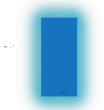
Make A Seamless Transition From R-22 To R-410A

Helpful facts gathered from more than 30 resources about R-410A and compiled to help you make a streamlined and seamless transition to alternative refrigerants.



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Introduction

We've taken it upon ourselves to gather information from web sites and books to give you the most pertinent facts you need to know to help you make a streamlined and seamless transition into alternative refrigerants. For instance, we've created, for your convenience, a quick reference to facilitate your learning of terms that are used in the industry. It is recommended that the reader first review these technical terms, listed in alphabetical order, to familiarize himself or herself with some of the industry concepts used when discussing refrigeration. This should make the reading of the article a much smoother and more understandable process.

The content of this report will focus on answering practical questions related to R-410A, while offering in-depth discussion of the EPA phase-out schedule, and why R-410A is targeted to replace R-22. We will also provide you with practical strategies and recommendations that will enable your plant to make a streamlined and seamless transition in compliance with the EPA phase-out schedule.

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Quick Reference To The Terms You Need To Know

Add-in — A refrigerant which may be added to equipment without removing the existing refrigerant. No modifications are required. (www.hysave.co.uk/downleads/indust.pdf).

AFEAS — Alternative Flourocarbon Environmental Acceptability Study. This is a study to determine the environmental impact of alternative refrigerants (www.hysave.co.uk/downleads/indust.pdf).

AREP — Alternative Refrigerant Evaluation Program. A study conducted to determine the performance of alternative refrigerants. (www.hysave.co.uk/downleads/indust.pdf).

ASHRAE — American Society Of Heating, Refrigerating, And Air Conditioning Engineers. This group is responsible for assigning number identification to a refrigerant, i.e., R-22; R-410A (Doolin's Trouble Shooters Bible, p. 291).

ASTM — American Society For Testing and Materials. This organization strives to be the foremost developer and provider of voluntary consensus standards, contributing to the reliability of materials, products, systems and services; and facilitate national, regional, and international commerce (www.astm.org/cgi-bin/SoftCart.exe/ NEWS/Mission2.htm1?L+mystore+egdy6474+1074787960).

Azeotrope — Blends which have a constant boiling point (no glide).

Azeotropic — In terms of Refrigerant chemical mixtures, this comprises a mixture of liquids in which the composition of the vapor is approximately the **same** as the liquid compound, and therefore it can be distilled without any change in composition. (www.hyperdictionary.com).

Blends — Refrigerants comprised of two or more components. (www.Suva.dupont.ca/H45938-3.pdf)

BTU — British Thermal Units.

BTUH — The number of BTUs in an hour.

CFC	Chloroflourocarbon. A refrigerant containing chlorine. Refrigerants in this category attack and harm the ozone. Examples: R-11; R-12; R-500; R-502 (Doolin's Trouble Shooters Bible, pp. 288-289).
Compressor	The part of the outdoor air conditioner or heat pump that compresses and pumps refrigerant in accordance with commercial or residential requirements.
Condensation	The transition state of a vapor to a more solid liquid state. This is usually initiated by a drop in temperature. (Meriam-Webster/Online).
Condenser Coil	The outdoor portion of an air conditioner or heat pump which releases or collects heat, depending on the time of year.
CVH	Gases which fall into this category of Control Volume Hydrodynamics (CVH) are, due to their properties and effects upon HVAC systems, considered "ideal" gases.
Desiccant	A drying agent (desiccant dryer).
Distill	To let precipitate in drops, as in a wet mist; to fall or materialize in drops or in fine moisture; to appear slowly or in small quantities as individual droplets collect.
DOE	The Department of Energy is a federal agency responsible for setting the standards for industries as far as the consumption of energy is concerned.
Entrainer	A liquid separating agent.
EPA	The Environmental Protection Agency develops and enforces federal environmental regulations which allow or disallow the use of a product according to its impact on the environment.
Fractionation (of R-410A)	To separate (a mixture) into different portions; to divide or break up, as with zeotropic gasses.
Glide	Usually spoken in terms of "temperature glide", which is defined as: The difference between the saturated vapor temperature and the saturated liquid temperature (at constant pressure). For example, a refrigerant enters the condenser as a saturated vapor at 117°F and exits the condenser as a saturated liquid at 109°F, which gives us a "temperature glide" of 8°F. (www.Suva.dupont.ca/ca/H45938-3.pdf).
GWP	Global Warming Potential. This indicates the ability of a gas to Store energy as well as the residency period of the gas in the atmosphere.

HCFC	Hydrochloroflourocarbons. These chemicals, found in refrigerants classified under this category, attack the ozone as well, but not as seriously as CFC's. Examples: R-408A; R-22; R-409A; R-123. (Doolin's Trouble Shooters Bible, pp. 288-289).
HFC	Hydroflourocarbons. Refrigerants in this category are not harmful to the ozone. Examples: R-134A; R-410A; R-404A. (Doolin's Trouble Shooters Bible, pp. 288-289).
Homogeneous Azeotropic Distillation	The separation of any single liquid-phase mixture containing one or more azeotropes into the desired pure component or azeotropic products which is brought about through continuous distillation (www.distillation.net/zeo.asp).
HVAC	Heating, Ventilating and Air Conditioning.
Hydrolysis	Refers to unfavorable chemical reactions within the system which may cause harm. Examples of hydrolytic compounds are polyvalent alcohols and carboxylic acids. Also, this term may be defined as a chemical process of decomposition involving the splitting of a bond and the addition of the hydrogen cation (positively charged ion) and the hydroxide anion (negatively charged ion) of water.
Hydroscopic	An element (oil) which absorbs moisture from the air. POE oils used with R-410A units are hydroscopic.
Inert Gas	A gas considered to be inactive, or lacking a usual or anticipated chemical or biological action.
ISO	International Standards Organization. A group of international standards for quality management and assurance.
LMTD	Log Mean Temperature Difference.
Miscible	Capable of being mixed; More specifically, two refrigerants or chemicals which can be combined or mixed without a separation into two phases occurring. Hence the term "miscible liquids".
MSDS	Material Safety Data Sheet.
NCG	Noncondensible Gas Package; noncondensible gasses (NCG's).
ODP	Ozone Depletion Potential. There is no unit or measurement for ODP, only some comparative classifications. R-410A has an ODP of zero, and therefore no ozone depletion potential.

OEM	Original Equipment Manufacturer. The OEM is the entity holding the design rights to a product. (www.fleetway.ca/engineering/acronyms.htm).
POE	Refers to synthetic polyolesters (oils), chosen for use with HFC's (such as R-410A) because of their stability, lubricity, and miscibility.
R-410A	A chlorine-free refrigerant that meets the EPA's most stringent guidelines for environmental safety, particularly in reference to the ozone.
Reclaim	To restore refrigerant to "like new" quality in order to reuse it.
Recover	To extract refrigerant from one container (equipment, Tank, etc) and place into another for storage (applies to recycling equipment). Within the industry, the terms reclaim and recover are sometimes used interchangeably.
Recycle	To "clean" a refrigerant of oil, debris (particulates), and moisture in order to reuse in equipment (applies to recycling equipment).
Refrigerant Lines	Two copper lines that connect the outdoor air conditioner or heat pump with the indoor evaporator coil.
Refrigerant	A chemical that produces a cooling effect while it expands and vaporizes. Most residential units contain the refrigerant R-22, but this is being phased out in favor of R-410A, in accordance with the EPA.
Saturated Liquid Temperature	The temperature at which a liquid refrigerant initially begins to boil (www.Suva.dupont.ca/H45938-3.pdf)
Saturated Vapor Temperature	This is also known as the dew point temperature, and is defined as: the temperature at which the last drop of liquid refrigerant has Boiled (www.Suva.dupont.ca/H45938-3.pdf).
SEER	The Seasonal Energy Efficiency Ratio is an energy rating which indicates the efficiency of air conditioners. The higher the SEER, the higher the energy performance, and better savings for the consumer.
Single Package	A single outdoor unit which is capable of both cooling and heating.
Split System	A combination heat pump and air conditioner, containing indoor components such as a furnace or blower coil.
Ton	A unit of measurement used to indicate cooling capacity. One ton equals 12,000 BTUH.

Zeotropic

Zeotropic refrigerants are blends of two or more components whose equilibrium vapor-phase and liquid phase compositions are **different** at given pressures. R-410A is considered a zeotropic refrigerant.

Compiled Resources
To Jumpstart Your Grasp On R-410A

Save Yourself the hassle of pouring through a multitude of books and website articles. Here are the highlighted points you need to learn, gleaned from some forty sources.

What Is R-410A?

R-410A is a refrigerant which falls within the group of refrigerants known as hydroflourocarbons (HFC). Refrigerants within this classification are low in chlorine-flourine and carbon atoms.[1] The significance of its impact on the environment will be discussed later on.

Zeotropic or Azeotropic?

Strictly speaking, R-410A is classified as a zeotropic mixture, being comprised of two different refrigerants, HFC-32 (60%) and HFC-125 (40%)[2], with two different boiling points. The temperature at which a liquid refrigerant initially starts to boil is known as the saturated liquid temperature (also called the bubble point temperature).[3] When these two different refrigerants condense or begin their liquid phase (dew point) from the previous vapor phase, this saturated liquid temperature is the temperature at which all of the refrigerant has been condensed to the liquid form.[4]

This occurs at a constant pressure, as each refrigerant arrives at its respective boiling point. Getting back to the aspect of temperature, the difference between the saturated vapor temperature and the saturated liquid temperature is referred to as the "temperature glide" of the refrigerant.[5] The two refrigerants which comprise R-410A, HFC-32 (60%) and HFC-125 (40%), have only a 0.1K "glide" boiling point differential between them.

This slight difference in boiling point or glide is significant in terms of the overall stability of R-410A under normal operating conditions, which is one of the main reasons HVAC manufactures find it so appealing. Due to this negligible difference of "glide", R-410A exhibits characteristics of a near Azeotropic blend. By definition, a near Azeotropic blend is one that cannot be divided (fractionated) into its individual components through

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[1] James Doolin, Doolin's Trouble Shooter's Bible, 3rd ed., (Dallas: Taylor Publishing Co., and ©DOOLCO, inc., 1996), p. 288.
[2] Michael Lechte, Editor, "How To Deal With R-410A", (Ratingen: Mitsubishi Electric Europe B.V. Air Conditioning Division, Gothaer Str. 8, Article number 148033, November, 2002), p. 5.

[3] DuPont® Suva® Refrigerants, "Temperature Glide In Suva® MP, Suva® HP, and Suva® 9000 Series Refrigerant Blends", (www.suva.dupont.ca/H45938-3.pdf), p. 1.
[4] Ibid.
[5] Ibid.

distillation, and thus possesses a single boiling point at a particular pressure and temperature.[6]

However, just because R-410A acts like a near Azeotropic mixture does not mean it should be handled as one. The composition of its liquid phase and vapor phase are only slightly different, but this difference is significant enough to warrant a handling of transfers only when the refrigerant is in its liquid phase.[7]

Higher Operating Pressure Requirements For Equipment

R-410A has a significantly higher operating pressure: about 1.6 to 1.8 times the pressure of R-22.[8] The higher operating pressures of R-410A necessitate a minimum rating of 400psi for all equipment used to store, deliver, test, pump, and utilize this refrigerant. Because of this, it is important to note that most R-22 equipment should not be used with R-410A due to a lower equipment pressure rating for R-22 equipment. However, it is safe to use R-410A equipment with R-22.[9]

Generally speaking, R-410A operating pressures are 50% higher than R-22 pressures. This means the copper or steel piping used with R-410A must also be rated for a minimum of 400psi operating pressure with additional attention given to:

- Gages: They need to be rated for a higher working pressure.
- Pressure Relief Valves: Must be rated higher or else inadvertent discharges might occur.[10]

It might seem logical to assume that because R-410A's operating pressures are higher, the system in general would run at higher temperatures. The opposite, however, is true: R-410A systems actually run at cooler temperatures than R-22 systems.[11]

As we can see, pressure rating for equipment used with R-410A is a primary issue. Because of this, operating plants must maintain separate equipment for R-22 and R-410A. They cannot mix with each other.[12]

Due to the high density and efficiency of R-410A, it is possible to reduce the size of the A/C's device components (condenser/ compressor, evaporator, etc.). This is necessary to accommodate the higher operating pressures of R-410A.[13]

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[6] Doolin, Doolin's Trouble Shooters Bible, p. 291.
[7] D.B. Bivens, J.R. Morley, W. Wells, DuPont Fluoroproducts, "R-410A-Application Experience", (www.eurocooling.com/articler410a.htm), p. 2.
[8] "Recovery facts: The New High Pressure Gas R410A", (www.bacharach-inc.com/r410_recovery_facts.htm), p. 1.
[9] Craig Thomas, Domenic Loconte, Matt Ricketts, Gus Rolotti, (Norman: York® International Corporation: ATOFINA; A Power Point presentation given on R-410A), p. 11.
[10] Ibid., p. 12.
[11] Emerson™ Climate Technologies, "R-410A Differences", (www.copeland-corp.com/cp_ac/KS9.htm), p. 1.
[12] Ibid., p. 27.
[13] Michael Lechte, Editor, "How To Deal With R-410A", (Ratingen: Mitsubishi Electric Europe B.V. Air Conditioning Division, Gothaer Str. 8, Article number 148033, November, 2002), p. 3.

Why R-410A
Is Becoming The Industry Standard

The air conditioning and refrigeration industry has been mandated by the Environmental Protection Agency (EPA) to phase out refrigerants with Ozone Depletion Potential (ODP) and Global Warming Potential (GWP).[14] EPA laws concerning recovery procedures of newer refrigerants and lubricants is very stringent, and phase-out schedules for refrigerants such as R-22 are imminent.

Through much testing, it has been discovered that the CFC refrigerants (chlorine-flourine and carbon atoms) are the primary detrimental agents responsible for the depletion of our ozone.[15] Even with these findings, many manufacturers in the HVAC industry do not like the changes and laws imposed by the EPA, but nevertheless, they must comply.[16] Education is critical, for there are many issues at stake involving the newer refrigerants. At this point it would be helpful to look at the main categories of refrigerants and discuss how each pertains to this discussion of the ozone.

Categories Of Refrigerants[17]

The refrigerants listed in these three categories are by no means exhaustive, but are exemplary of those frequently used in the industry:

A. Chloroflourocarbons (CFC)
This category attacks the ozone layer and will soon be prohibited

Refrigerant – 11
Refrigerant – 12
Refrigerant – 500
Refrigerant – 502

B. Hydrochloroflourocarbons (HCFC)
This category attacks the ozone layer as well but not as dramatically as the CFC's.

Refrigerant – 408A
Refrigerant – 22
Refrigerant – 409A
Refrigerant – 123

C. Hydroflourocarbons (HFC)
This category is safe for the ozone.

[14] Ibid., p. 4.
[15] Doolin, Doolin's Trouble Shooter's Bible, p. 288.
[16] Ibid.
[17] Ibid., pp. 288-289.

Refrigerant – 134A
Refrigerant – 32
Refrigerant – 135
Refrigerant – 410A (as stated above, this is a mixture of R-32 and R-125)

R-22 or HCFC-22 has been used as the commercial and residential refrigerant standard for over five decades.[18] The low ozone depletion potential of R-22 compared with CFC-11 (chlorofluorocarbon 11) or CFC-12, along with R-22's excellent refrigerant properties, have aided the transition away from CFC's. However, R-22 will be phased out in the first quarter of the present century.[19] In preparation for the phase-out, companies such as DuPont™ are offering R-410A alternatives, as environmentally acceptable alternatives to R-22.

Performance Factors

R-410A has a zero depletion potential and is targeted by manufacturers as the refrigerant of choice for new air conditioning applications, which have been traditionally serviced by HCFC-22.[20] Along with ozone-saving capability, the newer refrigerants and their corresponding lubricant oils must generally outperform those being replaced (R-22) in order to be considered acceptable in the industry.[21] Aside from environmental issues, R-410A is consistently being chosen to replace R-22 because of its clear-cut advantages.

R-410A Advantages[22]

- *System Performance*:
  From a system standpoint, manufacturers are finding that R-410A easily outperforms all other HFC refrigerant alternatives. Optimized system tests have proven R-410A delivers higher system efficiency than R-22. Its higher heat transfer coefficient and lower pressure drop allow for these performance advantages. This means the amount of coil surface areas engineered for a given system to effect cooling throughout the system may be reduced while maintaining the same efficiency. It has been found that R-410A also delivers better home dehumidification.

[18] "DuPont™ Suva® 407C (R-407C) and DuPont™ Suva® 410A (R-410A) Properties, Uses, Storage, and Handling", (www.dupont.com/suva/na/usa/literature/pdf/h65905.pdf), p. 1.
[19] Ibid.
[20] Ibid., p. 2.
[21] Ibid., p. 8
[22] Emerson™ Climate Technologies, "R-410A Advantages", (www.copeland-corp.com/cp_ac/KS9.htm), p. 1.

- *Compressor Sound*:

  Consistent field experience indicates that R-410A is more reliable, more efficient, and offers greater compressor sound reduction than those units using R-22. Its increasing use in residential markets should eventually drive down the cost of R-410A and provide stocking and service advantages within the commercial refrigeration industry as well.

Mineral Oil vs. POE

Typically, R-22 uses mineral oil in its operating systems, and R-410A uses POE oils. The main reason a particular lubricant is used with a given refrigerant is to ensure proper miscibility between the refrigerant and the oil in order to enable the oil to return to the compressor.[23] Generally the oil lubricants used are tailored to the compressor specifications, and differ in additives, viscosity, polarity, structure, and chemistry.[24]

Some critical specifications to keep in mind when discussing POE oils are:

- *Moisture:*

  The polyester oils used in R-410A refrigeration units are hydroscopic, i.e., they absorb moisture from the air. This moisture, if not removed, causes decomposition within the refrigeration materials. This in turn creates unwanted acids and alchohol, thus affecting material compatibility. Also, moisture has been known to create copper plating on metals.
- *Acidity:*

  May cause corrosion, reduce thermal stability, and promote higher hydrolytic decomposition.

- *Purity:*

  Purity or lack of purity in the lubricant has a great effect on the general stability of the product.[25]

Overall, the performance advantages of POE over Mineral Oil are as follows:

- HFC miscibility is good for POE; very poor for Mineral Oil (M.O.).
- The thermal stability of POE is better than M.O.
- The lubricity of POE is better than M.O.
- POE miscibility with M.O. is good (in general, M.O. miscibility with other oils or refrigerants is very poor).
- Materials compatibility with POE is good.

[23] Thomas et al., A Power Point Presentation Given On R-410A, p. 68.
[24] Ibid., p. 69.
[25] Ibid., p. 70

- Overall, POE lubricants are excellent solvents, and as a result, contaminants that R-22 and mineral oil left on refrigerant-bearing parts are eliminated by using HFC refrigerants such as R-410A. Some of these common contaminants are residual detergents from cleaning, drawing compounds, rust preventatives, plasticizers and lubricant additives.[26]

If POE and M.O. are inadvertently mixed together, there is no reported chemical reaction as a result.[27] If there is any real issue with POE, it lies in its ability to retain moisture. Retention of moisture, or hydroscopicity, is considered the main point of concern with POE, although this varies with specific POE oils used. Mineral oils do not exhibit this tendency.

Due to their high level of hygroscopicity, POE oils require careful handling so moisture does not contaminate the system.[28] The following POE handling recommendations would rectify this lubricant liability:

POE Handling

- In order to avoid moisture absorption from the air, POE must be **kept sealed**.
- Compressors and systems in general must not be left open to moisture exposure for **over fifteen minutes**.
- A system must be vacuumed to at least **500 microns.**
- Non-chemically "bonded" moisture may be removed utilizing dryers, vacuum, etc..
- Using a high capacity filter is recommended.[29]

[26] Parker Hannifin Corporation, "Refrigerant R-410A and Filter Dryers", (www.parker.com/rac/cat/english/R410A.pdf), p. 3.
[27] Thomas et al., A Power Point Presentation Given On R-410A, p. 74.
[28] Ibid., p. 71
[29] Ibid., p. 72

Complying With The EPA Phase-Out Schedule

Since their development in 1931, CFC's were thought to be ideal. They were low in toxicity, making them safe for both residential and industrial use. They were also very inexpensive, which resulted in their proliferation in the industry.[30] In 1974, CFC's were tentatively found to be destructive to the ozone. A little more than a decade following this, more research gave hard evidence to this reality, and in 1985 an official statement on the harming of the ozone by CFC's was released by the World Meteorological Organization and the United Nations Environmental Program (WMO/UNEP).[31]

The Montreol Protocol (1987), which was agreed to by almost one hundred and fifty countries, froze CFC consumption in 1989 and pledged to reduce it by one-half by 1998. In 1992, the Copenhagen Amendments went a step further by halting the production of CFC's in developed countries by 1996.[32]

With CFC's scheduled to be phased out, hydrochlorofluorocarbons (especially R-22) became increasingly popular. However, since these also were found detrimental to the ozone, although not as much as with CFC's, their production levels were controlled by 1992. The excitement over HCFC's declined sharply as the Vienna Convention of 1995 not only accelerated the HCFC-reduction timetable, but also required that all production cease by 2020.[33] Japan and a group of European countries have established cut-off dates that begin much earlier. In Switzerland, for example, HCFC's will be banned by 2005.[34]

With the search on for replacement refrigerants, the direction of competing markets has moved steadily towards R-410A as the primary replacement for R-22. As we have seen, this movement is a response to the mandates of the EPA and to a scientific inquiry which has lead leading proponents in the industry to choose R-410A for its overall performance factors. Given this, we need to look at the following proposed phase-out itinerary.

EPA Phase-Out

Placing the above dates in a proper practical framework, we can add to them the EPA regulations, which state that R-22 is scheduled to be phased out in 2010 for new equipment and then for all other emissive equipment applications in 2020.[35] In the U.S., production of new equipment using R-22 will have to come to a halt after 2010.[36] It is interesting to note that if R-22 is used as a raw material in manufacturing, where

[30] "The Need For Replacement Refrigerants", (www.me.gatech.edu/energy/laura/node4.html), p. 1.
[31] Ibid.
[32] Ibid.
[33] Ibid., p. 2.
[34] Ibid.
[35] Gus Rolotti, "An Update On R-22 Alternatives", (www.archrnews.com/CDA/ArticleInformation/features/BNP_Features_Item/0,1338,82961,00…), p. 1.
[36] Ibid.

refrigerant is transformed into another substance, or destroyed, it may be produced indefinitely.[37]

The Effects of These Dates

The ten-year window between 2010-2020 allows the manufacturing of R-22 for service purposes, but this service would always be on "older" equipment since newer equipment must be rated for higher pressures.[38] The decision HVAC industries have to make is how long they want to keep servicing the older equipment, rather than making the initial investment for newer R-410A equipment.

Manufactures need to look at the reality of continuing to sell new R-22 equipment after the 2010 ban on the production of that equipment. Although they will be allowed to sell it, what promise is there of the equipment retaining its value and usefulness when faced with all the prohibitions against R-22, and the pressure and expectation to convert to the more environmentally friendly and efficient R-410A?

R-22 can be used for service after 2020 as long as supplies last, but it is inevitable that supplies will sooner or later run out. In light of this fact, manufactures of alternate R-22 refrigeration equipment (i.e., R-410A equipment), will continue to advertise and promote this equipment to their customers. Education is of primary importance, as customers must be made "environmentally aware" as well as aware of "supply and availability" of R-22. As the old refrigerant line is phased out, availability will diminish and prices will escalate.[39]

In looking for solutions, companies must recognize the pros and cons of keeping non-converted systems operating efficiently, while having a plan which addresses phase-out schedule dates. By educating yourself in alternate refrigeration management, you can assess future developments and be prepared for critical deadlines. To ignore such deadlines is to risk a loss of business and added expenses.[40]

[37] Ibid.
[38] Gus Rolotti, "An Update On R-22 Alternatives", p.1.
[39] Doolin, Doolin's Trouble Shooter's Bible, p. 291.
[40] Ibid.

Equip Your Plant For A Streamlined And Seamless Transition To Alternative Refrigerants

Due to the aggressive "phase out schedules" of the EPA, leading manufacturers have been busy investigating efficient ways to transition to ozone friendly, EPA approved, new alternative refrigerants like R-410A.

The Transition Strategy

This transitional phase is expected to be a process occurring over several years. HVAC manufacturing companies are not going to just eliminate R-22 bearing air conditioners tomorrow for the following reasons:

- Leading HVAC industries are still manufacturing plenty of R-22 units. For example, the Trane® Corporation currently advertises six models of its R-22 Variable Speed Air-Tite™ Air Handlers (Models TWE031E13F, TWE037E13F, TWE040E13F, TWE049E13F, TWEO65E13F, TWE062E13F), compared with just five R-410A models of the same type.[41]

- R-22 A/C primary parts, such as corrugated aluminum permanent filters, condensate evaporators, condensers, gaskets, etc., are still manufactured in plentiful amounts.[42]

- HVAC plants are still equipped for R-22 unit production.

- R-22 is still cheaper than R-410A.

Although R-22 is still cheaper, it is expected to go up as the EPA exerts more pressure on the HVAC industry to phase it out. Also, as R-22 supplies begin to dwindle, prices are expected to increase. The necessity of coming to grips with this reality is paramount for companies involved and a sensible plan which will meet all requirements of the EPA is financially prudent. Companies willing to take appropriate action can make the transition smoothly and effectively before deadlines catch them unprepared.

[41] "Variable Speed TWE-E Air Handler", (www.trane.com/Residential/Products/AirHandlers/Twee.asp), p. 2.
[42] "Horizontal 7-12k BTU Air-Cooled Top-Mounted Air conditioners", (www.kooltronic.com).

In general terms, many manufacturers are opting for a transition strategy similar to the one depicted by the following graph.

1) Introduce R-410A units on a mall scale.

2) Gradually reduce R-22 and increase R-410A production, reaching an equilibrium.

3) Phase out R-22 completely by 2010.

How To Overcome The Top 6 Challenges To The Effective Implementation Of Your Transition Strategy

There are six practical and logistical challenges which need to be considered with the changeover of refrigerants in large plants. Find out how ECI can help you overcome them all.

Available Space Issues

Many plants do not have the additional space it would require to run an alternate refrigerant setup. When this is the case, portable and stand-alone operating systems can give the functionality you need.

DualCharge™

ECI's stand-alone Dual Refrigerant Evacuation and Charging Station is essentially two charge boards in one. The same foot print which would occupy a single-charge refrigerant system now has a double refrigerant charging capacity—all without needing to make extra room for another charging mechanism.

Visit www.ecicomplete.com/dualcharge.html for more information.

TriCharge™

Perhaps your company needs room to handle three different refrigerant charging stations. ECI's Triple Refrigerant Evacuation and Charging station is essentially three charge boards in one. It only occupies a ground dimension of approximately 48" wide by 30" deep using one computer and one barcode reader to retrieve the parameters. As with DualCharge™, TriCharge™ is stand-alone.

Visit www.ecicomplete.com/tricharge.html for more information.

Portable-RS™

ECI also offers a portable refrigerant supply system, providing an interim solution for transitional phases. It only requires a working dimension of 88"H x 28"W x 60"D. The components are mounted within a single steel encasement on a steel skid which is all portable by fork lift. Given this convenience, Portable-RS provides a one-stop solution for refrigerant delivery.

Visit www.ecicomplete.com/portable-rs.html for more information.

SR-Delivery™

We also offer a single-station refrigerant delivery system with dimensions of only 48"H x 36"W x 18"D to accommodate your alternate refrigerant. SR-Delivery™ includes a Haskel® pump and refrigerant accumulator. The Haskel® pump extracts the refrigerant from the supply tank and into your ECI refrigerant charging station. The accumulator ensures that the flow of liquid refrigerant is regulated, so that your charging station will receive a consistent flow.

Visit www.ecicomplete.com/sr-delivery.html for more information.

SR-Supply™

Refrigerant supply systems are usually associated with taking up large amounts of plant space. With SR-Supply™, ECI has designed a single-station refrigerant supply system that minimizes space utilization with overall dimensions of 94”W x 91”H x 66”D. The system is designed for ease of use and efficiency and is customized to your specific needs. Utilizing a Haskel® air pressure pump, the system extracts the refrigerant from the supply tank into a holding tank, equipped with a float switch. The holding tank ensures that liquid refrigerant is always supplied to the charging station and that the system will not run short of refrigerant during a charge cycle, which could result in a partially charged unit.

Visit www.ecicomplete.com/sr-supply.html for more information.

Cross-Contamination

An R-22 unit may look exactly the same as an R-410A unit to the typical operator. When two or more refrigerants are used inside one manufacturing facility, there always exists the very real risk of cross contamination—for example, reclaiming R-22 into the R-410A reclamation system, or vice versa. ECI designed CrossCheck™ to ***eliminate the risk*** of contaminating your valuable refrigerant supply.

CrossCheck™ Is Easy To Use And Fool Proof

ECI designed CrossCheck™ to eliminate the risk of contaminating your valuable refrigerant supply. CrossChecks are located throughout the plant wherever reclamation occurs. As soon as the operator hooks the unit up to the CrossCheck™ reclamation port, the system automatically senses the pressure difference and engages. The operator uses the touchscreen to initiate reclamation with a single touch. CrossCheck calibrates itself, collects a small sample and tests the refrigerant to determine its type. Then it opens the appropriate valve to route the refrigerant to either your R-22 or R-410A holding tank.

No guesswork. No operator errors. It's a hands-free, automated, scientific procedure that safeguards your valuable refrigerant supply.

See www.ecicomplete.com/crosscheck.html for details and software screen shots.

Moisture Issues

Insuring Proper Vacuum

Our single-point evacuation and charge stations, such as VacuCharge™, use computer-mandated, model-dependent evacuation parameters to insure proper vacuum and moisture removal every time.

Furthermore, since VacuCharge requires only one hook-up, there is no loss of vacuum between evacuation and charge. Thus, the advantages of our single-point evacuation and charge systems are amplified by R-410A's tightened hydroscopic tolerances.

Monitoring Moisture Control

To deal with hydroscopic issues, especially prevalent in R-410A, ECI has developed **MoistureCheck™** in its product line, which is a real-time refrigerant moisture content analyzer and monitoring system that can be used either while a unit is charging, or during a run test, when the refrigerant is already in the unit.

MoistureCheck™ integrates a hygrometer into ECI charging stations to measure the PPM moisture content of incoming refrigerants, as well as the dew point of the unit during evacuation. Both the dew point of the unit and the PPM of the refrigerant are recorded to the database by model and serial number for warranty tracking purposes. If the refrigerant's PPM exceeds the customer-configurable level, the refrigerant supply is closed or the supervisor is notified.

Waterless Coil Testing

Moisture issues are present with on-line leak testing of units that might compromise the integrity of the unit. **Leak-Proof™**, ECI's Coil Integrity and Helium Leak Testing Station, uses dry air or nitrogen to test coil integrity and gross leaks and helium to check for minute leaks in coils. There is no water involved in LeakProof's testing process, unlike bubble testing, (where the unit is submerged in water) or other systems involving water.

Demand-Flow Technology Requirements

It can be a daunting challenge to have a fluid production schedule that has the ability to respond to the changing demands of a fluctuating market. For instance, an operator may be required to charge one unit with R-22, and then the next model with R-410A. A demand flow environment requires a streamlined system that can change production schedules in a moment's notice.

Achieve The Goals Of DFT With The IPCS

ECI's Integrated Process Control System (IPCS) makes it possible to track, from start to finish, the testing, evacuation, and charging cycle of a unit. Computer-generated, real-time information and database processing, tracks each unit as it moves down the assembly line. Due to this cutting-edge technology, servicing different models with different refrigerant types, becomes easily achievable. Because each unit is given its own identity with a serial and model number, an R-410A unit may follow directly behind another unit charged with R-22, all without missing a beat in the production schedule.

Charging Multiple Refrigerants

We've discussed the inherent problems associated with cross contamination of refrigerants, especially involving the reclamation process. However, the same concern is ever-present when dealing with operator hook-up while charging individual units on a line. Unless the equipment is specifically designed to prevent incorrect hook-ups of refrigerant guns and hoses, you run the risk of charging units with the wrong refrigerant.

Eliminating Operator Error

With **DualCharge™** and **TriCharge™,** ECI has **eliminated the possibility of operator error** when handling multiple refrigerants. With DualCharge™, for example, there are two sets of guns—one for each refrigerant. The guns can be color- coded to distinguish the different refrigerants. More importantly, the guns are designed with different fittings: PCU for R-22 and Hansen for R-410A. This feature makes it **physically impossible to connect the wrong set of guns to a unit.**

Complete Refrigerant Accountability

The IPCS achieves complete refrigerant accountability by automating the refrigerant checking process. For example, **VacuCharge™,** ECI's single-refrigerant charging unit, determines refrigerant type and charge amount from a unit's Bill of Materials (BOM). The operator simply scans the unit, retrieves vital on-screen information regarding charge status and refrigerant type, then connects the unit and walks away.

Operators might make mistakes, but your Bill of Materials won't. Computer integration provides an assurance that the correct refrigerant type is used every time.

Full Refrigerant Transition Services

ECI offers an efficient, plant-wide refrigerant delivery system. With **PR-Delivery™**, we offer a system which is not only easy to use, but one customized to your specific needs for flow rate and distance. Utilizing multiple pumps for extra capacity and redundant back-up, you can count on trouble free operation for years to come. ASTM storage tanks are used with at least a 400psi rating, thereby, accommodating the higher pressure ratings of alternate refrigerants, such as R-410A.

Whether it's single-station refrigerant delivery (**SR-Delivery™**)**,** single-station refrigerant supply (**SR-Supply™**)**,** single-station refrigerant reclaim (**SR-Reclaim™**), a portable refrigerant system (**Portable RS™**), or plant-wide refrigerant delivery as mentioned above, ECI stands ready to help you make a seamless transition to alternative refrigerants.

Take The Next Step:
Schedule Your Free 45-Minute Consultation

Whatever the refrigerant specifications, ECI specializes in customizing refrigerant systems. Talk to us. We can make it happen.

Schedule your **FREE** 45-minute consultation with an ECI Account Executive: (901)-854-8088 or email us at sales@ecicomplete.com.