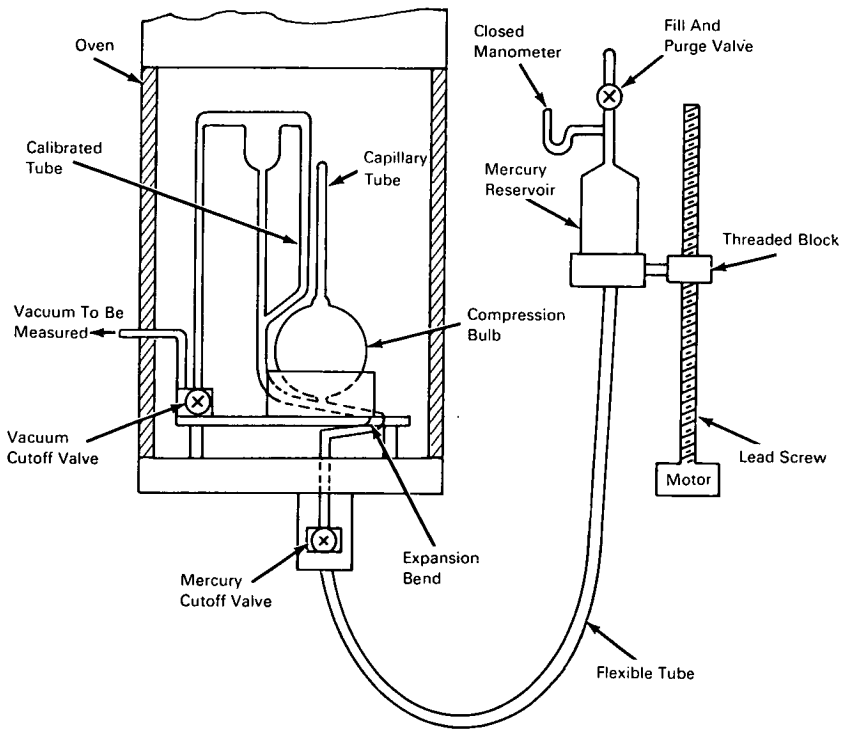
November 1965

Brief 65-10329

NASA TECH BRIEF

Baking Enables McLeod Gauge to Measure in Ultrahigh Vacuum Range



The problem: To effectively degas the glass walls of a conventional McLeod gauge in order to achieve measurements in the ultrahigh vacuum range. Conventional gauges use air pressure, CO_2 pressure, or a piston and cylinder to force the mercury from the reservoir into the gauge. In these arrangements contaminants come in contact with the mercury and impinge on the gauge walls so that only limited vacuums can be accurately measured. In the past, the glass walls have been degassed by means of a gas torch or electrical heating tape.

The solution: A closed system in which the mercury is forced into the gauge by gravity alone, and in which the gauge components may be baked out at 450°C for long periods (10 to 20 hours) to achieve complete degassing.

How it's done: Except for the expansion bend that permits expansion without rupture during bakeout, the gauge portion of the system is conventional. Below the expansion bend, the gauge tubing passes through a hole in the oven base into a stainless steel mercury

(continued overleaf)

cutoff valve. A flexible stainless steel tube connects the mercury cutoff valve to the stainless steel mercury reservoir that can be raised and lowered by means of a threaded block and lead screw arrangement. Atop the reservoir there is a closed-end manometer that continuously indicates the level of vacuum in the reservoir. A stainless steel valve above the manometer permits addition or removal of mercury and also permits purging of any gas in the reservoir.

As the mercury reservoir is raised by action of the threaded block and lead screw, mercury enters the compression bulb and compresses a portion of the gas, whose pressure is to be measured, into the capillary tube above the compression bulb. Obeying Boyle's law, the compressed gas exerts sufficient pressure to support a column of mercury in the calibrated tube sufficient for a reading. Readings are essentially independent of the composition of the gas.

Following the reading, the reservoir with its purge valve open is lowered until all mercury has drained to a point below the mercury cutoff valve, the valve is closed and the oven is fired for gauge bakeout in preparation for its next use.

Note: This system makes an excellent tool for the calibration of instruments designed for use in ultra-high vacuum ranges and which are more convenient to use for frequent measurements.

Patent status: Title to this invention has been waived under the provisions of the National Aeronautics and Space Act (42 U.S.C. 2457 (f)), to the GCA Corporation, Bedford, Massachusetts.

Source: Wallace S. Kreisman of GCA Corporation under contract to Goddard Space Flight Center (GSFC-440)