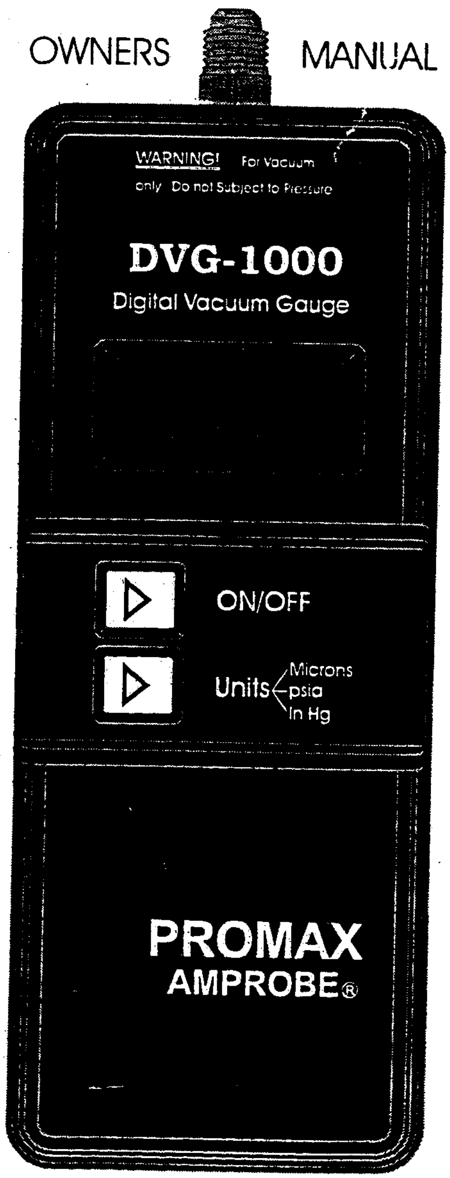
PROMAX
AMPROBE

DVG-1000

DIGITAL VACUUM GAUGE

OWNERS MANUAL



Vacuum Principles

The Earth is surrounded by various elements that make up the atmosphere. This atmosphere extends about 350 miles above the Earth's surface. Due to the weight of the atmosphere, a pressure is created on the surface of the Earth of 14.696 psia at sea level. This is known as atmospheric pressure. As shown in the chart below, when the altitude increases, the atmospheric pressure decreases. This is because the amount of atmosphere above decreases and the density of the atmosphere is reduced. A standard "Bourdon" dial gauge is used to read gauge pressure, or the pressure above local atmospheric pressure. With this type of gauge, atmospheric pressure is referred to as zero and a vacuum would be read as a negative pressure. The DVG-1000 is calibrated to an internal vacuum to read absolute pressure. With this type of gauge, "Zero" is a perfect vacuum and all pressure, including vacuum, is read as positive pressure (the lower the pressure, the better the vacuum). It should be noted at this time that the DVG-1000 is designed for vacuum use only and should **NEVER** be subject to pressure above atmospheric pressure.

ALTITUDE - MILES	#/sq in. absolute	#/sq in. gage	Inches Hg, abs.	Microns
60	0.000014	-14.695986	0.00003	0.72399
50	0.00017	-14.69583	0.0003	8.79
40	0.002	-14.694	0.004	103
25	0.04	-14.656	0.09	2,068
20	0.13	-14.566	0.26	6,722
10	1.49	-13.206	3	77,053
5	5.2	-9.496	10.6	268,912
1	12.1	-2.596	24.7	625,739
Sea Level	14.696	0	30	760,000

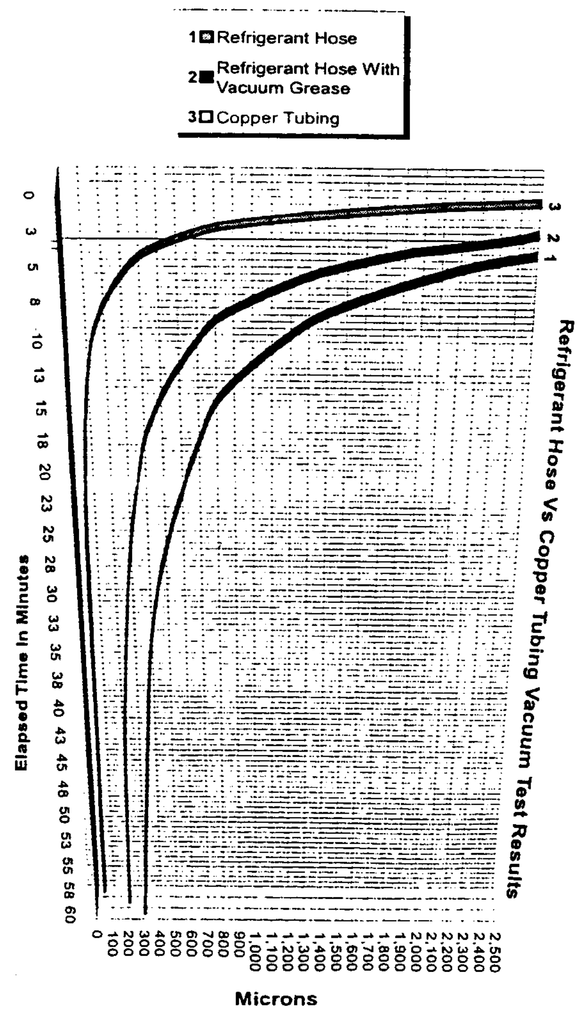
The "Drop Test"

The "drop test" is a method for determining if a system contains moisture and/or small leaks. The first step in conducting a "drop test" is to pull the system into as deep a vacuum as possible. Once this is accomplished, the system is isolated from the pump by closing a vacuum-tight valve. If a leak and/or moisture is present in the system, a rise in pressure or drop in vacuum will be registered on the high vacuum gauge. Two or more "drop-tests" are usually conducted to determine whether there is a leak in a system or the system contains moisture.

Refrigerant hoses vs. Copper tubing

When connecting the vacuum pump to a system, it is imperative that all connections be vacuum tight. This will allow the vacuum pump to reach a deep vacuum and maintain that vacuum while the service engineer performs the necessary diagnostics. It is also beneficial to use copper tubing as opposed to refrigerant charging hoses. As can be seen in the chart below, the pump-down speed is noticeably faster and a higher vacuum is obtained with copper tubing. This is due to the various leak paths present in the charge hose. If possible, rubber hoses should be avoided altogether.

Results of tests conducted with refrigerant hoses and copper tubing.



Why use a high vacuum pump?

Damage caused by moisture is one of the leading causes of failures in Air Conditioning and Refrigeration systems. Moisture can combine with your refrigerants to create acids that can corrode or cause copper plating inside the system. Refrigeration oil readily absorbs water and can turn into a sludge, loosing its lubricating ability. The best way to remove moisture from a system is with a good high-vacuum pump.

For a system to be adequately dehydrated, the deep vacuum must reach the farthest point in the system, not just the point where the gauge is attached. To accomplish this, a connecting line of the largest diameter and shortest length possible must be used, preferably 1/2" O.D. tubing.

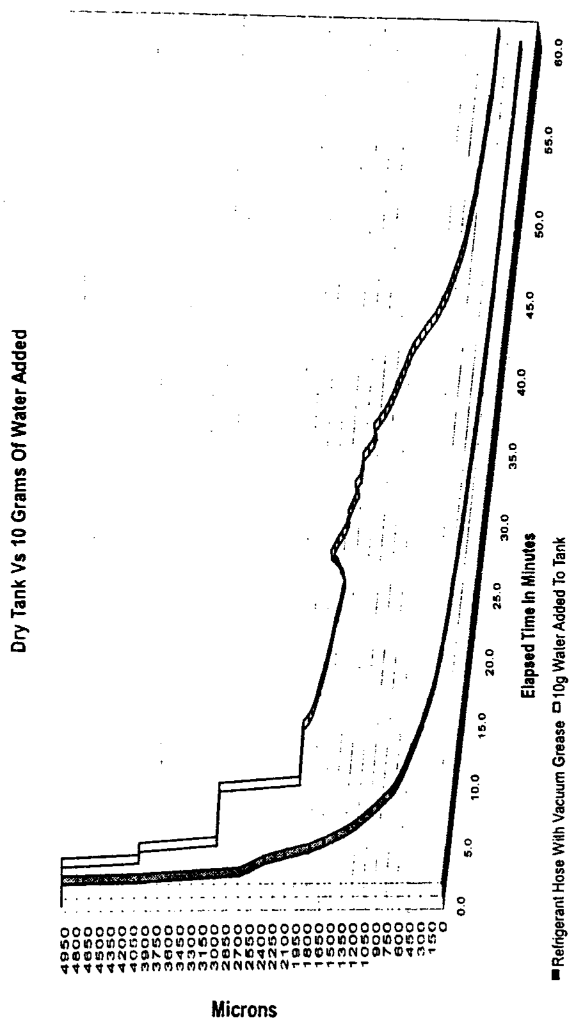
As the pressure in a system decreases, the boiling point of water decreases also. The chart below shows that you can get water to boil at 72° F by creating a vacuum of 29.12 Inches Hg in a system.

Boiling Temperatures of Water at Converted Pressures

Temperature in °F	Inches of Vacuum	Microns*	Pounds/Sq. In. (Pressure)
212°	0.00	759,968	14.696
205°	4.92	535,000	12.279
194°	9.23	525,526	10.162
176°	15.94	355,092	6.866
158°	20.72	233,680	4.519
140°	24.04	149,352	2.888
122°	26.28	92,456	1.788
104°	27.75	55,118	1.066
86°	28.67	31,750	.614
80°	28.92	25,400	.491
76°	29.02	22,860	.442
72°	29.12	20,320	.393
69°	29.22	17,780	.344
64°	29.32	15,240	.295
59°	29.42	12,700	.246
53°	29.52	10,160	.196
45°	29.62	7,620	.147
32°	29.74	4,572	.088
21°	29.82	2,540	.049
6°	29.87	1,270	.0245
-24°	29.91	254	.0049
-35°	29.915	127	.00245
-60°	29.919	25.4	.00049
-70°	29.9195	12.7	.00024
-90°	29.9199	2.54	.000049

* Remaining pressure in system in microns

Pumping Speed And Moisture



The chart above shows the time required to evacuate a 780 in^3 cylinder with dry air, and with 10 grams of water. With dry air it took 42 min. for the pump to reach a level of 150 microns. When 10 grams of water is added to the system the pump has only reached a level of 450 microns after 60 min. In this case, the water only had to be evaporated. If moisture is allowed to freeze in a system, it could take considerably longer to evacuate the system.

DVG-1000 DIGITAL VACUUM GAUGE

The DV-1000 digital vacuum gauge is a versatile and essential tool for the Service Engineer that will measure a vacuum down to 50 microns. It incorporates a high precision temperature compensated pressure sensor along with an integrated programmable controller that is fully temperature, drift and gain compensated.

The gauge displays vacuum in three units: microns, inches Hg and psia. The DVG-1000 is a high accuracy gauge with a resolution of 50 microns, 0.001 psia or 0.002 inches Hg increments for measuring a deep vacuum.

Over-pressure protection is provided by a unique design incorporating a vented manifold with a self sealing relief valve. This relief valve will vent accidental positive pressures up to 100 psi without damage to the sensor. Note: The DVG-1000 is designed to measure the negative pressure of a vacuum only; positive pressure should never be intentionally applied to the input port.

OPERATING PROCEDURE

The DVG-1000 should be connected to the system being serviced only after the refrigerant gas and all positive pressure has been removed from the system. It is recommended that the system be evacuated to the E.P.A. required vacuum with a refrigerant recovery machine such as the Promax Amprobe RG5000 before connecting the DVG-1000.

1. Verify that the system being serviced has been evacuated to the E.P.A. required level for recovery and is ready for the final stage of evacuation using a high vacuum pump. Because of the numerous restrictions and small diameter lines in refrigeration systems, there is no advantage to using a large pump for field service work. A 3 CFM pump is large enough to service up to 10 ton refrigeration units.

2. Connect the DVG-1000 in series between the high vacuum pump and the system being serviced, making sure to place a vacuum-tight valve between the DVG-1000 and the pump to allow for drop tests. See setup diagram on page 7 for details.
3. Turn on the DVG-1000 and start the vacuum pump. The gauge should display atmospheric pressure (approximately 560,000 to 760,000 microns).
4. Open the vacuum-tight valve between the pump and the gauge, allowing the pump to evacuate the system. The display reading on the gauge should start to decrease.
5. Monitor the gauge periodically to determine when the system has been evacuated to the desired vacuum. The DVG-1000 can be turned off between readings since its measurements are absolute and will always display the current pressure which is referenced to an internal vacuum.
6. When the desired vacuum is achieved, close the vacuum-tight valve and turn off the pump. Watch the display readout and verify that it does not change more than is allowed (drop test).
7. If the drop test indicates an unacceptable change in pressure, then the high vacuum evacuation should be repeated. If the change in pressure is excessive or fails to stabilize over a short period of time, then the system should be checked for leaks.
8. If the vacuum in the system continues to change at a steady rate, then you should check for a leak. The DVG-1000 will detect a leak that the standard high pressure test can miss, because the high pressure gauges are not sensitive enough to detect small pressure changes.

9. Check the system for any "freeze-up" situation that may exist. Look for the visible appearance of ice on the outer surfaces. Should a "freeze-up" occur, either introduce dry gas into the system, leaving it there until the ice thaws out and then slowly re-evaporate, or use an infrared lamp to apply heat to the frozen area. Note: if there is more than one frozen area, and you are using heat to thaw them out, start at the area farthest away from the pump. This will keep the water vapor from condensing at a spot even farther away from the pump.

When connecting the vacuum pump to the system, ensure all joints are vacuum tight. It is advisable to use a high vacuum sealant on all connections. Use vacuum lines of the largest diameter and shortest length possible. If the system contains an expansion valve, make sure it is wide open. For best results, remove the core from all "schrader" valves prior to starting evacuation.