TECHNICAL SPECIFICATION

ISO/TS 13399-150

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Cutting tool data representation and exchange —

Part 150:
Usage guidelines

Représentation et échange des données relatives aux outils coupants —

Partie 150: Lignes directrices d'utilisation

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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:

— an 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;

— 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order to decide whether it will be confirmed for a further three years, revised to become an International Standard, or withdrawn.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again after a further three years, at which time it must either be transformed into an International Standard or be withdrawn.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 13399-150 was prepared by Technical Committee ISO/TC 29, *Small tools*.

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]

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

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

Cutting tool data representation and exchange —

Part 150:
Usage guidelines

1 Scope

This part of ISO 13399 gives guidelines for the application of ISO 13399 as a whole, including guidance on the instantiation of the EXPRESS schema as described in ISO 13399-1, and the use of the reference data described in ISO/TS 13399-2, ISO/TS 13399-3, ISO/TS 13399-4, ISO/TS 13399-5, ISO/TS 13399-50 and ISO/TS 13399-60.

This part of ISO 13399 does not define the terms and properties for cutting items, tool items, adaptive items assembly items, reference systems or common features and connection systems.

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 639-2, *Codes for the representation of names of languages — Part 2: Alpha-3 code*

ISO 3166-1, *Codes for the representation of names of countries and their subdivisions — Part 1: Country codes*

ISO 13584, *Industrial automation systems and integration — Parts library*

ISO 10303-21, *Industrial automation systems and integration — Product data representation and exchange — Part 21: Implementation methods: Clear text encoding of the exchange structure*

3 Usage guidelines

This section explains the usage of ISO 13399. It is divided into several subsections, each with a specific topic related to the usage of ISO 13399.

3.1 Legend

In the guidelines different style will be used to indicate different concepts related to ISO 13399. The styles used are the following:

— EXPRESS entity: `item`

— Important concepts: *concept*

— Attributes in entity context: `item.description`

IMPORTANT — The illustrations in this document are simplified and do not include all information included in a ISO 10303-21 file. The illustrations are kept as simple as possible to provide a schematic overview. Complete examples are provided in the ISO 10303-21 examples.

3.2 Fundamental assumptions

3.2.1 Item representation

In ISO 13399 the things about which information is represented are called *items.* There are four types of *items*:

—   *Cutting item*

—   *Tool item*

—   *Adaptive item*

—   *Assembly item*

In the EXPRESS-schema in ISO 13399-1 these different types of items are all represented using the entity `item`. They are differentiated through the use of `specific_item_classification`. In the schema this type of classification is used to classify the information type of an `item`.

When building an assembly of items the assembly will be of one of the types of items listed previously. This is illustrated in Figure 1.

3.2.2 Reference data library

ISO 13399 uses a reference data library based on P-Lib (ISO 13584), for definitions of classes and properties. The use of reference data enables the information model in Part 1 to stay general, while still allowing explicitly defined standardized concepts in data exchange.
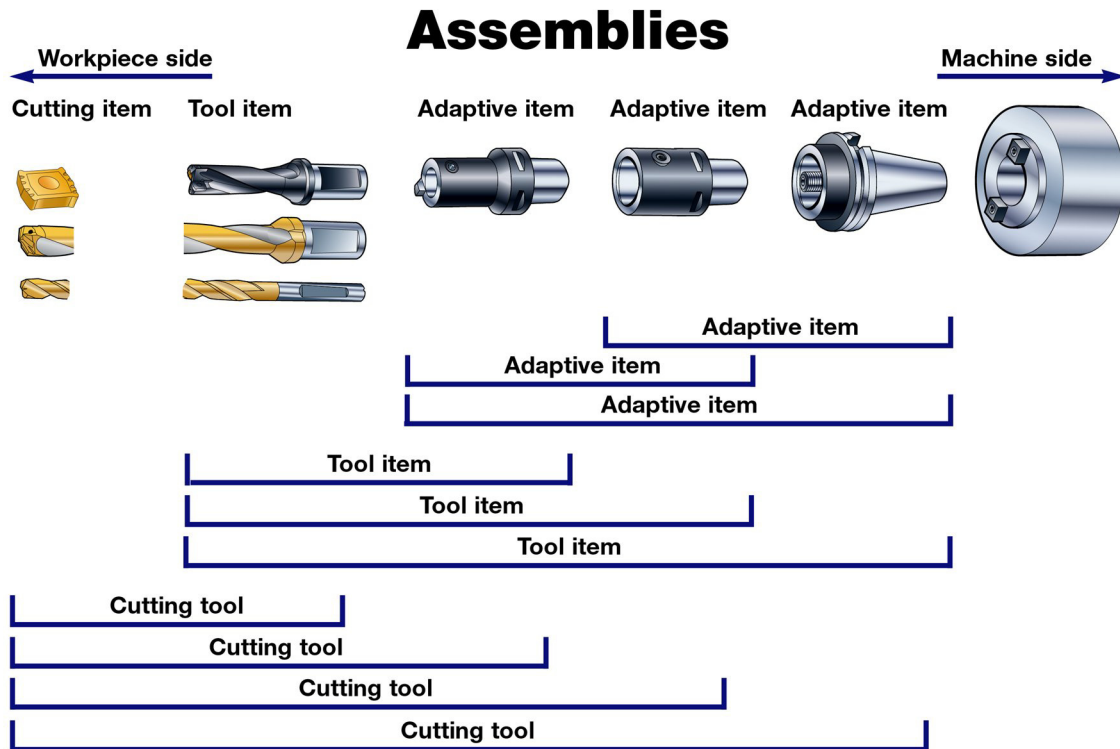
Figure 1 — Assemblies of different types of items

The current reference data library is based on ISO 13584. This will be referred to as P-Lib in this document.

When using reference data many attributes in the cutting_tool_schema are externally defined. In order not to duplicate information and create ambiguity (which is the master, the explicit data in the ISO 13399 file or the referenced data in the reference data library?), most attributes are set to "/IGNORE" when using reference data. This string tells an implementation that the data can be found in an external source. Based on the context the data that needs to be retrieved is known.

Table 1 — Description of special attribute values used in the ISO 10303-21 (or ISO 10303-28)[1) file

Value	Description
"	Indicates user data managed by the sending system but not provided for data exchange.
'/NULL'	Indicates user data in a mandatory attribute that is not managed by the sending system or currently not known.
$	$ is used in the physical file, if an optional attribute is not instantiated.
'/IGNORE'	Attribute values are set to '/IGNORE' when the information that could be held by the attribute is instead assigned to the instance of the entity.

3.3   Representing basic item information

3.3.1   Required cutting_tool_schema entities

— item

— item_definition

— item_version

— language

— multi_language_string

— organization

— person_organization_assignment

— specific_item_classification

— string_with_language

3.3.2   Representation

Basic item information includes information about the type of item being created, identifier for the item, name of the item, organization which owns the identifier, and the basic item, item_version, and item_definition entities.

IMPORTANT — The representation for basic item information is the core representation of ISO 13399 and is an assumed starting point for all following representation descriptions.

---

1) *Industrial automation systems and integration — Product data representation and exchange — Part 28: Implementation methods: XML representations of EXPRESS schemas and data, using XML schemas*

The recommendation is to represent descriptions and names as `multi_language_string` in order to always have support for multiple languages. Cf. Section 3.4 Representing information in multiple languages for further details on multiple languages.

IMPORTANT — The owner of the id of an `item` **shall be specified using a** `person_organization_assignment` **with a** `role` **of 'id owner'.**

An example instantiation diagram of basic item information is shown below.
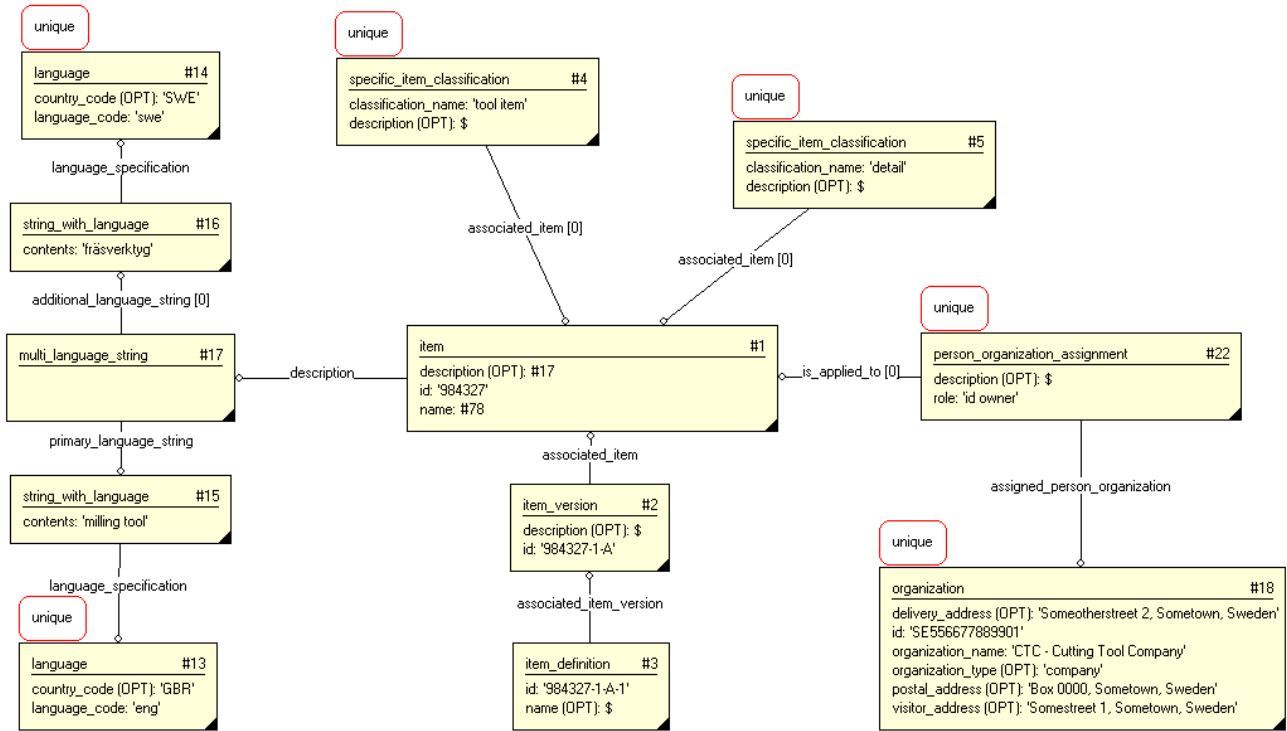
Figure 2 — Representing basic item information

An *item* will always be represented using a triplet of `item`, `item_version`, and at least one `item_definition`.

3.3.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing basic item information.p21','2007-02-20T10:52:10',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.17]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fr\S\dsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
ENDSEC;
END-ISO-10303-21;
```

3.4 Representing information in multiple languages

3.4.1 Required cutting_tool_schema entities

—— language

—— multi_language_string

—— string_with_language

3.4.2 Representation

Multiple languages are represented using multi_language_string. The actual string values in different languages are represented using string_with_language together with a specification of the language.

—— language.language_code shall be specified using Alpha-3 code as specified in ISO 639-2.

EXAMPLE   Possible values for language_code are, e.g., 'eng' for English, 'fra' for French, 'rus' for Russian, 'deu' for German, or 'swe' for Swedish.

—— language.country_code shall if used be specified using Alpha-3 code as specified in ISO 3166-1.

EXAMPLE   Possible values for country_code are, e.g., 'GBR' for the United Kingdom, 'USA' for the United States of America, or 'SWE' for Sweden.

The language shall be unique within the information base, e.g. ISO 10303-21 file.
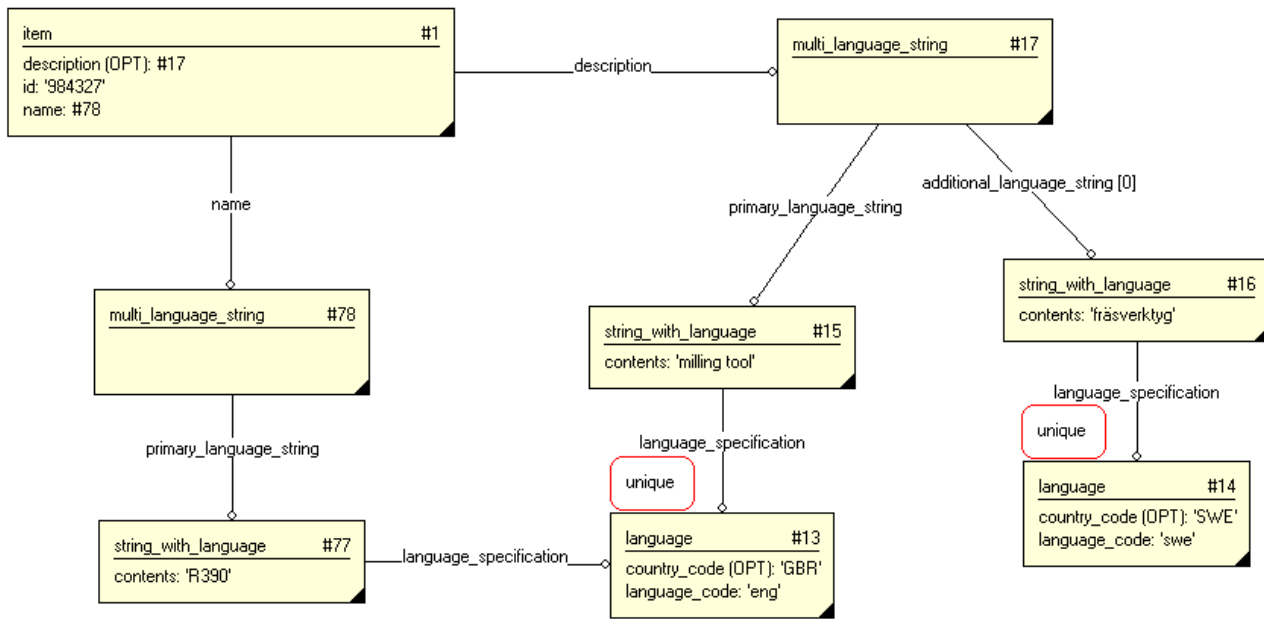
Figure 3 — Representing multiple languages for `item.description`

3.4.3   ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Master Data Example.p21','2007-02-20T10:52:10', ('someone'),(''),'',
'GraphicalInstance 1.0 Beta 5 [1.0.5.17]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',#369);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fr\S\dsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);

ENDSEC;
END-ISO-10303-21;
```

3.5 Representing person and organization

3.5.1 Required cutting_tool_schema entities

— `organization`

— `person`

— `person_in_organization`

— `person_organization_assignment`

3.5.2 Representation

Person and organizational information may be represented for many purposes, e.g. who created the item, which supplier does the item come from. A minimum requirement is set for organizational data; the owner of the id of an item shall be specified.

IMPORTANT — The owner of the id of an item shall be specified.

For companies the id of the organization is typically assigned and controlled by national registration authorities.
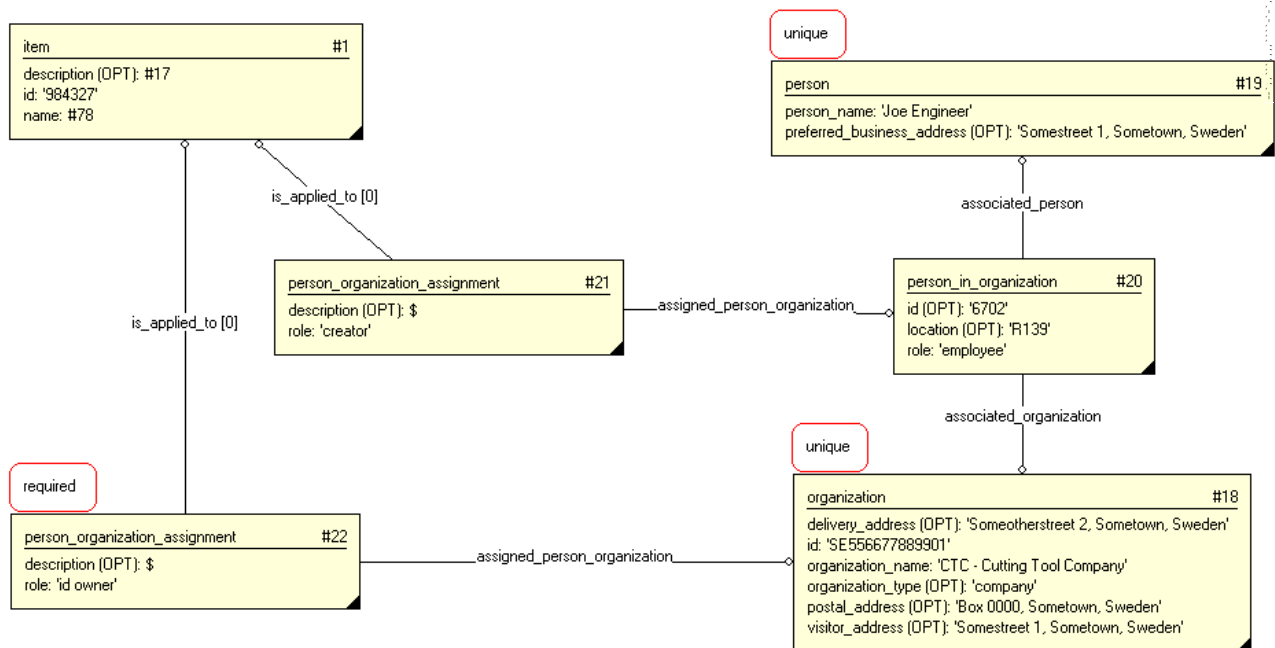
Figure 4 — Representing person and organization

Where applicable the following values shall be used in `person_organization_assignment.role`: 'author', 'classification officer', 'creator', 'custodian':, 'customer', 'design supplier', 'editor', 'id owner', 'location', 'manufacturer', 'owner', 'supplier', 'wholesaler'

Depending on the need for specifying organizational data on objects, some aspects are to be considered when instantiating the `person_organization_assignment.role`:

— 'author' should mainly be used for documents.

— 'classification officer' is described in section 3.10 Representing ownership of classifications.

— 'creator' is used for all objects for defining the creator.

— 'id owner' is described in section 3.3 Representing basic item information.

— 'owner' should primarily be used for defining ownership of objects, except documents

3.5.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing person and organisation.p21','2007-02-20T10:52:10',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.17]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',#369);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#19 = PERSON('Joe Engineer','Somestreet 1, Sometown, Sweden');
#20 = PERSON_IN_ORGANIZATION(#18,#19,'6702','R139','employee');
#21 = PERSON_ORGANIZATION_ASSIGNMENT(#20,$,(#1),'creator');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');

ENDSEC;
END-ISO-10303-21;
```

3.6   Representing a classification based on P-Lib

3.6.1   Required cutting_tool_schema entities

—— `classification_association`

—— `general_classification`

—— `plib_class_reference`

3.6.2 Representation

ISO 13399 uses a reference data library based on P-Lib (ISO 13584), for definitions of properties and classes. In the following example all data attributes of `general_classification` are set to "/IGNORE". These pieces of data shall be retrieved from P-Lib by using the `plib_class_reference.supplier_bsu` and `plib_class_reference.code` attributes. (See Section 3.2 Fundamental assumptions for an explanation)

—— The `general_classification.description` attribute shall be a concatenation of the "Definition", "Note" and "Remark" from P-Lib.

—— The `general_classification.id` shall be retrieved from `plib_class_reference.code`

—— The `general_classification.version_id` shall be retrieved from `plib_class_reference.version`
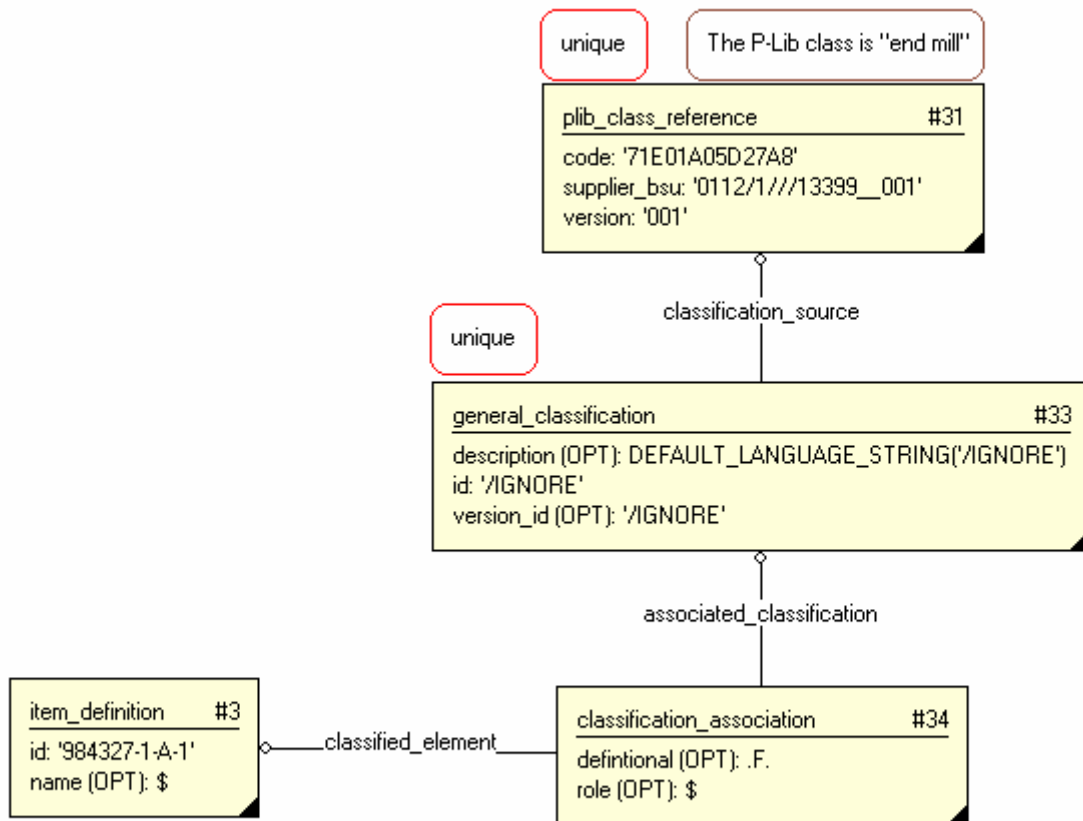
Figure 5 — Representing a classification based on P-Lib

The `classification_association` that assigns a `general_classification` to an *item* shall be associated to an `item_definition` of the item.

IMPORTANT — Classifications shall in general be associated to items at the `item_definition` **level.**

The format of the attribute `plib_class_reference.supplier_bsu` is defined in ISO 13584. For the reference data library in ISO 13399 the attribute shall be "0112/1///13399__"+library version, at the time of writing this is "001" which gives the complete string "0112/1///13399__001". ISO 13584 specifies the format for the identifier, and mandates he double underscore characters used.

IMPORTANT — The `supplier_bsu` **must contain version information to be able to validate the version of the library being used when interpreting the information.**

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3.6.3   ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('data.p21','2007-02-21T11:46:38', ('someone'),(''),'',
'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));

ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fr\S\dsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#31 = PLIB_CLASS_REFERENCE('71E01A05D27A8','0112/1///13399__001','001');
#33 =
GENERAL_CLASSIFICATION(#31,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNOR
E');
#34 = CLASSIFICATION_ASSOCIATION(#33,#3,.F.,$);

ENDSEC;
END-ISO-10303-21;
```

3.7   Representing a classification based on a general external library

3.7.1   Required cutting_tool_schema entities

—   classification_association

—   external_library_reference

—   general_classification

3.7.2   Representation

ISO 13399 uses a reference data library based on P-Lib (ISO 13584), for definitions of properties and classes. In those cases where using P-Lib as an external reference for classes is not possible, an external library is preferred as the storage for the class definitions, e.g. OWL or ISO 15926 [2].

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2)   *Industrial automation systems and integration — Integration of life-cycle data for process plants including oil and gas production facilities*
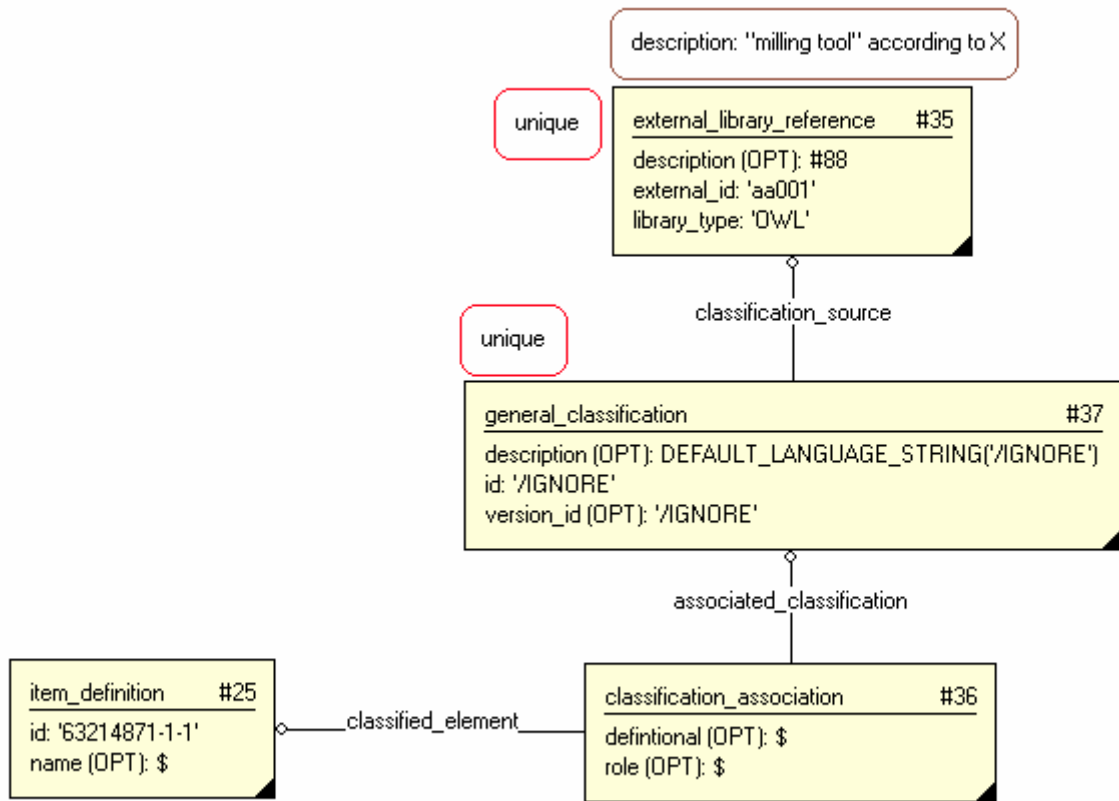
Figure 6 — Representing classification based on an external library

3.7.3   ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('data.p21','2007-02-21T11:46:38', ('someone'),(''),'',
'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#23 = ITEM(#118,'63214871',#118);
#24 = ITEM_VERSION(#23,$,'63214871-1');
#25 = ITEM_DEFINITION((),#24,'63214871-1-1',$);
#35 = EXTERNAL_LIBRARY_REFERENCE(#88,'aa001','OWL');
#36 = CLASSIFICATION_ASSOCIATION(#37,#25,$,$);
#37 =
GENERAL_CLASSIFICATION(#35,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNOR
E');
#117 = STRING_WITH_LANGUAGE('Mill 1-14',#13);
#118 = MULTI_LANGUAGE_STRING((),#117);

ENDSEC;
END-ISO-10303-21;
```

3.8   Representing a classification without external references

3.8.1   Required cutting_tool_schema entities

—— `classification_association`

—— `general_classification`

—— `multi_language_string`

—— `string_with_language`

3.8.2   Representation

Representation of classes without external references is sometimes necessary when an external definition does not exist for a class that needs to be part of the information exchange.

The attribute `general_classification.description` will be important to ensure the correct interpretation of a "non standard" class. It shall be represented using `multi_language_string` as described in Section 3.4 Representing information in multiple languages.
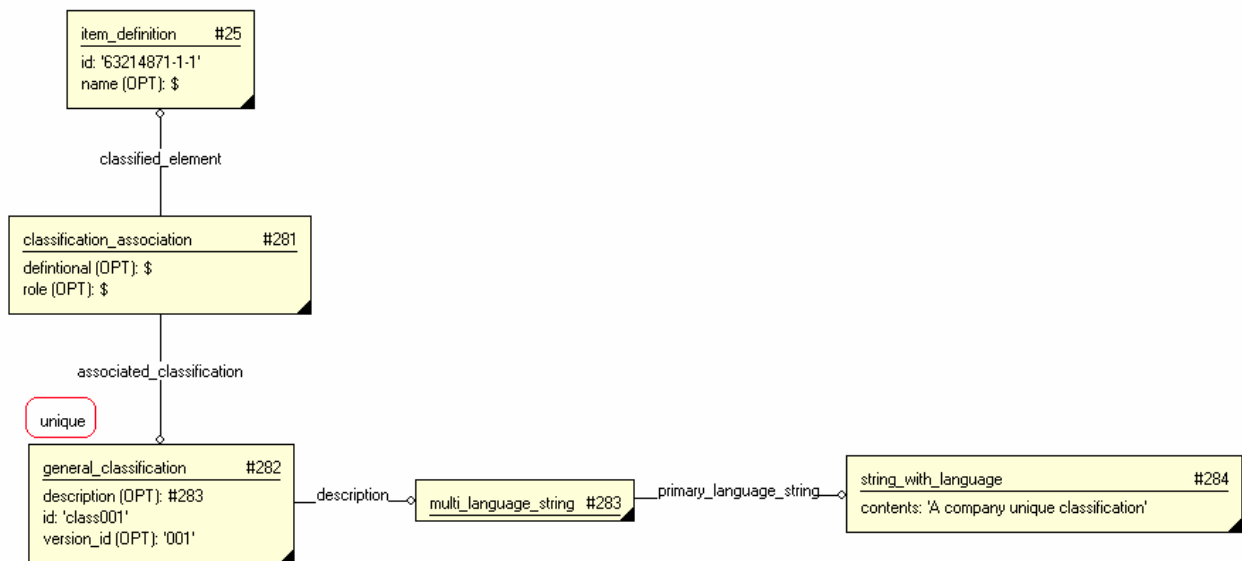
Figure 7 — Representing classification without external reference

3.8.3   ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing classification without external reference.p21','2007-02-
22T11:18:28', ('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370,#
212,#376),'tool item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#23 = ITEM(#118,'63214871',#118);
#24 = ITEM_VERSION(#23,$,'63214871-1');
#25 = ITEM_DEFINITION((),#24,'63214871-1-1',$);
#117 = STRING_WITH_LANGUAGE('Mill 1-14',#13);
#118 = MULTI_LANGUAGE_STRING((),#117);
#281 = CLASSIFICATION_ASSOCIATION(#282,#25,$,$);
#282 = GENERAL_CLASSIFICATION($,#283,'class001',$,'001');
#283 = MULTI_LANGUAGE_STRING((),#284);
#284 = STRING_WITH_LANGUAGE('A company unique classification',#13);

ENDSEC;
END-ISO-10303-21;
```

3.9   Representing classification relationships

3.9.1   Required cutting_tool_schema entities

—— `classification_association`

—— `classification_association_relationship`

—— `general_classification`

3.9.2   Representation

The representation of classification relationships can be used to represent combinations of classifications when a suitable class does not exist in the reference data. It may also be used to indicate that two classes should be considered as alternative classes.

—— In the scenario when the object being classified is a combination of the two classifications assigned to the object, the `classification_association_relationship.relationship_type` should be instantiated with the value 'combination'.

—— In the scenario when the object being classified can be considered as being either one or the other of the participating `general_classifications` the `classification_association_relationship.relationship_type` should be instantiated with the value 'alternative'.
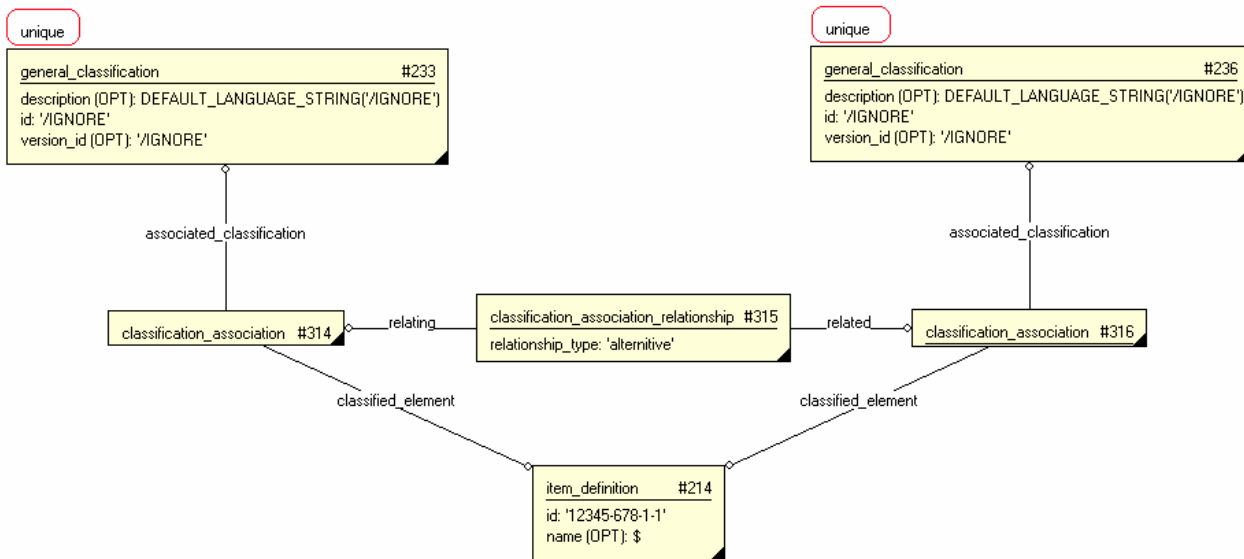
Figure 8 — Representing classification relationships

3.9.3   ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing classification relationships.p21','2007-02-22T11:04:25',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370,#
212,#376)),'tool item',$);
#5 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108,#212),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#212 = ITEM($,'12346-678',#239);
#213 = ITEM_VERSION(#212,$,'12346-678-1');
#214 = ITEM_DEFINITION($,#213,'12345-678-1-1',$);
#227 = PLIB_CLASS_REFERENCE('71E01A05D27A8','112/1///13399__001','001');
#228 = PLIB_CLASS_REFERENCE('71E01A0E9CBA9','112/1///13399__001','001');
#233 =
GENERAL_CLASSIFICATION(#227,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNO
RE');
#236 =
GENERAL_CLASSIFICATION(#228,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNO
RE');
#239 = MULTI_LANGUAGE_STRING((),#240);
#240 = STRING_WITH_LANGUAGE('Multi purpose tool',#13);
#314 = CLASSIFICATION_ASSOCIATION(#233,#214,.F.,$);
#315 = CLASSIFICATION_ASSOCIATION_RELATIONSHIP(#316,#314,'alternative');
#316 = CLASSIFICATION_ASSOCIATION(#236,#214,.F.,$);

ENDSEC;
END-ISO-10303-21;
```

3.10   Representing ownership of classifications

3.10.1   Required cutting_tool_schema entities

—   `classification_association`

—   `general_classification`

—   `organization`

—   `person_organization_assignment`

—   `plib_class_reference`

3.10.2 Representation

Representing ownership of classifications may be used to indicate an organization or person that is responsible for the classification of an entity.
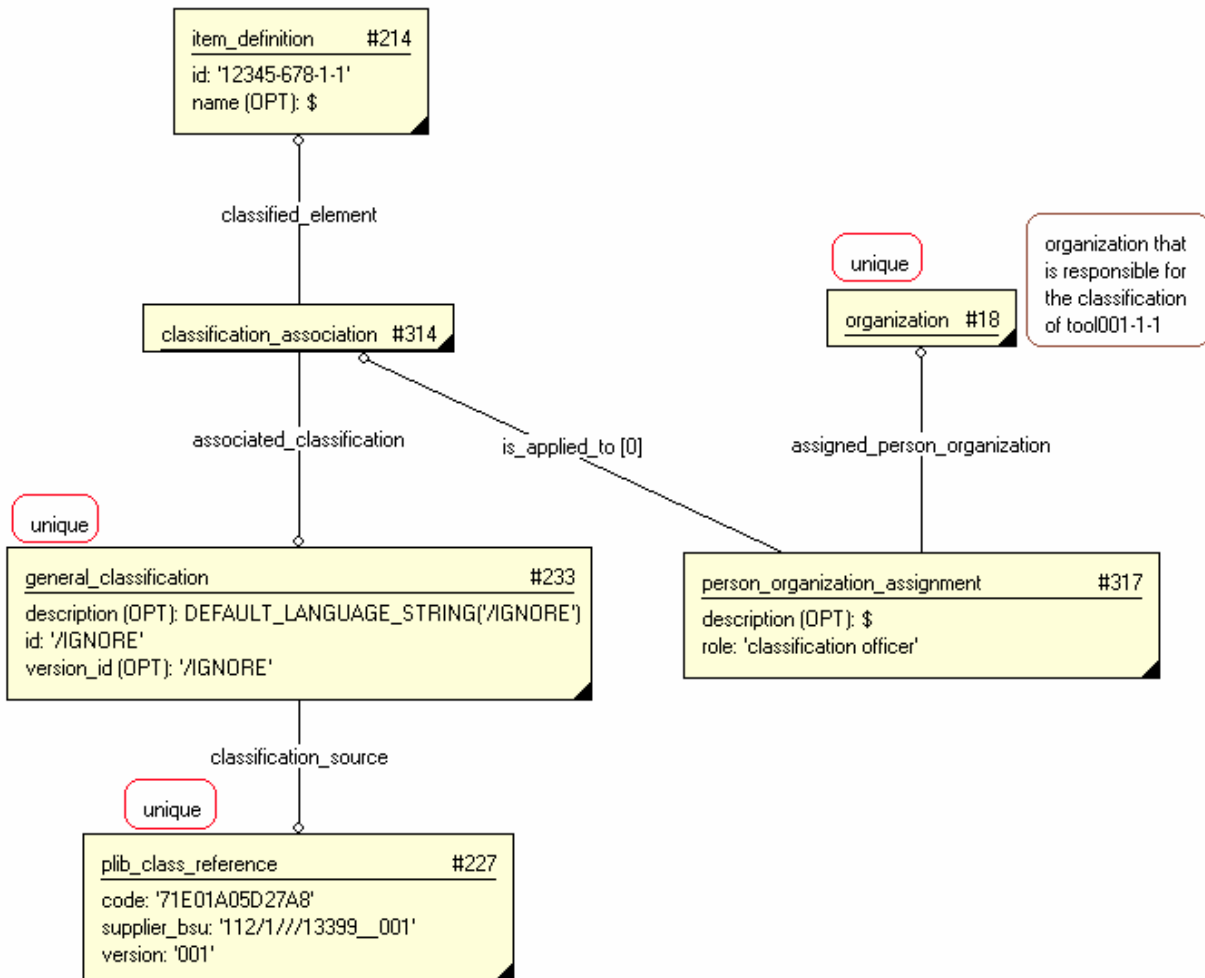
Figure 9 — Representing ownership of classifications

As shown in the example above, the `person_organization_assignment` is applied to the `classification_association` entity. The significance of this is that the organization is responsible for the classification of the item; it is not responsible for the class itself.

If the objective is to describe the ownership of the class itself (i.e. `general_classification`) the `person_organization_assignment.role` should be set to 'owner', and it should be applied to the `general_classification`. However, that should not be used when using P-Lib as the classification source.

3.10.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing ownership of classifications.p21','2007-02-22T11:04:25',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370,#
212,#376),'tool item',$);
#5 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108,#212),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370),'id owner');
#212 = ITEM($,'12346-678',#239);
#213 = ITEM_VERSION(#212,$,'12346-678-1');
#214 = ITEM_DEFINITION($,#213,'12345-678-1-1',$);
#227 = PLIB_CLASS_REFERENCE('71E01A05D27A8','112/1///13399__001','001');
#233 =
GENERAL_CLASSIFICATION(#227,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNO
RE');
#239 = MULTI_LANGUAGE_STRING((),#240);
#240 = STRING_WITH_LANGUAGE('Multi purpose tool',#13);
#314 = CLASSIFICATION_ASSOCIATION(#233,#214,.F.,$);
#317 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#314),'classification officer');
#377 = MULTI_LANGUAGE_STRING((),#378);
#378 = STRING_WITH_LANGUAGE($,#13);

ENDSEC;
END-ISO-10303-21;
```

3.11 Representing a property based on P-Lib

3.11.1 Required cutting_tool_schema entities

—— plib_class_reference

—— plib_property_reference

—— property

—— property_value

—— property_value_association

—— property_value_representation

—— unit

3.11.2 Representation

ISO 13399 uses a reference data library based on P-Lib (ISO 13584), for definitions of properties and classes. In the following example all of the information contained in the `property` entity is set to "/IGNORE". These pieces of data shall be retrieved from P-Lib. (See Section 3.2 Fundamental assumptions for an explanation)

— When reading the `property.description` attribute, the value shall be retrieved from P-Lib and be a concatenation of the "Definition", "Note" and "Remark".

— When reading the `property.id` attribute, the value shall be retrieved from `plib_property_reference.code`.

— When reading the `property.version_id` attribute, the value shall be retrieved from `plib_property_reference.version`.

— When reading the `property_value.value_name` attribute (in this example `numerical_vaule.value_name`), the value shall be retrieved from "short name" in the P-Lib property, hence the `property_value.value_name` shall be set to '/IGNORE'. The exception is when multiple values of the same property are represented for the same item; in this case it may be necessary to differentiate between the values by using an id. The complete id shall then be a concatenation of the "short name" from P-Lib and the individual id. If the property has a dependant property in P-Lib, e.g. "connection diameter" and "side", the identifier shall be set in another `property_value` and related using `property_value_representation_relationship`. Cf. Section 3.17 Representing property value relationships based on P-Lib for a description of using `property_value_representation_relationship`.

— The attribute `property.property_type` can not be explicitly interpreted from what is available in P-Lib. However, there is no point in specifying it when using P-Lib references. Hence, it should be set to '/IGNORE'.
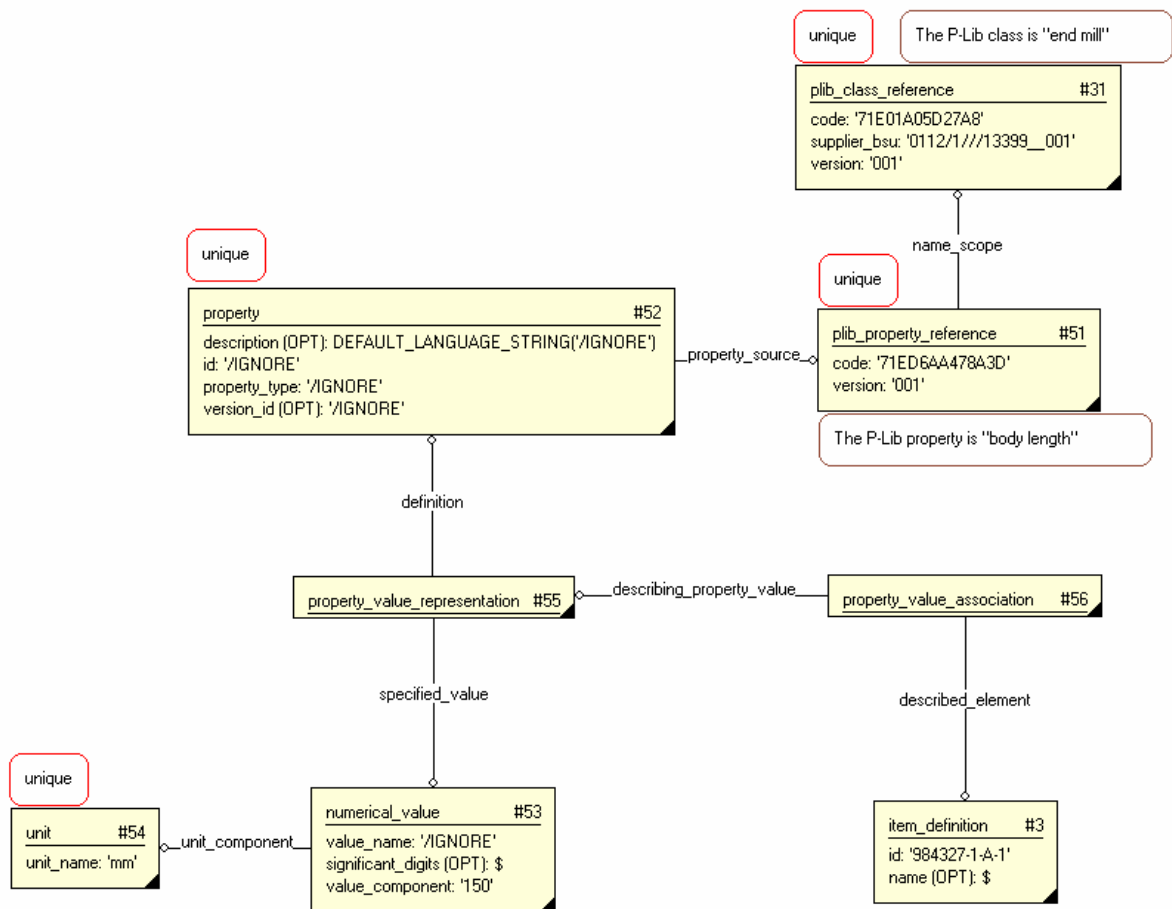
Figure 10 — Representing a property based on P-Lib

The `property_value_association` that assigns a `property_value_representation` to an *item* shall be associated to an `item_definition` of the item.

IMPORTANT — Properties are always associated to items at the `item_definition` **level.**

When creating the property, unit information may be retrieved from P-Lib to facilitate implementation. However, if a unit other than the one specified in P-Lib shall be used, e.g. inch instead of mm, then the unit information must be provided by the user/implementation.

The format of the attribute `plib_class_reference.supplier_bsu` is defined in ISO 13584. For the reference data library in ISO 13399 the attribute shall be "0112/1///13399__"+library version, at the time of writing this is "001" which gives the complete string "0112/1///13399__001". ISO 13584 specifies the format for the identifier, and mandates he double underscore characters used.

IMPORTANT — The `supplier_bsu` **must contain version information to be able to validate the version of the library being used when interpreting the information.**

In the example shown in Figure 10 — Representing a property based on P-Lib and in Section 3.11.3, a `numerical_value` is used as an example of a `property_value`. The use of this and other types of property values is described further in Section 3.14 Representing property values.

3.11.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing a property based on P-Lib.p21','2007-02-21T15:39:14',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#31 = PLIB_CLASS_REFERENCE('71E01A05D27A8','0112/1///13399__001','001');
#51 = PLIB_PROPERTY_REFERENCE('71ED6AA478A3D',#31,'001');
#52 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#51,'/IGNORE','/IGNORE')
;
#53 = NUMERICAL_VALUE('/IGNORE',$,#54,'150');
#54 = UNIT('mm');
#55 = PROPERTY_VALUE_REPRESENTATION(#52,$,$,#53,$);
#56 = PROPERTY_VALUE_ASSOCIATION($,#3,#55,$,$);
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);

ENDSEC;
END-ISO-10303-21;
```

3.12 Representing a property based on a general external library

3.12.1 Required cutting_tool_schema entities

— `external_library_reference`

— `property`

— `property_value_association`

— `property_value_representation`

3.12.2 Representation

ISO 13399 uses a reference data library based on P-Lib (ISO 13584), for definitions of properties and classes. In those cases where using P-Lib as an external reference for properties is not possible, an external library is preferred as the storage for the property definitions, e.g. OWL or ISO 15926.

Figure 11 — Representing property with external library reference

3.12.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing property with external library reference.p21','2007-02-
21T15:39:14', ('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);
```

```
#260 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#263,'/IGNORE','/IGNORE'
);
#261 = PROPERTY_VALUE_ASSOCIATION($,#3,#262,$,$);
#262 = PROPERTY_VALUE_REPRESENTATION(#260,$,$,$,$);
#263 = EXTERNAL_LIBRARY_REFERENCE($,'aa002','OWL');

ENDSEC;
END-ISO-10303-21;
```

3.13 Representing a property without external references

3.13.1 Required cutting_tool_schema entities

—— `multi_language_string`

—— `property`

—— `property_value_association`

—— `property_value_representation`

—— `string_with_language`

—— `unit`

3.13.2 Representation

Representation of properties without external references is sometimes necessary when an external definition does not exist for a property that needs to be part of the information exchange.

The attribute `property.property_type` shall, where applicable, have one of the following values specified in ISO 13399-1:

- —— 'cost': a property that specifies costs.
- —— 'dimension': a property that describes a dimension of an object.
- —— 'mass': a quantity of matter that an object consists of.
- —— 'shape': a property that describes the shape of an object.
- —— 'specification': a property that specifies a certain characteristic of an object.
- —— 'usage': a property that describes the use of an object.

The attribute `property.description` will be important to ensure the correct interpretation of a "non standard" property. It shall be represented using `multi_language_string` as described in Section 3.4 Representing information in multiple languages.

R390 tool body

item_definition	#3
id: '984327-1-A-1'	
name (OPT): $	

described_element

property_value_association	#265

describing_property_value

property_value_representation	#266

definition

unique

property	#264
description (OPT): #267	
id: '001'	
property_type: 'specification'	
version_id (OPT): '001'	

description

multi_language_string	#267

allowed_unit [0]

unique

unit	#54
unit_name: 'mm'	

primary_language_string

string_with_language	#268
contents: 'A company unique property'	

Figure 12 — Representing property without external reference

3.13.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing property without external reference.p21','2007-02-
21T15:39:14', ('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
```

```
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#54 = UNIT('mm');
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);
#264 = PROPERTY((#54),#267,'001',$,'specification','001');
#265 = PROPERTY_VALUE_ASSOCIATION($,#3,#266,$,$);
#266 = PROPERTY_VALUE_REPRESENTATION(#264,$,$,$,$);
#267 = MULTI_LANGUAGE_STRING((),#268);
#268 = STRING_WITH_LANGUAGE('A company unique property',#13);

ENDSEC;
END-ISO-10303-21;
```

3.14 Representing property values

3.14.1 Required cutting_tool_schema entities

—— `string_value`

—— `unit`

—— `value_with_unit`

3.14.2 Representation

Property values can be represented as `string_value`, `numerical_value`, `value_range`, `value_limit` or `value_list`.

As stated earlier, the `property_value.value_name` attribute shall have the value '/IGNORE', and be retrieved from "short name" in the P-Lib property when using P-Lib references, cf. Section 3.11 Representing a property based on P-Lib. The exception is when multiple instances of the same property are required. In this case it may be necessary to differentiate between the values by using an id. The complete id shall then be a concatenation of the "short name" from P-Lib and the individual id.

IMPORTANT — When using P-lib properties, it is not recommended to instantiate a `property.allowed_unit` **with the unit that should be assigned to the** `value_with_unit`, **unless a limitation of the allowed units is intended.**
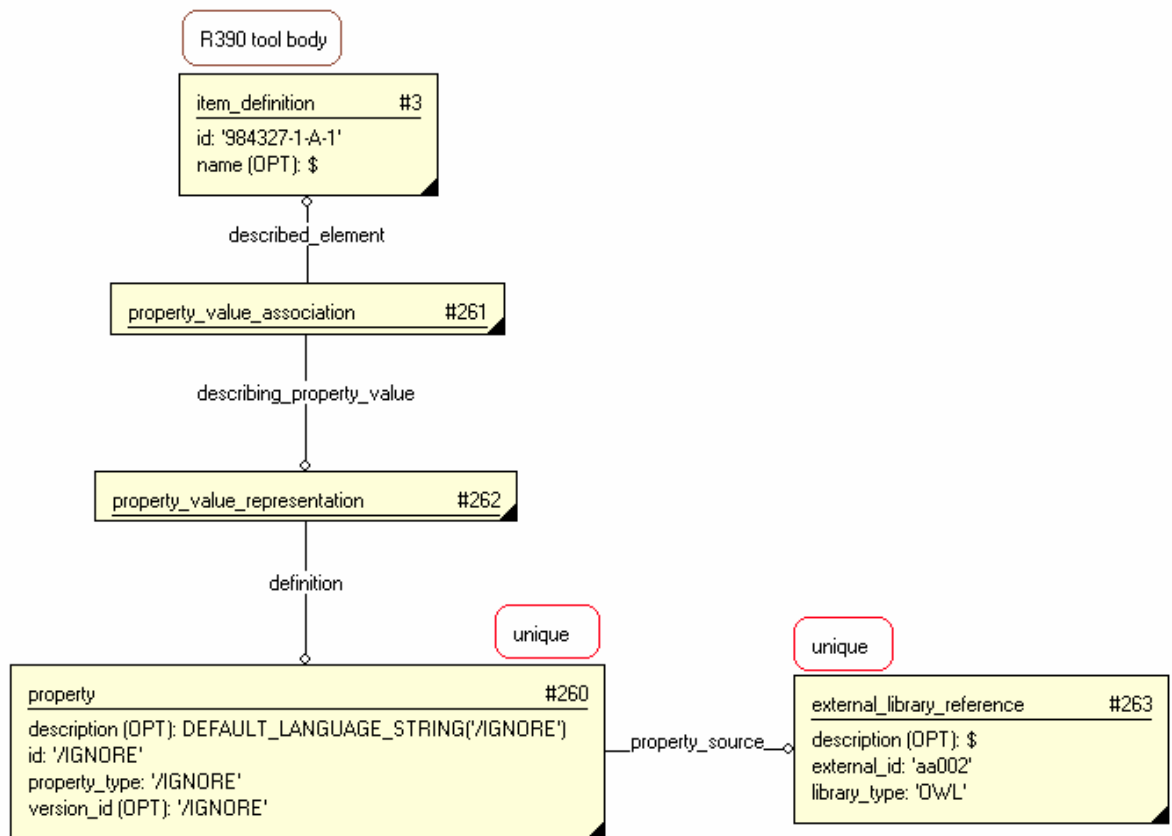
Figure 13 — Representing property values

3.14.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing property values.p21','2007-02-21T15:39:14',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#5 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108,#212),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370),'id owner');
#54 = UNIT('mm');
#212 = ITEM($,'12346-678',#239);
#213 = ITEM_VERSION(#212,$,'12346-678-1');
#214 = ITEM_DEFINITION($,#213,'12345-678-1-1',$);
#217 = PROPERTY_VALUE_ASSOCIATION($,#214,#220,$,$);
#220 = PROPERTY_VALUE_REPRESENTATION(#223,$,$,#229,$);
#223 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#246,'/IGNORE','/IGNORE'
);
#227 = PLIB_CLASS_REFERENCE('71E01A05D27A8','112/1///13399__001','001');
#229 = NUMERICAL_VALUE('/IGNORE',$,#54,'10');
#239 = MULTI_LANGUAGE_STRING((),#240);
#240 = STRING_WITH_LANGUAGE('Multi purpose tool',#13);
#241 = PROPERTY_VALUE_ASSOCIATION($,#214,#242,$,$);
#242 = PROPERTY_VALUE_REPRESENTATION($,$,$,#244,$);
#243 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#245,'/IGNORE','/IGNORE'
);
#244 = VALUE_RANGE('/IGNORE',$,#54,'28','35');
#245 = PLIB_PROPERTY_REFERENCE('71ED6AA478A3D',#227,'001');
#246 = PLIB_PROPERTY_REFERENCE('71ED6A9AF7D1D',#227,'001');
#247 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#252,'/IGNORE','/IGNORE'
);
#248 = PROPERTY_VALUE_REPRESENTATION(#247,$,$,#250,$);
#249 = PROPERTY_VALUE_ASSOCIATION($,#214,#248,$,$);
#250 = VALUE_LIMIT('/IGNORE',$,#251,'45','5');
#251 = UNIT('deg');
#252 = PLIB_PROPERTY_REFERENCE('71D08096F930C',#227,'001');
#253 = STRING_VALUE('/IGNORE',#255);
#254 = PROPERTY((),$,'/IGNORE',#259,'/IGNORE','/IGNORE');
#255 = MULTI_LANGUAGE_STRING((),#256);
#256 = STRING_WITH_LANGUAGE('SZD016002M0INT',#13);
#257 = PROPERTY_VALUE_REPRESENTATION(#254,$,$,#253,$);
#258 = PROPERTY_VALUE_ASSOCIATION($,#214,#257,$,$);
#259 = PLIB_PROPERTY_REFERENCE('71D102AE3B252',#227,'001');

ENDSEC;
END-ISO-10303-21;
```

3.15 Representing property value lists

3.15.1 Required cutting_tool_schema entities

—— `string_value`

—— `unit`

—— `value_with_unit`

—— `value_list`

3.15.2 Representation

Representing a list of values is useful when a number of property values are to be gathered for a certain task. For example when a tool has several different property values for the same property and all values are possible values. It could be used when the configuration of the tool is flexible, such as three different holes that a screw could be inserted in (to define the length) depending on the usage.
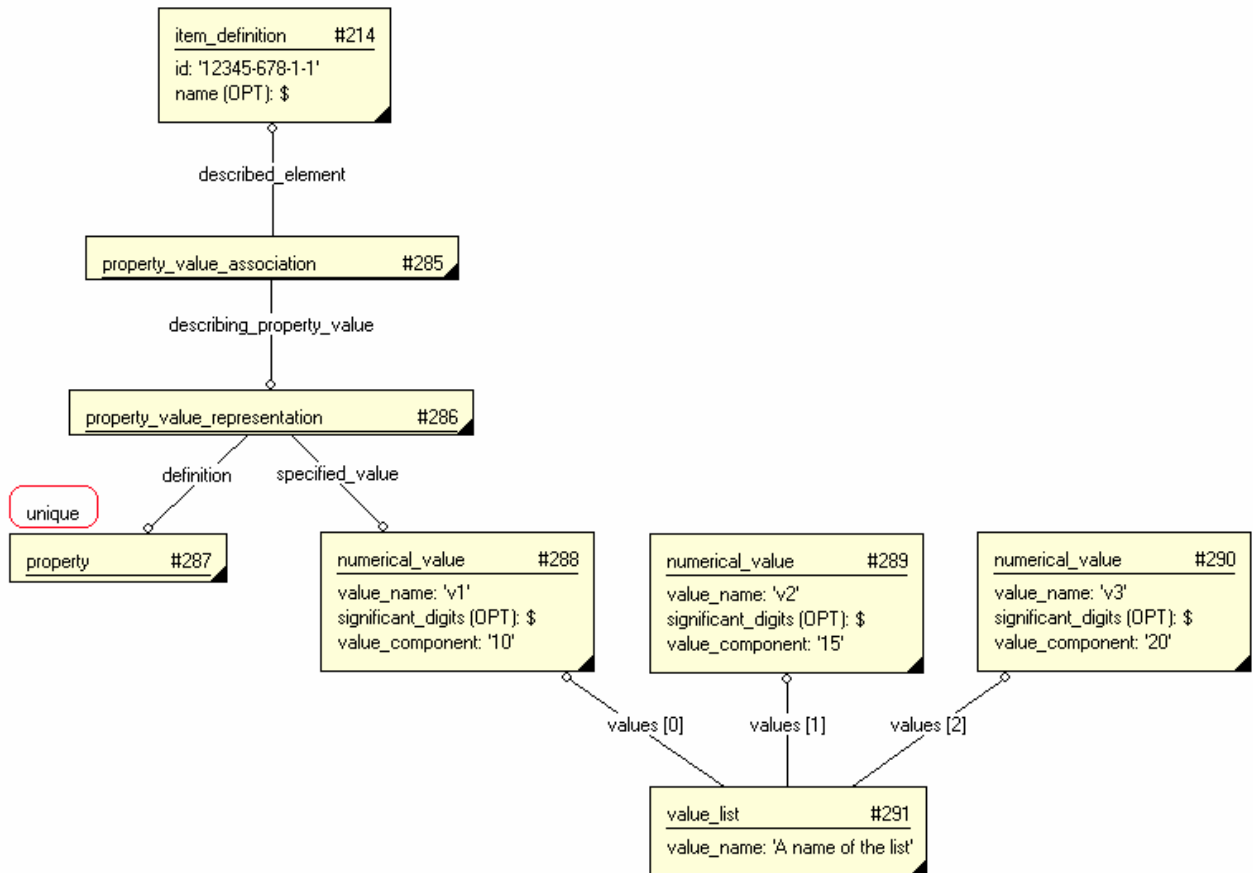
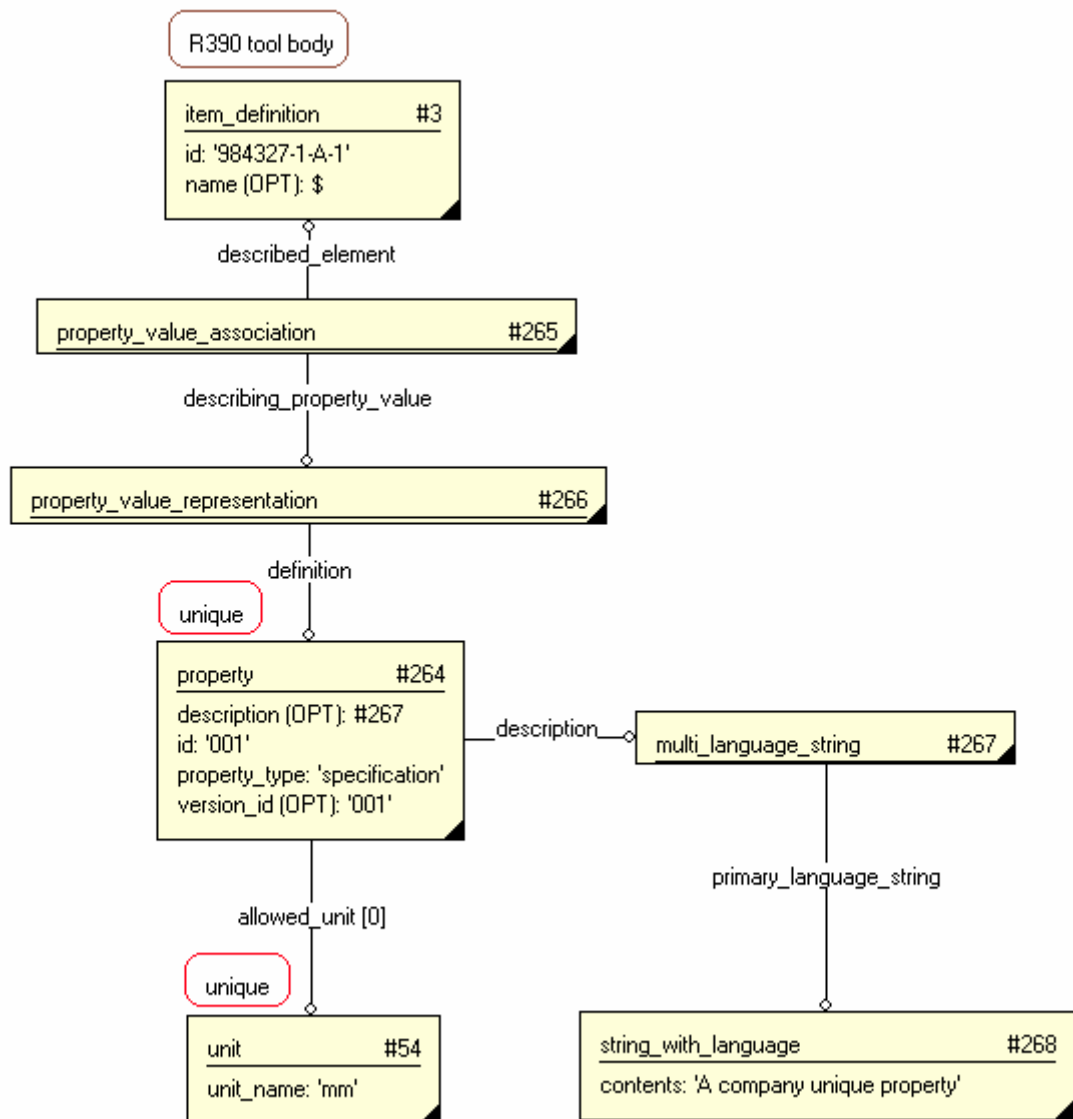**Figure 14 — Representing property value lists**

3.15.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing property value list.p21','2007-02-21T15:39:14',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#5 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108,#212),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370),'id owner');
#212 = ITEM($,'12346-678',#239);
#213 = ITEM_VERSION(#212,$,'12346-678-1');
#214 = ITEM_DEFINITION($,#213,'12345-678-1-1',$);
#239 = MULTI_LANGUAGE_STRING((),#240);
#240 = STRING_WITH_LANGUAGE('Multi purpose tool',#13);
#285 = PROPERTY_VALUE_ASSOCIATION($,#214,#286,$,$);
#286 = PROPERTY_VALUE_REPRESENTATION(#287,$,$,#288,$);
#287 = PROPERTY((),$,'/IGNORE',$,$,$);
#288 = NUMERICAL_VALUE('v1',$,$,'10');
#289 = NUMERICAL_VALUE('v2',$,$,'15');
#290 = NUMERICAL_VALUE('v3',$,$,'20');
#291 = VALUE_LIST('A name of the list',(#288,#289,#290));

ENDSEC;
END-ISO-10303-21;
```

3.16 Representing property value limitations

3.16.1 Required cutting_tool_schema entities

— `numerical_value`

— `value_limitaion`

— `plus_minus_bounds`

— `fitting_bounds`

— `limits`

3.16.2 Representation

Representing value limitations on numerical values can be done in three different ways: as a `plus_minus _bounds`, as `limits_and_fits` and as `fitting_bounds`. A `plus_minus_bounds` entity is used when the assigned numerical value is related between plus and minus limits. The `fitting_bounds` and the `limits_and_fits` entities are used mainly for fitting purposes (e.g. between holes and shafts). In the shown example the `fitting_bounds` and the `limits_and_fits` entities represent the same value. However, the `limits_and_fits` represents an ISO perspective whilst the `fitting_bounds` represents a plain numerical interpretation of the fitting. The 'connection diameter' example would look like this on a mechanical drawing: $40h7(^{+0}_{+0.025})$ where h7 is represented by `limits_and_fits`.

IMPORTANT — `limits_and_fits.fitting_type` **should have a value of either 'shaft' or 'hole', to avoid inconsistency.**
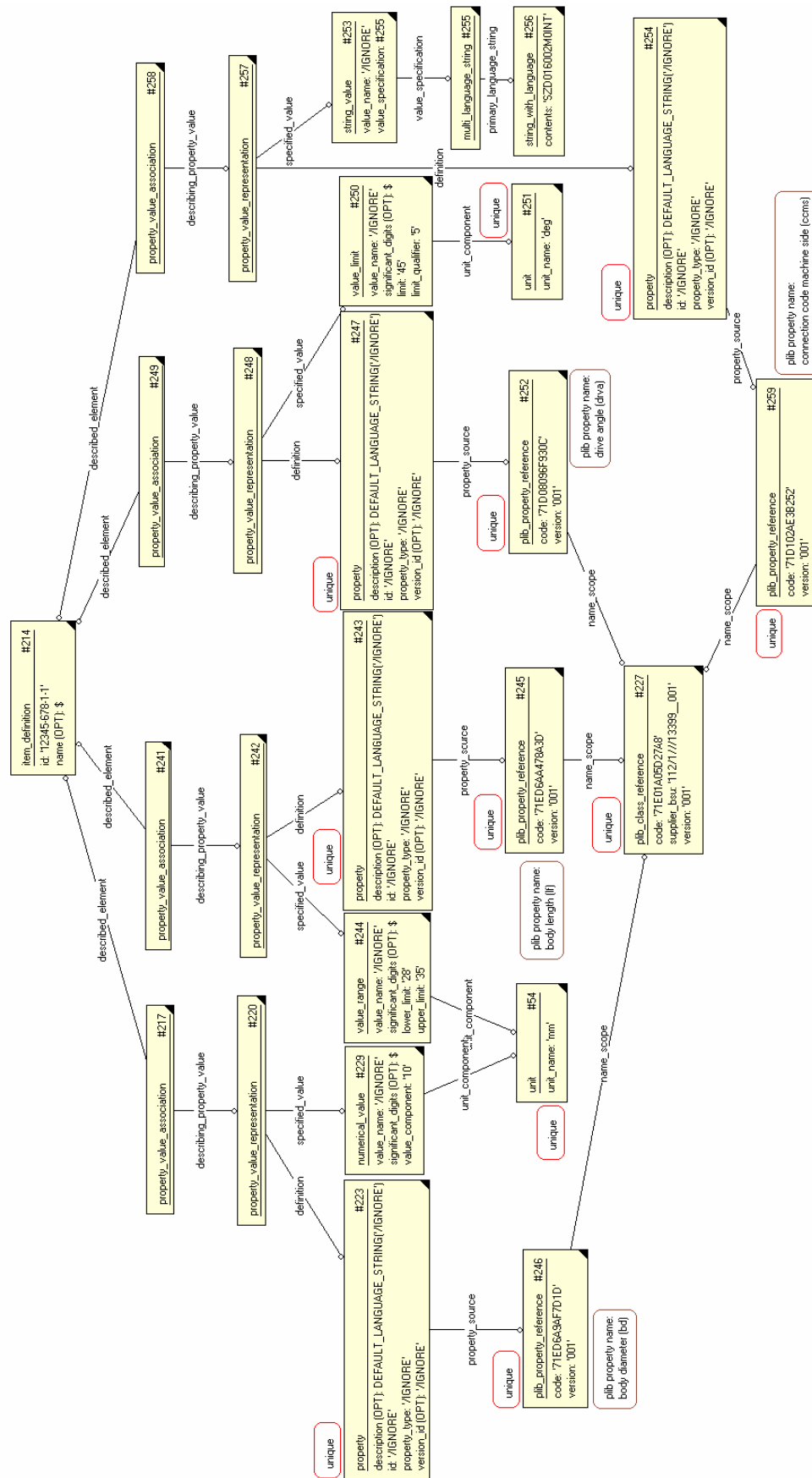
Figure 15 — Representing property value limitations

3.16.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing property value limitations.p21','2007-02-21T15:39:14',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;

#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#5 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108,#212),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370),'id owner');
#31 = PLIB_CLASS_REFERENCE('71E01A05D27A8','0112/1///13399__001','001');
#212 = ITEM($,'12346-678',#239);
#213 = ITEM_VERSION(#212,$,'12346-678-1');
#214 = ITEM_DEFINITION($,#213,'12345-678-1-1',$);
#239 = MULTI_LANGUAGE_STRING((),#240);
#240 = STRING_WITH_LANGUAGE('Multi purpose tool',#13);
#279 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#280,'/IGNORE','/IGNORE'
);
#280 = PLIB_PROPERTY_REFERENCE('71EBDBF5060E6',#31,'001');
#319 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#320,'/IGNORE','/IGNORE'
);
#320 = PLIB_PROPERTY_REFERENCE('71D08462F8185',#31,'001');
#321 = PROPERTY_VALUE_ASSOCIATION($,#214,#322,$,$);
#322 = PROPERTY_VALUE_REPRESENTATION(#319,$,$,#323,$);
#323 = NUMERICAL_VALUE($,$,$,'30');
#324 = PLUS_MINUS_BOUNDS('0.1',$,'0.05','designed');
#325 = VALUE_LIMITATION($,#324,#323);
#327 = PROPERTY_VALUE_ASSOCIATION($,#214,#328,$,$);
#328 = PROPERTY_VALUE_REPRESENTATION(#279,$,$,#329,$);
#329 = NUMERICAL_VALUE($,$,$,'40');
#330 = VALUE_LIMITATION($,#331,#329);
#331 = LIMITS_AND_FITS('h7','shaft','IT8');
#332 = VALUE_LIMITATION($,#333,#329);
#333 = FITTING_BOUNDS('-0.025',$,'0','designed');

ENDSEC;
END-ISO-10303-21;
```

3.17 Representing property value relationships based on P-Lib

3.17.1 Required cutting_tool_schema entities

⎯ property_value_representation_relationship

3.17.2 Representation

Some properties in the P-Lib reference data have dependency relationships between each other. An example of this is the property "connection diameter" which depends on the property "side".

In order to represent this information in ISO 13399, it is necessary to represent a relationship between two property_value_representation instances. These instances are the representations for "connection diameter" and "side" for a particular case.

In the example shown in Figure 16 — Representing property value relationships based on P-Lib
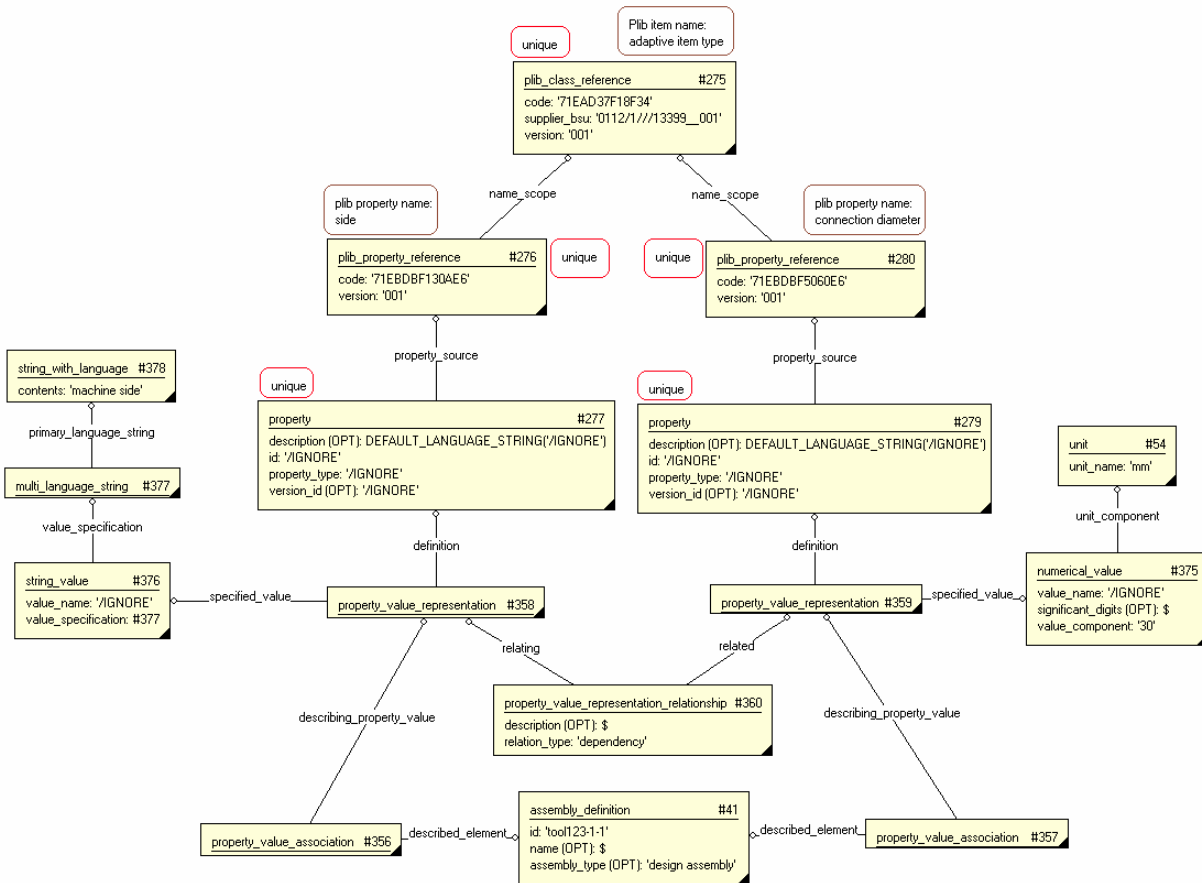
Figure 16 — Representing property value relationships based on P-Lib

3.17.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing property value relationships based on P-Lib.p21','2007-
02-21T15:39:14', ('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5
[1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370),'id owner');
#38 = ITEM(#124,'tool123',#116);
#39 = ITEM_VERSION(#38,$,'tool123-1');
#41 = ASSEMBLY_DEFINITION((),#39,'tool123-1-1',$,'design assembly');
#43 = SPECIFIC_ITEM_CLASSIFICATION((#38,#191),'assembly',$);
#54 = UNIT('mm');
#115 = STRING_WITH_LANGUAGE('R390 mill',#13);
#116 = MULTI_LANGUAGE_STRING((),#115);
#275 = PLIB_CLASS_REFERENCE('71EAD37F18F34','0112/1///13399__001','001');
#276 = PLIB_PROPERTY_REFERENCE('71EBDBF130AE6',#275,'001');
#277 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#276,'/IGNORE','/IGNORE'
);
#279 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#280,'/IGNORE','/IGNORE'
);
#280 = PLIB_PROPERTY_REFERENCE('71EBDBF5060E6',#31,'001');
#356 = PROPERTY_VALUE_ASSOCIATION($,#41,#358,$,$);
#357 = PROPERTY_VALUE_ASSOCIATION($,#41,#359,$,$);
#358 = PROPERTY_VALUE_REPRESENTATION(#277,$,$,#376,$);
#359 = PROPERTY_VALUE_REPRESENTATION(#279,$,$,#375,$);
#360 = PROPERTY_VALUE_REPRESENTATION_RELATIONSHIP($,#359,#358,'dependency');
#375 = NUMERICAL_VALUE('/IGNORE',$,#54,'30');
#376 = STRING_VALUE('/IGNORE',#377);
#377 = MULTI_LANGUAGE_STRING((),#378);
#378 = STRING_WITH_LANGUAGE('machine side',#13);
#379 = SPECIFIC_ITEM_CLASSIFICATION((#38),'adaptive item',$);

ENDSEC;
END-ISO-10303-21;
```

3.18 Representing property versions

3.18.1 Required cutting_tool_schema entities

— `property`

— `property_relationship`

3.18.2 Representation

To create new versions of a property it is suggested that the properties are tied together using `property_relationship`. The reason is that the traceability to which property version it evolves from will be stored. However, the first property version should always be treated as the master property which has all the relations to the objects it belongs to.

`property_relationship.relationship_type` should be instantiated with the value 'substitution'. This means that the property identified by `property_relationship.relating` is substituted by the property identified by `property_relationship.related`.

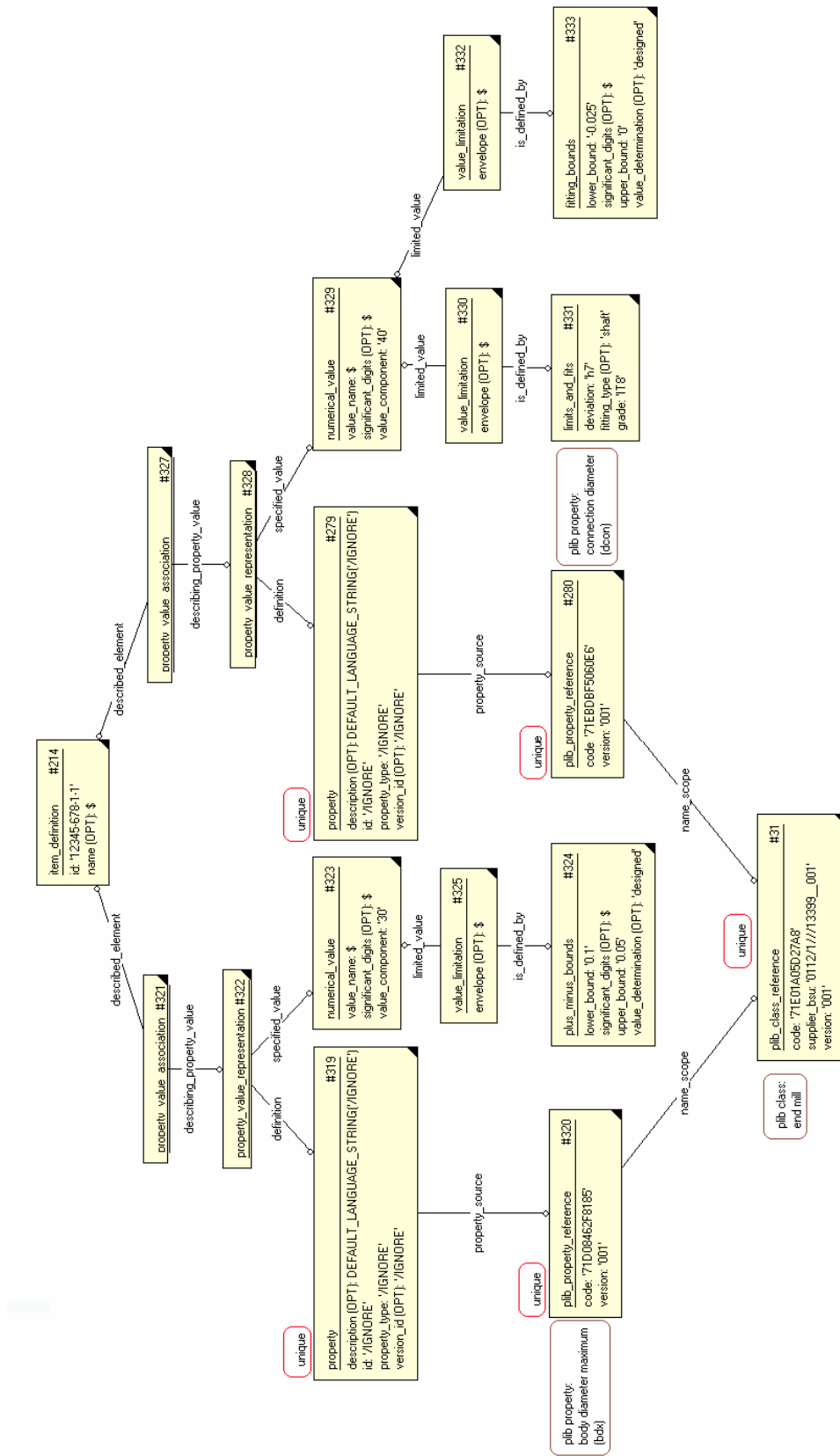**Figure 17 — Representing property versions**

3.18.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing property without external reference.p21','2007-02-
21T15:39:14', ('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#54 = UNIT('mm');
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);
#264 = PROPERTY((#54),#267,'001',$,'specification','001');
#265 = PROPERTY_VALUE_ASSOCIATION($,#3,#266,$,$);
#266 = PROPERTY_VALUE_REPRESENTATION(#264,$,$,$,$);
#267 = MULTI_LANGUAGE_STRING((),#268);
#268 = STRING_WITH_LANGUAGE('A company unique property',#13);
#271 = PROPERTY((),#273,'001',$,'specification','002');
#272 = PROPERTY_RELATIONSHIP($,#271,#264,'substitution');
#273 = MULTI_LANGUAGE_STRING((),#274);
#274 = STRING_WITH_LANGUAGE('A new version of a company unique property',#13);

ENDSEC;
END-ISO-10303-21;
```

3.19 Representing alias identification

3.19.1 Required cutting_tool_schema entities

—— alias_identification

—— organization

3.19.2 Representation

Representation of alias identifiers is used when representing identification of objects in different contexts, either in another organization, or in some other context.

The context for the alias identifier is specified either through the specification of an organization or through the description attribute.

Figure 18 — Representing alias identification

3.19.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing alias identification.p21','2007-02-21T11:46:38',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fr\S\dsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);

ENDSEC;
END-ISO-10303-21;
```

3.20 Representing assembly structure (Bill of Material)

3.20.1 Required cutting_tool_schema entities

— `assembly_association`

— `assembly_definition`

— `item_instance`

— `specific_item_classification`

3.20.2 Representation

An assembly structure is used to describe the hierarchical relationships between items, and specifying how many occurrences of an item is included in the assembly. The actual occurrence of an item is defined as an `item_instance` and is the entity used to represent a constituent of an assembly. The `assembly_association.relating` attribute identifies the parent in the assembly, and the `assembly_association.related` attribute identifies the child. If two occurrences of the same item should be represented in a structure, then two different instances of `item_instance` should be used.
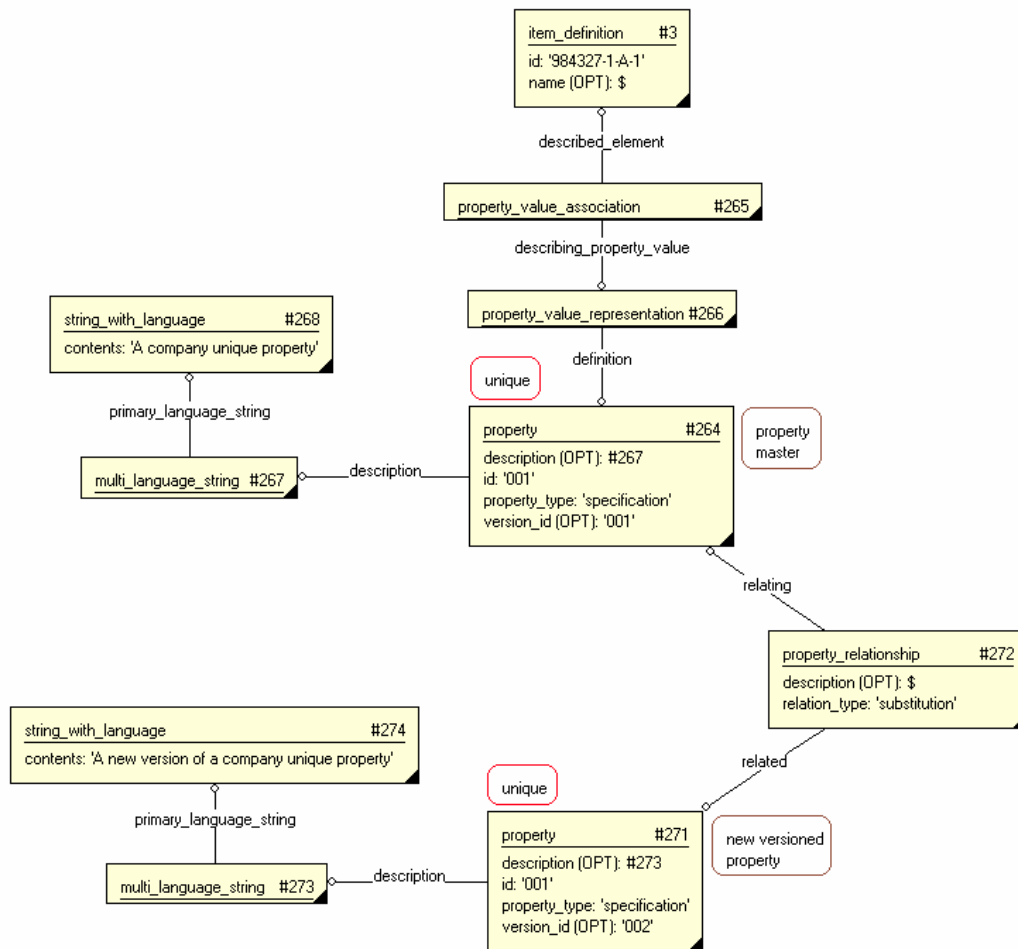
Figure 19 — Representing assembly structure

3.20.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing assembly structure.p21','2007-02-21T11:46:38',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,99,#105,#108),'detail',$);
#8 = ITEM($,'576321',#80);
#9 = ITEM_VERSION(#8,$,'576321-1-B');
#10 = ITEM_DEFINITION((),#9,'576321-1-B-1',$);
#11 = SPECIFIC_ITEM_CLASSIFICATION((#8),'cutting item',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#38 = ITEM(#124,'tool123',#116);
#39 = ITEM_VERSION(#38,$,'tool123-1');
#41 = ASSEMBLY_DEFINITION((),#39,'tool123-1-1',$,'design assembly');
#43 = SPECIFIC_ITEM_CLASSIFICATION((#38),'assembly',$);
#44 = ITEM_INSTANCE(#3,#90,'984327-1-A-1-1');
#45 = ASSEMBLY_ASSOCIATION(#161,#44,#41);
#46 = ITEM_INSTANCE(#10,#94,'576321-1-B-1-1');
#47 = ITEM_INSTANCE(#10,#92,'576321-1-B-1-2');
#49 = ASSEMBLY_ASSOCIATION($,#46,#41);
#50 = ASSEMBLY_ASSOCIATION(#162,#47,#41);
#71 = ITEM_DEFINITION($,#70,'8327-1-1',$);
#72 = SPECIFIC_ITEM_CLASSIFICATION((#69),'assembly item',$);
#75 = ITEM_INSTANCE(#71,#98,'8327-1-1-1');
#76 = ITEM_INSTANCE(#71,#97,'8327-1-1-2');
#89 = STRING_WITH_LANGUAGE('instance of R390 tool body',#13);
#90 = MULTI_LANGUAGE_STRING((),#89);
#91 = STRING_WITH_LANGUAGE('instance 2 of R390 insert',#13);
#92 = MULTI_LANGUAGE_STRING((),#91);
#93 = STRING_WITH_LANGUAGE('instance 1 of R390 insert',#13);
#94 = MULTI_LANGUAGE_STRING((),#93);
#95 = STRING_WITH_LANGUAGE('instance 1 of insert screw',#13);
#96 = STRING_WITH_LANGUAGE('instance 2 of insert screw',#13);
#97 = MULTI_LANGUAGE_STRING((),#96);
#98 = MULTI_LANGUAGE_STRING((),#95);
#115 = STRING_WITH_LANGUAGE('R390 mill',#13);
#116 = MULTI_LANGUAGE_STRING((),#115);

ENDSEC;
END-ISO-10303-21;
```

3.21 Representing mating structure

3.21.1 Required cutting_tool_schema entities

— `item_instance`

— `mated_item_relationship`

— `mating_association`

— `mating_definition`

3.21.2 Representation

A mating structure describes how different items in a structure are mated, i.e. which method and component is used in the mating of two or more items. A `mating_definition` represents one mating of an assembled item. The relationship between the parent (`mating_definition`) and children (`item_instance`) in the mating is represented using `mating_association`. A `mated_item_relationship`, which relates two `mating_associations` to each other, represents a mating surface where two parts are in contact. The attribute `mated_item_relationship.mating_material` specifies the material that is used to realise the mating. A `quantified_instance` is used to specify a `mating_material` such as glue where the quantity is not specified by multiple instances, but rather by a quantity with a value and a unit.

An item may have more than one `mating_definition` where each `mating_defnition` represents a separate mating.

If a `mating_definition` has more than two `mating_associations` then the `mated_item_relationship` indicates which items are in contact with each other but the different `mated_item_realtionship.mating_material` will point to the same `item_instance`.

IMPORTANT — A mating structure is only described for an item that already has an assembly structure. All instances in a mating structure shall be the same instances as in the assembly structure.

© ISO 2008 – All rights reserved
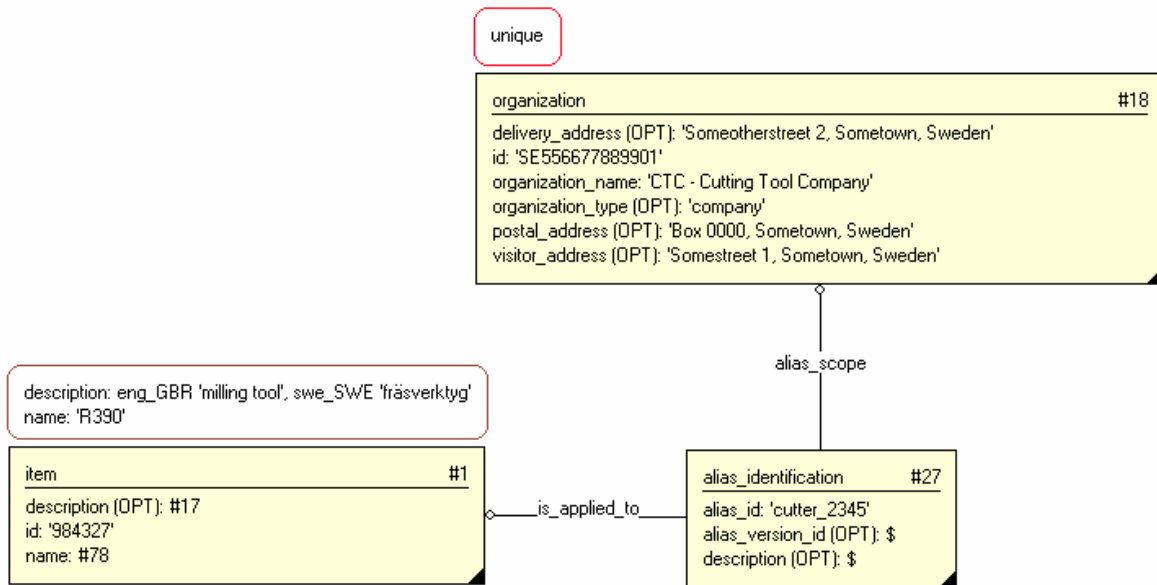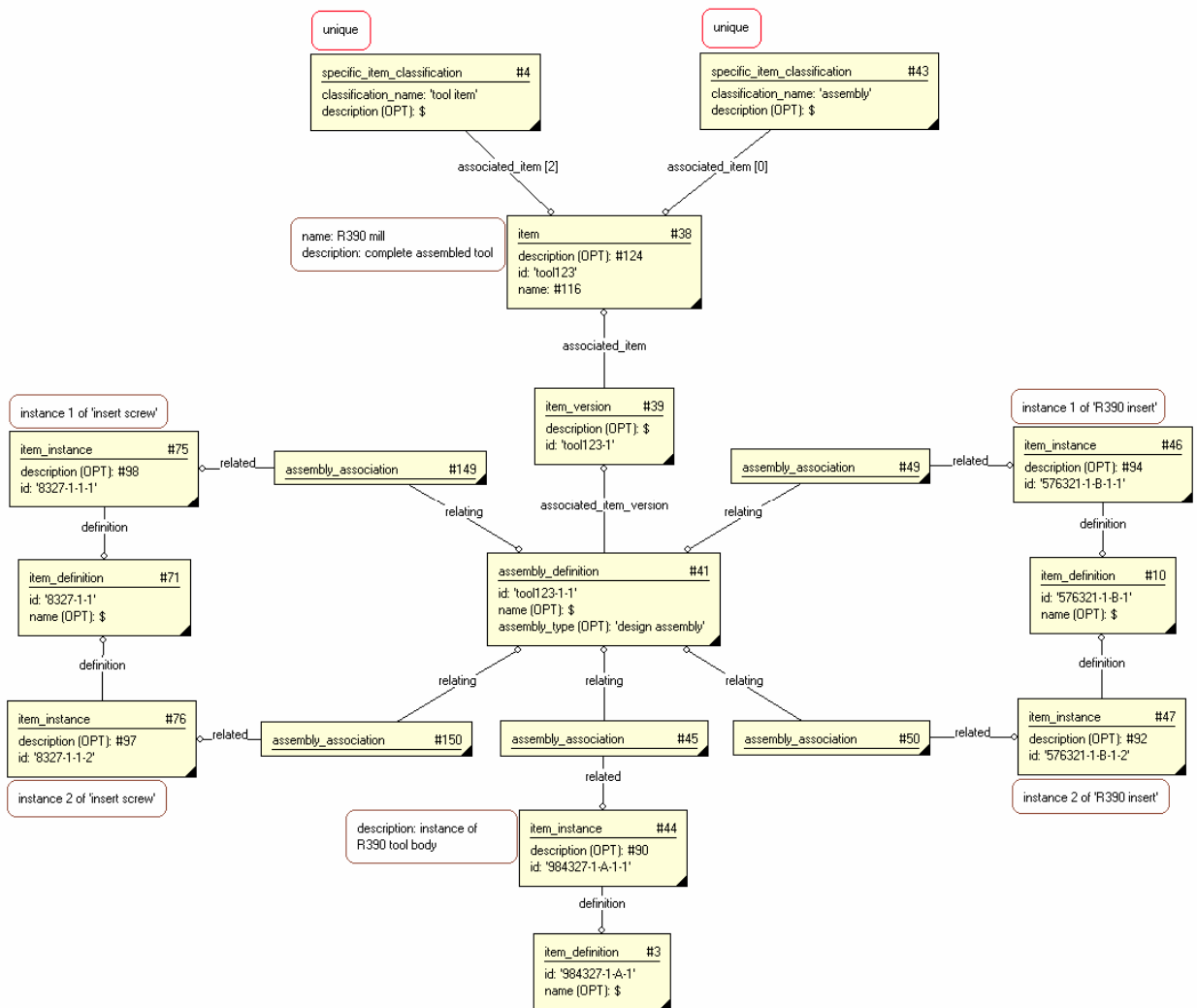
Not for Resale

39

Figure 20 — Representing mating structure

3.21.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing mating structure.p21','2007-02-21T11:46:38',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#8 = ITEM($,'576321',#80);
#9 = ITEM_VERSION(#8,$,'576321-1-B');
#10 = ITEM_DEFINITION((),#9,'576321-1-B-1',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#38 = ITEM(#124,'tool123',#116);
#39 = ITEM_VERSION(#38,$,'tool123-1');
#41 = ASSEMBLY_DEFINITION((),#39,'tool123-1-1',$,'design assembly');
#43 = SPECIFIC_ITEM_CLASSIFICATION((#38),'assembly',$);
#44 = ITEM_INSTANCE(#3,#90,'984327-1-A-1-1');
#46 = ITEM_INSTANCE(#10,#94,'576321-1-B-1-1');
#47 = ITEM_INSTANCE(#10,#92,'576321-1-B-1-2');
#61 = MATING_DEFINITION($,#39,'tool123-1-2',$,'bolted joint');
#62 = MATING_DEFINITION($,#39,'tool123-1-3',$,'bolted joint');
#63 = MATING_ASSOCIATION($,#44,#61);
#64 = MATING_ASSOCIATION($,#46,#61);
#65 = MATING_ASSOCIATION($,#44,#62);
#66 = MATING_ASSOCIATION($,#47,#62);
#67 = MATED_ITEM_RELATIONSHIP((#75),#64,#63);
#68 = MATED_ITEM_RELATIONSHIP((#76),#66,#65);
#71 = ITEM_DEFINITION($,#70,'8327-1-1',$);
#75 = ITEM_INSTANCE(#71,#98,'8327-1-1-1');
#76 = ITEM_INSTANCE(#71,#97,'8327-1-1-2');
#89 = STRING_WITH_LANGUAGE('instance of R390 tool body',#13);
#90 = MULTI_LANGUAGE_STRING((),#89);
#91 = STRING_WITH_LANGUAGE('instance 2 of R390 insert',#13);
#92 = MULTI_LANGUAGE_STRING((),#91);
#95 = STRING_WITH_LANGUAGE('instance 1 of insert screw',#13);
#96 = STRING_WITH_LANGUAGE('instance 2 of insert screw',#13);
#97 = MULTI_LANGUAGE_STRING((),#96);
#98 = MULTI_LANGUAGE_STRING((),#95);

ENDSEC;
END-ISO-10303-21;
```

3.22 Representing relationships between different versions of an item

3.22.1 Required cutting_tool_schema entities

—— `item_version_relationship`

3.22.2 Representation

When representing multiple versions of an `item`, all `item_version` entities are related to the same `item`. There may also be an `item_version_relationship` entity that relates the different versions to each other. The type of relationship is indicated using the `item_version_relationship.relation_type` attribute. In the case described here, where the `item_version` entities are related to the same item there are two types of relationships:

—— "hierarchy" and

—— "sequence"

IMPORTANT — There may only be one item_version_relationship between any two item_version entities.
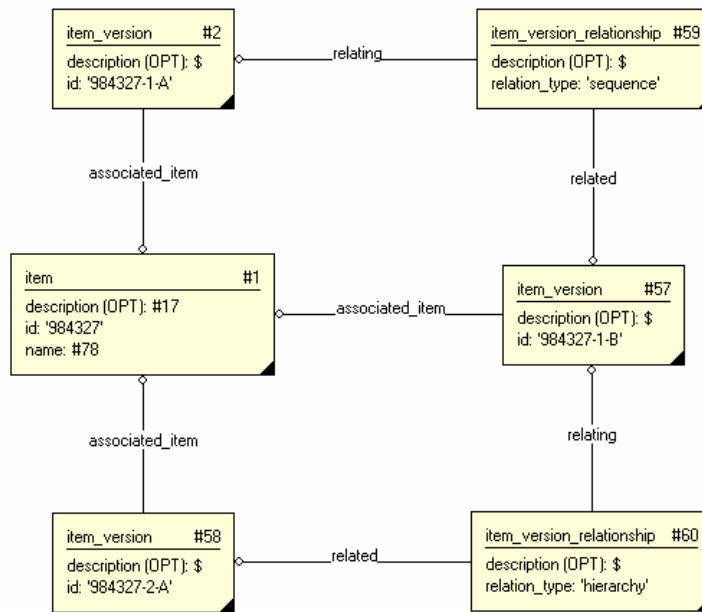
Figure 21 — Representing multiple versions

As shown in the example the following structure of versions is described:

984327-1-A   →   984327-1-B

                                ↓

                     984327-2-A
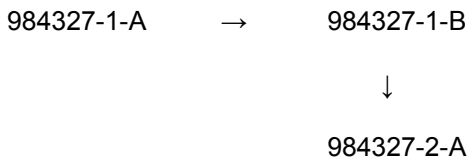
3.22.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing multiple versions.p21','2007-02-21T11:46:38',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108)'detail',$);
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fr\S\dsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#57 = ITEM_VERSION(#1,$,'984327-1-B');
#58 = ITEM_VERSION(#1,$,'984327-2-A');
#59 = ITEM_VERSION_RELATIONSHIP($,#57,#2,'sequence');
#60 = ITEM_VERSION_RELATIONSHIP($,#58,#57,'hierarchy');
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);

ENDSEC;
END-ISO-10303-21;
```

3.23 Representing derived relationship between different item_versions

3.23.1 Required cutting_tool_schema entities

— item_version_relationship

3.23.2 Representation

An item_version_relationship with a relation_type attribute of 'derived' is used to represent that the item_version_relationship.related item_version is derived from the item_version_relationship.relating item_version. This means that the related item_version belongs to a different item than the relating item_version, but is based on the latter.

Normal item_version_relationships, as described in Section 3.22 Representing relationships between different versions of an item, describe sequential or hierarchical relationships of different version of the same item. In this case, as stated previously, the versions belong to different items.
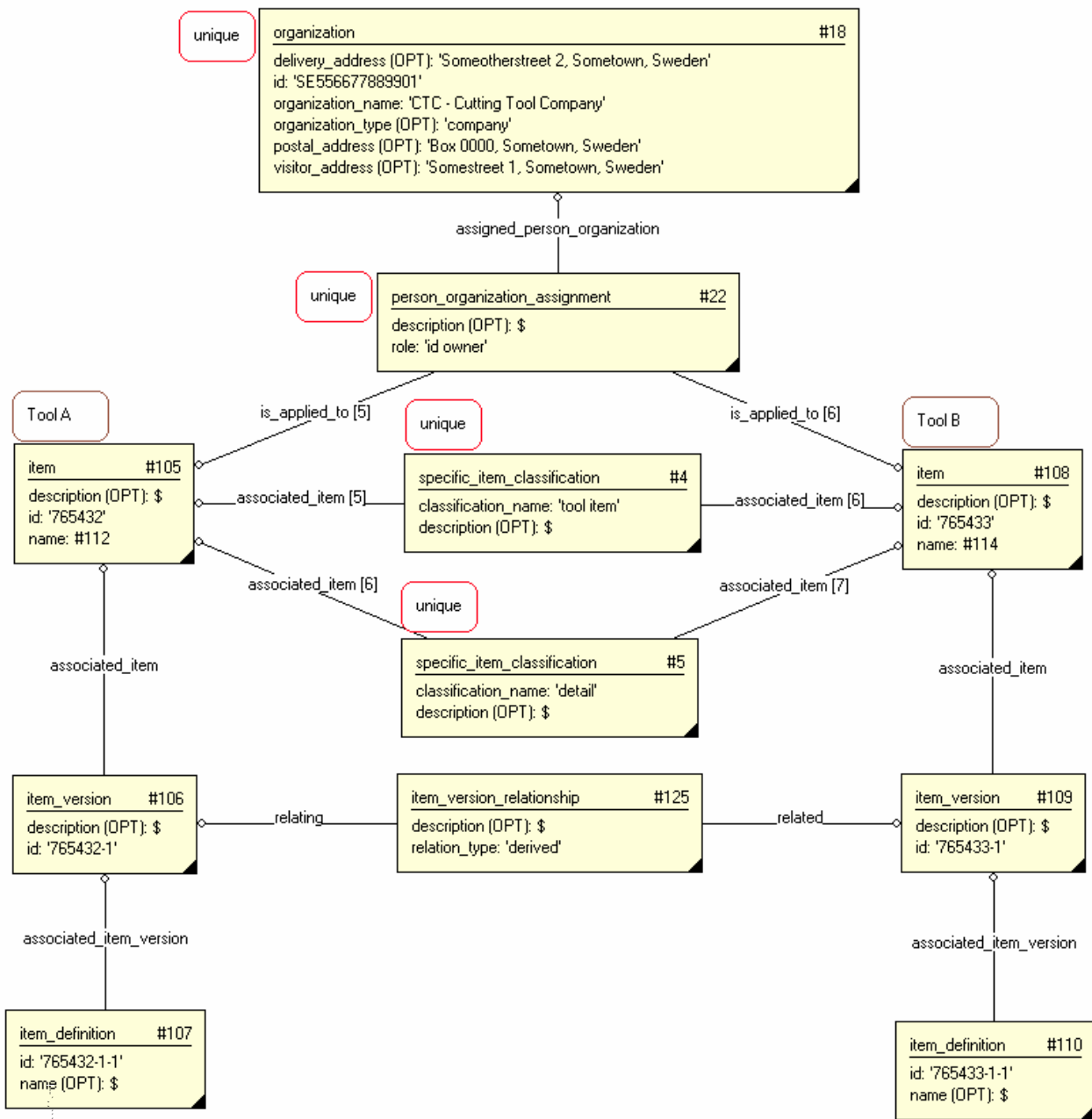
Figure 22 — Representing derived relationship between different item versions
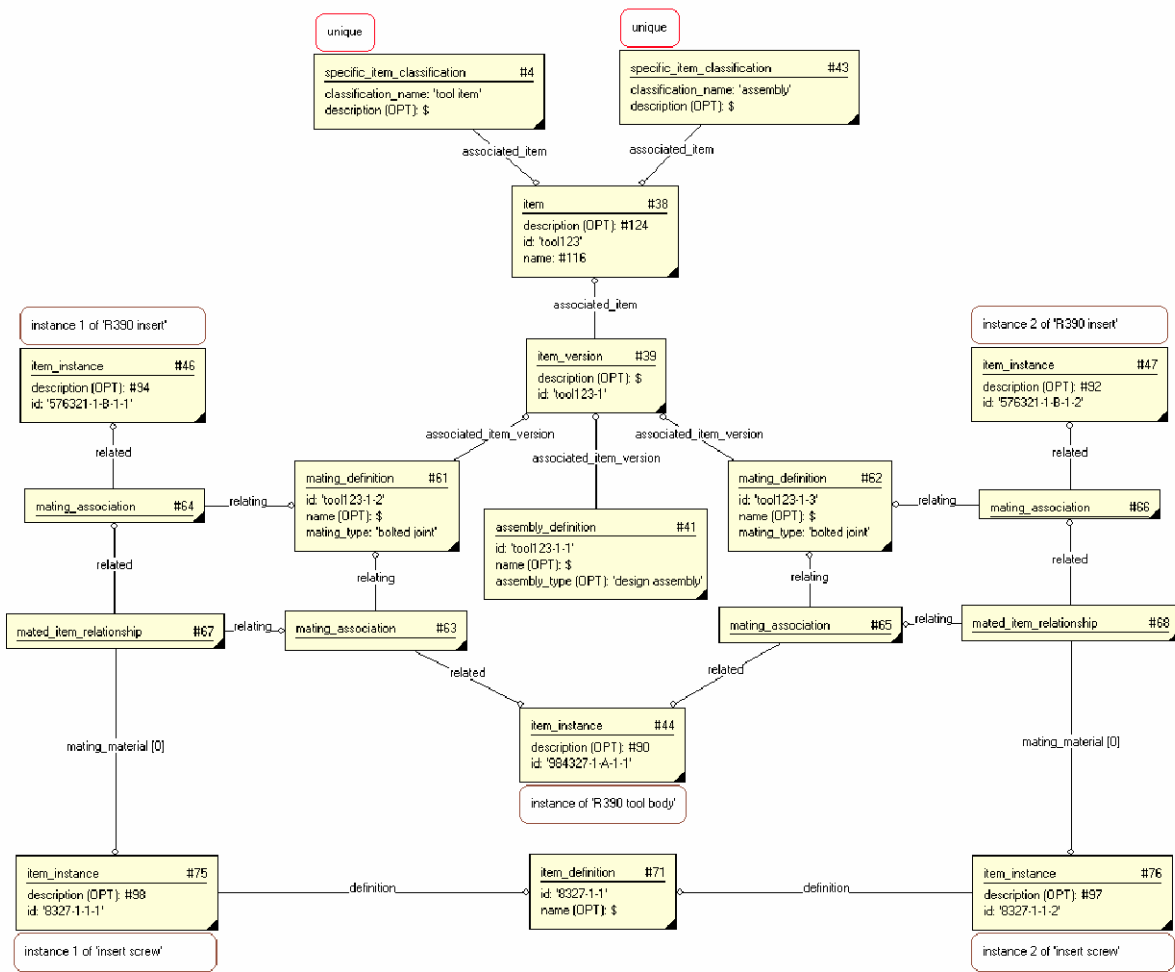
3.23.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing derived relationship between different item
version.p21','2007-02-21T11:46:38', ('someone'),(''),'', 'GraphicalInstance 1.0
Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#105 = ITEM($,'765432',#112);
#106 = ITEM_VERSION(#105,$,'765432-1');
#107 = ITEM_DEFINITION($,#106,'765432-1-1',$);
#108 = ITEM($,'765433',#114);
#109 = ITEM_VERSION(#108,$,'765433-1');
#110 = ITEM_DEFINITION($,#109,'765433-1-1',$);
#111 = STRING_WITH_LANGUAGE('Tool A',#13);
#112 = MULTI_LANGUAGE_STRING((),#111);
#113 = STRING_WITH_LANGUAGE('Tool B',#13);
#114 = MULTI_LANGUAGE_STRING((),#113);
#125 = ITEM_VERSION_RELATIONSHIP($,#109,#106,'derived');

ENDSEC;
END-ISO-10303-21;
```

3.24 Representing supplied relationship between different item_versions

3.24.1 Required cutting_tool_schema entities

3.24.2 Representation

An `item_version_relationship` with a `relation_type` attribute of 'supplied' is used to represent that the `item_version_relationship.related item_version` is an item supplied by another organization, and that the `item_version_relationship.relating item_version` is the representation of the item in the context of the supplying organization.

This representation is different from the use of alias identification, it is used when an item should have its own identity and be part of product structures within the receiving organization. Alias identification is a simpler representation where the desired effect is simply to have a different id of an item.

Normal `item_version_relationships`, as described in Section 3.22 Representing relationships between different versions of an item, describe sequential or hierarchical relationships of different version of the same item. In this case, as stated previously, the versions belong to items in different organizations
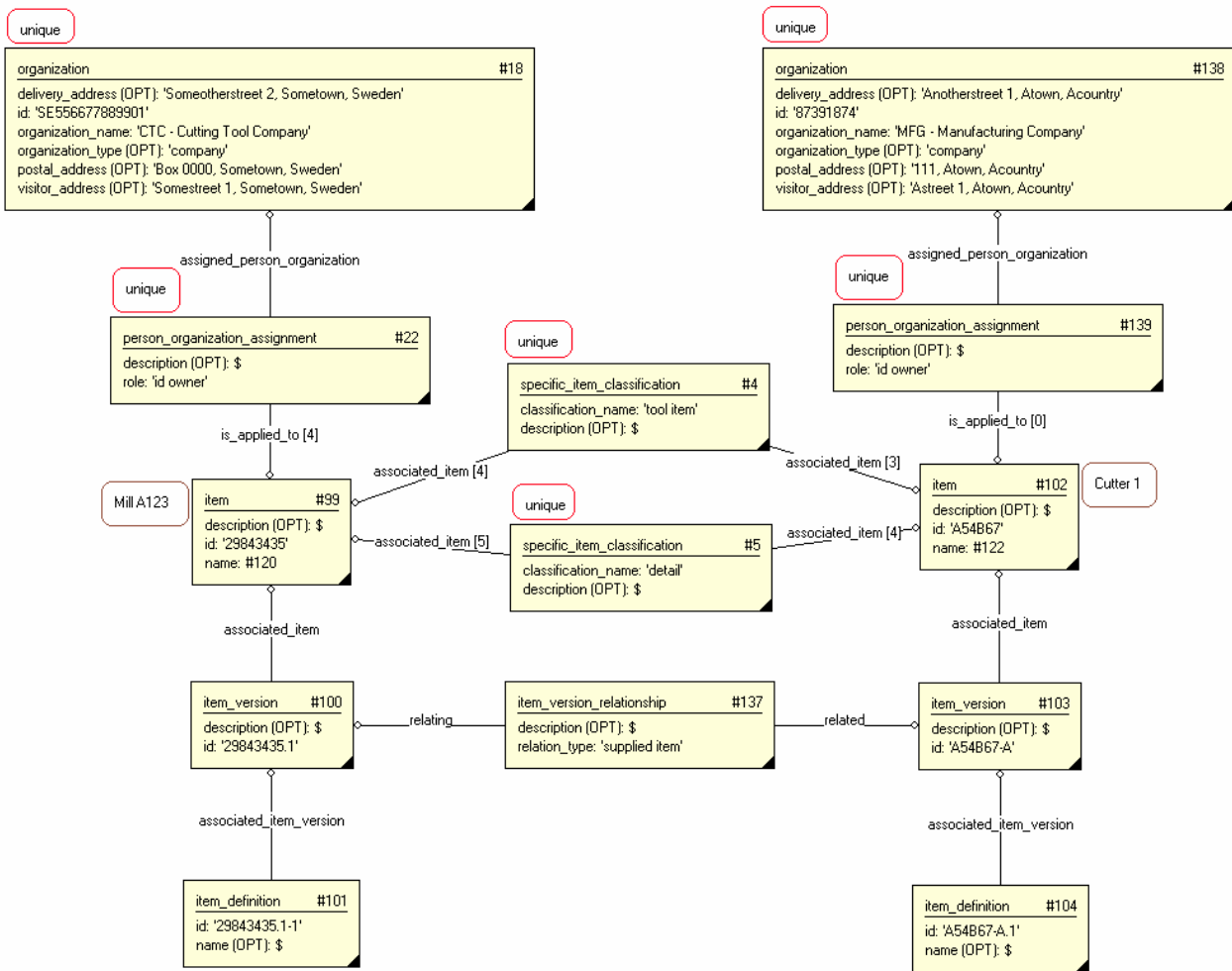
Figure 23 — Representing supplied relationship between item versions

3.24.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing supplied relationship between item versions.p21','2007-
02-21T11:46:38', ('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5
[1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#99 = ITEM($,'29843435',#120);
#100 = ITEM_VERSION(#99,$,'29843435.1');
#101 = ITEM_DEFINITION($,#100,'29843435.1-1',$);
```

```
#102 = ITEM($,'A54B67',#122);
#103 = ITEM_VERSION(#102,$,'A54B67-A');
#104 = ITEM_DEFINITION($,#103,'A54B67-A.1',$);
#119 = STRING_WITH_LANGUAGE('Mill A123',#13);
#120 = MULTI_LANGUAGE_STRING((),#119);
#121 = STRING_WITH_LANGUAGE('Cutter 1',#13);
#122 = MULTI_LANGUAGE_STRING((),#121);
#137 = ITEM_VERSION_RELATIONSHIP($,#103,#100,'supplied item');
#138 = ORGANIZATION('Anotherstreet 1, Atown, Acountry','87391874','MFG -
Manufacturing Company','company','111, Atown, Acountry','Astreet 1, Atown,
Acountry');
#139 = PERSON_ORGANIZATION_ASSIGNMENT(#138,$,(#102),'id owner');

ENDSEC;
END-ISO-10303-21;
```

3.25 Representing multiple views or functions

3.25.1 Required cutting_tool_schema entities

— `classification_association`

— `general_classification`

— `item_defintion`

— `plib_class_reference`

— `plib_property_reference`

— `property`

— `property_value` (numerical_value, string_value, value_list, value_range, value_limit)

— `property_value_association`

— `property_value_representation`

— `unit`

3.25.2 Representation

Representing multiple functions of a tool requires multiple `item_definition` instances. The example in Figure 24 — Representation of a tool with multiple functions shows a tool with three different functions; two turning functions and one milling function.

NOTE   Different functions can have the same property definitions with different values. It is also possible for different functions to have the same property value as well.

In this example, all functions have a functional length, but the value is different for each of the functions.

IMPORTANT — Because of the different name scope of functional length, in the context of end mill and boring bar, it is necessary to have two instances of `property` that identify different instances of `plib_property_reference` that in turn have their own `plib_class_reference`.
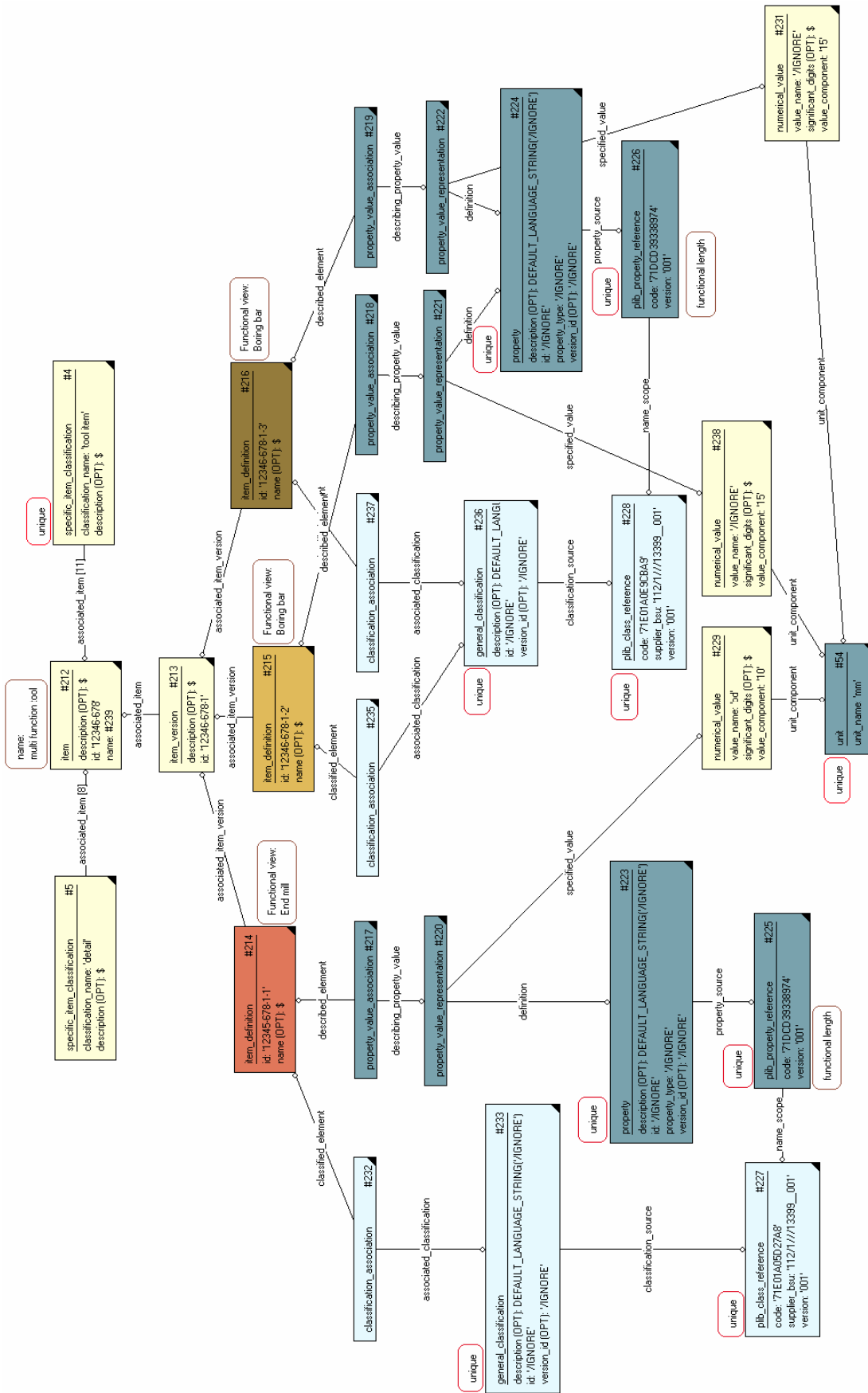
Figure 24 — Representation of a tool with multiple functions

3.25.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing multiple views or functions.p21','2007-02-21T11:46:38',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370,#
212,#376),'tool item',$);
#5 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108,#212),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370),'id owner');
#54 = UNIT('mm');
#212 = ITEM($,'12346-678',#239);
#213 = ITEM_VERSION(#212,$,'12346-678-1');
#214 = ITEM_DEFINITION($,#213,'12345-678-1-1',$);
#215 = ITEM_DEFINITION($,#213,'12346-678-1-2',$);
#216 = ITEM_DEFINITION($,#213,'12346-678-1-3',$);
#217 = PROPERTY_VALUE_ASSOCIATION($,#214,#220,$,$);
#218 = PROPERTY_VALUE_ASSOCIATION($,#215,#221,$,$);
#219 = PROPERTY_VALUE_ASSOCIATION($,#216,#222,$,$);
#220 = PROPERTY_VALUE_REPRESENTATION(#223,$,$,#229,$);
#221 = PROPERTY_VALUE_REPRESENTATION(#224,$,$,#238,$);
#222 = PROPERTY_VALUE_REPRESENTATION(#224,$,$,#231,$);
#223 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#246,'/IGNORE','/IGNORE'
);
#224 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#226,'/IGNORE','/IGNORE'
);
#225 = PLIB_PROPERTY_REFERENCE('71DCD39338974',#227,'001');
#226 = PLIB_PROPERTY_REFERENCE('71DCD39338974',#228,'001');
#227 = PLIB_CLASS_REFERENCE('71E01A05D27A8','112/1///13399__001','001');
#228 = PLIB_CLASS_REFERENCE('71E01A0E9CBA9','112/1///13399__001','001');
#229 = NUMERICAL_VALUE('/IGNORE',$,#54,'10');
#231 = NUMERICAL_VALUE('/IGNORE',$,#54,'15');
#232 = CLASSIFICATION_ASSOCIATION(#233,#214,$,$);
#233 =
GENERAL_CLASSIFICATION(#227,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNO
RE');
#235 = CLASSIFICATION_ASSOCIATION(#236,#215,$,$);
#236 =
GENERAL_CLASSIFICATION(#228,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNO
RE');
#237 = CLASSIFICATION_ASSOCIATION(#236,#216,$,$);
#238 = NUMERICAL_VALUE('/IGNORE',$,#54,'15');
#239 = MULTI_LANGUAGE_STRING((),#240);
#361 = MULTI_LANGUAGE_STRING((),#362);
#362 = STRING_WITH_LANGUAGE('multi function tool',#13);

ENDSEC;
END-ISO-10303-21;
```

3.26 Representing effectivity

3.26.1 Required cutting_tool_schema entities

—— `date_time`

—— `duration`

—— `effectivity`

—— `effectivity_assignment`

—— `item_version (from effectivity_element_select)`

—— `organization`

3.26.2 Representation

`effectivity` is used to represent the valid use of an aspect of product data, tracked by date or time. Representing the `effectivity` of something is only accurate with a defined time scope. In Figure 25 — Representing effectivity, the `effectivity` is set on an `item_version`, using a start date (`effectivity.start_definition`) and a period (`duration`).

IMPORTANT — An `effectivity` can not have an unspecified start time, it must be specified either by start date or by period and end date.

IMPORTANT — An instance of `effectivity` may define a period of ineffectivity, i.e., of invalid use. If ineffectivity is defined, the attribute `effectivity_assignment.effectivity_indication` must be set to FALSE (.F.).

Figure 25 — Representing effectivity

3.26.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing                    effectivity.p21','2007-01-30T11:12:43',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.12]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fräsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#196 = EFFECTIVITY((#18),$,$,$,$,#197,#198,$);
#197 = DURATION('130','day');
#198 = DATE_TIME('2007-01-30',$);
#199 = EFFECTIVITY_ASSIGNMENT(#196,#2,.T.,'planned');

ENDSEC;
END-ISO-10303-21;
```

3.27 Representing effectivity relationships

3.27.1 Required cutting_tool_schema entities

—— `date_time`

—— `duration`

—— `effectivity`

—— `effectivity_assignment`

—— `effectivity_relationship`

—— `item_version` (**from** `effectivity_element_select`)

—— `organization`

3.27.2 Representation

Representing effectivity relationships is used when the effectivity on one object is dependent upon the effectivity of another object. For example, one cutting item version is valid (or invalid) as long as the tool item version is valid (shown in example).

NOTE Sometimes the `effectivity` is not dependent on particular dates but on the `effectivity` of other items. In this case the dates are not instantiated and there is an `effectivity_relationship` to the referenced `effectivity`.

IMPORTANT — An instance of `effectivity` may define a period of ineffectivity, i.e., of invalid use. If ineffectivity is defined, the attribute `effectivity_assignment.effectivity_indication` must be set to FALSE (.F.).

The attribute `relation_type` is used to describe the meaning of the `effectivity_relationship`. The following values shall be used where applicable:

— 'constraint': The time period between the start and end definition of the related `effectivity` shall be within the time period of the relating `effectivity`;

— 'inheritance': The related `effectivity` shall not have a '`start_definition`' and '`end_definition`' specified but inherits the effectivity dates from the relating `effectivity`.
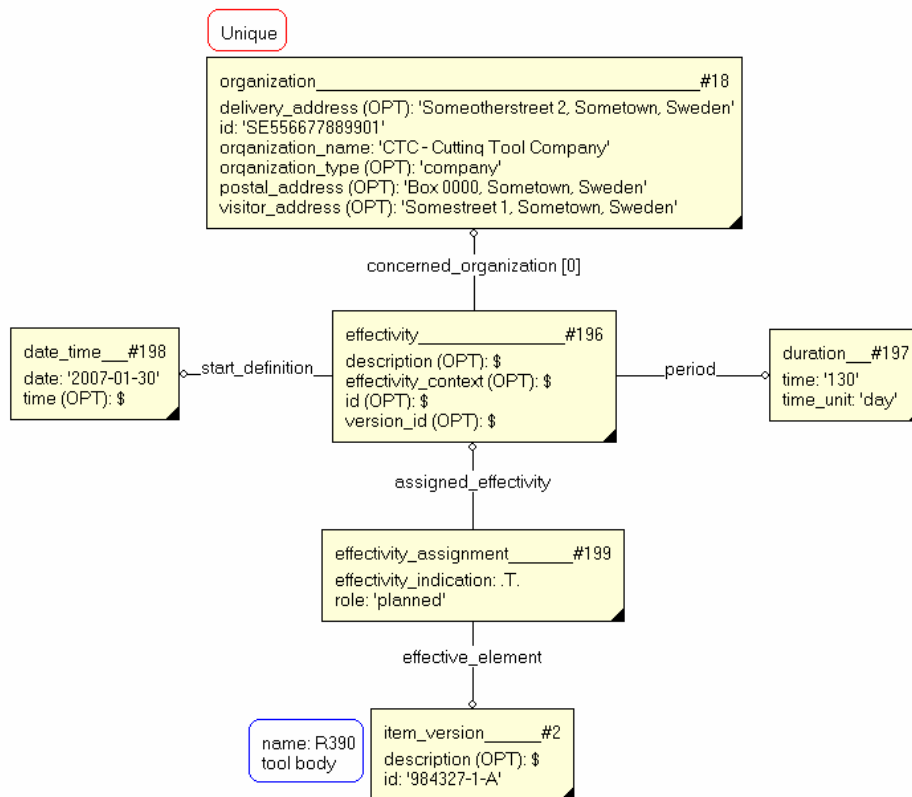

Figure 26 — Representing effectivity relationships

3.27.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing  effectivity  relationships.p21','2007-01-30T12:54:21',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.12]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#9 = ITEM_VERSION(#8,$,'576321-1-B');
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fräsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108),'id
owner');
#196 = EFFECTIVITY((#18),$,$,$,$,#197,#198,$);
#197 = DURATION('130','day');
#198 = DATE_TIME('2007-01-30',$);
#199 = EFFECTIVITY_ASSIGNMENT(#196,#2,.T.,'planned');
#200 = EFFECTIVITY((),$,$,$,$,$,$,$);
#201 = EFFECTIVITY_RELATIONSHIP($,#200,#196,'inheritance');
#202 = EFFECTIVITY_ASSIGNMENT(#200,#9,.T.,'planned');

ENDSEC;
END-ISO-10303-21;
```

3.28 Representing compatible relationship between items

3.28.1 Required cutting_tool_schema entities

—— `item`

—— `item_definition`

—— `item_definition_relationship`

—— `item_version`

—— `specific_item_classification`

3.28.2 Representation

A compatible relationship between two items means that they are explicitly compatible with each other. It is common to use implicit interface codes to describe compatibility, the mechanism described here offers an alternative, through which the items are explicitly related to each other. This representation should not be used for representing whether or not two items are substitutable, but rather to represent that two items have an interface to each other and are compatible (e.g. between cutting item and tool item, or between tool item and adaptive item).

Figure 27 — Representing compatible relationship

3.28.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing compatible relationship.p21','2007-02-20T12:58:16',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#8 = ITEM($,'576321',#80);
#9 = ITEM_VERSION(#8,$,'576321-1-B');
#10 = ITEM_DEFINITION((),#9,'576321-1-B-1',$);
#11 = SPECIFIC_ITEM_CLASSIFICATION((#8),'cutting item',$);
#12 = ITEM_DEFINITION_RELATIONSHIP(#82,#10,#3,'compatible');
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fr\S\dsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);#77 = STRING_WITH_LANGUAGE('R390',#13);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE5566778899901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#364,#370),
'id owner');
#78 = MULTI_LANGUAGE_STRING((),#77);
#79 = STRING_WITH_LANGUAGE('R390 insert',#13);
#80 = MULTI_LANGUAGE_STRING((),#79);

ENDSEC;
END-ISO-10303-21;
```

3.29 Representing substitutable relationship between items

3.29.1 Required cutting_tool_schema entities

—— `item`

—— `item_definition`

—— `item_definition_relationship`

—— `item_version`

—— `specific_item_classification`

3.29.2 Representation

Representing a substitutable relationship between items means that a cutting tool is explicitly substitutable with the other tool being selected. This representation shall be used for describing if an item of the same `specific_item_classification`., e.g. a cutting item, may be substituted for another item.
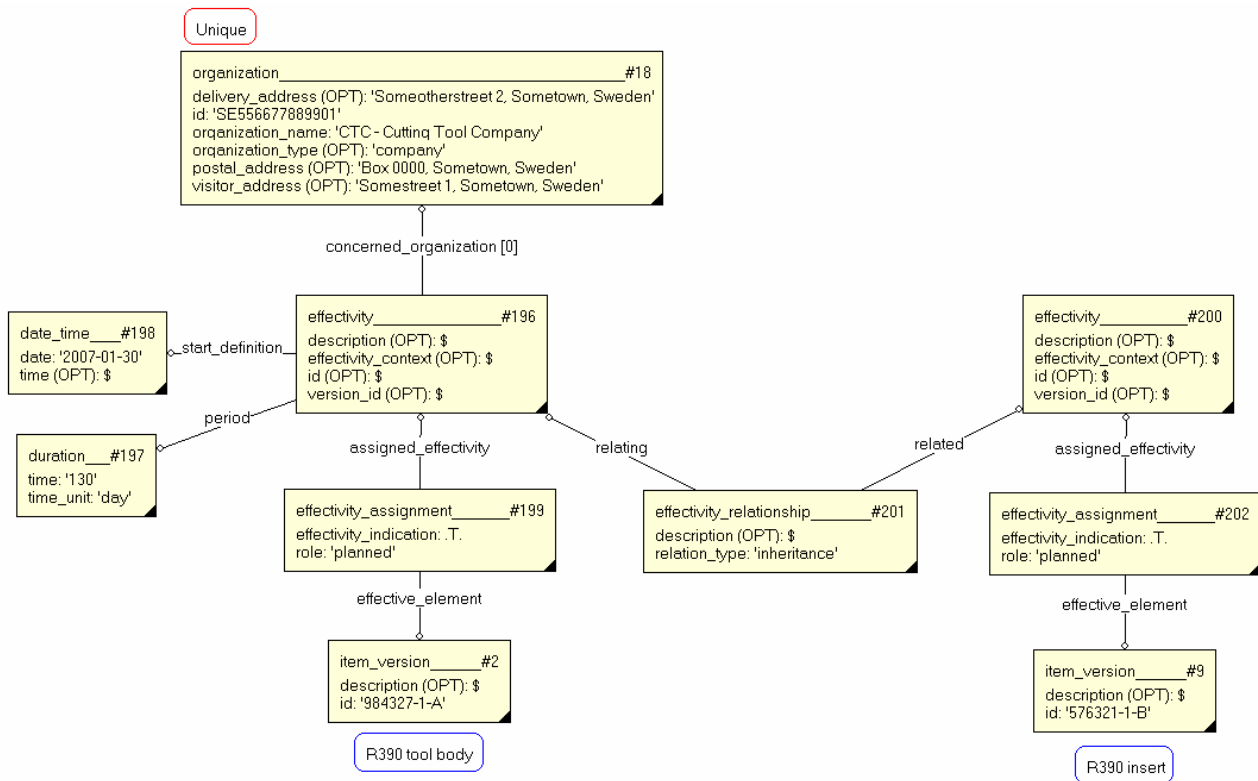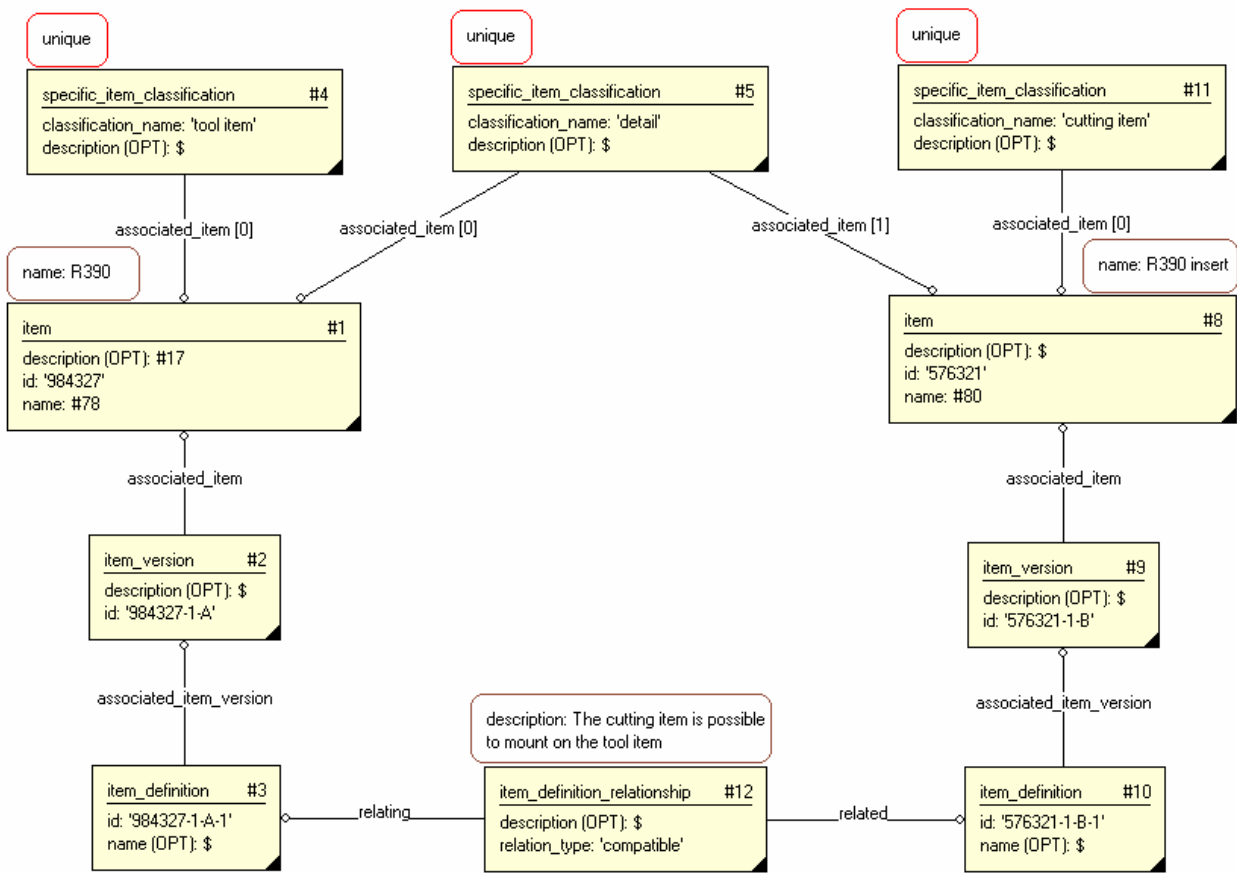
Figure 28 — Representing substitutable relationship

3.29.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing substitutable relationship.p21','2007-02-20T12:58:16',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fr\S\dsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#364,#370),
'id owner');
#23 = ITEM(#118,'63214871',#118);
#24 = ITEM_VERSION(#23,$,'63214871-1');
#25 = ITEM_DEFINITION((),#24,'63214871-1-1',$);
#26 = ITEM_DEFINITION_RELATIONSHIP(#84,#25,#3,'substitutable');
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);
#117 = STRING_WITH_LANGUAGE('Mill 1-14',#13);
#118 = MULTI_LANGUAGE_STRING((),#117);

ENDSEC;
END-ISO-10303-21;
```

3.30 Representing digital documents

3.30.1 Required cutting_tool_schema entities

—— digital_document

—— document

—— document_assignment

—— document_creation_property

—— document_version

—— document_location_property

—— document_format_property

—— document_creation_property

—— external_file_id_and_location

—— language

3.30.2 Representation

Digital documents are commonly represented with one or more corresponding digital files. The `digital_document` could be seen as a meta-level for the `digital_file`. The `digital_document.common_location` should correspond to the `external_file_id_and_location.location`.
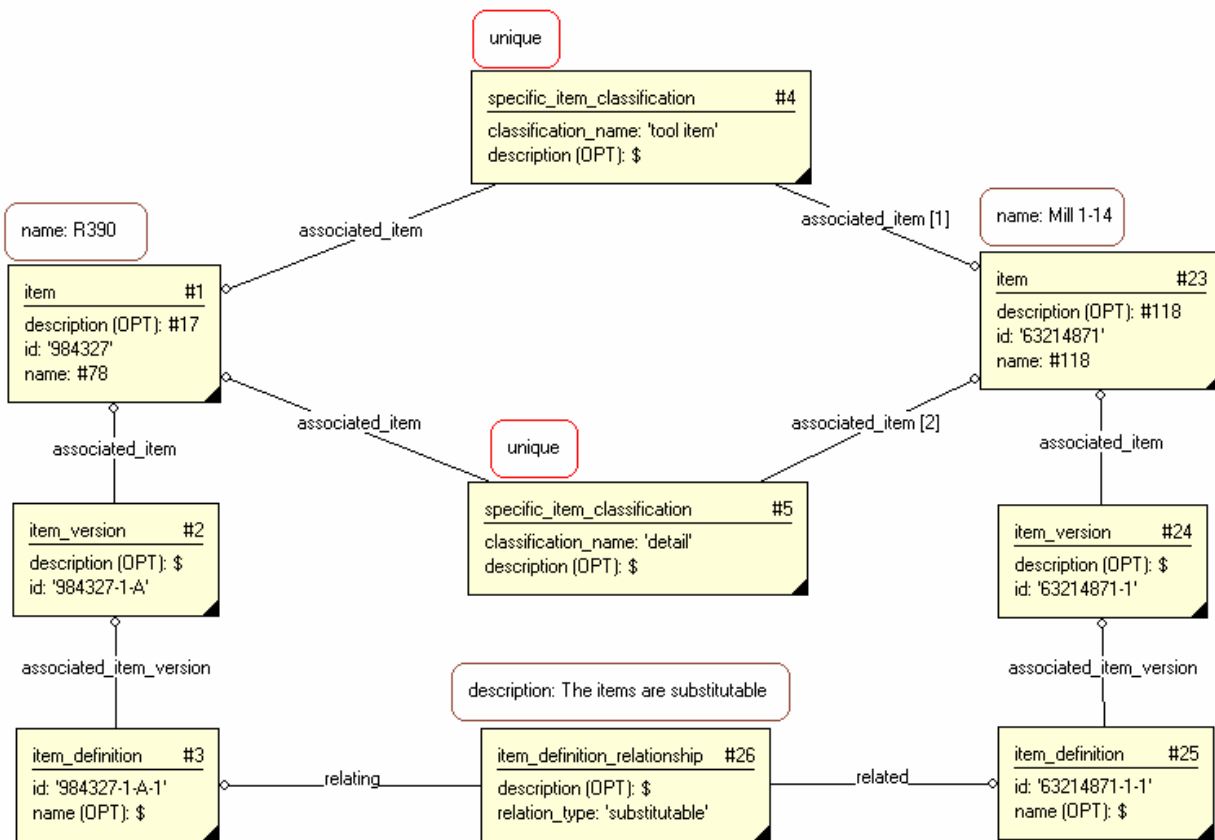

Figure 29 — Representing digital documents

3.30.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing digital documents.p21','2007-02-20T12:58:16',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108,#364,#370),'id
owner');
#151 = DOCUMENT($,'984327',#351);
#152 = DOCUMENT_VERSION(#151,$,'984327-A');
#153 = DIGITAL_DOCUMENT(#152,(#156),#157,#160,$,'984327-A-1',#158,$,(#154));
#154 = DIGITAL_FILE(#157,#160,$,(#155),#158,'/IGNORE',$,$);
#155 = EXTERNAL_FILE_ID_AND_LOCATION('FILE_984327-A-1',#156);
#156 = DOCUMENT_LOCATION_PROPERTY('.\\');
#157 = DOCUMENT_CONTENT_PROPERTY('rounded edges','solid model',(#13),$);
#158 = DOCUMENT_FORMAT_PROPERTY('ISO 8859-1','ISO 10303-214',$);
#160 = DOCUMENT_CREATION_PROPERTY($,'CAD system 1','WindowsXP');
#338 = DOCUMENT_ASSIGNMENT(#151,#3,'description');
#351 = MULTI_LANGUAGE_STRING((),#352);
#352 = STRING_WITH_LANGUAGE('R390 Geometric Description',#13);

ENDSEC;
END-ISO-10303-21;
```

3.31 Representing DMU structures with 3D models

3.31.1 Required cutting_tool_schema entities

— `assembly_association`

— `assembly_definition`

— `cartesian_coordinate_space_3d`

— `cartesian_point`

— `digital_file`

— `direction`

— `external_geometric_model`

— `geometric_model_relationship_with_transformation`

— `item_instance`

— `transformation_3d`

— `unit`

3.31.2 Representation

Representing DMU structures with 3D models requires a transformation mechanism. The `relating` attributes on `geometric_model_with_transformation` is pointing on the `geometric_model` that represents the parent in the structure. Similarly, the `related` attributes are pointing towards the children.

— The `geometric_model_relationship_with_transformation.relation_type` shall have the value 'hierarchy', in order to describe a hierarchical relation between the 3D models.
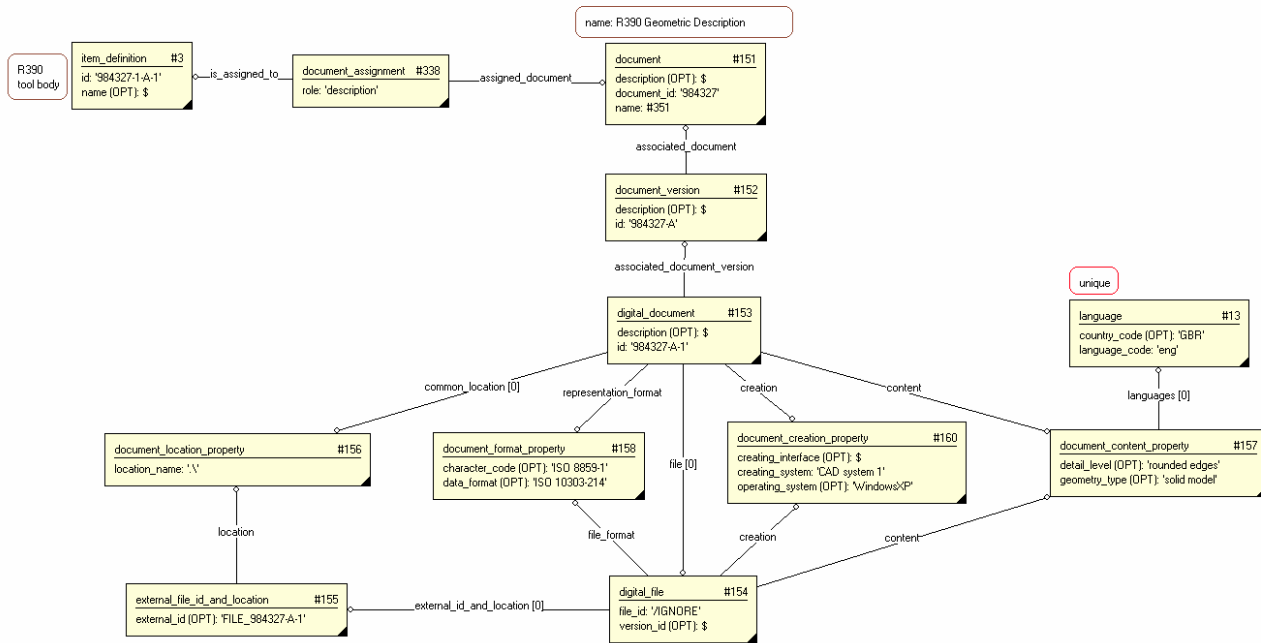

Figure 30 — Representing DMU structures with 3D models

3.31.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing DMU structure with 3D models.p21','2007-02-20T12:58:16',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#9 = ITEM_VERSION(#8,$,'576321-1-B');
#10 = ITEM_DEFINITION((),#9,'576321-1-B-1',$);
#11 = SPECIFIC_ITEM_CLASSIFICATION((#8,#188),'cutting item',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108,#364,#370),'id
owner');
#38 = ITEM(#124,'tool123',#116);
#39 = ITEM_VERSION(#38,$,'tool123-1');
#41 = ASSEMBLY_DEFINITION((),#39,'tool123-1-1',$,'design assembly');
#43 = SPECIFIC_ITEM_CLASSIFICATION((#38,#191),'assembly',$);
#44 = ITEM_INSTANCE(#3,#90,'984327-1-A-1-1');
#45 = ASSEMBLY_ASSOCIATION(#161,#44,#41);
#47 = ITEM_INSTANCE(#10,#92,'576321-1-B-1-2');
#50 = ASSEMBLY_ASSOCIATION(#162,#47,#41);
#54 = UNIT('mm');
#79 = STRING_WITH_LANGUAGE('R390 insert',#13);
#80 = MULTI_LANGUAGE_STRING((),#79);
#115 = STRING_WITH_LANGUAGE('R390 mill',#13);
#116 = MULTI_LANGUAGE_STRING((),#115);
#154 = DIGITAL_FILE(#157,#160,$,(#155),#158,'/IGNORE',$,$);
#161 =
GEOMETRIC_MODEL_RELATIONSHIP_WITH_TRANSFORMATION($,#169,#163,#166,'hierarchy');
#162 =
GEOMETRIC_MODEL_RELATIONSHIP_WITH_TRANSFORMATION($,#170,#164,#166,'hierarchy');
#163 = EXTERNAL_GEOMETRIC_MODEL($,#154,#165,'MODEL_984327-A-1',$);
#164 = EXTERNAL_GEOMETRIC_MODEL($,#167,#165,'MODEL_576321-A-1',$);
#165 = CARTESIAN_COORDINATE_SPACE_3D((#54,#251));
#166 = EXTERNAL_GEOMETRIC_MODEL($,#168,#165,'MODEL_123-A-1',$);
#167 = DIGITAL_FILE($,$,$,(),$,'File_576321-A-1',$,$);
#168 = DIGITAL_FILE($,$,$,(#353),$,'/IGNORE',$,$);
#169 = TRANSFORMATION_3D(#173,$,#171,$);
#170 = TRANSFORMATION_3D(#174,$,#172,$);
#171 = CARTESIAN_POINT(());
#172 = CARTESIAN_POINT(());
#173 = DIRECTION(());
#174 = DIRECTION(());
#251 = UNIT('deg');

ENDSEC;
END-ISO-10303-21;
```

3.32 Representing DMU structures with 2D models

3.32.1 Required cutting_tool_schema entities

—— `assembly_association`

—— `assembly_definition`

—— `cartesian_coordinate_space_2d`

—— `cartesian_point`

—— `digital_file`

—— `direction`

—— `external_picture`

—— `geometric_model_relationship_with_transformation`

—— `item_instance`

—— `transformation_2d`

—— `unit`

3.32.2 Representation

Representing DMU structures with 2D models requires a transformation mechanism. The `relating` attributes on `geometric_model_with_transformation` is pointing on the `external_picture` that represents the parent in the structure. Similarly, the `related` attributes are pointing towards the children.

The `geometric_model_relationship_with_transformation.relation_type` shall have the value 'hierarchy', in order to describe a hierarchical relation between the 2D models.
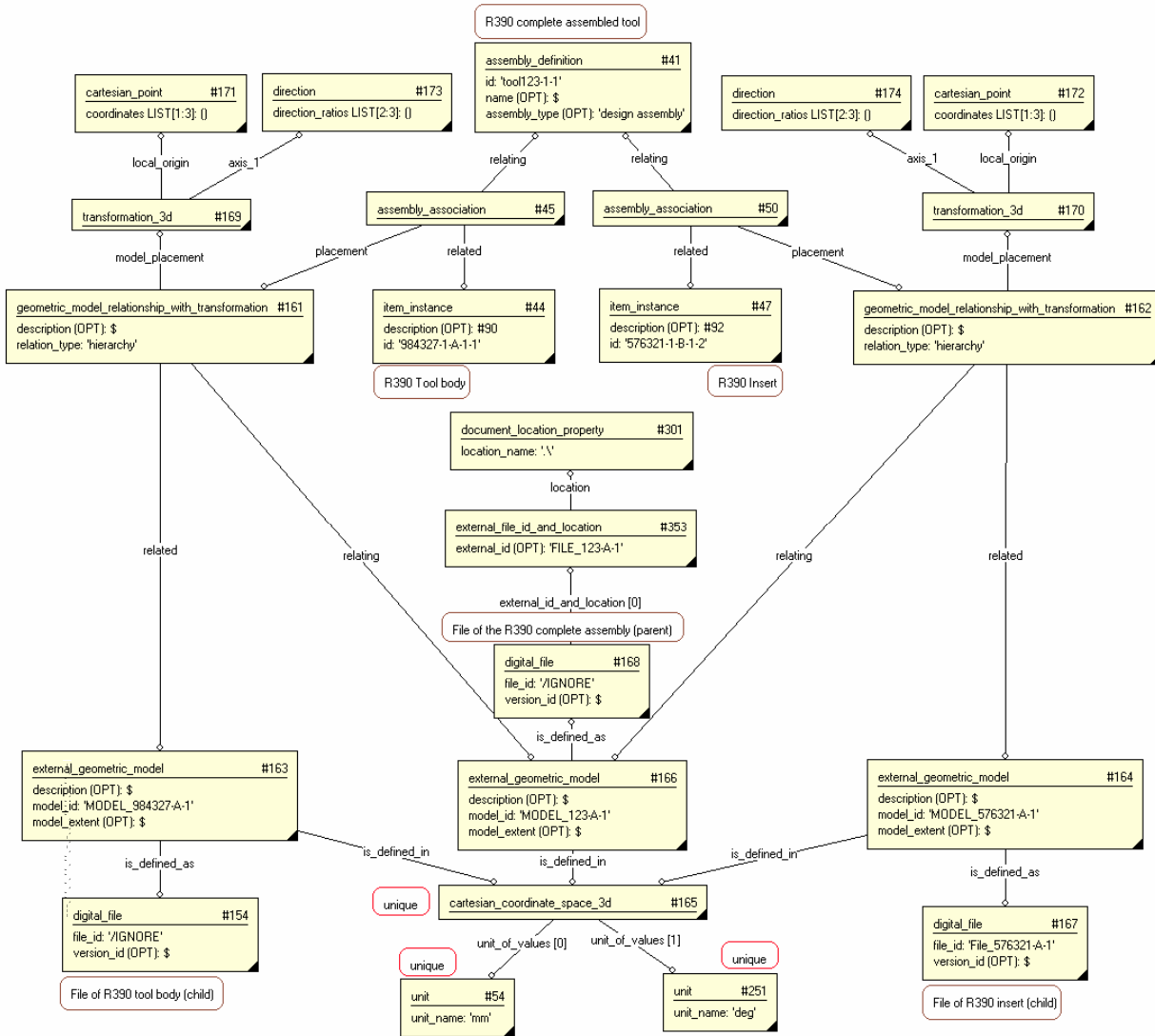
Figure 31 — Representing DMU structures with 2D models

3.32.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing DMU structure with 2D  models.p21','2007-02-20T12:58:16',
('someone'),(''),'',  'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#370),
'tool item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#8 = ITEM($,'576321',#80);
#9 = ITEM_VERSION(#8,$,'576321-1-B');
#10 = ITEM_DEFINITION((),#9,'576321-1-B-1',$);
#11 = SPECIFIC_ITEM_CLASSIFICATION((#8,#188),'cutting item',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108,#364,#370),'id
owner');
#38 = ITEM(#124,'tool123',#116);
#39 = ITEM_VERSION(#38,$,'tool123-1');
#41 = ASSEMBLY_DEFINITION((),#39,'tool123-1-1',$,'design assembly');
#43 = SPECIFIC_ITEM_CLASSIFICATION((#38,#191),'assembly',$);
#55 = PROPERTY_VALUE_REPRESENTATION(#52,$,$,#53,$);
#79 = STRING_WITH_LANGUAGE('R390 insert',#13);
#80 = MULTI_LANGUAGE_STRING((),#79);
#115 = STRING_WITH_LANGUAGE('R390 mill',#13);
#116 = MULTI_LANGUAGE_STRING((),#115)
#175 = EXTERNAL_PICTURE($,#179,#177,'MODEL2D_984327-A-1');
#176 = EXTERNAL_PICTURE($,#180,#177,'MODEL2D_576321-A-1');
#177 = CARTESIAN_COORDINATE_SPACE_2D((#54,#251));
#178 = EXTERNAL_PICTURE($,#181,#177,'MODEL2D_tool123-1-1');
#179 = DIGITAL_FILE($,$,$,(),$,'FILE2D_984327-A-1',$,$);
#180 = DIGITAL_FILE($,$,$,(),$,'FILE2D_576321-A-1',$,$);
#181 = DIGITAL_FILE($,$,$,(#355),$,'/IGNORE',$,$);
#182 = TRANSFORMATION_2D(#186,$,#184);
#183 = TRANSFORMATION_2D(#187,$,#185);
#184 = CARTESIAN_POINT(());
#185 = CARTESIAN_POINT(());
#186 = DIRECTION(());
#187 = DIRECTION(());
#251 = UNIT('deg');
#339 =
GEOMETRIC_MODEL_RELATIONSHIP_WITH_TRANSFORMATION($,#182,#175,#178,'hierarchy');
#340 =
GEOMETRIC_MODEL_RELATIONSHIP_WITH_TRANSFORMATION($,#183,#176,#178,'hierarchy');
#341 = ITEM_INSTANCE($,$,'984327-1-A-1-1');
#342 = ITEM_INSTANCE($,$,'576321-1-B-1-2');
#343 = ASSEMBLY_ASSOCIATION(#339,#341,#41);
#344 = ASSEMBLY_ASSOCIATION(#340,#342,#41);

ENDSEC;
END-ISO-10303-21;
```

3.33 Representing external models as 3D

3.33.1 Required cutting_tool_schema entities

—— `cartesian_coordinate_space_3d`

—— `digital_document`

—— `digital_file`

—— `document`

—— `document_assignment`

—— `document_location_property`

—— `document_version`

—— `external_file_id_and_location`

—— `external_geometric_model`

—— `item_definition` (item to be represented as 3d model)

—— `unit`

3.33.2 Representation

To represent a tool as a 3D model, an `external_geometric_model` entity should be created. It has its definition in a `digital_file` (of type `document_file`). The meta-data of the `digital_file` is represented as a `document` which in its turn is assigned to the definition of the tool (`item_definition`).

Note that the recommendation is to set the `digital_file.file_id` to '/IGNORE' in order to create more explicit information about the file and its location. Also, only relative paths should be used to define the locations.
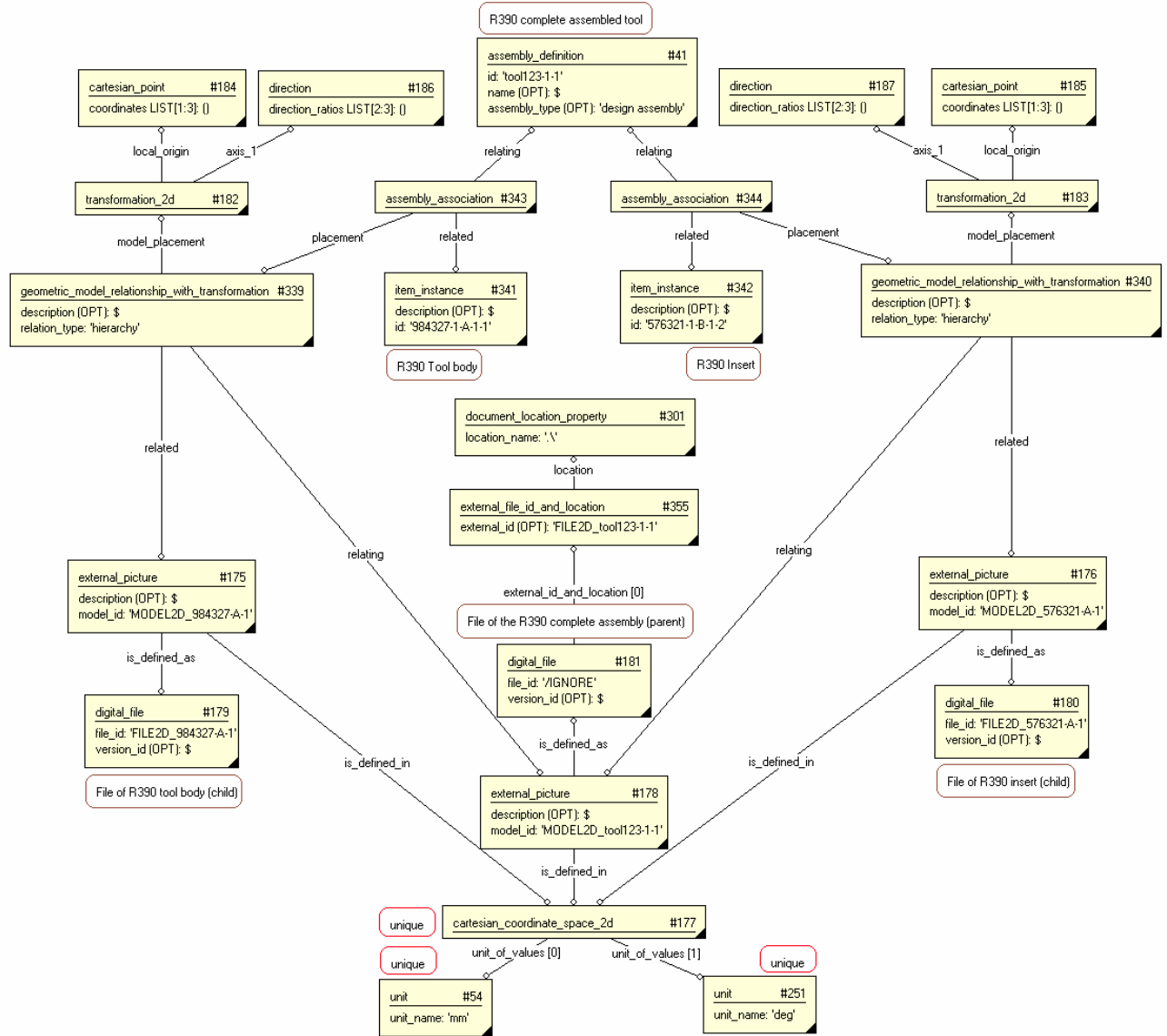

Figure 32 — Representing external model as 3D

3.33.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing external model as 3D.p21','2007-02-20T10:52:10',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.17]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141,#191,#364,#364,#
370),'tool item',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108,#364,#370),'id
owner');
#54 = UNIT('mm');
#251 = UNIT('deg');
#292 = ITEM_DEFINITION($,#369,'tool456-1-1',$);
#293 = DOCUMENT_ASSIGNMENT(#294,#292,'geometric description');
#294 = DOCUMENT_VERSION(#295,$,'DOC-tool456-1');
#295 = DOCUMENT($,$,#373);
#296 = DIGITAL_DOCUMENT(#294,(),$,$,$,'DOC-tool456-1-1',$,$,(#297));
#297 = DIGITAL_FILE($,$,$,(#300),$,'/IGNORE',$,'001');
#298 = EXTERNAL_GEOMETRIC_MODEL($,#297,#299,'MODEL-tool456-1-1',$);
#299 = CARTESIAN_COORDINATE_SPACE_3D((#54,#251));
#300 = EXTERNAL_FILE_ID_AND_LOCATION('FILE-DOC-tool456-1-1.3D',#301);
#301 = DOCUMENT_LOCATION_PROPERTY('.\\');
#369 = ITEM_VERSION(#370,$,$);
#370 = ITEM($,$,#371);
#371 = MULTI_LANGUAGE_STRING((),#372);
#372 = STRING_WITH_LANGUAGE('tool',#13);
#373 = MULTI_LANGUAGE_STRING((),#374);
#374 = STRING_WITH_LANGUAGE($,#13);

ENDSEC;
END-ISO-10303-21;
```

3.34 Representing external model as 2D

3.34.1 Required cutting_tool_schema entities

—— `cartesian_coordinate_space_2d`

—— `digital_document`

—— `digital_file`

—— `document`

—— `document_assignment`

—— `document_location_property`

—— `document_version`

—— `external_file_id_and_location`

— `external_picture`

— `item_definition` (item to be represented as 2d model)

— `unit`

3.34.2 Representation

To represent a tool as a 2D model, an `external_picture` entity should be created. It has its definition in a `digital_file` (of type `document_file`). The meta-data of the `digital_file` is represented as a document which in its turn is assigned to the definition of the tool (`item_definition`).

Note that the recommendation is to set the `digital_file.file_id` to '/IGNORE' in order to create more explicit information about the file and its location. Also, only relative paths should be used to define the locations.
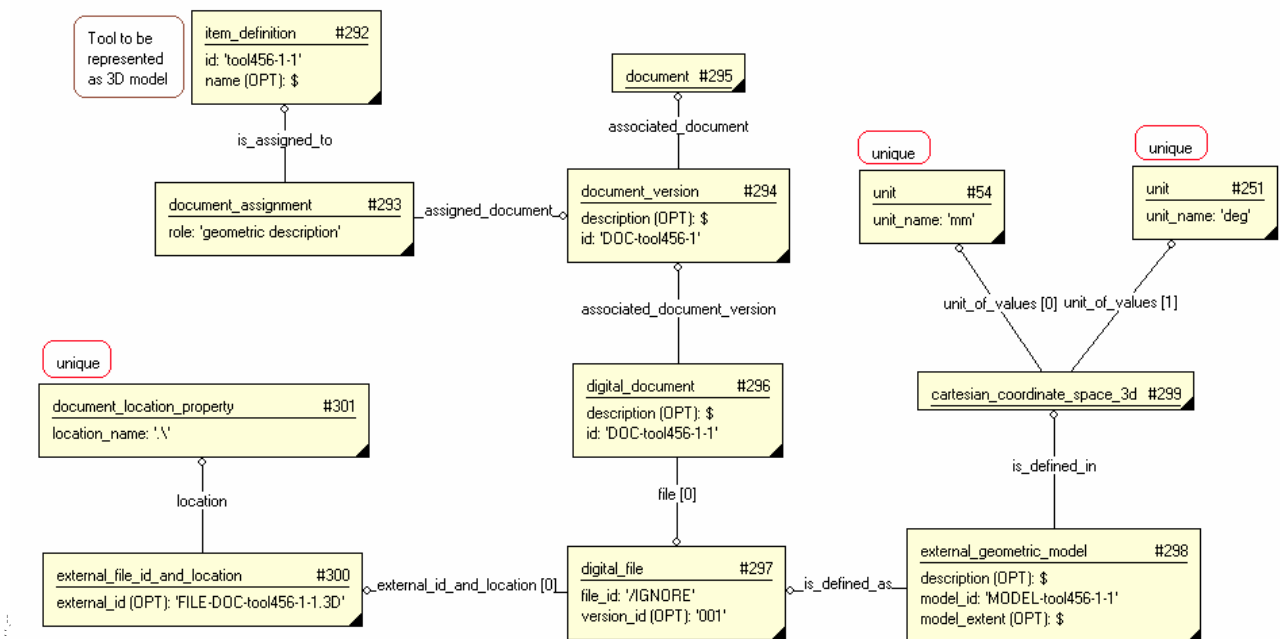

Figure 33 — Representing external model as 2D

3.34.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing external model as 2D.p21','2007-02-20T10:52:10',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.17]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#38,#69,#99,#105,#108,#364,#370),'id
owner');
#54 = UNIT('mm');
#251 = UNIT('deg');
#301 = DOCUMENT_LOCATION_PROPERTY('.\\');
#302 = ITEM_DEFINITION($,#363,'tool678-1-1',$);
#303 = DOCUMENT_ASSIGNMENT(#304,#302,'geometric description');
#304 = DOCUMENT_VERSION(#305,$,'DOC-tool678-1');
#305 = DOCUMENT($,$,#367);
#306 = DIGITAL_DOCUMENT(#304,(),$,$,$,'DOC-tool678-1-1',$,$,(#309));
#308 = EXTERNAL_PICTURE($,#309,#310,'MODEL-678-1-1');
#309 = DIGITAL_FILE($,$,$,(#311),$,'/IGNORE',$,'001');
#310 = CARTESIAN_COORDINATE_SPACE_2D((#54,#251));
#311 = EXTERNAL_FILE_ID_AND_LOCATION('FILE-DOC-678-1-1',#301);
#363 = ITEM_VERSION(#364,$,$);
#364 = ITEM($,$,#365);
#365 = MULTI_LANGUAGE_STRING((),#366);
#366 = STRING_WITH_LANGUAGE('tool',#13);
#367 = MULTI_LANGUAGE_STRING((),#368);
#368 = STRING_WITH_LANGUAGE($,#13);

ENDSEC;
END-ISO-10303-21;
```

3.35 Representing physical items

3.35.1 Required cutting_tool_schema entities

— location

— physical_item

— physical_item_definition

— physical_item_version

— physical_item_location_association

— physical_item_state_association

— specific_item_classification

— state

3.35.2 Representation

A `physical_item` is a type of item that identifies an individual artefact that has been made. The information that is represented for a `physical_item` shall only be "real world" information, e.g. no nominal values for properties only measured values.

The owner of the id shall be specified for a `physical_item` in the same way as for an `item`.

IMPORTANT — **The** **owner** **of** **the** **id** **of** **a** `physical_item` **shall** **be** **specified** **using** **a** `person_organization_assignment` **with a** `role` **of 'id owner'.**
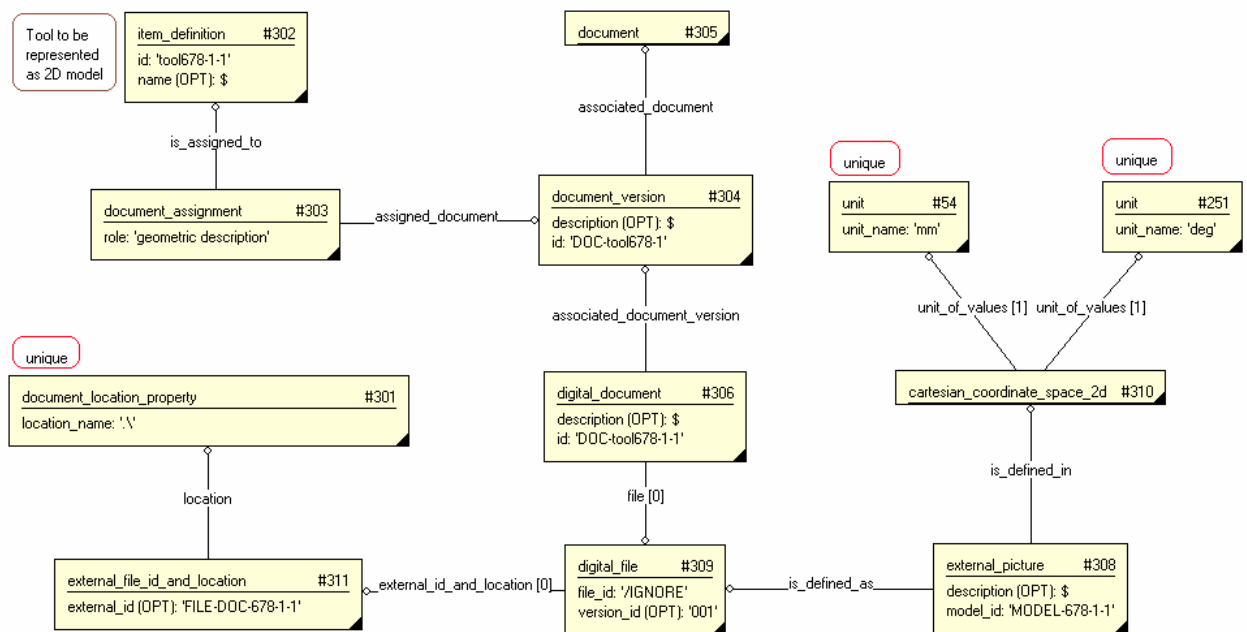

Figure 34 — Representing physical item

3.35.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing physical item.p21','2007-02-20T10:52:10',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.17]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#13 = LANGUAGE('GBR','eng');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370,#141),'id owner');
#141 = PHYSICAL_ITEM($,'984327',#345);
#142 = PHYSICAL_ITEM_VERSION(#141,$,'984327-1-A');
#143 = PHYSICAL_ITEM_DEFINITION($,#142,'984327-1-A-1',$);
#145 = STATE('Blunt edge');
#146 = PHYSICAL_ITEM_STATE_ASSOCIATION(#143,#145,'Observed');
#147 = PHYSICAL_ITEM_LOCATION_ASSOCIATION(#141,#148);
#148 = LOCATION('Pos 05','Machine X','Machine');
#345 = MULTI_LANGUAGE_STRING((),#348);
#348 = STRING_WITH_LANGUAGE('Physical item of R390 tool body',#13);

ENDSEC;
END-ISO-10303-21;
```

3.36 Representing physical items based on an item

3.36.1 Required cutting_tool_schema entities

— `item`

— `item_definition`

— `item_version`

— `location`

— `physical_item`

— `physical_item_definition`

— `physical_item_version`

— `physical_item_location_association`

— `physical_item_state_association`

— `realized_item_association`

— `specific_item_classification`

— `state`

3.36.2 Representation

This representation indicates that an explicit relationship exists between the `item` and the `physical_item`, e.g the `physical_item` is realized from the selected `item_version`. The `item` and the `physical_item` entities should be joined by a common `specific_item_classification` entity.

Only information that is unique to the `physical_item` should be represented on the `physical_item`. The information about the `item` should not be transferred to the `physical_item` when creating the `physical_item`. This concerns both classifications and properties.

IMPORTANT — The attribute `realized_item_association.realized_item_version` **may not identify a** `physical_item_version` **entity.**

The owner of the id shall be specified for a `physical_item` in the same way as for an `item`.

IMPORTANT — The owner of the id of a `physical_item` **shall be specified using a** `person_organization_assignment` **with a** `role` **of 'id owner'.**
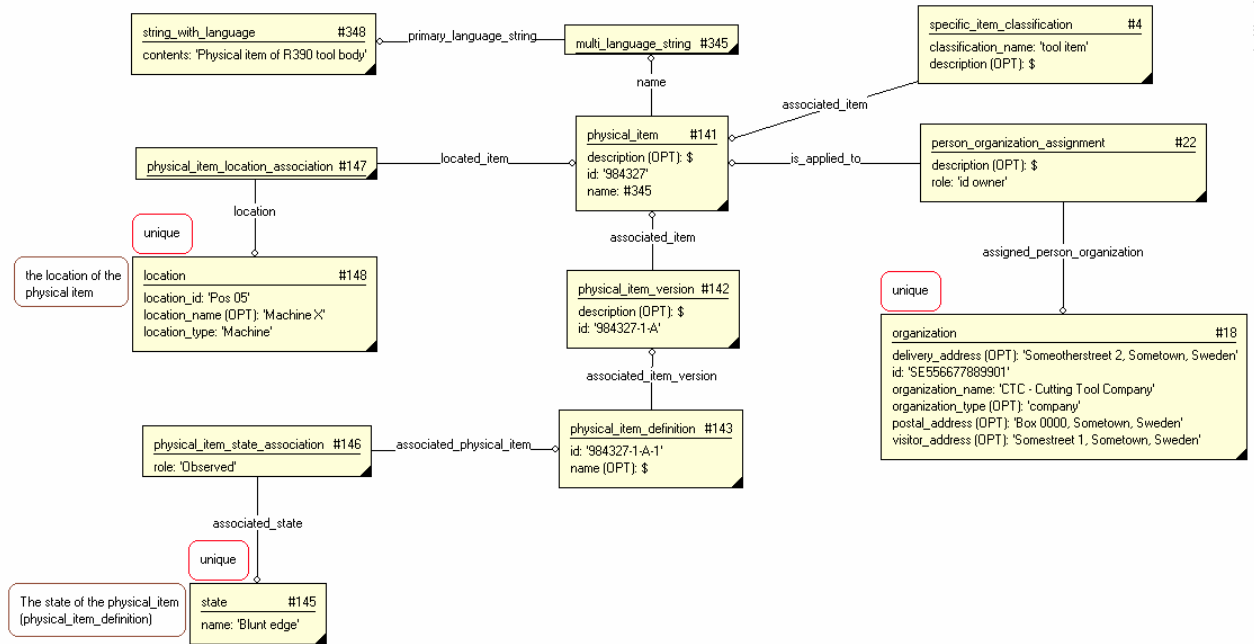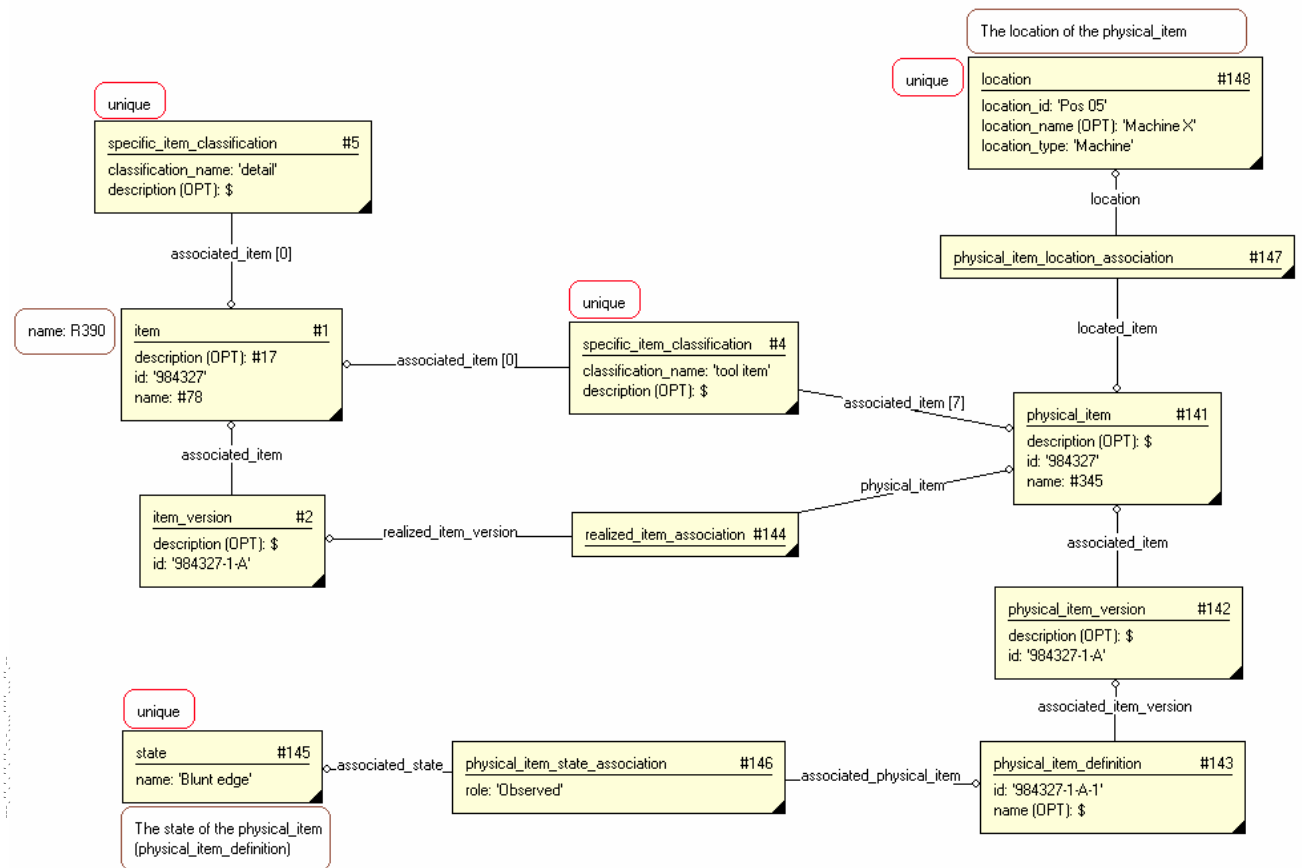

Figure 35 — Representing physical item based on an item

3.36.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing physical item.p21','2007-02-20T10:52:10',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.17]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fr\S\dsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370,#141),'id owner');
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);
#141 = PHYSICAL_ITEM($,'984327',#345);
#142 = PHYSICAL_ITEM_VERSION(#141,$,'984327-1-A');
#143 = PHYSICAL_ITEM_DEFINITION($,#142,'984327-1-A-1',$);
#144 = REALIZED_ITEM_ASSOCIATION(#141,#2);
#145 = STATE('Blunt edge');
#146 = PHYSICAL_ITEM_STATE_ASSOCIATION(#143,#145,'Observed');
#147 = PHYSICAL_ITEM_LOCATION_ASSOCIATION(#141,#148);
#148 = LOCATION('Pos 05','Machine X','Machine');
#345 = MULTI_LANGUAGE_STRING((),#348);
#348 = STRING_WITH_LANGUAGE('Physical item of R390 tool body',#13);

ENDSEC;
END-ISO-10303-21;
```

3.37 Representing realized item definition relationship

3.37.1 Required cutting_tool_schema entities

—— `item`

—— `item_definition`

—— `item_definition_relationship`

—— `item_version`

—— `realized_item_association`

—— `specific_item_classification`

3.37.2 Representation

This representation indicates that an explicit relationship exists between the `item_definition` and the `physical_item_definition`, i.e. the `physical_item_definition` is realized from the selected `item_definition`. The `item` and the `physical_item` entities should be joined by a common `specific_item_classification` entity. For a more general description of representing physical items, cf. Section 3.35.
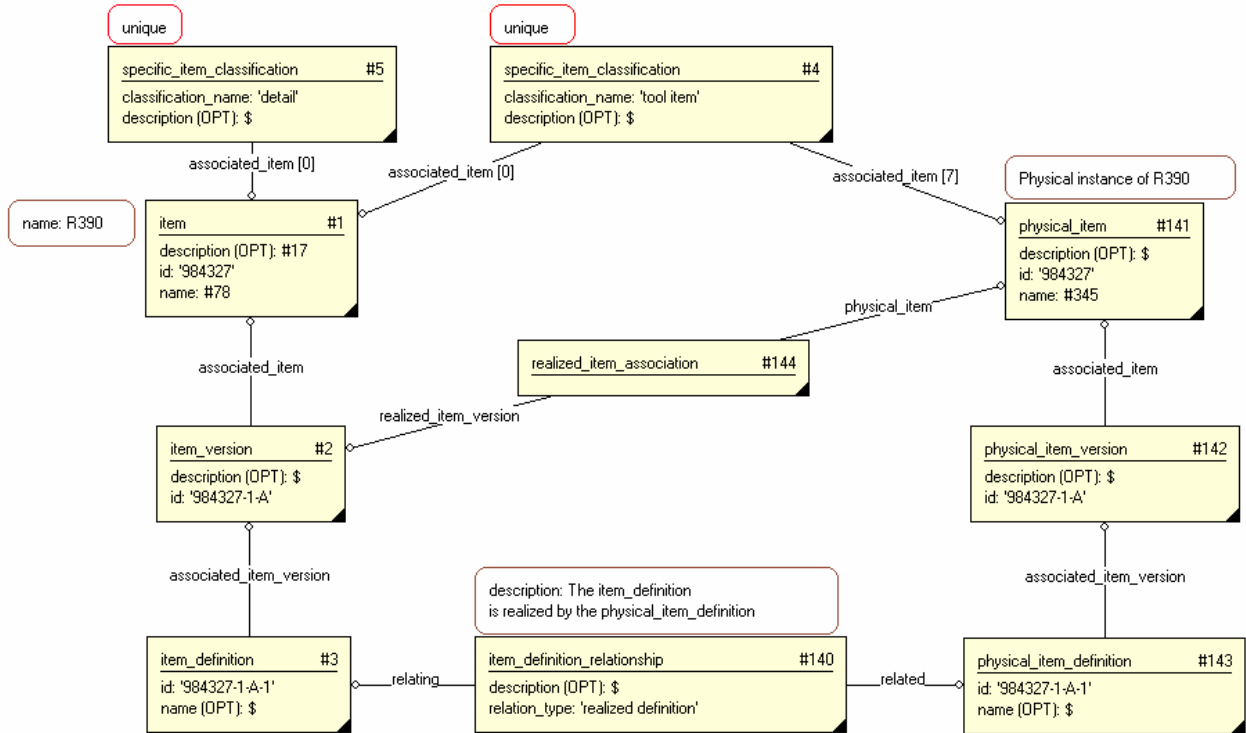

Figure 36 — Representing realized item definition relationship

3.37.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing realized item definition relationship.p21','2007-02-
20T10:52:10', ('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.17]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,99,#105,#108),'detail',$);
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fr\S\dsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370,#141),'id owner');
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);
#140 = ITEM_DEFINITION_RELATIONSHIP($,#143,#3,'realized definition');
#141 = PHYSICAL_ITEM($,'984327',#345);
#142 = PHYSICAL_ITEM_VERSION(#141,$,'984327-1-A');
#143 = PHYSICAL_ITEM_DEFINITION($,#142,'984327-1-A-1',$);
#144 = REALIZED_ITEM_ASSOCIATION(#141,#2);
#345 = MULTI_LANGUAGE_STRING((),#348);
#348 = STRING_WITH_LANGUAGE('Physical item of R390 tool body',#13);

ENDSEC;
END-ISO-10303-21;
```

3.38 Representing physical item structures

3.38.1 Required cutting_tool_schema entities

— `physical_item`

— `physical_item_definition`

— `physical_item_structure_association`

— `physical_item_version`

3.38.2 Representation

Generally, more detailed tool structures should be dealt with handling the generic (type) tool information e.g. `assembly_definition`, `item` etc. Physical item structures is built with the entity `physical_item_structure_association` where the relating is the next higher level and related is the next lower level.

Figure 37 — Representing physical item structures

3.38.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing physical item structure.p21','2007-02-20T10:52:10',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.17]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#11 = SPECIFIC_ITEM_CLASSIFICATION((#8),'cutting item',$);
#13 = LANGUAGE('GBR','eng');
#43 = SPECIFIC_ITEM_CLASSIFICATION((#38),'assembly',$);
#141 = PHYSICAL_ITEM($,'984327',#345);
#142 = PHYSICAL_ITEM_VERSION(#141,$,'984327-1-A');
#143 = PHYSICAL_ITEM_DEFINITION($,#142,'984327-1-A-1',$);
#188 = PHYSICAL_ITEM($,'576321',#346);
#189 = PHYSICAL_ITEM_VERSION(#188,$,'576321-1-A');
#190 = PHYSICAL_ITEM_DEFINITION($,#189,'576321-1-A-1',$);
#191 = PHYSICAL_ITEM($,'tool123',#347);
#192 = PHYSICAL_ITEM_VERSION(#191,$,'tool123-1-A');
#193 = PHYSICAL_ITEM_DEFINITION($,#192,'tool123-1-A-1',$);
#194 = PHYSICAL_ITEM_STRUCTURE_ASSOCIATION(#143,#193);
#195 = PHYSICAL_ITEM_STRUCTURE_ASSOCIATION(#190,#193);
#345 = MULTI_LANGUAGE_STRING((),#348);
#346 = MULTI_LANGUAGE_STRING((),#349);
#348 = STRING_WITH_LANGUAGE('Physical item of R390 tool body',#13);
#349 = STRING_WITH_LANGUAGE('Physical item of R390 insert',#13);

ENDSEC;
END-ISO-10303-21;
```

3.39 Representing work piece feature

3.39.1 Required cutting_tool_schema entities

—— `cartesian_coordinate_space`

—— `digital_file`

—— `external _model`

—— `item_characteristic_association`

—— `item_definition`

—— `unit`

—— `workpiece_feature`

3.39.2 Representation

The `item_characteristic_association` entity is used to bind a work piece feature to a cutting tool. `item_characteristic_association.relation_type` should be instantiated with a value of 'used for'. The semantic meaning is that the tool item can be used in the creation of the assigned work piece feature.
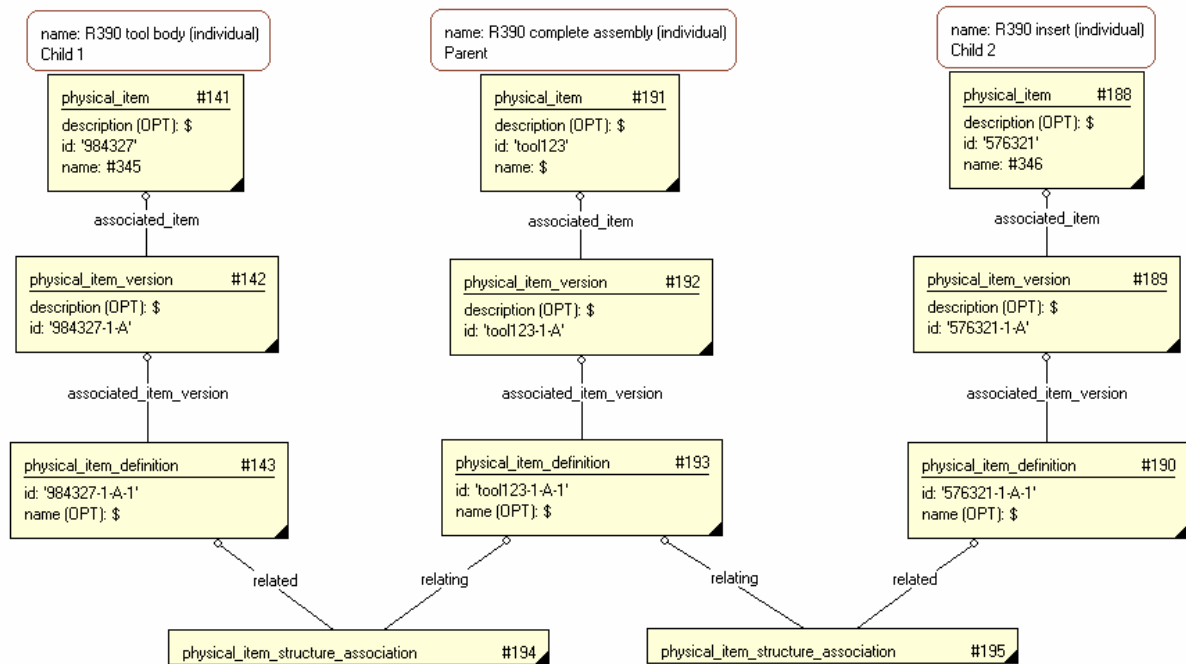

Figure 38 — Representing work piece feature

3.39.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing work piece feature.p21','2007-02-20T10:52:10',
('someone'),(''),'', 'GraphicalInstance 1.0 Beta 5 [1.0.5.17]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 = SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#141),'tool
item',$);
#5 = SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108),'detail',$);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370),'id owner');
#54 = UNIT('mm');
#251 = UNIT('deg');
#299 = CARTESIAN_COORDINATE_SPACE_3D((#54,#251));
#334 = EXTERNAL_GEOMETRIC_MODEL($,#337,#299,'MODEL_123456','200');
#335 = WORKPIECE_FEATURE($,'123456',(#334));
#336 = ITEM_CHARACTERISTIC_ASSOCIATION(#335,#3,'used for');
#337 = DIGITAL_FILE($,$,$,(),$,'FILE_MODEL_123456',$,'001');

ENDSEC;
END-ISO-10303-21;
```

3.40 Representing grade

3.40.1 Required cutting_tool_schema entities

—— coating

—— cutting_condition

—— grade

—— item_characteristic_association

—— material_designation

—— substrate

3.40.2 Representation

When representing a grade, it should be a simple straight forward representation of the grade of an item. Grades are represented for cutting items and solid carbide tools.
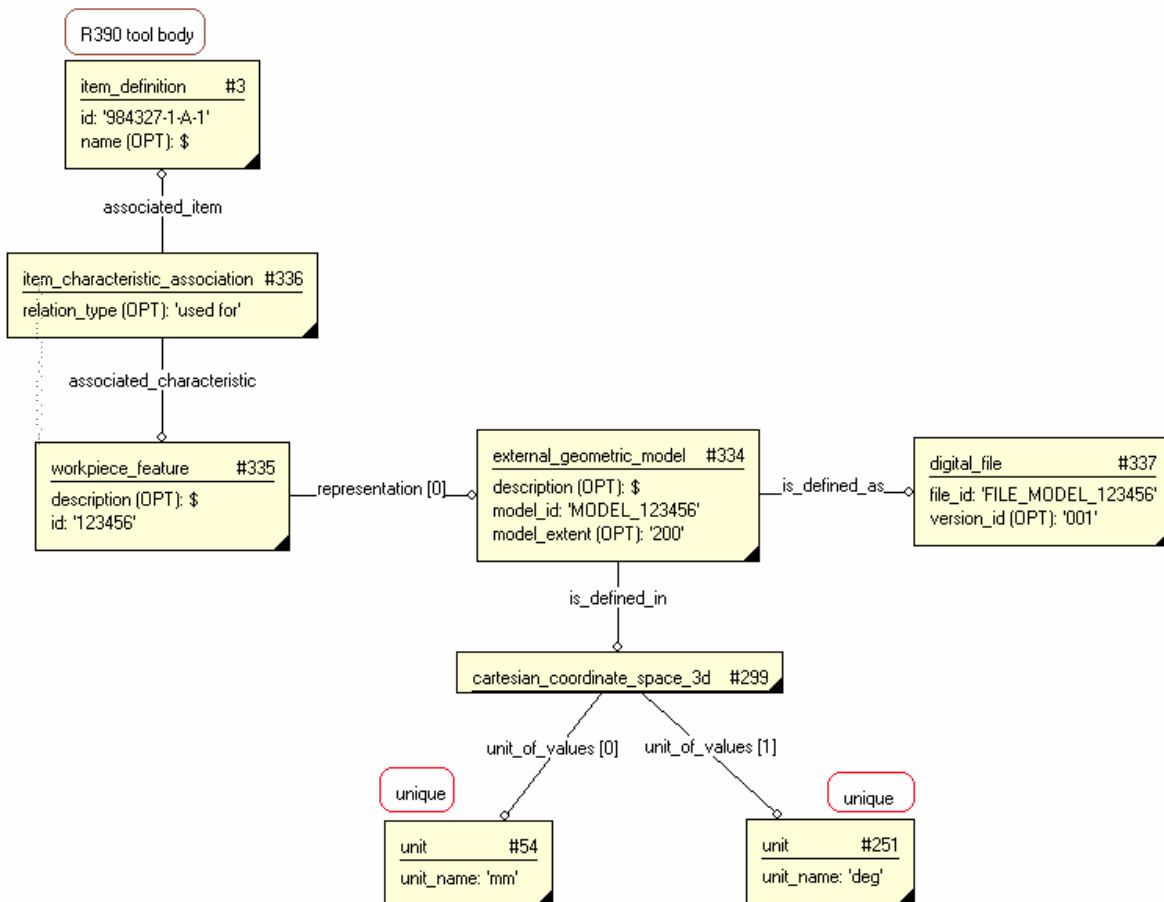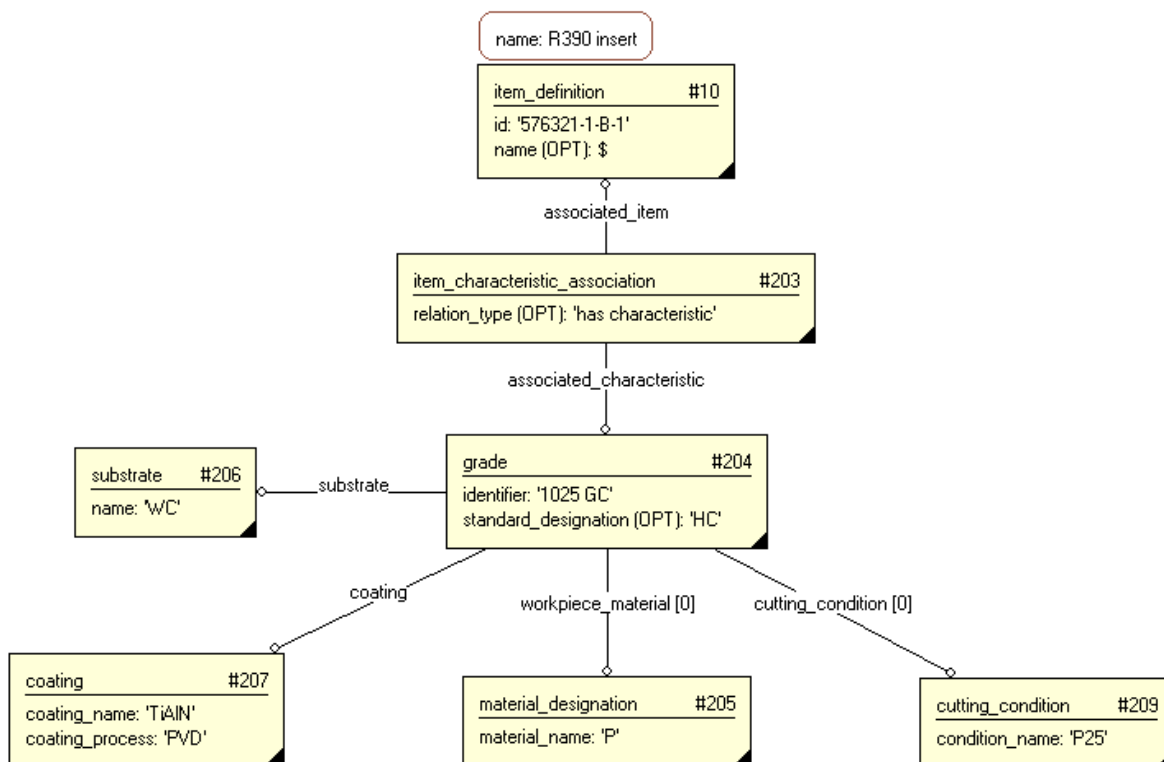
Figure 39 — Representing grade

3.40.3 ISO 10303-21 example

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Representing grade.p21','2007-02-27T15:48:01', ('someone'),(''),'',
'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#5 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108,#212),'detail',$);
#8 = ITEM($,'576321',#80);
#9 = ITEM_VERSION(#8,$,'576321-1-B');
#10 = ITEM_DEFINITION((),#9,'576321-1-B-1',$);
#11 = SPECIFIC_ITEM_CLASSIFICATION((#8,#188),'cutting item',$);
#12 = ITEM_DEFINITION_RELATIONSHIP($,#10,#3,'compatible');
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370),'id owner');
#203 = ITEM_CHARACTERISTIC_ASSOCIATION(#204,#10,'has characteristic');
#204 = GRADE(#207,(#209),'1025 GC','HC',#206,(#205));
#205 = MATERIAL_DESIGNATION('P');
#206 = SUBSTRATE('WC');
#207 = COATING('TiAlN','PVD');
#209 = CUTTING_CONDITION('P25');

ENDSEC;
END-ISO-10303-21;
```

Annex A
(informative)

Complete ISO 10303-21 file of the examples

```
ISO-10303-21;
HEADER;
FILE_DESCRIPTION(('Description'),'2;1');
FILE_NAME('Master Data Example.p21','2007-02-28T14:45:31', ('someone'),(''),'',
'GraphicalInstance 1.0 Beta 5 [1.0.5.18]','');
FILE_SCHEMA(('CUTTING_TOOL_SCHEMA_ARM'));
ENDSEC;

DATA;
#1 = ITEM(#17,'984327',#78);
#2 = ITEM_VERSION(#1,$,'984327-1-A');
#3 = ITEM_DEFINITION((),#2,'984327-1-A-1',$);
#4 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#23,#38,#102,#99,#105,#108,#191,#364,#370,#212,#
141),'tool item',$);
#5 =
SPECIFIC_ITEM_CLASSIFICATION((#1,#8,#23,#69,#102,#99,#105,#108,#212),'detail',$);
#6 = APPLICATION_CONTEXT('process planning',$);
#8 = ITEM($,'576321',#80);
#9 = ITEM_VERSION(#8,$,'576321-1-B');
#10 = ITEM_DEFINITION((),#9,'576321-1-B-1',$);
#11 = SPECIFIC_ITEM_CLASSIFICATION((#8,#188),'cutting item',$);
#12 = ITEM_DEFINITION_RELATIONSHIP($,#10,#3,'compatible');
#13 = LANGUAGE('GBR','eng');
#14 = LANGUAGE('SWE','swe');
#15 = STRING_WITH_LANGUAGE('milling tool',#13);
#16 = STRING_WITH_LANGUAGE('fr\S\dsverktyg',#14);
#17 = MULTI_LANGUAGE_STRING((#16),#15);
#18 = ORGANIZATION('Someotherstreet 2, Sometown, Sweden','SE556677889901','CTC -
Cutting Tool Company','company','Box 0000, Sometown, Sweden','Somestreet 1,
Sometown, Sweden');
#19 = PERSON('Joe Engineer','Somestreet 1, Sometown, Sweden');
#20 = PERSON_IN_ORGANIZATION(#18,#19,'6702','R139','employee');
#21 = PERSON_ORGANIZATION_ASSIGNMENT(#20,$,(#1),'creator');
#22 =
PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1,#8,#23,#38,#69,#99,#105,#108,#212,#364,#
370,#141),'id owner');
#23 = ITEM($,'63214871',#118);
#24 = ITEM_VERSION(#23,$,'63214871-1');
#25 = ITEM_DEFINITION((),#24,'63214871-1-1',$);
#26 = ITEM_DEFINITION_RELATIONSHIP($,#25,#3,'substitutable');
#27 = ALIAS_IDENTIFICATION('cutter_2345',#18,$,$,#1);
#28 = GENERAL_CLASSIFICATION($,#86,'milling tool',$,$);
#30 = CLASSIFICATION_ASSOCIATION(#28,#3,$,$);
#31 = PLIB_CLASS_REFERENCE('71E01A05D27A8','0112/1///13399__001','001');
#33 =
GENERAL_CLASSIFICATION(#31,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNOR
E');
#34 = CLASSIFICATION_ASSOCIATION(#33,#3,.F.,$);
#35 = EXTERNAL_LIBRARY_REFERENCE(#88,'aa001','OWL');
#36 = CLASSIFICATION_ASSOCIATION(#37,#25,$,$);
```

```
#37 =
GENERAL_CLASSIFICATION(#35,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNOR
E');
#38 = ITEM(#124,'tool123',#116);
#39 = ITEM_VERSION(#38,$,'tool123-1');
#41 = ASSEMBLY_DEFINITION((),#39,'tool123-1-1',$,'design assembly');
#43 = SPECIFIC_ITEM_CLASSIFICATION((#38,#191),'assembly',$);
#44 = ITEM_INSTANCE(#3,#90,'984327-1-A-1-1');
#45 = ASSEMBLY_ASSOCIATION(#161,#44,#41);
#46 = ITEM_INSTANCE(#10,#94,'576321-1-B-1-1');
#47 = ITEM_INSTANCE(#10,#92,'576321-1-B-1-2');
#49 = ASSEMBLY_ASSOCIATION($,#46,#41);
#50 = ASSEMBLY_ASSOCIATION(#162,#47,#41);
#51 = PLIB_PROPERTY_REFERENCE('71ED6AA478A3D',#31,'001');
#52 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#51,'/IGNORE','/IGNORE')
;
#53 = NUMERICAL_VALUE('/IGNORE',$,#54,'150');
#54 = UNIT('mm');
#55 = PROPERTY_VALUE_REPRESENTATION(#52,$,$,#53,$);
#56 = PROPERTY_VALUE_ASSOCIATION($,#3,#55,$,$);
#57 = ITEM_VERSION(#1,$,'984327-1-B');
#58 = ITEM_VERSION(#1,$,'984327-2-A');
#59 = ITEM_VERSION_RELATIONSHIP($,#57,#2,'sequence');
#60 = ITEM_VERSION_RELATIONSHIP($,#58,#57,'hierarchy');
#61 = MATING_DEFINITION($,#39,'tool123-1-2',$,'bolted joint');
#62 = MATING_DEFINITION($,#39,'tool123-1-3',$,'bolted joint');
#63 = MATING_ASSOCIATION($,#44,#61);
#64 = MATING_ASSOCIATION($,#46,#61);
#65 = MATING_ASSOCIATION($,#44,#62);
#66 = MATING_ASSOCIATION($,#47,#62);
#67 = MATED_ITEM_RELATIONSHIP((#75),#64,#63);
#68 = MATED_ITEM_RELATIONSHIP((#76),#66,#65);
#69 = ITEM($,'8237',#74);
#70 = ITEM_VERSION(#69,$,'8327-1');
#71 = ITEM_DEFINITION($,#70,'8327-1-1',$);
#72 = SPECIFIC_ITEM_CLASSIFICATION((#69),'assembly item',$);
#73 = STRING_WITH_LANGUAGE('insert screw',#13);
#74 = MULTI_LANGUAGE_STRING((),#73);
#75 = ITEM_INSTANCE(#71,#98,'8327-1-1-1');
#76 = ITEM_INSTANCE(#71,#97,'8327-1-1-2');
#77 = STRING_WITH_LANGUAGE('R390',#13);
#78 = MULTI_LANGUAGE_STRING((),#77);
#79 = STRING_WITH_LANGUAGE('R390 insert',#13);
#80 = MULTI_LANGUAGE_STRING((),#79);
#85 = STRING_WITH_LANGUAGE('Class of tools used for milling',#13);
#86 = MULTI_LANGUAGE_STRING((),#85);
#87 = STRING_WITH_LANGUAGE('"milling tool" according to X',#13);
#88 = MULTI_LANGUAGE_STRING((),#87);
#89 = STRING_WITH_LANGUAGE('instance of R390 tool body',#13);
#90 = MULTI_LANGUAGE_STRING((),#89);
#91 = STRING_WITH_LANGUAGE('instance 2 of R390 insert',#13);
#92 = MULTI_LANGUAGE_STRING((),#91);
#93 = STRING_WITH_LANGUAGE('instance 1 of R390 insert',#13);
#94 = MULTI_LANGUAGE_STRING((),#93);
#95 = STRING_WITH_LANGUAGE('instance 1 of insert screw',#13);
#96 = STRING_WITH_LANGUAGE('instance 2 of insert screw',#13);
#97 = MULTI_LANGUAGE_STRING((),#96);
#98 = MULTI_LANGUAGE_STRING((),#95);
#99 = ITEM($,'29843435',#120);
```

```
#100 = ITEM_VERSION(#99,$,'29843435.1');
#101 = ITEM_DEFINITION($,#100,'29843435.1-1',$);
#102 = ITEM($,'A54B67',#122);
#103 = ITEM_VERSION(#102,$,'A54B67-A');
#104 = ITEM_DEFINITION($,#103,'A54B67-A.1',$);
#105 = ITEM($,'765432',#112);
#106 = ITEM_VERSION(#105,$,'765432-1');
#107 = ITEM_DEFINITION($,#106,'765432-1-1',$);
#108 = ITEM($,'765433',#114);
#109 = ITEM_VERSION(#108,$,'765433-1');
#110 = ITEM_DEFINITION($,#109,'765433-1-1',$);
#111 = STRING_WITH_LANGUAGE('Tool A',#13);
#112 = MULTI_LANGUAGE_STRING((),#111);
#113 = STRING_WITH_LANGUAGE('Tool B',#13);
#114 = MULTI_LANGUAGE_STRING((),#113);
#115 = STRING_WITH_LANGUAGE('R390 mill',#13);
#116 = MULTI_LANGUAGE_STRING((),#115);
#117 = STRING_WITH_LANGUAGE('Mill 1-14',#13);
#118 = MULTI_LANGUAGE_STRING((),#117);
#119 = STRING_WITH_LANGUAGE('Mill A123',#13);
#120 = MULTI_LANGUAGE_STRING((),#119);
#121 = STRING_WITH_LANGUAGE('Cutter 1',#13);
#122 = MULTI_LANGUAGE_STRING((),#121);
#123 = STRING_WITH_LANGUAGE('complete assembled tool',#13);
#124 = MULTI_LANGUAGE_STRING((),#123);
#125 = ITEM_VERSION_RELATIONSHIP($,#109,#106,'derived');
#127 = ORGANIZATION('Someotherstreet 1, Sometown, USA','11-222-3344','CCTC -
Competing Cutting Tool Company','company','POBOX 000, Sometown, USA','Somestreet
1, Sometown, USA');
#132 = PERSON_ORGANIZATION_ASSIGNMENT(#127,$,(#23),'id owner');
#137 = ITEM_VERSION_RELATIONSHIP($,#103,#100,'supplied item');
#138 = ORGANIZATION('Anotherstreet 1, Atown, Acountry','87391874','MFG -
Manufacturing Company','company','111, Atown, Acountry','Astreet 1, Atown,
Acountry');
#139 = PERSON_ORGANIZATION_ASSIGNMENT(#138,$,(#102),'id owner');
#140 = ITEM_DEFINITION_RELATIONSHIP($,#143,#3,'realized definition');
#141 = PHYSICAL_ITEM($,'984327',#345);
#142 = PHYSICAL_ITEM_VERSION(#141,$,'984327-1-A');
#143 = PHYSICAL_ITEM_DEFINITION($,#142,'984327-1-A-1',$);
#144 = REALIZED_ITEM_ASSOCIATION(#141,#2);
#145 = STATE('Blunt edge');
#146 = PHYSICAL_ITEM_STATE_ASSOCIATION(#143,#145,'Observed');
#147 = PHYSICAL_ITEM_LOCATION_ASSOCIATION(#141,#148);
#148 = LOCATION('Pos 05','Machine X','Machine');
#149 = ASSEMBLY_ASSOCIATION($,#75,#41);
#150 = ASSEMBLY_ASSOCIATION($,#76,#41);
#151 = DOCUMENT($,'984327',#351);
#152 = DOCUMENT_VERSION(#151,$,'984327-A');
#153 = DIGITAL_DOCUMENT(#152,(#156),#157,#160,$,'984327-A-1',#158,$,(#154));
#154 = DIGITAL_FILE(#157,#160,$,(#155),#158,'/IGNORE',$,$);
#155 = EXTERNAL_FILE_ID_AND_LOCATION('FILE_984327-A-1',#156);
#156 = DOCUMENT_LOCATION_PROPERTY('.\\');
#157 = DOCUMENT_CONTENT_PROPERTY('rounded edges','solid model',(#13),$);
#158 = DOCUMENT_FORMAT_PROPERTY('ISO 8859-1','ISO 10303-214',$);
#160 = DOCUMENT_CREATION_PROPERTY($,'CAD system 1','WindowsXP');
#161 =
GEOMETRIC_MODEL_RELATIONSHIP_WITH_TRANSFORMATION($,#169,#163,#166,'hierarchy');
#162 =
GEOMETRIC_MODEL_RELATIONSHIP_WITH_TRANSFORMATION($,#170,#164,#166,'hierarchy');
#163 = EXTERNAL_GEOMETRIC_MODEL($,#154,#165,'MODEL_984327-A-1',$);
```

```
#164 = EXTERNAL_GEOMETRIC_MODEL($,#167,#165,'MODEL_576321-A-1',$);
#165 = CARTESIAN_COORDINATE_SPACE_3D((#54,#251));
#166 = EXTERNAL_GEOMETRIC_MODEL($,#168,#165,'MODEL_123-A-1',$);
#167 = DIGITAL_FILE($,$,$,(),$,'File_576321-A-1',$,$);
#168 = DIGITAL_FILE($,$,$,(#353),$,'/IGNORE',$,$);
#169 = TRANSFORMATION_3D(#173,$,#171,$);
#170 = TRANSFORMATION_3D(#174,$,#172,$);
#171 = CARTESIAN_POINT(());
#172 = CARTESIAN_POINT(());
#173 = DIRECTION(());
#174 = DIRECTION(());
#175 = EXTERNAL_PICTURE($,#179,#177,'MODEL2D_984327-A-1');
#176 = EXTERNAL_PICTURE($,#180,#177,'MODEL2D_576321-A-1');
#177 = CARTESIAN_COORDINATE_SPACE_2D((#54,#251));
#178 = EXTERNAL_PICTURE($,#181,#177,'MODEL2D_tool123-1-1');
#179 = DIGITAL_FILE($,$,$,(),$,'FILE2D_984327-A-1',$,$);
#180 = DIGITAL_FILE($,$,$,(),$,'FILE2D_576321-A-1',$,$);
#181 = DIGITAL_FILE($,$,$,(#355),$,'/IGNORE',$,$);
#182 = TRANSFORMATION_2D(#186,$,#184);
#183 = TRANSFORMATION_2D(#187,$,#185);
#184 = CARTESIAN_POINT(());
#185 = CARTESIAN_POINT(());
#186 = DIRECTION(());
#187 = DIRECTION(());
#188 = PHYSICAL_ITEM($,'576321',#346);
#189 = PHYSICAL_ITEM_VERSION(#188,$,'576321-1-A');
#190 = PHYSICAL_ITEM_DEFINITION($,#189,'576321-1-A-1',$);
#191 = PHYSICAL_ITEM($,'tool123',$);
#192 = PHYSICAL_ITEM_VERSION(#191,$,'tool123-1-A');
#193 = PHYSICAL_ITEM_DEFINITION($,#192,'tool123-1-A-1',$);
#194 = PHYSICAL_ITEM_STRUCTURE_ASSOCIATION(#143,#193);
#195 = PHYSICAL_ITEM_STRUCTURE_ASSOCIATION(#190,#193);
#196 = EFFECTIVITY((#18),$,$,$,$,#197,#198,$);
#197 = DURATION('130','day');
#198 = DATE_TIME('2007-01-30','hh:mm:ss');
#199 = EFFECTIVITY_ASSIGNMENT(#196,#2,.T.,'planned');
#200 = EFFECTIVITY((),$,$,$,$,$,$,$);
#201 = EFFECTIVITY_RELATIONSHIP($,#200,#196,'inheritance');
#202 = EFFECTIVITY_ASSIGNMENT(#200,#9,.T.,'planned');
#203 = ITEM_CHARACTERISTIC_ASSOCIATION(#204,#10,'has characteristic');
#204 = GRADE(#207,(#209),'1025 GC','HC',#206,(#205));
#205 = MATERIAL_DESIGNATION('P');
#206 = SUBSTRATE('WC');
#207 = COATING('TiAlN','PVD');
#209 = CUTTING_CONDITION('P25');
#210 = DOCUMENT_VERSION_RELATIONSHIP($,#211,#152,$);
#211 = DOCUMENT_VERSION(#151,$,$);
#212 = ITEM($,'12346-678',#239);
#213 = ITEM_VERSION(#212,$,'12346-678-1');
#214 = ITEM_DEFINITION($,#213,'12345-678-1-1',$);
#215 = ITEM_DEFINITION($,#213,'12346-678-1-2',$);
#216 = ITEM_DEFINITION($,#213,'12346-678-1-3',$);
#217 = PROPERTY_VALUE_ASSOCIATION($,#214,#220,$,$);
#218 = PROPERTY_VALUE_ASSOCIATION($,#215,#221,$,$);
#219 = PROPERTY_VALUE_ASSOCIATION($,#216,#222,$,$);
#220 = PROPERTY_VALUE_REPRESENTATION(#223,$,$,#229,$);
#221 = PROPERTY_VALUE_REPRESENTATION(#224,$,$,#238,$);
#222 = PROPERTY_VALUE_REPRESENTATION(#224,$,$,#231,$);
```

```
#223 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#246,'/IGNORE','/IGNORE'
);
#224 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#226,'/IGNORE','/IGNORE'
);
#225 = PLIB_PROPERTY_REFERENCE('71DCD39338974',#227,'001');
#226 = PLIB_PROPERTY_REFERENCE('71DCD39338974',#228,'001');
#227 = PLIB_CLASS_REFERENCE('71E01A05D27A8','112/1///13399__001','001');
#228 = PLIB_CLASS_REFERENCE('71E01A0E9CBA9','112/1///13399__001','001');
#229 = NUMERICAL_VALUE('/IGNORE',$,#54,'10');
#231 = NUMERICAL_VALUE('/IGNORE',$,#54,'15');
#232 = CLASSIFICATION_ASSOCIATION(#233,#214,$,$);
#233 =
GENERAL_CLASSIFICATION(#227,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNO
RE');
#235 = CLASSIFICATION_ASSOCIATION(#236,#215,$,$);
#236 =
GENERAL_CLASSIFICATION(#228,DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',$,'/IGNO
RE');
#237 = CLASSIFICATION_ASSOCIATION(#236,#216,$,$);
#238 = NUMERICAL_VALUE('/IGNORE',$,#54,'15');
#239 = MULTI_LANGUAGE_STRING((),#240);
#240 = STRING_WITH_LANGUAGE('Multi purpose tool',#13);
#241 = PROPERTY_VALUE_ASSOCIATION($,#214,#242,$,$);
#242 = PROPERTY_VALUE_REPRESENTATION($,$,$,#244,$);
#243 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#245,'/IGNORE','/IGNORE'
);
#244 = VALUE_RANGE('/IGNORE',$,#54,'28','35');
#245 = PLIB_PROPERTY_REFERENCE('71ED6AA478A3D',#227,'001');
#246 = PLIB_PROPERTY_REFERENCE('71ED6A9AF7D1D',#227,'001');
#247 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#252,'/IGNORE','/IGNORE'
);
#248 = PROPERTY_VALUE_REPRESENTATION(#247,$,$,#250,$);
#249 = PROPERTY_VALUE_ASSOCIATION($,#214,#248,$,$);
#250 = VALUE_LIMIT('/IGNORE',$,#251,'45','5');
#251 = UNIT('deg');
#252 = PLIB_PROPERTY_REFERENCE('71D08096F930C',#227,'001');
#253 = STRING_VALUE('/IGNORE',#255);
#254 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#259,'/IGNORE','/IGNORE'
);
#255 = MULTI_LANGUAGE_STRING((),#256);
#256 = STRING_WITH_LANGUAGE('SZD016002M0INT',#13);
#257 = PROPERTY_VALUE_REPRESENTATION(#254,$,$,#253,$);
#258 = PROPERTY_VALUE_ASSOCIATION($,#214,#257,$,$);
#259 = PLIB_PROPERTY_REFERENCE('71D102AE3B252',#227,'001');
#260 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#263,'/IGNORE','/IGNORE'
);
#261 = PROPERTY_VALUE_ASSOCIATION($,#3,#262,$,$);
#262 = PROPERTY_VALUE_REPRESENTATION(#260,$,$,$,$);
#263 = EXTERNAL_LIBRARY_REFERENCE($,'aa002','OWL');
#264 = PROPERTY((#54),#267,'001',$,'specification','001');
#265 = PROPERTY_VALUE_ASSOCIATION($,#3,#266,$,$);
#266 = PROPERTY_VALUE_REPRESENTATION(#264,$,$,$,$);
#267 = MULTI_LANGUAGE_STRING((),#268);
#268 = STRING_WITH_LANGUAGE('A company unique property',#13);
```

```
#271 = PROPERTY((),#273,'001',$,'specification','002');
#272 = PROPERTY_RELATIONSHIP($,#271,#264,'substitution');
#273 = MULTI_LANGUAGE_STRING((),#274);
#274 = STRING_WITH_LANGUAGE('A new version of a company unique property',#13);
#275 = PLIB_CLASS_REFERENCE('71EAD37F18F34','0112/1///13399__001','001');
#276 = PLIB_PROPERTY_REFERENCE('71EBDBF130AE6',#275,'001');
#277 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#276,'/IGNORE','/IGNORE'
);
#279 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#280,'/IGNORE','/IGNORE'
);
#280 = PLIB_PROPERTY_REFERENCE('71EBDBF5060E6',#31,'001');
#281 = CLASSIFICATION_ASSOCIATION(#282,#25,$,$);
#282 = GENERAL_CLASSIFICATION($,#283,'class001',$,'001');
#283 = MULTI_LANGUAGE_STRING((),#284);
#284 = STRING_WITH_LANGUAGE('A company unique classification',#13);
#285 = PROPERTY_VALUE_ASSOCIATION($,#214,#286,$,$);
#286 = PROPERTY_VALUE_REPRESENTATION(#287,$,$,#288,$);
#287 = PROPERTY((),$,'/IGNORE',$,$,$);
#288 = NUMERICAL_VALUE('v1',$,$,'10');
#289 = NUMERICAL_VALUE('v2',$,$,'15');
#290 = NUMERICAL_VALUE('v3',$,$,'20');
#291 = VALUE_LIST('A name of the list',(#288,#289,#290));
#292 = ITEM_DEFINITION($,#369,'tool456-1-1',$);
#293 = DOCUMENT_ASSIGNMENT(#294,#292,'geometric description');
#294 = DOCUMENT_VERSION(#295,$,'DOC-tool456-1');
#295 = DOCUMENT($,$,#373);
#296 = DIGITAL_DOCUMENT(#294,(),$,$,$,'DOC-tool456-1-1',$,$,(#297));
#297 = DIGITAL_FILE($,$,$,(#300),$,'/IGNORE',$,'001');
#298 = EXTERNAL_GEOMETRIC_MODEL($,#297,#299,'MODEL-tool456-1-1',$);
#299 = CARTESIAN_COORDINATE_SPACE_3D((#54,#251));
#300 = EXTERNAL_FILE_ID_AND_LOCATION('FILE-DOC-tool456-1-1.3D',#301);
#301 = DOCUMENT_LOCATION_PROPERTY('.\\');
#302 = ITEM_DEFINITION($,#363,'tool678-1-1',$);
#303 = DOCUMENT_ASSIGNMENT(#304,#302,'geometric description');
#304 = DOCUMENT_VERSION(#305,$,'DOC-tool678-1');
#305 = DOCUMENT($,$,#367);
#306 = DIGITAL_DOCUMENT(#304,(),$,$,$,'DOC-tool678-1-1',$,$,(#309));
#308 = EXTERNAL_PICTURE($,#309,#310,'MODEL-678-1-1');
#309 = DIGITAL_FILE($,$,$,(#311),$,'/IGNORE',$,'001');
#310 = CARTESIAN_COORDINATE_SPACE_2D((#54,#251));
#311 = EXTERNAL_FILE_ID_AND_LOCATION('FILE-DOC-678-1-1',#301);
#313 = ITEM_DEFINITION($,$,'tool001-1-1',$);
#314 = CLASSIFICATION_ASSOCIATION(#233,#214,.F.,$);
#315 = CLASSIFICATION_ASSOCIATION_RELATIONSHIP(#316,#314,'alternitive');
#316 = CLASSIFICATION_ASSOCIATION(#236,#214,.F.,$);
#317 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#314),'classification officer');
#318 = PERSON_ORGANIZATION_ASSIGNMENT(#18,$,(#1),$);
#319 =
PROPERTY((),DEFAULT_LANGUAGE_STRING('/IGNORE'),'/IGNORE',#320,'/IGNORE','/IGNORE'
);
#320 = PLIB_PROPERTY_REFERENCE('71D08462F8185',#31,'001');
#321 = PROPERTY_VALUE_ASSOCIATION($,#214,#322,$,$);
#322 = PROPERTY_VALUE_REPRESENTATION(#319,$,$,#323,$);
#323 = NUMERICAL_VALUE('/IGNORE',$,$,'30');
#324 = PLUS_MINUS_BOUNDS('0.1',$,'0.05','designed');
#325 = VALUE_LIMITATION($,#324,#323);
#327 = PROPERTY_VALUE_ASSOCIATION($,#214,#328,$,$);
#328 = PROPERTY_VALUE_REPRESENTATION(#279,$,$,#329,$);
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#329 = NUMERICAL_VALUE('/IGNORE',$,$,'40');
#330 = VALUE_LIMITATION($,#331,#329);
#331 = LIMITS_AND_FITS('h7','shaft','IT8');
#332 = VALUE_LIMITATION($,#333,#329);
#333 = FITTING_BOUNDS('-0.025',$,'0','designed');
#334 = EXTERNAL_GEOMETRIC_MODEL($,#337,#299,'MODEL_123456','200');
#335 = WORKPIECE_FEATURE($,'123456',(#334));
#336 = ITEM_CHARACTERISTIC_ASSOCIATION(#335,#3,'used for');
#337 = DIGITAL_FILE($,$,$,(),$,'FILE_MODEL_123456',$,'001');
#338 = DOCUMENT_ASSIGNMENT(#151,#3,'description');
#339 =
GEOMETRIC_MODEL_RELATIONSHIP_WITH_TRANSFORMATION($,#182,#175,#178,'hierarchy');
#340 =
GEOMETRIC_MODEL_RELATIONSHIP_WITH_TRANSFORMATION($,#183,#176,#178,'hierarchy');
#341 = ITEM_INSTANCE(#3,$,'984327-1-A-1-1');
#342 = ITEM_INSTANCE(#10,$,'576321-1-B-1-2');
#343 = ASSEMBLY_ASSOCIATION(#339,#341,#41);
#344 = ASSEMBLY_ASSOCIATION(#340,#342,#41);
#345 = MULTI_LANGUAGE_STRING((),#348);
#346 = MULTI_LANGUAGE_STRING((),#349);
#348 = STRING_WITH_LANGUAGE('Physical item of R390 tool body',#13);
#349 = STRING_WITH_LANGUAGE('Physical item of R390 insert',#13);
#351 = MULTI_LANGUAGE_STRING((),#352);
#352 = STRING_WITH_LANGUAGE('R390 Geometric Description',#13);
#353 = EXTERNAL_FILE_ID_AND_LOCATION('FILE_123-A-1',#301);
#355 = EXTERNAL_FILE_ID_AND_LOCATION('FILE2D_tool123-1-1',#301);
#356 = PROPERTY_VALUE_ASSOCIATION($,#41,#358,$,$);
#357 = PROPERTY_VALUE_ASSOCIATION($,#41,#359,$,$);
#358 = PROPERTY_VALUE_REPRESENTATION(#277,$,$,#376,$);
#359 = PROPERTY_VALUE_REPRESENTATION(#279,$,$,#375,$);
#360 = PROPERTY_VALUE_REPRESENTATION_RELATIONSHIP($,#359,#358,'dependency');
#361 = MULTI_LANGUAGE_STRING((),#362);
#362 = STRING_WITH_LANGUAGE('multi function tool',#13);
#363 = ITEM_VERSION(#364,$,$);
#364 = ITEM($,$,#365);
#365 = MULTI_LANGUAGE_STRING((),#366);
#366 = STRING_WITH_LANGUAGE('tool',#13);
#367 = MULTI_LANGUAGE_STRING((),#368);
#368 = STRING_WITH_LANGUAGE($,#13);
#369 = ITEM_VERSION(#370,$,$);
#370 = ITEM($,$,#371);
#371 = MULTI_LANGUAGE_STRING((),#372);
#372 = STRING_WITH_LANGUAGE('tool',#13);
#373 = MULTI_LANGUAGE_STRING((),#374);
#374 = STRING_WITH_LANGUAGE($,#13);
#375 = NUMERICAL_VALUE('/IGNORE',$,#54,'30');
#376 = STRING_VALUE('/IGNORE',#377);
#377 = MULTI_LANGUAGE_STRING((),#378);
#378 = STRING_WITH_LANGUAGE('machine side',#13);
#379 = SPECIFIC_ITEM_CLASSIFICATION((#38),'adaptive item',$);

ENDSEC;
END-ISO-10303-21;
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ISO/TS 13399-150:2008(E)

ICS 25.100.01; 35.240.50

Price based on 86 pages