NATIONAL STANDARD OF THE

PEOPLE'S REPUBLIC OF CHINA

GB/T 45132-2025

Tyre intelligent manufacturing - Interconnection network architecture - General specification

轮胎智能制造 互联网络架构 通用规范

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Table of Contents

1 Scope

GB/T 45132-2025 is the Chinese general specification for the interconnection network architecture of intelligent tyre manufacturing. A tyre plant is an unusually hard automation problem: the process runs from mixing through calendering, extrusion, building, curing and inspection, the material changes state at every stage, and every green tyre has to be traceable to its curing press and its recipe. The standard defines the network architecture that ties that together: the hierarchical model from the field devices through the control layer

to the manufacturing execution and enterprise layers, the network segmentation and the communication requirements at each level, the interfaces and protocols between the layers, the data model and the identification of the objects that move across it, the requirements on real-time performance, reliability and redundancy, and the network security requirements. For a tyre maker modernising a plant, an automation supplier or an integrator working in China, this is the common architecture the parties are expected to design to.

This document specifies the terms and definitions, abbreviations, demands and connection framework, network architecture, network implementation and network security requirements of the interconnection network of tires intelligent manufacturing. This document is applicable to the design, construction and upgrade of the interconnection network architecture for the tires intelligent manufacturing enterprises.

2 Normative References

The contents of the following documents constitute indispensable clauses of this document through the normative references in the text. In terms of references with a specified date, only versions with a specified date are applicable to this document. In terms of references without a specified date, the latest version (including all the modifications) is applicable to this document.

GB/T 22239-2019 Information Security Technology - Baseline for Classified Protection of Cybersecurity

GB 40050-2021 Critical Network Devices Security Common Requirements

3 Terms and Definitions

The following terms and definitions are applicable to this document.

3.1 network architecture The overall design of the communication system, providing criteria for network hardware, software, protocols, access control and topology.

3.2 field level The lowest-level part of the distributed control system, and also the most basic level. NOTE. including production equipment, instruments and apparatus, etc.

3.3 workshop level A unit with relatively independent functions in the production process. NOTE. in the tire industry, it mainly refers to the rubber mixing workshop, semi-finished product workshop, molding workshop, vulcanization workshop and inspection workshop, etc., which may vary from manufacturer to manufacturer according to actual conditions.

3.4 plant level The entire factory of a tire enterprise. NOTE. including design, production, logistics, management and other links.

3.5 network topology The physical layout of various devices interconnected by transmission media, constituting a specific physical (i.e., real), or logical (i.e. virtual) arrangement mode

between members of the network.

4 Abbreviations

The following abbreviations are applicable to this document. AGV. Automated Guided Vehicle API. Application Programming Interface CC-Link. Control & Communication Link CRM. Customer Relationship Management DCS. Distributed Control System ERP. Enterprise Resource Planning FCS. Fieldbus Control System HMI. Human Machine Interface IPv

5 Interconnection Network Demands and Connection

Framework of Tire Factories

5.1 Overall Demands for Interconnection Network of Tire Factories

5.1.1 Basic demands for interconnection network of tire factories The basic demands for the interconnection network of tire factories include.

a) Network isolation and special network for special purposes;

b) Cross-regional / cross-factory network collaboration;

c) Data factory-wide secure storage;

d) Adapt to production takt and with ultra-low latency (30 ms);

e) Data protocol conversion in the device-side edge computing / network control layer;

f) Simultaneous access to the intranet and the public network;

g) Wired and wireless connections, data collaborative sharing.

5.1.2 Design principles of network architecture The design principles of network architecture include.

d) Layered architecture.

5.1.3 Demands for six types of interconnections The entities of the six types of interconnection relations involve all aspects of the entire process from automation control to product production, use, and management, etc., including.

a) Intelligent equipment and factory control system;

b) Work-in-process products and intelligent equipment;

c) Work-in-process products and factory cloud platform (and management software); 5

6 Interconnection Network Architecture for Tires Intelligent

6.1 Interconnection Network Structural Division of Tire Factory The interconnection network structure of tire factory should be divided into two levels. IT network and OT network. The network level is divided into field level, workshop level and factory level in accordance with the actual management level of the tire factory. The two-layer three-level network structure of the tire factory is shown in Figure 4. equipment commands, data polling and collection, the delay shall not exceed 30 ms.

b) Support flexible IT/OT networking. Realize the separation of control plane and forwarding plane, coordinate network resource scheduling through SDN controller and manufacturing control and support flexible manufacturing and automatic production organization.

c) Support remote factory networking, preferably use MPLS special line technology or SD-Wan technology, and with the capability of accessing remote factory for networking.

d) Support IPv4 and IPv6, IT network and OT network, support IP protocol, and support direct interconnection between IT and OT nodes.

e) Support full-node visualized management, and provide functions, such as alarm management, performance management, report management, and audit management, etc..

f) It is advisable to support new technologies and new solution connections, such as TSN, 5G, WIA for industrial automation, and the sixth-generation wireless network (Wi-Fi 6) and other new technology connection modes.

7 Implementation of Interconnection Network for Tires

Intelligent Manufacturing

7.1 Implementation Framework The goal of interconnection network construction is to build a new infrastructure that is interconnected with all production factors and the entire system, as shown in Figure 7.

e) Data servers / cloud data centers for data aggregation and analysis of tire intelligent manufacturing factories;

f) Special line equipment for remote networking access.

7.4.2 Deployment requirements The basic requirements for the network construction of tire intelligent manufacturing factories are high reliability and large bandwidth. The key is to achieve agile network management, data collaboration and a full-coverage network system. The specific construction requirements shall include.

a) SDN technology shall be deployed using a flattening network architecture (for example, large Layer 2 network technology, etc.) to achieve flexible and simplified network management;