GUIDE 77-1

Guide for specification of product properties and classes —

Part 1:
Fundamental benefits

First edition 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.

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

Contents

Page

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.

Draft Guides adopted by the responsible Committee or Group are circulated to the member bodies for voting. Publication as a Guide requires approval by at least 75 % of the member bodies casting a vote.

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/IEC Guide 77-1 was prepared by the Joint Technical Advisory Group of the ISO Technical Management Board and the IEC Standardization Management Board on product properties and families.

ISO/IEC Guide 77 consists of the following parts, under the general title *Guide for specification of product properties and classes*:

— *Part 1: Fundamental benefits*

— *Part 2: Technical principles and guidance*

— *Part 3: Experience gained*

Introduction

Business processes are increasingly being conducted electronically, a situation which applies to internal processes as well as to the interfaces with external partners. Product data is currently defined predominantly on a system-specific or organization-specific basis, usually without the general exchangeability of the data being taken into account. On the originator side, this results in costly multiple definition and data storage for different addressees or customers and, on the recipient side, in repeated data editing and system integration of data from different sources combined with inherent, costly interpretation and conversion errors. Hence, there is a massive opportunity here for rationalization.

From the market side, pressure is increasingly being exerted to supply product data in electronic form and as this pressure grows, it will have a considerably impact on all businesses. For these reasons, a seamless exchange of product data, i.e. an exchange that is free from media discontinuities requires a unified, joint approach both for exchanging internal product data within a company and for exchanging product data with suppliers and customers.

Information about a product is generated over the entire life cycle of the product, from the idea, planning and design stages, through the manufacture, marketing, service and use stages, to product disposal. Information is required in the course of many process steps, both during product manufacture and sales and during product utilization (e.g. for maintenance and service) and recycling. Therefore, a harmonized, consistent process for preparing and disseminating relevant information about a product (across all organization and information systems) is of critical importance, as illustrated in Figure 1.

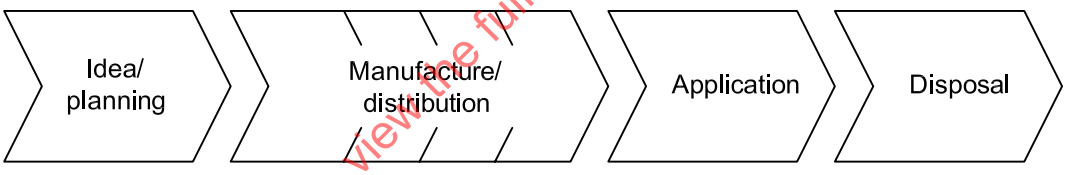


Figure 1 — Example of product life cycle and information transfer

This calls for the use of a methodology that allows product descriptions to be produced in a standardized, computer-sensible form that is acceptable over a wide range of industrial systems. Such a methodology is provided by IEC 61360-1 and ISO 13584-42. This methodology should be proactively promoted both internally in a company and externally between the business partners so that it becomes standard practice, thereby increasing the efficiency and cost-effectiveness of electronic business processes.

A company should respond to these external and internal requirements and ensure that electronic product data is supplied in a coordinated and inexpensive manner. This includes the provision of uniform data (i.e. product properties) for catalogues, electronic marketplaces, computer-aided design/computer-aided systems (CAD/CAx systems), product data management (PDM) systems, etc. To this end, rules for harmonization have been laid down. A common internal database is required to ensure the cost-effective utilization and distribution of this product data, both internally in a company and externally between the business partners.

Guide for specification of product properties and classes —

Part 1:
Fundamental benefits

1 Scope

ISO/IEC Guide 77 provides recommendations for standardization committees for the description of products and their properties for the creation of computer processable product libraries, catalogues and reference dictionaries. This description will provide the details of the products and their properties in an unambiguous manner capable of computer communication, in a form that is independent from any proprietary application software.

NOTE 1 The term “product” is taken to include devices, processes, systems, installations, etc.

ISO/IEC Guide 77 is intended to assist the objective of enabling the flow of technical information between internal and external business partners in a cost-effective and timely manner.

The guidance given in this part of ISO/IEC Guide 77 is intended to assist convenors and members of ISO and IEC Technical Committees, as well as managers and technical experts in the manufacturing industry.

This part of ISO/IEC Guide 77 is intended to provide an overview of the needs and benefits and the process of creating product libraries, catalogues and reference dictionaries. The following are within the scope of this part of ISO/IEC Guide 77:

— international standardization activities related to reference dictionaries;

— benefits of reference dictionaries to International Standards;

— a procedure for creating reference dictionaries;

— resources required;

— assessment of savings;

— sources of information and expertise.

The following are outside the scope of this part of ISO/IEC Guide 77:

— technical guidance for the creation of product libraries and dictionaries;

NOTE 2 Technical guidance for the creation of product libraries and dictionaries is provided in ISO/IEC Guide 77-2.

— case studies from experiences in the creation of dictionaries of product information in industrial practice.

NOTE 3 Experience gained in the creation of product libraries and dictionaries is provided in ISO/IEC Guide 77-3.

Reference dictionaries can be useful in the context of product data in the supply chain, as well as in the business context of product data management.

This part of ISO/IEC Guide 77 is for guidance only and is intended to support activities such as education.

2 Product data in the supply chain

2.1 General

This part of ISO/IEC Guide 77 is intended to assist technical standards committees and subcommittees, together with their working groups and project teams, who wish to describe products covered by their standards in a computer-sensible form.

This can also be useful for the following groups:

— suppliers of products who wish to describe them in catalogues, data sheets, etc.;

— information brokers and distributors;

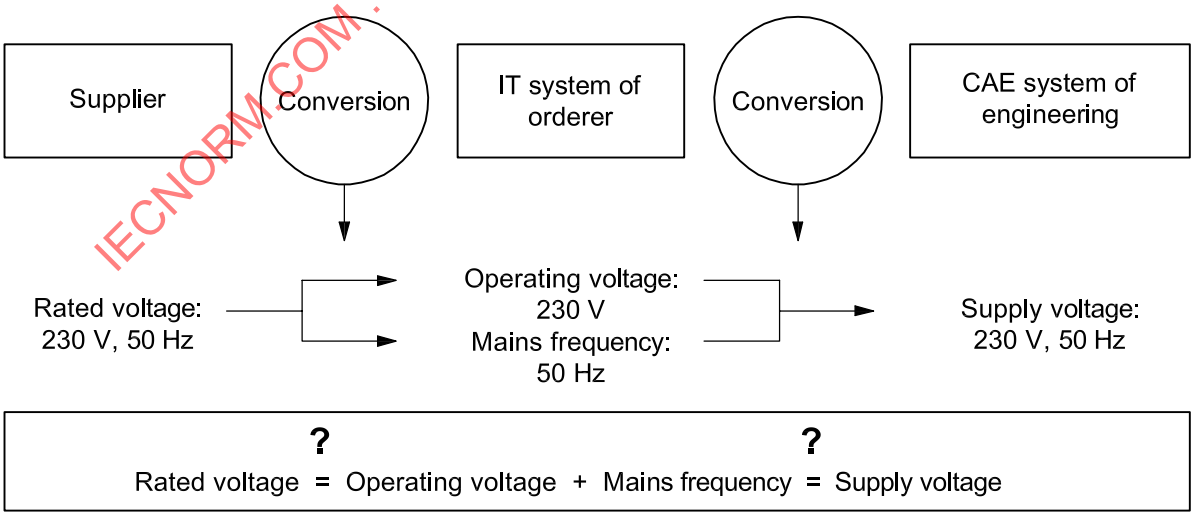
— end users who wish to build corporate databases.

Information on products is required at all stages of the life cycle of the product, from initial concepts through design and development to manufacture, then sales and marketing, followed by use of the product, which may entail maintenance, and finally to withdrawal from use, decommissioning and recycling. For all these phases in the life of a product, different requirements apply, resulting in different views on the product information, where each view may require a specific set of properties and their related product data. As well as the need for product data to be created, they also need to be communicated along the supply chain from the original manufacturer through to the end user and be capable of storage and retrieval for reference purposes.

2.2 Business context

2.2.1 General

Traditionally, product data have been made available as paper-based data sheets and catalogues. With the rapid increase in the use of IT tools for capturing, transmitting and using such data, there is an increasing demand for the data to be supplied from the outset in computer-sensible form, in order to avoid the delays and errors inherent in transcribing data from a paper-based form into a machine-based one. Furthermore, when data are transcribed in this way, the work is carried out without reference to standard methodologies that would, if used, ensure the exchangeability and interoperability of these data both within an enterprise and with partners outside it. Figure 2 illustrates some of the issues that arise in this information supply chain, notably the question of whether data really is exchangeable or not.



NOTE IT = information technology; CAE = computer-aided engineering.

Figure 2 — Exchangeability or non-exchangeability of data in information transfer

A considerable proportion of product data continue to be provided in paper form (e.g. catalogues, datasheets, operating instructions) or on paper-like electronic media [e.g. documents in portable document format (PDF)] that cannot be used directly in IT systems or cannot be processed further.

2.2.2 Non-structured definition and modelling of product data

Many items of product data are captured in data sheets, which therefore represent a vast capital asset for a company. Data sheets can be quite complex, as they contain much assumed information that is logical to the human reader but not to a computer that needs to interpret the product data.

Moreover many different views of the same product data are required depending on the user and his business use of the data. For the reuse of available product data in IT systems, the first step should usually be to bring the data into a computer-processable form, i.e. to analyse, convert and often even manually re-enter the data. In doing so, many different data models are used to describe the product data, meaning that there is a need to maintain knowledge about various data models in use by internal and external customers.

Where a formalized property definition is lacking, many interpretations can be given and are in use for product properties. For this reason, the user may be unsure as to what exactly is meant by each piece of data and is often obliged to verify the meaning with the originator or originators of the data. The probability is therefore very high that product data are in fact inconsistent, and it is very difficult to verify whether the product data are complete and consistent.

This is clearly a time-consuming and costly exercise, which in turn leads to misinterpretations and conversion errors.

The need for consistent and complete acquisition and dissemination of product data and information has been generally recognized worldwide. As a result, companies have worked on improvement of internal business processes and data structures. Information has been digitized, partly brought into enterprise resource planning (ERP) systems and, increasingly, standard software tools have been introduced.

At industry level, industry groups and solution providers have been engaged in working out standards for product model data that should facilitate unambiguous and efficient communication. Unfortunately, there are still many standards that partially overlap and often compete.

2.3 Goal and solution

From a business point of view, the goal is to achieve seamless product data exchange and storage over the full life cycle of the product, and equally over the life cycle of the plant or installation in which the product will be used.

One technical possibility is to create reference dictionaries where each property is defined unambiguously and in a computer-sensible way only once, and to continually reuse this definition (see Figure 3). This methodology, which should obtain international agreement, should then be used by all parties to ensure common property definitions across industry.

The technical solution to achieve this is to define and supply all properties of a product in a clear, unambiguous and internationally-agreed way, so that there can be no misunderstanding during the exchange processes. This can be done by providing a reference dictionary. These reference dictionaries can then be used to produce product catalogues or libraries of product information in computer-sensible form, in accordance with a well-defined and accepted methodology, so that they can be exchanged and processed by all who wish to use them.

To realize the technical solution, ISO/IEC Guide 77 proposes the following:

— for the clear and unambiguous definition and interpretation of product properties, common reference dictionaries need to be established with clear responsibilities for maintenance;

— a standard methodology should be used for product data cataloguing, based on the common reference dictionaries with clear responsibilities for maintenance and enrichment; this needs to be gradually integrated into the purchasing portals in use;

— external requirements of customers purchasing the product should be satisfied by providing product properties with references to the internationally-agreed reference dictionaries.

For each of these steps, any organization or, in particular, any company should ensure care has been taken of tasks such as continuous maintenance of those dictionaries and catalogues, so that these processes will be sustainable.

Since the mid-1990s, various industry groups and national standards bodies, as well as ISO and IEC, have been working very hard to produce product model data standards for creating common reference dictionaries and to produce a number of common reference dictionaries for a range of discipline subject areas.

In the context of ISO and IEC, internationally-agreed product model data standards have been developed and common reference dictionaries have been based on them. In order to achieve the long-term technical solution mentioned above, a huge task lies ahead that will take many years for industry to realize. Good, intelligent use needs to be made of both industry group dictionaries and internationally-agreed standard dictionaries. The latter group is outlined in 2.4 below.

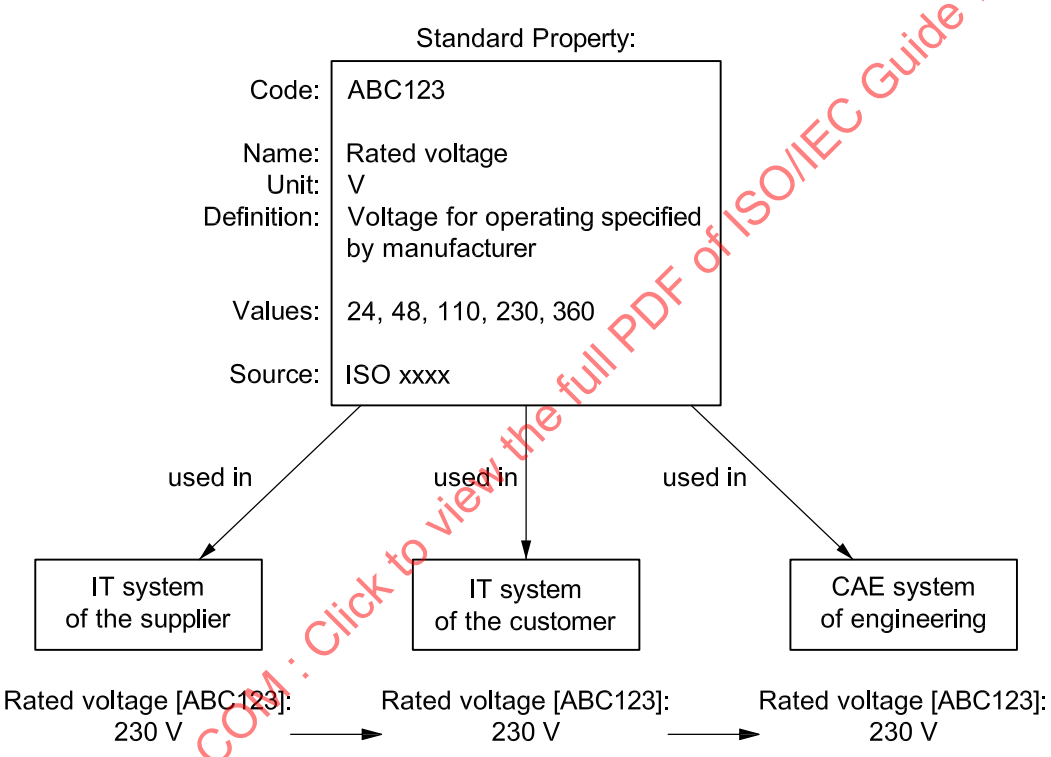


Figure 3 — Continual reuse of product characteristic

2.4 International standardization activities

Since the mid-1990s, technical experts from many companies and many countries have been working in ISO and IEC to develop internationally-agreed standards on product model data standards for creating common reference dictionaries and actually creating common standard reference dictionaries for some discipline areas. The result of this has been two main internationally-agreed standards for product model data and a number of standard common reference dictionaries, as outlined below.

a) ISO 13584 is a series of standards that provides:

— a formal information model for reference dictionaries;

— rules, guidelines and exchange formats for suppliers of product data libraries based on common reference dictionaries, in order to facilitate one consistent methodology for the exchange of these libraries or parts thereof and for their inclusion into multi-supplier libraries.

NOTE Although ISO 13584 is entitled “Parts library” (PLIB), it can be used for describing products composed of several products or parts.

b) IEC 61360 is a series of standards that defines a methodology for reference dictionaries in electro-technology. It includes the same information model as the one in ISO 13584, and it also provides a common reference dictionary for electrical components.

c) Standard common reference dictionaries comply with ISO 13584 and IEC 61360 for the following product areas:

— environment and laboratory-use measuring instruments (ISO 13584-501);

— mechanical fasteners (ISO 13584-511);

— cutting tools (ISO 13399).

Figure 4 summarizes these developments and situates ISO/IEC Guide 77 within the context of the developments: the basic standard is the common reference dictionary information model of ISO 13584-42 and IEC 61360-2. From the basis of this model, the development of domain reference dictionaries is done, mainly in technical committees of ISO and IEC. ISO/IEC Guide 77 aims to be a methodological basis for the use of the basic standards and a means to understand the basic elements by which reference dictionaries are built.

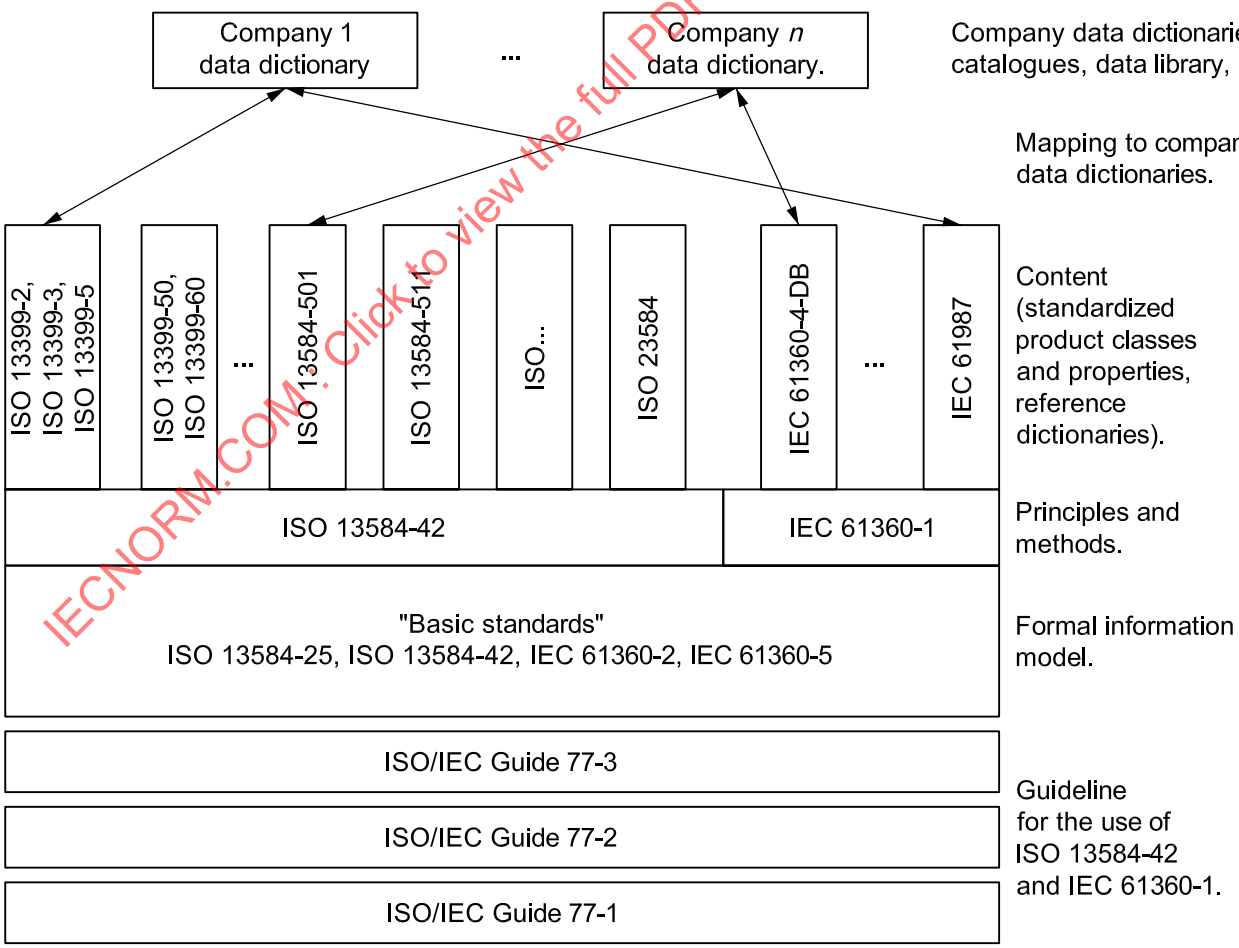


Figure 4 — Status of international standardization activities

Figure 4 also illustrates how the resulting reference dictionaries are used in companies. Companies often have their own databases for the description of product specifications. For the purpose of exchanging data with business partners, these dictionaries need to be mapped to the standardized reference dictionaries. Companies should be prepared to deal with these mappings in the context of modifications of standards (in accordance with defined maintenance processes) and in the context of their modifications of their dictionary structures. The means for mapping are described in ISO/IEC Guide 77-2. The mapping can be performed most efficiently if the companies follow an approach for managing their internal dictionaries which is similar to the one described in ISO/IEC Guide 77.

Over the same period of time, a number of other related ISO/IEC standards have been developed which are of importance because of their impact on dictionary work, notably those described below.

— The ISO 15926 series of standards has been developed particularly to be able to integrate product model data into a Data Warehouse. This is important for engineering procurement and construction contractors and plant operators, because they need to be able to integrate supplier product model data into these Data Warehouses so that they have access to coherent and consistent plant data across the life cycle of the plant. ISO 15926-2 provides a comprehensive integration model and ISO/TS 15926-4 provides the required object and properties hierarchy.

— The ISO 10303 series of standards (referred to as the STEP standard) has been developed to provide an extensive range of standards for the exchange of product model data of many kinds, e.g. shapes that can be used complementary to ISO 13584.

The relationship between these standards has been investigated in detail.

It is important to consider the ISO 13584 series of standards (i.e. the main subject of ISO/IEC Guide 77 for product families and properties) together with these other standards as the necessary standards range required to exchange and integrate product model data across the product and the supply chain.

2.5 Benefits

For industry, there are significant benefits to be obtained if it can agree to use the proposed internationally-agreed common standards and discipline reference dictionaries for specific areas. Product properties defined by means of a common reference dictionary are unambiguous, machine-interpretable, of high quality, up-to-date and can be used again and again. Agreement by industry to adopt this concept all across industry over the life cycle of products and installations will result in:

a) fewer data errors: since information does not have to be re-entered and converted, so misinterpretations and consequential errors are avoided; as a consequence the probability that the product will perform as designed will be higher and the number of litigation cases will be lower;

b) lower costs, because a single source is used for generating the product data descriptions and consequently less expense is involved in maintaining the dictionary data, and because the reference dictionaries are maintained on common servers and not on an individual company basis;

c) faster time to market, because less time is spent on interpreting data, part of which often is on the critical path of design, engineering, manufacture of a product or plant installation;

d) satisfying growing internal and external customer needs: in fact, plant operators are at the point in time where they will prescribe the way in which product data should be presented together with the product; it is also foreseeable that governments and regulatory bodies will include International Standards in regulations for safety and environment and corporate governance;

e) reduced needs in future for on-site data quality checks, as the data does not have to be continuously checked and adapted to suit external requirements.

A seamless exchange of product data (i.e. one where there are no media discontinuities) is possible in all sub-areas, see examples in Annex A.

It is also important to list the benefits for ISO and IEC Technical Committees, i.e.

— by focussing on a limited set of product model data standards and dictionaries supported by industry, less development time and effort will need to be spent by committees and working groups on developing standards;

— time and effort spent by committees can be dedicated to creating reference dictionaries of older models representing reference dictionaries;

— dictionaries of the various committees will gradually converge, so that they become compatible;

— committees will be able to share tools and knowledge available around the adopted standards.

3 Procedure for creating reference dictionaries

3.1 General

The general decisions and steps for creating a reference dictionary are:

— determine one position (see Figure 4);

— determine own targets (cost, benefit, time);

— verify collaboration with partners;

— decide on dictionary (standard, industry group, private);

— realize dictionary (legacy data transition);

— realize database, catalogue with company data mapping to PLIB;

— establish exchange in supply chain (technical, commercial).

3.2 Building a reference dictionary

Since the objective of creating a reference dictionary is to allow products from a particular technical domain to be described in a computer-sensible manner, the first steps should be to decide

— what properties are needed to describe the products, and

— what class structure should be used for those products.

A product will be described by a group of properties, each of which will be given a value (which may be numerical or non-numerical) to be included in a library of product information.

When creating a new dictionary, it is recommended that existing dictionaries be consulted first. This has two benefits:

a) the form of an existing dictionary can give an insight into the way in which to proceed with the new dictionary;

b) existing dictionaries can contain properties that can be used or referenced in the new dictionary, or they can have definitions that can be used as a basis for definitions in the new dictionary.

It is also recommended that consultations be held with any partners in an information exchange process, in order to ensure that the breadth and depth of the definitions in the dictionary are acceptable to them and that they are able to work with associated exchange formats.

Following this initial work, a class structure should be created. This entails deciding which product groups can be described by a common set of properties and then, if necessary, constructing a class hierarchy that reflects the relationships among product groups.

After this process, or in parallel with it, the properties that describe a product need to be defined and assigned to the relevant class or classes. At all times in defining properties, use should be made of terms and definitions that follow International Standards and the terminology used should be that which is familiar within the technology domain.

For example, in order to describe an electrical capacitor adequately, 40 or more properties can be needed, among which will be capacitance value, tolerance, voltage rating, physical dimensions, etc. Some of these properties will apply to all capacitors, whilst others will apply only to some types, e.g. the properties of polarity and electrolyte type will only apply to electrolytic capacitors. Consequently, within the product domain, it is essential as a first step to identify those groups of products that can be described by the same set of properties, as well as identifying properties that are common to several groups. This then implies building a class hierarchy in which there is a general class containing common properties (e.g. capacitors, itself a subclass of electronic components) with its subclasses (e.g. fixed capacitors), which can in turn have further subclasses (e.g. fixed electrolytic capacitors).

In defining new classes and properties, it is essential to follow the detailed guidance given in ISO/IEC Guide 77-2 and ISO/IEC Guide 77-3 and, in particular, in order to ensure full use and reuse of the definitions, the methodology of ISO 13584 and IEC 61360 should be followed.

3.3 Resources required

It is essential to have sufficient resources to build and manage a reference dictionary. Of particular importance is to have a group of personnel who collectively understand the technical issues inherent in modelling the product domain and who are able to map that knowledge onto the structures required in the dictionary.

In addition, tools should be available to assist these tasks:

— to formulate and manage a coordinated structure for product classes;

— to formulate and manage properties along with their attributes, assigned to a structure for product classes;

— to provide export facilities;

— to provide mapping and data conversion functions;

— to provide import facilities.

One important issue that should be recognized from the outset is that the dictionary is not likely to be completed at the first attempt, if ever. Maintenance of the dictionary will be required on an ongoing basis for correcting errors, extending or amending existing definitions, and for adding new properties and classes. When building a new dictionary, therefore, the question of maintainability should be borne in mind.

Another issue that may need to be addressed is the question of legacy data. Whilst there may be an immediate need for a reference dictionary to define new products, the need can also exist for existing products to be included too. A decision will need to be taken as to how much effort should be expended on older products which are of decreasing importance.

3.4 Maintenance

Maintenance of the reference dictionary should be considered (see Annex ST of the *ISO Supplement to the ISO/IEC Directives*).

4 Technical aspects

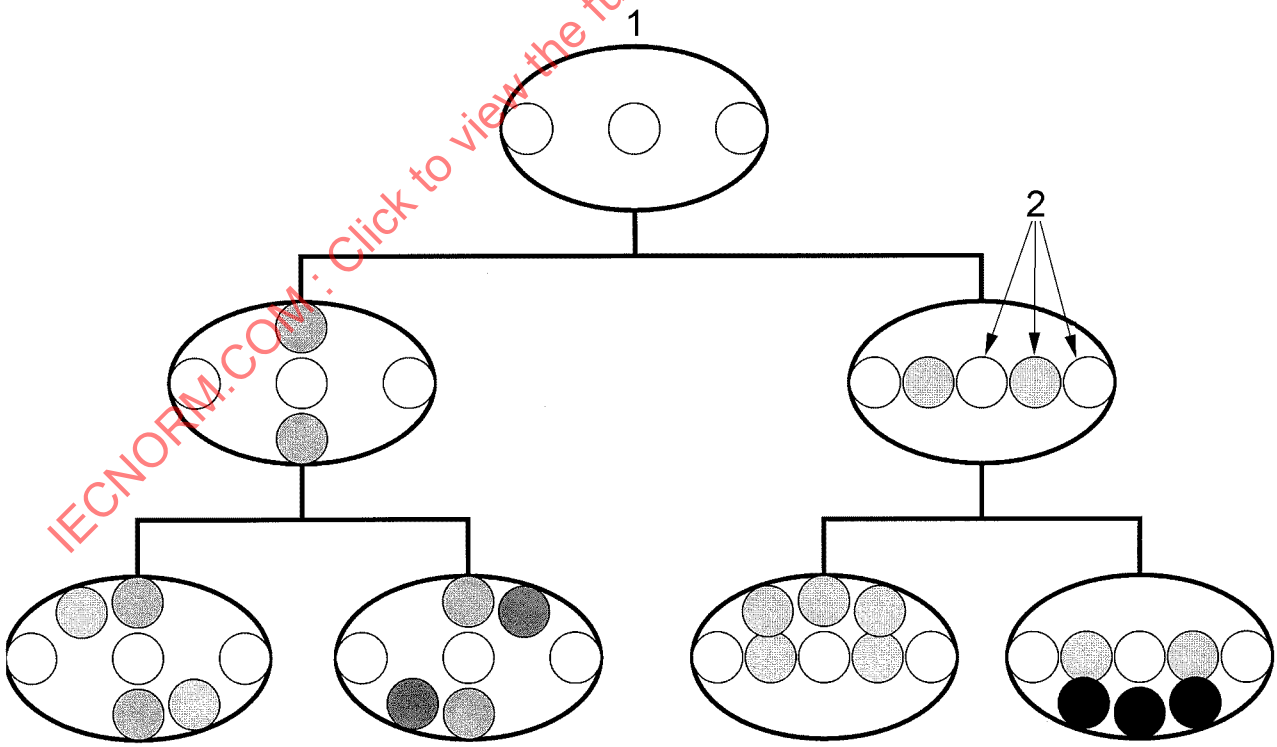
4.1 It should be recognized that a class structure is not unique: there may be several sensible ways in which to build a classification, e.g. the criteria for subdividing classes could depend on the function of the products or on the manufacturing technology. Whatever criteria are chosen for classification, they should be applied consistently throughout the hierarchy. Furthermore, whatever the form of classification used, the description of a product in terms of the properties to describe it should be the same.

Figure 5 shows the concept of a characterization hierarchy for a dictionary. For each class, there are a number of properties defined and an important concept in the hierarchy is that of inheritance. This means that

— any properties defined for a particular class are available for use in any of its subclasses or their subclasses, and

— a property which is used for all members of a higher-level class is entered into the dictionary only once (this is an important feature in maintenance of dictionary contents).

In Figure 5, a class is indicated by an oval area and the properties applicable to that class are shown by small circles within the class. For any class, the effect of inheritance is that the totality of the properties belonging to a class are the properties defined in that class plus all those defined in the classes from the branches above, all the way up to the root class at the top.



Key

1 class

2 properties

Figure 5 — Characterization hierarchy

4.2 Another issue to consider in building a characterization hierarchy is the granularity of the schema in terms both of the number of leaf classes (classes at the bottom of the hierarchy) and the number of levels in the hierarchy. In principle, it is possible to have a flat classification, i.e. all classes are at the same level below the root class, but experience has shown that such a schema raises problems both in locating classes within the schema and in maintaining it.

In defining new classes and properties, each is described in terms of a list of attributes, which are defined in detail in the relevant standards. These attributes can be divided into broad groups. For both classes and properties, these are as described below.

a) Identification attributes: each class or property should be identified uniquely within a dictionary, so an identifying code is used which is non-meaningful in the context of the products described and is independent of the dictionary language. In addition, there is a need to identify different versions of the definitions, with dates of changes, as well as allowing the use of recognizable names, symbols etc., which may be supplied in more than one language.

b) Semantic attributes: each class or property should have associated with it a clear and unambiguous definition of that element of the dictionary. This may be supplemented by other information in the form of notes, remarks, drawings, formulae and references to source documents. These definitions and the supplementary information may be supplied in more than one language. References may also be made to standards or other documents from which the definitions have been taken.

In addition, for properties, there are two further groups of attributes, as described below.

— Value attributes: these carry information concerning the type of data, its value domain and any units of measurement for quantitative properties, which are essential pieces of information in data exchange.

— Relationship attributes: these cover the type of property according to International Standards, as well as links to conditions on which property values can depend.

4.3 Both in building a new dictionary and in maintaining an existing one, two steps are needed to validate the entries:

a) to check that they comply with the requirements of the standards;

b) to ensure that the definitions are correct and meaningful.

For the first step, advantage should be taken of any software tools that are available for preparing the dictionary data and for verifying it against the information model in the standards. For the second step, there is no substitute for consulting relevant experts in the technical domain covered by the dictionary.

Annex A
(informative)

Assessment of savings potential

A.1 General

The cost/benefits for a given organization that considers implementation of a reference dictionary vary according to the organization, especially depending on the industry and the products manufactured, traded or maintained (e.g. mass production versus individual engineering).

Consequently, this part of ISO/IEC Guide 77 can only give an outline of factors impacting the cost/benefits, to aid each particular organization to evaluate the cost/benefits of introducing one (or several) reference dictionaries.

For an overall overview, the real cost/benefits should be determined and combined for all properties, in particular considering the impact factors outlined in Clauses A.2 to A.8 below.

A.2 Creating properties

The higher cost per individual property is offset by the much smaller number of properties to be defined. This results in a much lower total cost even in the property catalogue creation phase.

A.3 Maintenance of properties

The higher maintenance cost is offset by the much smaller number of properties to be maintained. This results in a much lower maintenance cost per year.

A.4 Using the properties for product definition

Each product only needs to be specified once, resulting in a much lower cost per year. The quality of the specification increases as the meaning of each individual item of information is clearly defined and errors are therefore eliminated.

A.5 Mapping properties to external (and different internal) data definitions

The cost is dependent on the number of data sources, i.e. on the number of internal processes, from which data needs to be supplied to external or other internal sinks. If there is a single source for defining product properties, the total cost can be considerably reduced.

Further cost reductions could be achieved over the medium to long term if the data sinks to be supplied also use the same set of properties. This is the reason why internationally standardized definitions should be the aim.