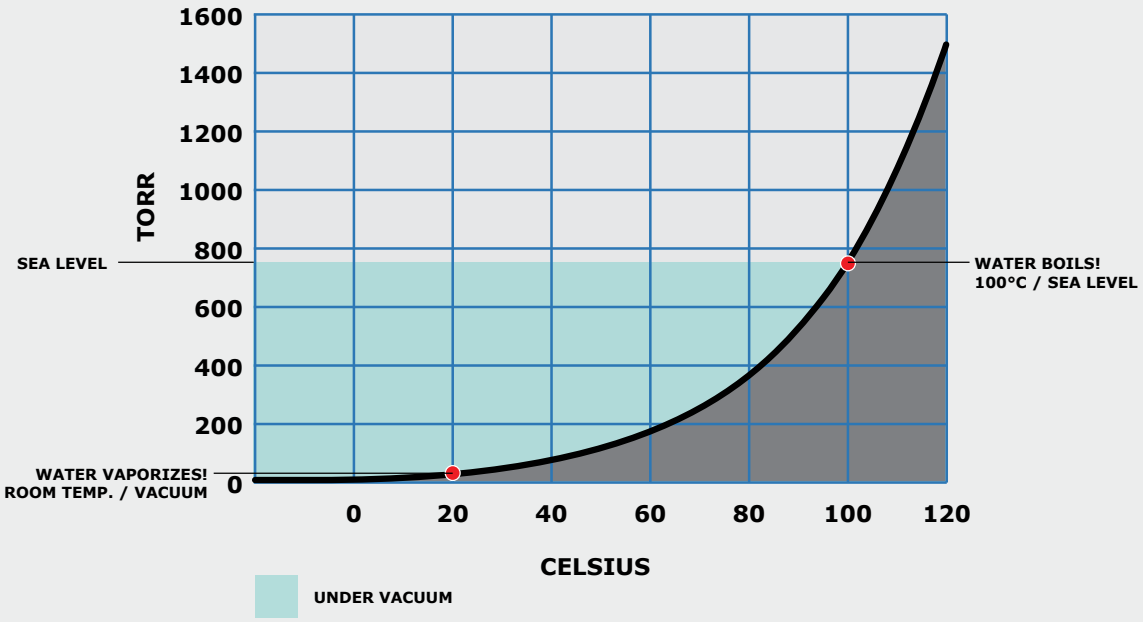
HOW VACUUM WORKS

Editors Note: *There will not be a test on this theory of operation. But it's good to know and may impress at your next geek fest.*

It's best to think of a vacuum oven as a pressure device, rather than a temperature controlled oven. Primarily, it is the change in pressure that is doing the drying, not the heat from the oven. The heat helps, you should use it, but that explanation is for the advanced course.

How does a change in pressure dry? Molecules have a "vapor pressure" – meaning, there is a pressure level at which a molecule will change from a solid molecule (think drop of water) to a vapor. In a vacuum oven you are reaching the vapor pressure of a molecule to change it from a solid to a gas. Then the pumping speed of the vacuum pump removes the vapor from the oven. Viola!

Here is an example of the vapor pressure of water:



Sea level is 760 Torr.
The chart shows that water will turn to a vapor (meaning boil) at about 100°C. This is common knowledge to us folks at sea level.

What would it take to boil water at say, room temp… approximately 20°C? The chart illustrates that at around 20°C, water molecules will turn to a vapor simply by changing the pressure from 760 Torr down to less than 50 Torr.

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VACUUM REFERENCE TABLE

There are many ways to measure vacuum. The TVO Vacuum ovens use a bourdon tube gauge that reads in Inches of Mercury (Hg). When the needle pegs 30", you are at "ultimate vacuum". This should happen fairly quickly. If the needle does not peg 30" quickly - the pump is dealing with a large gas load, or there is a leak in the connections between the oven and the pump.

EQUIVALENCE TABLE FOR PRESSURE / VACUUM MEASUREMENTS

Millitorr / Micron	torr / mmHg	mbar	psi	inches Hg absolute	inches Hg gauge	atmo-sphere	% vacuum	altitude (feet)	torr / mmHg
760,000	760	1013	14.696	29.92	0	1	0	0	760
750,000	750	1000	14.5	29.5	0.42	0.987	1.3	5,000	632.21
735,000	735.6	981	14.2	28.9	1.02	0.968	1.9	10,000	522.73
700,000	700	934	13.5	27.6	2.32	0.921	7.9	15,000	428.75
600,000	600	800	11.6	23.6	6.32	0.789	21	20,000	349.25
500,000	500	667	9.7	19.7	10.22	0.658	34	25,000	281.94
400,000	400	533	7.7	15.7	14.22	0.526	57	30,000	225.55
380,000	380	507	7.3	15	14.92	0.5	50	35,000	178.71
300,000	300	400	5.8	11.8	18.12	0.395	61	40,000	140.82
200,000	200	267	3.9	7.85	22.07	0.264	74	45,000	110.87
100,000	100	133.3	1.93	3.94	25.98	0.132	87	50,000	87.33
90,000	90	120	1.74	3.54	26.38	0.118	88	55,000	68.76
80,000	80	106.6	1.55	3.15	26.77	0.105	89.5	60,000	54.15
70,000	70	98.4	1.35	2.76	27.16	0.0921	90.8	65,000	42.65
60,000	60	80	1.16	2.36	27.56	0.07899	92.1	70,000	33.58
1,700	51.7	68.8	1	2.03	27.89	0.068	93.03	75,000	26.47
50,000	50	66.7	0.97	1.97	27.95	0.0658	93.5	80,000	20.83
40,000	40	63.3	0.77	1.57	28.35	0.0526	94.8	90,000	16.41
30,000	30	40	0.58	1.18	28.74	0.0395	96.1	95,000	12.92
25,400	25.4	38.8	0.4912	1	28.92	0.034	96.6	100,000	10.18
20,000	20	26.7	0.39	0.785	29.14	0.0264	97.4	110,000	8.02
10,000	10	13.33	0.193	0.394	29.53	0.0132	98.7	120,000	5.136
7,500	7.6	10.13	0.147	0.299	29.62	0.01	99	130,000	3.343
1,000	1	1.33	0.01934	0.03937	29.86	0.00132	99.9	140,000	2.269
750	0.75	1	0.0145	0.0295	29.89	0.000987	99.9	150,000	1.276
100	0.1	0.133	0.00193	0.00394	29.916	0.000132	99.99	160,000	1.128
10	0.01	0.0133	0.000193	0.000394	29.9196	0.00000132	99.999	170,000	0.8268
1	0.001	0.00133	0.000193	0.0000394	29.91996	0.0000013	99.99999	180,000	0.6154
0.1	0.0001	0.000133	0.00000193	0.00000394	29.91999	0.0000001	99.99999	190,000	0.4592
								200,000	0.3432
								250,000	0.04557

Sea Level

Expected Vacuum Range