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VTech e-news

#11

Customer Focus

Air Innovations adds VTech Charging Equipment

Air Innovations of Syracuse, NY recently installed a VTech 102 Dual Refrigerant Charging machine. Air Innovations manufactures a wide range of temperature, humidity and air quality control systems for diverse OEM customers including retail, medical, military and aerospace. Visit the company's website at www.airinnovations.com

"While our products are diversified, Air Innovations is by no means a small company," said Rich Gozigian, Director of Operations. "We have aggressively pursued both internal and external growth and we see VTech as a valued partner in our efforts of continuous process and quality improvement. "

As a "niche market" company, with hands in many smaller markets, they required a single system able to process units of varying size. Air Innovations' production lay-out is based on independent "work stations" on which virtually any of its products can be built. The VTech 102 is assembled on a self-contained roller cart holding the refrigerant tanks and can be wheeled around to work at any of the work stations.

The initial goal for the new VTech charging unit was to cut-down the process time required for pre-evacuation while improving quality by means of accurate metering of the refrigerant. The first goal was achieved thanks to VTech's provisions for evacuation from the high and low side of the compressor. In addition, the two-stage oil sealed vacuum pump can pump down the unit to a much lower vacuum than the "service" type pumps previously used. This resulted also in a lower level of residual moisture in the refrigeration circuit ensuring a higher efficiency of the unit.

The refrigerant charging accuracy goal was achieved thanks to VTech's proprietary precision metering system. This device, unlike any other system available on the market, relies on a series of optical targets connected via fibre-

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Industry News

Alternative Refrigerants

The Montreal Protocol Project eliminated the use of CFC refrigerants, namely R12, in the mid nineties and will begin the phase out of R22 on January 1, 2010 with a ban on new manufacturing with R22.

As a result, Air Conditioning and Refrigeration manufacturers had to redesign their products around different refrigerants, R134a, R404a, R410a just to name a few. Also emerging in the North American market is the demand for products that use other alternative refrigerants, "natural" substitutes such as R290 (Propane) and R600 (Isobutane). These refrigerants have been used in Europe and in Asia since the early nineties, but are just now catching the interest of North American markets.

This demand, unlike that of the Montreal Protocol, is created almost totally by end-users. Powerful companies such as Coca-Cola, McDonald's and GE are perceiving the "going green" movement as an opportunity to establish an "Environmentally Conscious" image with consumers. Alternative refrigerants are in their eyes a long-lasting solution to ozone depleting gases that also have a low Global Warming Potential.

The proposal of moving toward an HFC-Free Domestic Refrigerator is being considered under the Significant New Alternatives Policy (SNAP) http://www.epa.gov/ozone/snap/index.html, an EPA program that assesses substitutes to substances being phased out under the Clean Air Act for the protection of the Earth's ozone layer

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Technical Focus

Pumpdown Time and Pre-Evacuation Layout

Pumpdown Time
The vacuum pumps used during pre-evacuation must perform in the time allowed based on your takt time, number of units to be produced/hour or per/day.

In order to shorten the pre-evacuation phase, a couple of operations can improve your pump-down time, namely nitrogen purging or oven drying. By flushing the circuit with nitrogen you can remove a good amount of the residual moisture present in the circuit.

Typical pumpdown times for manufacturers range from 10-20 minutes, using 15-20 m^3/h (8-12 cfm) pumps, permitting a gradual vaporization of the moisture as opposed to employing oversized pumps which can pump down too quickly, turning the moisture into ice and forming sludge when refrigerant is added.

Pre-Evacuation Layout
There are two basic ways pumps are employed in manufacturer's production lines. They differ somewhat in their approach.

Manifold
The first method is a manifold system, which consists of one large capacity pump connected in parallel to several refrigeration circuits via a multi-coupling manifold. This method has several disadvantages. If one of the refrigeration circuits has a leak or contains too much moisture, it will be impossible to attain a good vacuum in the time allowed in either the defective system or in any of the other systems connected to the same manifold. It is difficult to determine which of the refrigeration circuits is the bad one; it can be isolated but not without adding a lot of extra time to the process. Unless there are multiple manifold systems employed, the manufacturer will have to keep a spare pump on hand in case of failure of the one working pump, otherwise production will be halted.

The only advantage to this method is the initial investment.. A 45 m^3/h (27 cfm) pump costs roughly as much as 2 or 3 smaller pumps.


Vacuum Pump Carousel — Refrigerator Production Line

Independent Systems
The second method is a series of smaller independent vacuum pumps (15-20 m^3/h or 8-12 cfm), each one dedicated to one refrigeration unit. The pumps should be connected to both the high and low side of the unit, thereby dramatically improving the effective conductance of the circuit.

This solution can be implemented either in a carousel type lay-out, with refrigeration units and vacuum pumps moving together along the production line, or with a series of stationary pumps to be connected to refrigeration units sitting on a manual conveyor.

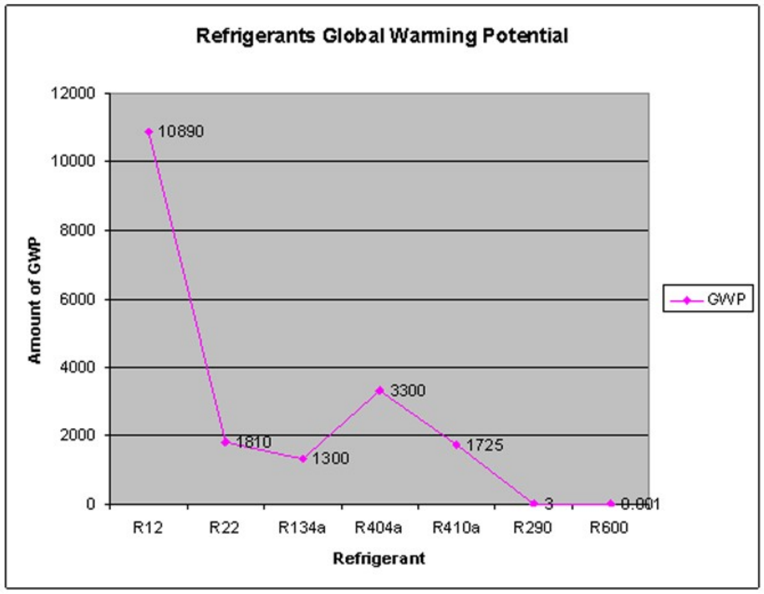
VTech has recently introduced an innovative solution to measure vacuum in carousel installations, that relies on an Active Pirani Gauge communicating with a central data collection station via radio frequency.

This article is excerpted from VTech's publication "High Vacuum and the Refrigeration Industry." Please see past issues of VTech e-news for previous installments and look for future contributions from this handy resource. Copies are available upon request.

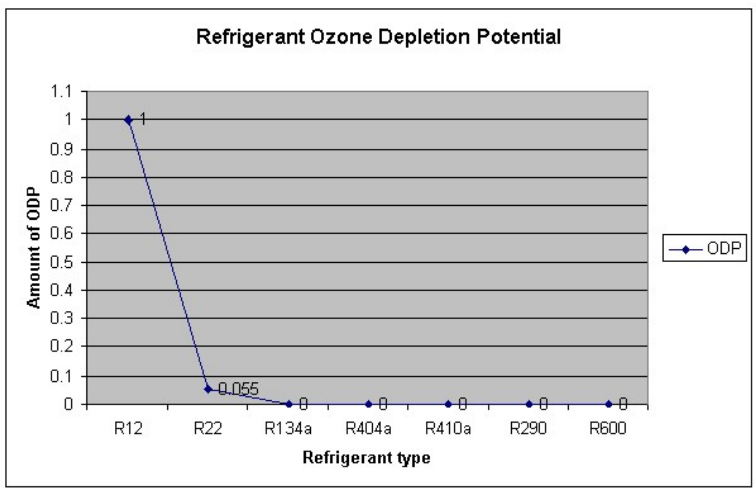
Alternative Refrigerants Continued from page 2

Source *Appliance Design* article October 31, 2008 http://www.appliancedesign.com/Articles/Latest_News/BNP_GUID_9-5-2006_A_10000000000000458025

When compared to even the most environmentally friendly HFCs these natural refrigerants are a valid alternative. The following tables show a comparison of the impact of hydrocarbon refrigerants vs. HCFC's and HFC's on Ozone Depletion Potential (ODP) and Global Warming. Data source EPA Website: http://www.epa.gov/Ozone/science/ods/index.html



HCFC's such as the soon to be phased out R22 have an ODP of 0.01 to 0.1 and are categorized as "Class II" Substances by the EPA. All HFC's have 0 ODP while they have higher GWP.



Definitions

What do these numbers mean? Obviously is both cases lower is better. Ozone Depletion Potential is the ratio of the impact on ozone of a chemical compared to the impact of a similar mass of CFC-11. HFC's do not contain chlorine and therefore have 0 ODP. The Global Warming Potential is the ratio of the warming caused by a substance to the warming caused by a similar mass of carbon dioxide (CO_2). Thus, the GWP of CO_2 is defined to be 1.0. Data source EPA website: http://www.epa.gov/Ozone/defns.html#ds

From a manufacturing standpoint, the use of Hydrocarbon refrigerants pose some new challenges as these gases are flammable and potentially explosive. Therefore the manufacturing area requires a safety zone and specialized equipment specifically designed for this use. Fortunately, manufacturers can piggy back on the experience of European and Asian companies that pioneered this technology many years ago. Therefore, there is nothing to worry about as long as you are dealing with equipment manufacturers who have previous experience in handling hydrocarbon refrigerants.

VTech is on the forefront of this emerging technology offering both production and R&D charging equipment suitable for hydrocarbons. Please visit the Products section of our web site (www.vtechonline.com) for more information on this equipment and other VTech products.

VTech 200 HC Charging System for Hydrocarbon Refrigerants

Refrigerant Leak Rate Formula

When expressing a leak rate most people use the ratio of atm.cc/sec (e.g. 1.8 x 10^{-5} atm cc/sec). That in itself is confusing enough if you're not sure what scientific notation signifies.
But what does that number really mean in terms of refrigerant mass leakage, the real reason anyone cares about leak rates to begin with? Thankfully we can compute refrigerant leak rate by using among other numbers the molecular weight of the gas we are going to be charging the unit with.

The following formula is handy for Converting Leak rate in atm. cc/sec to Refrigerant Mass/year

$$Qr = \frac{R}{M} x \frac{22400}{S} x \frac{T}{273}$$

Whereas:
R= Mass loss of refrigerant per year in grams.
M= Molecular mass of refrigerant in grams.
22400= Volume of one mole of gas at one atm. and 273 K.
S= Seconds in one year.
T= Reference temperature of refrigerant in Kelvin.
Qr= Leak rate in atm. cc/sec.

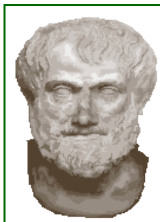
Example
Loss of 2.83 g (0.1 ounces)/year of R410a at 20 C° (68° F)

$$Qr = \frac{2.83}{72.58} x \frac{22400}{31{,}556{,}000} x \frac{293}{273}$$

Qr = 2.97 x 10^{-5} atm. cc/sec. of R410a.
Qr = R x 22400 x T
M S 273

Other Common Refrigerant Molecular Weights (grams)

R125	R22	R134a	R407c	R404a	R600a
120	86.5	102	95	97.60	58.2



Quotable Quote:

Aristotle on the subject of vacuum:

"How can *nothing* be *something*?"

Vacuum Checklist

Keep the following in mind when designing a lay-out for pre-evacuation or check your existing line to see if it conforms:

- ✓ The pump should be able to produce a vacuum in the refrigeration circuit in the range of 10^{-2} mbar.
- ✓ The residual balanced pressure should not exceed 1 mbar
- ✓ The optimum vacuum pump capacity is between 10 and 20 m³/h (6-12 cfm)
- ✓ The pump type with the best performance is a dual stage oil sealed rotary vane pump
- ✓ The ideal technical solution is one (adequately sized) vacuum pump per refrigeration unit evacuating from both the high and low side of the compressor.

Air Innovations and Cool Innovation

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optics. The PLC computes the data coming from the flow-transducer and matches them with the process recipe stored in the memory. To our knowledge, this is the most accurate metering technology in the world, being able to guarantee accuracy of up to 0.3 g (0.01 oz).

With low, medium and high production models, together with the many options available, VTech is able to provide the "best fit" solution for businesses of all sizes...and shapes.