



TECHNICAL NOTE

Vacuum Gauge Calibration Options

INTRODUCTION

Manufacturers are often required by their customers to have “calibrated” or NIST certified vacuum gauges. However, there is a great deal of uncertainty as to the actions necessary to meet specified requirements. Unfortunately, the governing bodies (the customer and ultimately the government) have given very little specific direction. Mil spec 45662 is often referenced, but only gives general information.

WHAT CALIBRATION ISN'T

Several alternatives are presented below to help manufacturers meet calibration requirements. However, it is important to first define what calibration is not:

“Test heads” or “gauge simulators” are not calibration heads. Their purpose is to check meter alignment of analog gauges and performance of digital instruments. Performance verification can be done periodically between calibrations, but is not a substitute for calibration. “Test heads” are available from most

vacuum gauge manufacturers for performance verification, not calibration. All vacuum gauge calibrations must include the sensor which is the primary source of error. “Test heads” or “gauge simulators” bypass the sensor.

Zero and span adjustments are also not calibration. These adjustments should always be made prior to calibrating an instrument, but they are not a substitute for it. (Span adjustments apply to Pirani sensors only.)

SEVERAL CHOICES

There are several options available to satisfy the need for calibration. They vary in cost, equipment requirements, time, and the traceability to NIST.

WHAT'S BEST

The best option for manufacturers will depend on the number of systems, availability of capital and manpower, and process requirements.

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Calibration Service

Periodically send the gauge system (controller, sensor, cable) to a calibration service that will compare it to a NIST traceable transfer standard and provide a certificate with proof of traceability. Manufacturers who choose this option will need to inventory spare calibrated gauge systems for rotation when production systems are sent out for calibration. Turnaround time is typically 2-4 weeks.

Advantages:

- Low capital investment required (spare gauges if desired).
- No manpower required to perform calibrations.

Disadvantages:

- Long-term costs increase proportionally to the number of systems requiring calibration.
- Extended calibration lead times may become a problem if a calibrated spare is not available.

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(continued)

Check Standard

Purchase an in-house “check standard” that has been NIST certified. The “check standard” consists of a controller, gauge, and cable that is periodically sent out for NIST certification and is used for comparison evaluation of process systems.

- a) A pump cart with all the appropriate crosses, tees, and fittings is purchased. The gauges are periodically removed from the system and put on the pump cart where they are compared to the NIST traceable gauge package.
- b) Vacuum system sensors are temporarily or permanently mounted on a tee. Certified gauges are mounted on the tee alongside the system sensors to “check calibration.”

Advantages:

- In-house capability provides maximum flexibility, minimizes system downtime.
- Long-term costs are low.
- Up-front costs for (b) are low.

Disadvantages:

- Manufacturers must keep their own detailed calibration records.
- Manpower must be allocated and trained to perform regular calibration duties.
- Up-front costs for (a) are high due to pump cart costs.

Transfer Standard

Another option similar to “check standard,” uses a NIST traceable spinning rotor gauge (SRG) as an in-house standard. It can be used with a pump cart or brought to each furnace to check calibration. The SRG is used by NIST as a primary transfer standard for high vacuum gauges. Depending on process calibration specifications, additional sensors for roughing pressures may be required.

Advantages:

- The SRG is more accurate than a hot cathode gauge, and therefore makes a better calibration standard.

Disadvantages:

- Large capital investment required.
- More training required to operate SRG.
- NIST certification of SRGs is costly.

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