

Calculating Boiling Points Under Vacuum with a Nomograph

The picture below is called a nomograph. With the aid of it and a ruler, you can determine at what temperature a certain liquid will boil under vacuum. You can also work backwards to estimate the strength of your vacuum.

Determining the boiling point of a liquid under a certain vacuum

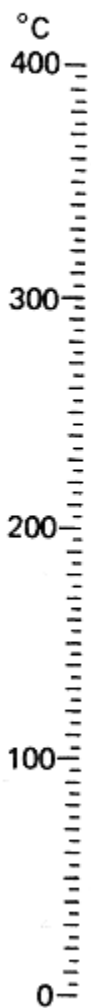
In this example, we assume that your vacuum source pulls 20 mmHg (20 Torr), and you want to determine the boiling point of water at 20 Torr. The boiling point of water at normal pressure (760 Torr) is 100°C. With the aid of a ruler, draw a line from 20 Torr in the pressure graph (to the right), through 100°C in the middle graph ("boiling point corrected to 760 torr", this is the normal atmospherical pressure), and where this line intersects the line to the left ("Observed boiling point"), take your reading. About 15°C, right? This means that at a vacuum of 20 Torr, water will boil at 15°C, well below normal room temperature.

Determining the strength of an unknown vacuum

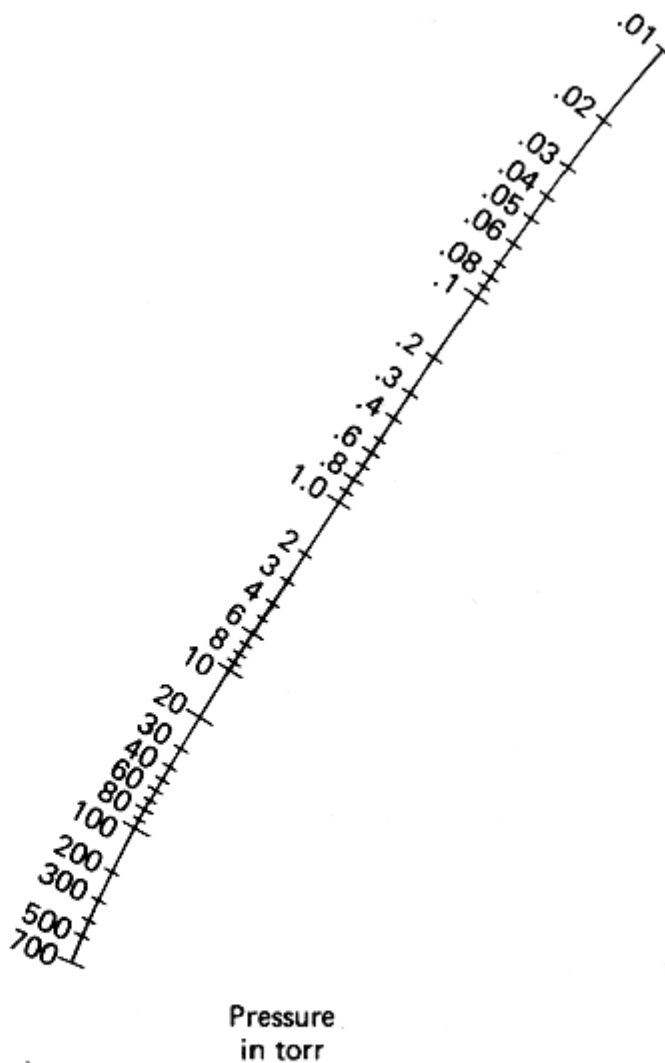
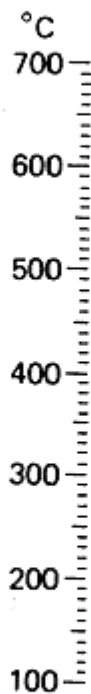
Suppose you have bought a brand new vacuum pump, but you don't know how much it will pull. The nomograph can help you with this too. To do this, you need to heat a quantity of liquid with a known boiling point with your vacuum pump attached. We will use water in our example again. A distillation apparatus would be a good for this. When distilling, you observe that the water boils at a temperature of 40°C after you have waited for the temperature to stabilize. You know that the normal boiling point of water is 100°C. Draw a line through 40°C in the leftmost graph, through 100°C in the middle one, and notice where the line intersects the pressure graph, at about 100 mmHg. This is how much your new vacuum pump will pull.

Note: All readings are approximate. The exact data depends on the nature of the distilled compound, and may differ by about 10%.

Liquid Name		
Boiling Point of Liquid at Room Temp		
Boiling Point under Vacuum	Temp	Vac



B.P. corrected to 760 torr



Observed B.P.