
**Industrial automation systems
and integration — Product data
representation and exchange —**

**Part 235:
Application protocol: Engineering
properties and materials information**

*Systèmes d'automatisation industrielle et intégration —
Représentation et échange de données de produits —*

*Partie 235: Protocole d'application: Propriétés d'ingénierie et
informations sur les matériaux*

ISO 10303-235:2019

<https://standards.iteh.ai/catalog/standards/iso/2dc1b2ca-ee9a-4b5a-b51e-486a7eb41f1e/iso-10303-235-2019>



iTeh Standards
(<https://standards.iteh.ai>)
Document Preview

ISO 10303-235:2019

<https://standards.iteh.ai/catalog/standards/iso/2dc1b2ca-ee9a-4b5a-b51e-486a7eb41f1e/iso-10303-235-2019>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2019

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

Foreword.....	v
Introduction.....	vi
1 Scope	1
2 Normative references	2
3 Terms and definitions.....	3
4 Information requirements	6
4.1 Units of functionality	7
4.1.1 activity UoF	8
4.1.2 administration UoF	8
4.1.3 approval UoF	9
4.1.4 condition UoF	9
4.1.5 document_management UoF	9
4.1.6 effectivity UoF	10
4.1.7 external reference UoF	11
4.1.8 geometry UoF	11
4.1.9 geometric tolerance UoF	12
4.1.10 location UoF	12
4.1.11 measure UoF	13
4.1.12 person organisation UoF	14
4.1.13 product UoF	14
4.1.14 product_property UoF	15
4.1.15 requirement UoF	15
4.1.16 resource UoF	15
4.1.17 state UoF	16
4.1.18 substance UoF	16
4.1.19 tolerance datum UoF	16
4.2 Application objects.....	17
4.2.1 Application objects for the activity UoF	17
4.2.2 Application objects for the administration UoF	24
4.2.3 Application objects for the approval UoF	31
4.2.4 Application objects for the condition UoF	36
4.2.5 Application objects for the document_management UoF	39
4.2.6 Application objects for the effectivity UoF	46
4.2.7 Application objects for the external reference UoF	53
4.2.8 Application objects for the geometry UoF	58
4.2.9 Application objects for the geometric_tolerance UoF	68
4.2.10 Application objects for the location UoF	74
4.2.11 Application objects for the measure UoF	78
4.2.12 Application objects for the person_organisation UoF	86
4.2.13 Application objects for the product UoF	92
4.2.14 Application objects for product_property UoF	96
4.2.15 Application objects for the requirement UoF	99
4.2.16 Application objects for the resource UoF	105
4.2.17 Application objects for the state UoF	108
4.2.18 Application objects for the substance UoF	112
4.2.19 Application objects for the tolerance datum UoF	115
5 Application interpreted model	120

5.1	Mapping specification.....	120
5.1.1	Activity UoF	122
5.1.2	Administration UoF	129
5.1.3	Approval UoF	135
5.1.4	Condition UoF	140
5.1.5	Document management UoF	142
5.1.6	Effectivity UoF.....	147
5.1.7	External reference UoF.....	152
5.1.8	Geometry UoF	161
5.1.9	Geometric tolerance UoF	169
5.1.10	Location UoF	175
5.1.11	Measure UoF.....	179
5.1.12	Person organisation UoF	186
5.1.13	Product UoF.....	191
5.1.14	Product property UoF	197
5.1.15	Requirements UoF	200
5.1.16	Resource UoF	207
5.1.17	State UoF.....	209
5.1.18	Substance UoF	212
5.1.19	Tolerance datum UoF.....	216
5.2	AIM EXPRESS short listing.....	223
5.2.1	Engineering properties and materials information type definitions.....	236
5.2.2	Engineering properties and materials information entity definitions.....	247
5.2.3	Engineering properties and materials information function definitions.....	266
5.2.4	Engineering properties and materials information rule definitions.....	267
6	Conformance requirements	270
Annex A (normative)	AIM EXPRESS expanded listing.....	271
Annex B (normative)	AIM short names	542
Annex C (normative)	Implementation method specific requirements.....	561
Annex D (normative)	Protocol Implementation Conformance Statement (PICS) proforma	562
Annex E (normative)	Information object registration.....	563
Annex F (informative)	Application activity model.....	564
Annex G (informative)	Application reference model.....	585
Annex H (informative)	AIM EXPRESS-G.....	605
Annex I (informative)	Computer interpretable listings.....	691
Annex J (informative)	Detailed changes	692
Bibliography.....		696
Index	697	

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.

This document was prepared by Technical Committee ISO/TC 184, *Automation systems and integration*, Subcommittee SC 4, *Industrial data*.

This second edition cancels and replaces the first edition (ISO 10303-235:2009), which has been technically revised. It also incorporates the Technical Corrigendum ISO 10303-235:2009/Cor 1:2011.

The changes made in this edition are documented in Annex J.

ISO 10303 is organized as a series parts, each published separately. Each part of ISO 10303 is a member of one of the following series: descriptive methods, implementation methods, conformance testing methodology and framework, integrated generic resources, integrated application resources, application protocols, abstract test suites, application interpreted constructs and application modules. This document is a member of the application protocols series.

A list of the parts of ISO 10303 is located at: https://standards.iso.org/iso/10303/tech/step_titles.htm.

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

ISO 10303 is an International Standard for the computer-interpretable representation and exchange of product data. The objective is to provide a neutral mechanism capable of describing product data throughout the life cycle of a product and independent from any particular system. The nature of this description makes it suitable not only for neutral file exchange, but also as a basis for implementing and sharing product databases and archiving.

This document defines the context, scope and information requirements for properties of products that can be used for product design and design validation and other purposes, the testing, measurement and approval processes used to determine those properties and specifies the integrated resources necessary to satisfy these requirements.

Clause 1 defines the scope and summarises the functionality and data covered by this document. Clause 3 lists the words defined in this document and gives pointers to words defined elsewhere. An application activity model that is the basis for the definition of the scope is provided in Annex F. The information requirements for the application are specified in Clause 4, using terminology appropriate to the application. A graphical representation of the information requirements, referred to as the application reference model (ARM), is given in Annex G.

Resource constructs from the Integrated Generic Resource Model are interpreted to meet the information requirements of this application and produce the application interpreted model (AIM). This interpretation, given in 5.1, shows the correspondence between the information requirements and the AIM. The short listing of the AIM specifies the interface to the integrated resources and is given in 5.2. Note that the definitions and EXPRESS provided in the integrated resources for constructs used in the AIM can include items in select lists and subtypes that are not imported into the AIM. The expanded listing given in Annex A contains the complete EXPRESS schema for the AIM without annotation. A graphical representation of the AIM is given in Annex H. Additional requirements for specific implementation methods are given in Annex C.

Engineering properties, which include materials properties, are not fundamental constants derived from physical or chemical laws. The understanding of an engineering property of a product is dependent on the process used to measure the property value and the value is dependent on the conditions used in that process.

If properties that are based on fundamental physical or chemical behaviour, such as latent heat or melting temperature, are measured by different methods, then the results obtained are usually sufficiently similar to be regarded as a single value. A method used for measuring an engineering property attempts to simulate the behaviour of a product in an engineering situation in the real world. Each aspect of behaviour, for example the hardness of a product, can be simulated by several different methods. The methods are usually designed to be convenient to use and to provide a consistent result from repeated measurements. However, the difference between physical or chemical properties of a substance and the engineering properties of a product is that if different methods are used to measure an engineering property, then different results are obtained. For example, the measurement of the elongation property attempts to provide a numerical value to represent the engineering concept of plastic ductility by stretching a specially shaped sample of a product by applying a uniaxial tensile load. The value of the elongation property is determined as a percentage of the original length of a portion of a sample piece of the product. Comparisons between values of the elongation property for different products are therefore only possible if the fixed length was the same for each case. It is therefore necessary to state this length explicitly for all values of the elongation property.

An engineering property is therefore the result from operating a specific test method in a specific manner and it is necessary to associate the value of an engineering property with the conditions in which it is valid, in order for the meaning of the value to be explicitly determined. This additional

information is called the data environment in ISO 10303-45. An alternative term that is often used is metadata - i.e. data about data.

In most communications of engineering data, the relationship of a property value to its data environment or metadata is often an implicit assumption and it might not be explicitly associated with the value. The purpose of this document is to provide the means to associate a property value explicitly to the conditions in which it was measured, and thus provide an audit trail to the origins of data values that can be used in product design.

In order to measure the properties of a product, it is sometimes possible to test the whole product but usually this is not possible and a sample of a product has to be taken to represent the bulk of the product. The procedure for taking this sample can be specified in a regulatory document, such as a quality manual, or in a standard. The operation of the testing apparatus and the measurement procedure can require that the item that is tested has a specific shape and dimensions, and it will be necessary to create this from the product sample by some manufacturing process. The result of this process can be called a test piece. The specific shape and dimensions of test pieces can also be defined in standards or other regulatory documents. The measurement of the engineering property is then carried out on the test piece by means of some measuring apparatus or testing machine, whose operation might need to be controlled to be within specified limits. Manufactured products can be assemblies or single products, but they are rarely homogeneous or isotropic in their properties, so it is necessary to know the relationships between the test piece, the sample and the original product if the results of the measurement need to be related to the original product.

Data produced by a testing or measurement process is rarely used in its original form. It is necessary to first evaluate data values by some process in order to determine if the conditions prescribed for a particular test method have been met. For many properties, such as fracture toughness as an example, the validity of a test result can only be determined by an evaluation process after all the measurements have been completed and that process is specified in the standard that describes how to make the measurement. Individual results are rarely used as single values, but can be combined or processed in some way to provide a collective result that is indicative of the results of a series of measurements. It is necessary to identify the most likely value of the collection and to provide the uncertainty associated with this value.

The validity of a test result can be established by an approval procedure which results in the issue of a certificate. The certificate affirms that the original product from which the sample was taken conforms to a particular requirement or specification, and that the tests used to determine this were carried out in an approved manner. The data obtained from a valid test can also be subject to a further approval procedure that confirms the suitability of property values for the design of a functional product. This procedure will use criteria for the approval based on the requirements that the product needs to satisfy. The approval process and the criteria can be established and administered by an independent regulatory body or authority.

Test data values are not used for design because they often represent a condition of failure of the test piece. Design values are derived from the test data to represent a condition in which it is safe to use the product, and it is also advisable to record explicitly the procedures by which a design value is derived. Further testing can be required to measure the design values.

The number of different engineering properties and test methods is too large for every property and test method to be included in this document. There are also differences in test methods, and therefore differences in the engineering meaning of the properties, between different national engineering systems. Provision has therefore been made for the names of test methods and their association with particular properties to be defined in computer-processable dictionaries conforming to ISO 13584 Parts Libraries, or defined in a referenced document. An entry in such a dictionary can be referenced from the information model in this document in order to make use of a particular property name associated with a particular measurement method.