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VTech e-news

Customer Focus

#9

The Power of an Unconditional Guarantee

VTech is in the forefront of innovation in refrigeration and A/C process equipment, not only from a technological standpoint, but also in the way we do business. VTech offers an unconditional guarantee by offering a free trial period of its machines or a 30-day money back guarantee– no questions asked!

The old saying "seeing is believing" applies, and our trial program convinces manufacturers with the most difficult applications that we can provide the solution they require.

One such customer is Thermo Fisher Scientific Corporation who came to us with a specific need for equipment that would improve their efficiency and automation. The VTech 101 Single Refrigerant Charging machine exceeded their expectations, delivering accuracy, consistency and dependability.

Another successful demonstration took place last year at Hussmann Corporation, which led to the purchase of multiple new machines. Ryan Morrone, Quality Assurance and Warranty Manager says "The level of service is great. VTech was the only company who really listened to what we wanted and needed and didn't try to get us to purchase more than we needed. The DEMO unit was a tremen-

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VTech 101 at Thermo Fisher

Product Spotlight

Why Work Hard? "Work *Easy*" with VTech

A lot can be said for working hard, but why not get even better results with less effort? Today's concentration on process flow and waste elimination, begins with production equipment selection, machines that are going to cut costs, man hours and down time while increasing efficiency and productivity and achieving the goal of "Perfect first-time quality."

Benjamin Franklin's *Poor Richard's Almanack* says of wasted time: "He that idly loses 5 shillings worth of time, loses 5s., and might as prudently throw 5s. into the river." Furthermore it is suggested that avoiding unnecessary costs is even more profitable than increasing sales.

That's where the thinking behind product design comes into play. The ergonomic design of VTech's equipment makes things easier on the operator by providing all necessary controls at "Hand Height" with all the pertinent information displayed on a touch screen.

Key principles of "autonomation" eliminate operator-dependence by having the machine perform the simple routine operations while alerting the operator to abnormal conditions. With the machine doing its job, the operator is free to walk away and do something else.

If there is a problem, the machine lets the operator know. Features like audio alarms, a stack light for enhanced visibility of cycle progression, built-in fault warnings and troubleshooting

"Easy Does It."

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Technical Focus

It's all about pressure!

In the last newsletter we talked a little about the refrigeration cycle and components of a refrigeration circuit. Vital to understanding refrigeration is the science of vacuum and the theoretical and practical principles involved.

The first concept has to do with the Ultimate Pressure (Vacuum level) inside the refrigeration circuit. One may ask why the circuit has to be evacuated and "dried" before being charged with refrigerant. The reason is that any air or more importantly moisture must be removed from the system. Air or other "non-condensable" gases diminish the high heat transfer coefficient typical of condensing vapors; the non-condensables would remain in the upper area of the circuit and raise the delivery pressure in the system.

Water, besides being unable to be vaporized in the evaporator, freezes at the colder part of the circuit and could block the expansion capillary tube or throttling valve. Moisture is picked up by the refrigerant and transported though the refrigerant line in a fine mist with ice crystals forming at the point of expansion. All it takes is a few milligrams of moisture in a critical part of the system to cause the system to not operate correctly. Moisture can also cause corrosion, made even more intense by its combination with refrigerant oil, which has a natural attraction for moisture and absorbs it rapidly. Acids are formed with the water which combines with the refrigerant creating "sludge" that greatly reduces the lubrication quality of the oil.

Both air and water absorb a portion of the compressor power without producing any cooling, or refrigeration effect. Furthermore, oxygen in air considerably increases corrosion in the circuit, especially at the compressor valve faces.

Residual Balanced Pressure and Water vapor

The Residual Balanced Pressure (RBP) inside the refrigeration circuit is the stable pressure that exists in an evacuated circuit after reaching the pressure equilibrium.

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CONVERSION CHART

TO CONVERT	MULTIPLY BY	TO OBTAIN	TO CONVERT	MULTIPLY BY	TO OBTAIN
ATMOSPHERES	1.013	BARS	MICRONS	1.316×10^{-6}	ATMOSPHERES
ATMOSPHERES	1.033	KG/CM^2	MICRONS	1.333×10^{-6}	BARS
ATMOSPHERES	14.7	LB/IN^2	MICRONS	1.359×10^{-6}	KG/CM^2
ATMOSPHERES	7.6×10^5	MICRONS	MICRONS	1.934×10^{-5}	LB/IN^2
ATMOSPHERES	1.04×10^3	MILLIBARS	MICRONS	1.333×10^{-3}	MILLIBARS
ATMOSPHERES	1.013×10^5	PASCALS	MICRONS	0.1333	PASCALS
ATMOSPHERES	7.6×10^2	TORR	MICRONS	1×10^{-3}	TORR
BARS	0.9869	ATMOSPHERES	MILLIBARS	9.869×10^{-4}	ATMOSPHERES
BARS	1.02	KG/CM^2	MILLIBARS	0.001	BARS
BARS	14.5	LB/IN^2	MILLIBARS	1.02×10^{-3}	KG/CM^2
BARS	7.5×10^5	MICRONS	MILLIBARS	1.45×10^{-2}	LB/IN^2
BARS	1000	MILLIBARS	MILLIBARS	7.5×10^2	MICRONS
BARS	1.0×10^5	PASCALS	MILLIBARS	100	PASCALS
BARS	7.5×10^2	TORR	MILLIBARS	0.75	TORR
KG/CM^2	0.9678	ATMOSPHERES	PASCALS	9.869×10^{-6}	ATMOSPHERES
KG/CM^2	0.9807	BARS	PASCALS	1×10^{-5}	BARS
KG/CM^2	14.22	LB/IN^2	PASCALS	1.02×10^{-5}	KG/CM^2
KG/CM^2	7.356×10^5	MICRONS	PASCALS	1.45×10^{-4}	LB/IN^2
KG/CM^2	9.807×10^2	MILLIBARS	PASCALS	7.5	MICRONS
KG/CM^2	9.807×10^4	PASCALS	PASCALS	1×10^{-2}	MILLIBARS
KG/CM^2	735.6	TORR	PASCALS	7.5×10^{-3}	TORR
LB/IN^2	6.8×10^{-2}	ATMOSPHERES	TORR	1.316×10^{-3}	ATMOSPHERES
LB/IN^2	6.89×10^{-2}	BARS	TORR	1.333×10^{-3}	BARS
LB/IN^2	7.03×10^{-2}	KG/CM^2	TORR	1.359×10^{-3}	KG/CM^2
LB/IN^2	5.17×10^4	MICRONS	TORR	1.934×10^{-2}	LB/IN^2
LB/IN^2	68.9	MILLIBARS	TORR	1.000×10^3	MICRONS
LB/IN^2	6.89×10^3	PASCALS	TORR	1.333	MILLIBARS
LB/IN^2	51.7	TORR	TORR	1.333×10^2	PASCALS

Definition: Outgassing

Outgassing is the process of evaporation and sublimation into a vacuum. All materials, solid or liquid, have a small vapor pressure, and their outgassing becomes important when the vacuum pressure falls below this vapor pressure. The most prevalent outgassing product in man-made vacuum systems is moisture absorbed by component materials. Outgassing has the same effect as a leak and can limit the achievable vacuum.

Units of Pressure

Absolute pressures in the vacuum field are usually measured in mbar. Other units of pressure that are still used in the US and Europe are Torr, Pascals and µ Hg. See the Conversion Chart at left.

Pressure 101

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If you use the formula of perfect gases, assuming that the RBP is caused by the residual humidity only, the amount of water vapor can be calculated:

$$PV = \frac{M}{\mu} RT$$

Where: P = pressure (mbar)
V = volume (liters)
M = mass (grams) – mass of water vapor is our Unknown value
μ = molecular weight
R = universal constant of perfect gases (mbar.l.mol^{-1}, K^{-1})

Example: Take a refrigeration circuit having an internal volume of 4 liters, with RBP of 1mbar. Using the formula above, you can determine the water vapor quantity is:

$$1x4 = \frac{M}{18} x83.15x300$$
$$M = 2.9mg\,H_2O$$

In theory this quantity is sufficient to block the capillary by forming ice. In practice, however, a good filter drier placed in the circuit can gradually absorb this quantity of water, therefore a RBP of 1mbar is considered acceptable. Filter dryers have a rating of X "drops" at X temperature of X PPM of refrigerant.

Optimum value of ultimate vacuum: How low should I go?
Considering the above, a refrigeration system will not work correctly with excess moisture in the system. The RBP should be no higher than 1 mbar in order to maintain a tolerable amount of water in the circuit. Data suggests that such a RBP value is achieved only if the pumping system is able to achieve vacuum levels in the range of 10^{-2} mbar (.75 Torr/.1 kPa) or lower.

A vacuum pump removes unwanted moisture by lowering the pressure inside the system, vaporizing it and then exhausting it along with the air. Next time we'll look at vacuum pumps and how science as well as practical experience comes into play when sizing a pump or pumps for production.

This article is excerpted from VTech's publication "High Vacuum and the Refrigeration Industry." Copies are available upon request.

Vacuum Levels

Atmospheric pressure
760 Torr
101.3 kPa

Low vacuum
760 to 25 Torr
100 to 3 kPa

Medium vacuum
25 to 1×10^{-3} Torr
3 kPa to 100 mPa

High vacuum
1×10^{-3} to 1×10^{-9} Torr
100 mPa to 100 nPa

Atmospheric pressure is variable but standardized at 101.325 kPa (760 Torr)

Low vacuum, also called *rough vacuum* or *coarse vacuum*, is vacuum that can be achieved or measured with rudimentary equipment such as a vacuum cleaner and a liquid column manometer.

Medium vacuum is vacuum that can be achieved with a single pump, but is too low to measure with a liquid or mechanical manometer. It can be measured with a McLeod gauge, thermal gauge or a capacitive gauge.

High vacuum is vacuum where the MFP (Mean Free Path) of residual gases is longer than the size of the chamber or of the object under test. High vacuum usually requires multi-stage pumping and ion gauge measurement.

Seeing, Believing

(Continued from page 1)

dous help as well. In fact we ended up purchasing the DEMO unit. I like the fact that VTech offers other process tools which we are currently investigating. It is nice to have a one-stop-shop supplier to deal with that takes care of its customers."

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Working Easy

(Continued from page 1)

tips all help make the most information available to the operator. Program logic prevents some of the most common operator errors such as double charging or changing of preset parameters (either accidentally or intentionally). If you include commercially available spare parts plus an internet support ready feature, you get a whole lot more with a lot less effort. That's *working easy*!

Business Building

Brand Identity

What's in a name? Years ago when packaged goods began to be produced, consumers still favored local commodities over those made someplace else. A Brand name helped familiarize the consumer with the product and created expectations of quality and uniformity no matter where one happened to live.

Conceptually, Marketers engaged in branding seek to develop or align the expectations behind the brand experience, creating the impression that a brand associated with a product or service has certain qualities or characteristics that make it special or unique. A brand that is widely known in the marketplace acquires brand recognition, which is a way of saying that the brand name now represents the product. It's like saying, when ordering a soft drink, "I'll have a Coke."

Brand recognition in capital equipment relies on the same principles except that the purchasing cycle is more involving and decisions are made on a more factual basis rather than emotional ones. When evaluating a bid for capital equipment, companies will seek to maximize the total package of benefits (value equation) that they will be acquiring from a supplier. This includes technology, customer/technical support and cost of ownership being it initial pricing, perceived risk and cost/availability of ongoing support. In some instances financing also comes into play, especially for international business.

VTech is addressing each and every element of the "value equation" as follows:

a. Our equipment is made in the US, therefore our prices are not subject to exchange rate fluctuations such as with European made equipment today;
b. Our free-trial period insures that the equipment will meet the multiple requirements of all parties involved being them manufacturing or process engineers, operators, maintenance.
c. Our US presence includes a manufacturing and service facility in New York State as well as a sales and support center located in Atlanta, GA. Our network of representatives adds an additional dimension in terms of local presence and customer support.

So relax, we've got you covered.

The NEW vtechonline, Coming Soon!

VTech will soon be unveiling our new website, which will include more product and technical information than ever before. Look for it in the very near future!

VTech

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