Manometer Encyclopedia Article

Manometer

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Manometer

Manometers, first invented in the seventeenth century, are used to measure the pressure of gases. During the 1600s, scientists tried to explain natural phenomena in logical, rational ways, instead of relying on mystical or magical explanations. At this time, most people, including the great scientist Galileo, believed water pumps demonstrated the commonly held theory that nature abhors a vacuum, but because they were unaware that air and other gases exert pressure, they could not explain why a pump could not raise water more than thirty-two feet (9.7 m). In 1643 Italian physicist Evangelista Torricelli tried to explain this phenomenon. In his experiments Torricelli used a vertical tube filled with mercury to measure air pressure, and, in doing so, he created the first mercury barometer, proving that air has weight and exerts pressure on all objects and substances on Earth. Soon afterward, British chemist Robert Boyle used a mercury barometer to determine the relationship between the pressure of air and its volume. In these experiments both Torricelli and Boyle used rudimentary versions of the manometer.

The simplest manometers are open-ended, U-shaped tubes that are partially filled with mercury, oil, or some other liquid. When a container of gas is connected to one end of the tube, the pressure of the gas causes the liquid in the manometer to become displaced and rise up into the arms of the tube. If the pressure of the gas introduced into the manometer is greater than the atmospheric pressure, the liquid will rise up into the open-ended arm; if the atmospheric pressure is greater, liquid rises up into the closed portion of the tube. From the amount of liquid which is displaced, scientists can determine the pressure of the gas.

Since its invention, the manometer has been altered and used for several different purposes. In some laboratory manometers, one arm of the tube is inclined at an angle instead to provide more accurate measurements. Other manometers contain a sealed-off vacuum at one end, so that changes in atmospheric pressure don't have to be accounted for in calculations. In research and industry, a special type of manometer called a McLeod gauge is used to measure extremely low pressures. Other common types of manometers include the sphygmomanometer, which is used to measure blood pressure.