

Calibration of pressure gauges

Highest accuracy with Pfeiffer Vacuum solutions



Vacuum is essential to manufacture many high-tech products and articles used in daily life: For example, vacuum technology plays a crucial role in applications of research and development, industrial processes, chips for cell phones, hard drives, solar cells, the drying of plastic parts or vacuum-packaged foods.

In an age characterized by precision and standards, reliable and reproducible measurement of the pressure required for production is essential. When recording measurements, high accuracy is crucial:

It has a direct impact on the quality of the manufactured products, the validity of scientific experiments and the reliability of the equipment used.

To ensure the high reliability of the pressure gauges used, they must be calibrated regularly. Depending on the specific requirements of each application, these calibrations should meet national or international standards.

Calibrate instead of having it calibrated

Particularly with high volumes or short calibration intervals, external calibration of the measuring instruments by a commercial provider can be time-consuming and costly.

Here, the compact calibration pumping stations by Pfeiffer Vacuum constitute an attractive alternative. The easy-to-use mobile systems are designed for the simultaneous checking of multiple measuring instruments and enable fast, ergonomic calibration on site.



Figure 1: HiCube calibration pumping station

Calibration requirements

The following requirements must be fulfilled prior to calibration:

- The final pressure ρ_E of the system must exceed the smallest calibration pressure ρ_{min} by a factor of 50 ($\rho_E \leq \rho_{min}/50$)
- The ambient temperature must be constant ($\pm 1^\circ\text{C}$)
- The calibration system must be thermally stabilized
- The reference gauges and gauge heads to be measured must be able to stabilize in operation under vacuum

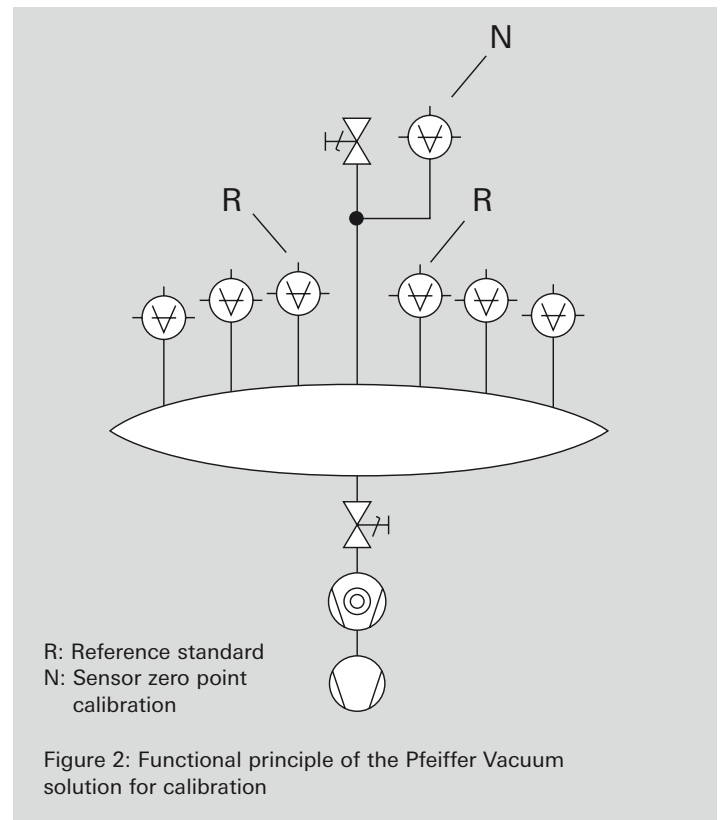
The Pfeiffer Vacuum solution

Pfeiffer Vacuum offers compact mobile calibration pumping stations. They consist of a combination of a turbo pumping station (e.g., HiCube 80 Eco) and a glass pearl blasted stainless steel recipient.

The turbo pumping station consists of a turbopump with a Holweck stage (HiPace 80) and a dry compressing diaphragm pump (MVP 015-2). It has a pumping speed of up to 67 l/s and reaches a final pressure of up to $1 \cdot 10^{-7}$ hPa.

The recipient has six concentrically arranged gauge connections. If requested by the customer, two reference standards (1 hPa and 1,000 hPa pressure transducer) and a cold cathode gauge head can be pre-installed, e.g., for pressure control and zero-point adjustment. All gauge heads are pre-calibrated and certified in compliance with the standards of the German Accreditation Body (German: Deutsche Akkreditierungsstelle – DAkkS). This ensures that the calibration of the gauge heads has been carried out competently and is in compliance with legal as well as normative requirements and was implemented on an internationally comparable level.

Additionally, up to four pressure gauges can be simultaneously flanged to the gauge connections for calibration. Identical vacuum requirements apply for all six gauge connections. A separate gas inlet connection with a dosing valve allows the setting of defined pressures during calibration.



R: Reference standard
N: Sensor zero point calibration

Figure 2: Functional principle of the Pfeiffer Vacuum solution for calibration

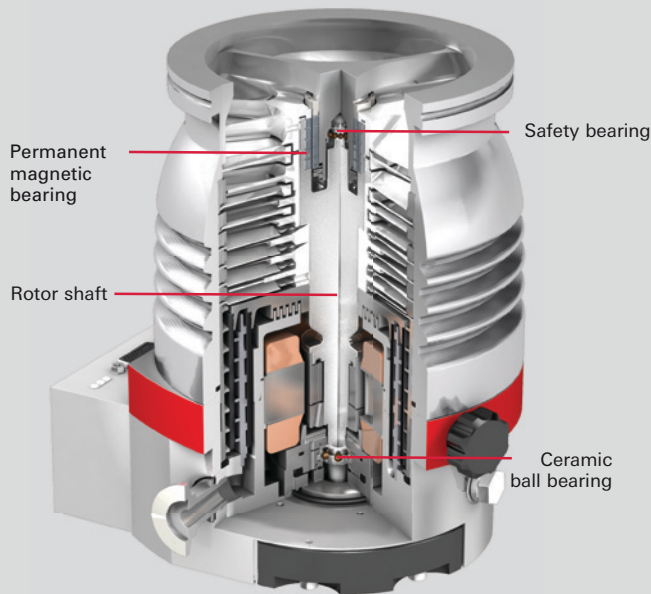


Figure 3: Cross-section of a HiPace turbopump

The components of the system at a glance

Turbopumps

Turbomolecular pumps (in short: turbopumps, TMP) consist of a multi-stage, turbine-like rotor with bladed disks driven by a brushless DC motor with hybrid bearing support. Between the rotor disks, there are bladed stator disks that have a similar geometry like the rotor disks and are arranged mirror-inverted of each other.

The principle of the turbopumps is the pulse transmission from fast rotating blades onto the gas molecules to be pumped. The molecules hit the rotating blades, are adsorbed and then leave the blades with a new speed, which consists of the blade speed and the thermal molecular speed. In order to prevent a slowdown by other molecules, the mean free path length¹⁾ must exceed the blade spacing. Therefore, a backing pump is connected upstream of the turbopump, which ensures that the particle density in the turbopump is small enough.

The turbopumps from Pfeiffer Vacuum stand out due to:

- High levels of compression and gas throughput
- High critical backing pressure
- Integrated electronic drive unit and cooling system
- High pumping speed: 10 to 2,000 l/s

Diaphragm pumps

With the diaphragm pump, a driven connecting rod moves a tensioned diaphragm. This sucks the gas through the inlet valve into the suction chamber and then conveys it through the outlet valve to the outside.

During this process, the pump can reach a final pressure of 70 hPa with a pumping speed of up to approx. 10 m³/h.

Advantages of Pfeiffer diaphragm pumps:

- Dry and oil-free
- Long service life of the diaphragm
- Low vibration and noise
- High reliability
- Easy to maintain

The Pfeiffer Vacuum calibration pumping stations enable reliable and high-quality pressure measurement in all kinds of production processes.

Advantages of Pfeiffer Vacuum calibration pumping stations at a glance:

- Cheaper than external calibration
- Compliance with national and international standards
- Portable calibration station for on-site calibration
- Several instruments can be calibrated simultaneously

¹⁾ Mean path length traveled by a particle between two consecutive collisions with other particles.

**Vacuum solutions
from a single source**

Pfeiffer Vacuum stands for innovative and custom vacuum solutions worldwide, technological perfection, competent advice and reliable service.

**Complete range
of products**

From a single component to complex systems: We are the only supplier of vacuum technology that provides a complete product portfolio.

**Competence in
theory and practice**

Benefit from our know-how and our portfolio of training opportunities! We support you with your plant layout and provide first-class on-site service worldwide.

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perfect vacuum solution?
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