DEHYDRATING COOLING APPLIANCES

It is critically important to adequately dehydrate and degas the cooling system prior to the introduction of refrigerant. By dehydrate, we mean remove as much moisture as possible and by degas remove as much air and other gases as possible. Moisture and gases present within the system have a chemical reaction within the system causing the oil within the system to break down. This results in a chemical decomposition of the refrigerant which combined with moisture in the cooling unit forms an acidic condition. Every 18ºF rise in operating temperature above 200ºF doubles the rate of chemical reaction. The results can cause product failure. Given the high operating temperatures of modern cooling appliances, it is clear that adequate, consistent dehydration of each cooling system is critical to product quality and reliability.

WATER BOILS UNDER A VACUUM

The most efficient way to assure adequate dehydration is by using a vacuum pump to remove water, air and other gases from the cooling unit. By looking at the table below, we know that at sea level water on a stove top is exposed to 14.7 pounds of atmospheric pressure and at that pressure, water must be heated to 212ºF to convert it to vapor. If the water can be contained in a vacuum tight chamber, it will boil at lower temperatures as the absolute pressure is lowered. In other words, water will boil at 70ºF if the pressure can be reduced from 14.7 to 0.2 psia or about 20,000 microns and be converted to a vapor.

BOILING POINT OF WATER (ºF)	UNITS OF ABSOLUTE PRESSURE lbs./sq. in.	microns Hg	UNITS OF VACUUM Inches Hg	mm Hg
212	14.7 psia	760,000	0	0
200	11.5	597,000	6.5	163
179	7.4	380,000	15.0	380
114	1.4	75,000	27.1	685
79	.5	25,400	29.0	735
72	.4	20,800	29.2	740
32	.01	4,579	29.8	755
-25	.005	250	29.99	
-40	.002	97	29.996	
-60	.0005	25	29.999	

WHAT IS VACUUM?

Vacuum can be defined as any pressure less than the atmospheric pressure which surrounds the earth. The weight of that pressure at sea level is 14.7 psia which is the equivalent weight of a column of mercury one inch in diameter and measuring 30 inches high. At the very low pressures used in the dehydration process, the inch of length is too course so by shifting to metric unit of length, the millimeter (mm) which is easily divided by 10. A millimeter is about 1/25 of an inch. 1” = 25.4 mm. 30” = 762 mm. We now have a convenient and precise unit of pressure, namely 760mm of mercury = 14.7 psia.

Airserco Manufacturing Company

Refrigerant Processing Equipment

7555 Tyler Boulevard ● Mentor, OH 44060 USA ● Voice: (800)473-1754

Outside the Continental USA: (440)946-2700 ● Fax: (440)946-8188

Internet: www.airserco.com ● e-mail: info@airserco.com

AIRSERCO

HOW THE VACUUM PUMP WORKS

Simply speaking, the vacuum pump creates a pressure differential that cause the gases to flow into the pump on where they are sufficiently compressed to be exhausted through the pumps discharge valve. It is important that the vacuum pump be capable of attaining the very low absolute pressures needed to dehydrate the cooling appliance by lowering the pressure for sufficient time to allow moisture and other gases to be converted to vapor and exhausted.

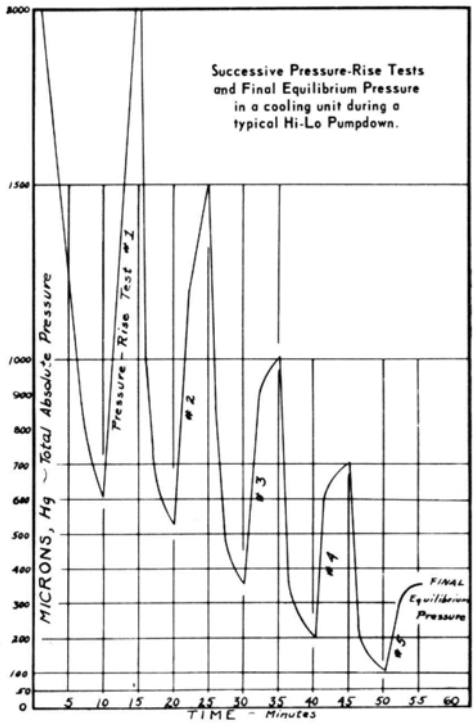
PRESSURE RISE TEST

Although there are no known "industry standards", most cooling equipment manufacturers prefer to dehydrate their systems for sufficient time to assure that their units are leak free and as dry as possible. Because it is impossible to remove 100% of all moisture, condensable gases, and air from a sealed system, many manufacturers establish production guidelines they feel best assures a clean, dry, leak free system. Again no formal rules exist, but experience shows that a combination of pumping time, low pressure achieved, and final equilibrium pressure measured is the best way to consistently achieve clean, dry units. The "Pressure Rise Test" is a crucial measurement which measures pressure rise over time that indicates leaks and existence of moisture. In an automatic vacuum pumping system, the operator may enter parameters such as: 1.) Expose the cooling system to a low pressure of 50 microns, or a maximum pump down time of 30 minutes: 2.) After reaching 50 microns absolute pressure, or 30 minutes of pumping time, isolate the pump from the cooling system and observe the rise in pressure on the system as it slowly seeks its own equilibrium pressure over a measured time period.

FINAL EQUILIBRIUM PRESSURE

Manufacturers realize that to merely attain an instant low pressure, is not a criterion that the unit has been adequately dehydrated. The important requirement is that, (1) when the unit has been pumped down, (2) valved off from the high vacuum pump and (3) held under vacuum, the magnitude of the pressure rise must be within the limits set by your quality control specifications.

The pressure at which the total absolute pressure gauge levels off during the pressure rise test shows the relative amount of moisture and air remaining in the entire cooling unit being dehydrated by high vacuum. This is an excellent indication of the dryness of a unit at any stage during a pump-down To note the progress of your dehydrating cycle, you may occasionally close the isolation valve to hold the cooling system unit under its vacuum. Its pressure will rise, but as shown on the graph at the right, repeated tests indicate that the pressure rise progressively decreases. This is good sign of successful progress. However, if the rise in pressure does not successively decrease, investigate for a probable leak!



Airserco Manufacturing Company

Refrigerant Processing Equipment

7555 Tyler Boulevard ● Mentor, OH 44060 USA ● Voice: (800)473-1754
Outside the Continental USA: (440)946-2700 ● Fax: (440)946-8188
Internet: www.airserco.com ● e-mail: info@airserco.com

AIRSERCO