SS ISO 18435-1 : 2019
ISO 18435-1:2009, IDT
(ICS 25.040.40)

SINGAPORE STANDARD

Industrial automation systems and integration – Diagnostics, capability assessment and maintenance applications integration

– Part 1 : Overview and general requirements

Singapore Standards Council

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Published by Enterprise Singapore

ISBN 978-981-48-9437-1

The content of this Singapore Standard was approved on 17 October 2019 by the Manufacturing Standards Committee (MSC) under the purview of the Singapore Standards Council.

First published, 2019

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MSC sets up the Technical Committee on Smart Manufacturing to oversee the preparation of this standard. The Technical Committee consists of the following members:

		Name	Representation
Co-Chairmen	:	Mr Yeoh Pit Wee	*Individual Capacity*
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Secretary	:	Mr Louis Lauw	*Singapore Manufacturing Federation – Standards Development Organisation*
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		Dr Carlos Toro	*Advanced Remanufacturing Technology Centre*

The Technical Committee sets up the Working Group on Smart Manufacturing Readiness Level to prepare this standard. The Working Group consists of the following experts who contribute in their *individual capacity*:

		Name
Co-Convenors	:	Mr Brandon Lee
		Mr Shridhar Ravikumar
Secretary	:	Mr Louis Lauw
Members	:	Dr Ian Chan Hian Leng
		Mr Cheong Siah Chong
		Mr David Chia
		Dr Andreas Hauser
		Mr Michael Leong
		Dr Lin Wei
		Dr Gary Ng
		Prof John Pang
		Dr Tan Puay Siew
		Mr Yeoh Pit Wee

The organisations in which the experts of the Working Group are involved are:

Advanced Remanufacturing Technology Centre
Beckhoff Automation Pte Ltd
INTECH Process Automation Pte Ltd
Nanyang Technological University
Rockwell Automation Southeast Asia Pte Ltd
SESTO Robotics Pte Ltd
Singapore Industrial Automation Association
Singapore Institute of Manufacturing Technology
TÜV SÜD Asia Pacific Pte Ltd

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National Foreword

This Singapore Standard was prepared by the Working Group on Smart Manufacturing Readiness Level set up by the Technical Committee on Smart Manufacturing under the purview of MSC.

This standard is identical with ISO 18435-1:2009, "Industrial automation systems and integration – Diagnostics, capability assessment and maintenance applications integration – Part 1: Overview and general requirements", published by the International Organization for Standardization.

NOTE – Reference to International Standards are replaced by applicable Singapore Standards and Technical References.

This standard is expected to be used by system integrators, government agencies, testing, inspection and certification bodies, professional institutions, institutes of higher learning and training providers.

Attention is drawn to the possibility that some of the elements of this Singapore Standard may be the subject of patent rights. Enterprise Singapore shall not be held responsible for identifying any or all of such patent rights.

NOTE

1. *Singapore Standards (SSs) and Technical References (TRs) are reviewed periodically to keep abreast of technical changes, technological developments and industry practices. The changes are documented through the issue of either amendments or revisions. Where SSs are deemed to be stable, i.e. no foreseeable changes in them, they will be classified as "Mature Standards". Mature Standards will not be subject to further review, unless there are requests to review such standards.*

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3. *Compliance with a SS or TR does not exempt users from any legal obligations.*

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 18435-1 was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 5, *Architecture, communications and integration frameworks*.

ISO 18435 consists of the following parts, under the general title *Industrial automation systems and integration — Diagnostics, capability assessment and maintenance applications integration*:

— *Part 1: Overview and general requirements*

The following parts are under preparation:

— *Part 2: Descriptions and definitions of application domain matrix elements*

— *Part 3: Applications integration description method*

Introduction

0.1 General

ISO 18435 defines a set of integration methods intended to be used when integrating diagnostics, capability assessment, and maintenance applications with the applications in production, control, and other manufacturing operations.

ISO 18435 describes application integration models and common application interoperability requirements. These application integration models are intended to:

a) provide diagnostics, capability assessment, and maintenance applications' integration reference architecture for manufacturing assets, such as equipment, automation devices, and software units;

b) enable integration of diagnostics, capability assessment, and maintenance applications with other applications;

c) provide for a system view context in dealing with asset management lifecycles.

Application integration models are intended to guide users of industry specifications or standards when integrating diagnostics, capability assessment, and maintenance applications with production and control applications. These integration models define elements and rules to help identify and select interfaces described in the interoperability templates. These interoperability templates are used to reference interoperability profiles based on international standards that are required for integrating the applications within and at different levels of an enterprise's functional and resource hierarchies.

The intended users of ISO 18435 are developers of industrial automation applications, especially those that design, implement, deploy, commission, and operate the required systems which integrate diagnostics, capability assessment, control, production, and maintenance applications.

0.2 Asset operation and maintenance lifecycle management integration framework

The main focus of ISO 18435 is to describe the integration requirements that manufacturing assets and resources need to meet in order to support the operation and maintenance phase within a manufacturing system's lifecycle (see Figure 1).

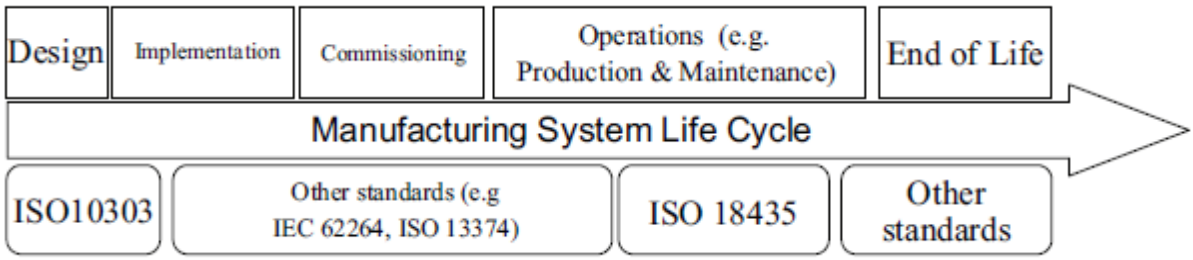

Figure 1 — Scope of ISO 18435 in the lifecycle of a manufacturing system

In Figure 2, the diagnostics and maintenance related activities are shown in a framework, where several combinations of these activities, as distinguished in scope by the ovals, provide effective mechanisms for adapting maintenance strategies to various changes in manufacturing operations, such as changes in production requirements, changes in operational conditions and environment, and changes to continuously improve manufacturing assets during their lifecycle.

For example, the first combination of activities deals with the operational phase of maintenance task execution, which consists of maintenance task planning, involving asset inspection, monitoring and diagnostics, followed by treatment or repair if needed, and ends in the evaluation of maintenance results. These activities are mainly concerned with controlling routine maintenance tasks.

The second combination of activities focuses on maintenance strategy planning that involves the selection of an approach for performing maintenance appropriate to each asset with options such as breakdown maintenance (BM), time-based maintenance (TBM) and condition-based maintenance (CBM). The maintenance strategies can be improved based on diagnostic capability assessment and maintenance histories.

The third combination of activities includes manufacturing asset design improvement driven by inputs from maintenance strategy planning. The design improvements drive maintenance strategy planning. This third cycle seeks to minimize maintenance costs or reduce maintenance effort and time through asset improvement.

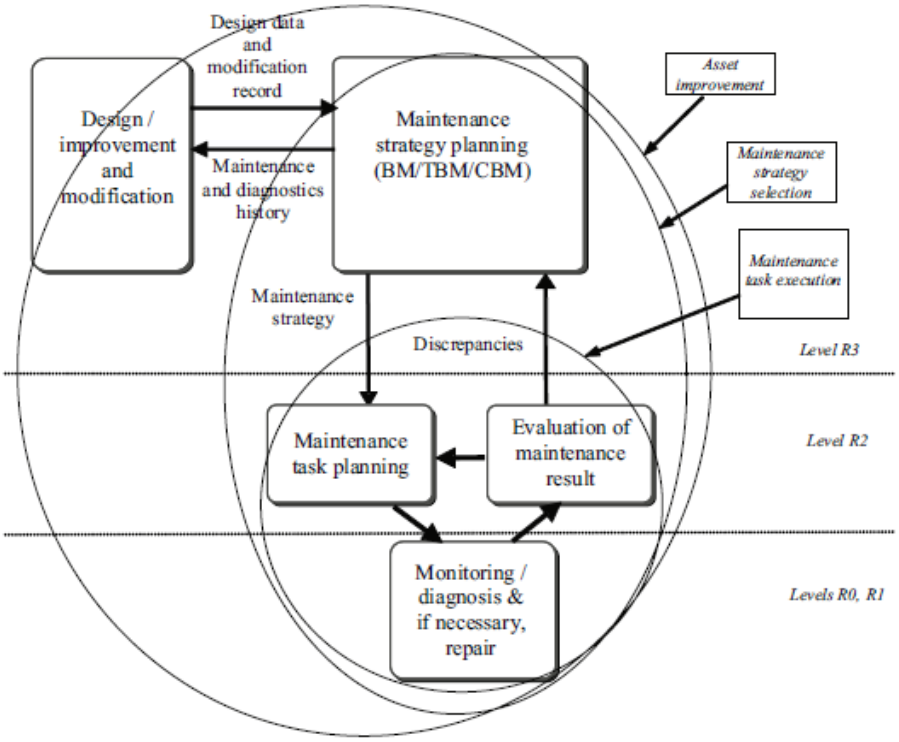

Figure 2 — Framework for maintenance management of manufacturing assets

Although condition-based maintenance (CBM) can be regarded as an advanced strategy, it is not always the most cost-effective method. When failures of machines or components are not critical, the breakdown maintenance (BM) approach is preferable. When the remaining useful life of machines or components can be estimated, time-based maintenance (TBM) is preferred.

ISO 18435 addresses the first cycle of maintenance task execution and the integration of maintenance applications with the other manufacturing applications, especially in the case of condition-based maintenance. The following are examples of integration issues concerning aspects of quality, cost and delivery:

a) quality aspect: conditions of manufacturing assets, kept by the maintenance tasks, used in product quality assurance;

b) cost aspect: trade off between maintenance cost and production loss due to malfunction, unsafe condition and inefficiency of assets;

c) delivery (time) aspect – coordinating maintenance schedule with production schedule.

0.3 Approach

In ISO 18435, the definitions and concepts in other international standards, such as IEC 62264, ISO 15745, and ISO 13374, are used to describe the functions and interfaces that gather information about the process, equipment, operators, and materials and other manufacturing assets and convey the information to various diagnostics and maintenance sub-systems in order to perform asset management. The information exchanges are denoted by a set of schemas that describe the conveyed information and the usage of the required interoperability interfaces.

In particular, reference is made to applicable concepts and definitions provided in ISO 15745, ISO 13374, IEC 61499, IEC 61131, IEC 62264, IEC 61915, ISO/IEC 15459-1, MIMOSA OSA-CBM and MIMOSA OSA-EAI.

0.4 Intended benefits

In a manufacturing enterprise, an appropriately integrated asset management system can provide critical information to improve the productivity of the manufacturing assets deployed. Ideally, effective and timely asset maintenance enables these assets to provide the services required by the production system.

In the past, the information about the process, equipment, operator and material that is already provided by many industrial automation systems and control devices, was not fully utilized in the manufacturing process. Today, with increasing use of digital signal processing in these devices, the available information can now be more effectively analyzed closer to the manufacturing process and used in the diagnostics, capability assessment, control, and maintenance applications. In addition, some of this information can be extracted via interfaces already present in the control system, without adding additional sensors to the manufacturing process. This increased information access capability needs to be presented in a standardized form to other analysis tools that diagnose process, material and equipment problems via well-defined interfaces.

Other benefits that can be gained are as follows:

a) end users can facilitate the specification and procurement of open, integrated and safe systems by referencing pre-defined diagnostics and maintenance application interoperability profiles;

b) system integrators can reduce the time to develop diagnostics and maintenance solutions by using generic tools based on ISO 18435;

c) suppliers of diagnostics and maintenance products and services can provide and develop new offerings using generic tools based on ISO 18435;

d) system aspects of safety management can be improved with an easy access to critical information.

Integration increases the likelihood of the system to realize process optimization per the performance and capacity targets of the application and the business requirements, such as, cost, safety, security, and environmental compatibility.

The application integration models and interoperability schemas can provide equipment and field device suppliers, system integrators, and application designers a means to assess the suitability of diagnostic and maintenance components when integrating the required condition monitoring, maintenance scheduling and asset management systems with other manufacturing applications.

0.5 Relationship to other parts of ISO 18435

The different parts of ISO 18435 are briefly described in Table 1 and illustrated in Figure 3.

In Figure 3, the focuses of the various parts of ISO 18435 are shown as dotted-line areas that bound specific portions of the UML class diagram representing the integration model for an application and between applications.

Table 1 — Outline of ISO 18435

Part	Description
ISO 18435-1	Overview of the integration approach and the application integration model elements, their relationships and a description of general requirements in terms of selected industry application scenarios.
ISO 18435-2[a]	Descriptions and definitions of application domain matrix elements and application interaction matrix elements which represent the application-to-application integration requirements.
ISO 18435-3[a]	Applications integration description method in terms of interoperability profile templates.
[a] Under preparation.	

This part of ISO 18435 provides an overview of the elements and the rules of a method to describe a manufacturing application's integration requirements. The elements include the key aspects when integrating a manufacturing application with other applications and the relationships of these key aspects. The rules include the information exchanges to support interoperability within an application and between applications.

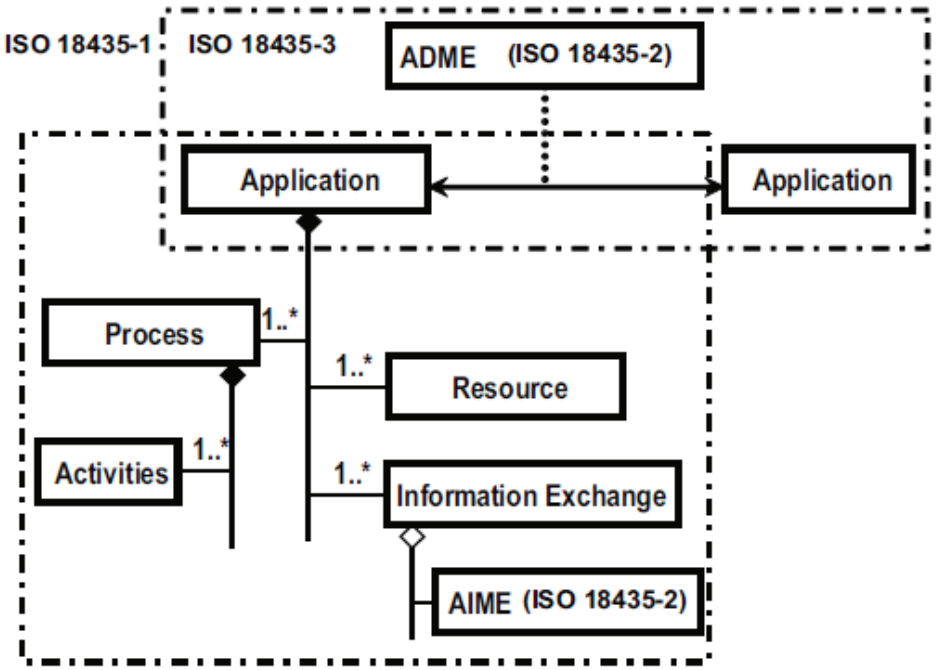

Figure 3 — Relationships within ISO 18435

ISO 18435-2 will provide the detailed definitions of the Application Interaction Matrix Element (AIME) and Application Domain Matrix Element (ADME) structures and their relationships. In particular, the steps for constructing an ADME from a set of AIMEs will be described.

ISO 18435-3 will define a recommended method to describe the interoperability and integration requirements between applications in two or more manufacturing domains within a manufacturing enterprise. The focus will be on the production operations and maintenance operations domains.

Industrial automation systems and integration — Diagnostics, capability assessment and maintenance applications integration —

Part 1: Overview and general requirements

1 Scope

This part of ISO 18435 defines an integration modelling method and its use to integrate diagnostics, capability assessment, prognostics and maintenance applications with production and control applications. The integration of other application aspects, such as security, is outside the scope of ISO 18435.

NOTE 1 Other parts of ISO 18435 will define the activity domain matrix elements and the detailed integration methods between applications in the application domain integration diagram.

NOTE 2 It is recognized that security is an important aspect of many applications; however, security will not be addressed in ISO 18435.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62264-1, *Enterprise-control system integration — Part 1: Models and terminology*

IEC 62264-2, *Enterprise-control system integration — Part 2: Object model attributes*

IEC 62264-3, *Enterprise-control system integration — Part 3: Activity models of manufacturing operations management*