

Research on Traceability of Measurement Value and Verification Technology

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Abstract: Traceability of measurement value is an important part of measurement, among which verification and calibration are important methods and means. As a basic work, measurement is widely used in all walks of life. Measurement is indispensable in every industry, which depends on the accurate test data of measuring instruments. Firstly, this paper analyzes the relationship between quantity value transfer and traceability. Then, this paper analyzes the comparison between the mass transfer system and the traceability system. Finally, this paper focuses on the traceability of measurement value and the implementation of verification.

1. Introduction

Measurement is the most basic work in any industrial system, which includes the whole process of production activities in all walks of life in China, including production, manufacturing, testing, technology, energy consumption, etc. It can be said that measurement is the basis of all kinds of production processes in any industry, which is indispensable in the production process. Therefore, the accuracy and reliability of measurement value will be the main purpose, which requires the accuracy of measurement value transfer, measurement value traceability and verification technology. Measurement requires verification and calibration between different standards. Measurement value transfer refers to the activity of transferring the unit measurement value of national measurement standard to all levels of measurement standards and working measuring instruments level by level through measurement verification or calibration. Traceability is a kind of characteristic that can make the measurement result or the value of the measurement standard contact with the specified reference standard through an uninterrupted comparison chain with the specified uncertainty. Reference standards are related to national or international measurement standards.

2. Basic Principles and Application Examples of Traceability of Measurement Value

2.1 The basic principles of traceability

The traceability of measurement value is a kind of characteristic that the value of measurement value or measurement standard can be connected with the specified reference standard through an uninterrupted comparison chain with specified uncertainty. The reference standards are mainly industry standards, the highest national defense standards, national standards, international standards, etc. There are many requirements for traceability of measurement value, for example, the laboratory should actively trace its own accuracy with the higher level verification agency, and the accuracy of the unit can be determined by comparison of measurement value, which can be corrected within the determined measurement value, generally following the rule of $1/10$ or $1/3$. Therefore, the value traceability is a bottom-up activity, which has objective initiative. However, the transfer of measurement value refers to the content of national compulsory verification, which is a top-down compulsory activity. Traceability of measurement value shall follow the following four basic principles, as shown in Figure 1.

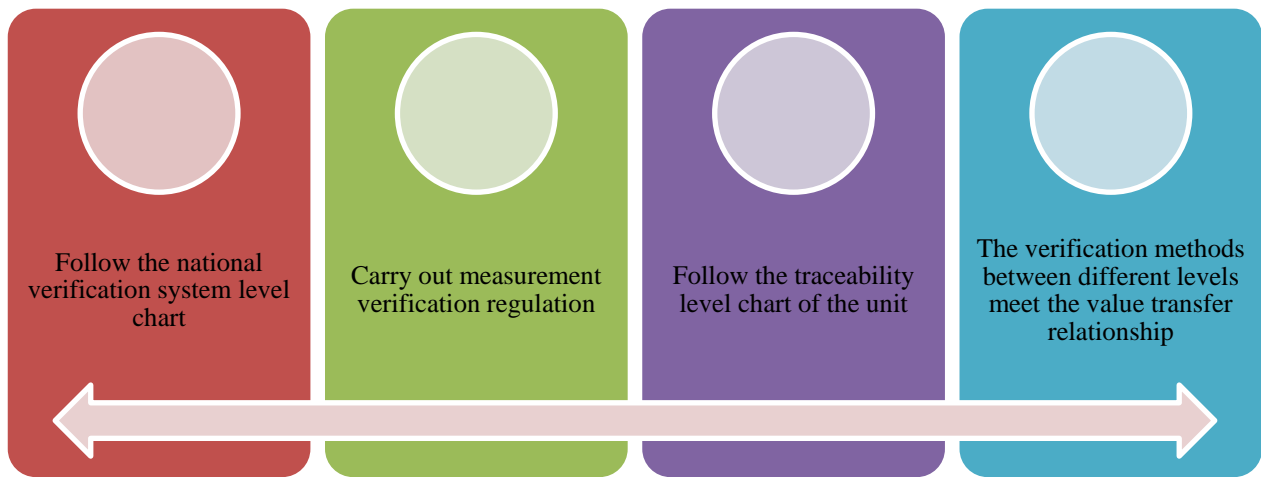


Figure 1: The basic principles of traceability

2.2 Application examples of traceability of measurement value

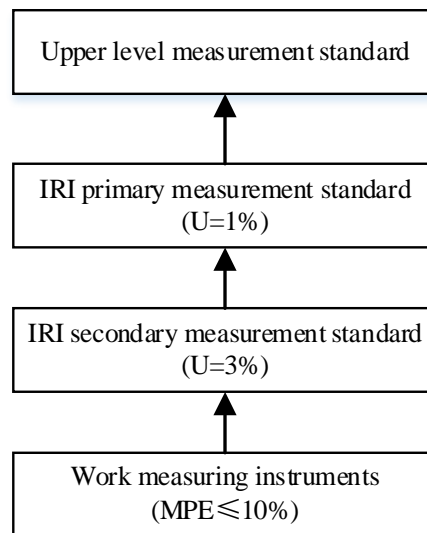


Figure 2: The level of two-level measurement standards

Platform road is an important direction of infrastructure construction in China, which can be achieved through IRI measurement standards. Through IRI measurement standard, we can output international roughness index. At the same time, we only need to input the elevation of the standard test platform road into the quarter car model, which will get the corresponding measurement error. According to the definition of international roughness index and model input, we can set the input amount. At present, the relative measurement error of most flatness measuring instruments in China is 10%. According to the requirements of the measurement standard level, the accuracy of the upper level measurement standard needs about 3%, which will ensure the convenience and effectiveness of transmission. The level of two-level measurement standards can be shown in Figure 2.

3. Comparison between Value Transfer System and Value Traceability System

Quantity value transfer and quantity value traceability are corresponding, which is the current corresponding form. Monitoring laboratory can monitor all kinds of data, which is the main body of traceability behavior. By ensuring the correctness of monitoring data, we can maintain a huge advantage in the market competition. Therefore, the society has produced the requirement of traceability, calibration and measurement will become the main way of traceability. Therefore, the calibration laboratory is not only the executor but also the beneficiary, with strong initiative. This paper compares the value transfer system with the value traceability system, as shown in Table 1.

Table 1: Comparison between value transfer system and value traceability system

	National value transfer system	National value traceability system
Objective	The unity of measurement unit system and the accuracy of measurement value	Ensure the unity of measurement unit system and the accuracy of measurement value
Legal attribute	Mandatory	Non mandatory
Mode	Top down, transfer	From bottom to top
Means	Test	calibration
Basis	Verification regulation	Calibration specifications or customer requirements
Qualifications	Social public measurement standard	Traceable to national standard (CNAS)
Composition mechanism	Legal metrology verification organization	Calibration company
Conclusion	Verification certificate or verification result notice	Calibration certificate, including measurement results and uncertainty

4. Measures for Traceability of Measurement Value

4.1 Establishment of quantity traceability system

The value traceability system is linear, which can be mainly composed of six parts, as shown in Figure 3. First of all, a complete traceability system needs to determine the monitoring object. Then, when we determine the monitoring conditions and uncertainty, we can choose the requirements and monitoring standards of uncertainty, which requires strict control of the total uncertainty. Therefore, we can focus on the uncertainty.

4.2 Measurement traceability and verification implementation

The measurement stations all have perfect measurement value transmission and traceability system, which will ensure that the measurement stations can provide measurement data and technical services for enterprises, including measurement verification, calibration and comparison. By establishing and improving the traceability system of measurement value, it will ensure the cycle of measuring instruments in China's basic industries. By ensuring the accuracy and reliability of the measuring instruments, we can carry out the measurement verification work more conveniently, which will save a lot of costs for the enterprise, including the cost of outgoing verification, personnel distribution and so on. Through the implementation of traceability and verification of local measurement station, the measurement station can reduce the production cost of the enterprise, which will maintain the overall interests of the enterprise.

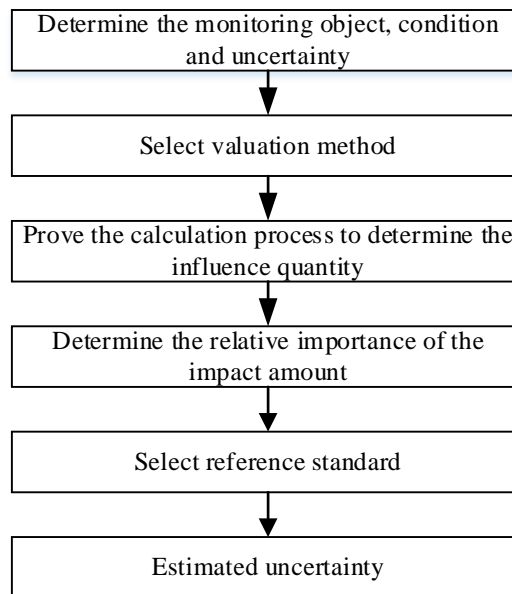


Figure 3: Establishment of quantity traceability system

Conclusions

Verification and calibration are important methods and means to implement traceability of measurement value. Therefore, we must enhance the verification ability and service quality of local legal metrology verification institutions, which is an important basis for the verification work of China's basic industries. The verification and calibration of measuring instruments is a delicate and complex work, which will be affected by many factors. Therefore, we must constantly improve the level of measurement technology, which will continue to strengthen the management of measurement laboratories. By ensuring the quality of verification and calibration of measuring instruments, the measuring station can promote the improvement of production technology level of local enterprises.

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