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**Intelligent service - Predictive maintenance - Collaborative
requirements for detection and monitoring
(English Translation)**

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Foreword

This document complies with the provisions of GB/T 1.1-2020 "Standardization Work Guidelines Part 1: Structure and Drafting Rules of Standardization Documents".

Drafting.

Please note that some content in this document may involve patents. The issuing organization of this document assumes no responsibility for identifying patents.

This document was proposed by the China Machinery Industry Federation.

This document is under the jurisdiction of the National Technical Committee on Standardization of Industrial Process Measurement, Control and Automation (SAC/TC 124).

Introduction

The operation and maintenance phase is a critical link in the entire equipment lifecycle. In the context of the transformation of manufacturing service models, it plays a vital role in ensuring operational safety and reducing maintenance costs.

Cost is playing an increasingly prominent role. Equipment operation and maintenance models are constantly evolving, driven by both the accumulation of experience among maintenance personnel and the improvement of equipment intelligence.

Evolution has occurred in the pursuit of a balance between maintenance costs and equipment operating benefits, constantly evolving from the traditional reactive maintenance model to a proactive one.

Maintenance modes, such as preventative maintenance and predictive maintenance.

With the improvement of the digitalization and intelligence level of equipment itself, and the increasing sophistication of equipment safety detection and monitoring technologies, the

amount of data that can be monitored and the amount of detection data has surged further, but the problem of information silos, caused by the independence of detection and monitoring technologies, restricts the ability to comprehensively perceive the status of equipment.

Single monitoring or detection technologies are no longer sufficient to meet the needs of complex equipment lifecycle management. For example, while dynamic monitoring (such as vibration sensors) can achieve...

While it can detect operational anomalies, it cannot identify static structural damage (such as pipe corrosion); whereas periodic inspections (such as ultrasonic testing) can cover structural integrity.

While exhibiting certain characteristics, these failures lack continuity. Furthermore, the failure modes of critical equipment such as moving parts, static parts, and instrumentation systems often combine sudden and gradual occurrences.

To identify potential risks, it is necessary to construct a multi-dimensional risk early warning model through spatiotemporal correlation analysis of monitoring and detection data, thereby avoiding the lag of traditional threshold alarms.

At the same time, the coexistence of multiple operation and maintenance modes also creates a strong demand for optimizing operation and maintenance strategies in order to meet the goal of efficient and economical operation and maintenance.

To address the spatiotemporal fragmentation caused by the sole use of domain monitoring and detection technologies, this paper proposes a collaborative approach between monitoring and detection technologies (hereinafter referred to as "monitoring and detection").

The collaborative sensing technology architecture specifies the detection and monitoring sensing methods and data requirements, clarifies the collaborative methods and requirements between the algorithm layer and the operation and maintenance layer, and optimizes...

Multiple operation and maintenance modes support operation and maintenance decision-making recommendations.

AI-driven operational model transformation facilitates deep collaboration between detection and monitoring, with the intelligent agent acting as a unified central hub, enabling multi-machine collaboration.

The system deeply integrates three collaborative modes of detection and monitoring, human-machine collaboration and embodied intelligence, enabling adaptive scheduling of detection and monitoring tasks and cross-role collaboration.

Evolving with autonomous decision-making, it promotes the deep integration of detection

and monitoring technologies.

Standardization can help build a collaborative sensing mechanism for equipment inspection and monitoring that integrates static and dynamic aspects, as well as point-to-area coordination, enabling all-time, all-domain sensing of equipment and wind...

Risk prevention and control are crucial for improving the predictive maintenance technology system, enhancing safety and control capabilities based on predictive maintenance, and improving the overall effectiveness of predictive maintenance.

Technological advancements are of great significance in helping to optimize and upgrade the equipment operation and maintenance industry and extend its value chain based on predictive maintenance.

Intelligent service predictive maintenance and monitoring collaboration requirements

1 Scope

This document specifies the predictive maintenance monitoring and control collaborative architecture, monitoring and control collaborative methods, and monitoring and control application models.

This document applies to the collaboration of predictive maintenance detection and monitoring data, resources, models, and applications, and guides the design of predictive maintenance systems.

Development and operation.

2 Normative references

The contents of the following documents, through normative references within the text, constitute essential provisions of this document. Dated citations are listed below.

For references to documents, only the version corresponding to that date applies to this document; for undated references, the latest version (including all amendments) applies. document.

GB/T 40571-2021 General requirements for intelligent service predictive maintenance

3 Terms and Definitions

The terms and definitions defined in GB/T 40571-2021 and GB/T 43555-2023, as well as the following terms and definitions, apply to this document.

Predictive maintenance Maintenance, whether continuous or intermittent, is carried out based on observed conditions to monitor, diagnose, or predict the conditions of structures, systems, and components.

index.

[Source. GB/T 40571-2021, 3.5] 3.2 monitoring the process of continuously observing and measuring the status of equipment.

detection

The process of non-continuously observing and measuring the status of equipment to determine whether a certain phenomenon (fault) exists.

Note: This includes periodic detection and non-periodic detection (task-oriented detection).

4 Inspection and monitoring collaborative architecture

Predictive maintenance and monitoring collaboration mainly targets moving equipment, static equipment, and intelligent instrument systems, using sensing to acquire monitoring and detection data.

Based on this, the analysis layer and the operation and maintenance layer collaborate and interact. The constructed predictive maintenance monitoring and control collaborative architecture is shown in Figure 1.