Design and implementation of code system for measuring instruments

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Abstract. This article introduces the preparatory preparation, structural principles, development process, application effects and existing problems of the mandatory verification measuring instrument code management system, and comprehensively expounds the birth, development and mature process of the first mandatory verification measuring instrument code management system in China.

1. Introduction
In November 2015, China's first compulsory verification measuring instrument management system went online in Xi'an. The compulsory verification of measuring instruments in Xi'an has been fully initiated. Since then, every strong measuring instrument in Xi'an has its own identification number. In the past three years, the code assignment work has fundamentally solved the long-term, unclear foundation and weak supervision of the mandatory inspection.

2. Reason for starting code management
The strong inspection system has been implemented in China for more than 30 years, and there have been serious problems such as "unclear foundation", "weak supervision", "concealment, omission of reports, non-reportation, rejection of inspections and over-cycle use". The main reasons for these problems are:
   a). The uniqueness of the equipment information cannot be guaranteed. The same equipment is repeatedly built and cannot be accurately tracked and located. There is no way to talk about the strong inspection base, coverage rate and re-inspection rate.
   b). The census, filing, updating, and supervision work was concentrated in the district (county) quality supervision branch bureaus, creating a management bottleneck. As a result, the quality of strong inspection data collection is not high, and a large amount of dirty data is formed.
   c). The filing and updating procedures are cumbersome, and the existing data of the verification agency cannot be used. Increasing the burden on enterprises and low cooperation among enterprises.
   d). Supervision data cannot be used by the public, and there is a lack of social supervision.

3. Preparing for code management work
3.1. Overall thinking
The fundamental method to solve the above problem is to let each appliance have its own identity code, that is, to implement the tracking management of the entire inspection process and life cycle of the appliance by assigning a code. And build "network intelligent archives", "measurement verification data sharing and real-time updates", "real-time dynamic supervision of grassroots quality supervision
bureaus", "online supervision of metrology management departments", "user online management appliances", "system automatic warning "Six in one new dynamic management model.

3.2. basic research
The "Catalogue of Compulsory Verification Work Measurement Apparatus" shall be detailed into the scientific name of each appliance in the applicable scope of the verification regulations. And establish the "instrument scientific name" and its verification rules, the verification cycle (longest), the use of appliances, inspection methods, units of measurement, accuracy levels, main parameters.

3.3. Coding scheme
Take FRID as the carrier. It adopts the coding method of "user organization code, three-in-one code, personal ID card + branch code + user assigned code sequence number". At the same time, each user has established his own library of built-in appliances.

3.4. Choice of handheld terminal RF instrument
By scanning the two-dimensional code on the measuring instrument, the handheld terminal radio frequency instrument can observe all the relevant information of the instrument, namely the basic information of the instrument, the calibration information of the instrument, etc. The supervisory department can check whether the device is the device by observing the basic information of the device by grasping this information, and further determine whether the measuring device meets the regulatory requirements through the verification information. As shown in Figure 1.

Figure 1. Field information collection map

4. Code Assignment Management System Design

4.1. Process Design
Through repeated demonstration of the code assignment process, a strong detection code assignment process as shown in FIG. 2 is finally determined.
4.2. **system design**
First, the use of modern Internet of Things technology solves the problem of the ambiguity of the appliance information, and implements the tracking and management of the entire life cycle of the appliance; secondly, through the establishment of a mandatory verification of the basic database and data associations, a unified, standardized and automatic data Matching and intelligent error correction. At the same time, the management of strong inspection was extended to the technical level, and problems such as over-range inspection were eliminated; again, through the design of the code assignment system, functions such as online application, online approval, online inspection, and progress inquiry were realized. Fourth, through regular exchanges with certification bodies. Realized automatic data update. Finally, through the application of the handheld terminal, online inspection and appliance reception were realized.

5. **Code Assignment Management System Development**
The strong inspection code system includes five modules: "user management module", "metering basic information module", "code assignment module", "report inspection module", and "analysis and statistics module".

5.1. **User Management Module**
The user management includes enterprise users, inspection agencies, various supervisory departments and Xi'an Quality Management Supervision Bureau. This article mainly introduces the management of enterprise users. The management of enterprise users is verified by various regulatory authorities on the unified social credit code certificates or organizational certificates of enterprises in their jurisdictions, and it is clear that the measuring instruments they use are within the jurisdiction of their jurisdiction.
5.2. Measurement basic information module
According to the "Medical Catalogue of Compulsory Verification of Work Measuring Apparatus", establish scientific names for each type of instrument, and at the same time establish the association between the scientific name and the name of the measurement parameter, the unit of measurement, and the accuracy level, so as to realize automatic loading of the measurement characteristic parameters of the device.

5.3. Code Assignment Module
After the new measuring instrument is approved, the system will automatically assign a unique code to each measuring instrument, that is, the identity code of the measuring instrument, as shown in Figure 3.

![Code flow chart](image)

Figure 3. Code flow chart

5.4. Inspection module
Within one month before the expiry date of the measuring instrument, the user can apply for an inspection online. After the application for the inspection is submitted, the system will initially match the qualification capabilities of the measuring instrument with the verification institution and find a suitable verification institution, and then submit it to the administrative agency Regional sub-bureaus are reviewed by the sub-bureaus and assigned to the verification agency. When the verification mechanism in the system can match the measuring instrument, the inspection process in the system is adopted, as shown in Figure 4.
If the system cannot find a verification organization that meets the verification capability, it applies for verification to a verification organization outside the system through the process of reporting outside the system, as shown in Figure 5.

5.5. Analysis and Statistics Module
Supervision departments can perform statistical analysis on the compulsory verification measurement instruments in the city through various statistical methods. Such as statistics by appliance use, appliance classification, regulatory area, administrative area, and inspection agency.

6. Running result
Since Xi’an’s code assignment work was officially launched in November 2015, the city has completed code assignments in the areas of gas refueling, medical physicochemicals, stores, supermarkets, and trade markets, and a large number of concealed, missed, unreported, and rejected inspection equipment
have been detect and achieve lifetime control. In Xi'an, there has been a blowout increase in the number of cases, inspections, and enforcement of strong inspection meters. In addition, the system takes into account the needs and interests of all parties. It is mainly reflected in the following six aspects:

6.1. For users
a). Implement the user's responsibility for filing the subject;
   b). After the compulsory inspection is stopped, ensure that the appliances that really need to be inspected complete the inspection on time and quality;
   c). Maximize and simplify the process to facilitate the masses;

6.2. For regulators
a). Free from cumbersome censuses, filing, and data updates;
   b). Real-time supervision, precise law enforcement, due diligence, and reduction of supervision risks for strong inspection equipment in the jurisdiction;

6.3. For measurement administration
a). Accurate statistics of forced inspections in the jurisdiction, and provide the government with evidence of due diligence;
   b). Real-time supervision and dynamic assessment of regulatory departments and inspection agencies to identify problems in a timely manner;

6.4. For metrology institutes
a). Implementation of graded inspections to resolve bottlenecks caused by centralized inspections after free inspections are free of charge.
   b). Find any missing items in the strong inspection project in time;

6.5. For the public
a). Draw a barcode or log in this system to query the entire process information of the strong inspection appliance from sales to scrapping;
   b). Violations can be reported online.

6.6. For other government departments
a). Provide various types of strong inspection data to government departments in a timely and accurate manner;
   b). Form a closed management loop and reduce regulatory risks.

7. Problem
a). Because the user needs to fill in the measurement characteristics of the appliance during the code assignment process. Although the system has established a large number of manufacturers, model specifications and measurement characteristics. However, due to the lack of collection summary and artificial intelligence, there are still many measurement characteristics that users need to fill in based on data or experience, and the system did not provide reference information filled in by the same model and manufacturer in the past.
   b). In the process of data access of the certification body, the existing database of the certification body needs to be modified. Individual institutions are unwilling to share data due to their own considerations, and their cooperation is low.
   c). FRID labels have problems with extremely small dimensions, surface contamination, and all-metal surfaces.
   d). The handheld terminal has not been explosion-proof certified and cannot be used in places with explosion-proof requirements, such as gas stations and gas stations. Only after the relevant information is copied out, inspections can be conducted outside the site.
8. Conclusion

After three years of operation and improvement, the management system for compulsory verification measurement instruments has strengthened the management of compulsory verification measurement instruments in Xi’an, which greatly facilitates enterprises to apply for inspection. However, the abovementioned problems still exist. To make the system more effective, convenient, and intelligent, a more detailed measurement basic database should be established, and the system can provide the value range of the measurement characteristics of the appliance according to the scientific name and specifications selected by the user; at the same time, the design of the system should be considered from the perspective of the enterprise instead of leaning on administrative management, optimizing the process, making the process of coding and inspection of measuring instruments easier and more efficient.

References

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