

DRAFT INTERNATIONAL STANDARD

ISO/DIS 23247-3

ISO/TC 184/SC 4

Secretariat: ANSI

Voting begins on:
2020-07-27

Voting terminates on:
2020-10-19

Automation systems and integration — Digital Twin framework for manufacturing —

Part 3: Digital representation of manufacturing elements

ICS: 25.040.40; 35.240.50

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO/DIS 23247-3](#)

<https://standards.iteh.ai/catalog/standards/sist/73aad9c0-2c6e-43b7-b7ba-ec5ee8ae0c01/iso-dis-23247-3>

THIS DOCUMENT IS A DRAFT CIRCULATED FOR COMMENT AND APPROVAL. IT IS THEREFORE SUBJECT TO CHANGE AND MAY NOT BE REFERRED TO AS AN INTERNATIONAL STANDARD UNTIL PUBLISHED AS SUCH.

IN ADDITION TO THEIR EVALUATION AS BEING ACCEPTABLE FOR INDUSTRIAL, TECHNOLOGICAL, COMMERCIAL AND USER PURPOSES, DRAFT INTERNATIONAL STANDARDS MAY ON OCCASION HAVE TO BE CONSIDERED IN THE LIGHT OF THEIR POTENTIAL TO BECOME STANDARDS TO WHICH REFERENCE MAY BE MADE IN NATIONAL REGULATIONS.

RECIPIENTS OF THIS DRAFT ARE INVITED TO SUBMIT, WITH THEIR COMMENTS, NOTIFICATION OF ANY RELEVANT PATENT RIGHTS OF WHICH THEY ARE AWARE AND TO PROVIDE SUPPORTING DOCUMENTATION.

This document is circulated as received from the committee secretariat.



Reference number
ISO/DIS 23247-3:2020(E)

© ISO 2020

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO/DIS 23247-3

<https://standards.iteh.ai/catalog/standards/sist/73aad9c0-2c6e-43b7-b7ba-ec5ee8ae0c01/iso-dis-23247-3>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2020

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Fax: +41 22 749 09 47
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Digital representation of the observable manufacturing elements	2
5 Information attributes of the observable manufacturing elements	2
5.1 General	2
5.2 Personnel information	3
5.3 Equipment information	4
5.4 Material information	4
5.5 Process information	5
5.6 Facility information	6
5.7 Environment information	7
5.8 Product information	7
5.9 Supporting document information	8
Annex A (informative) Existing technologies for representing the observable manufacturing elements	10
Annex B (informative) An example of information attributes	12
Bibliography	14

<https://standards.iteh.ai/catalog/standards/sist/73aad9c0-2c6e-43b7-b7ba-ec5ee8ae0c01/iso-dis-23247-3>
 ISO/DIS 23247-3

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.

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 documents 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).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: www.iso.org/iso/foreword.html. (standards.iteh.ai)

This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 4, *Industrial Data*. ISO/DIS 23247-3

<https://standards.iteh.ai/catalog/standards/sist/73aad9c0-2c6e-43b7-b7ba->

A list of all parts in the ISO 23247 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 23247 series defines a framework to support the creation of Digital Twins of observable manufacturing elements including personnel, equipment, materials, manufacturing processes, facilities, environment, products, and supporting documents.

The scopes of the four parts of this series are defined below:

- Part 1: Overview and general principles

General principles and requirements for developing Digital Twins in manufacturing;

- Part 2: Reference architecture

Reference architecture with functional views;

- Part 3: Digital representation of manufacturing elements

List of basic information attributes for the observable manufacturing elements;

- Part 4: Information exchange

Technical requirements for information exchange between entities within the reference architecture.

The framework is targeted to all types of manufacturing including discrete and continuous manufacturing of parts, assemblies and material. The actual type of manufacturing supported by a particular implementation depends on the standards and technologies available to model the observable manufacturing elements.

Digital Twin use cases that conform to the framework will be detailed in a series of technical reports attached to this series. Preliminary outlines for three use cases are given in the Annex of Part 4.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[ISO/DIS 23247-3](https://standards.iteh.ai/catalog/standards/sist/73aad9c0-2c6e-43b7-b7ba-ec5ee8ae0c01/iso-dis-23247-3)

<https://standards.iteh.ai/catalog/standards/sist/73aad9c0-2c6e-43b7-b7ba-ec5ee8ae0c01/iso-dis-23247-3>

Automation systems and integration — Digital Twin framework for manufacturing —

Part 3: Digital representation of manufacturing elements

1 Scope

This part of ISO 23247 provides a list of basic information attributes for the observable manufacturing elements.

The ISO 23247 series defines a framework to guide the creation of Digital Twins of observable manufacturing elements including personnel, equipment, materials, processes, facilities, environment, products, and supporting documents.

The following are within the scope of this part of ISO 23247:

- digital representation of observable manufacturing elements.

The following are described in other parts of ISO 23247:

- overview and general principles (Part 1);
- reference architecture (Part 2);
- Information exchange requirements for Digital Twins (Part 4).

The following are outside of the scope of ISO 23247, but will be identified as use cases in technical reports.

- selection of the manufacturing devices and other resources to be represented by Digital Twins;
- selection of the manufacturing processes to be represented by Digital Twins;
- selection of the manufacturing products to be represented by Digital Twins.

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 23247-1, *Automation systems and integration — Digital Twin framework for manufacturing — Part 1: Overview and general principles*

ISO 23247-2, *Automation systems and integration — Digital Twin framework for manufacturing — Part 2: Reference architecture*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 23247-1 apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

4 Digital representation of the observable manufacturing elements

Digital representation of the observable manufacturing elements shall include information that is both static and dynamic. Information that does not change during manufacturing is classified as static. For example, the serial number of a piece of material is static. However, the shape of the material, if it changes during manufacturing processes, is dynamic.

The blue-coloured box in [Figure 1](#) shows the types of observable manufacturing elements represented by the Core Entity defined in ISO 23247-2.

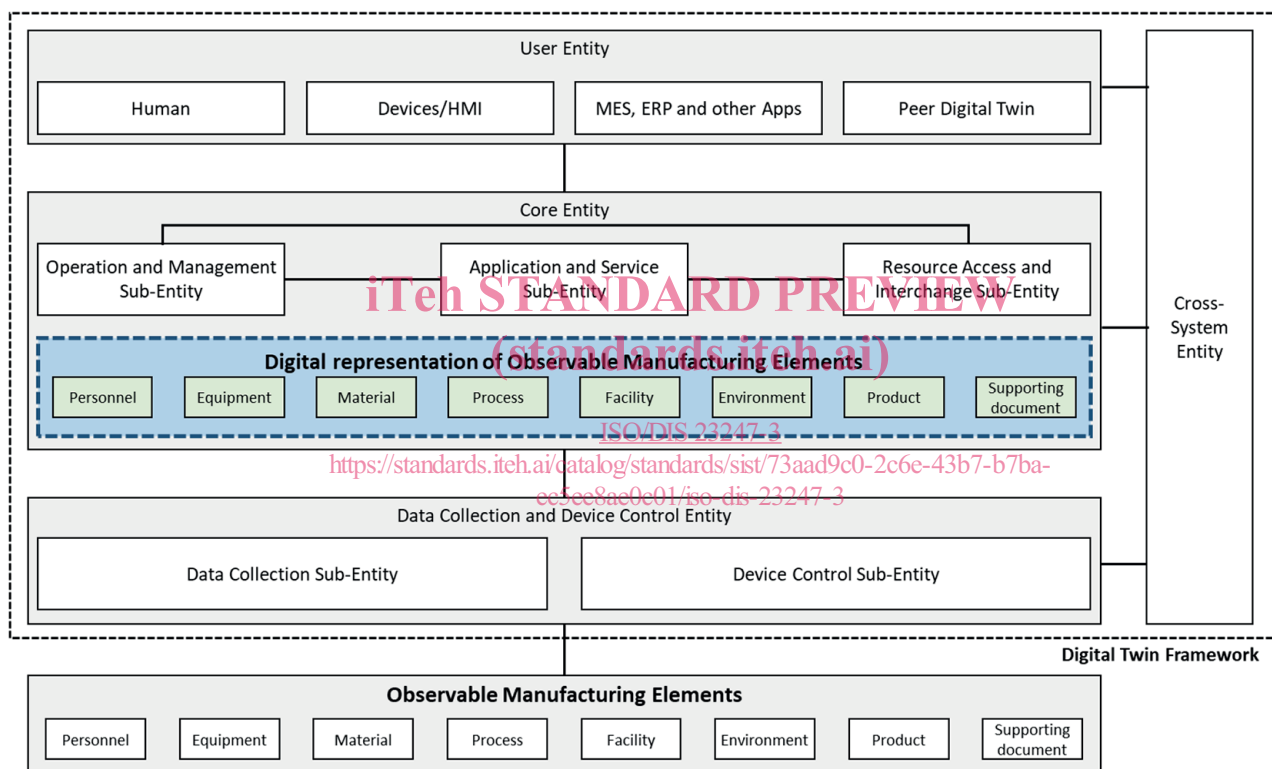


Figure 1 — The types of observable manufacturing elements in reference architecture (blue-coloured box)

5 Information attributes of the observable manufacturing elements

5.1 General

Standards such as IEC 62264-2 and ISO 10303 contain detailed information models for representing the observable manufacturing elements. An implementation of ISO 23247 shall select the models most appropriate for its use case.

[Annex A](#) lists some standards and technologies that can be selected for the digital representation. [Annex B](#) provides UML and XML descriptions for an example.

Table 1 shows a template used to describe the information attributes. Types of information attributes are not limited to those given in Table 1, but should be extended for specific use cases. The notation is taken from IEC 62264-2.

Table 1 — Information attributes for the observable manufacturing elements

Attribute	Description	Mandatory (M) Optional (O)
Identifier	Value used to uniquely identify an observable manufacturing element	M
Characteristics	A typical or noticeable feature of an observable manufacturing element	M
Schedule	Time information bound to a manufacturing process	M
Status	Situation of an observable manufacturing element involved in a manufacturing process	M
Location	Geographical or relative location information of an observable manufacturing element	M
Report	Description of activity done by or onto an observable manufacturing element	M
Relationship	A connection information between two or more observable manufacturing elements	M
...

5.2 Personnel information

Personnel includes employees who are engaged directly or indirectly in manufacturing processes. Personnel information attributes and examples are shown in Table 2.

Table 2 — Information attributes for Personnel

Attribute	Description	Examples
Identifier	ID assigned to a person	<ul style="list-style-type: none"> employee ID: 11223
Characteristics	Personal properties including skill level, classification, e.g., <ul style="list-style-type: none"> skill level <ul style="list-style-type: none"> — 1: master — 2: journeyman — 3: apprentice classification <ul style="list-style-type: none"> — 1: researcher — 2: administrator — 3: technician — 4: driver 	<ul style="list-style-type: none"> skill level: 2 classification: 3
Schedule	Personal working schedule, e.g., <ul style="list-style-type: none"> working day-off 	<ul style="list-style-type: none"> working: 8AM to 5PM
Status	Current working status	<ul style="list-style-type: none"> on break
Location	Location of the person	<ul style="list-style-type: none"> Operator #1: WorkUnit #3 and 50 cm away from Robot #2.
Report	Activity report of the person	<ul style="list-style-type: none"> May 14th 2019: 8 hours of work

Table 2 (continued)

Attribute	Description	Examples
Relationship	Information regarding collaborations among personnel and other observable manufacturing elements	<ul style="list-style-type: none"> Operator #1 is the supervisor of operator #2. WorkUnit #3 must have 4 persons for safety reasons. Operator #1 and Operator #2 are working in the WorkUnit #3. Operator #1 and Operator #2 are 70 cm away from Machine #2.

5.3 Equipment information

Equipment is a physical element that carries out an operation directly or indirectly for a manufacturing process. Equipment information attributes and examples are shown in [Table 3](#).

Table 3 — Information attributes for equipment

Attribute	Description	Examples
Identifier	ID assigned to the equipment	<ul style="list-style-type: none"> asset ID: dtm-200327-11
Characteristics	Functionalities, features of the equipment, e.g., <ul style="list-style-type: none"> milling turning grinding and pressing 	<ul style="list-style-type: none"> milling
Schedule	Plan for carrying out manufacturing activities, e.g., Monday to Friday first shift	<ul style="list-style-type: none"> Maintenance for Machine #1 is scheduled on every Sunday.
Status	Current state of the equipment, e.g., <ul style="list-style-type: none"> on / off working / breakdown energy usage (unit: kWh) temperature (unit: °C, °F) noise level (unit: dB) 	<ul style="list-style-type: none"> on energy usage: 10kWh temperature: 25°C
Location	Location of the equipment	<ul style="list-style-type: none"> Machine #2: Work Unit #2 in Room #3
Report	Activity report of the equipment engaged in manufacturing, maintenance, etc.	<ul style="list-style-type: none"> May 14th, 2019 9 AM to 6 PM: Regular Maintenance May 14th, 2019 11 AM: Machine #1 reports high temperature.
Relationship	Relationship information between the equipment and other observable manufacturing elements	<ul style="list-style-type: none"> Machine #1 operates with Material #2. Machine #1 is operated in WorkCenter #5.

5.4 Material information

Material includes physical matter that becomes a part or the whole of a product e.g., metal block, glass panel, etc., or is used to aid manufacturing processes, e.g., cleaning fluid, coolant, etc. Material information attributes and examples are shown in [Table 4](#).

Table 4 — Information attributes for material

Attribute	Description	Examples
Identifier	ID assigned to the material, e.g., <ul style="list-style-type: none"> bar code RFID tag 	<ul style="list-style-type: none"> bar code: 8809123456785
Characteristics	Features of the material, e.g., <ul style="list-style-type: none"> handle with care / fragile toxic / non-toxic liquid / solid / gas plastic / steel / rubber / powder 	<ul style="list-style-type: none"> handle with care
Schedule	Time information of the material, e.g., <ul style="list-style-type: none"> purchase schedule receiving / internal routing schedule machine load schedule 	<ul style="list-style-type: none"> purchase: May 14th, 2019
Status	Current situation of the material, e.g., <ul style="list-style-type: none"> Tested Availability liquid / solid / gas 	<ul style="list-style-type: none"> Tested
Location	Location of the material	<ul style="list-style-type: none"> Material #1: Shelf #3 in Warehouse #2
Report	Usage report of the material	<ul style="list-style-type: none"> May 14th, 2019: 8kg of Material #2 was used in WorkUnit #2.
Relationship	Relationship information between the material and other observable manufacturing elements	<ul style="list-style-type: none"> Material #1 is operated by an operator with skill level2.

5.5 Process information

A process includes an observable physical operation within manufacturing. Process information attributes and examples are shown in [Table 5](#).

Table 5 — Information attributes for process

Attribute	Description	Examples
Identifier	ID assigned to a process	<ul style="list-style-type: none"> process identifier
Characteristics	Classification of processes including production, maintenance, quality test, and inventory, e.g., <ul style="list-style-type: none"> production / maintenance / quality test / inventory milling / drilling additive manufacturing 	<ul style="list-style-type: none"> milling
Schedule	Time features of the process, e.g., <ul style="list-style-type: none"> periodic one time given specific time duration 	<ul style="list-style-type: none"> periodic: once a month