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Automation systems and integration — Evaluating energy efficiency and other factors of manufacturing systems that influence the environment —

Part 5:
Environmental performance evaluation data

Systèmes d'automatisation et intégration — Évaluation de l'efficacité énergétique et autres facteurs de fabrication des systèmes qui influencent l'environnement —

Partie 5: Données d'évaluation de la performance environnementale

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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 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).

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For an explanation of 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 www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 5, *Interoperability, integration, and architectures for enterprise systems and automation applications,* in collaboration with the International Electrotechnial Commission (IEC), Technical Committee IEC/TC 65, *Industrial-process measurement, control and automation*.

This second edition cancels and replaces the first edition (ISO 20140-5:2017), which has been technically revised.

The main changes are as follows:

a) renewal of Clause 4 according to EPE data class definition;

b) restructuring and updates of Clauses 5 to 8 into new Clause 5 and Clause 6 in terms of EPE data class definitions and their properties;

c) replacement of Annexes with new Annex A, Annex B and Annex C.

A list of all parts in the ISO 20140 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 20140 series specifies a method for evaluating the energy efficiency and other factors of a manufacturing system that influence the environment, such as energy consumption, waste, and release.

The ISO 20140 series can be used for:

— benchmarking the environmental performance against a generic reference manufacturing system or comparing between different manufacturing systems;

— alternative studies for improving environmental performance;

— setting targets for improving environmental performance;

— visualizing the environmental performance of a manufacturing system under operation;

— managing carbon footprints of products (CFP) in a supply chain;

— evaluating the environmental performance of manufacturing systems.

Expected users of the ISO 20140 series are:

a) managers who are responsible for the environmental conditions of a manufacturing system;

b) engineers who design manufacturing processes for products;

c) engineers who design a manufacturing system;

d) engineers and supervisors who are responsible for manufacturing products.

This document classifies environmental performance evaluation (EPE) data. The classification intends to support the association of EPE data with context information and transferring them across various locations and disciplines in the manufacturing system.

This document provides EPE data classes which are used in the aggregation process specified in ISO 20140-3 to evaluate environmental performance of a manufacturing system. This document intends to allow mapping EPE data to various implementations based on different technologies by providing formal and technology-independent definitions of EPE data classes. The EPE data classes are intended to be stored in concept data dictionaries (e.g. IEC CDD).

This document is the second edition of ISO 20140-5, which replaces the first edition ISO 20140-5: 2017. The objective and the scope of both documents are the same. Both documents define the same set of EPE data classes. In order to improve the applicability of EPE data for evaluating various manufacturing processes, this document defines EPE data classes by a classification scheme differently from the first edition. The classification of the first edition is based on properties of manufacturing operations, i.e., source and time of EPE data generation. The classification of this document is based on a general concept of a manufacturing process, and detailed EPE data classes are defined systematically. The definitions of EPE data classes and types of properties are given respectively in Clause 5 and Clause 6 of this document. In order to retain the general use of the definitions, individual EPE data derived from EPE data classes and its properties are not described in this document. Detailed individual EPE data and properties specified in the first edition of ISO 20140-5 can be represented by using the class definitions given in this document.

Automation systems and integration — Evaluating energy efficiency and other factors of manufacturing systems that influence the environment —

Part 5:
Environmental performance evaluation data

1 Scope

This document defines a set of environmental performance evaluation (EPE) data classes, including their properties.

It is applicable to entire manufacturing facilities or to parts of a manufacturing facility.

This document applies to manufacturing systems including discrete, batch and continuous control, which are defined in IEC 62264-1.

The following are outside the scope of this document:

— syntax of EPE data and data models;

— protocols to exchange EPE data;

— functions that can be enabled by the use of EPE data;

— product life cycle assessment;

— EPE data that are specific to a particular industry sector, manufacturer or machinery;

— acquisition of EPE data.

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 10303 (all parts), *Industrial automation systems and integration — Product data representation and exchange*

ISO 11014, *Safety data sheet for chemical products — Content and order of sections*

ISO 13584-42, *Industrial automation systems and integration — Parts library — Part 42: Description methodology: Methodology for structuring parts families*

ISO 14224, *Petroleum, petrochemical and natural gas industries — Collection and exchange of reliability and maintenance data for equipment*

ISO/TS 15926-4, *Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities — Part 4: Initial reference data*

ISO 20140-1, *Automation systems and integration — Evaluating energy efficiency and other factors of manufacturing systems that influence the environment — Part 1: Overview and general principles*

IEC TS 62720, *Identification of units of measurement for computer-based processing*

IEC 60721 (all parts), *Classification of environmental conditions*

IEC 61360-4, *IEC/SC 3D — Common Data Dictionary (CDD — V2.0015.0004)*

IEC 61987 (all parts), *Industrial-process measurement and control — Data structures and elements in process equipment catalogues*

IEC 62683-1, *Low-voltage switchgear and controlgear — Product data and properties for information exchange — Part 1: Catalogue data*

IEC/TR 63213, *Power measurement applications within electrical distribution networks and electrical installations*

3 Terms, definitions, abbreviated terms and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 20140-1 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/obp

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

3.1.1
assembly
number of parts, subassemblies or combinations thereof joined together

[SOURCE: IEC 60194:2021, 3.1.72, modified — removed Note 1 to entry.]

3.1.2
attribute
data element for the computer-sensible description of a class definition or a property

[SOURCE: IEC 61360-1:2017, 3.1.2, modified — "a property, a relation or a class" was replaced with "a class definition or a property".]

3.1.3
classifying property
property applicable for a particular class, having a value list whose values define the subclasses of the class

[SOURCE: IEC 61360-1:2017, 3.1.7]

3.1.4
consumable
any part or material that is necessary for continued use or maintenance of the product

[SOURCE: IEC/IEEE 82079-1:2019, 3.7]

3.1.5
environmental performance evaluation data
EPE data
data that are used to evaluate the environmental performance

[SOURCE: ISO 20140-3:2019, 3.7]

3.1.6
environmental performance evaluation data class
EPE data class
description of a set of EPE data that share common characteristics

Note 1 to entry: Adapted from IEC 62832-2:2020.

3.1.7
environmental performance evaluation data class definition
EPE data class definition
grouping of references to property or to another EPE data class definition, that defines the shared structure of a group of EPE data classes

3.1.8
environmental performance evaluation data value
EPE data value
number, text, or artefact encoding that expresses a quantity or quality held by EPE data

3.1.9
material
substance or mixture within a product or a part of a product

[SOURCE: IEC 62474:2012, 3.15]

3.1.10
part
material or functional element that is or can be a constituent of different products

[SOURCE: ISO 13584-1:2001, 3.1.16, modified – The phrase "intended to constitute a component" is replaced by "is or can be a constituent".]

3.1.11
product
intended or accomplished result of labour, or of a natural or artificial process

[SOURCE: IEC 81346-1:2022, 3.6]

3.1.12
property
defined parameter suitable for the description and differentiation of objects

Note 1 to entry: A property describes one characteristic of a given object.

Note 2 to entry: A property can have attributes such as code, version, and revision.

Note 3 to entry: The specification of a property can include predefined choices of values.

[SOURCE: IEC 61360-1:2017, 3.1.24]

3.1.13
subclass definition
environmental performance evaluation (EPE) data class definition that is included in another EPE data class definition

3.1.14
tool
device for imparting a desired shape, form, or finish to a material

Note 1 to entry: The desired shape can be achieved by different means, e.g. by material removal, forming, shaping.

[SOURCE: ISO 14955-3:2020, 3.5]

3.1.15
value type
stereotype of properties that is used to define types of values that are allowed to express information

3.2 Abbreviated terms

CAS   Chemical Abstracts Service

CFP   Carbon Footprint of Products

ECD   Environmental Characteristics Data

EPE   Environmental Performance Evaluation

GHG   Greenhouse Gas

ID   Identifier

IO   Input and Output

LCA   Life Cycle Assessment

NC   Numerical Control

UML   Unified Modelling Language

3.3 Conventions for defining class definitions and properties

Words connected with underscore (e.g. EPE_data) are used for representing class definitions and properties in Clause 4, Clause 5 and Clause 6.

Table 1 is the template used in this document for specifying an EPE data class definition.

Table 1 — Template for specifying EPE data class definitions

Attributes of the class definition	Value of the attribute	
ID of the class definition	<ID of the class definition >	
Preferred name	<preferred name of the class definition >	
Description of the class definition	<description of class definition >	
Source of the description	<source of the description>	
Preferred name of parent class definition	Subclause number defining the parent class definition	
<preferred name of parent class definition>	< Subclause number where the parent class definition is defined.>	
Property included in the class definition	Cardinality	Subclause defining the property
<preferred name of property #1>		<subclause number defining the property #1>
....		...
<preferred name of property #N>		<subclause number defining the property #M>
Class definitions included in this class definition	Cardinality	Subclause defining the class definition

Table 1 *(continued)*

<preferred name of class definition #1>		<subclause number defining the class definition #1>
...		...
<preferred name of class definition #N>		<subclause number defining the class definition #N>

The shaded cells indicate the meaning of associated unshaded cell.

The text in the angle bracket (i.e. "<" and ">") in each unshaded cell describes what the cell is used for.

The "Attributes of the class definition" part of the template provides identifying information for this EPE data class definition formatted as fields (unshaded cells) with respective values. The fields are designated ID of the class definition, Preferred name, and Description of the class definition.

The "Preferred name of parent class definition" part of the template provides references to another EPE data class definition (parent class definition). The EPE data class definition being specified inherits the properties of the parent class definition, which is referenced by preferred name.

The "Property included in the class definition" part of the template provides a list of properties for inclusion into this EPE data class definition by indicating the preferred names and the number of possible occurrences (cardinality). The first row for the "Property included in the class definition" part of the template is used for the classifying property of the class definition, if applicable. The preferred names of classifying properties are represented in bold text.

The "Class definitions included in the class" part of the template provides a list of other EPE class definitions for inclusion into this EPE data class. The EPE data class definition being defined inherits the properties of the included EPE data class definition that is referenced by indicating the preferred name and number of possible occurrences (cardinality).

NOTE   For ease of understanding, reference subclause numbers in this document are added to the tables.

The field "Cardinality" contains a range which defines the number of constituent elements, which are properties or EPE class definitions. The range is expressed using the following convention:

[a..b]

where:

    a   is the minimum number of constituent elements;

    b   is the maximum number of constituent elements.

EXAMPLE   The number of constituent elements can be expressed as follows:

    [0..1] indicates the EPE class definition has none or one constituent element;

    [0..n] indicates the EPE class definition has none or as many as n constituent elements;

    [1..1] indicates the EPE class definition has one constituent element;

    [1..n] indicates the EPE class definition has one or as many as n constituent elements.

Table 2 specifies the template used to list subclass definitions which are EPE class definitions derived from the class definition that is defined by the template of Table 1. It also indicates the value of the classifying property which characterizes each subclass definition.

Table 2 — Template for listing subclass definitions

Classifying property	Preferred name of subclass definition that is derived from the class definition	Subclause number in this document specifying the subclass definition
<value of classifying property #1>	<preferred name of subclass definition #1 that is derived from the class definition to be defined>	<subclause # for subclass definition #1>
….	….	….
<value of classifying property #N>	<preferred name of subclass definition #N that is derived from the class definition to be defined>	<subclause # for subclass definition #N>

Table 3 specifies the template to be used for defining a specific property.

Table 3 — Template for defining properties

Attribute of the property	Value of the attribute
ID of the property	<ID of the property >
Preferred name	<preferred name of the property >
Description of the property	<description of the property >
Source of the description	<source of the description>
Value type	< type of the property value which is defined in 3.4 >
Code of quantity	< Identifier of quantity defined by IEC TS 62720. This attribute applies properties whose value type is MeasureType.>
Coding system	<This attribute is used to specify the coding system(s) in case of properties whose value type is CodeType.>

The template provides the definition of a specific property of EPE data (identity and meaning) and the attributes for defining it. In some cases, additional rows are added.

Each shaded cell indicates the name of an attribute; the value is shown in the unshaded cell.

A specific property is defined by providing data in the relevant unshaded cells (i.e. the table is filled). An "N/A" in an unshaded cell indicates that the field is not applicable to the definition of the specific property.

The attribute of Code of quantity is used for specifying the quantity of the value specified by the property in the case where its value type is MeasureType.

NOTE   Since multiple units of measure can be used for a property, identifiers of quantities defined by IEC TS 62720 is used for specifying the code of quantity, instead of unit of measures. Specifying the unit of measure for properties is out of the scope of this document. In an implementation of exchanging properties, a unit of measure corresponding to the code of quantity is specified separately.

The attribute of Coding system can be used in the following three different ways for properties whose value type is CodeType.

— In the case where a specific existing coding system is used, a reference to the coding system (e.g. designation of standard, URL, name of coding systems) is specified.

— In the case where only the coding system is defined by this document, the Table number of the Table defining it is indicated. In this case, the coding system is defined by using the template specified by Table 4.

— In the case where multiple coding systems can be used, "SELECTABLE" is indicated. In this case, applicable coding systems are listed by using the template specified by Table 5.

Table 4 is the template for specifying the coding system by listing the possible values for properties defined with Table 3, whose value type is CodeType or IndicatorType.