# Westinghouse

## McLeod Vacuum Gauge

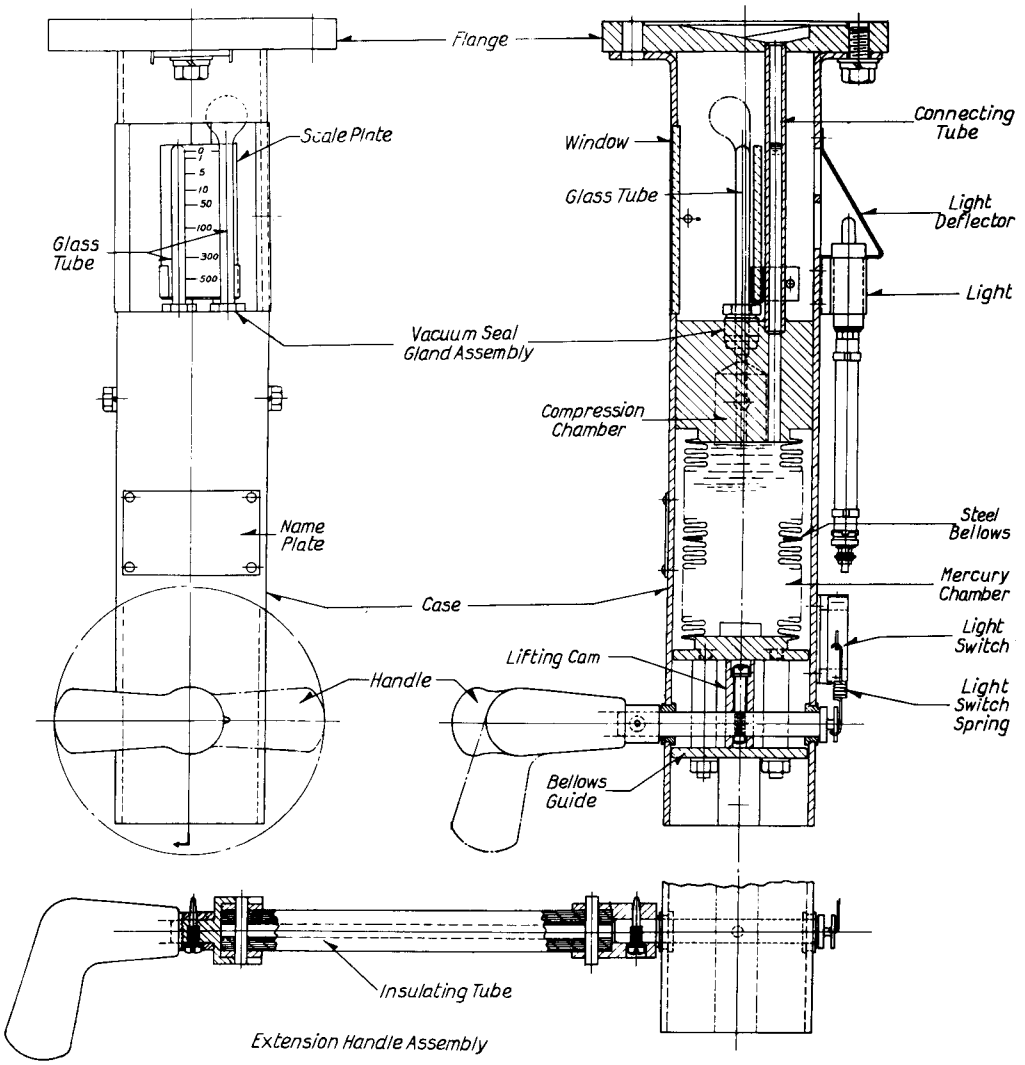


FIG. 1 — MCLEOD VACUUM GAUGE (BELLOWS TYPE)

GENERAL:

In high vacuum, (low pressure) practice where pressures of the order of 1 micron, or a millionth of a meter of mercury column (1/760,000 of an atmosphere) are encountered, a special form of gauge is required, since the eye cannot detect directly so small a difference in height. The McLeod gauge provides such a measurement by taking a sample of the gas and compressing it to a degree where it will support the head of mercury to a readable value.

OPERATION:

The gauge operates on the principle of Boyle's law for a perfect gas.

$$P_1 V_1 = P_2 V_2$$

where $P_1V_1$ and $P_2V_2$ are the pressures and volumes before and after compression. Gas in the vessel in which the pressure is to be measured and in the gauge equalize through the connecting steel tube that is welded to the connecting flange. Since the mercury level with the gauge in the lowered position is below the compression chamber, gas is admitted to both glass tubes (refer to Fig. 1). To take a reading, the gauge handle, which operates a cam against the lower portion of the bellows constructed mercury chamber, is turned. The mercury level is raised and traps the gas in the compression chamber and tubes and is further raised until the mercury column reaches the zero line back of the long tube, (right hand tube). The gas in the compression chamber is compressed into the small end of the closed tube which raises the pressure to a readable value.

The neight of mercury in the short tube is read on the scale. This scale is calibrated in microns. A light back of the scale plate is automatically operated from the cam shaft to facilitate taking readings in poorly lighted installations.

NOTE: Do not attempt to take a reading with atmospheric pressure on the gauge as mercury may be forced out of the flange. The quantity of mercury in the bellows chamber is critical in this gauge.

CONSTRUCTION:

The bellows type gauge consists of a piece of square tubing bolted to the connecting flange which covers the mercury chamber and movable bellows assembly. The tubing has a machined recess and a window through which the scale plate can be viewed.

The inner part of the gauge consists of a steel bellows mercury chamber welded to a steel block in which a compression chamber is machined. The steel block and flange are permanently connected by a steel tube, thereby making the connecting flange, steel tube and bellows chamber a complete factory-fabricated assembly.

Compression of the bellows is caused by a cam acting on the lower portion of the bellows assembly. The removable handle actuates the cam shaft to take pressure readings. The handle should normally be held in the lower bellows position or pointing to the floor.

MAINTENANCE:

This gauge is completely welded and vacuum tested before leaving the factory and is also filled with the necessary amount of mercury.

This gauge has a distinct advantage over other commercial gauges in that all the parts are made of metal so that once the gauge is properly degassed, no further gas will be given off to affect the readings.

In case a leak is suspected, the 3-way spigot valve should be closed and the pressure read in the gauge every few minutes for approximately 20 minutes. The leakage rate should be approximately 1 micron per minute. If the leakage rate is higher than this, a search for a leak should be made. The gland nuts around the tubes should first be tightened and another leakage taken. If the gauge leakage is still high, it should be dismantled and air pressure applied to the interior of the mercury chamber through the flange. All parts should be covered with liquid soap. The appearance of bubbles will indicate the location of the leak. If the leak occurs in the bellows proper, a new bellows assembly should be ordered from the factory. It is very improbable that a leak in the bellows can be satisfactorily repaired in the field.

In searching for a leak in the interior of the gauge, the mercury should be removed and kept in a glass jar or beaker. If the mercury is carefully removed, without loss, it should be returned to the mercury chamber after the location and repair of the leak. The amount of mercury necessary for proper operation is determined by a cut and try method as each bellows has a slightly different volume. There should be sufficient mercury in the chamber so that when connected to a vacuum and the cam is in the upper position both columns of mercury reach the zero line. If too much mercury is added, the compression chamber may be trapped when the bellows is in its lower position. Care should be taken to insure that both of these conditions are met.

After a gauge has been dismantled, it will probably read inaccurately for several days or until the trapped gas has been removed from the mercury chamber.

**Westinghouse Electric & Manufacturing Company**

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