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METROLOGICAL SUPPORT IN MANUFACTURING ENTERPRISES

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Abstract: This article compiles information about organizing metrological support in manufacturing enterprises and its importance. It discusses the concept of metrology, standards and methodologies, organizational foundations of metrological support, calibration, and its prospects.
Keywords: metrological support, measurements, standards, ISO, methodology.

Introduction: Metrological support is the process of ensuring the accuracy of measurements and measuring instruments, playing a significant role in controlling and managing quality during manufacturing processes. Accurate and reliable measurements in production processes, ensuring product quality control and compliance with standards, have great importance in metrology. The improvement of product quality, reduction of costs, and increased competitiveness depend on metrological support.

Metrology is the science of studying the scientific basis of measurements and measurement methods. In manufacturing, metrological support is essential for carrying out precise and reliable measurements and for managing product quality. The key elements of metrological support include:•

– Measuring instruments and equipment: Technical tools used for measuring products and manufacturing processes.

– Standards: Norms and standards set for the proper evaluation of measurement results.

– Methodologies: Rules that show how measurements should be made and what results should be obtained.

Metrological support is an integral part of quality control in manufacturing enterprises. Through precise measurements, every aspect of the product is checked, and errors arising in the production process are identified and corrected. Accurate measurements increase a company's competitiveness as customers expect high-quality products. Effective metrological support is the first step in quality control.

Organizational Foundations of Metrological Support in Manufacturing Enterprises

To effectively organize metrological support in manufacturing enterprises, separate metrological services are established. These services include:

– Organizing metrological laboratories and ensuring they are equipped with modern devices.

– Developing and implementing measurement and testing methodologies.

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– Developing a precise plan for calibrating and adjusting measuring instruments.
– Conducting training courses and workshops to improve staff qualifications.

A metrological laboratory is a place where measurements and tests are carried out, scientific and practical research is conducted, and precise and reliable measurements are provided in manufacturing processes. Such laboratories play an important role in checking and verifying measurement accuracy in manufacturing enterprises. Before establishing metrological laboratories, they must have the necessary licenses and comply with international or national standards. Furthermore, to ensure the reliability of measurement results and their legal significance, the laboratory must be accredited. The laboratory should be equipped with highly accurate measuring instruments. These instruments help ensure high accuracy in measurements. For example, micrometers, calipers, electronic and digital thermometers, distributing measuring devices, spectrometers, and laser measuring equipment can be part of the laboratory's main equipment. All of these instruments must comply with calibration requirements and undergo testing before being put into operation. Specialized conditions are needed in the laboratory to ensure high measurement accuracy. Measurement practices, especially constant temperature and humidity control, as well as protection from various environmental factors, are necessary.

Measurement Methodology

Measurement methodology is a set of scientific and practical rules applied when performing specific measurements. Developing and implementing measurement and testing methodologies is necessary to ensure accurate and reproducible measurements. Every measurement methodology must be scientifically based to ensure the accuracy and reliability of the results. Before developing any methodology, its scientific aspects and the needs of users are considered. Methodologies must comply with national or international standards. The standards and methodologies used for validating measurements and evaluating results should be clearly defined. For instance, ISO 9001, ISO 17025, and other international standards serve as key documents for measurement control. Testing and experiments should be conducted before developing measurement methodologies to ensure their effective performance in real-world conditions. After developing new methodologies, they must be introduced into the manufacturing process, integrating them into all stages of production and training staff accordingly.

Calibration

Calibration is the process of confirming the accuracy and reliability of measuring instruments and adjusting them to meet required standards. Each measuring instrument requires regular calibration to maintain its accuracy. Calibration verifies the instrument's precision and ensures its compliance with standards. The goal of calibration is to ensure that the instrument's measurements are accurate and reliable. By calibrating measuring instruments, errors and uncertainties in measurements are minimized, which helps improve product quality. The calibration process includes:

1. **Checking the Measuring Instrument:** Verifying the working condition of the instrument, where it will be used, and what measurements will be made.
2. **Comparing Measurement Results:** Comparing the instrument's results with national or international standards. If there is a difference in results, the instrument is adjusted or updated.

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3. **Adjustment:** If errors are detected during calibration, the instrument is adjusted to meet the standards.
4. **Recalibration and Monitoring:** Regularly repeating the calibration process and continuously monitoring the condition of the measuring instrument. After calibration, it is important to monitor the instrument's performance and record the results.

Developing a Calibration Plan:

– **Setting the Calibration Interval:** Determining how often the measuring instruments should be calibrated. This varies depending on the type of instrument and its working conditions.

– **Calibration Methodology:** Developing clear rules and methodologies for calibrating the measuring instrument. The necessary technical tools and standards for calibration are identified.

– **Recording Data:** All measurements and adjustments made during the calibration process should be recorded, and the results should be verified.

To improve metrological support, several measures need to be taken: Introducing new and more accurate measuring instruments, regularly updating staff knowledge in metrology, and developing new methods to minimize measurement errors.

Conclusion

Metrological support plays a crucial role in ensuring the quality of manufacturing processes. The accuracy and reliability of measurements are necessary for improving product quality, increasing manufacturing efficiency, and reducing costs. Effective management of metrological support requires high-quality measuring instruments, methodologies, and skilled staff. Additionally, the application of digital technologies can make metrological support more efficient and accurate.

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