AILEIKE ALKT512 Micro-Pressure Calibration Bench

Technical White Paper

1. Product Overview and Technical Background

1.1 Product Overview

The AILEIKE ALKT512 Micro-Pressure Calibration Bench is a precision manual pressure source specifically designed for high-precision calibration and verification of micro-pressure instruments. Featuring an open-frame design and using clean air as the working medium, it offers core advantages such as smooth pressure ramping, reliable sealing, user-friendly operation, and simple maintenance. It is suitable for both fixed laboratory calibration and mobile on-site testing scenarios.

1.2 Technical Background

1.2.1 Driven by Industry Demand

Micro-pressure measurement technology is widely used in numerous industries, including pharmaceuticals, aerospace, semiconductors, and chemicals. The accuracy of micro-pressure instruments directly impacts process control stability, monitoring reliability, and product quality consistency. With the continuous improvement of industrial automation and the rapid development of metrology technology, the market has set higher standards for the calibration of micro-pressure instruments.

Multi-scenario Adaptability: The growing demand for on-site calibration requires equipment to offer excellent portability, environmental adaptability, and rapid switching between positive and negative pressure.

Efficiency Improvement: There is an urgent need to optimize calibration workflows; dual-output interfaces can reduce wiring and switching time, significantly improving work efficiency.

1.2.2 Technological Trends

Micro-pressure calibration technology is rapidly evolving toward higher precision, integration, convenience, and standardization:

High-precision pressure regulation: Through the optimized combination of precision mechanical structures and fine-tuning mechanisms, pressure control accuracy at the 1 Pa level is achieved, meeting the demand for improved precision in micro-pressure sensors.

Standardized and modular interfaces: The use of M20×1.5 universal threaded interfaces (customization available) ensures compatibility with mainstream micro-pressure instruments, while the dual-output interface design drives the standardization of calibration processes.

Sealing Technology Innovation: The combination of aging-resistant sealing materials and precision machining processes significantly reduces pressure leakage rates, ensuring long-term pressure stability.

Lightweight and Portable Design: Optimized structural design controls the device’s size and weight while maintaining accuracy, meeting the portability requirements of on-site calibration.

1.2.3 Core Technology Support

Precision Pressure Regulation Technology: Utilizes a two-stage regulation system consisting of “coarse adjustment via a manual pressure adjustment handle + fine adjustment via a micro-adjustment device” to achieve 1 Pa-level precision control and ensure stable pressure output.

Rapid Positive/Negative Pressure Switching Technology: Through an optimized internal air circuit design, rapid switching between positive and negative pressure is achieved without replacing any components, accommodating the calibration needs of bidirectional micro-pressure instruments.
High-Reliability Sealing Technology: Utilizes aging-resistant sealing materials in conjunction with precision-machined air passage chambers to achieve low leakage rates, ensuring pressure stability during the calibration process.
Open-Structure Design: Balances operational convenience with service accessibility, reducing operating and maintenance costs while extending the equipment's service life.

2. Technical Parameters and Performance Indicators

2.1 Basic Technical Parameters

Parameter Category	Technical Specifications	Notes
Operating Environment	Laboratory or Field Use	Suitable for various working environments
Ambient Temperature	-10 to 60°C	Wide operating temperature range
Relative Humidity	<80%	Moisture-resistant design
Pressure Range	-10 to 10 kPa	Supports both positive and negative pressure requirements
Measured Medium	Clean air	Excellent compatibility with various media
Pressure Output	2	Can connect both standard meters and test meters simultaneously
Threaded Connection	M20×1.5 or as specified by the user	Flexible interface configuration
Adjustment Precision	min 1 Pa	High-precision pressure regulation
Dimensions	320×190×140 mm	Compact design
Weight	4.9 kg	Easy to carry

2.2. Key Performance Features

Open-frame design: Rational structure, intuitive operation, smooth pressure regulation, leak-resistant, and easy to maintain and service, thereby reducing operating and maintenance costs and extending the equipment's service life.
Regulation accuracy: Regulation precision as fine as 1 Pa, meeting the high-precision calibration requirements of low-pressure instruments, ensuring accurate and reliable measurement traceability, and suitable for calibrating modern high-precision low-pressure sensors.
Dual Output Port Design: Equipped with two pressure output ports, it allows simultaneous connection of the calibrator and the instrument under test, eliminating the need for frequent port switching, significantly improving calibration efficiency, and accommodating various low-pressure instrument calibration scenarios.
Quick Positive/Negative Pressure Switching: Enables rapid switching between positive and negative pressure without the need to replace equipment or components, meeting the calibration

requirements of different types of low-pressure instruments and expanding the device's range of applications.

Sealing Performance: Utilizing high-quality sealing materials and precision machining processes, the unit offers excellent sealing performance. This effectively prevents pressure leakage, ensures stable pressure during calibration, and enhances calibration accuracy and repeatability.

Lightweight and Portable Design: Weighing 4.9 kg with a compact size, the unit is easy to carry. It is suitable for both laboratory and field operations, meeting the portability requirements for on-site calibration.

3. Operating Procedure

3.1. Preparations

(1) Place the calibration bench on a stable, level work surface to ensure the equipment is secure and free from wobbling.

(2) Inspect the equipment's exterior to confirm there is no damage, no signs of leakage, and that the O-rings are intact.

(3) Connect the standard gauge to one of the pressure output ports and the gauge under test to the other port, ensuring the connections are secure and properly sealed.

(4) Select the positive or negative pressure mode according to calibration requirements, and ensure the gas lines are connected correctly.

(5) Verify that the relief valve is closed and the shut-off valve is open.

3.2. Pressure Calibration Procedure

(1) Turn the pressure adjustment handle outward to an appropriate position to allow space for pressure adjustment.

(2) Turn the pressure adjustment handle inward to apply pressure, observe the reading on the standard gauge, and quickly approach the target pressure value.

(3) When the pressure approaches the target value, stop turning the pressure adjustment handle and switch to the fine-tuning mechanism for precise adjustment until the standard gauge reading reaches the pressure verification point.

(4) Close the shut-off valve to lock in the pressure, maintain a stable pressure, and record the reading of the meter under test.

(5) Follow the calibration procedure to sequentially complete the pressure calibration at each pressure verification point.

3.3. Depressurization Calibration Procedure

(1) Open the shut-off valve and turn the pressure adjustment handle outward to begin depressurization. Observe the reading on the standard gauge and quickly approach the target pressure value.

(2) When the pressure approaches the target value, stop turning the manual pressure adjustment handle and switch to the fine-tuning device for precise adjustment until the standard gauge reading reaches the pressure verification point.

(3) Close the shut-off valve to lock in the pressure, maintain a stable pressure, and record the reading of the meter under test.

(4) Follow the calibration procedure to sequentially complete the pressure reduction calibration at each pressure verification point.

3.4. Concluding the Work

(1) After calibration at all test points is complete, open the pressure relief valve and slowly release the system pressure to 0 Pa.
(2) Disconnect the standard gauge from the gauge under test, and clean dust and debris from the connection points.
(3) Close all valves, clean the equipment surface, and store the equipment properly in a dry, well-ventilated environment.

4. Maintenance and Care

4.1. Routine Maintenance (Before and After Each Use)

(1) Inspect the seals at the equipment interfaces. If the O-rings are aged, deformed, or damaged, replace them promptly to prevent pressure leaks that could affect calibration accuracy.
(2) Clean the equipment surfaces and interfaces to prevent dust and contaminants from entering the interior, which could damage components or compromise sealing performance.
(3) Check the smooth operation of the valves. If they are stiff, apply a suitable lubricant (Never use ordinary engine oil)
(4) Confirm that there is no residual pressure in the equipment and ensure the pressure relief valve is open before storing it

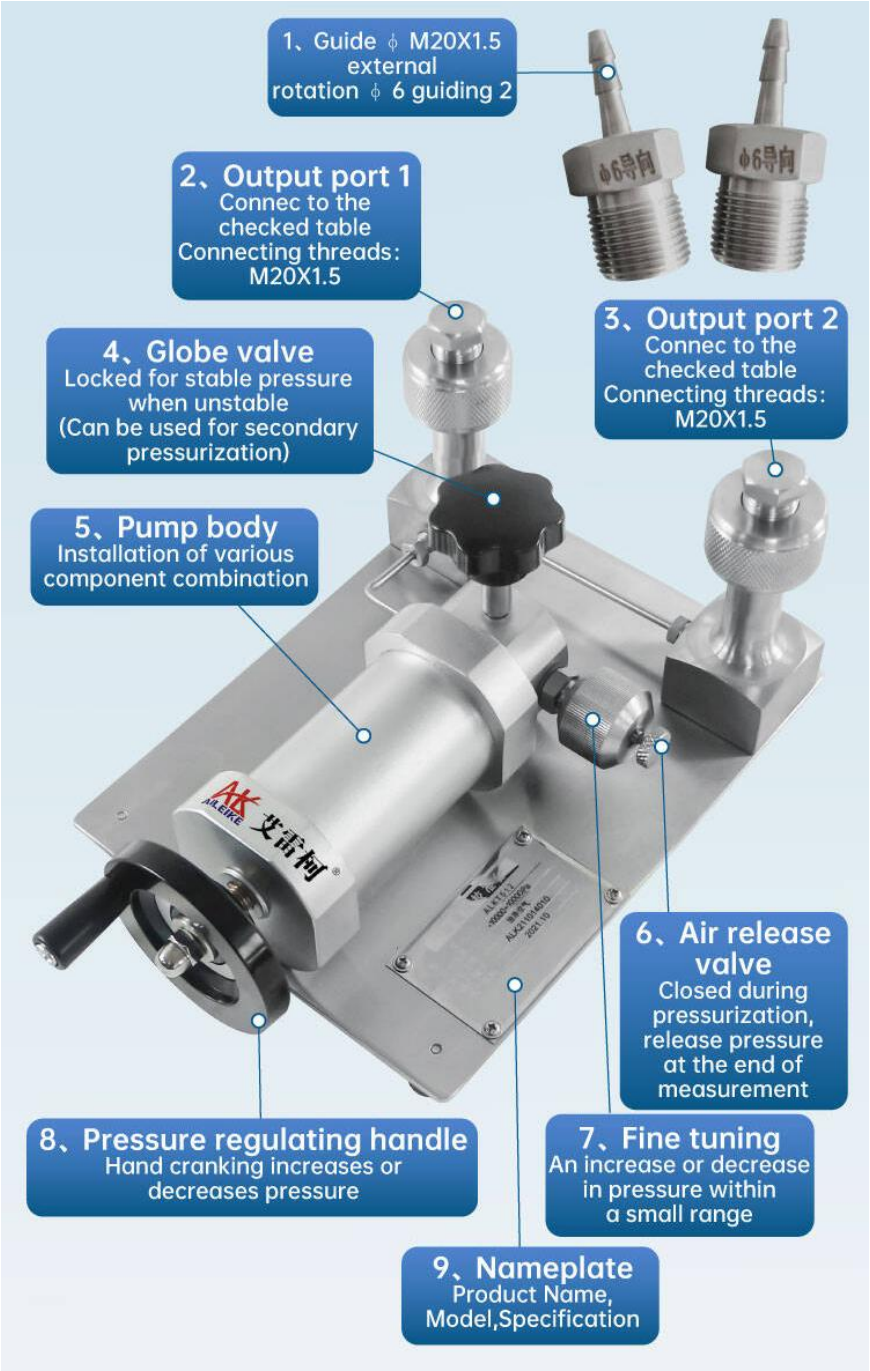
4.2. Periodic Maintenance (Recommended every 6 months)

(1) Inspect all sealing components, including O-rings and gaskets, and promptly replace any aged or damaged parts
(2) Clean the interior of the air passages to remove any impurities and ensure unobstructed airflow
(3) Inspect the mechanical connections between the pressure adjustment handle and the fine-tuning mechanism to ensure smooth operation and no looseness
(4) Perform functional tests on the equipment, including pressure regulation accuracy, pressure stability, and positive/negative pressure switching functions, to ensure normal performance

4.3. Long-Term Storage

(1) Clean the equipment surface and interfaces to ensure they are free of dust and oil residue
(2) Ensure all valves are closed and the relief valve is open to release system pressure
(3) Replace all O-rings (long-term storage may cause O-rings to age)
(4) Store the equipment in a dry, well-ventilated environment free of corrosive gases, avoiding direct sunlight, high temperatures, and humid conditions
(5) Inspect the equipment periodically (recommended every 3 months)

5. Structural Features



6. Conclusion

This device is capable of performing precise calibration on various low-pressure instruments, including low-pressure gauges, differential pressure transmitters, low-pressure sensors, and differential pressure switches. When paired with the Aileko ALKC400HW low-pressure standard gauge, it forms a complete low-pressure calibration system, enabling efficient pressure traceability. It is widely used in metrology and testing laboratories, research institutes, industrial and mining enterprises, and the instrument manufacturing industry, meeting the stringent requirements for high-precision calibration in the field of low-pressure measurement.