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Part 2:
Object model attributes

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INTERNATIONAL ELECTROTECHNICAL COMMISSION
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ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 2: Object model attributes

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International Standard IEC 62264-2 has been prepared by subcommittee 65A: System aspects, of IEC technical committee 65: Industrial-process measurement and control, and ISO SC5, JWG 15, of ISO technical committee 184: Enterprise-control system integration.

It is published as double logo standard.

This standard is based upon ANSI/ISA-95.00.02-2001, Enterprise-Control System Integration, Part 2: Object Model Attributes. It is used with permission of the copyright holder, the Instrumentation, Systems and Automation Society (ISA)[1]. ISA encourages the use and application of its industry standards on a global basis.

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[1] For information on ISA standards, contact ISA at: ISA – The Instrumentation, Systems and Automation Society, PO Box 12277, Research Triangle Park, NC 27709, USA, Tel. 1+919.549.8411, URL: standards.isa.org.

This standard was submitted to the National Committees for voting under the Fast Track Procedure as the following documents:

FDIS	Report on voting
65A/408/FDIS	65A/416/RVD

Full information on the voting for the approval of this standard can be found in the report on voting indicated in the above table. In ISO, the standard has been approved by 10 P members out of 11 having cast a vote.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

IEC 62264 consists of the following parts under the general title *Enterprise-control system integration:*

Part 1: Models and terminology

Part 2: Object model attributes

Part 3: Models of manufacturing operations

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "http://webstore.iec.ch" in the data related to the specific publication. At this date, the publication will be

• reconfirmed;
• withdrawn;
• replaced by a revised edition, or
• amended.

A bilingual version may be issued at a later date.

INTRODUCTION

IEC 62264 is a multi-part standard that defines the interface content between enterprise activities and control activities. This part of IEC 62264 provides the definitions of the attributes of the object models in IEC 62264-1.

IEC 62264 defines object models of exchanged information between enterprise systems and control systems. This part of IEC 62264 adds details to the object models through the definition of attributes, so that implement able interfaces may be constructed. IEC 62264 does not define models of enterprise objects or control objects.

The area of concern of this standard is strongly related to the ISO TC 184 (Industrial automation systems and integration) scope. Nevertheless the objectives and approaches are completely different and complementary. Relevant TC184 standards or work in progress address the modeling of enterprise and/or the modeling of enterprise objects whereas this standard specifies the content of interfaces between control functions and enterprise functions. The functions may be precisely modeled with TC184 standards. See ISO/IEC 62264-1 Annex A for further details.

ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 2: Object model attributes

1 Scope

This part of IEC 62264, in conjunction with IEC 62264-1, specifies generic interface content between manufacturing control functions and other enterprise functions. The interfaces considered are the interfaces between Levels 3 and 4 of the hierarchical model defined in IEC 62264-1. The goal is to reduce the risk, cost, and errors associated with implementing these interfaces.

Since IEC 62264 covers many domains, and there are many different standards in those domains, the semantics of this Standard are described at a level intended to enable the other standards to be mapped to these semantics. To this end, this Standard defines a set of generic interfaces content elements, together with a mechanism for extending those elements for implementations.

The scope of this part of IEC 62264 is limited to the definition of attributes of the IEC 62264-1 object models.

This part of IEC 62264 does not define attributes to represent the object relationships defined in IEC 62264-1.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62264-1, *Enterprise-Control System Integration – Part 1: Models and terminology*

ISO 10303-1:1994, *Industrial automation systems and integration – Product data representation and exchange – Part 1: Overview and fundamental principles*

ISO 15704:2000, *Industrial automation systems – Requirements for enterprise–reference architectures and methodologies*

3 Terms and definitions

For the purpose of this document, the terms and definitions given in IEC 62264-1 as well as the following apply.

3.1
event
representation of a solicited or unsolicited fact indicating a state change in the enterprise

3.2
product
the desired output or by-product of the processes of an enterprise

NOTE 1   A product may be an intermediate product or end product from a business perspective.

NOTE 2   Also defined in ISO 10303-1 as: 'a substance produced by a natural or artificial process'.

3.3
property
object denoting an implementation specific characteristic of an entity

4 Object model attributes

4.1 General

This clause describes the attributes associated with the objects listed in IEC 62264-1.

Tables 3 to 88 in Clause 4 define the attributes of objects defined in IEC 62264-1, Clause 7. The attributes are an extension to the object information model presented in IEC 62264-1 and are thus a part of the definition of terms. The attributes of this part of IEC 62264 and the object models of IEC 62264-1 define interface content for integration of Level 3 and Level 4 enterprise-control systems. See also IEC 62264-1, Clause 7.4.

In this part of IEC 62264, the word "Class" used as part of an object definition name is to be considered as a category, not as a "Class" in the object-oriented sense.

EXAMPLE "Personnel class" is to be considered a "personnel category", in the sense of distinguishing between the kinds of personnel in the real world.

A minimum set of industry-independent information has been defined, in this part of IEC 62264, as attributes. However, values for all attributes may not be required depending on the actual usage of the models. If additional information, including industry- and application-specific information, is needed, it shall be represented as property objects. This mechanism is the extension capability referenced in Clause 1. This solution increases the usability through the use of standard attributes, and allows flexibility and extensibility through the use of properties. This was done to make the standard as widely applicable as possible.

4.2 Attribute extensibility

For particular applications, the objects defined in the object models will need to be extended through the addition of attributes to object class definitions. Accordingly, this part of IEC 62264 provides for attributes that are application or industry specific, to be modeled in terms of properties and represented in property classes in the model. For example, the personnel class property would be used to define application or industry specific attributes for personnel classes, and person property would be used to contain instance values for the properties.

4.3 Object model structure

The object models are depicted using the Unified Modelling Language (UML) notational methodology.

Table 1 defines the UML notations used in the object diagrams.

Table 1 – UML notation used

Symbol	Definition
Package	Defines a package, a collection of object models, state models, use classes, and other UML models. In this document a package is used to specify an external model, such as a production rule model, or a reference to another part of the model.
Class	Defines a class of objects, each with the same types of attributes. Each object is uniquely identifiable or enumerable. No operations or methods are listed for the classes. Attributes with a " – " before their name indicate attributes that are generally optional in any use of the class.
Role 1..1 / 0..n Association name Role	An association between elements of a class and elements of another or the same class. Each association is identified. May have the expected number or range of members of the subclass, when 'n' indicates an indeterminate number. For example, 0,n means that zero or more members of the subclass may exist.
Is a type of	Generalization (arrow points to the super class) shows that an element of the class is a specialized type of the super class.
Depends on	Dependence is a weak association that shows that a modelling element depends on another modelling element. The item at the tail depends on the item at the head of the relationship.
Is an aggregation of	Aggregation (made up of) shows that an element of the class is made up of elements of other classes.
Is a composite of	Composite shows a strong form of aggregation, which requires that a part instance be included in at most one composite at a time and that the composite object has sole responsibility for disposition of its parts.
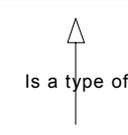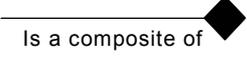
4.4 Explanation of tables

4.4.1 Tables of attributes

This subclause gives the meaning of the attribute tables. This includes a listing of the object identification, data types, and presentation of the examples in the tables.

4.4.2 Object identification

Many objects in the information model require unique identifications (IDs). These IDs shall be unique within the scope of the exchanged information. This may require translations:

– from the internal ID of the source system to the interface content ID;

– from the interface content ID to the internal ID of the target system.

EXAMPLE A unit may be identified as "X6777" in the interface content, as resource "R100011" in the business system, and as "East Side Reactor" in the control system.

A unique identification set shall be agreed to in order to exchange information.

The object IDs are used only to identify objects within related exchanged information sets. The object ID attributes are not global object IDs or database index attributes.

Generally, objects that are elements of aggregations, and are not referenced elsewhere in the model, do not require unique IDs.

4.4.3 Data types

The attributes presented are abstract representations, without any specific data type specified. A specific implementation will show how the information is represented.

Example 1   An attribute may be represented as a string in one implementation and as a numeric value in another implementation.

Example 2   A date/time value may be represented in ISO standard format in one implementation and in Julian calendar format in another.

Example 3   A relationship may be represented by two fields (type and key) in database tables or by a specific tag in XML.

4.4.4 Presentation of examples

Examples are included with each attribute given. Where multiple examples are used, there are multiple rows in the right hand column. See Table Table 2 below for how the example rows and columns are used.

Table 2 – Example table

Attribute name	Description	Examples
Name of first attribute	Description of first attribute	Example #1 for first attribute
		Example #2 for first attribute
		Example #3 for first attribute
Name of second attribute	Description of second attribute	Example #1 for second attribute
		Example #2 for second attribute
		Example #3 for second attribute
Name of third attribute	Description of third attribute	Example #1 for third attribute
		Example #2 for third attribute
		Example #3 for third attribute

When an example value is a set of values, or a member of a set of values, the set of values is given within a set of braces, {}.

The examples are purely fictional. They are provided to further describe attributes in the model. No attempt was made to make the examples complete or representative of any manufacturing enterprise.

4.4.5 Data relationships

The models used to document a reference to a resource, in another package, using the class or instance, with additional optional specification using properties, are not fully illustrated in the IEC 62264-1 object model figures. This relationship does not conform to the Unified Modeling Language (UML) modeling methodology, but was done to keep the diagrams simpler. Figure 1 illustrates how it is currently presented, on the left side, and how it could be more accurately modeled in UML on the right side. UML was used in this standard as a visualization method and not meant to describe implementations. The simplified relationship diagram method is used for the following objects and their relationship to another package:

Personnel capability	Equipment capability
Material capability	Personnel segment capability
Equipment segment capability	Material segment capability
Personnel segment specification	Equipment segment specification
Material segment specification	Personnel specification
Equipment specification	Material specification
Personnel requirement	Equipment requirement
Material produced requirement	Material consumed requirement
Consumable expected	Personnel actual
Equipment actual	Material produced actual
Material consumed actual	Consumable actual

Figure 1 – Detailed relationship models
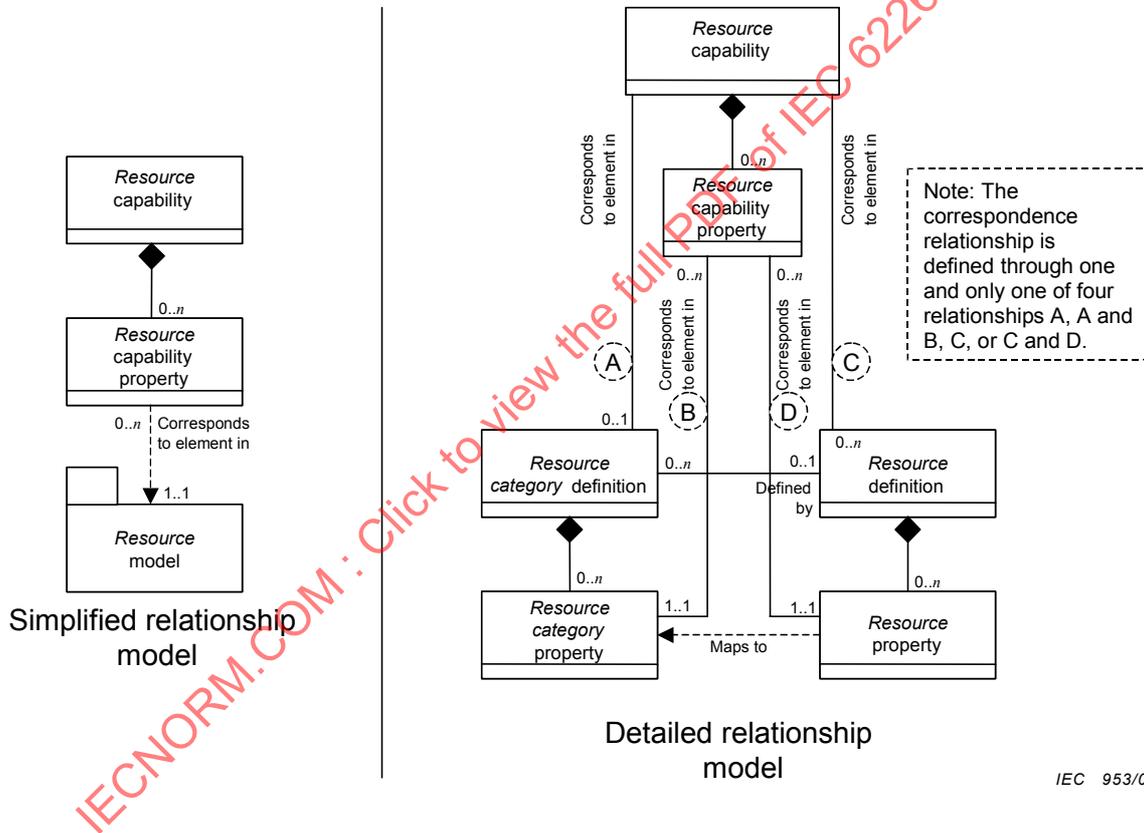
The correspondence relationship is determined through one and only one of four possible relationships: to the *resource catagory definition;* to the *resource catagory definition* and *resource catagory property;* to the *resource definition;* or to the *resource definition* and *resource property*.

In the model above, the term *resource catagory* indicates: personnel class, equipment class, material class, and material definitions. The term *resource* indicates: person, equipment, material lot, and material sublot. The term *resource capability* indicates the use in the capability model, the process segment capability model, the process segment model, the product definition model, the production schedule model, and the production performance model.

4.5 Personnel

4.5.1 Personnel model

The personnel model contains the information about specific personnel, classes of personnel, and qualifications of personnel. Figure 2 is a modified copy of Figure 14 in Part 1. This corresponds to a resource model for personnel, as given in ISO 15704.
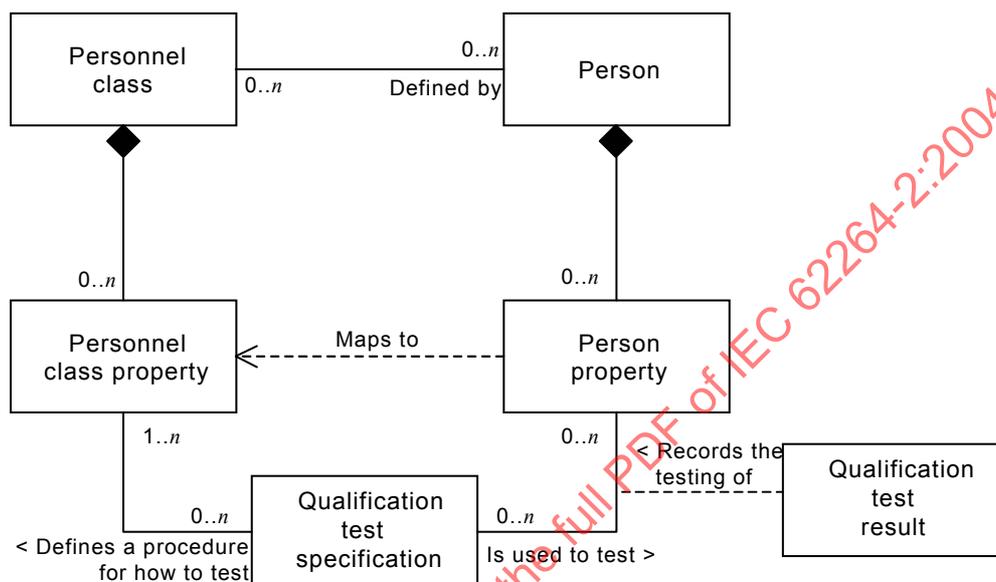
Figure 2 – Personnel model

4.5.2 Personnel class

Table 3 lists the attributes of *personnel class.*

Table 3 – Attributes of personnel class

Attribute name	Description	Example
ID	A unique identification of a specific *personnel class*. These are not necessarily job titles, but identify classes that are referenced in other parts of the model.	Widget assembly operator
Description	Additional information and description about the *personnel class*.	"General information about widget assembly operators."

4.5.3 Personnel class property

Table 4 lists the attributes of *personnel class property.*

Table 4 – Attributes of personnel class property

Attribute name	Description	Examples
ID	An identification of the specific property, unique under the scope of the parent *personnel class* object. For example, the property "*has class 1 safety training*" (with values of *yes* or *no*) may be defined under several different *personnel class* definitions, such as *fork lift operator* and *pipe fitter* classes, but has a different meaning for each class.	Class 1 certified
		Night shift available
		Monthly exposure hours maximum
Description	Additional information and description about the *personnel class property*.	"Indicates the certification level of the operator."
		"Indicates if operator is available for night shift."
		"Indicates the maximum monthly exposure hours that can be used."
Value	The value, set of values, or range of the property. This presents a range of possible numeric values, a list of possible values, or it may be empty if any value is valid.	{True, False}
		{True, False}
		[0..20]
Value unit of measure	The unit of measure of the associated property values, if applicable.	Boolean
		Boolean
		h

4.5.4 Person

A person is a representation of a specifically identified individual. A person may be a member of zero or more personnel classes. Table 5 lists the attributes of *person.*

Table 5 – Attributes of person

Attribute name	Description	Examples
ID	A unique identification of a specific person, within the scope of the information exchanged (*production capability, production schedule, production performance*, etc.) The ID shall be used in other parts of the model when the *person* needs to be identified, such as the *production capability* for this person, or a *production response* identifying the person.	999-123-4567
		Jane W Smith – #2
		Employee 23
Description	Additional information about the resource.	"Person information"
		"Person information"
		"Person information"
Name	The name of the individual. This is meant as an additional identification of the resource, but only as information and not as a unique value.	Joe Smith III
		Jane
		Bubba

4.5.5 Person property

Table 6 lists the attributes of *person property.*

Table 6 – Attributes of person property

Attribute name	Description	Examples
ID	An identification of the specific property.	Class 1 certified
		Exposure hours available
		Pager number
Description	Additional information about the *person property*.	"Indicates if the person is class 1 certified widget assembly operator"
		"Indicates number of exposure hours available this month"
		"Pager number"
Value	The value, set of values, or range of the property. The value(s) is assumed to be within the range or set of defined values for the related *personnel class property*.	True
		4
		800-555-1212
Value unit of measure	The unit of measure of the associated property value, if applicable.	Boolean
		h
		Phone number

4.5.6 Qualification test specification

Table 7 lists the attributes of *qualification test specification.*

Table 7 – Attributes of qualification test specification

Attribute name	Description	Example
Name	An identification of a test for certifying one or more values for one or more *person properties*. For example, this may be the name of a document that describes or defines the qualification test.	Class 1 widget assembly certification test
Description	Additional information and description about the *qualification test specification.*	"Identifies the test for class 1 widget assembly certification – returns a true or false value for the *class 1 widget assembly certification* property
Version	An identification of the version of the qualification test specification. In cases where there are multiple versions of a qualification test specification, then the version attribute shall contain the additional identification information to differentiate each version.	V23

4.5.7 Qualification test result

Table 8 lists the attributes of *qualification test result.*

Table 8 – Attributes of qualification test result

Attribute name	Description	Example
ID	A unique instance identification that records the results from the execution of a test identified in a *qualification test specification* for a specific *person*. (For example, this may just be a number assigned by the testing authority.)	T5568700827
Description	Additional information and description about the *qualification test results*.	"Results from Joe's widget assembly qualification test for October 1999."
Date	The date and time of the qualification test.	1999-10-25 13:30
Result	The result of the qualification test. For example: pass, fail	Pass
Result unit of measure	The unit of measure of the associated test result, if applicable.	{Pass, fail}
Expiration	The date of the expiration of the qualification.	2000-10-25 13:30

4.6 Equipment

4.6.1 Equipment model

The equipment model contains the information about specific equipment, the classes of equipment, equipment capability tests, and maintenance information associated with equipment. This corresponds to a resource model for equipment, as defined in ISO 15704:2000.

Figure 3 is a modified copy of Figure 15 in Part 1.
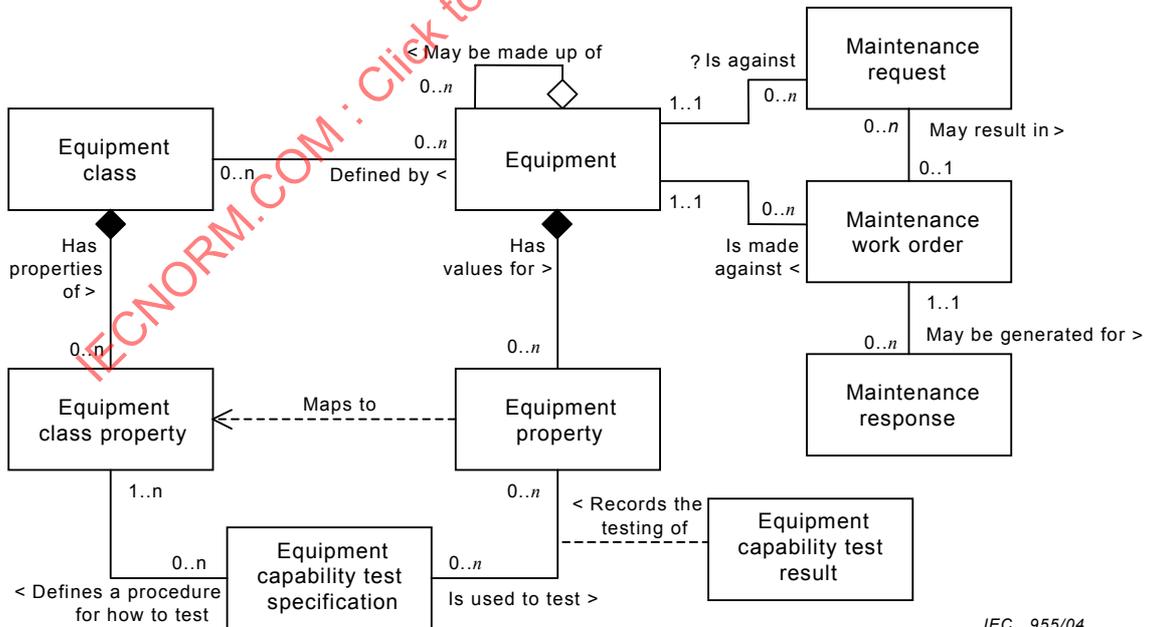
IEC   955/04

Figure 3 – Equipment model

4.6.2 Equipment class

Table 9 lists the attributes of *equipment class.*

Table 9 – Attributes of equipment class

Attribute name	Description	Example
ID	A unique identification of a specific *equipment class*, within the scope of the information exchanged (*production capability*, *production schedule*, *production performance*, etc.) The ID shall be used in other parts of the model when the *equipment class* needs to be identified, such as the *production capability* for this equipment class, or a *production response* identifying the equipment class used.	WJ6672892
Description	Additional information about the *equipment class*.	"Jigs used to assemble widgets."

4.6.3 Equipment class property

Table 10 lists the attributes of *equipment class property.*

Table 10 – Attributes of equipment class property

Attribute name	Description	Examples
ID	An identification of the specific property.	Run rate
		Template size
Description	Additional information about the *equipment class property*.	"Range of run rate for the widget machines."
		"Range of template sizes for widget machines."
Value	The value, set of values, or range of the property.	{1..100}
		{10,20,30,40,100,200,300}
Value unit of measure	The unit of measure of the associated property value, if applicable.	Widgets/h
		cm

4.6.4 Equipment

Table 11 lists the attributes of *equipment.*

Table 11 – Attributes of equipment

Attribute name	Description	Example
ID	A unique identification of a specific piece of equipment, within the scope of the information exchanged (*production capability, production schedule, production performance*, etc.) The equipment ID shall be used in other parts of the model when the equipment needs to be identified, such as the *production capability* for a piece of equipment, or a *production response* identifying the equipment used.	Jig 347
Description	Additional information about the equipment.	"This is the east side, north building, widget jig."

4.6.5 Equipment property

Table 12 lists the attributes of *equipment property.*

Table 12 – Attributes of equipment property

Attribute name	Description	Examples
ID	An identification of the specific property.	Equipment name
		Run rate
		Template size
Description	Additional information about the *equipment property*.	"Local name for the widget machine."
		"Widget making average run rate"
		"Widget jig template size."
Value	The value, set of values, or range of the property. The value(s) is assumed to be within the range or set of defined values for the related *equipment property*.	Big Bertha
		59
		300
Value unit of measure	The unit of measure of the associated property value, if applicable.	[not applicable]
		Widgets/h
		cm

4.6.6 Equipment capability test specification

Table 13 lists the attributes of *equipment capability test specification.*

Table 13 – Attributes of equipment capability test specification

Attribute name	Description	Example
Name	An identification of a test for certifying one or more values for one or more *equipment properties*. For example, this may be the name of a document that describes or defines the capability test.	WAJTT-101
Description	Additional information about the *equipment capability test specification*.	"Widget assembly jig throughput test – returns the run rate for a specific machine"
Version	An identification of the version of the capability test specification. In cases where there are multiple versions of an equipment capability test specification, then the version attribute shall contain the additional identification information to differentiate each version.	1.0

4.6.7 Equipment capability test result

Table 14 lists the attributes of *equipment capability test result.*

Table 14 – Attributes of equipment capability test result

Attribute name	Description	Example
ID	A unique instance identification that records the results from the execution of a test identified in a *capability test specification* for a specific piece of *equipment*. (For example, this may just be a number assigned by the testing authority.)	FQ101/01-10-2000
Description	Additional information about the *equipment capability test result*.	"Results from run rate test for JIG 237 for October 1999."
Date	The date and time of the capability test.	1999-10-25 13:30
Result	The result of the capability test.	48
Result unit of measure	The unit of measure of the associated test result, if applicable.	Widgets/h
Expiration	The date of the expiration of the capability.	2000-10-25 13:30

4.6.8 Maintenance request

Table 15 lists the attributes of *maintenance request.*

Table 15 – Attributes of maintenance request

Attribute name	Description	Example
ID	A unique identifier of a specific *maintenance request*.	MR-1001029928
Problem	A description of the maintenance issue.	"Limit Switch, XS101, failed ON. PLC X24 input forced to OFF."
Requested completion date	Date and time the request is expected to be completed.	2000-03-30 10:00 EST
Requested priority	The initially defined priority of the *maintenance request*.	High
Requestor	An identification of the person, system, or equipment making the *maintenance request*.	ID# 236663
Status	The status of *maintenance request*. For example: submitted, denied, closed, in work, in review.	Submitted
Reviewer	An identification of the person, system, or equipment reviewing the *maintenance request.*	ID# 236664
Submission date	Date and time of maintenance request submission.	2000-03-28 10:33 EST

4.6.9 Maintenance work order

Table 16 lists the attributes of *maintenance work order.*

Table 16 – Attributes of maintenance work order

Attribute name	Description	Example
ID	A unique identifier of a specific *maintenance work order*.	WO-1001029928
Planned start	The planned start date and time for the *maintenance work order*.	2000-03-29 16:00 EST
Planned finish	The planned finish date and time for the *maintenance work order*.	2000-03-29 18:30 EST
Responsible person	Person or function responsible for work order, or assigned to work.	Second shift maintenance crew
Resources	List of resources needed to perform the work.	{Duct tape, safety glasses, breathing air}
Status	Current status of the work order, for example "in work", "not started", and "assigned".	Assigned

4.6.10 Maintenance response

Table 17 lists the attributes of *maintenance response.*

Table 17 – Attributes of maintenance response

Attribute name	Description	Examples
ID	A unique identifier of a response to a specific *maintenance work order*.	MR-1001029928-01
		MR-1001029928-02
		MR-1001029928-03
Cause	The diagnosis of the fault or problem, or reason for *maintenance work order*.	Wet floor
		Bad duct tape
		Preventive maintenance
Correction	The action taken to perform the work.	"Wet floor sign placed on wet area"
		"Duct tape replaced"
		"Filters replaced"
Actual start time	The actual start date and time for the work order.	2000-03-29 16:00 EST
		2000-03-29 16:00 EST
		2000-03-29 16:00 EST
Actual finish time	The actual finish date and time for the work order. Empty if this is a status update response or work is incomplete.	2000-03-31 18:30 EST
		2000-03-31 18:30 EST
Status	Status of the work order as of the current update period.	"In process"
		"Suspended"
		"Completed"
Status time	Time and date stamp for the *maintenance response*.	2000-03-30 18:30 EST
		2000-03-30 18:30 EST
		2000-03-30 18:30 EST
Responsible person	Person or function responsible for response.	Second shift maintenance crew
		999-12-3456
		Bill

4.7 Material

4.7.1 Material model

The material model defines the actual materials, material definitions, and information about classes of material definitions. Material information includes the inventory of raw, finished, and intermediate materials. The current material information is contained in the material lot and material sublot information. Material classes are defined to organize materials. This corresponds to a resource model for material, as defined in ISO 10303.

Figure 4 is a copy of Figure 16 in IEC 62264-1. An additional association is shown between a QA test specification and a material class property.
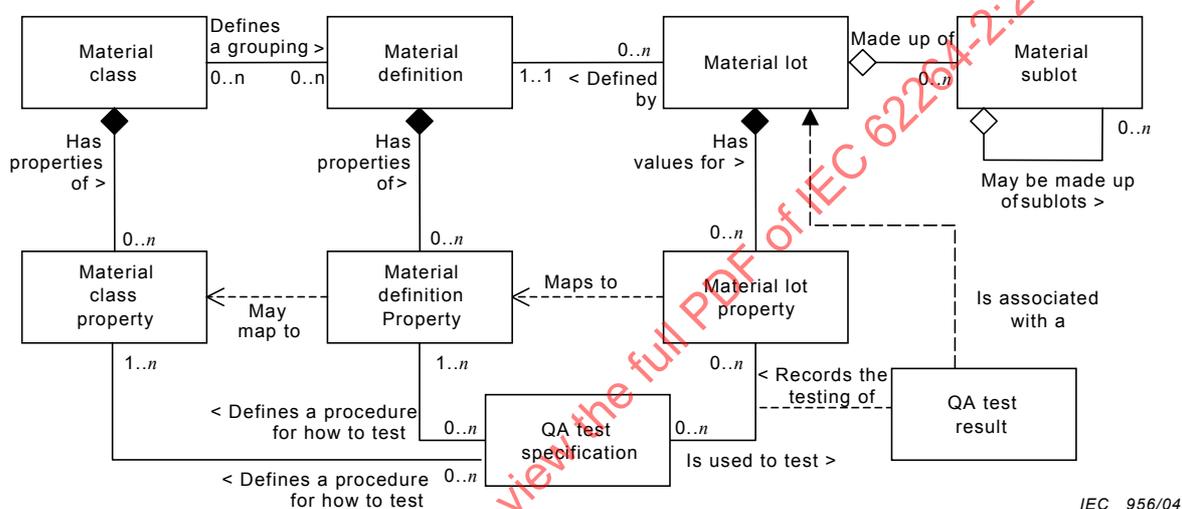
Figure 4 – Material model

4.7.2 Material class

Table 18 lists the attributes of *material class*.

Table 18 – Attributes of material class

Attribute name	Description	Example
ID	A unique identification of a specific *material class*, within the scope of the information exchanged (*production capability*, *production schedule*, *production performance*, etc.) The ID shall be used in other parts of the model when the *material class* needs to be identified, such as the *production capability* for this *material class*, or a *production response* identifying the *material class* used.	Polymer sheet stock 1001A
Description	Additional information about the *material class*.	"Solid polymer resin"

4.7.3 Material class property

Table 19 lists the attributes of material class property.

Table 19 – Attributes of material class property

Attribute name	Description	Example
ID	An identification of a specific *material class property*.	Polyethylene sheets
Description	Additional information about the *material class property*.	"Sheet thickness"
Value	The value, set of values, or range of the property.	{5, 10, 25}
Value unit of measure	The unit of measure of the associated property value, if applicable.	mm

4.7.4 Material definition

Table 20 lists the attributes of *material definition.*

Table 20 – Attributes of material definition

Attribute name	Description	Example
ID	A unique identification of a specific *material definition*, within the scope of the information exchanged (*production capability*, *production schedule*, *production performance*, etc.) The ID shall be used in other parts of the model when the *material definition* needs to be identified, such as the *production capability* for this *material definition*, or a *production response* identifying the *material definition* used.	Sheet stock 1443a
Description	Additional information about the *material definition*.	General purpose sheet stock

4.7.5 Material definition property

Table 21 lists the attributes of *material definition property.*

Table 21 – Attributes of material definition property

Attribute name	Description	Example
ID	An identification of the specific material definition property.	1443a5mm
Description	Additional information about the *material definition property*.	5 mm sheet
Value	The value, set of values, or range of the property.	5
Value unit of measure	The unit of measure of the associated property value, if applicable.	mm

4.7.6 Material lot

Table 22 lists the attributes of *material lot.*

Table 22 – Attributes of material lot

Attribute name	Description	Example
ID	A unique identification of a specific *material lot*, within the scope of the information exchanged (*production capability*, *production schedule*, *production performance*, etc.) The ID shall be used in other parts of the model when the *material lot* needs to be identified, such as the *production capability* for this *material lot*, or a *production response* identifying the *material lot* used.	L66738-99
Description	Additional information about the material lot.	PlastiFab 10/31 shipment
Status	Status of the *material lot*. For example, released, approved, blocked, in process, in quality check.	In process

4.7.7 Material lot property

Table 23 lists the attributes of *material lot property.*

Table 23 – Attributes of material lot property

Attribute name	Description	Examples
ID	An identification of the specific *material lot property*.	Average sheet thickness
		Density
Description	Additional information about the *material lot property*.	Measured thickness
		Measured Density
Value	The value, set of values, or range of the property.	5,002
		34,5
Value unit of measure	The unit of measure of the associated property value, if applicable.	mm
		g/^{cm3c}

4.7.8 Material sublot

Table 24 lists the attributes of *material sublot*.

Table 24 – Attributes of material sublot

Attribute name	Description	Examples
ID	A unique identification of a specific *material sublot,* within the scope of the information exchanged (*production capability*, *production schedule*, *production performance* etc.) The ID shall be used in other parts of the model when the *material sublot* needs to be identified, such as the *production capability* for this *material sublot*, or a *production response* identifying the *material sublot* used.	1999-10-27-a67-B6653
Description	Additional information about the *material sublot*.	Pallet 2 of 6
Status	Status of the current *material sublot*. For example, released, approved, blocked, in process, in quality check.	Released
Storage Location	An identification of the storage location of the *material sublot*.	"Warehouse 1 Rack 12 Slot 4"
Quantity	The quantity of the *material sublot*.	40
Quantity Unit of Measure	The unit of measure of the associated quantity, if applicable.	Sheets

4.7.9 QA test specification

Table 25 lists the attributes of *QA test specification.*

Table 25 – Attributes of QA test specification

Attribute name	Description	Example
Name	An identification of a test for certifying one or more values for one or more *equipment properties*. For example, this may be the name of a document that describes or lists the capability test.	STMT-101
Description	Additional information about the *QA Test Specification*.	"Sheet thickness measurement test – returns the average sheet thickness based on a sample plan and technique for a specific lot"
Version	An identification of the version of the *QA test specification*. In cases where there are multiple versions of a QA test specification, then the version attribute shall contain the additional identification information to differentiate each version.	1.0

4.7.10 QA test result

Table 26 lists the attributes of *QA test result.*

Table 26 – Attributes of QA test result

Attribute name	Description	Example
ID	A unique instance identification that records the results from the execution of a test identified in a *QA test specification* for a lot or sublot. (For example, this may just be a number assigned by the testing authority.)	THK101/01-10-2000
Description	Additional information about the *QA Test Result*.	"Results from thickness test for PlastiFab lot on 1999-10-25"
Date	The date of the QA test.	1999-10-25 11:30
Result	The value or list of values returned from the performance of the QA test. For example: Pass, Fail, 95, Red, Green.	Pass
Result unit of measure	The unit of measure of the associated test result, if applicable.	{Pass, Fail}
Expiration	The date of the expiration of the test results.	2000-10-25 13:30

4.8 Process segment

4.8.1 Process segment model

A process segment is a logical grouping of personnel resources, equipment resources, and material required to carry out a production step. A process segment defines the needed classes of personnel, equipment, and material, and/or it may define specific resources, such as specific equipment needed. A process segment may define the quantity of the resource needed.

Figure 5 is a copy of Figure 17 in IEC 62264-1, with a clarification of the relationship to the personnel, equipment, and material models, and with an additional object to contain the *process segment dependency*.
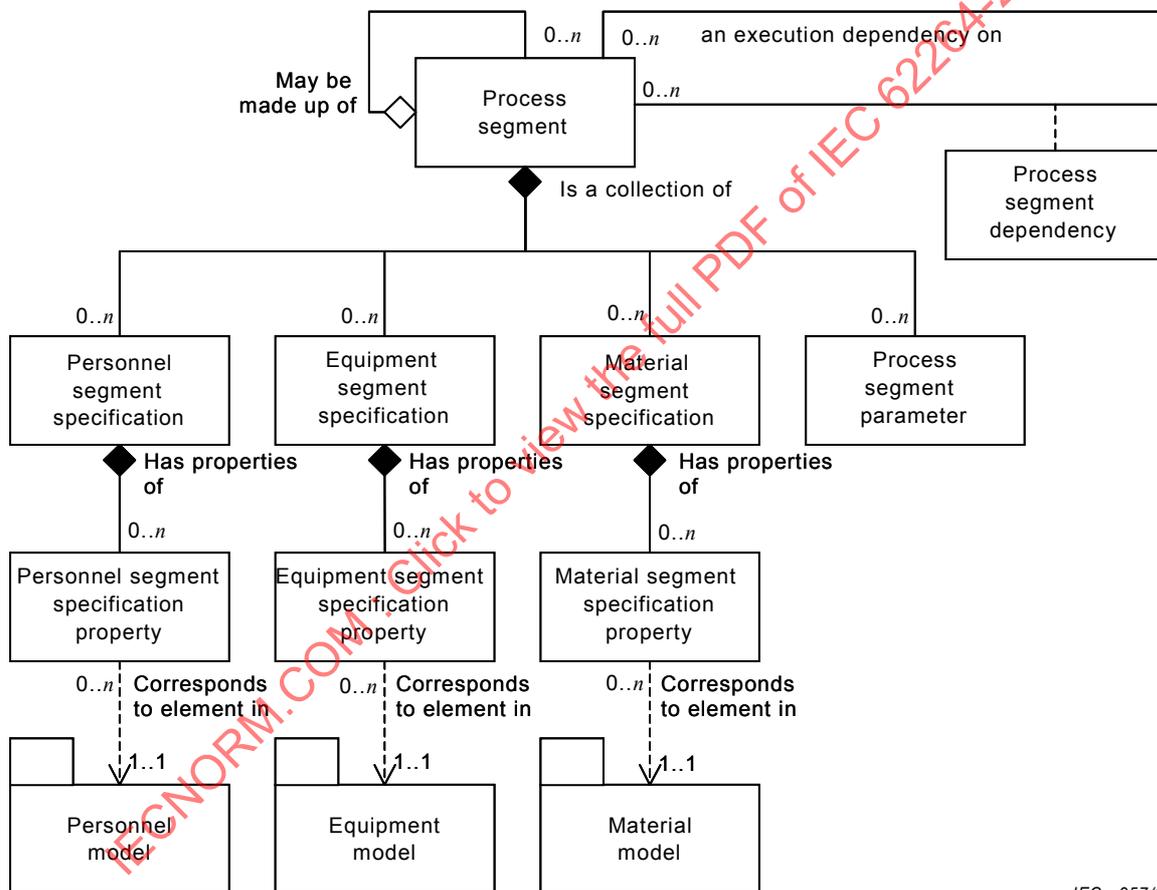
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Figure 5 – Process segment model

4.8.2 Process segment

Table 27 lists the attributes of *process segment.*

Table 27 – Attributes of process segment

Attribute name	Description	Examples
ID	A unique identification of a *process segment*, within the scope of the information exchanged (*production capability*, *production schedule*, *production performance* etc.)	Frame milling
		Top assembly
	The ID shall be used in other parts of the model when the *process segment* needs to be identified, such as the *production capability* for this segment, or a *production response* identifying the segment.	Polish and paint
Description	Additional information about the *process segment*.	"Frame milling operation, separately costed operation"
		"Top assembly operation, separately costed operation"
		"Polish and paint operation"
Location	An identification of the associated element of the equipment hierarchy model.	South shore production line
		East wing manufacturing line #2
	Optionally lists the scope of the process segment definition, such as the site or area it is defined for.	East wing manufacturing line #3
Element Type	A definition of the type of the associated element of the equipment hierarchy model.	Site
		Production line
		Production line
uration	Duration of process segment, if known.	25
		2
		0,85
Duration unit of measure	The units of measure of the duration, if specified.	min
		h
		Days

4.8.3 Personnel segment specification

Table 28 lists the attributes of *personnel segment specification.*

Table 28 – Attributes of personnel segment specification

Attribute name	Description	Example
Personnel class	Identifies the associated *personnel class* or set of *personnel classes* of the specification for a specific *process segment*.	Milling machine operator
Person	Identifies the associated *person* or set of *persons* of the specification for a specific *process segment*.	{999-55-1212, 999-55-1234, 999-55-4567}
Description	Contains additional information and descriptions of the *personnel segment specification* definition.	"Lists the time for journeyman milling machine operators for each widget frame milling process segment."
Quantity	Specifies the personnel resource required for the parent *process segment*, if applicable.	1,3
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	h/piece

4.8.4 Personnel segment specification property

Table 29 lists the attributes of *personnel segment specification property.*

Table 29 – Attributes of personnel segment specification property

Attribute name	Description	Example
Property Name	An identification of a property of the associated *personnel segment specification*.	Height
Description	Contains additional information and descriptions of the *personnel segment specification property* definition.	"Lists the required minimum height of a milling machine operator."
Value	The value, set of values, or range of the property.	150
Value unit of measure	The unit of measure of the associated property value, if applicable.	cm
Quantity	Specifies the personnel resource required for the parent *process segment*, if applicable.	1,3
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	h/piece

4.8.5 Equipment segment specification

Table 30 lists the attributes of *equipment segment specification.*

Table 30 – Attributes of equipment segment specification

Attribute name	Description	Example
Equipment class	Identifies the associated *equipment class* or set of *equipment classes* of the capability for a specific *process segment*.	Milling machine
Equipment	Identifies the associated *equipment* or set of *equipment* of the capability for a specific *process segment*.	{Mill 15, Mill 16, Mill 19}
Description	Contains additional information and descriptions of the *equipment segment specification* definition.	"Equipment needed for widget milling process segment"
Quantity	Specifies the amount of resources required for the parent *process segment*, if applicable.	1,3
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	Machine h/piece

4.8.6 Equipment segment specification property

Table 31 lists the attributes of *equipment segment specification property.*

Table 31 – Attributes of equipment segment specification property

Attribute name	Description	Example
Property name	An identification of a property of the associated *equipment segment capability.*	Milling direction
Description	Contains additional information and descriptions of the *equipment segment specification property* definition.	"Only vertical milling machines are suitable for widget milling."
Value	The value, set of values, or range of the property. For example: Vertical, Horizontal.	Vertical
Value unit of measure	The unit of measure of the associated property value, if applicable.	{Vertical, Horizontal, Universal}
Quantity	Specifies the amount of resources required for the parent *process segment*, if applicable.	1,0
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	Machine h/piece

4.8.7 Material segment specification

Table 32 lists the attributes of *material segment specification.*

Table 32 – Attributes of material segment specification

Attribute name	Description	Examples
Material class	Identifies the associated *material class* or set of *material classes* of the capability for a specific *process segment.* [a]	Polymer sheet stock 1001A
		Rivet
Material definition	Identifies the associated material definition or set of *material definitions* of the capability for a specific *process segment.* [a]	Sheet stock 1443a
		Rivet-10002
Description	Contains additional information and descriptions of the *material segment specification* definition.	"Lists the polymer required for a widget milling process segment."
		"Lists the rivet material required for a widget milling process segment."
Material use	Lists the material use: material consumed, material produced, or consumable	Material consumed
		Material consumed
Quantity	Specifies the amount of resources required for the parent *process segment*, if applicable.	0,35
		6
Quantity unit of measure	The unit of measure of the associated property value, if applicable.	Sheets/piece
		Number/piece
[a] Typically either a *material class* or *material definition* is specified.		

4.8.8 Material segment specification property

Table 33 lists the attributes of *material segment specification property.*

Table 33 – Attributes of material segment specification property

Attribute name	Description	Example
Property name	An identification of a property of the associated *material segment specification*.	Average surface roughness
Description	Contains additional information and descriptions of the *material segment specification property* definition.	"Lists the minimum polyethylene roughness quality."
Value	The value, set of values, or range of the property.	66,748
Value unit of measure	The unit of measure of the associated property value, if applicable.	Angstroms
Quantity	Specifies the amount of resources required for the parent *process segment*, if applicable.	0,10
Quantity unit of measure	The unit of measure of the associated property value, if applicable.	Sheets/piece

4.8.9 Process segment parameter

Table 34 lists the attributes of *process segment parameter.*

Table 34 – Attributes of process segment parameter

Attribute name	Description	Example
Name	Name of the *process segment parameter* for a specific *process segment*.	Milling time
Description	Contains additional information of the *process segment parameter.*	"Range of acceptable milling times."
Value	The value, set of values, or range of acceptable values.	{5..10}
Unit of measure	Unit of measure of the values, if applicable.	min

4.8.10 Process segment dependency

Table 35 lists the attributes of *process segment dependency*. The *process segment dependencies* can be used to describe process dependencies that are independent of any particular product.

EXAMPLE   It may declare that an inspection segment must follow an assembly segment.

Table 35 – Attributes of process segment dependency

Attribute name	Description	Example
Description	Contains additional information and descriptions of the *process segment dependency* definition for a specific *process segment*.	"Lists the ordering of assembly processes for the widget assembly process segment"
Dependency type	Lists the execution dependency constraints of one segment by another segment. Examples of these constraints, using A and B to identify the segments, or specific resources within the segments, and T to identify the time window, include: B cannot follow A B may run in parallel to A B may not run in parallel to A Start B at A start Start B after A start Start B after A end Start B no later than T (*Time window*) after A start Start B no earlier than T (*Time window*) after A start Start B no later than T (*Time window*) after A end Start B no earlier than T (*Time window*) after A end	Start *Cleanout* no earlier than T (*Time window*) after *Production* end
Time window	Time window used by dependency	25
Time unit of measure	The units of measure of the time window, if specified.	min

4.9 Production capability

4.9.1 Production capability model

Production capability information is the collection of information about all resources for production for selected times. This is made up of information about equipment, material, personnel, and process segments. Production capability describes the names, terms, statuses, and quantities of which the manufacturing control system has knowledge. The production capability information contains the 'vocabulary' for capacity scheduling and maintenance information. Production capability is defined as a collection of personnel capabilities, equipment capabilities, material capabilities, and process segment capabilities, for a given segment of time (current or future), and defined as committed, available, and unattainable.

Figure 6 is a copy of Figure 18 in Part 1, with a clarification of the relationship to the personnel, equipment, and material models.
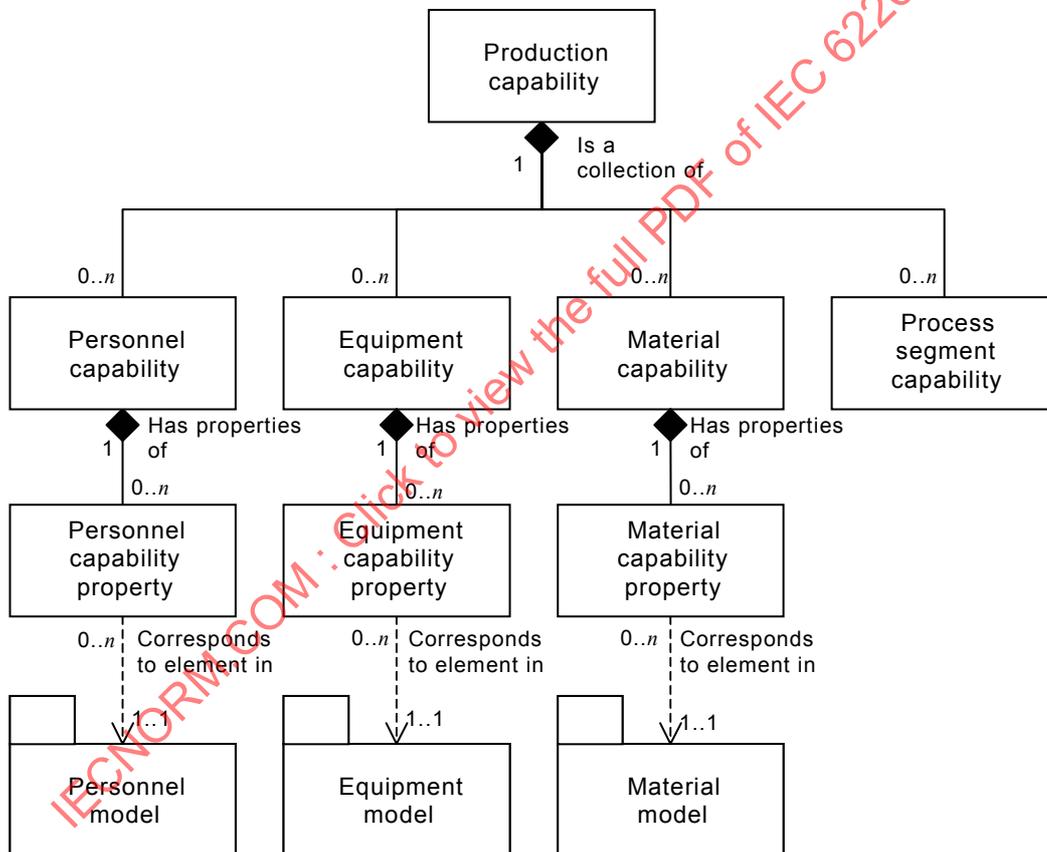
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Figure 6 – Production capability model

4.9.2 Production capability

Table 36 lists the attributes of *production capability*.

Tabe 36 – Attributes of production capability

Attribute name	Description	Examples
ID	Gives a unique instance of a production capability for a specified element of the equipment hierarchy model [IEC 62264-1, Subclause 5.2] (*enterprise, site, area, process cell, production line, or production unit*).	1999/12/30-HPC52 1999/12/30-HPC52.01 1999/12/30-HPC52.01.02
Description	Contains additional information and descriptions of the *production capability* definition.	"One day's production capability for the Boston Widget Company." "One day's production capability for the South Shore production plant." "One day's production capability for the East Wing manufacturing line."
Capacity type	The capacity type: Available, Unattainable, or Committed. (See IEC 62264-1, Subclause 7.6.6 for definitions.)	Available Unattainable Committed
Reason	Gives the reason for the capacity type. For example, if committed, then committed for production or for maintenance; or if unavailable, then the reason for the unavailability.	Available for production Due to power outage Available for maintenance
Location	An identification of the associated element of the equipment hierarchy model. Zero or more as required to identify the specific scope of the production capability definition.	Boston widget company South shore production plant East wing manufacturing line #2
Element type	A definition of the type of associated element of the equipment hierarchy model.	Enterprise Site Production line
Start time	The starting date and time of the time span defining the capability type.	1999-12-29 11:59 1999-12-30 11:59 1999-12-31 11:59
End time	The ending date and time of the time span defining the capability type.	1999-12-30 12:00 1999-12-31 12:00 2000-01-01 12:00

4.9.3 Personnel capability

Table 37 lists the attributes of *personnel capability.*

Table 37 – Attributes of personnel capability

Attribute name	Description	Example
Personnel class	Identifies the associated *personnel class* of the capability.	Widget assembly machine operator
Person	Identifies the associated *person* of the capability.	SSN 999-55-1212
Description	Contains additional information and descriptions of the *personnel capability* definition.	"Widget machine operator availability over the 2000 New Year boundary"
Capacity type	The capacity type: Available, Unattainable, or Committed.	Available
Reason	Gives the reason for the capacity type.	Available for production
Location	An identification of the associated element of the equipment hierarchy model. If omitted, then the capability is associated to the parent *production capability* location. Zero or more as required to identify the specific scope of the production capability definition.	South shore production plant
Element type	A definition of the type of associated element of the equipment hierarchy model.	Site
Start time	The starting time of the time span defining the capacity type. If omitted, then the capacity is associated to the parent *production capability* start time.	1999-12-30 11:59
End time	The ending time of the time span defining the capacity type. If omitted, then the capacity is associated to the parent *production capability* end time.	2000-01-01 12:00
Quantity	Specifies the quantity of the personnel capability defined, if applicable.	48
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	h

Where *persons* are members of multiple *personnel classes,* then the *personnel capability* information presented by *personnel class* should be used carefully because of possible double counts, and personnel resources should be managed at the instance level.

4.9.4 Personnel capability property

Table 38 lists the attributes of *personnel capability property.*

Table 38 – Attributes of personnel capability property

Attribute name	Description	Examples
Property name	An identification of a property of the associated *personnel capability*.	Operator level
		Packing machine certified
Description	Contains additional information and descriptions of the *personnel capability property* definition.	"Level of operator certification"
		"Level of packing machine operator certification"
Value	The value, set of values, or range of the property.	Apprentice
		Journeyman
Value unit of measure	The unit of measure of the associated property value, if applicable.	{Apprentice, journeyman, master}
		{Apprentice, journeyman, master}
Quantity	Specifies the quantity of the personnel capability defined, if applicable.	1
		16
Quantity unit of measure	The unit of measure of the associated quantity.	Days
		h

4.9.5 Equipment capability

Table 39 lists the attributes of *equipment capability.*

Table 39 – Attributes of equipment capability

Attribute name	Description	Examples
Equipment class	Identifies the associated *equipment class* of the capability.	Widget jig
		Widget lathe
Equipment	Identifies the associated *equipment* of the capability.	Reactor 101
		Lathe machine 15
Description	Contains additional information and descriptions of the *equipment capability* definition.	"Widget jig commitment over the 2000 new year boundary"
		"Widget lathe availability over the 2000 new year boundary"
Capacity type	The capacity type: Available, Unattainable, or Committed.	Committed
		Unattainable
Reason	Gives the reason for the capacity type.	Available for production
		Due to Y2K noncompliance
Location	An identification of the associated element of the equipment hierarchy model. If omitted, then the capability is associated to the parent *production capability* location. Zero or more, as required to identify the specific scope of the production capability definition.	South shore production plant
Element type	A definition of the type of associated element of the equipment hierarchy model.	Site
Start time	The starting time of the time span defining the capacity type. If omitted, then the capability is associated to the parent *production capability* start time.	1999-12-30 11:59
		1999-12-30 11:59
End time	The ending time of the time span defining the capacity type. If omitted, then the capability is associated to the parent *production capability* end time.	2000-01-01 12:00
		2000-01-01 12:00
Quantity	Specifies the quantity of the equipment capability defined, if applicable.	48
		2
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	h
		Days

Where *equipment* are members of multiple *equipment classes,* then the *equipment capability* information represented by *equipment class* should be used carefully because of possible double counts, and equipment resources should be managed at the instance level.

4.9.6 Equipment capability property

Table 40 lists the attributes of *equipment capability property.*

Table 40 – Attributes of equipment capability property

Attribute name	Description	Examples
Property name	An identification of a property of the associated *equipment capability*.	Heating capability
		Volume
Description	Contains additional information and descriptions of the *equipment capability property* definition.	"Measure of the heating capability"
		"Measure of the equipment volume"
Value	The value, set of values, or range of the property.	146
		10 000
Value unit of measure	The unit of measure of the associated property value, if applicable.	W
		l
Quantity	Specifies the quantity of the equipment capability defined, if applicable.	2
		12
Quantity unit of measure	The unit of measure of the associated quantity.	Days
		h

4.9.7 Material capability

Table 41 lists the attributes of *material capability.*

Table 41 – Attributes of material capability

Attribute name	Description	Examples
Material class	Identifies the associated *material class* of the capability. [a]	Polymer sheet stock 1001A
		Lubricant oil
Material definition	Identifies the associated *material definition* of the capability. [a]	Sheet stock 1443a
		Lube Oil 8999
Material lot	Identifies the associated *material lot* of the capability. [a]	1443a5mm
		8999LU-5G
Material sublot	Identifies the associated *material sublot* of the capability. [a]	1443a5mmSL1
		8999LU-5G-SL15
Description	Contains additional information and descriptions of the *material capability* definition.	"Polymer sheet stock commitment"
		"Lubricant oil commitment over the 2000 new year boundary"
Capacity type	The capacity type: Available, Unattainable, or Committed.	Committed
		Committed
Reason	Gives the reason for the capacity type.	Available for production
		Available for production
Location	An identification of the associated element of the equipment hierarchy model. If omitted, then the capability is associated to the parent *production capability* location.	South shore production plant
		Production line 15
	Zero or more as required to identify the specific scope of the production capability definition.	
Element type	A definition of the type of associated element of the equipment hierarchy model.	Site
		Production line
Material use	Lists the material use: material consumed, material produced, or consumable.	Material consumed
		Material consumed
Start time	The starting time of the time span defining the capacity type.	1999-12-30 11:59
		1999-12-30 11:59
	If omitted, then the capability is associated to the parent *production capability* start time.	
End time	The ending time of the time span defining the capacity type.	2000-01-01 12:00
	If omitted, then the capability is associated to the parent *production capability* end time.	2000-01-01 12:00
Quantity	Specifies the quantity of the material capability defined, if applicable.	2 000
		155
Quantity unit of measure	The unit of measure of the material quantity, if applicable.	Sheets
		l
[a] Typically a material class, material definition, material lot, or material sublot is specified.		

Where *materials* are members of multiple *material classes,* then the *material capability* information presented by *material class* should be used carefully because of possible double counts, and material resources should be managed at the instance level.

4.9.8 Material capability property

Table 42 lists the attributes of *material capability property.*

Table 42 – Attributes of material capability property

Attribute name	Description	Examples
Property name	An identification of a property of the associated *material capability*.	Concentration
		pH
Description	Contains additional information and descriptions of the *material capability property* definition.	"Concentration of active ingredient"
		"pH of active ingredient"
Value	The value, set of values, or range of the property.	50
		6,3
Value unit of measure	The unit of measure of the associated property value, if applicable.	%
		pH
Quantity	Specifies the quantity of the material capability defined, if applicable.	55
		2 567
Quantity unit of measure	The unit of measure of the associated quantity.	ml
		kl

4.10 Process segment capability

4.10.1 Process segment capability model

A process segment capability is a representation of a logical grouping of personnel resources, equipment resources, and material that is committed, available, or unavailable for a defined process segment for a specific time.

Figure 7 is a copy of Figure 19 in IEC 62264-1, with a clarification of the relationship to *process segments*, and the personnel, equipment, and material models.

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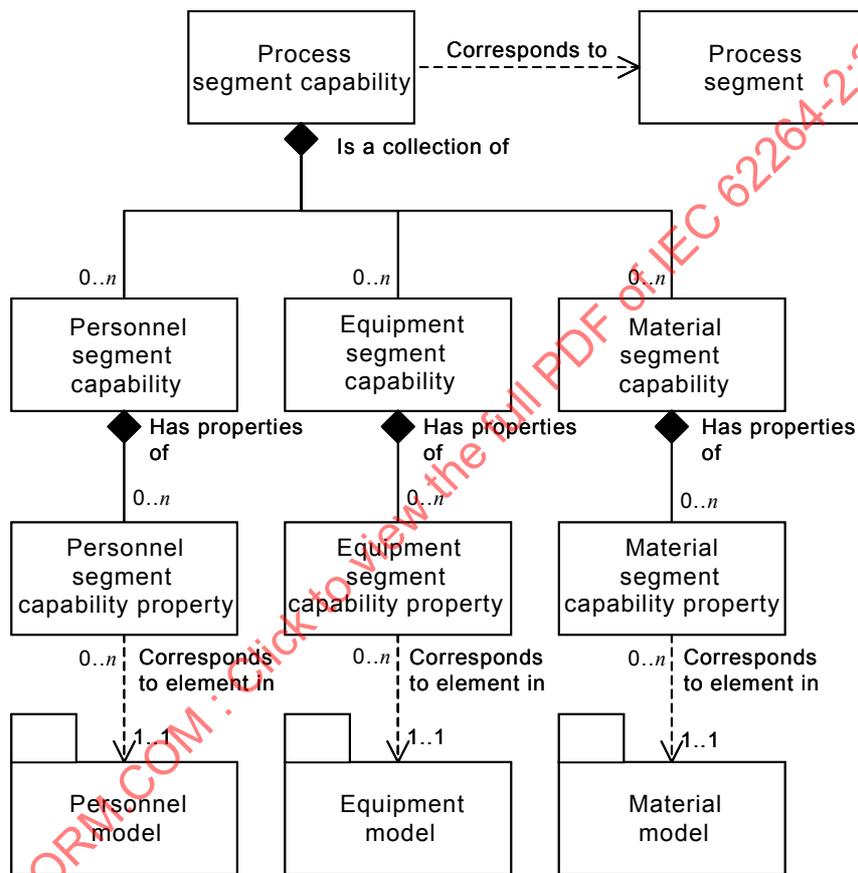
Figure 7 – Process segment capability

4.10.2 Process segment capability

Table 43 lists the attributes of *process segment capability. Process segment capability* has an equivalent structure to the personnel, equipment and material structure of *production capability*, except the *process segment capability* is defined for a specific *process segment*.

Table 43 – Attributes of process segment capability

Attribute name	Description	Example
ID	A unique identifier of the *process segment capability* within the scope of the parent *production capability*.	1000104
Description	Contains additional information and descriptions of the *process segment capability* definition.	"Defines the available capability for the widget assembly process segment"
Process segment	Identifies the *process segment*.	Widget assembly
Capacity type	The capacity type: Available, Unattainable, or Committed.	Available
Reason	Gives the reason for the capacity type.	Available for production
Location	An identification of the associated element of the equipment hierarchy model. If omitted, then the capability is associated to the parent *production capability* location. Zero or more as required to identify the specific scope of the production capability definition.	Production line #15
Element type	A definition of the type of associated element of the equipment hierarchy model.	Production line
Start time	The starting time of the time span defining the capacity type. If omitted, then the capability is associated to the parent *production capability* start time.	1999-12-30 11:59
End time	The ending time of the time span defining the capacity type. If omitted, then the capability is associated to the parent *production capability* end time.	2000-01-01 12:00

Process segment capabilities should be used carefully because of possible double counts of resources.

EXAMPLE A resource may be shown as available in multiple *process segments*, but in actual fact, may be available for use in only a single *process segment*.

4.10.3   Personnel segment capability

Table 44 lists the attributes of *personnel segment capability*.

Table 44 – Attributes of personnel segment capability

Attribute name	Description	Example
Personnel class	Identifies the set of associated *personnel classes* of the capability.	Assembly operator
Person	Identifies the set of associated *persons* of the capability.	SSN 999-55-1212
Description	Contains additional information and descriptions of the *personnel segment capability* definition.	Available personnel for the widget assembly operation
Capacity type	The capacity type: Available, Unattainable, or Committed.	Available
Reason	Gives the reason for the capacity type.	Available for production
Location	An identification of the associated element of the equipment hierarchy model. If omitted, then the capability is associated to the parent *production capability* location. Zero or more, as required to identify the specific scope of the production capability definition.	Production line #15
Element type	A specification of the type of associated element of the equipment hierarchy model.	Production line
Start time	The starting time of the time span defining the capacity type. If omitted, then the capability is associated with the parent *process segment capability* start time.	1999-12-30 11:59
End time	The ending time of the time span defining the capacity type. If omitted, then the capability is associated with the parent *process segment capability* end time.	2000-01-01 12:00
Quantity	Specifies the quantity of the personnel capability defined, if applicable.	48
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	h

Where *persons* are members of multiple *personnel classes,* then the *personnel capability* information represented by *personnel class* should be used carefully because of possible double counts, and personnel resources should be managed at the instance level.

4.10.4   Personnel segment capability property

Table 45 lists the attributes of *personnel segment capability property*.

Table 45 – Attributes of personnel segment capability property

| Attribute name	Description	Example
Property name	An identification of a property of the associated *personnel segment capability*.	Assembly apprentice operators
Description	Contains additional information and descriptions of the *personnel segment capability property* definition.	"Number of apprentice assembly operator hours available for the widget assembly operation."
Value	The value, set of values, or range of the property.	Apprentice
Value unit of measure	The unit of measure of the associated property value, if applicable.	<not applicable>
Quantity	Specifies the quantity of the personnel capability defined, if applicable.	24
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	h

4.10.5 Equipment segment capability

Table 46 lists the attributes of *equipment segment capability*.

Table 46 – Attributes of equipment segment capability

Attribute name	Description	Example
Equipment class	Identifies the associated *equipment class* of the capability.	Widget assembly jig
Equipment	Identifies the associated *equipment* of the capability.	JIG 101
Description	Contains additional information and descriptions of the *equipment segment capability* definition.	"Committed assembly jigs for the widget assembly operation."
Capacity type	The capacity type: Available, Unattainable, or Committed.	Committed
Reason	Gives the reason for the capacity type.	Available for production
Location	An identification of the associated element of the equipment hierarchy model. If omitted, then the capability is associated to the parent *production capability* location. Zero or more as required to identify the specific scope of the production capability definition.	Production line #15
Element type	A definition of the type of associated element of the equipment hierarchy model.	Production line
Start time	The starting time of the time span defining the capacity type. If omitted, then the capability is associated with the parent *process segment capability* start time.	1999-12-30 11:59
End time	The ending time of the time span defining the capacity type. If omitted, then the capability is associated with the parent *process segment capability* end time.	2000-01-01 12:00
Quantity	Specifies the quantity of the equipment capability defined, if applicable.	1
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	h

Where *equipment* are members of multiple *equipment classes,* then the *equipment capability* information presented by *equipment class* should be used carefully because of possible double counts, and equipment resources should be managed at the instance level.

4.10.6 Equipment segment capability property

Table 47 lists the attributes of *equipment segment capability property*.

Table 47 – Attributes of equipment segment capability property

Attribute name	Description	Example
Property name	An identification of a property of the associated *equipment segment capability*.	Jig status
Description	Contains additional information and descriptions of the *equipment segment capability property* definition.	"Committed widgets per hour"
Value	The value, set of values, or range of the property.	Small
Value unit of measure	The unit of measure of the associated property value, if applicable.	{Small, Medium, Large}
Quantity	Specifies the quantity of the equipment capability defined, if applicable.	1
Quantity unit of measure	The unit of measure of the associated quantity.	h

4.10.7 Material segment capability

Table 48 lists the attributes of *material segment capability.*

Table 48 – Attributes of material segment capability

Attribute name	Description	Example
Material class	Identifies the associated *material class* of the capability. a)	Rivet-10002
Material definition	Identifies the associated *material definition* of the capability. a)	General purpose 2 mm rivet
Material lot	Identifies the associated *material lot* of the capability. a)	L66272
Material sublot	Identifies the associated *material sublot* of the capability. a)	L66272-SL4
Description	Contains additional information and descriptions of the *material segment capability* definition.	Rivets available for the widget assembly operation
Capacity type	The capacity type: Available, Unattainable, or Committed.	Available
Reason	Gives the reason for the capacity type.	Available for production
Location	An identification of the associated element of the equipment hierarchy model. If omitted, then the capability is associated to the parent *production capability* location. Zero or more as required to identify the specific scope of the production capability definition.	Production line #15
Element type	A definition of the type of associated element of the equipment hierarchy model.	Production line
Material use	Presents the material use: material consumed, material produced, or consumable.	Material consumed
Start time	The starting time of the time span defining the capacity type. If omitted, then the capability is associated with the parent *process segment capability* start time.	1999-12-30 11:59
End time	The ending time of the time span defining the capacity type. If omitted, then the capability is associated with the parent *process segment capability* end time.	2000-01-01 12:00
Quantity	Specifies the quantity of the material capability defined, if applicable.	3 000
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	Pieces
a) Typically, either a material class, material definition, material lot, or material sublot is specified.		

Where *materials* are members of multiple *material classes* then the *material capability* information presented by *material class* should be used carefully because of possible double counts, and material resources should be managed at the instance level.

4.10.8 Material segment capability property

Table 49 lists the attributes of *material segment capability property.*

Table 49 – Attributes of material segment capability property

Attribute name	Description	Example
Property name	An identification of a property of the associated *material segment capability*.	Length
Description	Contains additional information and descriptions of the *material segment capability property* definition.	Length of rivet
Value	The value, set of values, or range of the property.	25,4
Value unit of measure	The unit of measure of the associated property value, if applicable.	mm
Quantity	Specifies the quantity of the material capability defined, if applicable.	200
Quantity unit of measure	The unit of measure of the associated quantity.	Pieces

4.11 Product definition

4.11.1 Product definition model

The product definition is information that is shared between product production rule, bill of material, and bill of resources. These three external models are represented by packages in Figure 8 (also see Figure 21 in IEC 62264-1); their definitions are beyond the scope of this part of IEC 62264.
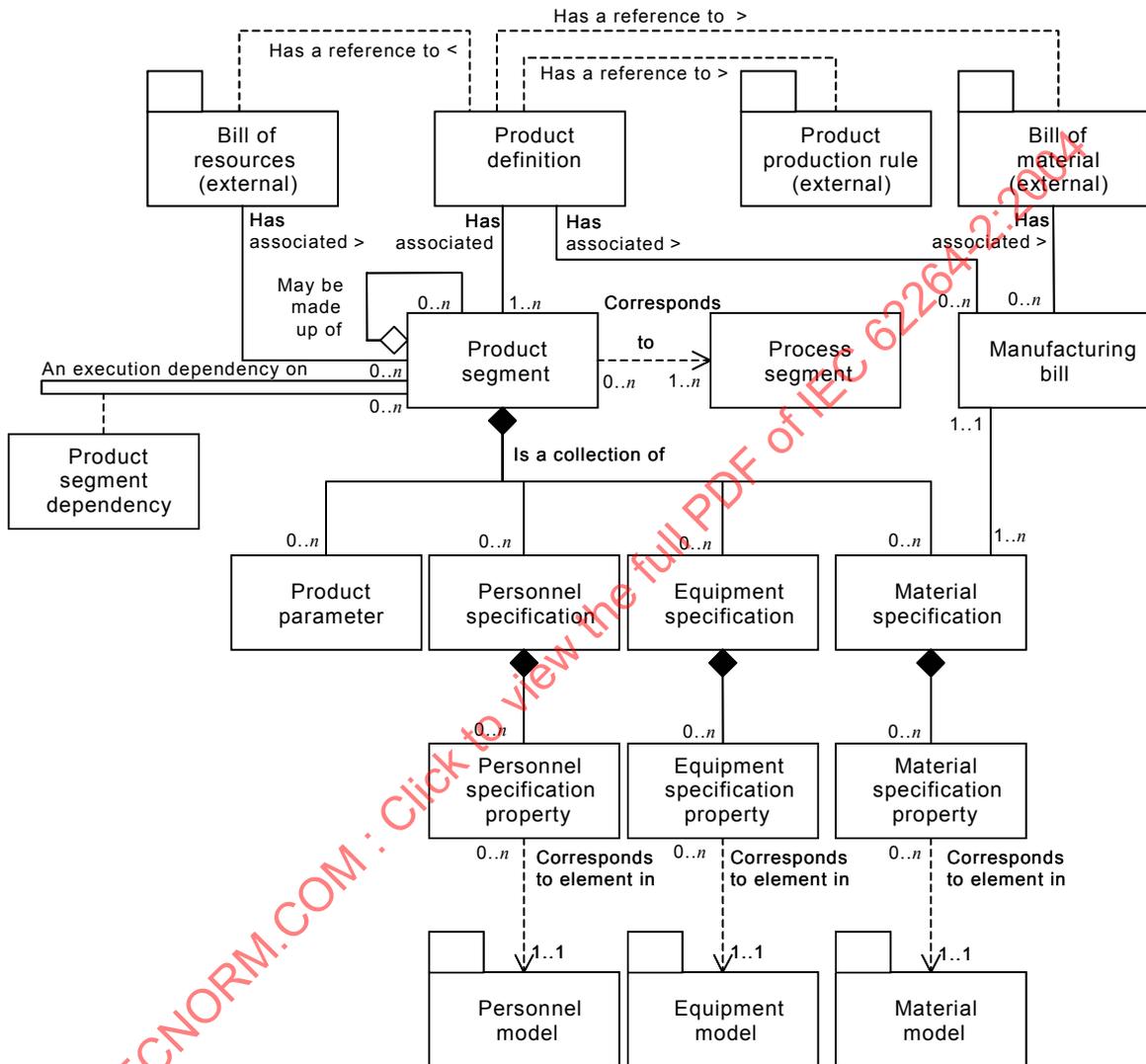
Figure 8 – Product definition model

4.11.2 Product definition

Table 50 lists the attributes of *product definition.*

Table 50 – Attributes of product definition

Attribute name	Description	Example
ID	Uniquely identifies the product. The ID shall be used in other parts of the model when the *product definition* needs to be identified.	Export quality widget
Version	An identification of the version of the *product definition.* In cases where there are multiple versions of a *product definition*, then the version attribute shall contain the additional identification information to differentiate each version.	1.0
Description	Contains additional information and descriptions of the *product definition.*	"Information defining resources required for production of a single 'export quality widget'".

4.11.3 Manufacturing bill

Table 51 lists the attributes of *manufacturing bill.*

Table 51 – Attributes of manufacturing bill

Attribute name	Description	Example
ID	A unique identification of a *manufacturing bill*.	10000827
Description	Contains additional information of the *manufacturing bill*.	"All materials required in the manufacturing process for a single widget."
Material class	Identifies the associated *material class* or set of *material classes* required for production. Only the material class or the material property is usually defined.	{Polymer sheet stock 1001A, rivets}
Material definition	Identifies the associated *material definition* or set of *material definitions* required for production.	{Sheet stock 1443a , rivet-10002}
Quantity	Specifies the amount of resources required for production.	{1.0, 26}
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	{Sheets/piece, number/piece}

4.11.4 Product segment

Table 52 lists the attributes of *product segment.*

Table 52 – Attributes of product segment

Attribute name	Description	Example
ID	A unique identification of a specific *product segment* within the scope of the information exchanged. The ID shall be used in other parts of the model when the *product segment* needs to be identified.	Final polished widget
Description	Contains additional information of the *product segment.*	"A brightly polished widget."
Duration	Duration of *product segment*, if known.	25
Duration unit of measure	The units of measure of the duration, if specified.	min
Process segment	Identifies the associated process segments. There may be multiple alternate process segments that could be used for the product segment.	Widget polishing

4.11.5 Product parameter

Table 53 lists the attributes of *product parameter.*

Table 53 – Attributes of product parameter

Attribute name	Description	Example
Name	Name of the *product parameter* for a specific *product segment*.	Widget roughness
Description	Contains additional information of the *product parameter*.	"Range of acceptable surface roughness to be manufactured."
Value	The value, set of values, or range of acceptable values.	{80..2 500}
Value unit of measure	Unit of measure of the values, if applicable.	Angstroms

4.11.6 Personnel specification

Table 54 lists the attributes of *personnel specification.*

Table 54 – Attributes of personnel specification

Attribute name	Description	Example
Personnel class	Identifies the associated *personnel class* or set of *personnel classes* of the specification for a specific *product segment*.	Widget polisher
Person	Identifies the associated *person* or set of *persons* of the specification for a specific *product segment*.	999-12-3456
Description	Contains additional information of the *personnel specification*.	"Polisher skill required for export quality polished widget"
Quantity	Specifies the amount of personnel resources required for the parent *product segment*, if applicable.	0,25
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	Man h/piece

4.11.7 Personnel specification property

Table 55 lists the attributes of *personnel specification property.*

Table 55 – Attributes of personnel specification property

Attribute name	Description	Examples
Property name	An identification of a property of the associated *personnel specification*.	Polishing certification level
Description	Contains additional information and descriptions of the *personnel specification property*.	"Level of polishing skill certification required for the widget polisher"
Value	The value, set of values, or range of the property. For example: Apprentice, Journeyman, Master.	Master
Value unit of measure	The unit of measure of the associated property value, if applicable.	{Apprentice, journeyman, master}
Quantity	Specifies the amount of personnel resources required.	0,10
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	Man h/piece

4.11.8 Equipment specification

Table 56 lists the attributes of *equipment specification* object.

Table 56 – Attributes of equipment specification

Attribute name	Description	Example
Equipment class	Identifies the associated *equipment class* or set of *equipment classes* of the specification for a specific *product segment*.	Widget Polishing Machine
Equipment	Identifies the associated *equipment* or set of *equipment* of the specification for a specific *product segment*.	WPM-10
Description	Contains additional information and descriptions of the *equipment specification*.	"Equipment required to polish export quality widgets."
Quantity	Specifies the amount of equipment resources required for the parent *product segment*, if applicable.	0,25
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	min/piece

4.11.9 Equipment specification property

Table 57 lists the attributes of *equipment specification property.*

Table 57 – Attributes of equipment specification property

Attribute name	Description	Example
Property name	An identification of the associated *equipment property* or *equipment class property* for a specific *product segment*.	Polisher type
Description	Contains additional information and descriptions of the *equipment specification property* definition.	"Wet polisher required for export quality widget polishing."
Value	The value, set of values, or range of the property. For example: wet, dry.	Wet
Value unit of measure	The unit of measure of the associated property value, if applicable.	{Wet,dry}
Quantity	Specifies the amount of equipment resources required for the parent *product segment*, if applicable.	0,10
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	min/piece

4.11.10 Material specification

Table 58 lists the attributes of *material specification.*

Table 58 – Attributes of mmaterial specification

Attribute name	Description	Example
Material class	Identifies the associated *material class* or set of *material classes* of the specification for a specific *product segment*. a)	Abrasives
Material definition	Identifies the associated *material definition* or set of *material definition* of the specification for a specific *product segment*. a)	Rouge
Description	Contains additional information and descriptions of the *material specification*.	"Polishing material for export quality widget polishing."
Material use	Lists the material use: material consumed, material produced, or consumable.	Material consumed
Quantity	Specifies the amount of material resources required for the parent *product segment*, if applicable.	10
Quantity unit of measure	The unit of measure of the associated property value, if applicable.	g/piece
a) Typically either a *material class* or *material definition* is specified.		

4.11.11 Material specification property

Table 59 lists the attributes of *material specification property.*

Table 59 – Attributes of material specification property

Attribute name	Description	Example
Property name	An identification of the associated *material property* for a specific *product segment*.	Grit size
Description	Contains additional information and descriptions of the *material specification property*.	"Measure of required grit size for export quality widget polishing."
Value	The value, set of values, or range for the associated property.	{1 300..1 500}
Value unit of measure	The unit of measure of the associated property value, if applicable.	Grit number
Quantity	Specifies the amount of material resources required for the parent *product segment*, if applicable.	5
Quantity unit of measure	The unit of measure of the associated property value, if applicable.	g/piece

4.11.12 Product segment dependency

Table 60 lists the attributes of *product segment dependency*. The *product segment dependencies* can be used to describe dependencies that are product specific.

EXAMPLE   A wheel assembly and a frame assembly that can run in parallel.

Table 60 – Attributes of product segment dependency

Attribute name	Description	Example
Description	Contains additional information and descriptions of the *product segment dependency* definition for a specific *product segment*.	"Lists the ordering of widget washing during the widget assembly product segment"
Dependency type	Lists the execution dependency constraints of one segment by another segment. Examples of these constraints, using A and B to identify the segments, or specific resources within the segments, and T to identify the time window, include: B cannot follow A B may run in parallel to A B may not run in parallel to A Start B at A start Start B after A start Start B after A end Start B no later than *T* (*time window*) after A start Start B no earlier than *T* (*time window*) after A start Start B no later than *T* (*time window*) after A end Start B no earlier than *T* (*time window*) after A end	Start *acid addition* no later than *T* (*time window*) after *reaction complete* end
Time window	Time window used by dependency. (See C.10).	25
Time unit of measure	The units of measure of the time window, if specified.	min

4.12 Production schedule

4.12.1 Production schedule model

A production schedule is a request for production. A production schedule is made up of one or more production requests. A production request is a request for production for a single product identified by a production rule. A production request contains the information required by manufacturing to fulfil scheduled production. A production request contains at least one segment requirement, even if it spans all production of the product.

Figure 9 is a copy of Figure 22 in IEC 62264-1, with a clarification of the relationship to *product segments*, *process segments*, the personnel, equipment, and material models.
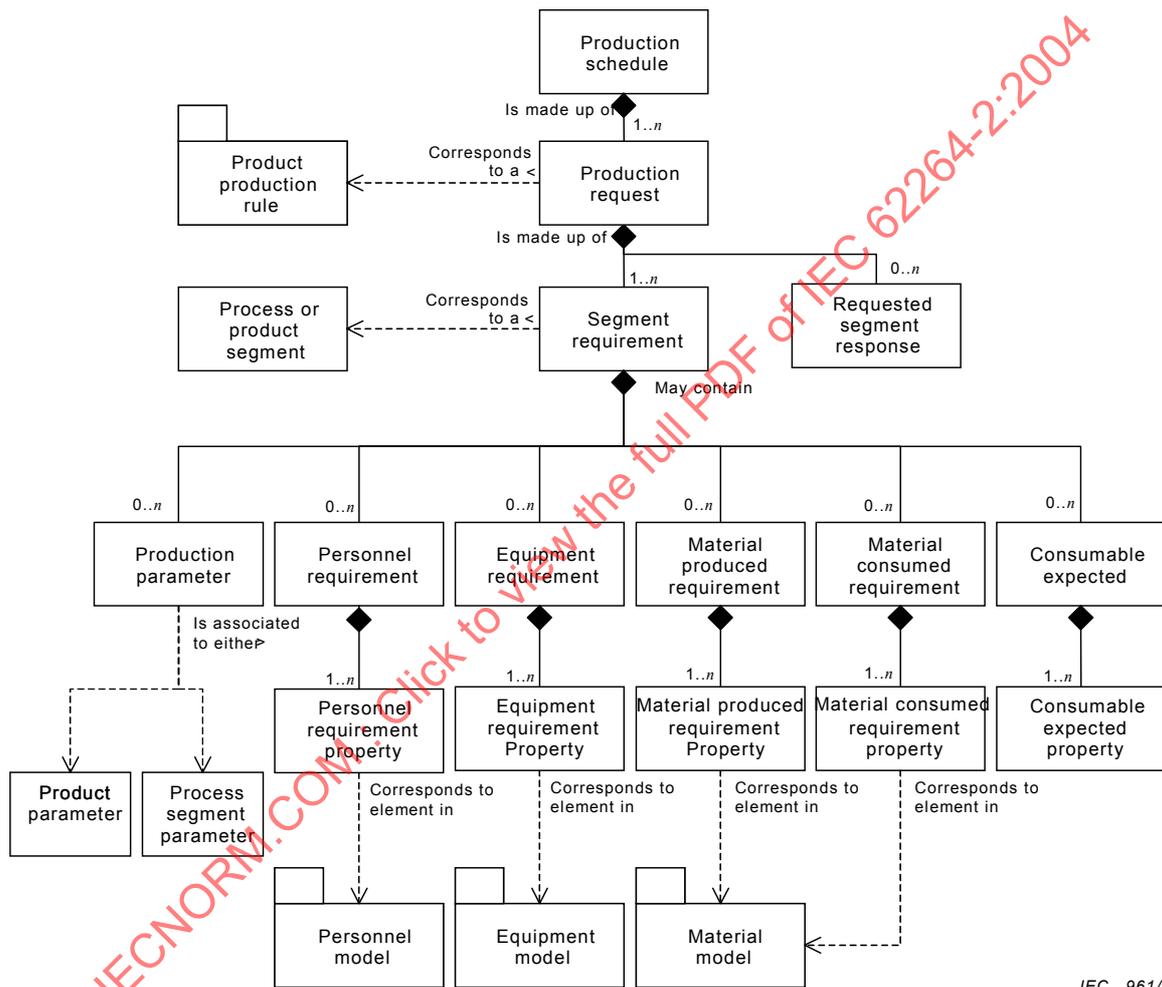
Figure 9 – Production schedule model

4.12.2 Production schedule

Table 61 lists the attributes of *production schedule.*

Table 61 – Attributes of production schedule

Attribute name	Description	Example
ID	A unique identification of the *production schedule* and could include version and revision identification. The ID shall be used in other parts of the model when the *production schedule* needs to be identified.	1999-10-27-A15
Description	Contains additional information and descriptions of the *production schedule.*	"Widget manufacturing schedule."
Start time	The starting time for the associated *production schedule*, if applicable.	10-28-1999
End time	The ending time for the associated *production schedule*, if applicable.	10-30-1999
Event	The starting condition for the associated *production schedule*, if applicable.	"Line 2 becomes available"
Location	An identification of the associated element of the equipment hierarchy model.	East wing manufacturing line #2
Element type	A definition of the type of the associated element of the equipment hierarchy model. For example: enterprise, site, area.	Production line

4.12.3 Production request

Table 62 lists the attributes of *production request.*

Table 62 – Attributes of production request

Attribute name	Description	Example
ID	A unique identification of the *production request*. The ID shall be used in other parts of the model when the *production request* needs to be identified.	1001091
Description	Contains additional information and descriptions of the *production request.*	"Production request for export quality widgets for October 29, 1999."
Product production rule	Identifies the associated *product production rule* to be used, if applicable.	Export quality widget
Start time	When production is to be started, if applicable.	1999-10-27 8:00 UTC
End time	When production is to be completed, if applicable.	1999-10-27 17:00 UTC
Event	The starting condition for the associated *production request*, if applicable.	"Request 1001090 complete"
Priority	The priority of the request, if applicable.	Highest

4.12.4 Segment requirement

Table 63 lists the attributes of *segment requirement* object.

Table 63 – Attributes of segment requirement

Attribute name	Description	Examples
ID	A unique identification of the *segment requirement* within the scope of a *production request*.	A54
		A6646
Segment	An identification of the *process segment* or *product segment* associated with the *segment requirement*, if applicable.	Master segment
		Polish and paint segment
Description	Contains additional information and descriptions of the *segment requirement.*	"Master segment, containing customer name and final produced material requirements."
		"Polish and paint segment, containing specifications for personnel, materials and equipment."
Earliest start time	The expected earliest start time of this *segment requirement*, if applicable.	1999-10-27 8:33 UTC
		1999-10-27 14:13 UTC
Latest end time	The expected latest ending time of this *segment requirement*, if applicable.	1999-10-27 16:55 UTC
		1999-10-27 16:55 UTC
Duration	The expected duration of this segment requirement, if applicable.

NOTE This should match the associated *product segment* or *process segment* duration. | 1 |
		15
Duration unit of measure	The unit of measure of the duration, if applicable.	h
		min

There are multiple segments presented in the example. There is one master segment of production that applies to the entire production request. The master segment is made up of multiple nested segments for individually specified and reported segments of production.

EXAMPLE 1 Information that applies across all segments of the production request, such as a customer name, may be represented as a production parameter in the master segment.

EXAMPLE 2 Information that applies to specific segments of production, such as widget polishing equipment utilization, may be specified as part of the polish and paint segment.

Each *segment requirement* corresponds to, or references, a *process segment* (see 4.8) or *product segment* (see 4.11.4).

4.12.5 Production parameter

Table 64 lists the attributes of *production parameter.*

Table 64 – Attributes of production parameter

Attribute name	Description	Examples
Name	The *production parameter* name.	Customer name
		Widget clock speed
		Polishing finish
Description	Contains additional information and descriptions of the *production parameter.*	"Master segment – customer name"
		"Minimum widget clock speed."
		"Polish and paint segment – polishing finish"
Value	The value, set of values, or range of the value to be used for this parameter.	Bridgett's widgets store
		200
		High gloss
Value unit of measure	The engineering units in which the value is used, if applicable.	[not applicable]
		MHz
		{High gloss, low gloss, satin finish}

4.12.6 Personnel requirement

Table 65 lists the attributes of *personnel requirement.*

Table 65 – Attributes of personnel requirement

Attribute name	Description	Example
Personnel class	Identifies the associated *personnel class* or set of *personnel classes* of the requirement for a specific *segment requirement*.	Widget polisher
Person	Identifies the associated *person* or set of *persons* of the requirement for a specific *segment requirement*. Typically either *personnel class* or *person* is specified, but not both.	Gidget
Description	Contains additional information and descriptions of the *personnel requirement.*	"Lists the specific polishing operator assigned to this production request."
Quantity	Specifies the amount of personnel resources required for the parent segment, if applicable. Applies to each member of the *person* and *personnel class* sets.	1
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	Full time equivalents

4.12.7 Personnel requirement property

Table 66 lists the attributes of *personnel requirement property.*

Table 66 – Attributes of personnel requirement property

Attribute name	Description	Example
Property name	An identification of the associated *person property* or *personnel class property* for a specific *segment requirement*.	Polishing certification level
Description	Contains additional information and descriptions of the *personnel requirement property* definition.	"Level of polishing skill certification required for the widget polisher"
Value	The value, set of values, or range of the property. For example: apprentice, journeyman, master.	Journeyman
Value unit of measure	The unit of measure of the associated property value, if applicable.	{Apprentice, journeyman, master}
Quantity	Specifies the amount of personnel resources required for the parent segment, if applicable.	1
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	h

4.12.8 Equipment requirement

Table 67 lists the attributes of *equipment requirement.*

Table 67 – Attributes of equipment requirement

Attribute name	Description	Example
Equipment Class	Identifies the associated *equipment class* or set of *equipment classes* of the requirement for a specific *segment requirement*.	Widget polishing machine
Equipment	Identifies the associated *equipment* set of *equipment* of the requirement for a specific *segment requirement*. Typically either *equipment class* or *equipment* is specified, but not both.	WPM-19
Description	Contains additional information and descriptions of the *equipment requirement*.	"Specifies the expected machine to be used for this production request."
Quantity	Specifies the amount of equipment resources required for the parent segment, if applicable. Applies to each member of the *equipment* and *equipment class* sets.	1
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	Units

4.12.9 Equipment requirement property

Table 68 lists the attributes of *equipment requirement property.*

Table 68 – Attributes of equipment requirement property

Attribute name	Description	Example
Property name	An identification of the associated *equipment property* or *equipment class property* for a specific *segment requirement*.	Polisher type
Description	Contains additional information and descriptions of the *equipment requirement property* definition.	"Polisher required for this production request."
Value	The value, set of values, or range of the associated property. For example: wet, dry.	Dry
Value unit of measure	The unit of measure of the associated property value, if applicable.	{Wet, dry}
Quantity	Specifies the amount of equipment resources required for the parent segment, if applicable.	1
Quantity unit of measure	The unit of measure of the associated quantity, if applicable.	Units

4.12.10 Material produced requirement

Table 69 lists the attributes of *material produced requirement.*

Table 69 – Attributes of material produced requirement

Attribute name	Description	Example
Material class	Identifies the associated *material class* or set of *material classes* of the requirement of a specific *segment requirement*.[a]	Widgets
Material definition	Identifies the associated *material definition* or set of *material definitions* of the requirement for a specific *segment requirement*.[a]	Export quality widgets
Material lot	Identifies the associated material lot, or set of *material lots* of the requirement for a specific *segment requirement*.[a]	BWLOT-2282
Material sublot	Identifies the associated material sublot, or set of *material sublots* of the requirement for a specific *segment requirement*.[a]	BWLOT-2282-A
Description	Contains additional information and descriptions of the *material produced requirement* definition.	"Master segment – number of widgets to produce."
Location	Identifies the proposed location of the produced material, if applicable.	Finished goods inventory
Quantity	Specifies the amount of material to be produced, if applicable. Applies to each member of the *material lot*, *materials definition*, or *material class* sets.	1 500
Quantity unit of measure	Identifies the unit of measure of the quantity if applicable.	Units
[a] Typically a material class, material definition, material lot, or material sublot is specified.		

4.12.11 Material produced requirement property

Table 70 lists the attributes of *material produced requirement property.*

Table 70 – Attributes of material produced requirement property

Attribute name	Description	Example
Property name	An identification of a property of the associated *material produced requirement.*	Color
Description	Contains additional information and descriptions of the *material produced requirement property* definition.	"Specifies the color for the painted parts for this specific production request, done as the last step in polishing"
Value	The value, set of values, or range of the associated property. For example, red, orange, yellow, green, blue, indigo, violet.	Red
Value unit of measure	The unit of measure of the associated property value, if applicable.	{Blue, green, yellow, orange, red, purple, black, white}
Quantity	Specifies the amount of material to be produced, if applicable.	100
Quantity unit of measure	Identifies the unit of measure of the quantity if applicable.	Units

4.12.12 Material consumed requirement

Table 71 lists the attributes of *material consumed requirement.*

Table 71 – Attributes of material consumed requirement

Attribute name	Description	Examples
Material class	Identifies the associated *material* class or set of *material classes* of the requirement for a specific *segment requirement*. [a]	Paint
Material definition	Identifies the associated *material definition* or set of *material definitions* of the requirement for a specific *segment requirement*.[a]	Red paint
Material lot	Identifies the associated *material lot* or set of *material lots* of the requirement for a specific *segment requirement*. [a]	GP-RED-42
Material sublot	Identifies the associated material sublot, or set of *material sublots* of the requirement for a specific *segment requirement*.[a]	GP-RED-42-A
Description	Contains additional information and descriptions of the *material consumed requirement property* definition.	"Paint to be used on painted parts after the polishing."
Location	Identifies the location of the material to be consumed, if applicable.	Floor stock
Quantity	Specifies the amount of material resources required for the parent segment, if applicable. Applies to each member of the *material sublot material lot*, *materials definition*, or *material class* sets.	12
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	355 ml cans
[a] Typically a material class, material definition, material lot, or material sublot is specified.		

4.12.13 Material consumed requirement property

Table 72 lists the attributes of *material consumed requirement.*

Table 72 – Attributes of material consumed requirement property

Attribute name	Description	Example
Property name	An identification of the associated *material property* or *material class property* for a specific *segment requirement*.	Gloss
Description	Contains additional information and descriptions of the *material consumed requirement property* definition.	"Lists the specific type of red paint to be used for this production request."
Value	The value, set of values, or range of the property. For example: flat, satin, high gloss.	High gloss
Value unit of measure	The unit of measure of the associated property value, if applicable.	{High gloss, low gloss, satin finish}
Quantity	Specifies the amount of material resources required for the parent segment, if applicable.	6
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	355 ml cans

4.12.14 Consumable expected

Table 73 lists the attributes of *consumable expected.*

Table 73 – Attributes of consumable expected

Attribute name	Description	Example
Material class	Identifies the associated *material class* or set of *material classes* of the requirement for a specific *segment requirement*.	Tape
Material definition	Identifies the associated *material definition* or set of *material definitions* of the requirement for a specific *segment requirement*. Typically either *material class or material definition* is specified, but not both.	Masking tape
Location	Identifies the location of the material to be consumed, if applicable.	Shop floor
Description	Contains additional information and descriptions of the *consumable*.	"Expected usage of masking tape for polish and paint segment."
Quantity	Specifies the amount of material resources required for the parent segment, if applicable. Applies to each member of the *material definition*, or *material class* sets.	3
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	m

4.12.15 Consumable expected property

Table 74 lists the attributes of *consumable expected property.*

Table 74 – Attributes of consumable expected property

Attribute name	Description	Example
Property name	An identification of the property of the associated *consumable expected*.	Tape width
Description	Contains additional information and descriptions of the *consumable expected property* definition.	"Width of the tape expected to be used for this production request."
Value	The value, set of values, or range of the associated property.	10
Value unit of measure	The unit of measure of the associated property value, if applicable.	mm
Quantity	Specifies the amount of material resources required for the parent segment, if applicable.	1,5
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	m

4.12.16 Requested segment response

The identification of the information sent back as a result of the *production request* is a *requested segment response*. This information is of the same form as a *segment response*, but without actual values. (see the 4.13.4)

A *requested segment response* may include required information, which presents information reported on from production, such as the actual amount of material consumed.

A *requested segment response* may include optional information, which presents information that may be reported on from production, such as operator-entered comments.

4.13 Production performance

4.13.1 Production performance model

Production performance is a report on requested manufacturing and is a collection of production responses. Production responses are responses from manufacturing that are associated with a production request. There may be one or more production responses for a single production request if the production facility needs to split the production request into smaller elements of work.

Figure 10 is a copy of Figure 23 in IEC 62264-1, with a correspondence to a *product production rule* shown, plus a clarification of the relationship to the personnel, equipment, and material models.
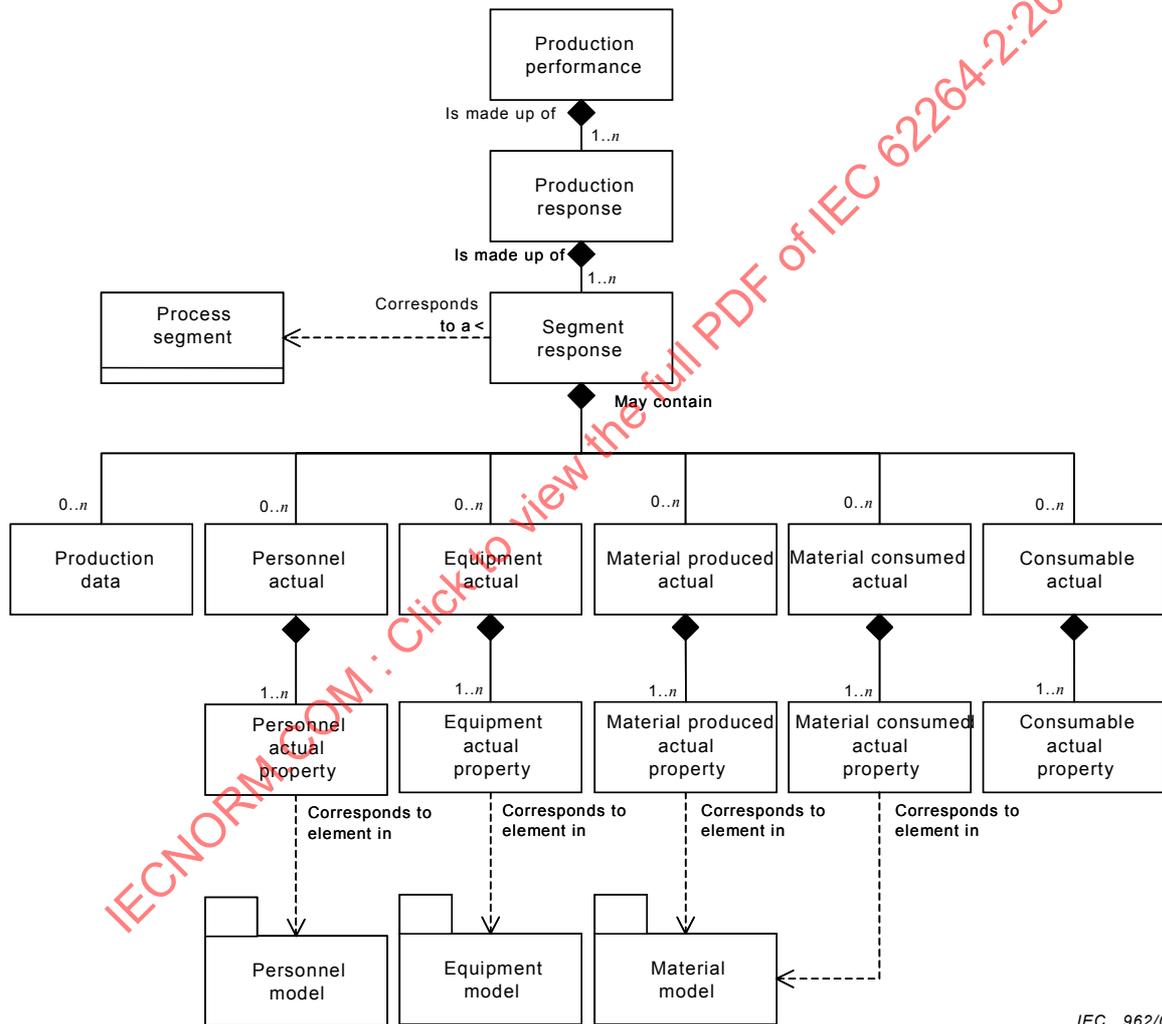
Figure 10 – Production performance model

4.13.2 Production performance

Table 75 lists the attributes of *production performance.*

Table 75 – Attributes of production performance

Attribute name	Description	Example
ID	A unique identification of the *production performance* and could include version and revision identification. The ID shall be used in other parts of the model when the *production performance* needs to be identified.	1999-10-27-A15
Description	Contains additional information and descriptions of the *production performance.*	"Production performance report on October 27, 1999 production schedule."
Production schedule	An identification of the associated *production schedule*, if applicable. *Production performance* may not relate to a *production schedule*, it may be a report on all production for a specific time, or reported on by plant floor events.	1999-10-27-A15
Start time	The actual starting time of the associated *production performance*, if applicable.	10-28-1999
End time	The actual ending time of the associated *production performance*, if applicable.	10-30-1999
Current status	The status of the performance against the production schedule, if applicable.	"In work"
Location	An identification of the associated element of the equipment hierarchy model.	East wing manufacturing line #2
Element type	A specification of the type of associated element of the equipment hierarchy model. For example: enterprise, site, area.	Production line

4.13.3 Production response

Table 76 lists the attributes of *production response.*

Table 76 – Attributes of production response

Attribute name	Description	Example
ID	An identification within the associated *production response*. The ID shall be used in other parts of the model when the *production response* needs to be identified.	1001091
Production request	An identification of the associated *production request*, if applicable. *Production response* may not relate to a *production request*, it may be a report on all production for a specific time, or reported on by plant floor events.	1001091
Product production rule	Identifies the associated *product production rule* that was used, if applicable. This may not match the request, if alternate specifications are allowed.	Export quality widget
Start time	The starting time of this *production response*.	1999-10-27 8:33 UTC
End time	The ending time of this *production response*.	1999-10-27 16:55 UTC
Current status	The status of the response against the production request, if applicable.	"Complete"

4.13.4 Segment response

Table 77 lists the attributes of *segment response.*

Table 77 – Attributes of segment response

Attribute name	Description	Examples
ID	Uniquely identifies an instance of a *process segment* executed. NOTE The same process segment may be executed multiple times in production.	A54-1
		A6646
Process segment	An identification of the *process segment* associated with the *segment response*.	Master segment
		Polish and paint segment
Description	Contains additional information and descriptions of the *segment response*.	"Master segment, containing material produced actuals."
		"Polish and paint segment containing personnel, material, and equipment actuals.
Actual start time	The actual start time of this *segment response*.	1999-10-27 8:33 UTC
		1999-10-27 14:13 UTC
Actual end time	The actual end time of this *segment response*.	1999-10-27 16:55 UTC
		1999-10-27 16:55 UTC
Current status	The status of the segment response against the segment request, if applicable.	"In work"
		"Complete"

There are multiple segments presented in the example. There is one master segment of production that applies to the entire production response. The master segment is made up of multiple nested segments for individually reported segments of production.

EXAMPLE 1 Information that applies across all segments of the production response, such as a final material produced, may be represented as a material produced in the master segment.

EXAMPLE 2 Information that applies to specific segments of production, such as widget polishing equipment actually used, may be reported as part of the polish and paint segment.

4.13.5 Production data

Table 78 lists the attributes of *production data.*

Table 78 – Attributes of production data

Attribute name	Description	Examples
Name	The *production data* name.	Widget clock speed
		Explanation
Description	Contains additional information and descriptions of the *production data*.	"Lists the average measured clock speed of the produced widgets."
		"Explanation of deviations from expected."
Value	The value or set of values of the *production data*.	233
		"Widget polishing machine WPM-19 was out of service, WPM-20 used instead."
Value unit of measure	The engineering units in which the value is used, if applicable.	MHz
		[not applicable]

4.13.6 Personnel actual

Table 79 lists the attributes of *personnel actual.*

Table 79 – Attributes of personnel actual

Attribute name	Description	Example
Personnel class	Identifies the associated *personnel class* or set of *personnel classes* actually used for a specific *segment response*.	Widget polisher
Person	Identifies the associated *person* or set of *persons* actually used for a specific *segment response*. Typically either *personnel class* or *person* is specified, but not both.	Gidget
Description	Contains additional information and descriptions of the *personnel actual.*	"Lists the specific polishing operator used in production request."
Quantity	Specifies the amount of personnel resources used in the parent segment, if applicable. Applies to each member of the *person* and *personnel class* sets.	1
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	Full time equivalents

4.13.7 Personnel actual property

Table 80 lists the attributes of *personnel actual property.*

Table 80 – Attributes of personnel actual property

Attribute name	Description	Example
Property name	An identification of the associated *person property* or *personnel class property* for a specific *segment response*.	Polishing certification level
Description	Contains additional information and descriptions of the *personnel actual property* definition.	"Level of polishing skill certification actually used for the widget polisher."
Value	The value or set of values for the associated property. For example: apprentice, journeyman, master.	Master
Value unit of measure	The unit of measure of the associated property value, if applicable.	{Apprentice, journeyman, master}
Quantity	Specifies the amount of personnel resources used in the parent segment, if applicable.	0,25
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	h

4.13.8 Equipment actual

Table 81 lists the attributes of *equipment actual.*

Table 81 – Attributes of equipment actual

Attribute name	Description	Example
Equipment class	Identifies the associated *equipment class* or set of *equipment classes* actually used for a specific *segment response*.	Widget polishing machine
Equipment	Identifies the associated *equipment* or set of *equipment* actually used for a specific *segment response*. Typically, either *equipment class* or *equipment* is specified, but not both.	WPM-20
Description	Contains additional information and descriptions of the *equipment actual.*	"Specifics the actual machine used for this production request."
Quantity	Specifies the amount of equipment resources used in parent segment, if applicable. Applies to each member of the *equipment* and *equipment class* sets.	0,05
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	Machine h

4.13.9 Equipment actual property

Table 82 lists the attributes of *equipment actual property.*

Table 82 – Attributes of equipment actual property

Attribute name	Description	Example
Property name	An identification of the associated *equipment property* or *equipment class property* for a specific *segment response*.	Polisher type
Description	Contains additional information and descriptions of the *equipment actual property* definition.	"Actual polisher used for this production segment."
Value	The value or set of values for the associated property. For example: wet, dry.	Dry
Value unit of measure	The unit of measure of the associated property value, if applicable.	{Wet, dry}
Quantity	Specifies the amount of equipment resources used in parent segment, if applicable	0,05
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	Machine h

4.13.10 Material produced actual

Table 83 lists the attributes of *material produced actual.*

Table 83 – Attributes of material produced actual

Attribute name	Description	Example
Material class	Identifies the associated *material class* or set of *material classes* actually made for a specific *segment response*.[a]	Widgets
Material definition	Identifies the associated *material definition* or set of *material definitions* actually made for a specific *segment response*.[a]	Export quality widgets
Material lot	Identifies the associated *material lot* or set of *material lots* actually made for a specific *segment response*.[a]	BWLOT-2282
Material sublot	Identifies the associated *material sublot* or set of *material sublots* actually made for a specific *segment response*.[a]	BWLOT-2282-A
Description	Contains additional information and descriptions of the *material produced actual*.	"Master segment – number of widgets actually produced."
Location	Identifies the actual location of the produced material, if applicable.	Finished goods inventory
Quantity	Specifies the amount of material produced by the parent segment. Applies to each member of the *material lot*, *materials definition*, or *material class* sets.	1 498
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	Units
[a] Typically a material class, material definition, material lot, or material sublot is specified.		

4.13.11 Material produced actual property

Table 84 lists the attributes of *material produced actual property.*

Table 84 – Attributes of material produced actual property

Attribute name	Description	Example
Property name	An identification of the associated *material property* or *material class property* for a specific *segment response*.	Color
Description	Contains additional information and descriptions of the *material produced actual property* definition.	"Lists the color actually produced, in the polish and paint segment"
Value	The value or set of values for the associated property. For example: red, orange, yellow, green, blue, indigo, violet.	Red
Value unit of measure	The unit of measure of the associated property value, if applicable.	Color
Quantity	Specifies the amount of material produced by the parent segment. Applies to each member of the *material lot*, *materials definition*, or *material class* sets.	1 002
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	Units

4.13.12 Material consumed actual

Table 85 lists the attributes of *material consumed actual.*

Table 85 – Attributes of material consumed actual

Attribute name	Description	Example
Material class	Identifies the associated *material class* or set of *material classes* actually used for a specific *segment response*. [a]	Paint
Material definition	Identifies the associated *material definition* or set of *material definitions* actually used for a specific *segment response*. [a]	Red paint
Material lot	Identifies the associated *material lot* or set of *material lots* actually used for a specific *segment response*. [a]	GP-RED-42
Material sublot	Identifies the associated *material sublot* or set of *material sublots* actually made for a specific *segment response*. [a]	GP-RED-42-A
Description	Contains additional information and descriptions of the *material consumed actual.*	"Paint to be used to finish the widgets in the polish and paint segment."
Location	Identifies location from which the material was consumed.	Maintenance crib
Quantity	Specifies the amount of material resources consumed by the parent segment, if applicable. Applies to each member of the *material lot*, *material sublot*, *material definition*, or *material class* sets.	12
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	355 ml cans
[a] Typically a material class, material definition, material lot, or material sublot is specified.		

4.13.13 Material consumed actual property

Table 86 lists the attributes of *material consumed actual property.*

Table 86 – Attributes of material consumed actual property

Attribute name	Description	Example
Property name	An identification of the associated *material property* or *material class property* for a specific *segment response*.	Gloss
Description	Contains additional information and descriptions of the *material consumed actual property* definition.	"Lists the type of paint used in production."
Value	The value or set of values for the associated property. For example: flat, satin, high gloss.	High gloss
Value unit of measure	The unit of measure of the associated property value, if applicable.	{High gloss, low gloss, satin finish}
Quantity	Specifies the amount of material resources consumed by the parent segment, if applicable.	4
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	355 ml cans

4.13.14 Consumable actual

Table 87 lists the attributes of *consumable actual.*

Table 87 – Attributes of consumable actual

Attribute name	Description	Examples
Material class	Identifies the associated *material class* or set of *material classes* actually used for a specific *segment response*. [a]	Tape
Material definition	Identifies the associated *material definition* or set of *material definitions* actually used for a specific *segment response*. [a]	Masking tape
Description	Contains additional information and descriptions of the *consumable actual*.	"Usage of masking tape for polish and paint segment."
Location	Identification of the location from which the consumable was obtained, if applicable.	Shop floor
Quantity	Specifies the amount of material resources consumed by the parent segment, if applicable. Applies to each member of the *material definition* or *material class* sets.	2,8
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	m
[a] Typically either a *material class* or *material definition* is specified.		

4.13.15 Consumable actual property

Table 88 lists the attributes of *consumable actual property.*

Table 88 – Attributes of consumable actual property

Attribute name	Description	Example
Property name	An identification of the associated *material property* or *material class property* for a specific *segment response*.	Tape width
Description	Contains additional information and descriptions of the *consumable actual property* definition.	"Width of the tape used in production."
Value	The value or set of values for the associated property.	10
Value unit of measure	The unit of measure of the associated property value, if applicable.	Mm
Quantity	Specifies the amount of material resources consumed by the parent segment, if applicable.	1,2
Quantity unit of measure	Identifies the unit of measure of the quantity, if applicable.	m

4.14 Summary of objects

Figure 11 provides an informative illustration of how the object models inter-relate. The production information presents what was made and what was used. Its elements correspond to information in production scheduling that listed what to make and what to use. The production scheduling elements correspond to information in the product definition that shows what is specified to make a product. The product definition elements correspond to information in the process segment descriptions that present what can be done with the production resources.

The slanted rectangles in Figure 11 represent any of the resources (personnel, equipment, or material) or properties of the resources.
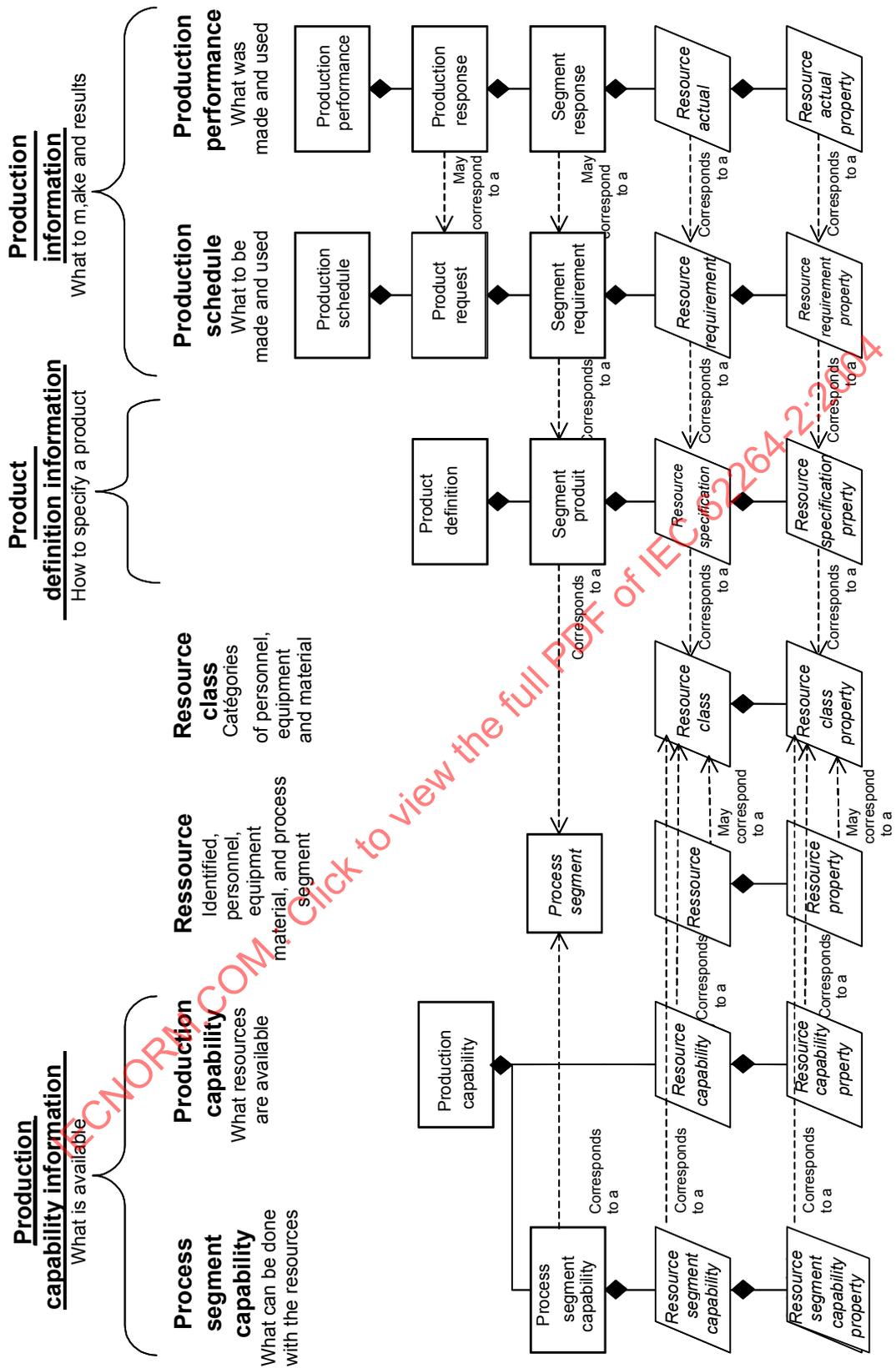
Figure 11 – Object model inter-relationships

4.15 List of objects

The following tables present a complete list of the objects discussed in this standard.

Table 89 – Personnel model objects

Person
Person property
Personnel class
Personnel class property
Qualification test specification
Qualification test result

Table 90 – Equipment model objects

Equipment
Equipment property
Equipment class
Equipment class property
Equipment capability test specification
Equipment capability test result
Maintenance request
Maintenance work order
Maintenance response

Table 91 – Material model objects

Material class
Material class property
Material definition
Material definition property
Material lot
Material lot property
Material sublot
QA test specification
QA test result

Table 92 – Process segment model objects

Process segment
Personnel segment specification
Personnel segment specification property
Equipment segment specification
Equipment segment specification property
Material segment specification
Material segment specification property
Process segment dependency
Process segment parameter

Table 93 – Production capability model objects

Production capability
Personnel capability
Personnel capability property
Equipment capability
Equipment capability property
Material capability
Material capability property

Table 94 – Process segment capability model objects

Process segment capability
Personnel segment capability
Personnel segment capability property
Equipment segment capability
Equipment segment capability property
Material segment capability
Material segment capability property

Table 95 – Product definition object models

Product definition
Manufacturing bill
Product segment
Product parameter
Personnel specification
Personnel specification property
Equipment specification
Equipment specification property
Material specification
Material specification property
Product segment dependency

Table 96 – Production schedule model objects

Production schedule
Production request
Segment requirement
Production parameter
Personnel requirement
Personnel requirement property
Equipment requirement
Equipment requirement property
Material produced requirement
Material produced requirement property
Material consumed requirement
Material consumed requirement property
Consumable expected
Consumable expected property
Requested segment response

Table 97 – Production performance object models

Production performance
Production response
Segment response
Production data
Personnel actual
Personnel actual property
Equipment actual
Equipment actual property
Material produced actual
Material produced actual property
Material consumed actual
Material consumed actual property
Consumables actual
Consumables actual property

5 Compliance

Any assessment of compliance of a specification shall be qualified by the following:

a) The use of the terminology defined in IEC 62264-1, Clause 7.

b) The object models supported (personnel, material, equipment, process segment, production capability, process segment capability, product definition, production schedule, and production performance).

c) The use of objects listed in 4.15 that are supported.

d) The use of the attributes for each supported object.

e) The relationships between the supported objects.

f) A statement of the total compliance concerning definitions, objects, attributes, and relationships or, in case of partial compliance, a statement identifying explicitly the areas of noncompliance.

Annex A
(informative)

Use and examples

A.1   Use and examples

This part of IEC 62264 is expected to be used in the specification of interfaces (at level 3 and level 4) between new applications, between legacy applications, or between new applications and legacy applications. That may facilitate the usage of packaged software in a legacy application context, which may be the most powerful initial use of the standard.

Through the use of this standard, the definition of the interface content may be provided faster and more accurately. In addition, the specification of interface content may be easily reused. This will be facilitated by the correct use of compliance assessments, that identify which object models are supported by the interface content specification.

IEC 62264-1 defines the categories of information that should be exchanged between business systems and manufacturing operations and control systems. Four (4) categories are defined;

- Product definition
- Production capability
- production schedule
- Production performance   } Production

Each of these four (4) categories relies on the four (4) resources also defined in IEC 62264-1.

- Personnel
- Equipment
- Material
- Process segment

IEC 62264-1 presents the corresponding UML models. This part of IEC 62264 defines the attributes for the objects contained in the UML models. The UML models are software independent descriptions of the data exchange between business systems and the manufacturing operations and control systems.

UML relies on object-oriented methodology. Very briefly, this means that there are classes, subclasses and instances (objects). A class can for example be "car", and the instances can be "Mrs Mine's car" or "My car". A class has attributes, and the instances have values on the attributes, for example, the class "car" has an attribute "license plate" whereas the instance "Mrs. Mine's car" has the attribute "license plate= ABC 123".

IEC 62264-1 defines the UML models, and thereby also the classes. This part of IEC 62264 defines attributes that should belong to these classes.

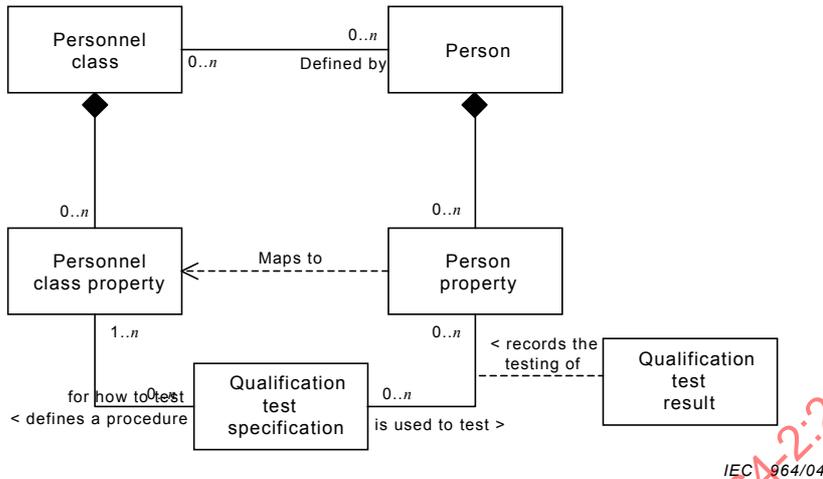EXAMPLE 1   Figure A.1 shows the UML model for personnel.

Figure A.1 – Personnel model

The model shown in Figure A.1, a copy of Figure 2, defines six (6) classes; person, personnel class, person property, personnel class property, qualification test specification and qualification test results. This part of IEC 62264 defines the attributes for each of these six (6) classes.

Table A.1 shows the attributes for person (a copy of Table 5).

Table A.1 – Attributes of person

Attribute name	Description	Examples
ID	A unique identification of a specific person, within the scope of the information exchanged (*production capability, production schedule, production performance*, etc.)	999-123-4567
		Jane W Smith – #2
		Employee 23
	The ID shall be used in other parts of the model when the *person* needs to be identified, such as the *production capability* for this person, or a *production response* identifying the person.	
Description	Additional information about the resource.	"Person information"
		"Person information"
		"Person information"
Name	The name of the individual.	John Smith
	This is meant as an additional identification of the resource, but only as information and not as a unique value.	Lou Brown
		Jane Mine

This means that the class person should have ID, description and name as attributes.

Figure A.2 shows the class person with the attributes, and two instances for example John Smith and Lou Brown.

IEC 965/04
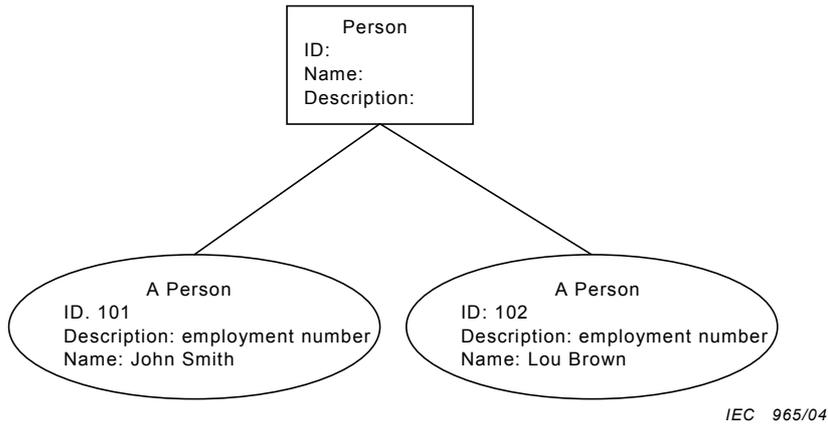
Figure A.2 – Instances of a person class

In the same manner, there is a class for "personnel class" (personnel class should be thought of as personnel group/category); the instances used depends on the application but could be for example, engineers, night-shift workers, drilling-machine-operators etc.

Of course, certain attributes for classes will depend on the application. to support application specific attributes, the "property" should be used. the instances of the properties will define the attributes for the corresponding class. The UML model says that there can be none, one or many properties linked to the corresponding class as shown in Figure A.3.


IEC 966/04
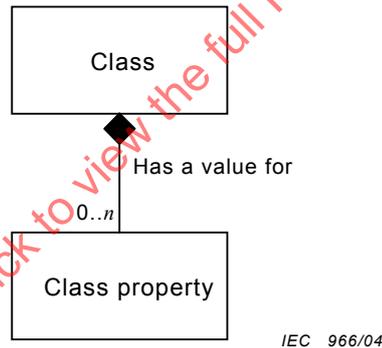
Figure A.3 – UML model for class and class properties

This means that all the instances of "Property" will effectively describe attributes to the class. Each instance of the class will contain values for the attributes.

EXAMPLE 2   Certain attributes for Person as well as for personnel class depend on the application, for example, it might be useful to exchange info about a person's date of birth in one application but not in another. To support application specific attributes, the "person property" or "personnel class property" should be used. The instances of the properties will define the attributes for the person/personnel class. The UML model says that there can be none, one or many properties linked to person/personnel class.

There is a class called person property. Each property is uniquely defined by its ID, description, value and value unit of measure, as shown in Figure A.4.

IEC 967/04
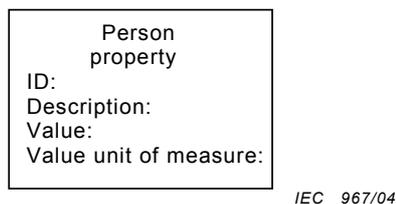
Figure A.4 – Class property

The class can have for instances, two for the date of birth, one for John and one for Lou, and two for shoe sizes, one for John and one for Lou, as shown in Figure A.5.
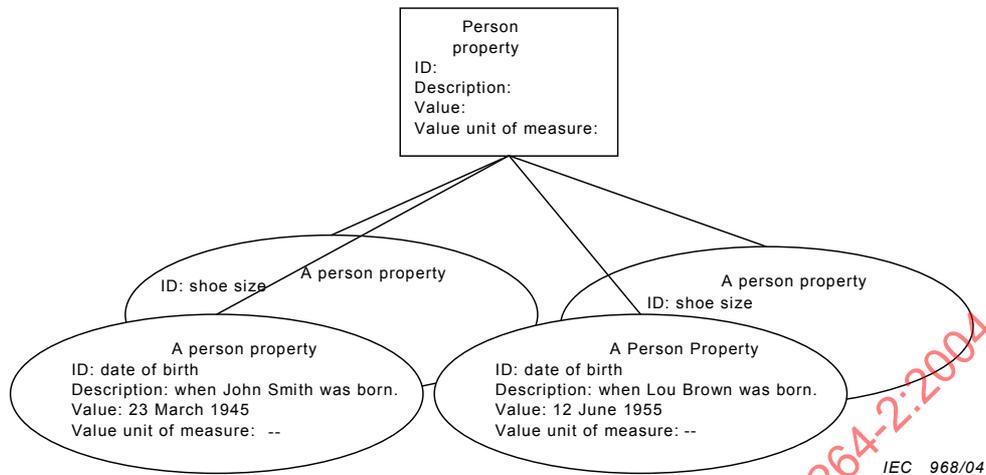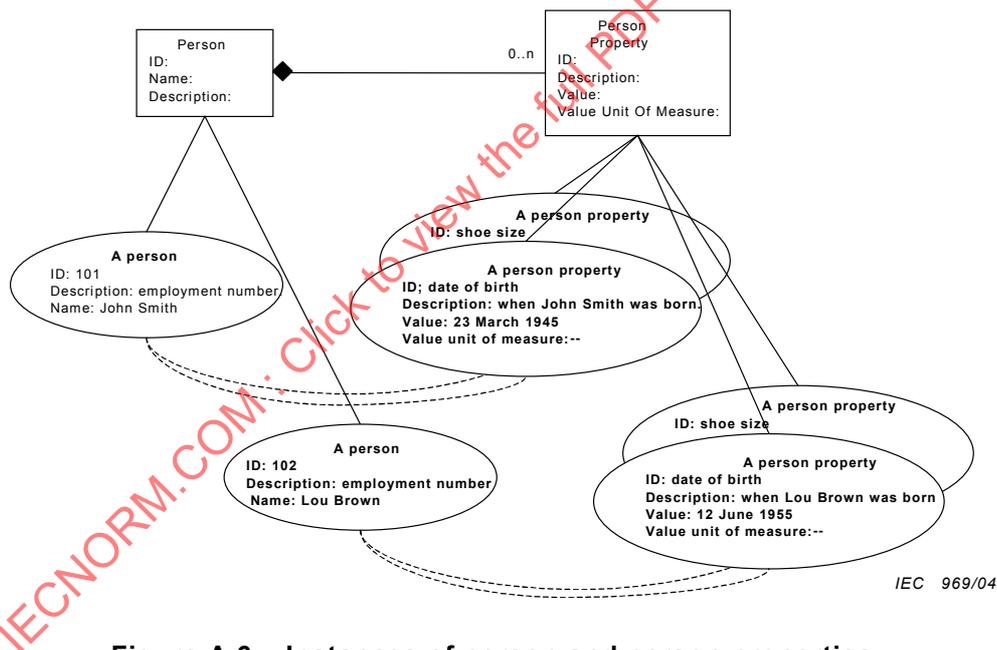

Figure A.5 – Instances of a person properties

This means that each person (instance) will have info about its properties as shown in Figure A.6.

Figure A.6 – Instances of person and person properties

It is important to note that supporting products will need to allow the definition of classes, creation of instances, and manipulation of instances. However, the specific instances created will depend on the application.

A.2 Application of the standard

When designing or creating a system that implements the standard, one must make sure that the system supports the classes needed (for example person, personnel class, person property, personnel class property, etc). To completely comply with the standard, all classes defined in IEC 62264-1 should be supported in the system.

Before the systems are put in execution mode, it has to be decided what properties the classes should have (i.e., what instances the property class should have). Of course, only the properties that need to be exchanged between the systems have to be decided. The reasons this has to be decided include:

- Due to the internal structure of databases, some databases cannot be enlarged during execution mode, and therefore it needs to know in advance what properties should be supported.

- Different systems might have different constraints on the naming of the properties for example, a maximum length of property-name, the usage of upper and lower case letters.

- Different systems might be developed in different languages, for example, in one system all properties are presented in French, whereas in another one, the properties are presented in English.

During execution, data regarding the instances can be exchanged. The data exchanged can be done in many different ways. One possibility is through databases, another possibility is through XML and XML schemas that have been developed in accordance with the IEC 62264 models.

A.3   Database mapping of the models

If a database is used for data exchange, then there are many different ways of structuring the database. Tables A.2 and A.3 are included as examples of a data base structure that can be used to contain the data. The attribute "key" indicates a unique value that may be required for relational integrity.

Table A.2 – Database structure for person

TABLE: Person		
ID	Description	Name

Table A.3 – Database structure for person property

TABLE: Person property				
ID	Description	Value	Value unit of measure	Key

When the system is in execution, the database could contain the information shown in Table A.4 and Table A.5.

Table A.4 – Database for person with data

TABLE: Person		
ID	Description	Name
101	The employment number	John Smith
102	The employment number	Lou Brown
103	The employment number	Jane Mine

Table A.5 – Database for person property with data

TABLE: Person Property
ID	**Description**	**Value**	**Value unit of measure**	**Key**
Date of birth	Indicates when a person is born	1945-03-23	YYYY-MM-DD	101
Shoe size	Indicates the shoe size of a person	43		101
Date of birth	Indicates when a person is born	1955-06-12	YYYY-MM-DD	102
Shoe size	Indicates the shoe size of a person	45		102
Date of birth	Indicates when a person is born	1969-12-24	YYYY-MM-DD	103
Shoe size	Indicates the shoe size of a person	38		103

A.4   XML usage

If XML documents are used for data exchange, then there are many different ways of structuring the documents. The structure for an XML document is defined in a "schema". A schema is the equivalent of a data base table definition.

Figure A.7 illustrates a possible XML schema for "person". The schema defines a place for ID, description, name, the person properties, and a place to contain the list of personnel classes the person belongs to. A person (instance) is defined by its ID, description, name, PersonProperty, and PersonnelClassID. The ID, description and name, correspond to the attributes ID, description and name defined in this part of IEC 62264.

PersonnelClassID is defined as the ID of a personnel class. PersonnelClassID (there may be many) contains a link to instances of PersonnelClass.

PersonProperty is defined as a complex type that contains the property ID, description, and value.

```
<xsd:complexType name = "PersonType">
 <xsd:sequence>
     <xsd:element name = "ID"
                              type = "xsd:string"/>
     <xsd:element name = "Description"
                              type = "xsd:string"
                              minOccurs = "0" maxOccurs = "unbounded"/>
     <xsd:element name = "Name"
                              type = "xsd:string"/>
     <xsd:element name = "PersonProperty"
                              type = "PersonPropertyType"
                              minOccurs = "0" maxOccurs = "unbounded"/>
     <xsd:element name = "PersonnelClassID"
                              type = "PersonnelClassIDType"
                              minOccurs = "0" maxOccurs = "unbounded"/>
 </xsd:sequence>
</xsd:complexType>

<xsd:simpleType name="PersonnelClassIDType">
 <xsd:restriction base="xsd:string">
 </xsd:restriction>
</xsd:simpleType>
```

IEC 970/04

Figure A.7– XML schema for a person object

PersonProperty contains the instances of PersonProperty (there can be many). A PersonProperty (instance) is defined by its ID, description, value, and value unit of measure. The ID, description and value and value unit of measure, correspond to the attributes ID, description and name defined in this part of IEC 62264.

A PersonProperty (instance) could be defined in the schema shown in Figure A.8

```
<xsd:complexType name = "PersonPropertyType">
 <xsd:sequence>
     <xsd:element name = "ID"             type = "IDType"/>
     <xsd:element name = "Description"     type = "DescriptionType"
                         minOccurs = "0" maxOccurs = "unbounded"/>
     <xsd:element name = "Value"           type = "ValueType"
                         minOccurs = "0" maxOccurs = "unbounded"/>
     <xsd:element name = "ValueUnitOfMeasure" type = "ValueUOMType"
                         minOccurs = "0" maxOccurs = "unbounded"/>
     <xsd:element name = "QualificationTestSpecificationID"
                         type                                    =
"QualificationTestSpecificationIDType"
                         minOccurs = "0" maxOccurs = "unbounded"/>
     <xsd:element name = "TestResult"      type = "TestResultType"
  minOccurs = "0" maxOccurs = " unbounded"/>
 </xsd:sequence>
</xsd:complexType>
```

IEC 971/04

Figure A.8 – XML schema for person properties

During execution, an XML document is created and the values of the attributes are filled in and exchanged between the systems. Figure A.9 illustrates a sample XML document, matching the schema given in Figure A.8, that contains person and person property information.

```
<PersonType>
      <ID> 101</ID>
      <Description>Employment Number</Description>
      <Name>John Smith</Name >
      <PersonProperty>
              <ID>date-of-birth</ID>
              <Description>indicates when a person is born
              </Description>
              <Value>1945-03-23</Value>
              <Value Unit of Measure> YYYY-MM-DD
  </Value Unit of Measure>
              <ID>Shoe size</ID>
              <Description>indicates the shoe size </Description>
              <Value>43</Value>
      </ PersonProperty >
      <PersonnelClassID>{night-shift-operator, engineer}
      </PersonnelClassID>
 </PersonType>
```

IEC 972/04

Figure A.9 – Example of person and person property

The information about an instance (for example, product manager or engineer) of PersonnelClass could be exchanged in a separate XML schema, as shown in Figure A.10.

```
<PersonClassType>
<ID>Engineer</ID>
<Description> a registered professional engineer</Description>
      <PersonnelClassPropertyType>
            <ID>Engineer's License Number</ID>
            <Description>"The official engineer's license number"
            </Description>
      </PersonnelClassPropertyType>
</PersonClassType>
```

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Figure A.10 – Example of person class information

Since the XML schemas of the objects and their attributes might not be implemented or have the same designation inside different systems, it might be required to have an "adapter/translator" inside the systems. This "adapter/translator" translates from the IEC 62264-2 terminology to the terminology used within the different systems. Figure A.11 illustrates an adaptor that maps property names and property types (date formats).
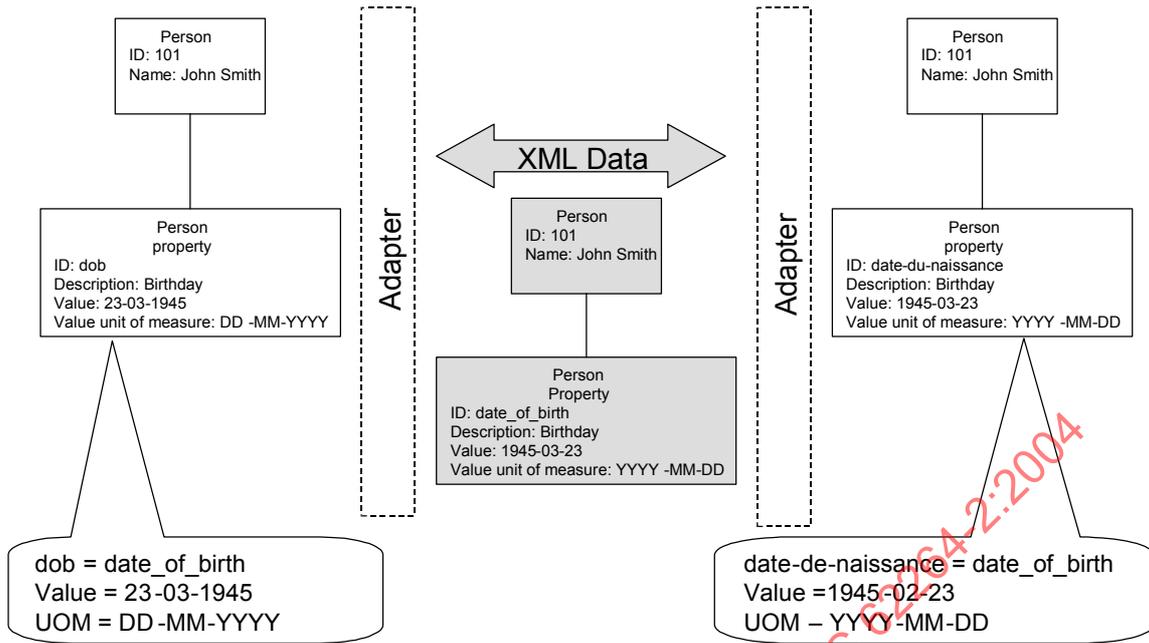
Figure A.11 – Adaptor to map different property names and values

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Annex B
(informative)

Example data sets

B.1   Introduction

The following sections contain example data sets, based on the models in IEC 62264-1, and using the attributes listed in this part of IEC 62264.

B.2   Material model example

This is a simplified example of material information that may be used in the food processing industry. The example presents shared information about a material class (pork), a material definition (pork 80% lean), a material lot, and a material sublot. In a full example, there may be multiple material classes and material description information sets that are shared, with lot and sublot dynamically shared. Indentation of objects is used to illustrate the relationship between the objects.

Material Class

    ID – Pork
    Description -
    Properties

        ID – Lethal Heat
        Description – Temperature to kill bacteria
        Value – 160
        Units of Measure – Degrees F

        ID – Receiving Temperature Target
        Description -
        Value – 32
        Units of Measure – Degrees F

        ID – Receiving Temperature Max
        Description -
        Value – 36
        Units of Measure – Degrees F

        ID – Receiving Temperature Min
        Description -
        Value – 28
        Units of Measure – Degrees F

        ID – Maximum Allowable Cut Time
        Description – Time since cut
        Value – 3
        Units of Measure – Days

Material Definition

    ID – Pork 80
    Description – Boneless pork cut up with a target lean percentage of 80
    Value -
    Unit of Measure -
    Properties

        ID – Percentage Lean
        Description -
        Value – 80
        Units of Measure – Percentage

            QA Test Specification
                ID – JackSpratTest1