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DATE: September 2011 Rev. 1

REFERENCE DOCUMENT NO. RD-0027-E

# GUIDELINES FOR UTILIZATION OF

**R410A**

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After many years of testing and investigation, R410A is recognized as a suitable alternative refrigerant for R22 in medium and high temperature applications such as residential and light commercial air conditioning.

R410A is a near azeotropic blend of hydro fluorocarbon or HFC compounds, comprising 50% of R32, 50% of R125. It has no chlorine content, no ozone depletion potential, and only a modest direct global warming potential. ODP = 0, GWP = 1725.

R410A is **NOT** a “drop-in” replacement for R22. In addition to the nearly 50% increase in pressures compared to R22, there are also differences between R410A and R22 that must be considered when handling, processing, and applying refrigerants. These guidelines are offered to assist in understanding the differences.

Any Tecumseh compressor with the letter “B” in the Model Number (Example: RGA5512BXA) is approved for use with R410A.

### I. REFRIGERANT PROPERTIES

A) Pressure/temperature table of R410A vs. R22 is shown in Figure 1.

Figure 1

Temperature		Pressure			
		PSIG		kPa	
°F	°C	R22	R410A	R22	R410A
-40	-40.0	0.6	10.8	4.1	74.4
-30	-34.0	4.9	17.8	33.8	122.7
-20	-28.0	10.2	26.3	70.3	181.3
-10	-23.0	16.5	36.4	113.6	250.9
0	-18.0	24.0	48.3	165.5	333.0
10	-12.2	32.8	62.2	226.2	428.8
20	-9.0	43.1	78.3	297.2	539.8
30	-1.0	55.0	96.8	379.2	667.4
40	4.4	68.6	118.1	473.0	814.2
50	10.0	84.1	142.2	579.9	980.4
60	15.6	101.6	169.6	700.5	1,169.3
70	21.1	121.4	200.4	837.1	1,381.7
80	26.7	143.6	234.9	990.1	1,619.5
90	32.2	168.4	273.5	1,161.1	1,885.7
100	37.8	195.9	316.4	1,350.7	2,181.5
110	43.3	226.4	364.1	1,561.0	2,510.3
120	48.9	260.0	416.9	1,792.7	2,874.4
130	54.4	296.9	475.4	2,047.1	3,277.7
140	60.0	337.4	540.1	2,326.4	3,723.8
150	65.6	381.7	611.9	2,631.8	4,218.9



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### **I. REFRIGERANT PROPERTIES (Cont'd)**

- B)** The solubility of water in R410A is comparable to that of water in R22. It is necessary to keep the system dry. See Section II, B.
- C)** Extensive investigation and testing has been conducted to determine that R410A is compatible with all materials used in Tecumseh compressors designed for use with R410A refrigerant.

### **II. SYNTHETIC LUBRICANTS: POLYOL ESTERS (POEs) and POLYVINYL ETHERS (PVEs)**

#### **A) Miscibility**

1. Miscibility is the ability of the lubricant and the refrigerant to mix. This miscibility is a very important factor in providing proper heat transfer and in returning lubricant to the compressor in a refrigeration system over its range of operating temperatures.
2. R410A and Mineral oils (MO) are not miscible
3. Polyol Ester (POE) as well as Polyvinyl Ether (PVE) oils and R410A are miscible.

#### **B) Moisture**

1. Polyol Ester and Polyvinyl ether oils are **100 times** more hygroscopic (ability to absorb moisture) than MO or SA oils. This moisture is difficult to remove even with heat and vacuum.
2. **Utmost care must be taken to prevent moisture from getting into the refrigeration system.** Do not leave the compressor or system open to the atmosphere for longer than 10 minutes maximum. The preferred method of assembly would be to remove system component plugs and caps just prior to brazing. The maximum system moisture content after completing system processing should be 80 PPM. After running the system with the appropriate filter-drier installed, the system moisture level should be 50 PPM or less. These levels are based on measuring moisture in liquid refrigerant samples taken from the system.
3. **Always** use an appropriate filter-drier in the system when using R410A. (See section on FILTER-DRIERS.)

#### **C) Compatibility**

Extensive investigation and testing have been conducted by Tecumseh Products Company to determine that the polyol ester and polyvinyl ether lubricants **approved by Tecumseh** are compatible with all materials used in Tecumseh hermetic compressors. Contact your Tecumseh sales representative for the latest list of approved oils. (Policy Bulletin No. 105)

### **III. SYSTEM DESIGN**

#### **A) Compressor Selection**

Tecumseh is continuing to test and approve R410A compressors with the compatibility of oil, refrigerant, and materials in mind. These compressors will have the letter "B" as the refrigerant designator, e.g. RGA5512BXA.

#### **B) Expansion Valve Selection**

Expansion valve manufacturers have designed product specifically for use with R410A. Consult them for their recommendations.

#### **C) Capillary Tubes**

R410A requires approximately 15% less capacity for the metering device compared to R22. This information can be used when selecting the appropriate capillary tube.

#### **D) Filter-Driers**

Tecumseh requires that an appropriate filter-drier be used on every R410A system. (See section on FILTER-DRIERS.)

### **FILTER-DRIERS**

- A)** Synthetic POE lubricants used with R410A are prone to hydrolyze with moisture resulting in the formation of acids. Tecumseh requires that an appropriate filter-drier be used in every R410A application.
- B)** Molecular sieve filter-driers which are compatible with R410A should be used..
- C)** For specific filter-drier selection, contact your filter-drier supplier.



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#### **IV. SYSTEM PROCESSING**

##### **A) Compatibility**

1. Polyol Ester and Polyvinyl ether oils are good solvents and have a tendency to wash system processing materials such as drawing compounds, rust inhibitors, and cleaning compounds from system surfaces. Care must be taken to remove such processing materials from all the system components.
2. Residual chlorinated materials **should** be considered system contamination and eliminated from all internal surfaces of the refrigeration system.

##### **B) Compressor Handling**

1. To prevent moisture from getting into the compressor, the plugs should be left in the tubes until the line connections are ready to be brazed.

##### **C) Evacuation**

1. **The evacuation levels for R410A systems should be** the same as R22 systems (minimum of 200 microns at the system and pulled from both the low and high pressure sides of the system). If care is not taken to prevent moisture from entering the system components prior to assembly, evacuation could be expected to take longer to achieve acceptable limits of system moisture and non-condensables. Tecumseh recommends a maximum of 2% non-condensable and 80 PPM moisture. The completed system should have a moisture level of 50 PPM or less after running with an appropriate filter-drier installed. These levels are based on measuring moisture in liquid refrigerant samples taken from the system.
2. Polyol Ester and Polyvinyl ether oils vaporize much less than mineral oils at the same level of heat and vacuum. Therefore, if oil vaporization was not a problem with the R22 system processing, it should not be a problem with the R410A system processing.

3. Consult your vacuum pump manufacturer to learn if your existing equipment may need to be converted for use on R410A polyol ester or polyvinyl ether systems.

##### **D) Leak Testing**

1. Use equipment which is designed for R410A detection or approved for R410A use by its manufacturer. Many leak detector manufacturers have R410A detectors on the market, and more are in development. Consult these manufacturers for their recommendations on their equipment.

##### **E) Refrigerant Charging**

1. Only use refrigerant charging equipment specifically designed for R410A. **Operating pressures of R410A can be twice as high as other refrigerants.**
2. R410A is an azeotrope and must be charged in the liquid state into the liquid line.
3. 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.
4. Break the system vacuum by charging R410A liquid refrigerant into the liquid line. **CAUTION: Never start the compressor while it is under a deep vacuum.**
5. Charge the system using industry acceptable charging methods.