

Granite Parallel Gauge Introduction

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1. Product Introduction

1.1 Definition and Function

A granite parallel gauge is a high-precision measuring and positioning tool meticulously fabricated from top-grade natural granite. Characterized by two flat, parallel surfaces, it serves as a reliable reference for ensuring dimensional accuracy and geometric precision in manufacturing and inspection processes. Its primary function is to provide a stable, unchanging standard for checking the **parallelism** of surfaces, as well as for supporting workpieces during measurement or machining operations. For example, when measuring the thickness of a flat workpiece with a dial indicator, the granite parallel gauge can be placed under one end of the workpiece to create a level and parallel reference plane. This setup enables precise thickness measurement by comparing the indicator readings at different points, ensuring the accuracy of the measurement results.

1.2 Structure and Components

- **Base Material:** Constructed from dense, fine-grained granite, the parallel gauge benefits from the material's excellent physical properties. Granite has a very low coefficient of thermal expansion, typically around 0.5 - 1.0 ppm/°C. This characteristic ensures that the gauge maintains its dimensions even when exposed to significant temperature fluctuations, guaranteeing consistent measurement accuracy. Additionally, granite is highly resistant to corrosion, wear, and magnetic interference, making the parallel gauge durable and suitable for long-term use in various industrial environments.
- **Parallel Surfaces:** The two main surfaces of the granite parallel gauge undergo a series of precision grinding and lapping processes. These operations result in surfaces with an extremely high level of flatness and parallelism. High-quality gauges can achieve flatness tolerances within a few micrometers, and the parallelism between the two surfaces is typically maintained within very tight limits, often within 1 - 3 micrometers over the length of the gauge. The surfaces are polished to a smooth finish, usually with a surface roughness in the range of Ra 0.2 - 0.8 μm . This smooth finish reduces friction when in contact with workpieces, ensuring accurate and consistent measurement results.
- **Shape and Sizes:** Granite parallel gauges usually come in rectangular bar shapes. They are available in a wide range of sizes to meet different application requirements. The lengths can vary from a few centimeters to several hundred centimeters, widths from several centimeters to tens of centimeters, and thicknesses are also adjusted according to specific needs. Smaller gauges are convenient for measuring smaller components or in confined spaces, while larger gauges are suitable for inspecting or supporting larger workpieces. Some parallel gauges may also have additional features, such as tapped holes on the surfaces. These holes can be used to mount fixtures or accessories during measurement operations, enhancing the versatility of the gauge.

1.3 Working Principle

The working principle of a granite parallel gauge is based on the precision of its parallel surfaces. When checking the parallelism of two surfaces of a workpiece, the gauge is placed

on a flat reference surface, such as a granite surface plate. The workpiece is then positioned on top of the gauge. A dial indicator or other measuring devices are used to measure the distance between the workpiece surface and the gauge surface at multiple points. If the readings at all points are the same (or within the allowable tolerance range), it indicates that the workpiece surface is parallel to the gauge surface. When using the gauge for workpiece support during machining or measurement, its stable and parallel surfaces ensure that the workpiece remains level and correctly positioned. This reduces errors caused by uneven support, enabling accurate machining and measurement. The stable nature of the granite material also ensures that the gauge remains unaffected by external factors such as vibrations and temperature changes during the measurement process, providing reliable and consistent results.

2. Application Scenarios

2.1 Precision Machining

In precision machining, granite parallel gauges are essential tools for quality control. They are used to set up workpieces accurately. For instance, when milling a flat surface on a workpiece, the gauge can be placed under the workpiece to ensure that the surface to be machined is parallel to the milling cutter's path. This helps in achieving a uniform cut and the desired surface finish. After machining, the parallel gauge is used to check the parallelism of the machined surfaces, ensuring that the parts meet the strict dimensional requirements. In the production of precision molds, granite parallel gauges play a crucial role in ensuring that the mold components are parallel to each other. This is essential for proper mold assembly and the quality of the molded products.

2.2 Metrology and Calibration

Metrology and calibration laboratories rely on granite parallel gauges as important reference standards. They are used to calibrate other measuring instruments related to parallelism measurement, such as parallelism gauges and some components of coordinate measuring machines (CMMs). By comparing the measurements of these instruments with the known high-precision parallelism of the granite parallel gauge, technicians can verify and adjust the accuracy of the instruments. This calibration process is vital for maintaining the traceability and reliability of measurement results across different industries. It ensures that all measurements are consistent and accurate, which is particularly important in fields where precision is critical, like aerospace, semiconductor, and medical device manufacturing.

2.3 Aerospace and Defense Industries

In the aerospace and defense sectors, where components must meet extremely tight tolerances, granite parallel gauges are indispensable. They are used to inspect the parallelism of aircraft structural parts, such as wing spars, fuselage frames, and engine components. Ensuring the parallelism of these parts is critical for the aerodynamic performance, structural integrity, and overall functionality of aerospace vehicles. In the production of missile components, the gauge helps in accurately positioning and measuring parts to ensure proper assembly and the reliability of the missile system. Any deviation from parallelism in these components can lead to significant performance issues, making the granite parallel gauge a key tool for quality assurance in these industries.

2.4 Electronic Component Manufacturing

In the manufacturing of electronic components, especially those with flat and precisely-

dimensioned parts, granite parallel gauges are widely used. For example, when manufacturing printed circuit boards (PCBs), the gauge can be used to check the parallelism of the layers or the flatness of the board surface. This is important for ensuring the proper alignment of components during assembly and the overall performance of the electronic device. In the production of semiconductor wafers, the parallel gauge can assist in positioning and measuring the wafers to ensure accurate processing and high-yield production. The high precision and stability of the granite parallel gauge make it suitable for meeting the strict requirements of the electronic component manufacturing industry.

3. Maintenance and Troubleshooting

3.1 Maintenance

- **Regular Cleaning:** After each use, the granite parallel gauge should be thoroughly cleaned. Use a soft-bristle brush and a mild, non-abrasive cleaning agent to gently remove dirt, debris, metal shavings, and oil from the surfaces. Avoid using harsh chemicals or abrasive tools that could scratch the surface of the gauge. Rinse the gauge with clean water and dry it carefully using a clean, lint-free cloth. Regular cleaning not only maintains the appearance of the gauge but also prevents the accumulation of contaminants that could interfere with measurement accuracy.
- **Inspection for Damage:** Periodically inspect the granite parallel gauge for any signs of damage, including cracks, chips, or scratches. Even minor damage on the parallel surfaces can cause inaccuracies in measurement. Pay close attention to the edges and corners of the gauge, as these areas are more susceptible to damage during handling. If any damage is detected, the gauge should be repaired or replaced immediately, depending on the severity of the damage.
- **Proper Storage:** Store the granite parallel gauge in a clean, dry environment. If possible, cover it with a protective cloth or case to prevent dust and debris from settling on the surface. Avoid storing the gauge in areas with high humidity or extreme temperatures, as these conditions can cause the granite to expand, contract, or corrode over time. When not in use, place the gauge on a stable, level surface to prevent deformation.
- **Calibration:** Regular calibration is crucial for maintaining the accuracy of the granite parallel gauge. Calibration should be performed using a high-precision reference standard, such as a master parallel gauge or a calibrated flat plate with known parallelism. The calibration process involves comparing the parallelism of the granite gauge with the reference standard and making any necessary adjustments. The calibration interval depends on the frequency of use and the criticality of the measurements, but it is generally recommended to calibrate the gauge at least once a year.

3.2 Troubleshooting

- **Inaccurate Parallelism Measurements:** If the measurements of parallelism using the granite parallel gauge are inaccurate, first check the cleanliness and condition of the gauge. Re-clean the gauge and conduct a detailed inspection for any signs of damage or wear. If the gauge appears to be in good condition, the issue may be related to calibration. Re-calibrate the gauge as per the calibration procedure. Additionally, ensure that the measuring instruments used in conjunction with the

gauge, such as dial indicators, are properly calibrated and used correctly.

- **Surface Irregularities:** When the surfaces of the granite parallel gauge show signs of irregularities, such as small bumps or depressions, it may be due to wear, damage, or improper handling. For minor surface imperfections, a professional may be able to refinish the surface through precision grinding and lapping. However, if the irregularities are severe or widespread, it may be necessary to replace the gauge to ensure accurate measurements.
- **Lack of Stability During Use:** If the gauge feels unstable or shifts during measurement or workpiece support, check the surface on which it is placed. Ensure that the base surface is flat and stable. If the problem persists, there may be an issue with the gauge's structure, such as internal cracks or deformation, and it should be inspected and repaired or replaced as necessary.

4. Performance Characteristics

- **High Precision:** Granite parallel gauges can achieve an extremely high degree of parallelism and flatness precision. With tolerances often within a few micrometers, they are capable of meeting the stringent requirements of high-precision manufacturing and metrology applications. This high precision allows for accurate measurement and positioning of workpieces, ensuring the quality of products in industries that demand strict dimensional control.
- **Dimensional Stability:** Due to the low thermal expansion coefficient of granite, these gauges maintain their shape and dimensions even when exposed to significant temperature variations. This stability ensures consistent measurement results over time, reducing the need for frequent recalibration and minimizing errors caused by thermal expansion or contraction. It enables reliable measurements in various working environments, regardless of temperature fluctuations.
- **Durability:** Made from durable natural granite, parallel gauges are resistant to corrosion, wear, and impact. They can withstand the rigors of regular use in industrial environments without significant degradation in performance. The robust construction of granite ensures that the gauge can maintain its accuracy and functionality for a long time, providing a cost-effective solution for measurement and inspection tasks.
- **Vibration Damping:** The dense structure of granite effectively absorbs vibrations, providing a stable platform for measurement and workpiece support. This vibration-damping property helps eliminate errors caused by external disturbances, enabling more accurate and reliable results, especially in environments where vibrations are prevalent, such as near operating machinery.
- **Ease of Use:** Granite parallel gauges have a simple and straightforward design, making them easy to handle and use. Their flat and parallel surfaces allow for quick and accurate alignment with workpieces, and the smooth surface finish reduces friction, facilitating seamless operation during measurement and positioning processes. Even operators with basic knowledge of measurement techniques can use the gauge effectively.

