blends can vary in performance when compared to R22. Regardless, system adjustments must be made to insure that performance differences (between R22 and HFC blends) are minimized.

Suggested system adjustments are highlighted in this document.

Tecumseh Products Company does not endorse any particular retrofit refrigerant. Given that an independent decision has been reached to use R417A or R422 blends, the following guidelines are provided to assist in better applying Tecumseh compressors. The application should be reviewed carefully prior to making decisions regarding retrofit or replacement refrigerants as oftentimes there can be capacity and efficiency losses.

Consult Tecumseh's Refrigerant Matrix for additional HFC blends.

The matrix may be viewed on line under the Technical Resource Center section of Tecumseh's North American Compressor Group web site at <http://202.56.127.90/nacg/>. Considerations should be given to oil compatibility, refrigerant temperature glide, heat exchanger compatibility, operating pressure differences, system performance and pressure drop. The greater the difference in performance between R22 and the alternate refrigerant, the more complex the system adjustments may be, increasing the likelihood that compressor reliability will be adversely affected.

Tecumseh works with refrigerant and lubricant manufacturers to stay up-to-date with ongoing research and development. We review available solutions and test our compressors for capacity and efficiency gains/losses and, for adequate lubrication. While we review an assortment of refrigerants, our standard practice is to develop compressors for well proven, commercially available refrigerants.

Today, a number of R22 alternative refrigerants are available for use in Low, Medium, and High temperature applications. Some of the popular commercially available HFC refrigerants include R134a, R404A/R507, R407C and R410A.

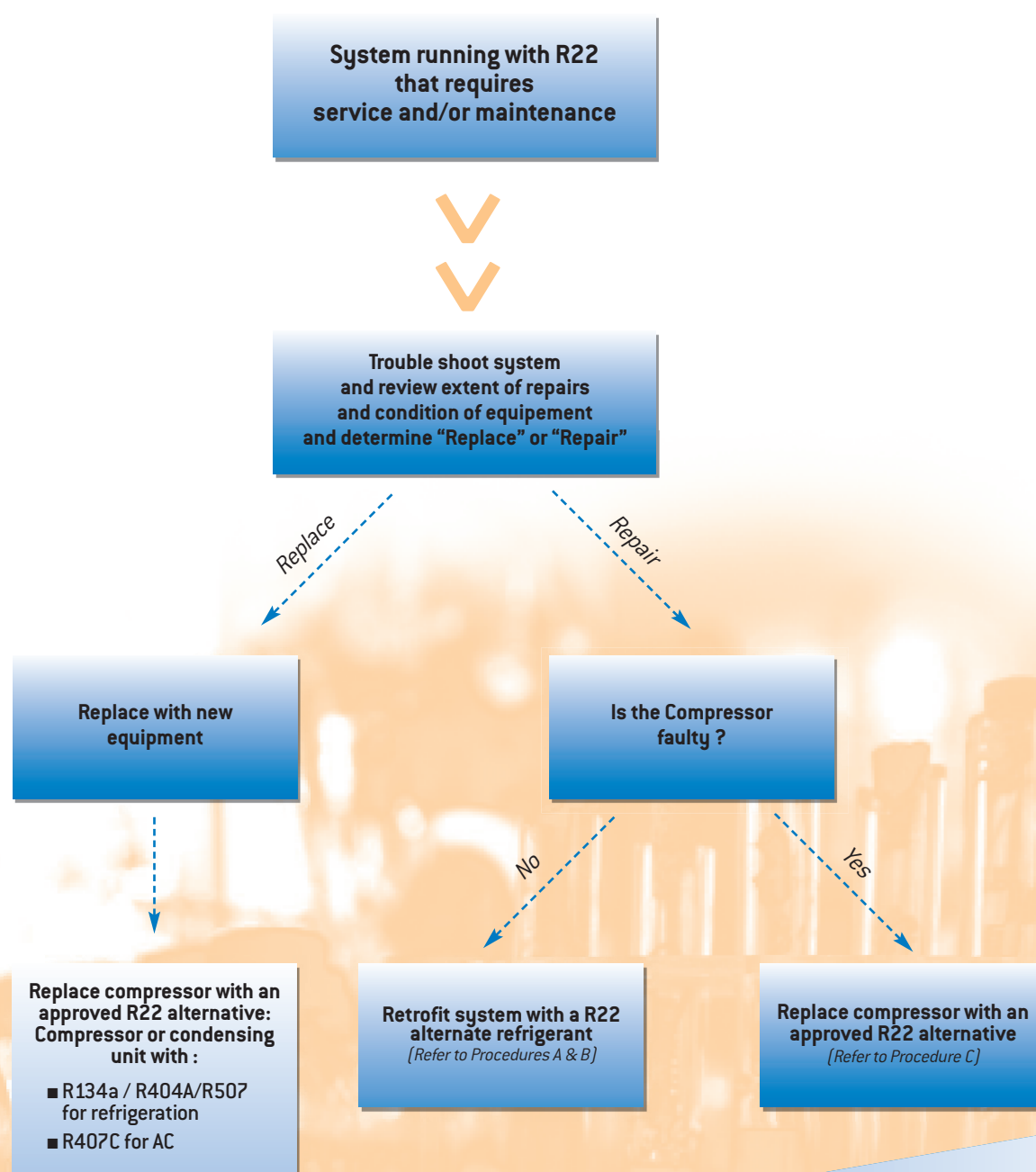
A broad range of Tecumseh compressors and condensing units are available for use with refrigerants R134a, R404A/R507 and R407C to serve our diverse customer base. For certain applications, compressors are available for use with R410A.

Refrigerant suppliers promote a number of alternate blends for use in service and maintenance of equipment. Tecumseh is involved with programs to evaluate R417A, R422A, R422B, R422C and R422D as potential candidates to replace R22. **At this time however, only refrigerants approved by Tecumseh are to be used with Tecumseh compressors.**

>> R22 Phase out Options

Repair or Replace?

Replace with an Approved R22 Alternative or Retrofit with an HFC Blend



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For repair, guidelines procedures

CAUTION

Performance reduced by

R404A & R507 ~ -5%
R407C ~ -5%

Performance reduced by

R422A & R422C -10 ~ -5%
R422B & R422D -20 ~ -10%
R417A -30%

Check Tecumseh's retrofit recommendation

A) Procedure for Refrigerant Change-Out Only

(No Oil Change-Out)

1. Disconnect power.
2. Recover R22 refrigerant from the system using proper recovery equipment. Weigh and record the amount.
3. Replace liquid line filter drier with a drier that is compatible with the replacement refrigerant.
4. Replace metering device as needed.
5. Leak test using nitrogen (refer to Tecumseh's Service Handbook for proper leak test procedure). When pressure testing confirms that the system is free of leaks, evacuate the system thoroughly. Air, moisture and non-condensables must be removed to ensure long term compressor reliability. Evacuate to a minimum of 500 microns. Always use a vacuum gauge to measure vacuum levels.
6. Recharge with refrigerant in the liquid state to 90% of the original R22 name plate charge or weighed amount. Depending on the application and system design, refrigerant charge may vary.
7. Operate system and follow procedures outlined by the equipment or component manufacturer for measuring superheat. Adjust refrigerant metering device and operating control(s) settings as needed.
8. Label the compressor with the new refrigerant and oil type. Consult refrigerant supplier for color coding.

B) Procedure for Retrofitting System With a Different Refrigerant and Oil Type

(Applies to Reciprocating Compressors Only)

1. Disconnect power
2. Recover R22 refrigerant from the system using proper recovery equipment. Weigh and record the amount.
3. Remove the compressor from the system and drain the oil. Drain as much oil as possible from the compressor through the suction tube. Typically, ten (10) minutes is sufficient. When retrofitting systems with a change from MO or SA to POE, a residual of 1% to 5% of the original oil charge is acceptable. A second oil change is recommended to reduce system residual oil to an acceptable level.
4. Recharge the compressor with the correct amount of POE oil as recommended by Tecumseh.
Refer to Tecumseh's Policy Bulletin No. PB105 for the correct oil type and Tecumseh's compressor technical data sheet for the required amount of oil.
5. Run the compressor using recovered R22 refrigerant to purge the system of any residual oil. A sufficient amount of recovered R22 should be used to bring the system to operating condition.
6. Repeat Steps 1 to 4 (above).
7. Replace liquid line filter drier with a drier that is compatible with the replacement refrigerant.
8. Replace metering device as needed.
9. Leak test using nitrogen (refer to Tecumseh Service Handbook for proper leak test procedure). When pressure testing confirms that the system is free of leaks, evacuate the system thoroughly. Air, moisture and non-condensables must be removed to ensure long term reliability. Evacuate to a minimum of 500 microns. Always use a vacuum gauge to measure vacuum levels.
10. Recharge with refrigerant in the liquid state to 90% of the original R22 name plate charge or weighed amount. Depending on the application and system design, refrigerant charge may vary.
11. Operate system and following procedures outlined by the equipment or component manufacturer for measuring superheat. Adjust refrigerant metering device and operating control(s) settings as needed.
12. Label the compressor with the new refrigerant and oil. Consult the refrigerant supplier for color coding.

NOTE: Alternate blends may inhibit oil return on systems using SA/MO oil. This is important on rotary compressors where by design, the oil can not be drained.

For replace, guidelines procedures

C) Compressor or Condensing Unit Using an Approved Refrigerant Such As R404A/R507 or R407C *(Depending on the application)*

1. R404A/R507: Refer to RD-0007-E
2. R407C: Refer to RD-0005-E

RETROFITTING

The ideal situation regarding the use of R404A/R507 / R407C would be that it be limited to new equipment only. In this way, the system components would all be selected and tested by a system designer with all the necessary concerns regarding R404A/R507 / R407C and polyol ester and polyvinyl ether oils in mind. However, in the real world of today with millions of existing R22 in the systems in the field, and the supply of R22 rapidly declining as the CFC phase-out date approaches, this would not be possible.

We offer some general guidelines to those who elect to retrofit existing R22 units in the field (with compressor change-out) with R404A/R507 / R407C. Specific procedures can only be determined after an in depth evaluation of the existing equipment. Contact the equipment OEM for specific details.

C1) Replacing an R22 compressor with a R404A/R507 or R407C *(“C” or “Z” denoted in the compressor model number) compressor: Use generally accepted system change-out procedures, taking special effort not to leave the system or the R404A/R507 / R407C compressor open to the atmosphere for more than a few minutes (10 minutes maximum).*

1. Recover the R22 refrigerant in the system using proper recovery equipment. Take special effort to remove any residual mineral oil left in the system. The remaining amount of mineral oil should be 5% or less (1% or less is preferred).
2. Refit the system with the proper capillary tube, expansion valve, or other appropriate expansion device.
3. Install a drier suitable for R404A/R507 / R407C of suitable size for the system being retrofitted.
4. Install the proper Tecumseh R404A/R507 / R407C (“C” or “Z”) compressor. Be sure to use the correct electrical components, they could differ from those applied with a R22 compressor.
5. When pressure testing confirms that the system is free of leaks, evacuate the system thoroughly. Air, moisture and non-condensables must be removed to ensure long term reliability.

6. Break the system vacuum by charging R404A/R507 / R407C liquid refrigerant into the liquid line.
7. Change the system using industry acceptable charging methods with the proper amount of R404A/R507 / R407C. Generally the system will use the same amount of refrigerant as R22.
8. Check the system for proper operation. After retrofitting an R22 system with R404A/R507 / R407C, always identify the system as being charged with that refrigerant and containing a polyol ester oil. Indicate on the unit the amount of refrigerant used.

C2) Tecumseh compressors which have refrigerant designation codes other than “C” or “Z” are NOT approved for use with R404A/R507 (for “Z”) / R407C (for “C”).

C3) Tecumseh R404A/R507 (for “Z”) / R407C (“C” or “Z”) compressors can be used with R22, although the preferred refrigerant for these compressors is R404A/R507 (for “Z”) / R407C (for “C”).

The transition from R22 refrigerant to R404A/R507 / R407C refrigerant presents many challenges to our industry. Tecumseh Products Company is working diligently to meet these challenges. For information regarding the new Tecumseh R404A/R507 / R407C “C” or “Z” compressors, contact your Tecumseh sales representative.

NOTE: Tecumseh recommends a compressor change to be considered when retrofitting an existing R22 system with refrigerant R407C for Air Conditioning and R404A/R507 for commercial and industrial refrigeration. This is due to the potential difference in compressor performance and the compatibility of electrical components (of utmost importance is the overload protector).

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Which alternate refrigerant?

R22 Alternate Refrigerant Selection Guidelines
HCFC R22 to HFC R404A/R507, R407C, R410A, R417A, R422A/C and R422B/D
Data according to Ashrae conditions

New Equipment Applications of Compressors and Condensing Units					
Evaporating Conditions	Refrigerant(s)	Lubricant(s)	Compressor Type	Capacity Range (W)	Equipment/Application ⁺
Low Temperature -10°F (-23.3°C)	R404A, R507	Polyol Ester	Reciprocating	176 to 6448	Commercial and Walk-In Freezers, Process Chillers, Soft Serve Ice Cream and Yogurt Machines
		Polyvinylether	Rotary	702 to 1026	
	R134a	Polyol Ester	Scroll	2198 to 6741	Commercial Refrigerators and Vending Equipment
		Polyol Ester	Reciprocating	60 to 545	
Medium Temperature +20°F (-6.7°C)	R404A, R507	Polyol Ester	Reciprocating	366 to 10698	Commercial Refrigerators and Display Cases, Ice Machines, Beverage Dispensers, Refrigerated Air Driers
		Polyvinylether	Rotary	967 to 1980	
		Polyol Ester	Scroll	2579 to 12896	
	R134a	Polyol Ester	Reciprocating	107 to 6301	Transport Refrigeration Commercial Refrigerators and Vending Equipment
		Polyvinylether	Rotary	659 to 1278	
		Polyvinylether	Rotary	1518 to 3804	
High Temperature +45°F (7.2°C)	R410A	Polyvinylether	Rotary	1518 to 3804	Residential and Light Commercial Air Conditioners and Heat Pumps
	R407C	Polyol Ester	Reciprocating	1905 to 21102	
		Polyvinylether	Rotary	1369 to 3664*	
		Synthetic Alkylate			
	R134a	Polyol Ester	Reciprocating	410 to 3546	Commercial Refrigerators and Vending Equipment
		Polyvinylether	Rotary	999 to 3429	PTAC/PTPH, Transport Refrigeration, Electronics Cooling
Retrofit Applications of Compressors and Condensing Units					
Evaporating Conditions	Refrigerant(s)	Lubricant(s)	Compressor Type	Capacity Range (W)	Potential Equipment/Application
Low Temperature -10°F (-23.3°C)	R422A, R422C	Polyol Ester Mineral Oil Synthetic Alkylate	Reciprocating	440 to 3224	Commercial and Walk-In Freezers, Process Chillers, Soft Serve Ice Cream and Yogurt Machines, Commercial Refrigerators and Vending Equipment
Medium Temperature +20°F (-6.7°C)	R417A, R422B, R422D	Polyol Ester Mineral Oil Synthetic Alkylate	Reciprocating	366 to 10698	Walk-In Coolers, Refrigerated Air Driers and Dehumidifiers
		Synthetic Alkylate	Rotary	929 to 2050	Dehumidifiers and Beverage Dispensers
High Temperature +45°F (7.2°C)	R407C	Polyol Ester	Reciprocating	1612 to 21102	Residential and Light Commercial Air Conditioners and Heat Pumps
	R417A, R422B	Synthetic Alkylate	Rotary	1612 to 7327	
		Polyol Ester Mineral Oil Synthetic Alkylate	Reciprocating	1612 to 21102	
		Synthetic Alkylate	Rotary	1612 to 5275*	

Notes
This Selection Guide is for reference only and does not represent an endorsement by Tecumseh Products Company of any particular retrofit refrigerant. Guidelines are provided to assist in better applying Tecumseh compressors.
* 50 Hz models available in a wider capacity range.
+ For a complete list of compressor applications refer to Reference Document RD-0004-E
Tecumseh approved alternate R22 refrigerant, guidelines available
Tecumseh guidelines are available for these additional listed refrigerants
Data according to Ashrae conditions



Which alternate refrigerant?

Refrigerant selection guidelines
Oil and miscibility

Refrigerant (ASHRAE#)	Alternate for:	Type	Refrigerant Components	Refrigerant Composition (%)	Type	ODP	GWP	Vapor Pressure (DP) bar (relative pressure)			Compatible Lubricants*
								-23.3°C (-10°F)	7.2°C (+45°F)	54.4°C (+130°F)	
R12	N/A	CFC	12	100	Pure Fluid	1.000	10600	0.31	2.87	12.48	MO, SA
R500			12/152a	74/26	Azeotrope	0.630	7900	0.54	3.57	15.04	MO, SA
R502			22/115	49/51	Azeotrope	0.230	4500	1.56	6.12	22.12	MO, SA
R22		HCFC	22	100	Pure Fluid	0.050	1700	1.14	5.24	20.46	MO, SA
R134a	R12	HFC	134a	100	Pure Fluid	0.000	1300	0.14	2.76	13.72	POE, PVE
R401A		HCFC	22/152a/124	53/13/34	Zeotrope	0.030	1100	0.17	2.80	13.62	SA, MO
R401B			22/152a/124	61/11/28		0.035	1200	0.24	3.03	14.48	SA, MO
R406A			22/142b/600a	55/41/4		0.036	1900	0.13	2.57	12.34	MO, SA
R409A			22/142b/124	60/15/25		0.050	1500	0.15	2.76	13.72	MO, SA
R414B			22/124/600a/142b	50/39/1.5/9.5		0.031	1300	0.055**	2.44	12.38	MO, SA
R290*		HC	N/A	100	Pure Fluid	0.000	0	2.16	5.89	18.84	MO, SA
R600a+			N/A	100		0.000	3	0.62	2.01	7.62	MO, SA
R402A	R502	HCFC	22/125/290	38/60/2	N-Azeotrope	0.020	2700	1.79	6.89	25.51	SA, POE
R402B			22/125/290	60/38/2		0.030	2300	1.56	6.32	23.79	SA, POE
R403B			22/218/290	56/39/5		0.025	4300	2.04	7.14	25.01	MO, SA, POE
R408A			22/143a/125	47/46/7		0.016	3000	1.34	5.94	22.90	MO, SA, POE
R404A			125/143a/134a	44/52/4		0.000	3800	1.65	6.52	24.34	POE, PVE
R507		HFC	125/143a	50/50	Azeotrope	0.000	3900	1.79	6.82	25.36	POE
R422C			125/134a/600a	82/15/3	Zeotrope	0.000	3033	1.41	6.12	24.41	POE, (MO, SA)
R407A			32/125/134a	20/40/40	Zeotrope	0.000	2000	2.06	6.40	23.69	POE
R407B			32/125/134a	10/70/20	Zeotrope	0.000	2700	1.43	6.27	24.99	POE
R407C			32/125/134a	23/25/52	Zeotrope	0.000	1700	0.84	4.82	20.92	POE, PVE, (SA)
R410A	R22	HFC	32/125	50/50	N-Azeotrope	0.000	2000	2.60	9.12	33.02	POE, PVE
R404A			125/143a/134a	44/52/4		0.000	3800	1.65	6.52	24.34	POE, PVE
R507			125/143a	50/50		0.000	3900	1.79	6.82	25.36	POE
R417A			125/134a/600	47/50/3	Zeotrope	0.000	1950	0.78	4.32	17.93	POE, (MO, SA)
R422A			125/134a/600a	85/12/3		0.000	2530	1.65	6.48	24.24	POE, (MO, SA)
R422B			125/134a/600a	55/42/3		0.000	2080	1.18	5.34	20.73	POE, (MO, SA)
R422C			125/134a/600a	82/15/3		0.000	3033	1.41	6.12	24.41	POE, (MO, SA)
R422D			125/134a/600a	65/32/3		0.000	2700	1.37	5.81	22.08	POE, (MO, SA)
R421A			125/134a	58/42		0.000	2600	1.14	5.25	20.61	POE, (MO, SA)
R424A			125/134a/600/600a/601a	50/47/1/1/1		0.000	2011	0.40	3.53	16.94	POE, (MO, SA)
R427A			32/125/143a/134a	15/25/10/50		0.000	1830	0.74	4.52	19.96	POE, (MO, SA)
R438A			32/125/134a/600/601a	8/45/44/2/1		0.000	2264	0.80	4.67	20.13	POE, (MO, SA)

* Compatible Lubricant: MO = Mineral Oil; SA = Synthetic Alkylate (also referred to as AB or Alkylbenze); POE = Polyol Ester; PVE = Polyvinyl Ether
Lubricants shown in BOLD ITALIC are recommended for use with the corresponding refrigerants. Consult Tecumseh's Policy Bulletin PB105 to verify approved compressor lubricants.

** Inches of mercury below atmospheric pressure
+ Local regulations apply to the use of Hydrocarbon refrigerants

Notes

- 1. This listing is for reference only and does not represent an endorsement by Tecumseh Products Company of any particular refrigerant supplier.
- 2. GWP, Global Warming Potential (for 100 year integration)

Tecumseh approved alternate R22 refrigerant, guidelines available
Tecumseh guidelines are available for these additional listed refrigerants
Data according to Ashrae conditions

See refrigerant properties in annex



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Technical information and recommendations

CAUTION

An increase in engine capacity may be necessary
Use a different oil
Maximum operating pressure changes for given saturated temperature
Fluid load: 5% to 15% less depending on the fluid.
Exchangers: can be less effective because of the fluid glides and the oil film
Change and resizing expansion devices
Change joints (*hermetic compressors not concerned*)

LUBRICANTS

A) Types, Miscibility and Charge

POE	Polyol Ester Oil
MO	Mineral Oil
SA	Synthetic Alkylate (also referred to as Alkylbenzene, AB)

1. Consult Tecumseh Products Company's Policy Bulletin no. PB105 to verify original oil type.
2. R417 and R422 blends contain a small percentage of hydrocarbons to promote oil return. The hydrocarbon component of the refrigerant provides only partial miscibility with MO or SA oils. Whenever practical, the compressor oil should be changed to POE.
3. Do NOT use MO or SA oil with HFC blends in systems using a receiver tank. MO or SA will suspend on top of the refrigerant and collect in the receiver. In such systems the MO or SA oil must be replaced with POE oil.

B) Moisture

1. POE oil is more hygroscopic than MO or SA oils and will absorb moisture quickly. POE oil along with moisture and heat of the operation will cause acid and alcohol to form in the system resulting in reduced system efficiency and capacity, reduced compressor bearing lubrication, component corrosion, blockages, and coppering of parts.
2. Care should be taken not to leave the system open to the atmosphere for more than 10 minutes. Pull a system vacuum to a minimum of 500 microns. This applies to any retrofitting process using any type of oil.

C) Compatibility

1. POE acts as a solvent and can dislodge deposit debris in older systems operating with MO. The liquid line filter drier must be changed to keep the system free of debris. Multiple refrigerant and liquid line filter drier changes may be needed.
2. While POE is compatible with MO or SA oils, it should not be indiscriminately mixed. This practice could reduce the ability of the oil to return to the compressor and/or reduce heat transfer performance in the evaporator.

SYSTEM COMPONENTS AND DESIGN

A) Compressor Selection

1. Once the system operating problem has been diagnosed consideration should be given to the cost of service retrofit compared to the cost of new equipment. Issues with equipment age, lost system capacity, system performance, product warranty, service replacement component cost and availability, agency approval, human and environmental safety impact (TEWI), and, time/labor should weigh into the decision.
2. If the retrofit is extensive, often the best option is to replace the compressor or condensing unit. In this case, a compressor already designed for R404A/R507 or R134a, R407C should be selected depending on the application. The same applies when a compressor problem is diagnosed that requires compressor replacement.

3. When the decision is made NOT to change the compressor, the following points need to be considered:
 - a. Compressor RLA values may increase with the use of a higher pressure refrigerant compared to R22.
 - b. The system has to be labeled as retrofitted with the specific refrigerant blend used. Differences in capacity may require system adjustments for refrigeration balancing.

B) Capillary Tube Selection

1. Conversion to R422B or R422D generally does not require capillary tube changes. Capillary tubes selected for R22 applications should be adequate for a preliminary selection.
2. Conversion to R417A, R422A, or R422C may require that the capillary tube be replaced or shortened. Check system subcooling, superheat over the evaporator coil and superheat at the compressor before and after the change out.
3. Consult the Original Equipment Manufacturer for recommended capillary tube requirements.

C) Expansion Valves

1. R422A and R422C will have higher superheat. Replace the expansion valve orifice (where possible) or the entire valve.
2. R417A, R422B and R422D will have lower superheat. Adjust the valve approximately 20% as more capacity is needed from the expansion device.

D) Filter Drier

1. Recommended filter driers are comprised of a 70% (minimum by weight) molecular sieve absorbent and 30% (maximum by weight) activated alumina absorbent, regardless of whether drier construction is solid core or bead type. Filter driers should be selected at 1 to 2 PSI (0.07 to 0.14 BAR) pressure drop according to ARI 710-86 and DIN 8949. It is essential to use a sight glass with moisture indicator that is capable of indicating relative humidity (water) levels of 3% or less.
2. Solid core driers made with bauxite are not recommended. Solid core driers made with bauxite tend to absorb POE oil and moisture. Ester could hydrolyze and form acidic materials.
3. Once the drier meets absorption capacity it will release the acidic material back into the refrigeration system.

4. When retrofitting from HCFC to HFC the filter drier should be changed. Filter drier types XH-7 and XH-9 or molecular sieve non-bonded core types are recommended.

E) Return Gas and Discharge Temperatures

1. The maximum discharge temperature for any type (reciprocating, rotary and scroll) of Tecumseh hermetic compressor must NOT exceed 260°F (127°C).
2. Return gas and discharge temperatures are largely influenced by the metering device and refrigerant charge. Ambient temperatures and system operating conditions are also a factor.
3. Consult Tecumseh's Technical Service Team (+33 4 74 82 24 00) for assistance.

F) Refrigerant Charge

1. ASHRAE Series 400 refrigerants are zeotrope blends. Charging must be done in the liquid phase to obtain proper composition. In order to avoid feeding excessive liquid directly into the compressor, charge into the liquid line or place a restrictor into the charging equipment to limit the feed rate.
2. Due to the performance differences and varying amounts of temperature glide the charge amounts of alternate refrigerants will rarely match original charge specifications. Use good charging techniques and adjust for proper superheat and subcooling.
3. The Liquid Density of each refrigerant is different. Charge an equal volume if charging by cylinder or to OEM name plate if charging with a scale.
4. Approximately 3% less charge will be required for R422 blends compared to the original system charge. Charge to 90% of the original name plate amount. If additional refrigerant is needed after confirming system subcooling and superheat, add refrigerant in small increments being careful NOT to exceed 90% of the receiver pump down capacity or 115% of the name plate charge in systems without a receiver tank.
5. To avoid overcharging do NOT charge HFC blends to a clear sight glass.
6. Do NOT mix refrigerants

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G) Pressure Switches and EPR Valves

1. For satisfactory operation, Low and High Pressure switches and EPR Valve settings need to be checked and possibly reset due to the higher pressures of the HFC blends.
2. Caution should be taken to assure that over pressure protection is maintained on systems where over pressure as a result of condenser fan failure is limited by the compressor motor protector (no High pressure control).

SYSTEM RETROFIT *(Consult Tecumseh's Service Data Book)*

The following guidelines to replace R22 are intended for service when substituting R422A or R422C in Low Temperature applications and R417A, R422B or R422D in Commercial and High Temperature applications.

Service technicians should use generally accepted system retrofit procedures. Tecumseh's Service Data Book may be referenced for assistance. The Service Data Book can be found under the Technical Resource Center section of Tecumseh's North American Compressor Group website (<http://202.56.127.90/nacg/>)

After service has been completed, operate the system to determine compressor run time and cycle rate. Confirm system pressures and temperatures, allowing the compressor to operate within its approved parameters. Correct as needed.

Consult Tecumseh Policy Bulletins and Engineering Recommendations for approved operating parameters. The above mentioned documents can be found under the Technical Resource Center section of Tecumseh's North American Compressor Group website (<http://202.56.127.90/nacg/>)

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Warranty

No compressor warranty will be insured if the compressor is running with another fluid than the one it is supposed to support. The Tecumseh compressor, named with "E" letter, have warranty for R22 use only, not for alternate refrigerant.

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Annexes

Refrigerant properties

- A) Pressure/temperature of R417A and R422 blends (R422A, R422B, R422C, and R422D) are shown in Figure 1.
B) Depending on the application, R417A and R422 blends will have less capacity in comparison to R22.

Figure 1

	Température		Pressure (PSIG)					
	°F	°C	R22	R422A	R422B	R422C	R422D	R417A
	-40	-40	0,6	3,1	0,9	2,2	2,4	4,2
	-30	-34	4,9	8,3	5,4	7,1	7,1	1,5
	-20	-28	10,2	14,6	10,7	13,2	12,9	5,9
	-10	-23	16,5	22,1	17,1	20,4	19,8	11,2
	0	-18	24,0	30,9	24,7	29,0	27,9	17,6
	10	-12	32,8	41,4	33,6	39,1	37,5	25,1
	20	-9	43,1	53,5	43,9	50,8	48,5	33,9
	30	-1	56,8	67,5	55,9	64,4	61,3	44,2
	40	4,4	68,6	83,5	69,6	80,1	75,9	56,1
	50	10	84,1	107,3	85,3	97,9	92,6	69,8
	60	16	101,6	128,4	103,0	125,4	111,4	95
	70	21	121,4	152,1	123,0	148,7	132,6	114
	80	27	143,6	178,6	145,4	174,7	156,3	134,5
	90	32	168,4	208,1	170,4	203,7	182,8	157,3
	100	38	195,9	240,9	198,2	253,9	212,2	182,6
	110	43	226,4	277,1	229,0	271,5	244,7	210,6
	120	49	260,0	317,1	263,1	310,8	280,7	241,3
	130	54	296,9	361,2	300,6	354,1	320,2	275,0
	140	60	337,4	409,7	341,8	401,8	363,7	311,7
	150	66	381,7	463,2	387,1	454,2	411,4	-

DEW Pt.

Bubble Pt.

	Température		Pressure (kPa)					
	°F	°C	R22	R422A	R422B	R422C	R422D	R417A
	-40	-40	3,9	21,4	6,2	15,2	16,5	28,7
	-30	-34	33,9	57,2	37,2	48,9	48,9	10,6
	-20	-28	70,3	100,6	73,7	90,9	88,9	40,9
	-10	-23	113,9	152,3	117,8	140,6	136,4	77,3
	0	-18	165,6	212,9	170,2	199,8	192,2	120,9
	10	-12	226,3	285,2	231,5	269,4	258,4	172,6
	20	-9	296,9	368,6	302,5	350,0	334,2	233,3
	30	-1	391,1	465,1	385,2	443,7	422,4	304,3
	40	4	472,4	575,3	479,5	551,9	523,0	386,2
	50	10	579,2	739,3	587,7	674,5	638,0	480,7
	60	16	700,0	884,7	709,7	864,0	767,5	659,2
	70	21	836,4	1048,0	847,5	1024,5	913,6	785,2
	80	27	989,4	1230,6	1001,8	1203,7	1076,9	926,4
	90	32	1160,3	1433,8	1174,1	1403,5	1259,5	1083,8
	100	38	1349,8	1659,8	1365,6	1749,4	1462,1	1258,1
	110	43	1559,9	1909,2	1577,8	1870,6	1686,0	1450,8
	120	49	1791,4	2184,8	1812,8	2141,4	1934,0	1662,5
	130	54	2045,6	2488,7	2071,1	2439,7	2206,2	1894,5
	140	60	2324,7	2822,8	2355,0	2768,4	2505,9	2147,8
	150	66	2629,9	3191,4	2667,1	3129,4	2834,5	-

DEW Pt.

Bubble Pt.

R22 Phase Out
→ Novembre 2009



R22 phase out schedules by geographic region

	Year	EUROPE	USA	LATIN AMERICA & INDIA
	2000	R22 discontinued for use with new equipment.		
	2010	End sales of virgin R22 for service and maintenance. Only recovered and recycled R22 may be used.	As of January 1, 2010, production and import of R22 banned for use in new equipment. R22 production and importing continues for service of existing equipment.	
	2013			Freeze base level production of R22
	2015	R22 phased-out for service and maintenance use.		Ten percent (10%) reduction in production of R22 from base level.
	2020		As of January 1, 2020, production and import of R22 will be banned entirely. Only recycled, reclaimed and/or stockpiled R22 may be used for servicing existing equipment.	Thirty-five percent (35%) reduction in R22 production from base level.
	2025			Sixty-seven and one-half percent (67.5%) reduction from base level.
	2030			One hundred percent (100%) reduction in R22 production with two and one-half percent (2.5%) of base level available for service until 2040
	2040			R22 completely phased out.

Web references links

Web Site / Document
EU Protection of the Ozone Layer
U.S. Environmental Protection Agency
India Ministry of Environments & Forests
Tecumseh Technical Resource Center

Web Address
http://ec.europa.eu/environment/ozone/community_action.htm
<http://www.epa.gov/ozone/strathome.html>
<http://www.ozonecell.com/index.jsp>
<http://202.56.127.90/nacg/>

Content
European Phase-Out
U.S. Refrigerant Phase-Out
Brazil & India Refrig. Phase-Out
Refrigerant Matrix & Guidelines

Tecumseh Europe and its distribution network always at your service

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