Discussion on Environmental Worthiness Technology System of CNC System

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Abstract. Environmental worthiness is one of the most important and basic performance of CNC system. This paper analyzes the environmental worthiness technology system of CNC system firstly. Following, an improved scheme on environmental worthiness technology system of CNC system is put forward. It is significance for keeping CNC system to maintain a healthy and rapid development.

Introduction

CNC machine tool is widely used in national defense and sophisticated industry with high processing precision, good quality, high efficiency production and other advantages. Its technology level is an important symbol to a country's comprehensive strength [1, 2]. Nowadays, CNC system has become the enabling technology of emerging high-tech industry and sophisticated industry as the core of CNC machine tool. CNC system is irreplaceable in accelerating national economic development, improving the comprehensive national strength and the national status [3].

China is the world's biggest CNC machine tool importer country accounting for 30% to 50% of the total cost on CNC system. Statistics show that domestic economic CNC system leads the CNC system market of China, accounting for 60% market share. What's more, the technology gap with foreign universal CNC system is narrowed. However, domestic high-end CNC system falls behind the same kind product of foreign significantly. Foreign CNC system accounts for 70% of the high-end CNC system in China. And some high-end CNC machine tools are used as strategic goods subject to embargo restrictions on international markets [4, 5]. High-end CNC system has restricted the development of China's manufacturing and economic.

Environmental worthiness is one of the most important and basic performance of CNC system. The specific technical requirements, test requirements and test methods for environmental worthiness of CNC system has been put forward [6] and improved [7]. However, these requirements are not widely accepted by the company. What's worse, the rapid development of CNC systems and the expansion of application scope make the environmental worthiness technology system of CNC system out of the demand gradually. In a word, the environmental worthiness technology system of CNC system limits the development of CNC system.

The Environmental Worthiness Technology System of CNC System

The environmental worthiness technology system of CNC System is important on the environmental worthiness design and test verification of CNC System. It implicates to all types of CNC machine tools, including metal cutting machine tools, forging tools, woodworking machinery and special machine tools. And it provides the basic requirements of designing, manufacturing and using for CNC system, including technical requirements, inspection requirements, test methods and so on.

The environmental worthiness technology system of CNC System mainly includes three aspects, namely climate environmental requirements, storage and transportation environmental

requirements and mechanical environmental requirements. A typical technical requirement of CNC System on environmental worthiness is shown in Figure 1.

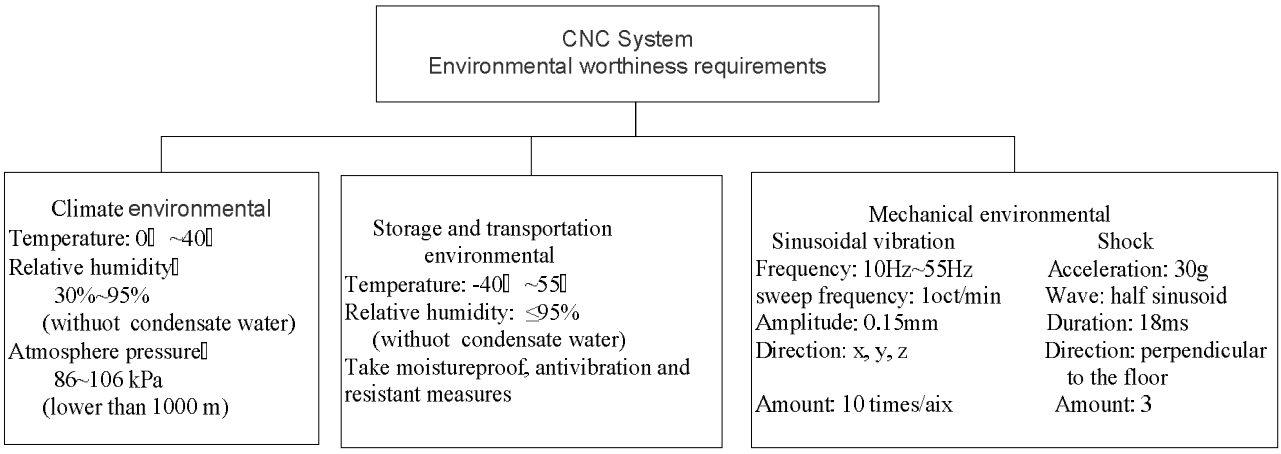

Fig. 1 A typical technical requirement of CNC System on environmental worthiness [6]

The test verification methods are corresponding to environmental worthiness requirements of CNC system, including upper limit and lower limit temperature storage test, upper limit and lower limit temperature working test, constant humidity, vibration and shock tests. During the upper limit temperature working test, the ability of CNC system to withstand voltage fluctuations is assessed by setting voltage lower or higher than rated. And the vibration test containing endurance vibration test and energized sweep vibration test assesses the vibration resistance capabilities of CNC system separately. The basic requirements are listed as follows.

(1) During the test, the CNC system mustn't add any protective packaging unless otherwise specified.

(2) During the test, the temperature change rate lower than 1℃/min; No condensation or freezing occurred in the duration of temperature changing.

(3) It is allowed to seal the CNC system by polystyrene film without affecting the test conditions, if condensation or freezing is inevitable. If necessary, moderate moisture absorption agent is also allowed to add to the sealed bag.

(4) CNC system is running under idle condition.

The Environmental Worthiness Requirements of CNC System

The environmental worthiness requirements of CNC system contain three aspects of climate environmental, storage and transport environmental and mechanical environmental. They have been put forward and improved with time. However, the rapid development of CNC systems technology and the expansion of application scope make CNC systems facing more complex environmental effects in practice. Existing environmental worthiness technical requirements severely limit the application of CNC system. What's more, it causes that CNC system exists serious hidden quality problems. The environmental worthiness requirements of CNC system is analyzed by climate environmental and storage and transport environmental by example following.

First of all, the highest elevation of CNC system's working range is 1000 meters in the climate environmental. It seriously limits the application of CNC system. Data shows, many places of China such as Yunnan, Ningxia, Gansu, Sichuan and Guizhou are higher than 1000 meter. In addition, these places occupy an important position in China's manufacturing industry. In addition, environmental factors are insufficient consideration in storage and transportation environmental, such as salt spray. According to the reflection of enterprises, CNC system is corroded evidently after maritime transport. What's more, China has a large number of coastal cities faced with severe salt spray environmental, which are the heart places of China's manufacturing industrial.

With the development of quality, technology and the expansion of application range (including export overseas), the problems of domestic CNC systems is becoming more severe. And some problems haven't yet been exposed is emerging gradually. Therefore, the environmental worthiness requirements of CNC system can't meet the actual needs any more. It is desiderate need for systematic studies to establishment a new environmental worthiness technology system of CNC systems.

Improvement Measures to Environmental Worthiness Technology of CNC System

This paper analyzes the lack of environmental worthiness requirements of CNC system. However, Improvement measures to environmental worthiness technology of CNC system shouldn't limited to the given opinions above. Broad-based environmental investigation, scientific statistical analysis and the other actual research work should be done to improve the environmental worthiness technology of CNC system comprehensively and systematically. Figure 2 provides a way to develop the environmental worthiness technology of CNC system.

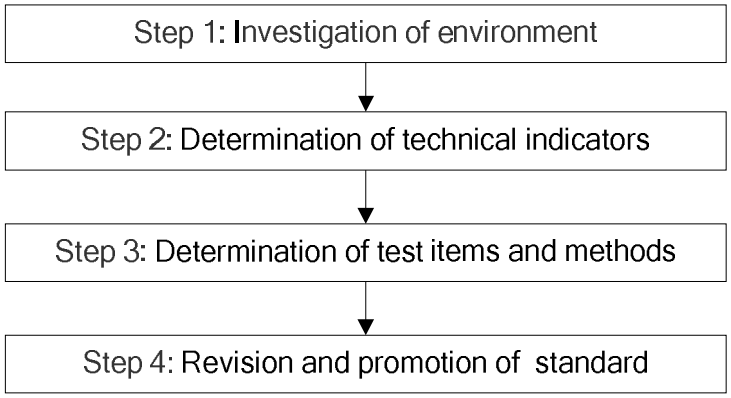

Fig. 2 A develop way on environmental worthiness technology of CNC system

Step 1: Investigations of environment

Environmental data is the basis of environmental worthiness system. A mature environmental worthiness system has already possessed. So the environmental data of CNC system faced can be obtained by measuring or analyzing of existing environmental data. Temperature, pressure, working vibration and other environmental data of CNC system specially can be obtained by measuring. On the other side, obtains the environmental data such as transportation vibration, shock by industry standards selectively. For example, GB/T 4857.23-2003 "Packaging -Transport packages-Random vibration test method"[8] provides some spectral density data of transport random vibration for packages. Anyhow, investigation of environmental data should keep in realistic.

Step 2: Determination of technical indicators

CNC system experience different environment significantly on different regions or different machine types. So, it must determine different environmental worthiness technical indicators corresponding to the different environments to ensure the final quality and reduce the total cost. At this stage, environmental worthiness technical indicators should be determined by considering actual physical environment, economic indicators, scope of application and other factors scientifically. What's more, tailoring guidelines should be provided.

Step 3: Determination of test items and methods

Test items and methods are used for assessing the environmental worthiness technical indicators of CNC system correspondingly. Due to the insufficient of environmental worthiness requirements for CNC system, the test items and methods are need to be supplemented and perfected. Test items

and methods should considering the existing standard related to CNC system and the other industry standard slimily with CNC system for improving.

Step 4: Revision and promotion of standards

Standards are the most powerful tool for promotion and popularization of new technologies and methods. Some standard have been widely used and well received industry recognition. However, lacking of effective assessment and monitoring mechanisms for implementation leaves quality problems of CNC system. High-end CNC system is important national strategic material related to the country's safety and manufacturing technology. New standards should be revised, promoted and compulsory executed to improving the environment adaptability and quality of CNC system.

Prospects

Some enterprises manufacturing CNC system has established professional laboratory to improve and vivificate the environmental worthiness of CNC system. The phenomenon shows that the environmental worthiness of CNC system has already won widely ratification and become a research focus. So it is expected optimistically that environmental worthiness technology system of CNC system will be improved gradually in the future.

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