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PUBLICLY AVAILABLE SPECIFICATION

PRE-STANDARD

Generic specification of information on products – Part 1: Principles and methods

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GENERIC SPECIFICATION OF INFORMATION ON PRODUCTS –

Part 1: Principles and methods

FOREWORD

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IEC/PAS 62569-1 has been prepared by technical committee 3: Information structures, documentation and graphical symbols.

The text of this PAS is based on the following document:	This PAS was approved for publication by the P-members of the committee concerned as indicated in the following document
Draft PAS	**Report on voting**
3/940/PAS	3/944/RVD

Following publication of this PAS, which is a pre-standard publication, the technical committee or subcommittee concerned may transform it into an International Standard.

This PAS shall remain valid for an initial maximum period of 3 years starting from the publication date. The validity may be extended for a single 3-year period, following which it shall be revised to become another type of normative document, or shall be withdrawn.

A list of all parts of IEC 62569 series, under the general title *Generic specification of information on products*, can be found on the IEC website.

INTRODUCTION

This PAS is intended as the first part of a standard series defining methods and guidelines for the establishing of generic electronic specifications of information for products (including plants, systems, equipment or components, in the following all called products), along its life cycle for later use e.g. in the procurement, operating and maintenance.

This series is prepared to transfer the former paper-based applications of blank detail specifications or product descriptions towards supporting the electronic business allowing the evaluation and management of described items by computers.

This PAS establishes general principles required for the other parts of this series. It specifies the infrastructure required to manage the product-related information as described in the following parts along the life cycle.

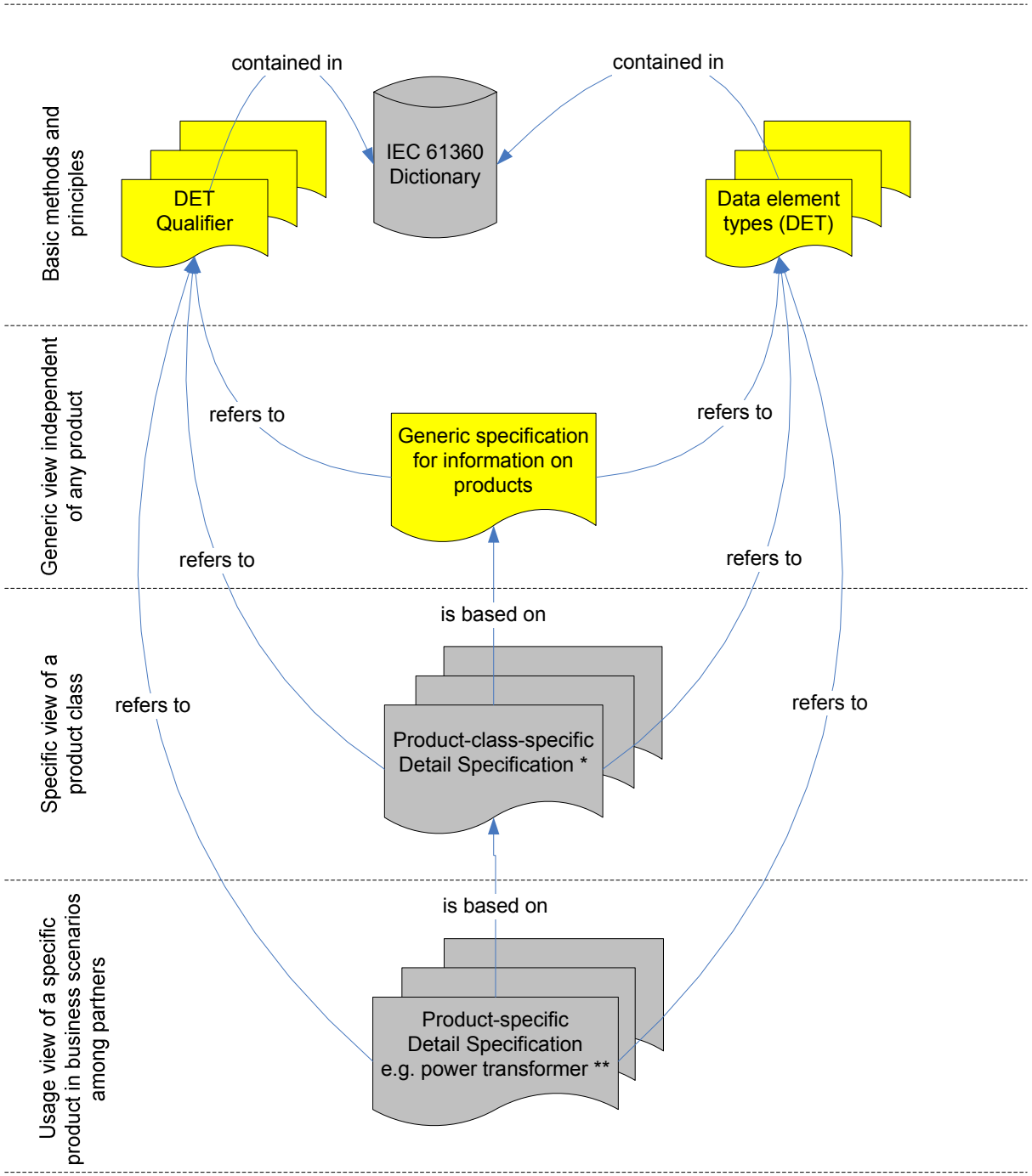
Part 2 provides a generally applicable structure of a generic specification of information on products presenting those common clauses which are independent of any specific equipment, component and device. It serves as a guide for the preparation of technical specifications for various items. Due to its generic type, particular issues referring to specific product classes are excluded. These need to be obtained from the specific product descriptions within product standards.

Part 2 is the basis for an XML based electronic template, serving as generic template for the development of product-specific specifications of information by product committees within IEC and ISO, industrial consortia or other industrial organizations.

The result of such product-specific blank detail specifications may be made available as a web-based collection of product-specific specifications for information, allowing users and technical committees to upload and/or download detail specifications for industrial use in the business process.

A prerequisite of the above series is the existence of an international available data dictionary, providing collections of data element types following common methods as defined in the IEC 61360 series.

Referring from product descriptions to previously defined semantic data element type descriptions is the key issue of an effective and secure electronic business. For the relations among data element types, the associated data dictionary and the different specifications see Figure 1.



* Developped by Product Committees, Consortia or other Organizations, e.g. for lifting cranes, capacitors, resistors, power transformers

** Filled with product specific data at a specified time in the life cycle process of a power transformer; used in a defined business scenario among industrial partners, e.g. seller,buyer

Figure 1 – Context of generic specification for information on products

NOTE 1 Such a dictionary is available as a data base application to be found under http://std.iec.ch/iec61360

NOTE 2 A test version of the above data base can be found under http://std.iec.ch/test/61360.nsf

NOTE 3 As web sites may change along time, the previously given URLs may not be found under the given URL.

Figure 2 shows a business scenario about the usage of a detail specification (based on the generic specification) for information on products between business partners.

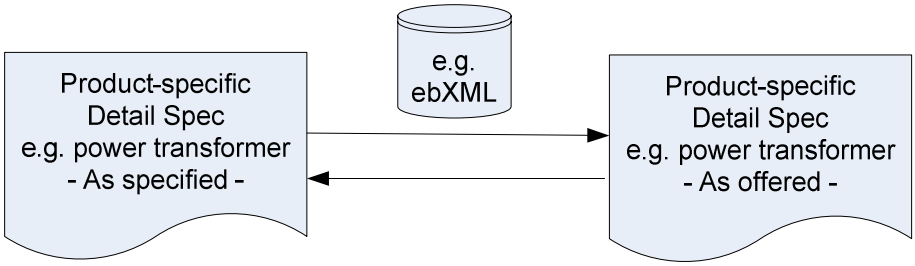


Figure 2 – Business scenario between partners

If a specification for information in the form of an electronic template is associated with a schema for data exchange, e.g. an XML schema or any other tagged electronic file format, the content of the product-specific detail specification can be easily used for import and export of data values in conjunction with data bases for material management systems. See Figure 3.

A specification template can also be imported for the setting up of the internal structures within a data base without having the need to import associated values.

Vice versa detail specifications can be generated to export data using a predefined template based on the generic specification for information on products.

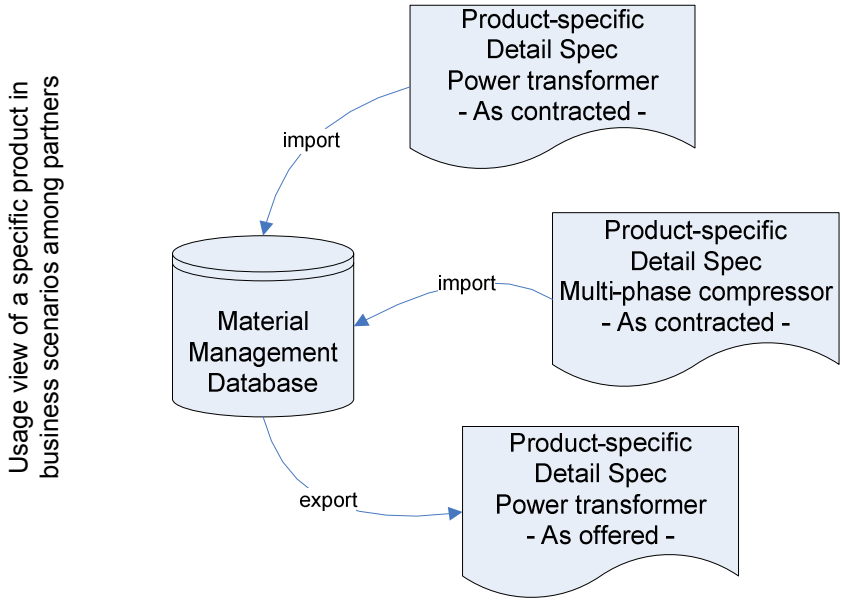


Figure 3 – Import/export possibilities using tagged formats

GENERIC SPECIFICATION OF INFORMATION ON PRODUCTS –

Part 1: Principles and methods

1 Scope

The IEC 62569 series of publications will provide principles and methods for the specification of products by properties, e.g. in data sheets. It uses data element types defined in the data dictionary of IEC 61360.

This PAS provides qualifiers to be used in addition to the properties considering life cycle and other aspects. It is a prerequisite for the other parts of this series.

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.

IEC 60027 (all parts), *Letter symbols to be used in electrical technology*

IEC 61360-1: 2004, *Standard data element types with associated classification scheme for electric components Part 1: Definitions. Principles and methods*

IEC 81346-1, *Industrial systems, installations and equipment and industrial products - Structuring principles and reference designations*

ISO 31-0:1992, *Quantities and units - Part 0: General principles*

ISO 1000: 1992, *SI units and recommendations for the use of their multiples and of certain other units*

ISO 80000 (all parts), *Quantities and units*

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

NOTE Definitions taken from other standards (issued or in preparation) are not necessarily literally cited, but the form is adapted.

3.1.1
product
result of labour or of a natural or industrial process

[IEC 61360-1, 2.11]

3.1.2
class
<of *products*> abstraction of a set of similar *products*

[ISO/IEC Guide 77-2]

3.1.3
product (characterization) class
class of products that fulfill the same function and that share common *properties*

[ISO/IEC Guide 77-2]

3.1.4
product type
result of a specific development process for a range of *products* belonging to the same *product class*

3.1.5
product specimen
product instance
physical implementation of a *product type*

3.1.6
property
defined parameter suitable for the description and differentiation of *objects*

[ISO/IEC Guide 77-2, modified]

NOTE The term *property* used in this standard is **not** identical with the term *data element type* used in IEC 61360. A *data element type* is a unit of data for which the identification, description and value representation have been specified **in the context of a dictionary**, while the term *property* is used for an **occurrence** of such a *data element type* **in the context of a specification of an object**. This distinction makes it possible to qualify a property in an object specification and still refer to the same data element type definition in the dictionary.

3.1.7
specification
document that states requirements, functionally related characteristics, processes, or rules related to a unique quality that an in-process part, a finished part, or a *product* shall possess

[IEC 62079, modified]

3.1.8
generic specification of information on products
product class independent *specification* of the *properties* of a *product* by the use of *data element types*

3.1.9
product-class-specific specification (of information)
generic specification of information on products adapted to a specific *product class*

NOTE A product-class-specific specification is often used as a basis for the development of templates for use in engineering activities. Depending on the tools in use different templates can be developed for the same purpose.

3.1.10
product-type-specific specification (of information)
product-class-specific specification of information adapted to a specific *product type*

3.1.11
detail specification
product-class-specific or *product-type-specific specification* with filled in *values* of the *properties*

3.1.12
life cycle
<of a *product specimen*> consecutive and interlinked stages of a *product* or system, from raw material acquisition or generation of natural resources to the final disposal

[ISO 14040]

3.1.13
life cycle
<of a *product type*> consecutive and interlinked stages of a *product type* from conception to phasing out

3.1.14
life cycle
<of a *component* occurrence in a *product*> consecutive and interlinked stages of a *component* occurrence in a *product* or system from identification of need over implementation with a *product specimen*, replacement, etc., to final disposition

3.1.15
product standard
standard that specifies requirements to be fulfilled by a *product* or group of *products* to establish its fitness for purpose

NOTE 1 A product standard may include, in addition to the fitness-for-purpose requirements, directly or by reference, aspects such as terminology, sampling, testing, packaging and labelling and, sometimes, processing requirements.

NOTE 2 A product standard can either be complete or not, according to whether it specifies all or only a part of the necessary requirements. In this respect, one may differentiate between standards such as dimensional, material and technical delivery standards.

[ISO/IEC Guide 2]

3.1.16
data element type
unit of data for which the identification, description and *value* representation have been specified

[IEC 61360-1, 2.3]

3.1.17
quantitative data element type
data element type with a numerical *value* representing a measurable *physical quantity*, a *quantity* of information or a count of *products*

[IEC 61360-1, 2.5]

3.1.18
non-quantitative data element type
data element type which identifies or describes a *product* by means of codes, abbreviations, names, references or descriptions

[IEC 61360-1, 2.6]

3.1.19
condition data element type
kind of *data element type* whose *value* affects the *value* of another *data element type*

NOTE 1 A condition data element type has only a meaning when it is used in combination with another data element type.

NOTE 2 A condition data element type does not form part of the classification tree and can be used on every level of the classification.

[IEC 61360-1, 2.7]

3.1.20
(physical) quantity
(measurable) quantity
attribute of a phenomenon, body or substance that may be distinguished qualitatively and determined quantitatively

NOTE 1 The term quantity may refer to a quantity in a general sense (examples: length, time, mass, temperature, electrical resistance, amount-of-substance concentration) or to a particular quantity (examples: length of a given rod, electrical resistance of a given specimen of wire, amount-of-substance concentration of ethanol C_2H_5OH in a given sample of wine).

NOTE 2 Quantities that can be placed in order of magnitude relative to one another are called quantities of the same kind.

NOTE 3 Quantities of the same kind may be grouped together into categories of quantities, for example: work, heat, energy, thickness, circumference, wave length.

[IEV 111-11-01]

3.1.21
base quantity
one of the *quantities* which, in a set of *quantities*, are by convention accepted as independent of one another

[IEV 111-11-03]

3.1.22
derived quantity
quantity which, in a set of *quantities*, is related to the *base quantities* by a quantity equation

[IEV 111-11-04]

3.1.23
value (of a *quantity*)
magnitude of a particular *quantity* generally expressed as a *unit of measurement* multiplied by a number

NOTE 1 The value of a quantity may be positive, negative or zero.

NOTE 2 The value of a quantity may be expressed in more than one way. Examples: length of a rod: 5,34 m or 534 cm; mass of a body: 0,152 kg or 152 g; amount of substance of a sample of water (H_2O): 0,012 mol or 12 mmol.

NOTE 3 The values of quantities of dimension one are generally expressed as numbers.

NOTE 4 A quantity that cannot be expressed as a unit of measurement multiplied by a number may be expressed by reference to a conventional reference scale or to a measurement procedure or to both.

[IEV 111-11-22]

3.1.24
unit (of measurement)
particular *quantity*, defined and adopted by convention, with which other *quantities* of the same kind are compared in order to express their magnitudes relative to that *quantity*

NOTE 1 Units of measurement have conventionally assigned names and symbols.

NOTE 2 Units of quantities of the same dimension may have the same names and symbols even when the quantities are not of the same kind.

[IEV 111-11-08]

3.1.25
base unit
unit of measurement of a *base quantity* in a given system of *quantities*

[IEV 111-11-09]

3.1.26
derived unit
unit of measurement of a *derived quantity* in a given system of *quantities*

[IEV 111-11-10]

3.2 Abbreviations

DET Data Element Type

DS Detail Specification

GSIP Generic Specification of Information for Products

4 Specifications

Product class or product type specific specifications, often also known as functional specifications, device profiles or blank detail specifications, are used widely in industry. Such specifications apply predefined properties of products. The properties are independent of any specific product specimen at the time of preparing the specification.

During the life cycle of a product, each property will be associated with specific values which are either specific to the referred product type or product specimen. The values of a property may be selected from a range of predefined values.

Normally, such specifications are for the first time in the life cycle of a product (type) used in the context of a (functional) specification.

This PAS takes provisions in order to reuse the once defined properties of a referred product for different purposes at different points in time, e.g. starting with the inquiry, offer, contract, delivery, operation, maintenance, etc.

In the past product class specific specifications have been used mostly on paper or in electronic form intended for human reading only.

It is realized that such specifications need also be made available as computer interpretable templates downloadable from a web server or other future web-based applications.

An electronic template is structured, grouping information in the form of sets of properties required for specification, procurement, engineering planning and construction, operation and maintenance along the life cycle of the referred product.

It is recommended to apply a generic structure for all specifications for products independent of their types in order to ease and accelerate the use of a template also by humans.

Due to occurring changes of the value(s) associated with the *same* property of the *same* product type in the development process, it is necessary to keep track of those changes, done at the different stages in the life cycle. Therefore each change in such a specification and/or property need be stored and clearly distinguished. This allows to keep track of changes of values between different stages in the development process and to refer back to the originally required values.

This PAS provides generic methods with respect to content–related issues contained in product class specific specification.

It is of high industrial value to make the resulting electronic templates available for download by market actors.

This standard series establishes general requirements with respect to:

– the structural content of a specification independent of a specific product class;
– the specification of properties describing a specific product class;
– the reuse of existing specifications and existing properties along the life cycle of a described product;
– the general requirements with respect to a computer sensible evaluation of the data contained in such an electronic template independent of their visual presentation in a specification document;
– import and export requirements from and to data bases for the generation of electronic detail specifications.

5 Properties

5.1 Properties versus data element types

A product can generally be described by its properties.

A property is a named parameter that is assigned a quantitative or qualitative value. During the life cycles of a product, product type, or product specimen the value of such a parameter is usually undergoing changes. It may therefore be necessary to qualify the parameter with regard to the conditions valid for the value in the actual situation. For example: In a later phase of the life cycle it may be of interest to retrieve the value from an earlier phase. Similar needs for qualification of a property may exist with regard to the processes for obtaining the value and the applicability of a property.

A data element type (DET) is a unit of data for which the identification, description and value representation have been specified. Defined data element types are contained in dictionaries, for example IEC 61360 DB (IEC CDD) and ISO 13548-42 compliant data dictionaries. The data elements in a dictionary are intended to be used as references for the establishment of product specifications and descriptions.

A property needed in a product specification can therefore be unambiguously expressed by means of a reference to a specific data element type in a dictionary. This reference is independent of how the property is qualified in the actual context. In other words; a property can be seen as an occurrence of a data element type in a specification context. This can be illustrated as shown in Figure 4.

NOTE This and the following figures uses a **simplified** EXPRESS-G notation based on ISO 10303-11. For a short reading introduction, please refer to http://tc3.iec.ch/txt/xpress.pdf. More elaborated models will be introduced in part 2.

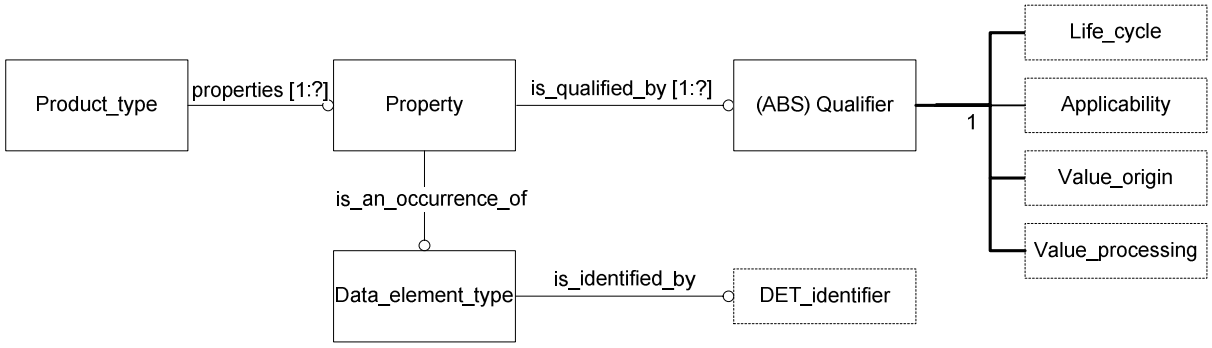


Figure 4 – Relation between the properties of a product type and the data element types of a dictionary used for their expression

In a specification there may be many occurrences of the same data element type, differentiated by means of qualifiers (or property designations). By studying the different

occurrences of a specific data element type in a given specification, it is thus possible to study the development and quality of the values assigned to the property. Since data element types are rigorously defined in order to allow computer assisted interpretation such a study can easily be performed by computer.

From the statement that a property is an occurrence of a data element type follows that all attributes that define this data element type apply also to the property. Note, however, that the name can be a “local” one, e.g. one of the possible synonyms, and that the values in practice can be restricted to just a part of the possible set of values.

The different qualifiers for a property are described in clause 6.

5.2 Sets of properties for specific purposes

Specifications are usually prepared to serve specific purposes (activities) in the life cycle of a product. Such purposes are often of a recurring and generic nature, and it may therefore be useful to describe the purposes for which such sets are needed. See Figure 5.

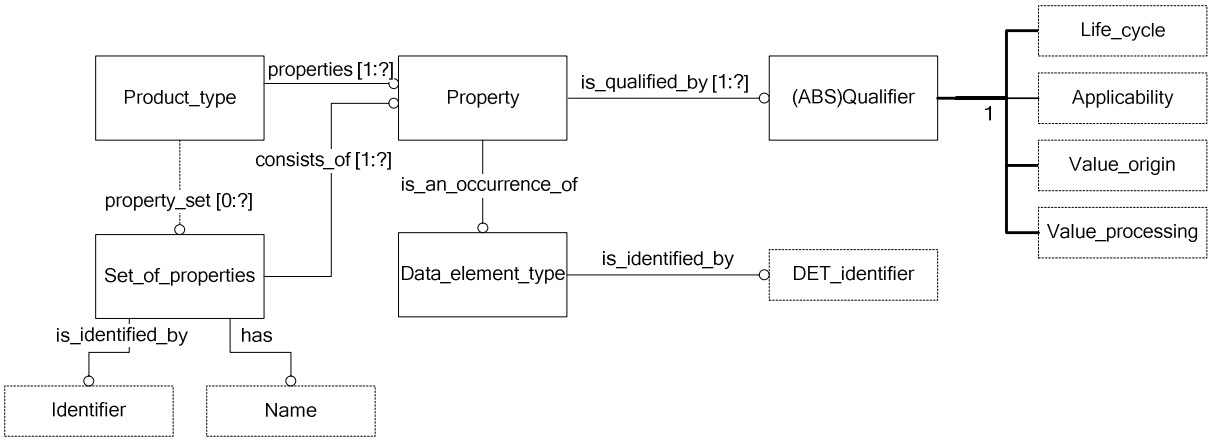


Figure 5 – Inclusion of sets of properties

Such sets of properties are further described in part 2 of this publication series.

5.3 Properties of components

Properties are in many cases assigned to a product type seen as a whole unit, i.e. they are assigned to the product seen as a “black box”. In such cases there is no need to care about the internal structure of the product type, and its possible components can be left unspecified in the actual situation.

In other cases the properties can or need to be assigned to expected, planned or known components of the product type. In such cases the product should be structured, preferably in accordance with IEC 81346-1, with the goal to identify the components down to a level where no further decomposition is required for assignment of properties.

IEC 81346-1 can be applied to any planned or existing product or system type, and the structuring can be performed along the function, product, location or other aspect.

If a final structure (i.e the complete set of applicable hierarchical structures) of the product type is already known at the time of preparation of a specification this structure should be used for the definition of the components and the assigned reference designations used for their identification.

If a final structure is not known at the time of preparation of the specification a structure can be created, together with expected components. Also such components can be identified with reference designations. IEC 81346-1 describes how this can be done, and gives also guidance on how such a structure may be converted into a “real” one at a later stage in the life cycle.

In any case the defined structure should then be used also for the structuring of the specification, so that all components are readily identified and the relations between them highlighted. Properties shall then be assigned to each of these components to the extent required. Figure 6 illustrates how the product type under consideration is composed of components, identified by reference designations in the context of this product. The components are in their turn occurrences of other product types defined and identified elsewhere, for example in a product catalogue.

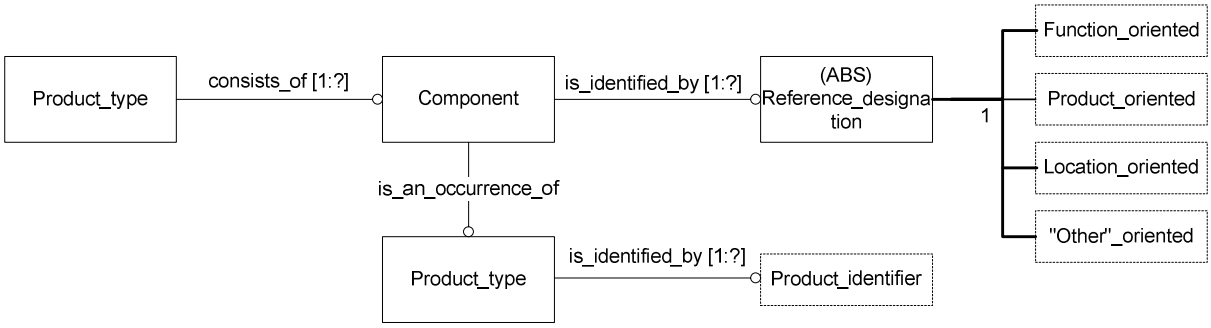


Figure 6 – Relation between the components of a product type and the product type used for their implementation

6 Property qualifiers

6.1 General

A qualifier to a property can be applied in different ways:

– as global qualifier; or

– as single qualifier.

If the qualifier is to be globally applicable, it shall be applied in the heading of the relevant specification document; its value is therefore implicitly associated with each property contained in that document. It provides the condition under which the values of all properties within a document are understood and applicable.

If the qualifier shall have local effect to a single property only, it shall be explicitly applied together with that particular property. In this case, the globally defined value of the qualifier will be overruled by the existence of an explicitly defined local value.

6.2 Life cycle qualifier

In order to associate a property to the life cycle of a product, allowing a computer-supported value tracing and related processing, an explicitly given qualifier called *life cycle qualifier* is defined in order to provide information about the life cycle aspect of a property at different stages in time.

The value of the qualifier is either user-defined or predefined. The predefined values of the *life cycle qualifier* are the following:

– SPE - as specified;

– INQ - as inquired;

– OFF - offered;

– CON - as contracted;
– SUP - as supplied;
– BUILT - as built;
– OP - operated.

Further values outside of this enumeration shall be defined and agreed among the partners involved in an information exchange.

NOTE It is generally understood that at each stage of the life cycle a date and time stamp need to be provided.

6.2.1 SPE

Property value as required from the planning process design.

6.2.2 INQ

Property value as requested in an inquiry directed to an organization asking for an offer.

6.2.3 OFF

Property value as given in a formal offer directed to an organization normally based on a previous inquiry of that organization.

6.2.4 CON

Property value as contractually guaranteed and agreed between both organizations.

6.2.5 SUP

Property value as manufactured and supplied to the customer.

NOTE It is generally understood that a product, when bought or sold without being explicitly marked, always comes along with the qualifying value “as supplied”.

6.2.6 BUILT

Property value as put into service.

6.2.7 OP

Property value set and/or available under operation.

6.2.8 Example of the use of the life cycle qualifier

The following example shows how the value of the property “body length” develops during the life cycle by making use of the *life cycle qualifier* and how the data element “body length” is recursively used for all defined situations.

Property: Body length		**Value**	
Life Cycle qualifier	**Referenced DET**	**Measure**	**Unit**
as specified	AAE019 body length (max)	2,490	m
as inquired		2,500	
as offered		2,600	
as contracted		2,600	
as supplied		3,000	
as built		2,600	
as operated		2,600	

Figure 7 shows the development over time in the process.

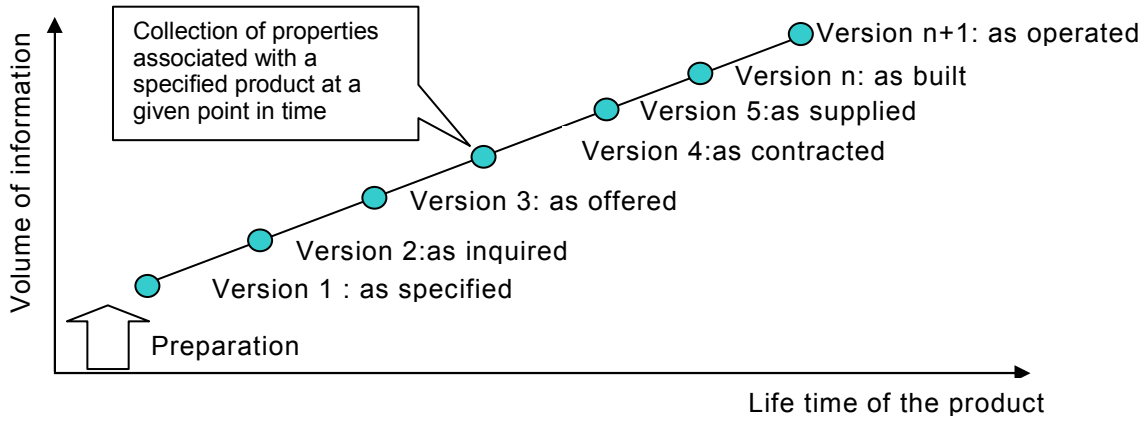


Figure 7 – Development of life cycle qualifier over time

6.3 Applicability qualifier

In order to cover a wide variety of possible application areas, predefined specifications (templates) may contain a variety of properties from which – in a specific context - not all may be applicable, or may be applicable but their corresponding values are not available and have to be assumed, or shall be processed in a specific way.

In order to support tracking of such properties and support semi-automatic or automatic routines in computer systems, it is required to know how a property or its current value(s) are to be processed. For this purpose the “Applicability qualifier” is provided.

If the applicability qualifier is not used, a property is by default considered applicable and it is expected that associated value(s) are entered, respectively given.

The value of the qualifier is either user-defined or predefined. The predefined value codes and its meaning of the *applicability qualifier* are the following:

– AVP - applicable, value provided
– AVA - applicable, value assumed
– AVN - applicable, value not assigned
– NA - not applicable.

Further values outside of this enumeration shall be defined and agreed among the partners involved in an information exchange.

NOTE The term applicable used here has no relation to the term applicable as used within ISO 13584/IEC 61360-5 in the context of setting up hierarchy class structures with data element types.

6.3.1 AVP

The associated property is considered being applicable in a given context and a value shall be assigned to it, resulting in a mandatory entry. The value has been provided by a known specification.

6.3.2 AVN

The associated property is considered being applicable in a given context and a value shall be assigned to it, resulting in a mandatory entry. In this case, however, the value is not yet assigned.

If the value *"AVN"* of the applicability qualifier is given, the property will be processed. This allows a computing system to generate a warning with respect to missing data.

6.3.3 AVA

The associated property is considered being applicable in a given context and a value shall be assigned to it, resulting in a mandatory entry. Due to missing input the value has been assumed.

If the value *"AVA"* of the applicability qualifier is given, the DET will be processed with the assigned assumed value.

NOTE It is recommended to get assumed values confirmed by the responsible organization. A confirmed value would cause a change from "AVA" to "AVP".

6.3.4 NA

The associated property is considered not being applicable in a given context.

If this value of the applicability qualifier is given, the property will not be considered in further processing, irrespective of possible existing values.

6.3.5 Application example - Method A (implicit marking)

A property list is structured into several clauses; each clause with the properties applicable or not within a specific case.

In order to document how the properties in the relevant clause are dealt with, a local clause-bound data qualifier is defined and the following qualifier values apply:

a) If not applicable, select from the drop-down list the value "Not applicable"; all property values are left empty.
b) If applicable but all required values not provided, select "Applicable, value assumed".
c) If applicable and values provided, select "Applicable, value provided" ; then fill in all values.
d) If applicable but data not assigned, select "Applicable, value not assigned", then fill in the data according to the performance of the product you request or provide.

By this method the relevant value is implicitly associated to each occurring property.

Example Method A

I.I Cold and heat		**Applicable, value provided**	
Absolute ambient temperature [°C]	min		max
Ambient temperature [°C/ year]	min	typ	max
Rate of change of temperature [K/min]		typ	max
I.II Humidity		**Not applicable**	
Relative humidity [%]	min		max
Absolute humidity [g/m³]	min		max

NOTE The DETs referenced here can be found in the IEC Reference collection IEC 61360-4 DB under the URL http://std.iec.ch/iec61360 within the class identifier AAA 650 Environmental conditions

6.3.6 Application example – Method B (explicit marking)

Whereas by method A the property is implicitly marked, method B provides an explicit marking applying the same qualifier values. Method B is independent of any structure in the specification.

Each single property may be associated with one of the same data values as provided in the drop down list as in clause 6.3.5.

With respect to data evaluation, both methods A and B show the same result.

6.4 Value origin qualifier

In order to support semi-automatic or automatic routines in computer systems, it is often required to know how current values of properties have originated or been gathered in the development process. For this purpose the “Value origin qualifier” is provided.

The value of the qualifier is either user-defined or predefined. The predefined values of the *value origin qualifier* are the following:

– EST As estimated;
– CAL As calculated;
– MEA As measured;
– SET As set.

Further values outside of this enumeration shall be defined and agreed among the partners involved in an information exchange.

6.4.1 EST

Property value based on estimation.

6.4.2 CAL

Property value gained from computation, e.g. derived from a 3-dimensional model, or by any other calculation method.

6.4.3 MEA

Property value gained from any kind of measuring devices.

6.4.4 SET

Property value set during putting into operation, in operation or maintenance either by humans or via automatic controllers.

6.4.5 Example of the use of the value origin qualifier

The following example shows how the value of the property “cable length” develops making use of the *value origin qualifier* and how the data element “overall length” is recursively used for all defined situations.

Property: Cable length		**Value**	
Value origin qualifier	**Referenced DET**	**Measure**	**Unit**
as estimated	AAE581 overall length (max)	2500	mm
as calculated		2560	
as measured		2600	

6.5 Value processing qualifier

Very often it is important to know what kind of data is provided; as such information may lead to different conclusions.

It is for example important to know whether a value for a temperature is a single (measured) one, or originating from a series of single data, processed via a defined method and as such providing e.g. an arithmetic mean value.

In order to indicate whether a value of a property is an “original” value or a derived one, the “Value processing qualifier” is introduced.

If the property is not associated with the *value processing qualifier*, the value is considered to be a single “original” one.

This possibility provides the following advantages:

– the values supplied represent what is expected by the sending organization;
– the receiving organization knows how the values are gained;
– raising the quality of submitted data;
– can be optionally used.

The value is either user-defined or predefined. The predefined values of the *value processing qualifier* are the following:

– ARITHM - arithmetic mean;
– MED - median;
– MODE - mode;
– WARITHM - weighted arithmetic mean;
– GEOM - geometric mean;
– WGEOM - weighted geometric mean;
– HARM - harmonic mean;
– RMS - root mean square

Further values outside of this enumeration shall be defined and agreed among the partners involved in an information exchange.

NOTE The codes can be used as index in symbols for the quantity representing the property, e.g. U_{rms}.

6.5.1 ARITHM

Property value selected from a list of numbers, where the sum of all the members of the list is divided by the number of items in the list. The value is being processed by using the formula:

$$\bar{x}_{arithm} = \frac{1}{n}\sum_{i=1}^{n} x_i$$

NOTE The arithmetic mean is not to be confused with the median or the mode. The mean is the arithmetic average of a set of values or distribution; for skewed distributions, the arithmetic mean is not necessarily the same as the middle value (median) or the most likely (mode).

6.5.2 MED

Property value selected from a finite list of sequentially ordered numbers for which half the numbers are smaller and half are larger. If there are two middle numbers, the median is the arithmetic mean of the two middle numbers.

Example 1:

1; 3; 7; 9; 12; 15; 25 ⇨ Median = 9

Example 2:

1; 3; 7; 9; 12; 15 ⇨ Median = (7+9)/2 = 8

NOTE The median is a good choice to represent the centre of distribution when the distribution is skewed or has outliers.

6.5.3 MOD

Property value that occurs most often in a list of numbers

Example:

2, 3, 3, 4, 5, 5, 5 ⇨ Mode = 5

6.5.4 WARITHM

Property value being processed by using the formula:

$$\bar{x}_{warithm} = \frac{\sum_{i=1}^{n} w_i \cdot x_i}{\sum_{i=1}^{n} w_i} \quad \text{with } w_i > 0$$

6.5.5 GEOM

Property value of a collection of positive numbers being defined as the *n*th root of the product of all the members of the set of numbers, where *n* is the number of members. The value is being processed by using the formula:

$$\bar{x}_{geom} = \sqrt[n]{x_1 \cdot x_2 \cdot \ldots \cdot x_n} \quad \text{with } x_i > 0$$

6.5.6 WGEOM

Property value being processed by using the formula:

$$\bar{x}_{wgeom} = \exp\left(\frac{\sum_{i=1}^{n} w_i \cdot \ln x_i}{\sum_{i=1}^{n} w_i}\right)$$

NOTE If all weights are equal, the weighted geometric mean is the same as the geometric mean.

6.5.7 HARM

Number of items in the list divided by the sum of the reciprocals of the members in the list. The property value is being processed by using the formula:

$$\bar{x}_{harm} = \frac{n}{\sum_{i=1}^{n} \frac{1}{x_i}} \text{ with } x_i > 0$$

NOTE For a given data set, the harmonic mean is always the least, while the arithmetic mean is always the greatest and the geometric mean is always in between.

6.5.8 RMS

The property value is being processed by using the formula:

$$\bar{x}_{rms} = \sqrt{\frac{x_1^2 + x_2^2 + \ldots x_n^2}{n}}$$

6.6 Multiple qualifiers

The defined qualifiers express different aspects on the associated value are not mutually exclusive. Cases may therefore occur where more than one qualifier applies for a specific value. For example: A property qualified “as specified” may initially be “as estimated” and later “as calculated”. A property may therefore be qualified by more than one qualifier.

Property: Body length			**Value**	
Life Cycle qualifier	**Value origin qualifier**	**Referenced DET**	**Measure**	**Unit**
as specified	*as estimated*	AAE019 body length (max)	2,600	m
as specified	*as calculated*		2,578	

7 Property values

7.1 General

A property shall be assigned a value in accordance with the rules applicable for the referenced data element type (DET)

7.2 How to deal with special values

The following rules are established in accordance with IEC 61360-1:

a) The character COMMA SIGN (,) is defined as the applicable decimal marker in accordance with ISO 1000.

b) A negative value shall be always preceded with the character MINUS SIGN (–).

c) A value representing by intention the physical quantity ZERO of a DET, shall be explicitly entered either by

- the character ZERO SIGN representing an integer type, or
- the character ZERO SIGN, followed by the decimal marker and at least one character ZERO SIGN representing a real type.

d) DETs having no explicit value assigned (NIL values), shall be considered as not applied and shall not be processed.

7.3 How to use the level value qualifiers

The *level value qualifier* (min, typ, nom, max) as given in IEC 61360-1 indicates whether the values given are to be considered as a minimum, nominal, typical or maximum value. For more information, please refer to IEC 61360-1, clause 4.

a) to indicate a range, always the minimum and the maximum values shall be given;

b) to indicate a typical or nominal value only, only that value needs to be provided.

NOTE In product standards there is actually not yet a general agreement between the semantic meaning of a rated value and a nominal value. Within IEC standards a rated value is in products with > 1 kV generally defined as the maximum design value; i.e. for which a product is designed and manufactured. Any operating value shall therefore not exceed the maximum design value.

7.4 Availability of values associated with data element types

Depending on the domain of application and on the process stage for a specification, not all values of the data element types are available at a given point in time. Therefore the values should be provided as soon they are available for further processing, see also 6.3.

7.5 Application of unit systems

Where possible, the properties shall be expressed by applying the SI system for quantities and units as defined in ISO 31, IEC 60027 and ISO 80000.

NOTE 1 The possibility to use alternative units is under consideration in the context of IEC 61360.

NOTE 2 The use of units is regulated by regional or national laws. Therefore the use of units it is under the exclusive responsibility of the user in its business application; therefore IEC cannot be held liable.

7.6 Use of units in software applications

With respect to the data element types listed, respectively referring to the IEC data dictionary IEC 61360-4, all quantitative data elements are shown with their basic SI-units (e.g.: m, kg, s) or derived SI-units (e.g. m/s, kgm^2)according to ISO 31, ISO 80000 and IEC 60027, without any decimal prefix sign.

In a software tool a variety of decimal prefix signs may be needed according to the habits of a user or the industrial environment. Therefore it is advised that the software allows the user to adapt the presentation of a quantitative data element type with prefix signs as listed in ISO 1000 and IEC 60027-2 according to the needs, although the system might be storing the value provided, using the preferred unit as given in the IEC data dictionary 61360.

8 Data reliability and quality

8.1 General

Any supplier or manufacturer of a product shall be aware that his organization is responsible for the quality of the data provided.

It shall be assumed that the data are of such quality that a user can apply them correctly under the limits given by the supplier.

Imprecise and not reliable values, not corresponding to reality, might provide harm to his organization by annoyed customers and users, etc., resulting in possible claims and might lead to safety and health problems as well as consequences with respect to product liability or legal civil processes.

Any supplier of data in electronic form needs to be aware that the supplied data will be in future electronically read, checked and processed by computers, etc.

It shall not be taken as granted that a human user will verify the delivered data.

Any value provided shall therefore be as near as possible to the real value.

Therefore it is expected - without any further verification – that the provided data values are precise, otherwise the value shall be explicitly assigned with a positive, negative or symmetrical tolerance, see 8.3.

NOTE It is under the responsibility of an organization to request a specific data quality.

8.2 Description of inaccuracies of quantitative values

If it is not yet possible to provide a final design value, the property shall be associated with

– the value origin qualifier construct given in 6.4 and providing additional information about the possible tolerance until the final value is fixed either by
  a) applying the local applicable tolerance construct providing
    1) the symmetrical percentage tolerance, or
    2) the unsymmetrical percentage tolerance
  b) or by applying the same construct in the header of a document indicating that it is globally applicable; indicating the case that *all* quantitative values contained in the document are associated with the same inaccuracy.

If the tolerance features shall have local effect to a single property only, it shall be explicitly applied together with that particular property.

The globally defined value of the tolerance features will be overruled by the existence of an explicitly defined local value of the tolerance in conjunction with a particular property.

The associated data element types are the following:

Identifier	Preferred name	Definition
AAF443	symmetric tolerance	The percentage tolerance (in %) on the nominal value of a characteristic property where both positive and negative tolerance values are equal
AAF444	negative tolerance	The negative value of the percentage tolerance (in %) on the nominal value of a characteristic property where positive and negative tolerance values are unequal
AAF445	positive tolerance	The positive value of the percentage tolerance (in %) on the nominal value of a characteristic property where positive and negative tolerance values are unequal

NOTE For full information about each DET see http://std.iec.ch/iec61360

8.3 Intended design tolerances on products

Some products are designed to have an *intended* design tolerance, for example capacitors or resistors. In such cases each property needs to be defined explicitly that it is designed with a tolerance.

Annex A

List of data element types

This annex contains the formal specifications for the data element types described in this publication. They fulfill the formal requirements for inclusion in the IEC 61360 DB.

A.1 DET Life cycle qualifier

DT XXX001
VE 001
RV 01
CL A82
EN life cycle qualifier
SH life cycle qual
DF Qualifier to assign to a property a specific meaning in the life cycle of a component
DA simple
DV non-quantitative code
FM M..8
VL BUILT = As built
VL CON = As contracted
VL INQ = As inquired
VL OFF = As offered
VL SPEC = As specified
VL SUP = As supplied
VL OP = As operated
ST PROP
CR 2008-10-12
VR IEC TC3
*

A.2 DET Applicability qualifier

DT XXX003
VE 001
RV 01
CL A82
EN applicability qualifier
SH applicability qual
DF Qualifier to assign to a property the information how it is managed
DA simple
DV non-quantitative code
FM M..8
VL AVP = Applicable, value provided
VL AVA = Applicable, value assumed
VL AVN = Applicable, value not assigned
VL NA = Not applicable
ST PROP
CR 2008-10-12
VR IEC TC3
*

A.3 DET Value origin qualifier

DT XXX002
VE 001
RV 01
CL A82
EN value origin qualifier
SH origin qual
DF Qualifier to assign to a property the information how its value has been gained
DA simple
DV non-quantitative code
FM M..8
VL CAL = As calculated
VL EST = As estimated
VL MEA = As measured
VL SET = As set
ST PROP
CR 2008-10-12
VR IEC TC3
*

A.4 DET Value processing qualifier

DT XXX004
VE 001
RV 01
CL A82
EN value processing qualifier
SH value proc qual
DF Qualifier to assign to a property the information by which mathematical method the provided value(s) has been gained
DA simple
DV non-quantitative code
FM M..8
VL ARITH = Arithmetic mean
VL MED= Median
VL MODE=mode
VL WARITH = weighted arithmetic mean
VL GEOM = geometric mean
VL WGEOM = weighted geometric mean
VL HARM= harmonic mean
VL RMS= root mean square
ST PROP
CR 2008-10-12
VR IEC TC3
*

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