Automation systems and integration — Equipment behaviour catalogues for virtual production system~~—~~

Part 3:
Requirements and recommendations for construction of an equipment instance model

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Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee *[or Project Committee]* ISO/TC 184, *Automation systems and integration*, Subcommittee SC 5, *Interoperability, integration, and architectures for enterprise systems and automation applications*.

A list of all parts in the ISO 16400 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The ISO 16400 series introduces a concept of an equipment behaviour catalogue (EBC), addresses the requirements of an EBC and provides requirements and recommendations to generate an executable model representing the dynamic behaviour of a nominal or a physical instance of an equipment. An equipment instance model is implemented, such as a software agent. Such an executable model plays a vital role when configuring virtual production systems used for simulation and verification of a future process as well as monitoring of a current process. Therefore, EBCs will constitute an important part in the development of smart manufacturing.

An EBC enables an efficient and standardized way for a provider of equipment to communicate its dynamic behaviour.

The ISO 16400 series consists of the following parts, under the general title "*Automation systems and integration — Equipment behaviour catalogues for virtual production system*":

Part 1: *Overview*

Part 2: *Formal description of a catalogue template*

Part 3 (this document): *Requirements and recommendations for construction of an equipment instance model*

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Automation systems and integration — Equipment behaviour catalogues for virtual production system—— ——

Part 3:
Requirements and recommendations for construction of an equipment instance model

1 Scope

This document provides construction requirements and recommendations on how to construct an equipment instance model using an equipment behaviour catalogue (EBC) item.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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.

ISO 16400‑1:2020, *Automation systems and integration — Equipment behaviour catalogues for virtual production system — Part 1: Overview*

ISO 16400‑2:20——¹2024, *Automation systems and integration — Equipment behaviour catalogues for virtual production system — Part 2: Formal description of a catalogue template*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 16400-1 and the following apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

— —— ISO Online browsing platform: available at https://www.iso.org/obphttps://www.iso.org/obp

— —— IEC Electropedia: available at https://www.electropedia.org/https://www.electropedia.org/

3.1
construction processor
software tool to construct an equipment instance model from an equipment behaviour catalogue (EBC) item refering to construction requirements

3.2
equipment instance model
executable model corresponding to a specification of an equipment behaviour catalogue (EBC) item

4 Abbreviated terms

XML   eXtensible Markup Language

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¹ Under development. Stage at the time of publication: ISO/DIS 16400-2.

XSL   eXtensible Stylesheet Language

XSLT   eXtensible Stylesheet Language Transformations

5 Required functionalities for an equipment instance model

When the virtual production system of interest is constructed, an equipment instance model shall be constructed from an appropriate EBC item.

An equipment instance model shall have the following functionalities:

— processable description of behaviour flow specified in the EBC item;

NOTE 1   Behaviour flow means a sequence of behaviours performed during the execution of an equipment instance model.

— processable description of formula(s) or mathematical model(s);

— processable description of external interactions.

To fulfil these functionalities, an equipment instance model can be modelled in various ways, e.g. agent-based modelling, discrete event modelling, dynamic system modelling. In this document, an equipment instance model is implemented as a software agent.

6 Role of construction requirements

6.1 Relationship between an EBC item and an equipment instance model

A production system model is constructed using equipment instance models. An equipment instance model is constructed from the selected EBC item. The EBC items and the EBC templates are registered in a shared repository (see ISO 16400-1:2020, Figure 4).

~~Figure 1~~Figure 1 shows three cases for construction of an equipment instance model. All cases shall be treated by the construction requirements.
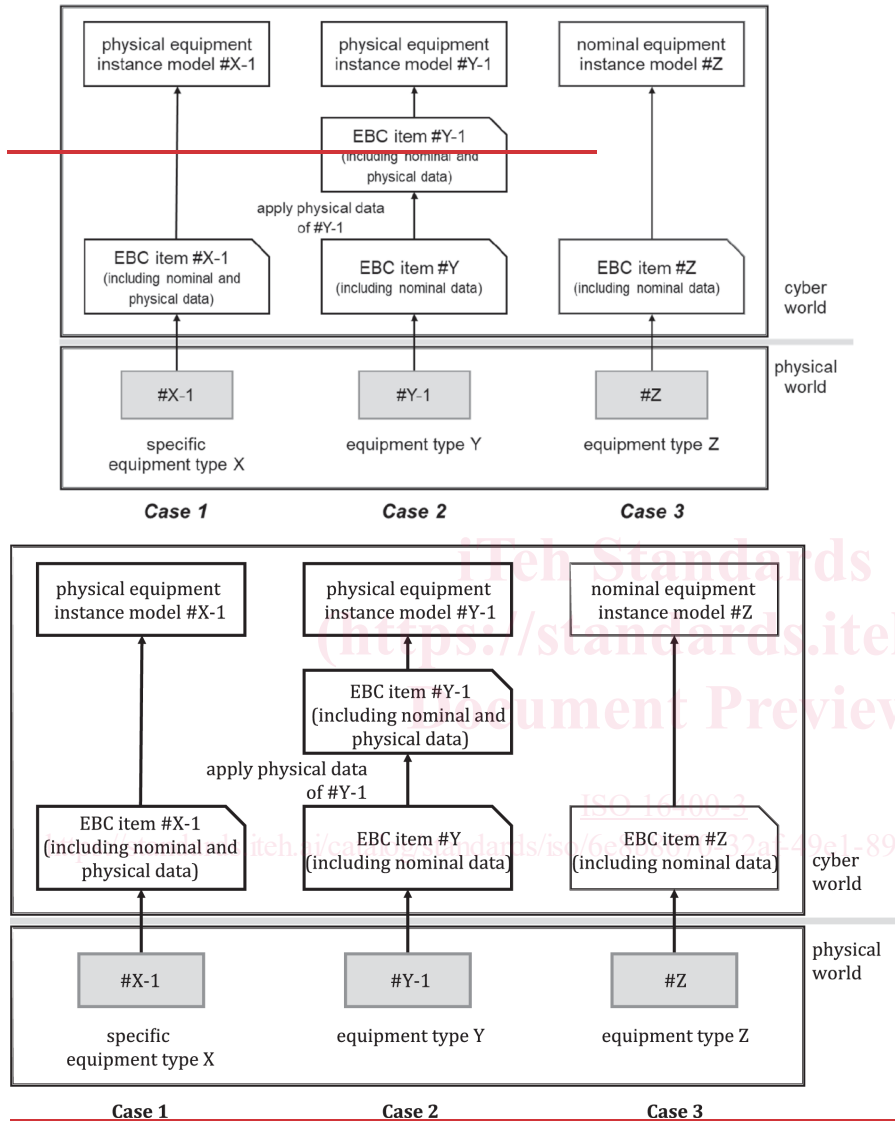
Figure 1 — Three cases for the construction of equipment instance models

— —Case 1: If the EBC item contains the physical data of specific equipment that actually exists, a physical equipment instance model is constructed;

— ~~——~~Case 2: If the EBC item contains only nominal data as designed for a specific equipment, but the specific physical data exists, applying the physical data to the corresponding EBC item, a physical equipment instance model is constructed;

— ~~——~~Case 3: If the EBC item contains only nominal data as designed for specific a specific equipment, a nominal equipment instance model is constructed.

6.2 Construction processor

An equipment instance model shall be constructed using the construction requirements. These construction requirements shall be applicable to the above three cases.

The construction processor of the target environment where the equipment instance model will be executed takes an EBC item as an input and constructs an equipment instance model.

Depending on whether the EBC item contains nominal data or physical data, there can be three cases in which the equipment instance model is constructed by a construction processor using the construction requirements as shown in ~~Figure 2.~~Figure 2.
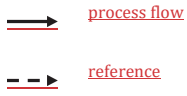

Key

4

process flow

reference
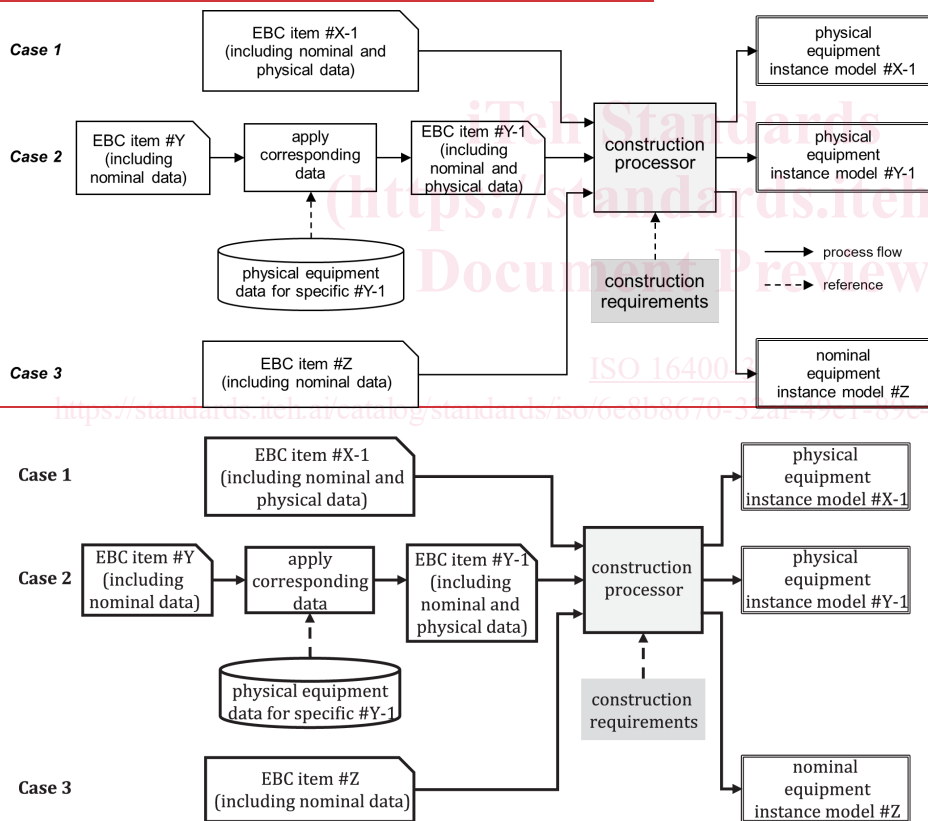
Figure 2 — Construction of equipment instance model

7 Construction requirements

7.1 General

The construction requirements are represented by the construction rules. Details of construction rules are described in ~~7.2~~7.2. The construction procedures shall be implemented in the construction processor by following the construction requirements. The construction procedures are executed by the construction processor which accepts an EBC item to construct an equipment instance model. ~~Figure 3~~Figure 3 shows a construction processor based on the construction requirements.
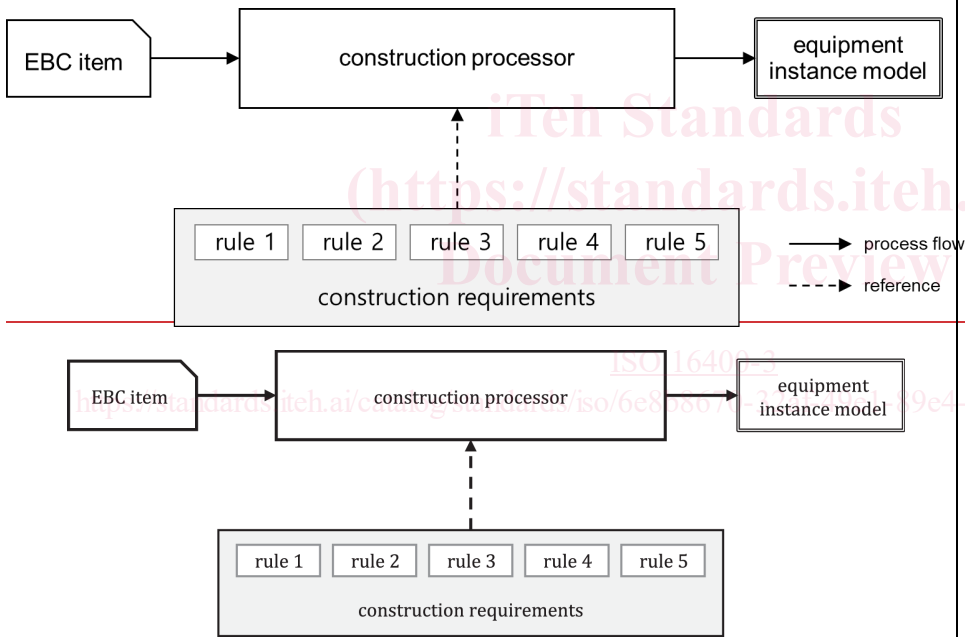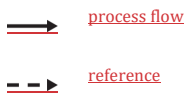

Figure 3 — Construction processor