



# EASY ON THE OZONE, HARD ON THE COMPETITION.

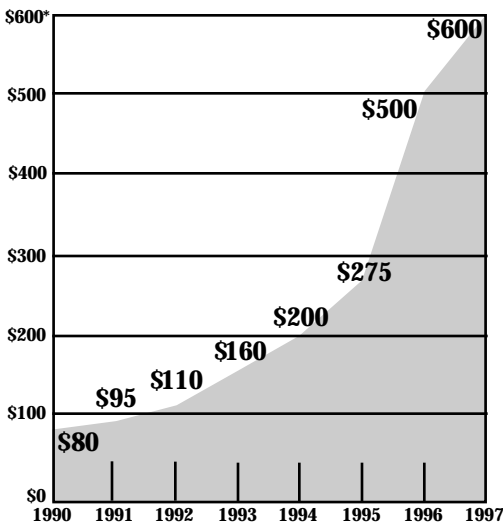
WEATHERMAKER® AIR CONDITIONERS AND HEAT PUMPS WITH PURON™ REFRIGERANT.



SPRING 1998

# Puron™ refrigerant clears the way for a better environment and solid results.

Ten years ago, the wheels were set in motion to begin phasing out ozone-depleting refrigerants, such as R-12 and R-22, creating the need for an environmentally sound refrigerant. Today, Carrier is the first manufacturer in the HVAC industry to offer Puron™—the Carrier brand name for an environmentally sound, R-410A refrigerant that offers high efficiency and long-term cost savings to homeowners. It is truly revolutionary in every sense of the word, and its creation is essential to the future of the heating and cooling industry.



*The price of R-12 rose dramatically as a result of its depletion.*

*\*Per 30-pound cylinder*

## Montreal Protocol.

In 1987, scientists and government officials convened in Montreal in response to the growing pressure to preserve the earth's ozone layer. **What emerged was the Montreal Protocol—an internationally-binding action plan to eliminate ozone-harming chemicals.**

*Chlorofluorocarbons* (CFCs)—such as R-12—were targeted first since they caused the most damage to the environment. A cap

was placed on the production of CFCs and in 1996, by law, all manufacturing was required to cease. The industry to suffer the greatest impact was the automotive industry, which accounted for 64 percent of CFC consumption. For consumers requiring R-12 refrigerant for their automobile air conditioning units, the price of R-12 has been costly. Their only cooling alternative has been an even more expensive system retrofit using R-134A.

## Tighter Restrictions.

**Today, the Montreal Protocol's current phaseout targets are hydrochlorofluorocarbons (HCFCs), including R-22, the primary refrigerant in residential HVAC products.** The 1990 Clean Air Act, in conjunction with the Montreal Protocol, established January 1, 2010 as the date when the U.S. will ban the manufacturing of products using HCFCs.

In addition, a production cap on HCFCs (on a country-by-country consumption formula) was established for January 1, 1996. This production cap is intended to reduce the amount of HCFCs that will be consumed in developed countries like the U.S., Canada, the European Union and Japan. The Europeans have since adopted an even more aggressive cap and have been urging the U.S. to do the same, but to date the U.S. government has resisted.

## Higher Consumption Demand.

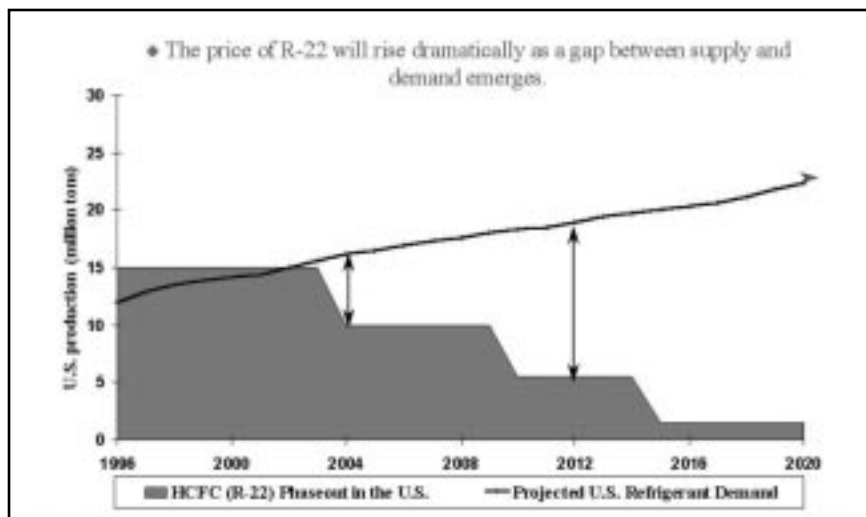
As the demand for residential refrigerants increases, the production of R-22 will decrease sharply in less than six years. Production is capped at 15 million tons per year from 1996 through 2003. However, actual consumption in 1996 was 12 million tons. Despite the cool summer, consumption increased in 1997 to 12.95 million tons, roughly 85 percent of the cap. Beginning in 2004, the HCFC cap will be reduced 33 percent to 10 million tons per year, far below the demand of 1997. As you can see, the phaseout of R-22 begins now.

**As consumption increases and production decreases, the price of R-22 is expected to rise, just as in the case of R-12.** The most significant increase is expected just prior to 2004, when the production cap is reduced

23 percent below the projected 1998 demand. As R-22 is phased out, consumers who purchased a product containing Puron will benefit due to a lower cost for future service. **On the other hand, those who purchased an R-22 product can expect to feel the high price associated with service as the supply of HCFCs is depleted.**

## A Global Solution.

Aware of the impending HCFC-phaseout, the major chemical suppliers found evidence in 1994 that R-410A (Puron) would become the accepted replacement for R-22. Allied Signal, Dupont, Elf Atochem and ICI have shifted investment capital away from R-22 and into Puron for residential applications and R-407C and R-134A for commercial applications. Allied Signal has since licensed the right to produce Puron to both Dupont and Elf Atochem.



There were several factors that contributed to the emergence of Puron for residential applications. First, **Puron is a hydrofluorocarbon (HFC), meaning it does not contain chlorine and will not harm the ozone.**

Furthermore, it is as safe as R-22, due to its low flammable nature and low toxicity. In fact, it is one of only a few replacements approved under the EPA's Significant New Alternative Policy (SNAP) guidelines.

The EPA's SNAP program has the responsibility for evaluating and approving or rejecting refrigerant candidates. This involves measuring the refrigerant's ozone-depletion potential,

Date	Restriction
January 1, 1996	An annual production cap of 15 million tons is imposed on HCFCs, including R-22.
January 1, 2004	The HCFC production cap is reduced to 10 million tons per year, 23 percent below 1998's total refrigerant demand.
January 1, 2010	Production of equipment using HCFCs is banned; production and consumption of HCFCs are frozen at baseline levels; ban on the production and consumption of HCFCs unless used as feedstock or refrigerant in equipment manufactured prior to January 1, 2010.
January 1, 2020	The total phaseout of HCFCs is complete.

*The table above indicates the significant phaseout dates associated with R-22.*

# Industry Refrigerant Overview

Refrigerant	Most Likely Application	Pro	Con
Puron™	<ul style="list-style-type: none"> <li>Residential and light commercial equipment under 15 tons</li> </ul>	<ul style="list-style-type: none"> <li>Offers improved efficiency over R-22</li> <li>Does not separate from its blended state</li> <li>Non-toxic/non-flammable</li> </ul>	<ul style="list-style-type: none"> <li>Higher operating pressures</li> <li>Requires some product redesign                             <ul style="list-style-type: none"> <li>Lubricant, burst strength and compressor displacement</li> </ul> </li> </ul>
R-134A	<ul style="list-style-type: none"> <li>Large commercial equipment above 75 tons</li> </ul>	<ul style="list-style-type: none"> <li>Near drop in for R-12</li> <li>Does not fractionate (separate)</li> </ul>	<ul style="list-style-type: none"> <li>Equipment redesign required                             <ul style="list-style-type: none"> <li>Compressor, lubricants and coil circuiting</li> </ul> </li> <li>40% lower capacity than R-22</li> <li>Significantly reduced efficiency (for larger units)</li> <li>Significantly higher system cost in residential products</li> </ul>
R-407C	<ul style="list-style-type: none"> <li>Commercial equipment 15 tons through 75 tons</li> </ul>	<ul style="list-style-type: none"> <li>Near drop in R-22</li> <li>Limited redesign required (lubricant)</li> </ul>	<ul style="list-style-type: none"> <li>Reduced efficiency of approximately 5 - 7%</li> <li>Fractionates                             <ul style="list-style-type: none"> <li>Leaks can allow only one component to escape</li> <li>More difficult to service (loss of efficiency if charge is imbalanced)</li> </ul> </li> </ul>
Propane	<ul style="list-style-type: none"> <li>None at unitary charge levels</li> <li>Small refrigerators</li> </ul>	<ul style="list-style-type: none"> <li>Near drop in for R-22</li> <li>Little redesign required</li> </ul>	<ul style="list-style-type: none"> <li>Service and transportation risks</li> <li>Extremely flammable</li> </ul>

toxicity and flammable nature, as well as any other application limits. Upon evaluation and approval, Puron earned a best possible A1/A1 rating by the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) for both flammability and toxicity. However, the EPA approval does not evaluate a refrigerant's performance within a refrigeration system. And it is Puron's outstanding performance that leads to its emergence as the replacement for R-22.

R-22 is a single compound, recognized for its ideal heating and cooling capabilities. No single compound replacement candidates could match its performance and meet the EPA's criteria. This is the primary reason other refrigerant blends, such as R-407C, have been rejected as replacements for R-22 in residential systems.

Although Puron is not a single compound (it is a 50:50 mixture of R-32 and R-125), it acts azeotropic – meaning it behaves like a single component refrigerant. It has a glide of less than 0.3° F and simplifies charging while negating any performance effects due to a leak in the system, unlike other compound blends. A system leak involving a non-azeotropic mixture would result in one component of the refrigerant leaking more than the other, potentially leading to a system performance problem.



*The operating pressures of Puron™ are 50 to 70 percent higher than those of R-22.*

There are additional differences between Puron and R-22, such as higher operating pressures. Puron's operating pressures are 50 percent to 70 percent higher than those of R-22 (typical operating pressures at 95° F are suction: 140 PSI; and discharge: 400 PSI.) Specific equipment, including a recovery machine and manifold gauge set are available for use with Puron products. Nevertheless, the basic procedures for charging a system are the same. Puron systems are lubricated using a synthetic polyolester (POE) oil, instead of mineral oils and alkylbenzenes used with R-22.



*The FV4A and FX4A fan coils with Puron™ provide customers with high-efficiency and performance.*

Since POE oils have an affinity for moisture, it is required that a liquid line filter drier always be installed and is included with each Puron system.

**In most instances, replacing an outdoor R-22 unit with a unit containing Puron does not require a line set change nor a coil change. However, upgrading the indoor coil is strongly recommended for top performance. Any metering device or TXV on the indoor coil must be replaced with one specifically designed for Puron.**

Carrier also is introducing a line of indoor fan coils with Puron that provide maximum performance.

### *Installation considerations for WeatherMaker® products with Puron™*

- Drain any residual mineral oil or alkybenzene in the system. Pay particular attention to low areas where oil may collect. Puron systems can tolerate small amounts of mineral oil.
- Replace the metering device with one designed for Puron and install a liquid-line filter drier. A filter drier is shipped with all Carrier products containing Puron.
- If the system is left open, then assume there is moisture in the system, recover refrigerant, install a filter drier, and pull a vacuum down to 500 microns, then recharge the unit.

## Strategic Partnership.

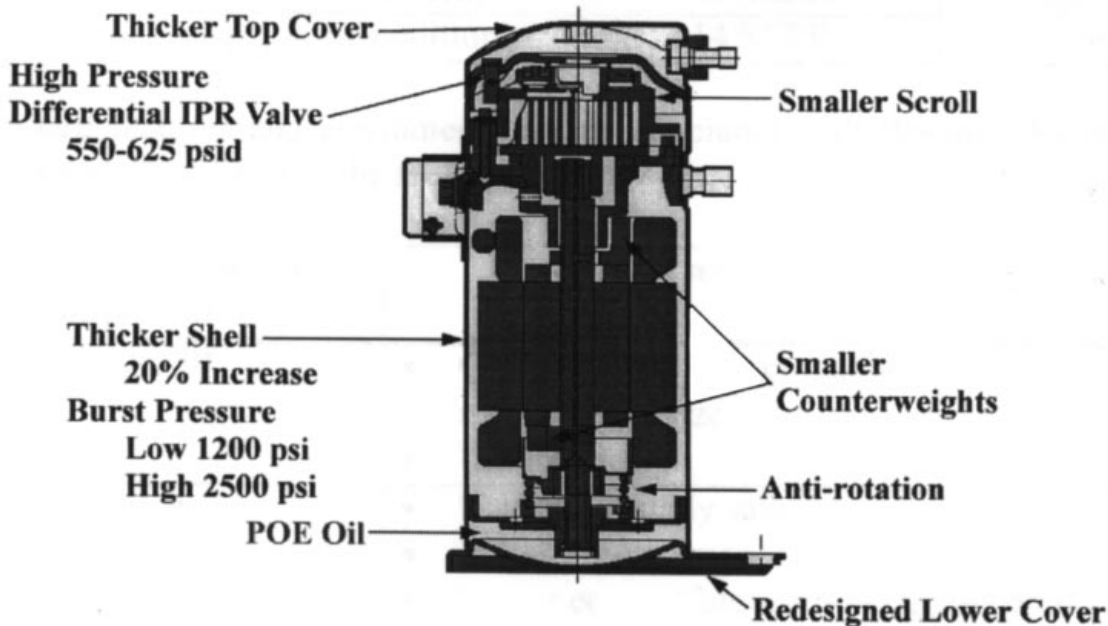
**Puron is not a drop-in replacement for R-22. Carrier invested a considerable amount of time, along with millions of dollars in research and development, to bring products utilizing Puron to the market.**

Carrier began its use of Puron by partnering with Allied Signal and United Technologies Research Center to develop a viable design within the framework of its WeatherMaker® platform. Meanwhile, Copeland joined this effort to bring forward the "ZP series," an optimized scroll compressor which uses Puron refrigerant. All of Carrier's WeatherMaker products with Puron use this compressor.

## Outstanding Performance.

The basic design for the "ZP" series is similar to its "ZR" counterpart used with R-22 systems, although some differences do exist. For example, the top cover and shell are thicker, and the compressor has a heavier motor. **The goal was to introduce a system as dependable and technologically advanced as other Carrier products.** Copeland added an anti-rotation device to offer quiet operation and prevent the compressor from spinning backwards. This, in tandem with the thicker shell, makes this compressor one of Copeland's quietest.

## Copeland "ZP" Compressor



## Carrier's deluxe product line featuring Puron™



**WeatherMaker®  
38TSA  
14 SEER  
Deluxe Air Conditioner**



**WeatherMaker®  
38TXA  
13 SEER  
Deluxe Air Conditioner**



**WeatherMaker®  
38YXA  
13 SEER  
Deluxe Heat Pump**



**WeatherMaker®  
38TZA  
12 SEER  
Deluxe Air Conditioner**



**FV4A  
Fan Coil**



**FX4A  
Fan Coil**

## A Cost-Saving, Environmentally Sound Product Line.

Carrier leads the HVAC industry by introducing its deluxe products featuring Puron for the competitive advantages they afford channel partners—loyal Carrier dealers and distributors. Sales results and Carrier's market research validate the dual role of products that are environmentally sound and offer high efficiency; a unique combination that competitors cannot yet match. Dealers are also seeing their close rates increase by educating consumers on the anticipated costs associated with future services. Consumers requiring future service of products containing Puron will avoid higher costs down the road as the supply of R-22 is depleted. Carrier achieved its goals of developing these new products within the framework of the proven success of its deluxe WeatherMaker platform.

This line of WeatherMaker products provides dealers and distributors with an extreme competitive edge in their marketplace. Since Carrier is the only HVAC manufacturer that offers this unique refrigerant, distribution channel members can begin educating consumers, utilities and builders about the phaseout of R-22 and the performance and cost-saving levels of Carrier's new products with Puron. In the long run, they will be saving for the future in more ways than one.

**For more information about Puron and Carrier products with Puron, visit our website at [www.carrier.com](http://www.carrier.com) or contact your local Carrier distributor or call 1-800-CARRIER.**

## Carrier WeatherMaker® Deluxe Air Conditioners, Heat Pump and Fan Coils.



**WeatherMaker®  
Deluxe Air Conditioner**



**WeatherMaker®  
Deluxe Heat Pump**

Standard Puron™ WeatherMaker® Components	Consumer Benefit	Puron™ Exclusive
Silencer System™	<ul style="list-style-type: none"> <li>• Quieter than all competitors' models regardless of size</li> <li>• Durable design</li> </ul>	
Puron™ refrigerant	<ul style="list-style-type: none"> <li>• Environmentally sound</li> <li>• Reliable performance</li> <li>• Lower cost of future service (compared to R-22)</li> <li>• Improved efficiency</li> </ul>	✓
Scroll compressor	<ul style="list-style-type: none"> <li>• Durable design</li> <li>• Quiet operation</li> <li>• Reliable performance</li> </ul>	
High and low pressure switches	<ul style="list-style-type: none"> <li>• Reliable performance</li> <li>• Compressor protection</li> </ul>	✓
54% thicker tubing	<ul style="list-style-type: none"> <li>• Durable design</li> </ul>	✓
Filter drier	<ul style="list-style-type: none"> <li>• Reliable performance with four times the contaminant protection</li> </ul>	✓
Additional Standard 38YXA Components	Consumer Benefit	Puron™ Exclusive
PressureGuard™	<ul style="list-style-type: none"> <li>• Consumer peace of mind</li> <li>• Cost savings (no line set change required)</li> </ul>	✓
Discharge muffler	<ul style="list-style-type: none"> <li>• Quiet operation</li> </ul>	
Special accumulator	<ul style="list-style-type: none"> <li>• Durable design</li> <li>• Quiet operation</li> </ul>	✓
Heavy duty reversing valve	<ul style="list-style-type: none"> <li>• Durable design</li> </ul>	✓
New fan coils with Puron refrigerant	<ul style="list-style-type: none"> <li>• Cost savings (no metering device change out)</li> </ul>	
Additional Standard 38TSA Components	Consumer Benefit	Puron™ Exclusive
TXV	<ul style="list-style-type: none"> <li>• Ensures peak performance</li> </ul>	✓





**CUSTOM MADE INDOOR WEATHER<sup>SM</sup>**

*Visit our web site at [www.carrier.com](http://www.carrier.com).*