TECHNICAL SPECIFICATION

ISO/TS 13399-100

Second edition
2008-12-15

Cutting tool data representation and exchange —

Part 100: Definitions, principles and methods for reference dictionaries

Représentation et échange des données relatives aux outils coupants —

Partie 100: Définitions, principes et méthodes pour les dictionnaires de référence

Reference number
ISO/TS 13399-100:2008(E)

© ISO 2008

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

COPYRIGHT PROTECTED DOCUMENT

© ISO 2008

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

Published in Switzerland

 © ISO 2008 – All rights reserved

Contents

Page

© ISO 2008 – All rights reserved

 © ISO 2008 – All rights reserved

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.

In other circumstances, particularly when there is an urgent market requirement for such documents, a technical committee may decide to publish other types of document:

a) ISO Publicly Available Specification (ISO/PAS) represents an agreement between technical experts in an ISO working group and is accepted for publication if it is approved by more than 50 % of the members of the parent committee casting a vote;

b) an ISO Technical Specification (ISO/TS) represents an agreement between the members of a technical committee and is accepted for publication if it is approved by 2/3 of the members of the committee casting a vote.

An ISO/PAS or ISO/TS is reviewed after three years in order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn. If the ISO/PAS or ISO/TS is confirmed, it is reviewed again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.

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/TS 13399-100 was prepared by Technical Committee ISO/TC 29, *Small tools*.

This second edition cancels and replaces the first edition (ISO/TS 13399-100:2004), which has been technically revised.

ISO 13399 consists of the following parts, under the general title *Cutting tool data representation and exchange*:

— *Part 1: Overview, fundamental principles and general information model*

— *Part 2: Reference dictionary for the cutting items* [Technical Specification]

— *Part 3: Reference dictionary for tool items* [Technical Specification]

— *Part 4: Reference dictionary for adaptive items* [Technical Specification]

— *Part 5: Reference dictionary for assembly items* [Technical Specification]

— *Part 50: Reference dictionary for reference systems and common concepts* [Technical Specification]

— *Part 60: Reference dictionary for connection systems* [Technical Specification]

© ISO 2008 – All rights reserved

— *Part 100: Definitions, principles and methods for reference dictionaries* [Technical Specification]

— *Part 150: Usage guidelines* [Technical Specification]

 © ISO 2008 – All rights reserved

Introduction

ISO 13399 provides the means to achieve an electronic representation of cutting tool data by providing the information structure needed to describe various data about cutting tools and cutting tool assemblies. It is intended to facilitate the use, manipulation and exchange of cutting tool data within and between manufacturing, distribution and usage.

This part of ISO 13399 defines the principles and methods for the construction of reference dictionaries for data related to cutting tools with defined cutting edges. The purpose of this part of ISO 13399 is to provide a specification for the creation of the reference dictionaries that support the use of the general information model defined in ISO 13399-1. This specification is based on the example of IEC 61360-1. Informal advice on the creation of the reference dictionaries is provided in Annexes B, C, D and E.

A cutting tool with defined cutting edges is used on a machine tool to remove workpiece material through a shearing action at the cutting edge(s) of the tool. Cutting tool data are characteristics of the cutting tool and its use that must be known and evaluated in order to make manufacturing decisions and to perform manufacturing operations.

ISO 13399 includes the data representation of everything between the workpiece and the machine tool. Information about inserts (e.g. regular- and irregular-shaped replaceable cutting items), solid tools (e.g. solid drill and solid endmill), assembled tools (e.g. boring bars, indexable drills and indexable milling cutters), adaptors (e.g. milling arbor and chucks), components (e.g. shims, screws and clamps) or any combination of the above can be exchanged.

Possible assemblies of the components of a cutting tool are illustrated in Figure 1.

The objective of ISO 13399 is to provide the means to represent the information that describes cutting tools in a computer-sensible form that is independent of any particular computer system. Such a representation will facilitate the processing and exchange of cutting tool data within and between different software systems and computer platforms and support the application of this data in manufacturing planning, cutting operations and the supply of tools. 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 for archiving. The methods that are used for these representations are those developed by ISO/TC 184, *Automation systems and integration*, SC 4, *Industrial data*, for the representation of product data by using standardized information models and reference dictionaries.

An information model is a formal specification of types of ideas, facts and processes which together describe a portion of interest of the real world and which provides an explicit set of interpretation rules. Information is knowledge of ideas, facts and/or processes. Data are symbols or functions that represent information for processing purposes. Data are interpreted to extract information by using rules for how that should be done and a dictionary to define the terms that identify the data. Everyone in a communication process must use the same information model, the same set of explicit rules and the same dictionary in order to avoid misunderstanding. If an information model and its dictionary are written in a computer-sensible language then there is the additional benefit that they can be *computer-processable*.[1]

An engineering information model is therefore a specification for data that establishes the meaning of that data in a particular engineering context. A model has to be developed by formal methods to ensure that it meets the needs of the situation that it represents. An engineering information model defines the information objects that represent the concepts in an engineering application, the attributes of the objects and their relationships and the constraints that add further meaning. An information model is an abstract concept that can be used repeatedly for any example of the real-world situation that it represents. An instance of the model is produced when it is populated with the data items and their values that are applicable to a particular example of that situation.

© ISO 2008 – All rights reserved

ISO 13399 is intended for use by manufacturers, tool vendors or producers, and developers of manufacturing software, among others. It provides a common structure for exchanging data about cutting tools (see Figure 1), and is intended to allow or improve several capabilities, including

— the integration and sharing of cutting tool and assembly data between software applications,

— direct import of vendor cutting tool data into customer databases or applications, and

— the management of cutting tool information from multiple sources and for multiple applications.

Different companies use different business models to determine their need for the communication of information about their products. For example, one cutting tool manufacturer could regrind its customers' tools while another could allow its customers to do the regrinding and provide the information to enable them to do so. Therefore, the two cutting tool manufacturers could have a different set of cutting tool properties to communicate using the information model and dictionaries provided by ISO 13399.

ISO 13399 defines only that information which could be communicated; it does not specify what information must be communicated.

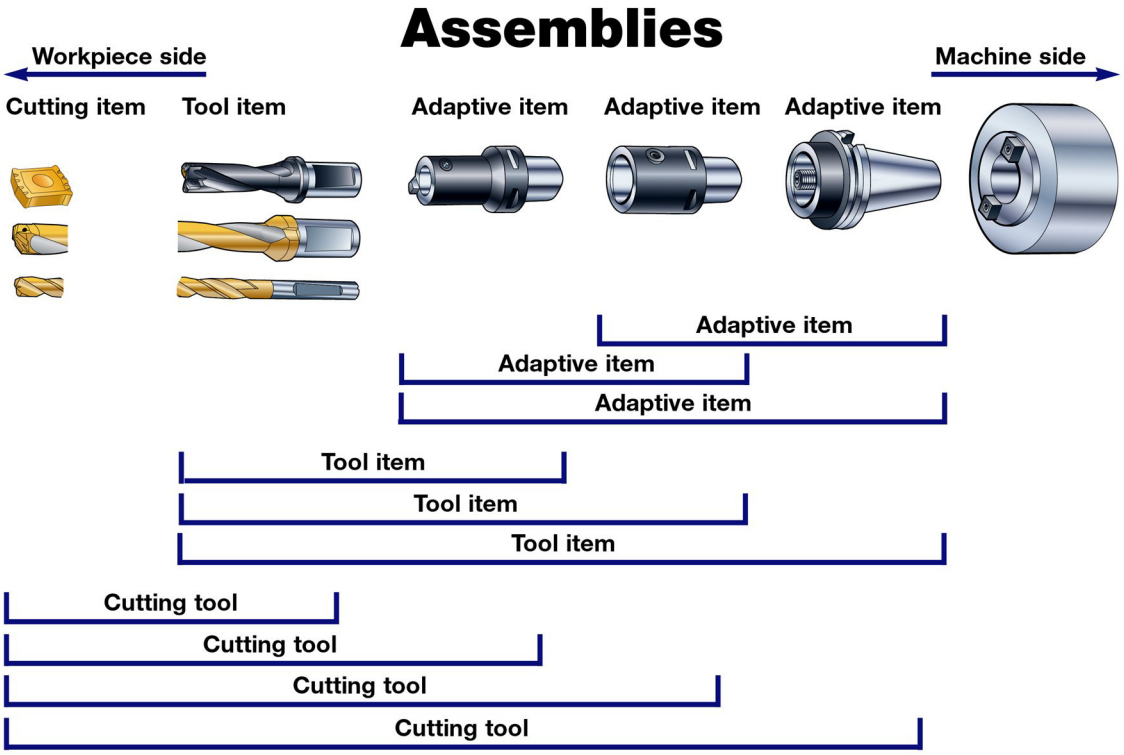

Figure 1 — Possible assemblies of the components of a cutting tool

© ISO 2008 – All rights reserved

Cutting tool data representation and exchange —

Part 100:
Definitions, principles and methods for reference dictionaries

1 Scope

This part of ISO 13399 defines the principles and methods for creating unambiguous identifications and definitions of the items and their properties relating to cutting tools in computer-sensible dictionaries to be used for reference by the information model defined in ISO 13399-1.

It is applicable to:

— the specification of data element types, their identifying, semantic and value attributes;

— the specification of item classes, their identifying and semantic attributes;

— the specification of feature classes, their identifying and semantic attributes.

It is not applicable to:

— information model for cutting tools;

— classifications and definitions of items and data element types relating to cutting tools;

— the association between properties and items in a classification.

NOTE 1 The information model for cutting tools is defined in ISO 13399-1.

NOTE 2 The classification of items relating to cutting tools, the definitions of items and data element types and the association of properties to items are defined in ISO 13399-2, ISO 13399-3, ISO 13399-4, ISO 13399-50 and ISO 13399-60.

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.

ISO 31 (all parts), *Quantities and units*[1)]

ISO 6093, *Information processing — Representation of numerical values in character strings for information interchange*

ISO 9735, *Electronic data interchange for administration, commerce and transport (EDIFACT) — Application level syntax rules*

1) To be replaced by ISO 80000.

© ISO 2008 – All rights reserved

ISO/IEC 10646, *Information technology — Universal Multiple-Octet Coded Character Set (UCS)*

IISO 13584-25, *Industrial automation systems and integration — Parts library — Part 25: Logical resource: Logical model of supplier library with aggregate values and explicit content*

ISO 13584-26, *Industrial automation systems and integration — Parts library — Part 26: Logical resource: Information supplier identification*

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

IEC 61360-1, *Standard data element types with associated classification scheme for electronic components — Part 1: Definitions — Principles and methods*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 61360-1 apply.

© ISO 2008 – All rights reserved

4 Data element type specification attributes

4.1 General

This clause explains and defines the attributes of the data element types that are used to represent properties in a reference dictionary in ISO 13399. The list of attributes is shown in Table 1. These attributes are for the identification, description and value of data element types and for the relationships between data element types.

Table 1 — List of attributes of data element types

attributes	clause number
Code	4.2.1
Version	4.2.2
Date of current version	4.2.3
Revision	4.2.4
Date of current revision	4.2.5
Preferred name	4.2.6
Synonymous name	4.2.7
Short name	4.2.8
Preferred symbol	4.2.9
Synonymous symbol	4.2.10
Definition	4.3.1
Date of original definition	4.3.2
Note	4.3.3
Remark	4.3.4
Formula	4.3.5
Figure	4.3.6
Source document of data element type definition	4.3.7
Data type	4.4.1
Value format	4.4.2
Unit of measure	4.4.3
Value list	4.4.4.
Value	4.4.4.1
Value format	4.4.4.2

© ISO 2008 – All rights reserved

4.2 Information model of a data element type

The attributes of a data element type are divided into four main groups:

— identifying attributes;

— semantic attributes;

— value attributes;

— relationship attributes.

In the following sub-clauses the attributes are specified and clarified by using information models. The information models (or entity-association diagrams) of a data element type shall be read as follows:

— from inside outwards starting with the 'Entity' in bold capital letters;

— the associated entities are indicated by ellipses;

— the association between and entity and an associated entity is shown by the line between the two ellipses;

— text beside the line between an entity and an associated entity describing the association;

— the combination of an association and an entity constituting the attribute of a data element type;

— two numerals separated by a dot indicate the occurrence of the attribute: the first digit indicates the minimum number of occurrences, the second one the maximum number of occurrences;

— associations and the corresponding occurrence indications are positioned on the same side of the association line;

— in the information models the name of the entities shall be in uppercase letters and the name of the associated entities shall be in lower case letters.

Entity:	DATA ELEMENT TYPE
Association:	known by
Associated entity:	preferred name
Attribute:	known by preferred name
	NOTE The attribute is composed of the association and the relevant entity
Cardinality:	1.1 (one and only one)

Figure 2 — Principle of information models

© ISO 2008 – All rights reserved

4.3 Data element types - Identifying attributes

4.3.1 General

In order to identify a data element type uniquely within the ISO 13399 reference dictionaries and for electronic information exchange, a language-independent combination of characters shall be used. Figure 3 shows the possible attributes of a data element used to identify a data element type.

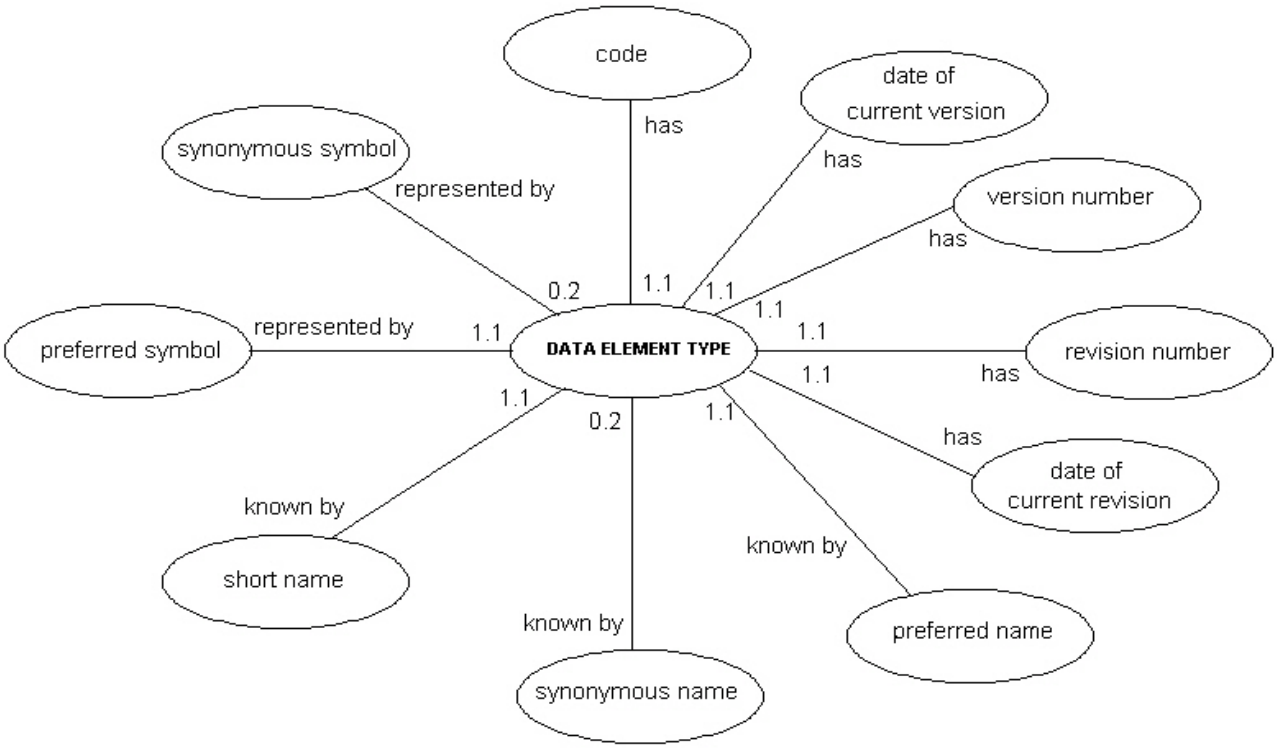

Figure 3 — Identifying attributes for a data element type

4.3.2 Code

Attribute name: code

Attribute definition: unique string of alphabetic and numeric characters.

Comments: the characters in the string shall be generated at random and should not bear any relationship with the meaning of the data element types or the structure of the dictionary. In case of a change in at least one attribute of a data element type which affects the meaning and or communication of the data element type, then a new (other) data type having a new code, shall be defined. Such attributes which affect the meaning are:

— definition;

— unit of measure;

— condition data element type;

© ISO 2008 – All rights reserved

— value format;

— data type.

Obligation: mandatory

Character type of values: upper case Latin letters A through Z (except O and I), digits 0 through 9.

4.3.3 Version number

Attribute name: version number

Attribute definition: number used to control the versions of a data element type.

Comments: the version number of a data element type shall consist of three digits. Consecutive version numbers shall be used in ascending order. A new version of the data element type shall be generated if at least one attribute of the data element type is changed which affects the use but which does not affect the meaning of that data element type. These attributes are:

— preferred name;

— short name;

— preferred symbol;

— preferred name of condition data element type;

— value meaning;

— item class.

Obligation: mandatory

Character type of values: digits 0 through 9.

4.3.4 Date of current version

Attribute name: date of current version

Attribute definition: calendar day on which the current version of the data element type was established

Comments: for the first version, the date is the same as the original definition. The format of the representation shall be dd-mm-ccyy, where dd is the identification number of the day in the month, mm is the identification number of the month in the year and ccyy is the identification number of the year.

Obligation: mandatory

Character type of values: digits 0 through 9

© ISO 2008 – All rights reserved

4.3.5 Revision number

Attribute name: revision number

Attribute definition: number used for the administrative control of a data element type.

Comments: the revision number of the occurrence of a data element type shall consist of three digits. Consecutive revision numbers shall be in ascending order. Only one revision number per data element type is current at any moment. A new revision number of a data element type shall be generated if an attribute of the data element type is changed which neither affects the use nor the meaning of the data element type, or when editorial changes of typing and spelling errors have been implemented. These attributes are:

— synonymous name;

— synonymous symbol;

— source document of definition;

— remark;

— spelling error in the text of the definition or note.

Obligation: mandatory

Character type of values: digits 0 through 9.

4.3.6 Date of current revision

Attribute name: date of current revision

Attribute definition: calendar day on which the current revision of the data element type was established

Comments: for the first entry, the date is the same as the original definition. The format of the representation shall be dd-mm-ccyy, where dd is the identification number of the day in the month, mm is the identification number of the month in the year and ccyy is the identification number of the year.

Obligation: mandatory

Character type of values: digits 0 through 9

4.3.7 Preferred name

Attribute name: preferred name

Attribute definition: single- or multi-word label to identify a data element type.

Comments: the preferred name shall be identical to the name for the same concept as used in international standards, if available.

© ISO 2008 – All rights reserved

Obligation: mandatory

Character type of values: those characters from the character set of ISO/IEC 10646-1.

4.3.8 Synonymous name

Attribute name: synonymous name

Attribute definition: single- or multi-word label that identifies the same concept as the preferred name but is a widely used and acceptable alternative

Comments: the number of synonymous names shall be limited to two

Obligation: optional

Character type of values: those characters from the character set of ISO/IEC 10646-1

4.3.9 Short name

Attribute name: short name

Attribute definition: label used to identify a data element type.

Comments: the preferred short name shall be the same as the preferred symbol (see 4.3.10) with the Latin characters in lower-case.

Obligation: mandatory

Character type of values: lower case Latin letters A through Z (except O and I), digits 0 through 9.

4.3.10 Preferred symbol

Attribute name: preferred symbol

Attribute definition: label used as an identifier for a concept.

Comments: the preferred symbol shall be constructed from a combination of digits and Latin upper-case letters.

Obligation: mandatory

Character type of values: upper case Latin letters A through Z (except O and I), digits 0 through 9.

4.3.11 Synonymous symbol

Attribute name: synonymous symbol

Attribute definition: label used as an identifier for a concept that is different from the preferred symbol but identifies the same concept and is a widely used and acceptable alternative.

© ISO 2008 – All rights reserved

Comments:	the synonymous symbol shall be constructed from a combination of Latin upper-case letters and digits. The number of synonymous symbols shall be limited to two.
Obligation:	optional
Character type of values:	upper case Latin letters A through Z (except O and I), digits 0 through 9.

4.4 Data element types - Semantic attributes

4.4.1 General

Figure 4 shows the possible attributes of a data element type that are used to clarify its semantics.

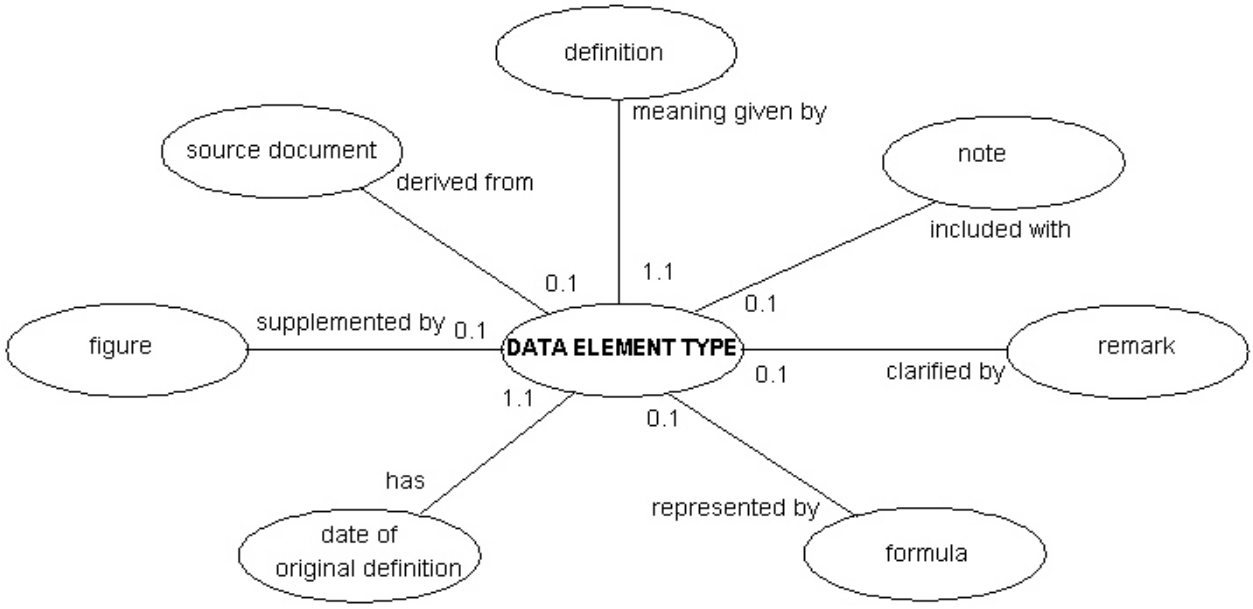

Figure 4 — Semantic attributes for a data element type

4.4.2 Definition

Attribute name:	definition
Attribute definition:	statement that describes the meaning of a data element type in an unambiguous and unique manner to permit its differentiation from all other data element types.
Comments:	the definition of a data element type shall be derived from the original ISO or IEC definition, if available.
Obligation:	mandatory
Character type of values:	those characters from the character set of ISO/IEC 10646-1

© ISO 2008 – All rights reserved

4.4.3 Date of original definition

Attribute name:	date of original definition
Attribute definition:	calendar day on which the definition of the data element type was first established
Comments:	the format of the representation shall be dd-mm-ccyy, where dd is the identification number of the day in the month, mm is the identification number of the month in the year and ccyy is the identification number of the year.
Obligation:	mandatory
Character type of values:	digits 0 through 9

4.4.4 Note

Attribute name:	note
Attribute definition:	statement that provides further information on the definition which is essential to the understanding of the definition
Obligation:	optional
Character type of values:	those characters from the character set of ISO/IEC 10646-1

4.4.5 Remark

Attribute name:	remark
Attribute definition:	explanatory text to further clarify the meaning of the definition
Comments:	remarks shall not influence the meaning of the definition
Obligation:	optional
Character type of values:	those characters from the character set of ISO/IEC 10646-1

4.4.6 Formula

Attribute name:	formula
Attribute definition:	rule or statement in mathematical form expressing the semantics of a quantitative data element type
Comments:	a formula shall not change any essential information of the meaning of the definition. The graphical representation of a formula shall be stored in a file in a generally available format. Methods for referring to such a file are described in detail in ISO 13584-24.
Obligation:	optional
Character type of values:	those characters from the character set of ISO/IEC 10646-1

© ISO 2008 – All rights reserved

4.4.7 Figure

Attribute name: figure

Attribute definition: illustration to clarify the meaning of the definition of a data element type

Comments: a figure shall not change any essential information of the meaning of the definition. The graphical representation of a figure shall be stored in a file in a generally available format. Methods for referring to such a file are described in detail in ISO 13584-24. Advice on the construction of figures for ISO 13399 is provided in Annex C.

Obligation: optional

4.4.8 Source document of Data Element Type definition

Attribute name: source document of data element type definition

Attribute definition: reference that identifies the document from which the definition of the data element type has been derived

Comments: the document shall be recognised by the ISO or IEC committee concerned as having wide acceptance and authoritative status as well as being publicly available and should be an International Standard if possible.

Obligation: optional

Character type of values: those characters from the character set of ISO/IEC 10646-1

4.5 Data element types - value attributes

4.5.1 General

Figures 5 and 6 shows the attributes association with the value of the data element type.

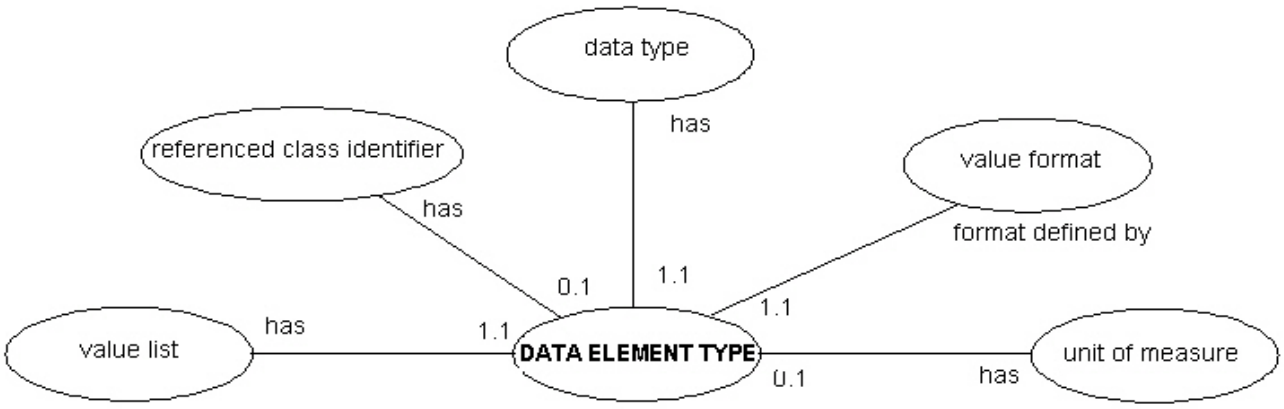

Figure 5 — Value attributes for a data element type

© ISO 2008 – All rights reserved

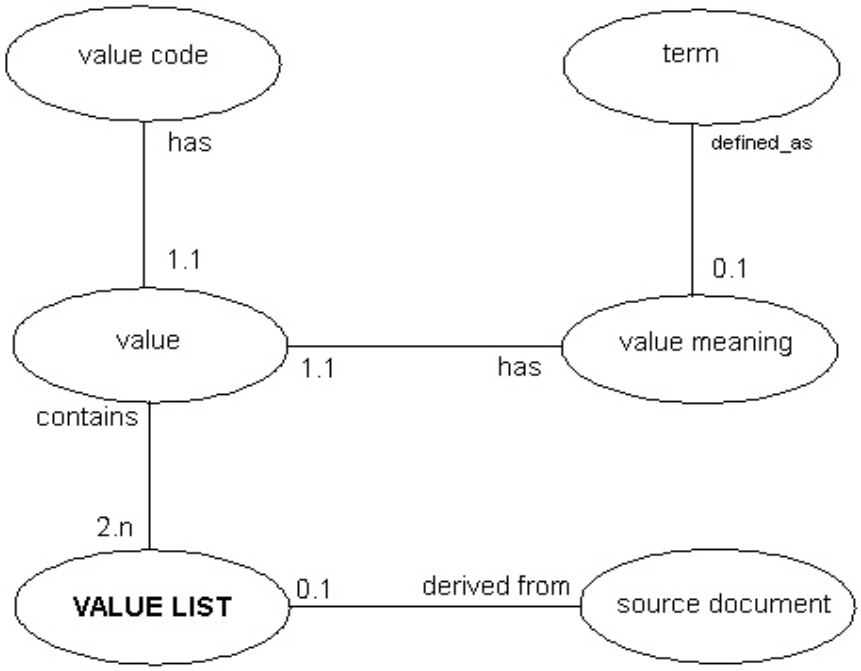

Figure 6 — Attributes of the value list for a data element type

Every data element type has a value domain which defines a range of permissible values being implicit by the value format or explicit by listing the possible values. For quantitative data element type, such a domain can be expressed either as a value range with limits within which all values must lie, or a list of discrete possible values. For non-quantitative data element types, the value domain can be expressed by presenting permissible values in the form of text strings.

In this document, no mechanism is given for defining value ranges for quantitative data element types. For non-quantitative data element types, a mechanism using values represented by value codes and associated value meanings is defined as described in clause 4.5.5. It is noted that in many cases a value domain may be undefined, unknown or infinite. In such cases a value list is not specified in a data element type definition. For classifying data element types a value list shall be specified.

4.5.2 Data type

4.5.2.1 General

Attribute name: data type

Attribute definition: specifies the type of data that is used to represent the value for a data element type

Comments: data types are divided into two groups:

a) simple type: all simple types contain single values

b) complex type: all complex types may contain multiple values. The complex data types specified in ISO 13399 are:

— level type;

— class instance type.

© ISO 2008 – All rights reserved

Obligation: mandatory

Character type of values: those characters from the character set of ISO/IEC 10646-1.

4.5.2.2 Simple type

This is a data type that specifies that the value of the data element type is a single value. The value format shall be defined according to clause 4.5.3. For a simple type the allowed data values are:

— string type;

— non-quantitative code type;

— integer measure type;

— real measure type;

— Boolean type.

4.5.2.3 Complex type

4.5.2.3.1 General

This is a data type that specifies that the value of the data element type may be constructed of two or more associated values. For a complex type the allowed subtypes are:

— level type;

— class instance type.

4.5.2.3.2 Level type

A complex type indicating the value of the data element type consists of one up to four real measure or integer measure values that define a characteristic of an item in the fixed sequence of: minimum, nominal, typical, maximum. The value format shall be defined according to clause 4.5.3. For a simple data type the allowed values are:

— real measure type;

— integer measure type.

4.5.2.3.3 Class instance type

This is a complex type that provides a link to a class containing a collection of data element types in any part of the classification hierarchy. Its value consists of the class identifier for the class to which the link is made. All properties in the class to which the link is made become properties of the class in which the class instance type is used and are inherited by all subclasses of that class. Since all the properties in the class to which the link is made have their own definitions, which include their respective value formats, a class instance type shall not have an associated value format. For a class instance type only the data value: 'class reference identifier' is allowed.

NOTE Use of the class instance type allows an extension of the data element types through the use of the feature class.

© ISO 2008 – All rights reserved

4.5.3 Value format

Attribute name: value format

Attribute definition: specification of the type and length of the representation of the value of a data element type

Obligation: mandatory

Character type of values: those characters form the character set of ISO/IEC 10646-1

Comments: for data element types for which the data type is the complex type class instance type, the value formats are defined by data element types in the referenced class and could be different (see 4.6). The value format shall be defined according to the definition below:

a) Non- quantitative data value format types

A = alphabetic, letters only

M = mixed, all characters allowed

N = numeric, digits only

X = alphanumeric

B = binary, 0 or 1

b) Quantitative data value formats types in accordance with ISO 6093

NR1 = integers

NR2 = rational numbers with decimal mark (real numbers)

NR3 = rational numbers with decimal mark and exponent mark (floating point numbers)

S = signed or sign (positive or negative)

. = decimal mark

E = exponent mark, base 10: (A)E(B) represents the value $Ax10^{B}$

c) Field length

The field length of a non-quantitative data value shall be indicated by a number (e.g.17). A variable field length shall start with two dots. The following preferred standard formats derived from ISO 9735 and ISO 6093 have been defined:

A..3	N..3	X..3	M..3	B1
A..8	N..8	X..8	M..8	
A..17	N..17	X..17	M..17	
A..35	N..35	X..35	M..35	
A..(nx35)	N..(nx35)	X..(nx35)	M..(nx35)	

© ISO 2008 – All rights reserved

A fixed field length shall start with one space (examples: A 3, N 8, etc.). In these formats, no special characters shall be allowed.

The field length of a quantitative data value shall be indicated by a combination of digits and characters (e.g. 3.3ES2). A variable field length shall start with two dots. The following preferred standard formats derived from ISO 9735 and ISO 6093 have been defined:

NR1..4	Positive integers
NR1 S..4	Positive or negative integers
NR2..3.3	Positive reals
NR S..3.3	Positive or negative reals
NR3..3ES2	Floating point positive
NR3 S..3.3ES2	Floating point, positive or negative

A fixed field length shall start with one space (examples: NR1 4, NR1 S 4, etc.). In these formats no special characters shall be allowed.

4.5.4 Unit of measure

Attribute name: unit of measure

Attribute definition: prescription of the unit in which the value of a quantitative data element type shall be expressed

Comments: SI units shall be used except for the cases identified below. Prefixes, for example: 'milli', may be used if this conforms to normal practice. The meaning of the letter symbols used for the quantities shall be according to ISO 31. For quantitative data element types of which the data type is the complex type class_instance_type, the units of measure are defined by data element types in the referenced class and could be different (see clause 4.6). The unit of measure for angles shall be degree of angle. The unit of measure for temperature shall be degrees Celsius.

Obligation: conditional

Condition: unit of measure shall be specified for quantitative data element types

Character type of values: those characters from the character set of ISO/IEC 10646-1

4.5.5 Value list

4.5.5.1 General

Attribute name: value list

Attribute definition: list of representations of permissible values of a data element type

Comments: none

Obligation: conditional

Condition: for non-classifying data element types a value list may be specified

© ISO 2008 – All rights reserved

4.5.5.2 Value

Attribute name:	value
Attribute definition:	representation of a permissible instance of a data element type as an element of a value list
Comments:	the value of a non-quantitative data element types shall be composed of the attributes: value code
Obligation:	conditional
Condition:	for non-classifying data element types a value may be specified

4.5.5.3 Value code

Attribute name:	value code
Attribute definition:	coded representation of a permissible value of a non-quantitative data element type
Comments:	the value code of non-quantitative data element types may be abbreviated for communication efficiency
Obligation:	conditional
Condition:	if there is a value, the value code shall be specified
Character type of values:	those characters from the character set of ISO/IEC 10646-1

4.5.5.4 Value meaning

Attribute name:	value meaning
Attribute definition:	descriptive part of a permissible value of a non-quantitative data element type.
Comments:	for classifying data element types the value meaning shall be defined as a term
Obligation:	conditional
Condition:	if there is a value, the value meaning shall be specified
Character type of values:	those characters from the character set of ISO/IEC 10646-1

4.5.5.5 Source document of value list

Attribute name:	source document of value list
Attribute definition:	reference that identifies the source document from which the value list was derived.
Comments:	the source document will usually be an international standard.

© ISO 2008 – All rights reserved

Obligation: optional

Character type of values: those characters from the character set of ISO/IEC 10646-1

4.5.5.6 Referenced class identifier

Attribute name: referenced class identifier

Attribute definition: class identifier as defined in clause 5.3

Comments: the class referenced will contain a set of related data element types. The data element type from which the reference is made shall not have either a value format or a unit of measure. These attributes will be defined by the data element types in the referenced class

Obligation: conditional

Condition: a referenced class identifier shall be supplied when the data type of a data element type is a class instance type

Character type of values: those characters from the character set of ISO/IEC 10646-1

4.6 Relationship attributes

4.6.1 General

Data element types in general shall be regarded as characteristic properties of objects. Both the objects and their data element types may be classified according to their type (see Figure 7). Data element types may be related because these:

— are of the same data element class;

— apply to the same object class (item, component, material or feature class);

— refer to a condition data element type. If a data element type is conditioned by more than one condition data element type, then all conditions shall be satisfied simultaneously;

— apply to the same feature class.

Figure 7 — Relationship attributes for a data element type

4.6.2 Condition data element type

Attribute name: condition data element type

Attribute definition: data element type that affects the value of another data element type

Comments: many data element types have values which depend on the value(s) of one or more independent data element types (called 'condition data element types').

© ISO 2008 – All rights reserved

This data element type only has a meaning when it is used in combination with another data element type. The definition of a condition data element type shall always contain the phrase 'as a variable'. When the value of a condition data element type is given as a range, it shall be specified by two condition data element types, representing the upper and lower bound of this range

Obligation: optional

Character type of values: identical to the identifier of a data element type.

4.6.3 Data element type class

The classification of data element types is not used in ISO 13399, in conformance with ISO 13584-42.

5 Class specification

5.1 General

For the classification of objects or items the principle of dividing the whole set of items into sections as defined in 2 shall be applied repeatedly, thereby creating a hierarchical tree of several classes. The tree will start with a root class and consists of further super classes and subclasses.

The principles of classification are:

— a class that has two or more subclasses is a superclass;

— a subclass shall have one superclass;

— a subclass becomes a super class when it has subclasses.

The root class is a super class and only has subclasses. The root class shall be an item class and the subclasses shall be item classes or feature classes.

An item class in ISO 13399 is a representation of an individual object. A feature class is representation of an aspect of an object that cannot exist in isolation from that object.

EXAMPLE A replaceable cutting insert can be represented by an Item class. A cutting edge on a replaceable insert can be represented by a Feature class.

NOTE ISO 13584 allows for the use of other types of class, i.e. component class and material class, which are not used in this document.

The goal of the classification is to arrange the data element types that represent objects or features in an unambiguous and structured way that makes clear any association or relationship between them. Each data element type that represents a property or characteristic is defined as visible at the level of the root class. This implies that a data element type for a property may be used throughout the whole of the reference collection. A property data element type may define as applicable at any class in the classification tree. A property data element type which is applicable to any class is also applicable to all subclasses of that class. Property data element types which are only applicable for a limited number of subclasses should be made applicable in each relevant subclass.

The terms that define the branches of the classification tree have the following properties:

— they are significant: vague or ambiguous terms such as ' general purpose', 'high speed', etc. are not allowed;

— they have a clearly defined objective meaning;

 © ISO 2008 – All rights reserved

— the terms and their definitions conform to international standards where available;

— where synonyms are in common use, one term is selected as the preferred term and the others refer to it;

— the specific meaning of homonyms is explained by context indications.

5.2 Class specification attributes

In this subclause the various attributes of classes in the specification are explained. These attributes are related to identification, description and to relationships between classes and data element types. The attributes are listed in Table 2.

Table 2 — List of attributes of class

Attributes	Subclause number
Code	5.3.1
Version number	5.3.2
Date of current version	5.3.3
Revision number	5.3.4
Date of current revision	5.3.5
Preferred name	5.3.6
Short name	5.3.7
Definition	5.4.1
Date of original definition	5.4.2
Note	5.4.3
Remark	5.4.4
Drawing reference	5.4.5
Source document of class definition	5.4.6

5.3 Information model of a class

A class is a set of items or features where each member can be described by the same group of properties. The properties may be obtained by inheritance. The attributes of a class are divided into two main groups: identifying attributes and semantic attributes. The information models (entity-association diagrams) of a class are given in Figures 8 and 9 and should be read using the same rules as described in 4.2 for a data element type.

NOTE When applying the rules of Clause 4.2 to this subclause, substitute 'class' for 'data element type'.

© ISO 2008 – All rights reserved

5.4 Class - Identifying attributes

5.4.1 General

A language independent combination of characters shall be used to identify a class uniquely within a reference dictionary. The identifier of a class shall be a code in the form of an alphanumeric string where the characters of the code shall be generated at random.

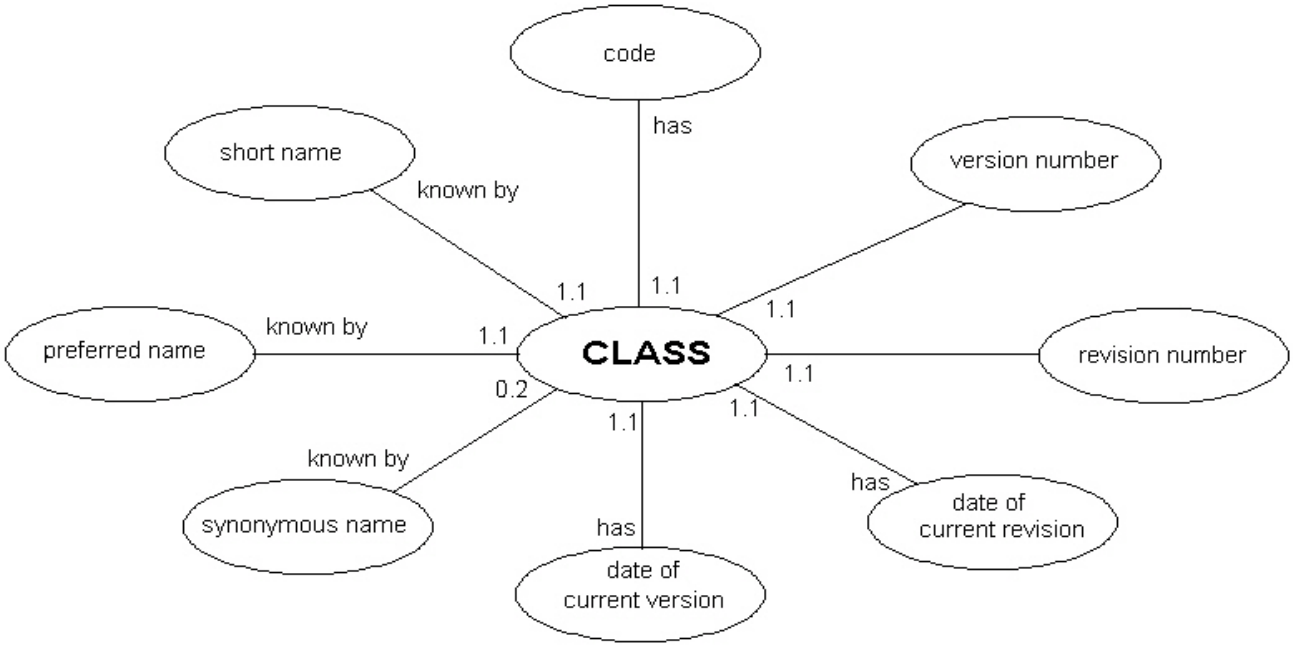

Figure 8 — Identifying attributes for a class

5.4.2 Code

Attribute name:	code
Attribute definition:	unique alphanumeric string of characters
Comments:	the code should not have any relationship with the meaning of the class or the structure of the dictionary
Obligation:	mandatory
Character type of values:	upper case Latin letters A through Z ; digits 0 through 9.

5.4.3 Version number

Attribute name:	version number
Attribute definition:	number used to indicate the versions of a component class during its life cycle
Comments:	the version number of a class should consist of up to three numerical characters. Consecutive version numbers shall be issued in ascending order. A new version of a class shall be generated if at least one attribute of the class is changed that affects the use (for communication, database definition, etc.) but which does not affect the meaning of that class. These attributes are:

© ISO 2008 – All rights reserved

— preferred name;

— short name;

— definition.

Obligation: mandatory

Character type of values: digits 0 through 9.

5.4.4 Date of current version

Attribute name: date of current version

Attribute definition: calendar day on which the current version of the class was established

Comments: for the first version, the date is the same as the original definition. The format of the representation shall be dd-mm-ccyy, where dd is the identification number of the day in the month, mm is the identification number of the month in the year and ccyy is the identification number of the year.

Obligation: mandatory

Character type of values: digits 0 through 9

5.4.5 Revision number

Attribute name: revision number

Attribute definition: number used for the administrative control of a class

Comments: the revision number of a class shall consist of up to three numerical characters. Consecutive revision numbers shall be issued in ascending order. For each class with a unique identifier, only one revision number is current at any one time. A new revision number for a class shall be generated if an attribute of the class is changed which neither affects the use nor the meaning of the class, or when editorial changes of typing and spelling errors have been implemented. These attributes are:

— synonymous name;

— source document of definition;

— remark;

— spelling error in the text of the definition.

Obligation: mandatory

Character type of values: digits 0 through 9.

5.4.6 Date of current revision

Attribute name: date of current revision

Attribute definition: calendar day on which the current revision of the class was established

© ISO 2008 – All rights reserved

Comments:	for the first entry, the date is the same as the date of the original definition. The format of the representation shall be dd-mm-ccyy, where dd is the identification number of the day in the month, mm is the identification number of the month in the year and ccyy is the identification number of the year.
Obligation:	mandatory
Character type of values:	digits 0 through 9

5.4.7 Preferred name

Attribute name:	preferred name
Attribute definition:	single-word or multi-word identifier assigned to a class
Comments:	none
Obligation:	mandatory
Character type of values:	those characters from the character set of ISO/IEC 10646-1

5.4.8 Short name

Attribute name:	short name
Attribute definition:	single word identifier derived from the characters in the preferred name.
Comments:	the first character should be a letter.
Obligation:	mandatory
Character type of values:	lower case Latin letters A through Z ; digits 0 through 9.

5.5 Class – Semantic attributes

5.5.1 General

The attributes for the definition of the semantics of a class are illustrated in Figure 9.

© ISO 2008 – All rights reserved

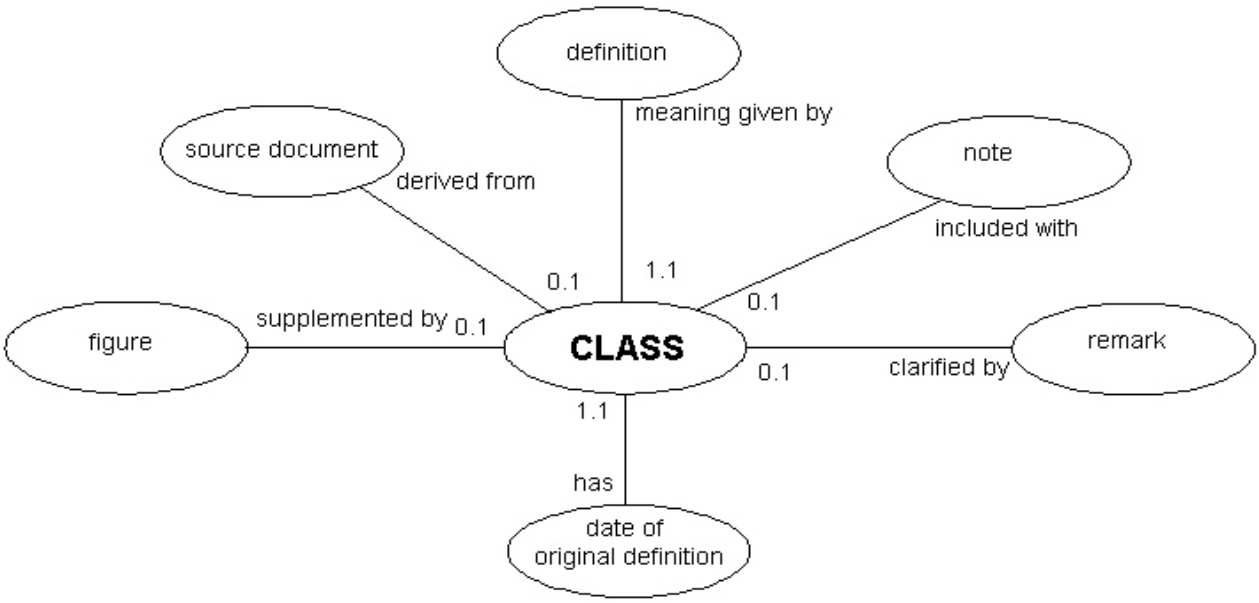

Figure 9 — Semantic attributes of a class

5.5.2 Definition

Attribute name: definition

Attribute definition: statement that describes the meaning of the class and permits its differentiation from other classes

Comments: the definition should be derived from international standards where available

Obligation: mandatory

Character type of values: those characters from the character set of ISO/IEC 10646-1.

5.5.3 Date of original definition

Attribute name: date of original definition of the class

Attribute definition: calendar day on which the definition of the class was first established

Comments: the format of the representation shall be dd-mm-ccyy, where dd is the identification number of the day in the month , mm is the identification number of the month in the year and ccyy is the identification number of the year.

Obligation: mandatory

Character type of values: digits 0 through 9

5.5.4 Note

Attribute name: note

Attribute definition: statement which provides further information on the definition and which is essential to the understanding of that definition.

© ISO 2008 – All rights reserved

Comments: none

Obligation: optional

Character type of values: those characters from the character set of ISO/IEC 10646-1.

5.5.5 Remark

Attribute name: remark

Attribute definition: explanatory text to further clarify the meaning of the definition

Comments: a remark shall not influence the meaning of that definition

Obligation: optional

Character type of values: those characters from the character set of ISO/IEC 10646-1.

5.5.6 Drawing reference

Attribute name: drawing reference

Attribute definition: an identifier that provides a reference to a figure which illustrates the meaning of a class where the class represents a geometrical concept

Comments: the format for the identifier is defined in ISO 13584-26. Advice on the preparation of figures for ISO 13399 is provided in Annex C

Obligation: conditional

Condition: this reference shall only be given for classes that represent geometrical concepts

5.5.7 Source document of class definition

Attribute name: source document of class definition

Attribute definition: identifier of a document from which the definition of the class was derived

Comments: the document shall be recognised by the ISO or IEC committee concerned as having wide acceptance and authoritative status as well as being publicly available and should be an International Standard if possible.

Obligation: optional

Character type of values: Those characters from the character set of ISO/IEC 10646-1.

5.6 External identification of classes and properties

5.6.1 General

To make an identifier code (see 5.4.1) globally unique, there shall be added to the identification code: a supplier code, used to identify the suppliers of the information in the contents of the reference dictionary and, when the content of the dictionary is defined in a standard document, a code that identifies this standard document. The supplier code and the code for the identification of the standard document are defined in ISO 13584-26.

© ISO 2008 – All rights reserved

5.6.2 Organisation identification scheme

Data element name:	International Code Designator
Symbol:	ICD
Definition:	identification of an organisation identification scheme
Comments:	part of a supplier identification
Obligation:	mandatory
Data type:	integer
Maximum length	4
Value for ISO 13399:	112

5.6.3 Organisation identifier

Data element name:	Organisation Identifier
Symbol:	OI
Definition:	identification of an organisation within an identification scheme
Comments:	part of a supplier identification
Obligation:	mandatory
Data type:	string
Maximum length:	35
Value for ISO 13399:	1

5.6.4 Supplier code

The supplier code for a standard document shall consist of the concatenation of the supplier code, with a syntax specified in ISO 13584-26, followed a slash ('/') followed by the standard number encoded as specified in subclauses 5.1 or 5.2 of ISO 13584-26.

EXAMPLE The supplier code for the first edition of ISO 13399-2 is: 112/1///13399_2_1

5.6.5 Identification of a class specified in another dictionary

The identification for a class specified in other dictionary shall consist of the concatenation of the supplier code for the external dictionary and the identification code for the class.

EXAMPLE The identification of the externally threaded component class defined in ISO 13584-511 is: 112/1///13584_511_1.P511AAA004.

5.6.6 Identification of a property of a class specified in another dictionary

The identification for a property of a class specified in other dictionary shall consist of the concatenation of the supplier code for the external dictionary, the identification code for the class and the identification code for the property.

EXAMPLE The identification of the Nominal diameter for the externally threaded component class in ISO 13584-511 is: 112/1///13584_511_1.P511AAA004.P511BAA118.

© ISO 2008 – All rights reserved

Annex A
(normative)

Information object registration

In order to provide for unambiguous identification of an information object in an open system, the object identifier:

{iso technical specification 13399 part (100) version (2)}

is assigned to this part of ISO 13399. The meaning of this value is defined in ISO/IEC 8824-1 and is described in ISO 13584-1.

© ISO 2008 – All rights reserved

Annex B
(informative)

Experience of developing a reference dictionary for ISO 13399

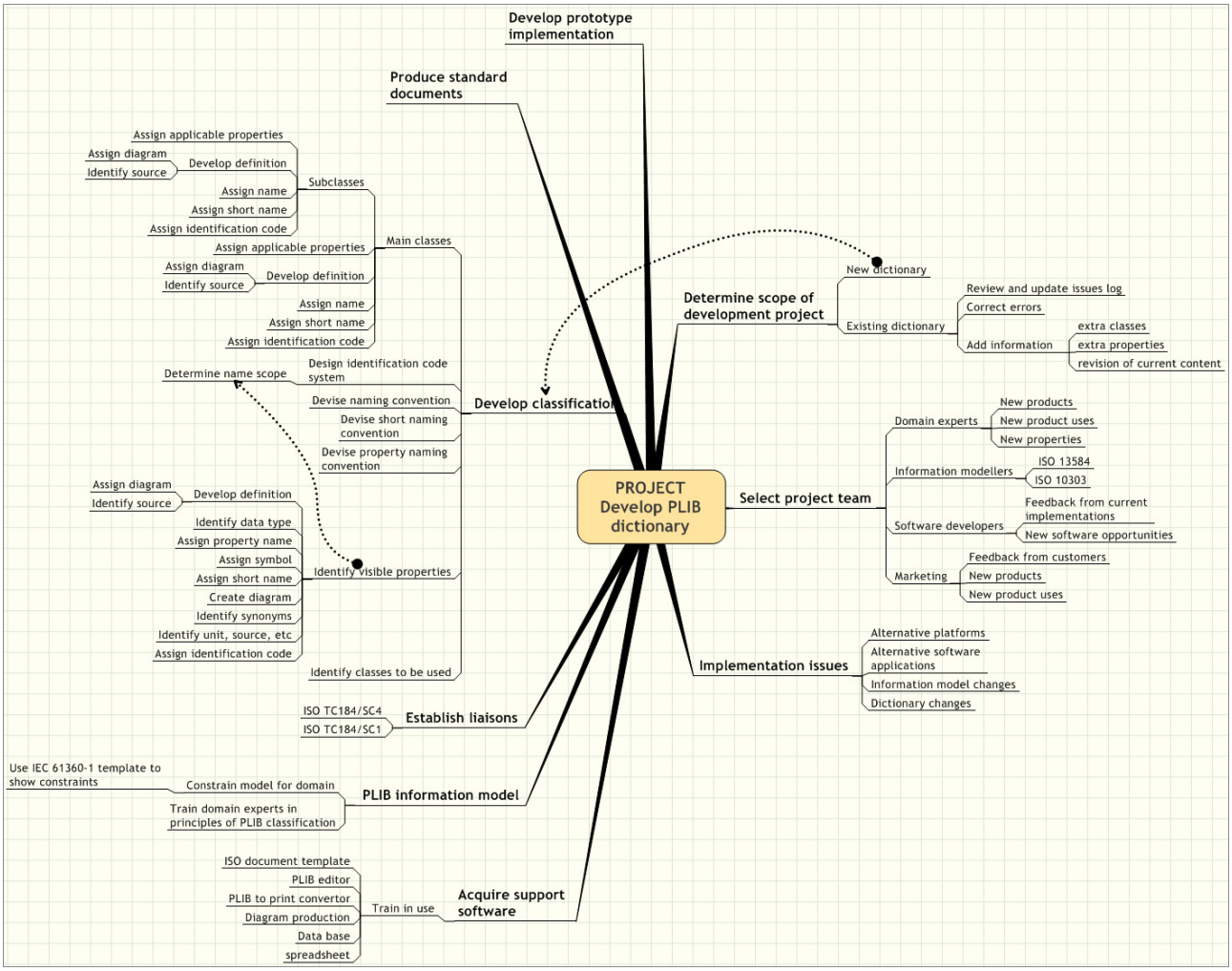

Figure B.1 — Project to develop a reference dictionary for ISO 13399

B.1 Introduction

The contents of this Annex provide a narrative account of the experience of developing the reference dictionary for ISO 13399. It is similar to the account included in the compilation of experiences of the development of dictionaries conforming to ISO 13584 published by ISO/IEC JWG1 [2]. Figure B.1 summarises the main actions for the whole project.

The reasons for the development were:

— cutting tools with defined cutting edges have become more complex with multiple replaceable inserts to perform the cutting operation;

— the use of cutting tools has become more adaptable following the changes in design of machine tools able to use the same tool for many different operations;

© ISO 2008 – All rights reserved

— the existing ISO standard, ISO 3002, only defined cutting tools with a brazed cutting items for single operations;

— the reference system in the ISO 3002 was not adequate to define all the properties of all the components of a modern cutting tool (see Figure 1);

— customers are increasingly requiring that cutting tool data should be supplied in computer processable form and the suppliers need to have one method for supplying this data to reduce their costs and complexity;

— the main method of supplying data for modern cutting tool components and assemblies is intended to be the information model of ISO 13399-1;

— the PLIB dictionary of classes and properties for cutting tools was therefore developed as a separate part of the ISO 13399 to provide the data dictionary for the information model and enable the dictionary to be updated with new developments and new requirements in the future;

— many property names in the ISO TC29 standards for cutting tools did not have unambiguous definitions;

— the same property names were used for different concepts in the ISO TC29 standards in the domain of machine cutting tools.

B.2 Determine the scope of the development project

B.2.1 New dictionary

The development project produced a new dictionary for the ISO 13399 and an entity relationship specified in ISO 13399-1. The main role of the dictionary was to support the entity relationship information model (the information model). The information model provides the resources to represent component parts of a modern cutting tool and the assembly of parts to form a complete tool. The information model also enables parts to be identified by using standardized labels from the dictionary or to be referred to by their aliases using the labels used by particular companies.

The main activities in the development of the dictionary were therefore to develop the classification of items within the domain of machine cutting tools and to define the properties of the classes.

The scope of the domain is indicated in Figure 1. A modern cutting tool is an assembly of four main parts:

— cutting item – removes material from the work piece by a shearing action at defined cutting edges;

— tool item – supports the cutting item or items in the cutting operation;

— adaptive item – provides the connection between the tool item and the machine tool;

— assembly item – provides the forces to hold the cutting on the tool item.

The cutting item may be a detachable insert capable of being repositioned to bring different cutting edges into use, or be permanently attached by a brazed joint, or be part of a solid tool. These four parts were the starting basis for the classification.

The convention adapted for the scope was that the classes and their properties applied to the 'tool in the hand'. The alternative convention is for the 'tool in use'. The 'tool in use' convention will require additional classes and properties which will be the subject of a subsequent project.

© ISO 2008 – All rights reserved

B.2.2 Select the project team

The selection of the project team is an important requirement of the development and depends on the scope of the project. The project team should always include domain experts and information modellers. The ISO 13399 project did not include marketing experts or software developers. While these omissions could be justified at the earlier phases, once the development reached the point where the technical outcome was clear, the extension of the scope of the project team to include marketing and software experts would have been valuable.

The role of the domain experts was to input their knowledge from their companies' products but to generalize them to a neutral representation that could be applicable to all products in the cutting tool industry. The domain experts were also familiar with the previous ISO standards (ISO 3002, 5608, 5609, etc.) in this domain and what is now needed as a result of new developments in the technology of cutting tools.

The role of the information modellers in the earliest stages was to develop the information model to represent all the structural capabilities for cutting tools determined by the domain experts and illustrated in Figure 1. When the need to develop a reference dictionary for the terminology and properties was identified, the roles of the information modellers were: to interpret the ISO 13584 standard for application to cutting tools, ensure that the requirements of the domain experts could be met by the provisions of this standard and to integrate the operation of the information model and the reference dictionary. It is important that the information modellers were conversant with the development of the ISO 13584 and ISO 10303 and aware of any changes that have occurred or are planned. This required an active liaison with the WG2 and WG3 of ISO TC184/SC4.

If software developers are included in the Project Team then their role would be to anticipate what the implementation issues could be and to input new ideas into the functionality of software that would use the standard.

If marketing experts are included in the Project Team then their role would be to provide a bridge between the needs of customers and the developers of the standard and to input information on new product types and new applications to extend the scope of the standard.

B.2.3 Acquire supporting software

The creation of a PLIB dictionary requires software to support the development activities. The software needed to support the development of the dictionary for ISO 13399 was:

— an editor conforming to ISO 13584 – for the compilation of the dictionary;

— ISO STD2 Template - for the production of the standard documents;

— software to convert the dictionary file to a printable version;

— CAD software to create the diagrams to support the definitions of properties;

— a database to provide a searchable record of the content and provide checks against duplication of names, etc.;

— spreadsheet software to provide complete lists of classes and properties and their association with illustrations.

It was necessary to train the members of the Project Team in the use of the software that was appropriate to their roles.

B.2.4 Establish liaisons

ISO TC29 was the committee responsible for the ISO 13399 and an official liaison was established between ISO TC29 and ISO TC184/SC4. This relationship was essential to provide access to the latest developments in the technology and standards for product data representation.

© ISO 2008 – All rights reserved

B.3 Information model for the reference dictionary

The PLIB information model used for this project was ISO 13584-25. This model was further constrained to limit the meaning of the data types used in the dictionary:

— the classes used were item classes and feature classes only;

— some of the data types were constrained to use only a limited number of data formats.

The scope and constraints on the model were described in ISO/TS 13399-100 by adopting the diagrammatic presentation methods used in IEC 61360-1.

The domain experts were provided with some training in the use of the ISO 13584 by using the PLIB Editor software. It was not necessary to refer directly to the information model for the dictionary. The domain experts soon understood the principles of the development and were very comfortable with compiling the dictionary by using the PLIB editor software.

B.4 Development of the classification of items and features

B.4.1 Main classes

The main sections of the classification were initially identified as the components in Figure 1:

— cutting items – the portion of the cutting tool in contact with the workpiece;

— tool items – the assembly that is the support for the cutting item;

— adaptive items – the components that connect the tool item to the machine tool;

— accessory items – items that hold the cutting item to the tool item and items that are used to create the assembly.

The root class was an item class and the main classes were either item classes or feature classes, where a feature was an aspect of an item class that could not exist in isolation. Every effort was made to keep the classification with as few subsidiary levels as possible and to avoid information modelling in the classification. The use of feature classes simplified a minimised the levels and the complexity of subsidiary classes. The classification of cutting tool items may include several views (functional, geometric, etc.) and the use of feature classes was critical to resolve the classification.

As the development of the dictionary proceeded, changes to this initial division needed to be made. Accessory items were restricted to assembly items to hold the cutting item in place on the tool item;

Further main classes were identified as:

— reference systems to provide a coordinate axis system for the definition of angles and lengths;

— classes that were common to several of the original sections;

— classes of connection systems.

B.4.2 Reference to other dictionaries

As the dictionary neared to completion, it was realised that two of the classes in the ISO 13399 were the same concepts as classes in the ISO 13584-511:

— threaded fasteners as a subclass in the assembly item class;

— thread as a common feature of several classes.

© ISO 2008 – All rights reserved

The class of externally threaded item was copied from the Part 511 and was defined as an item_class_case_of in the ISO 13399. Then a reference was made from the ISO 13399 to the class with the same name in the ISO 13584-511. The properties for this class in the ISO 13399 were accessed from the ISO 13584-511 by use of the 'Add dictionary' function in the PLIB Editor. By this means the contents of the externally threaded item class from the Part 511 are known to the dictionary in ISO 13399. There are some special threaded fasteners particular to the assembly of cutting tools that are not standardized in the sources from which the Part 511 is derived. These special items were created as subclasses of externally threaded item in the ISO 13399. The illustrations of the reference to externally threaded item are shown in Figures B.4 and B.5.

Thread, as a feature of an object, is a common feature of several items in the domain of ISO 13399 and so it was made a feature class with no superclass, other than the root class. Care was taken to ensure that the properties of thread did not include any properties related to the cutting of the thread, which are properties of some types of cutting item. The feature class of thread in the Part 511 did not include all the types of thread and all the properties of a thread that were thought to be necessary for the ISO 13399. Cooperation with the developers of the Part 511 was therefore established to extend the Part 511 to meet the requirements of the ISO 13399 and when this is completed the reference can be made from the ISO 13399 to the ISO 13584-511 in the same manner as for the externally threaded item.

B.4.3 Feature classes

ISO 13584 allows for the classification of the features of an object, where a feature can be defined as a class of object that cannot exist in isolation. For example, a cutting edge is a feature of a cutting item. This aspect of the classification is needed to avoid repetition, e.g. to avoid having to define a subclass of cutting edge for every class of cutting item. It is also needed to be able to assign properties to a feature as a class.

In the ISO 13399, the association between an object and a feature was made by assigning a property to the item class that indicates by its value whether the object possesses the feature. The data type for this kind of property was Boolean. For example, a cutting item may or may not have a chip breaker as part of its design. The Boolean property 'chip breaker property' was made applicable to the cutting item class and the value of the property will indicate whether or not an instance of a cutting item has a chip breaker. The properties of the chip breaker itself are then made applicable to the chip breaker feature class.

However, the ISO 13584 does not provide the means to identify the item class of which the feature class is a part: only the forward association can be identified by the method described above. The correct association between a feature and the object of which is a part would have to be achieved in a software implementation of the dictionary.

B.4.4 Assign class names

Class names were devised by the domain experts based on common industrial practice where possible. Differences between the class names used for the same concept in the companies that participated in the Project Team were resolved by choosing one of the alternatives, or by choosing an existing ISO name, or by devising new names for use in ISO 13399. The convention adopted for long names in the dictionary was to use only lower case letters with no joining character between multiple words. Where groups of classes were associated with an aspect of a cutting tool, the names were devised with common elements to identify the association.

The convention adopted for short names was to use lower case letters in a truncated form of the long name. The compilation of the classes in a data base was used to verify that there was no repetition of names or short names.

B.4.5 Assign definitions

Definitions were derived from other ISO standards wherever possible and in these cases the source was identified. However, much of the content of the dictionary was new material that needed original definitions. Whenever it was possible, a diagram was produced to support the definition.

© ISO 2008 – All rights reserved

B.4.6 Assign identification code

The assignation of an identification code to a class is a fundamental feature of the PLIB method. For the ISO 13399 each identification code was a random number that was generated by the editor software. The benefit was to assign no meaning to the code so that the position of a class could be changed if it was necessary to change the classification as the dictionary developed.

B.4.7 Assign applicable properties

Properties were selected from the list of visible properties (see 8) to be applicable to the appropriate level of the classification. This was the important contribution from the domain experts and also resulted in changes to the classification to reflect the grouping of classes and their properties.

B.4.8 Examples of the classification

A high level view of the classification in ISO 13399 is shown in Figure B.2. Notice that there is an additional library from the ISO 13584-511.

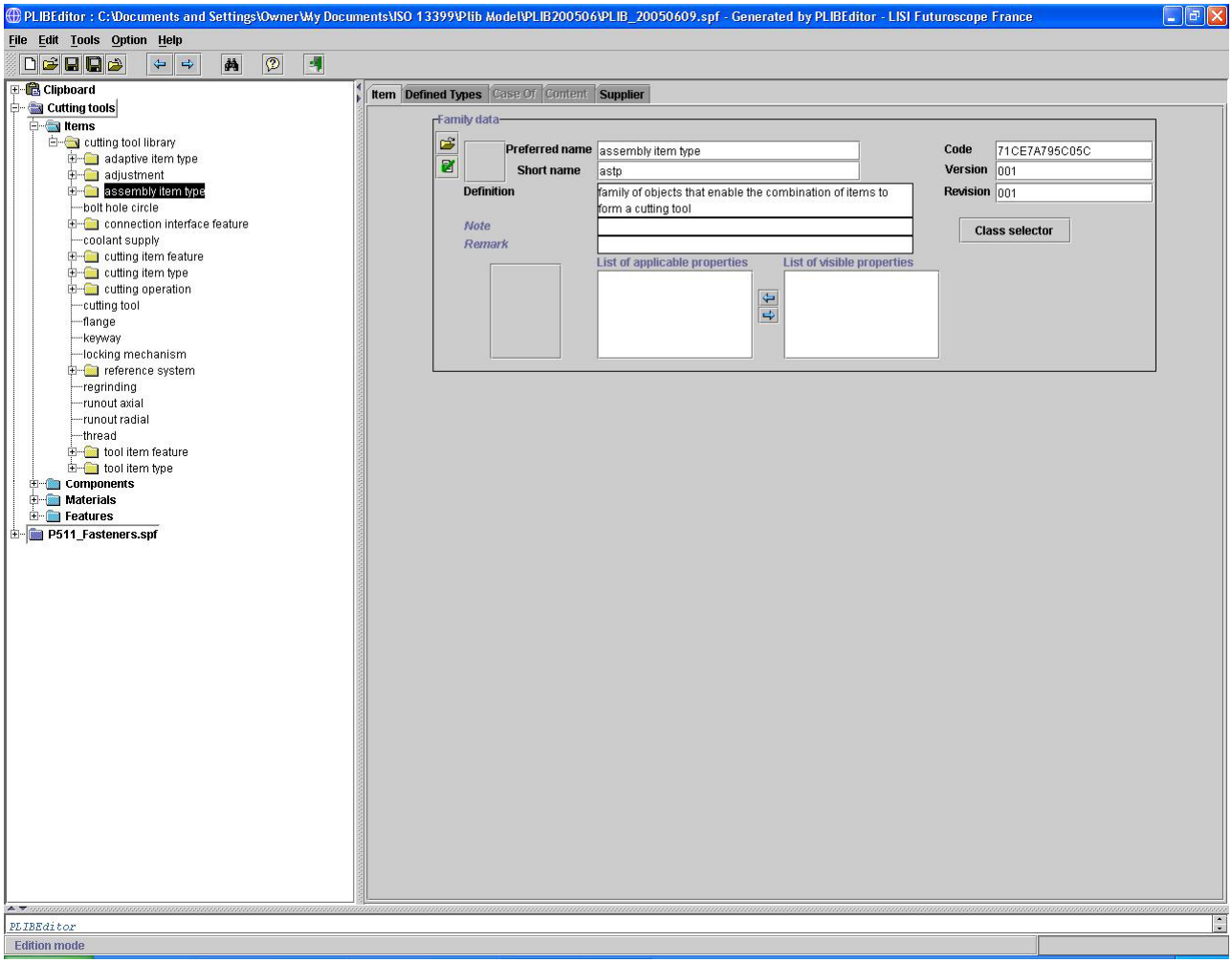

Figure B.2 — Example of the classification in the ISO 13399 dictionary

The section of the classification that defines the reference systems for modern cutting tools is shown in Figure B.3.

© ISO 2008 – All rights reserved

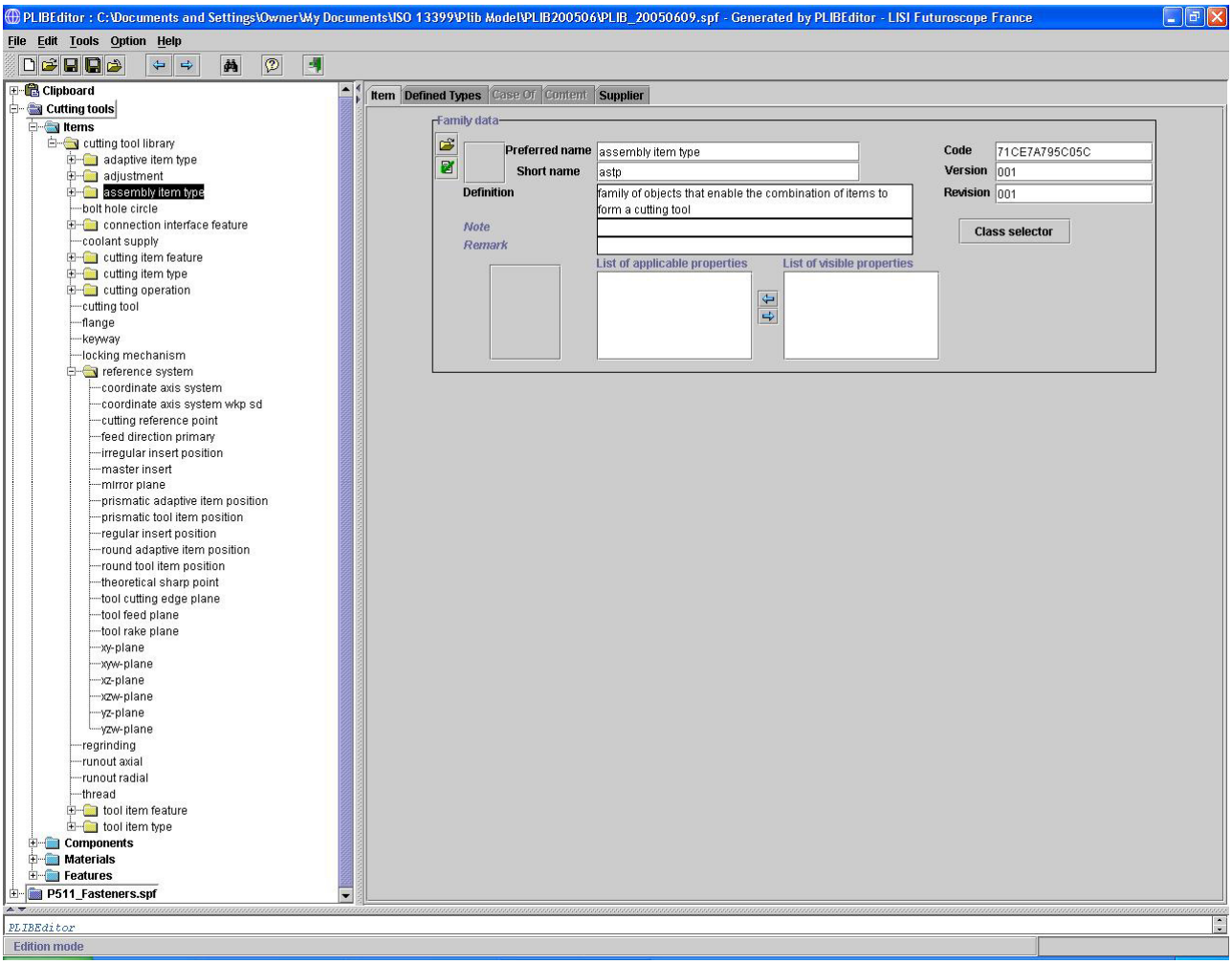

Figure B.3 —Classification of reference systems

The examples of the use of another dictionary as a reference are provided in Figure B.4 and Figure B.5. Figure B.4 shows the references to the ISO 13584-511 in the list of applicable properties for externally threaded component in the ISO 13399. Figure B.5 shows the properties from the ISO 13584-511 applied to the externally threaded fastener component in the ISO 13399. Notice how in Figure B.5 the Code value of the highlighted property in the lower part of the screen is not the same type as the Code values in the ISO 13399.

© ISO 2008 – All rights reserved

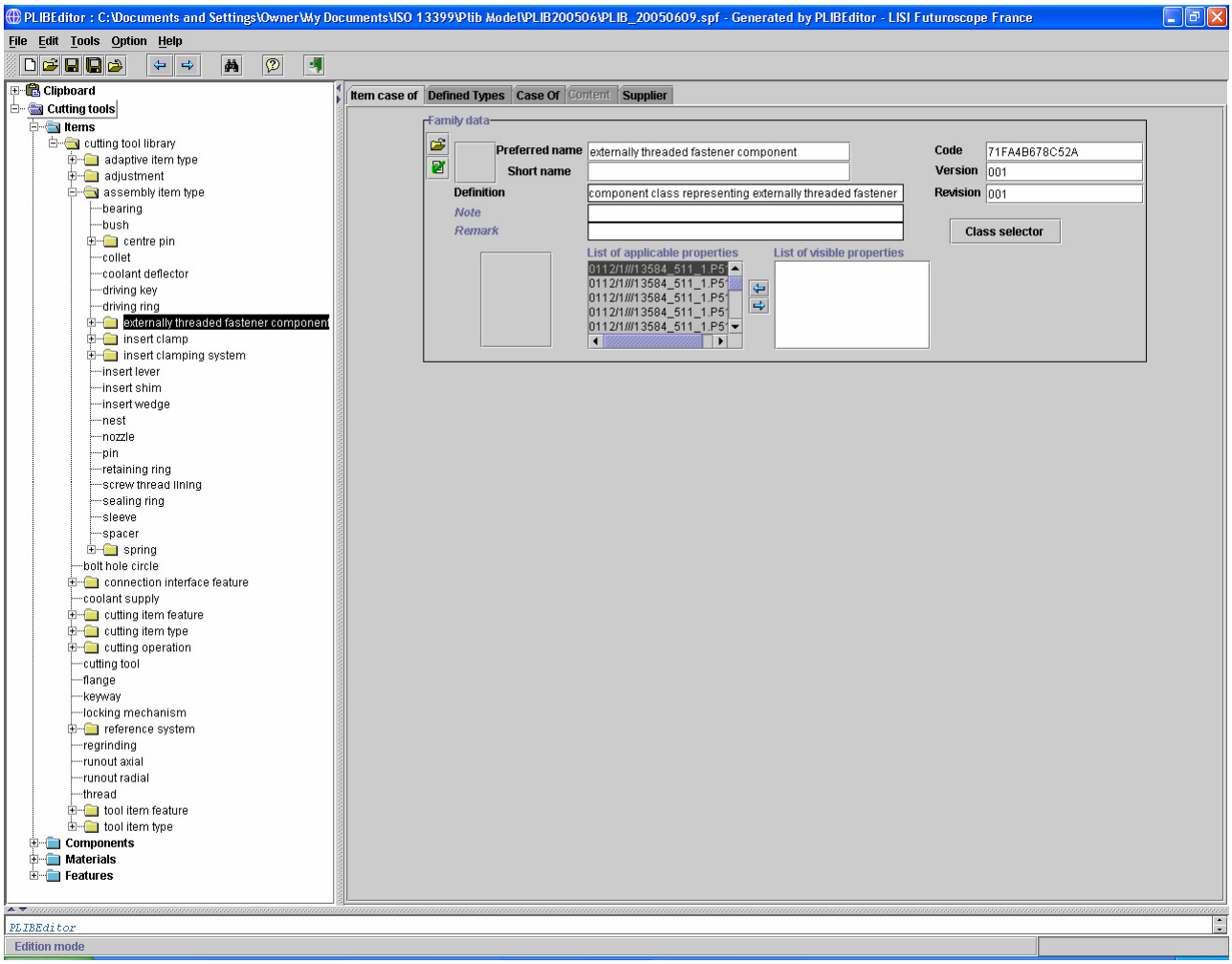

Figure B.4 — Example of the references to ISO 13584-511 for the applicable properties of the externally threaded fastener component

© ISO 2008 – All rights reserved

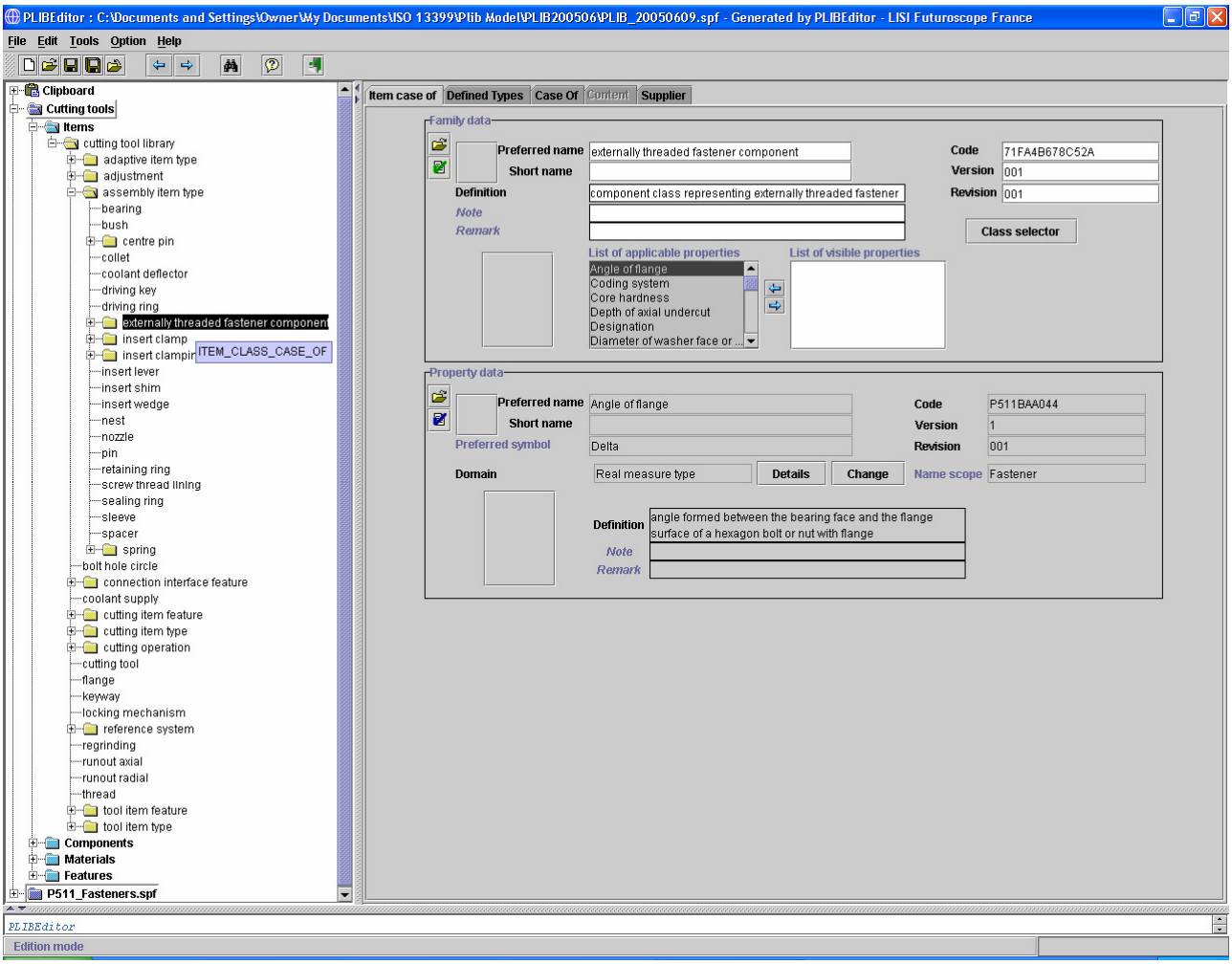

Figure B.5 — Example of the use of the applicable properties defined in ISO 13584-511 for the externally threaded fastener component in ISO 13399

B.5 Visible properties

The development of the list of visible properties was the largest part of the development process. The companies in the development team provided lists of properties from their company data bases and a great effort was made either to harmonise the names or to create independent names and derive rigorous definitions. The concepts enshrined in the definitions were regarded as the most important aspects of the properties with the names acting as labels for the definitions. The properties chosen for representation in the dictionary were restricted to the properties that are commonly described in the tool company catalogues. Properties that related to the design or the manufacture of the tools were not included.

B.5.1 Name scope of identification codes

All the visible properties were created at the root level of the dictionary and were assigned identification codes that were generated at random by the editor software. This had the advantage that the assignment of applicable properties could be made at any level in the classification.

B.5.2 Assignment of property names

The convention adopted for long names in the dictionary was to use only lower case letters with no joining character between multiple words. Where groups of properties were associated with an aspect of a cutting tool, the names were devised with common elements to identify the association.

© ISO 2008 – All rights reserved

The usual convention adopted for short names was to use lower case letters in a truncated form of the long name. In some cases the short name was derived from the common industry symbol for the property. A compilation of the properties names in a data base was used to verify that there was no repetition of short names.

B.5.3 Assignment of property symbols

Property symbols were copies of the short name in upper case symbols. The data base was used to ensure that there was no repetition of symbols.

B.5.4 Development of property definitions

The development of definitions was a joint effort between the domain experts and the information modellers. All the definitions were in British English and so it was helpful to have a native English speaker as part of the development team. Definitions were derived from existing ISO standards where they existed but much of the content was new and original definitions had to be derived in most cases. The large number of dimensional properties made it essential to define a geometrical reference system (see ISO 13399-50) before the definition of dimensional properties could be achieved.

It was necessary to review and revise definitions several times in cases where the concept described was particularly complex or it was necessary to relate definitions to other properties that came later in the development process.

B.5.5 Assignment of diagrams to the property definitions

A definition of a geometrical property in the ISO 13399 was supported by a diagram where appropriate. Each diagram could illustrate several properties but the limitations of the ISO 13584 standard require that each property reference has a reference to a separate diagram. This multiplies the number of diagrams that are included in the dictionary. The diagrams were developed in industry standard CAD systems and then converted to the JPEG format for inclusion in the dictionary. A master list of diagrams was compiled as a spreadsheet to show their associations with applicable properties, classes and reference systems.

B.5.6 Identify data type, unit name and synonyms

For each property a data type was identified and a unit string was assigned if the data type was a real value. In a few cases synonyms were identified where industrial practice required them but the number of synonyms was kept to a low level.

B.6 Checking the records

Spread sheets were used to display the whole content of the dictionary in order to check for any missing items in each record. The content of the dictionary was converted into a form that could be displayed in a spreadsheet by using the software for producing a printable version. The formatted printed version was also a valuable aid in checking for errors, discrepancies and inconsistencies.

B.7 Prototype implementation

The purpose of the dictionary was to provide the terminology for use by the entity relationship model in ISO 13399-1. A prototype implementation of the information model in ISO 13399-1 was therefore created test its capability for aliasing, assembly and mating of components, documents and effectivity, and to demonstrate that the information model could make a correct reference to the relevant section of the dictionary for cutting items.

B.8 Producing the standard documents

The dictionary was developed as single data file that contained all the classes and their properties. However it was decided to publish the dictionary in sections in a series of documents to achieve a manageable compilation of the contents in a form that would be understandable by a tool engineer without the need for specialist software. The parts were conceived as Technical Specifications with a shorter ballot process and with the capability for more frequent revision.

© ISO 2008 – All rights reserved

The standard documents of ISO 13399 describe the main divisions of the classification and their properties as in:

— Part 2 – Reference dictionary for cutting items;

— Part 3 – Reference dictionary for tool items;

— Part 4 – Reference dictionary for adaptive items;

— Part 5 – Reference dictionary for assembly items;

— Part 50 – Reference dictionary for reference systems and common concepts;

— Part 60 – Reference dictionary for connection systems;

— Part 100 – Definitions, principles and methods for reference dictionaries.

All these documents were produced by using the ISO template STD2. The sections of the dictionary were isolated from the complete file and the contents of a section were converted into a printable form. The classes and their applicable properties were published as one Annex and the details of the properties and the classes to which they applied were published as another Annex. Diagrams to illustrate the properties were published in a series of Annexes and reference to the diagram that illustrated a property was made in the description of the relevant property.

Part 100 was a specification of how the ISO 13584 was constrained for the purpose of the dictionary. The method adopted for describing the implementation of the ISO 13584 was based on the approach in IEC 61360-1, using simple diagrams to describe the information model and formal text to define the constraints.

There is a risk in publishing the parts in stages because later developments may have an impact on information already published. Part 2 was regarded as complete and Part 100 was independent of the others and so both these parts were published first. There was a strong interaction between Parts 3, 4, 50 and 60 and so these parts were developed and published together. Part 5 was less dependent on the other parts and so was published last.

B.9 Expenditure of effort

The production of the dictionary for the ISO 13399 was a major effort. The project involved the two largest manufacturers of cutting tools and has taken approximately 5 years. In that time there were approximately four meetings per year of the full project team of usually 6 persons, each lasting for two weeks. In addition, there were many man months of individual efforts between the meetings in order to produce the standard documents and the drawings to illustrate the property definitions. The effort in the regular meetings amounted to approximately 5 man years and the associated individual efforts approximately doubled that to achieve a total of approximately 10 man years of effort.

B.10 Conclusions

The production of the dictionary in ISO 13399 was more a research project than a development project. There was almost no information available at the start of the project about how to proceed with this task. There was also no knowledge of the information technology by the domain engineers and there was only one other dictionary that could be used as a partial guide. The progress was therefore one of experimentation in the early stages until confidence could be gained and the process could become quicker. The result is however unique in the domain of machine cutting tools and some aspects are also unique within the field of product data technology.

The main features of the dictionary are suggested to be:

— a single coordinate reference system that applies to all components of the cutting tool from the workpiece to the machine tool;

© ISO 2008 – All rights reserved

— a capability to define, with respect to this coordinate system, all the components of a modern cutting tool and all the properties that are commonly available in tool catalogues;

— a capability to support the entity relationship model of ISO 13399-1 with terms and their definitions;

— an association of the visible properties with the root class of the dictionary;

— the use of random number strings as the identification codes for classes and properties;

— the use of item classes and feature classes to simplify the classification;

the use of references to another dictionary to access the concepts that are held in common between the two dictionaries.

© ISO 2008 – All rights reserved

Annex C
(informative)

The illustration of classes and properties

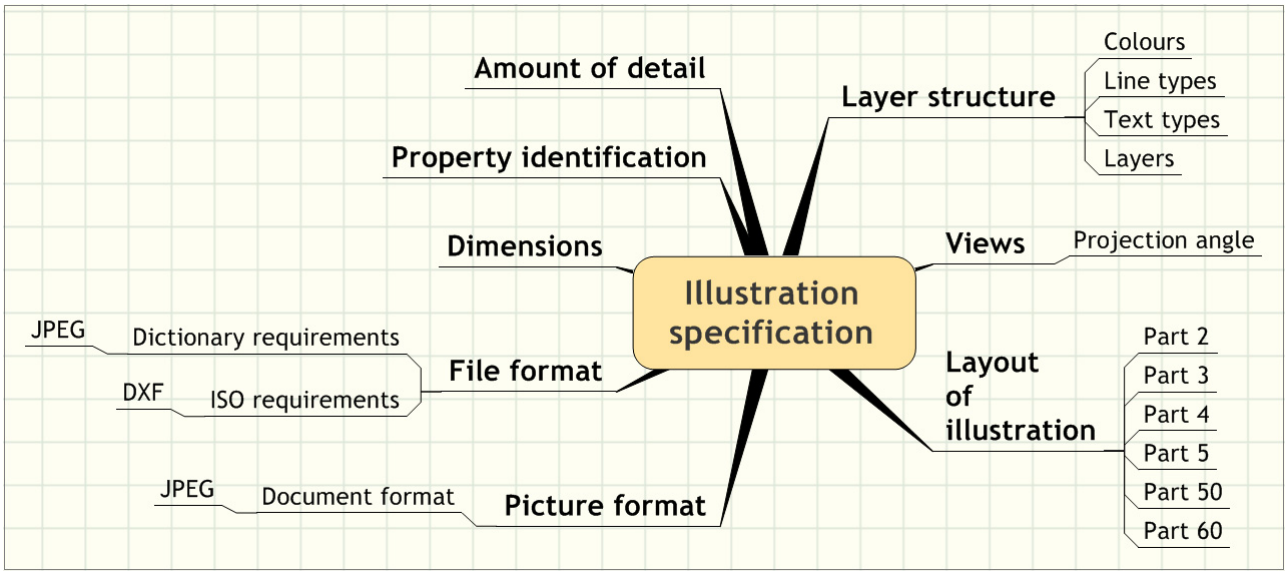

Figure C.1 — Summary of the requirements for an illustration

C.1 Introduction

This Annex provides advice on the creation of diagrams to illustrate properties and classes in the ISO 13399.

Illustrations should be provided to supplement the definitions of classes and properties in the dictionary wherever this is possible. The amount of detail in these illustrations should be sufficient to show the properties associated with an item or a feature but should not show values of dimensions and other details that would enable the manufacture of a part.

C.2 Layer structure

The diagrams to illustrate properties and classes in ISO 13399 have been constructed in a CAD system with the specifications of the lines as shown in Table C.1.

© ISO 2008 – All rights reserved

Table C.1 — Specifications of lines used for diagrams in ISO 13399

Layer identifier	Colour	Line type	Line width	Applications
1	cyan	continuous	0.5 mm	visible contours
2	white	continuous	0.25 mm	dimensions, threads, broken lines
3	red	hidden	0.35 mm	hidden contours
Layer identifier	**Colour**	**Line type**	**Line width**	**Applications**
4	yellow	centre line	0.25 mm	centre lines
SK6	blue	continuous	0.25 mm	hatches

C.3 Text definitions

For illustrations that are not to be reduced in size the text should have the following attributes:

— Text style – simplex

— Text height – 3.5 mm

For illustrations that can be reduced in size the text should have the following attributes:

— Text style – simplex

— Text height – 5 mm

C.4 Dimensions

Dimensions should be readable horizontally.

Values of the dimensions of properties created by the CAD system should be replaced by the relevant symbol of the property.

If only one side of a dimension is to be shown then the other side of the dimensional construct should be removed.

C.5 Views

Views will be arranged in accordance with the ISO-E (first angle) projection.

C.6 Property identification

Properties should be identified by the symbol for the property as specified in the dictionary. The text for the symbol shall be in upper case.

© ISO 2008 – All rights reserved

C.7 Layout of illustrations

C.7.1 ISO/TS 13399-2

C.7.1.1 Irregular inserts

An irregular insert is placed on the coordinate axis system in the XY quadrant with:

— the cutting edges in the xy-plane;

— the cutting profile pointing in the negative Y direction;

— the forward extremity of the cutting profile on the positive X axis;

— the side extremity of the insert on the positive Y axis.

C.7.1.2 Regular inserts

An irregular insert is placed on the coordinate axis system in the XY quadrant with:

— the cutting edges on the xy-plane;

— the major cutting edge on the positive X axis;

— the theoretical sharp point of the insert on the Y axis.

C.7.2 ISO/TS 13399-3

Properties should be illustrated on examples of tool item types where they are most relevant. The tool item should be shown with the insert and any clamping mechanism in place. The orientation of the tool item in the illustration was with the cutting item end on the left hand side of the illustration. Prismatic tool items are located on the coordinate system with the base of the tool item on the xy-plane and the main axis of the tool item pointing to the workpiece along the direction of the negative X axis.

C.7.3 ISO/TS 13399-4

Properties should be illustrated on examples of the connection item types where they are most relevant. The orientation of the connection item in the illustration was with the machine side of the connection item on the right hand side of the illustration.

C.7.4 ISO/TS 13399-5

The illustrations in Part 5 are examples of classes without properties. The illustrations are pictorial representations positioned to show the main features of an item.

C.7.5 ISO/TS 13399-60

The illustrations in Part 60 were intended to show examples of the main types of ways in which connections can be made between adaptive items, tool items and machines and with the properties relevant to the example. Each illustration showed two aspects of the connection – the machine side connector and the workpiece side connector. The workpiece side connector shows the direction to the machine side and the workpiece side connector shows the direction to the workpiece side.

C.8 File Formats

C.8.1 Dictionary requirements

Files of illustrations that are incorporated in the dictionary by reference should be in JPEG format.

© ISO 2008 – All rights reserved

C.8.2 Document requirements

Files of illustrations that are inserted into the documents should be in the JPEG format.

C.8.3 ISO requirements

Files of illustrations that are submitted to ISO with the document versions should be provided in DXF format for geometrical drawings and in JPEG format for other illustrations.

© ISO 2008 – All rights reserved

Annex D
(normative)

Maintenance procedure

D.1 General

The ISO 13399 dictionaries conform to the general information model for part library defined in ISO 13584-25.

Since, the content of those dictionaries will evolve according to industrial innovations and constant improvement of technology in cutting tools, maintenance of the data dictionaries is necessary.

The purposes of the maintenance procedure are:

— to ensure that the released data dictionary content is relevant, validated and approved;

— to manage change requests in a predefined and agreed manner within a particular time frame.

For ISO 13399 dictionaries, the maintenance is supported by a Maintenance Agency whose secretariat is appointed by ISO/TMB. This maintenance Agency shall conform with ISO/IEC Directives, Part 1, Annex G (5th edition, 2004).

Modifications to the reference dictionaries handled under the Maintenance Agency may include:

— correcting errors in the entries of existing classes and properties;

— adding new properties to existing classes;

— adding new classes and their properties;

— managing the status of those properties and classes;

— transferring the dictionaries to subsequent versions of ISO 13584.

D.2 Members of the Maintenance Agency

Maintenance Agency experts shall be designated by their National Standardization bodies and proposed to ISO/TMB to be appointed.

NOTE It is up to the National Committee to decide for how long time a member should be appointed.

Among the experts of the Maintenance Agency, an executive group of experts (composed of 1 up to 5 experts, named Validation Team) shall be appointed by and acting on behalf of their National Committees to validate proposed requests for modification.

NOTE Each appointed experts is subjected to justify current or past involvement in ISO/TC 29 activities.

The following tasks are assigned to the Maintenance Agency members:

— Evaluation task: to determine whether the Change Request (CR) is within the scope of the database and valid for further work.

— Validation task: validation with regard to the technical content and the formal voting on behalf of the National Committees.

— Reporting task: reporting to ISO/TC 29 on submitted and approved requests.

© ISO 2008 – All rights reserved

D.3 Hosting of the Maintenance Agency

Hosting is the process of maintaining the updated dictionaries and their draft revisions/amendments in a computer environment and a web infrastructure that can provide a range of services to users.

a) Hosting for public access.

Public access to ISO 13399 dictionaries shall conform to ISO rules.

Public access enables users to access the contents of the ISO 13399 dictionaries but not to change any of their contents.

b) Hosting for maintenance.

In order to carry out maintenance operations, the dictionary needs to be in a computer system that enables secure access from authorised persons and in an environment where the dictionary can be securely stored in all its variants separately from the version that is provided for public access.

The versions shall be clearly identified, and a distinction shall be made between the "public" (published) version and the "draft" (working) ones.

D.4 Procedure

D.4.1 Principles

The procedures described in this Annex are based on the use of a web-accessible data file and electronic communication and are specific to the maintenance of the ISO 13399 dictionaries. The prescribed throughput time for maintenance/validation can only be achieved by means of electronic communication.

The relevant parts of the ISO 13399 dictionaries shall be available in database format.

The maintenance procedure is divided in 2 steps: preliminary stage and either normal database procedure or extended database procedure.

D.4.2 Preliminary stage for maintenance

D.4.2.1 Initiation of Change Request (CR)

Indication of the address of the MA web site shall be given in the printed editions of ISO 13399.

A CR template form shall be provided in the web site of the MA. This form shall contain the change request and, wherever possible a proposed change.

This form shall contain identification of the "proposer" (name, affiliation, phone & fax & e-mail). This identification is mandatory before submission.

The proposer shall be guided by a template to give the MA all the necessary technical/editorial informations.

NOTE Anybody can be a "proposer" for CR, as long as the identification is properly filled.

This form shall clearly indicate that CR with proposed changes receives a priority treatment.

NOTE Open questions are possible, but they are dealt with as a second priority.

© ISO 2008 – All rights reserved

D.4.2.2 Preparation for evaluation

The Secretariat, when receiving the question, shall:

— send a confirmation receipt of the question to the proposer and indicate, wherever possible, the expected target date for a given answer

NOTE If, when sending this confirmation, it appears that the identification of the proposer is wrong, the preliminary stage ends immediately, and the CR is cancelled.

— register the CR in the MA database, with an identification number, and a status tag[2)];

— prepare the consultation of VT experts.

D.4.3 Evaluation of the change request

The MA secretariat, with the help of the VT experts, shall evaluate and determine whether the CR is within the scope of the database and valid for further work or should be rejected, or whether it is purely editorial.

If the CR is purely editorial (correction of typing error, etc), the Secretariat shall implement the modification without any further consultations. The relevant dictionary (accessible online) is updated (with clear identification of the version number)[3)] and the procedure is finished.

Any request that would extend beyond the scope of maintenance shall be transferred to ISO/TC 29.

A Change Request shall be rejected if it is not within the scope of the ISO 13399 reference dictionary.

Within 6 weeks, the outcome of this evaluation shall be either:

— continuation with the Normal database maintenance procedure, or

— continuation with the Extended database maintenance procedure, or

— rejection of the CR.

NOTE If the original CR references many items, and if some of these might be acceptable for continuation with the normal database procedure while others are not, the original CR might be divided into two or more new CRs and processed separately. Such new CRs start at the status level already achieved.

In the case of rejection, the proposer shall be notified of the reasons for rejection.

NOTE The proposer may adapt the original Change Request according to the advice of the Maintenance Agency and resubmit using the original Change Request and assigned identification.

NOTE In cases where the proposal for the new item has been generated in the context of an ongoing project in another technical committee, and when the result is required in a timely manner to complete that project, a good synchronization is necessary. This is best achieved through immediate involvement of this other committee. E.g. through a task force or an advisory group, in the development of the proposal before submitting it for evaluation.

D.4.4 Normal database maintenance procedure

The normal database procedure is faster than the extended procedure and relies on the Maintenance Agency (MA) Experts acting on behalf of their National Committees for the final voting on proposals.

---

2) The status describes the life cycle of the CR. It can be "recorded, evaluated, under validation, standard, implemented, rejected".

3) Change tracking is to be further developed. Some guidelines can be found in the P-Lib 13584 standard series.

© ISO 2008 – All rights reserved

The normal database procedure shall be typically applicable for changes to existing items and for new items within the boundaries of the existing domain of the database or in cases where there is an urgent need for standardization.

A consultation form shall be prepared by the secretariat, containing the following:

— the identification number;

— the CR and proposed answer, reworded if necessary to make easier the answer in the form YES or NO and COMMENTS;

— a specific warning for the group of experts responsible of the issue;

— a closing date for the answer/comments;

and sent by e-mail and/or submitted on a "private" zone of the MA web site to the MA experts.

The decision shall be taken on the basis of the received answers:

— at least 2 answers are needed to confirm the "correction/modification/addition";

— if answers are converging, the "correction/modification/addition" is immediately prepared;

— in case of diverging answers, a second round is organized on the basis of comments received;

— in case of continuously diverging answers, a formal meeting of the MA experts shall take place either to resolve the issue or to transfer the CR to the extended database maintenance procedure. The proposer shalll be informed of the delay needed to give him the answer.

A record of answers from MA experts shall be maintained by the MA secretariat.

If the proposed item(s) are accepted, the status level of the item(s) is changed to standard. If they are not accepted, then the reason(s) are noted and the status level of the item(s) is set to "rejected".

After setting the final status levels for the items and noting the reasons, the status level of the CR is set to be implemented and the relevant dictionary is updated (with clear identification of the version number) and the procedure is finished.

The set of items approved in accordance with the normal database procedure is summarized by the MA secretariat in a report to the TC/SC plenary meeting. At the TC/SC plenary meeting all items standardized since the previous plenary meeting are presented.

D.4.5 The extended database maintenance procedure

The extended database procedure respects all stages described in the ISO/IEC Directives for the approval of standards as printed documents, (the original procedure). The procedure involves the National Committees in the traditional way in which the different draft stages are introduced by formal documents/messages to the National Committees. However, as with the normal procedure, the information in the database shall be considered as the original source of information.

D.5 Regular maintenance of the entire Standard or Technical Specification

In addition to the continuous maintenance of the standard described above, a comprehensive review of the database contents carried out by the MA experts at regular intervals may be necessary. For such reviews the maintenance cycle concept as defined elsewhere in the ISO/IEC Directives is relevant.

© ISO 2008 – All rights reserved

The resulting proposal from such review shall be entered formally into the database as one or many change requests and then each change request is dealt with according to the normal or extended database procedure as appropriate.

D.6 Appeals

If, at any time after acceptance of an item, a National Committee is dissatisfied with the result of the validation process on an item, it should bring forward a change request with a proposal for an amendment to the item which will re-open consideration of it under the procedures described above.

D.7 Meeting of the MA experts

The MA experts shall meet formally either once every year or when more than 5 CR are pending.

D.8 Information about availability of new version

A "log file" of the updated versions of the dictionaries shall be managed by the MA secretariat.

With every new update of the dictionary, the MA secretariat shall inform all ISO/TC 29 secretariats, the MA experts and all the "proposers".

© ISO 2008 – All rights reserved

Annex E
(informative)

The definition of connection interface features

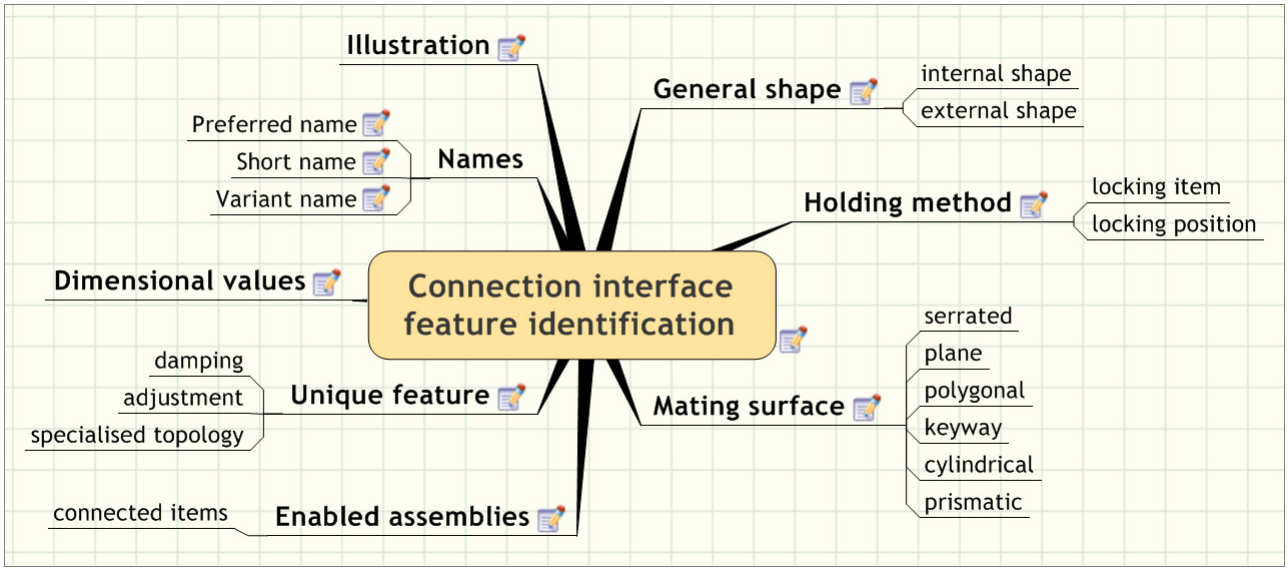

Figure E.1 — Information to be included in the description of connection interface features

E.1 Introduction

This Annex provides advice on the identification of the classes of connection features. The classification of connection interface features is based on the products produced by different companies and so this methodology is intended to assist in the harmonisation of definitions created by different sources.

E.2 General approach

The required identification should consist of a preferred name, a short name and text to describe a connection interface feature type or its variants. The purpose of the identification is to create a consistent method to reach a definition to distinguish one connection feature from another.

The descriptive text should start with a lower case letter and should include as a minimum requirement:

— general shape

— mating surface

— enabled assemblies

— dimensional values

Where it is desirable to establish a unique description then the holding mechanism and a unique feature should be added.

© ISO 2008 – All rights reserved

E.2.1 Names

E.2.1.1 Preferred name

The preferred name is a combination of two strings, separated by a space:

<short name> < label>.

The label could be a brand name or a trade name or a short explanatory string of text.

EXAMPLE CCS Coromant Capto System

NOTE Coromant Capto System is a registered trade mark of AB Sandvik Coromant.

The ownership of any trade mark name or other intellectual properties is identified as a Note in the standard.

E.2.1.2 Short name

The short name should be in the form of a string of three capital letters derived from the initial letters of the label section of the preferred name. The string is unique in the collection of the dictionary.

EXAMPLE CCS

E.2.1.3 Variant name

Each class of connection interface feature should have subclasses of at least one variant. The variant name should be a combination of the following strings separated by single spaces:

< variant <variant ordinal number>> of <preferred name label>

The variant ordinal number should be two characters in a sequence starting with 01 in each class of a connection interface feature.

When there is only one variant of a class then this should be identified as:

normal version of the <text that describes the class>.

EXAMPLE normal version of Coromant Capto System

E.2.2 General shape

The general shape should be described by text to describe the overall appearance of the connector.

EXAMPLE connection of cylindrical shape

It may be necessary to differentiate between and describe the internal and external shape of a connection.

E.2.3 Mating surface

The mating surface should be described by text to describe the topological characteristics of the surfaces that form the connection. Terms that should be used to describe the types of mating surface include:

- cylindrical;
- keyway;
- planar;
- polygonal;
- prismatic;
- serrated.

EXAMPLE polygonal mating surface

© ISO 2008 – All rights reserved

E.2.4 Enabled assemblies

Enabled assemblies are identified by text that describes the items are connected together.

EXAMPLE connecting a cartridge to a boring bar

E.2.5 Dimensional values

The description of this attribute should have the required text: 'with the values of the dimensions conforming to <insert manufacture's identifier>'.

EXAMPLE with the values of the dimensions conforming to Coromant 570

NOTE Coromant 570 is a registered Trade Mark of AB Sandvik Coromant

E.3 Additional information

Further information may be added to supplement the required information in order to achieve a unique identification of the connection feature.

E.3.1 Holding method

The characteristics of the method of locating the connection and the means for securing the connection may be described by text. The locking item and the locking position may be included.

EXAMPLE secured by screws

E.3.2 Unique feature

A connection may be described by text to describe unique attributes that characterise the connection.

Terms that may be used to characterise a connection could include, as examples:

- adjustable;
- damping;
- specialised topology.

EXAMPLE adjustable radially

E.4 Illustrations

Dictionary entries should be illustrated whenever possible.

The illustration should be:

- line drawings with no commercial identification.
- image in the template required by the ISO Directives and ISO 13584.
- drawings showing the most characteristic features either as a view and or a cross section.
- drawing showing both the machine side and the workpiece side of the connection and the direction to these sides indicating with appropriate labelled arrows.

without specific dimensions for the connection. Reference dimensions for the whole tool should be indicated with symbols.

© ISO 2008 – All rights reserved

Bibliography

[1] ISO 1087-1, *Terminology work — Vocabulary — Part 1: Theory and application*

[2] ISO/IEC 646, *Information technology — ISO 7-bit coded character set for information interchange*

[3] ISO/IEC 2382-1, *Information technology — Vocabulary — Part 1: Fundamental terms*

[4] ISO/IEC 6429, *Information technology — Control functions for coded character sets*

[5] ISO/IEC 11179-3, *Information technology — Metadata registries (MDR) — Part 3: Registry metamodel and basic attributes*

[6] IEC 61360-2, *Standard data element types with associated classification scheme for electronic components — Part 2: EXPRESS dictionary schema*

[7] IEC 61360-5, *Standard data element types with associated classification scheme for electronic components — Part 5: Extensions to the EXPRESS dictionary schema*

[8] SCHENK, D and WILSON, P. *Information Modelling the EXPRESS Way*, Oxford University Press, New York, 1994

[9] ISO/IEC Guide 77, *Guide for the specification products properties and classes*, ISO/IEC JWG1 (to be published)

© ISO 2008 – All rights reserved

ICS 25.100.01; 35.240.50

Price based on 51 pages

© ISO 2008 – All rights reserved