BSI Standards Publication

Enterprise-control system integration

Part 5: Business to manufacturing transactions

bsi.

National foreword

This British Standard is the UK implementation of EN 62264-5:2016. It is identical to IEC 62264-5:2016. It supersedes BS EN 62264-5:2012 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee AMT/7, Industrial communications: process measurement and control, including fieldbus.

A list of organizations represented on this committee can be obtained on request to its secretary.

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This British Standard was published under the authority of the Standards Policy and Strategy Committee on 31 December 2016.

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EUROPEAN STANDARD

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English Version

Enterprise-control system integration - Part 5: Business to manufacturing transactions (IEC 62264-5:2016)

Intégration du système de commande d'entreprise -
Partie 5 : Transactions entre systèmes de gestion de
commande d'entreprise et systèmes de fabrication
(IEC 62264-5:2016)

Integration von Unternehmensführungs- und Leitsystemen -
Teil 5: Transaktionen zwischen Unternehmungsführungs-
und Produktionsleitsystemen
(IEC 62264-5:2016)

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CENELEC

European Committee for Electrotechnical Standardization
Comité Européen de Normalisation Electrotechnique
Europäisches Komitee für Elektrotechnische Normung

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European foreword

The text of document 65E/459/CDV, future edition 2 of IEC 62264-5, prepared by SC 65E "Devices and integration in enterprise systems", of IEC/TC 65 "Industrial-process measurement, control and automation" and ISO/SC 5/JWG 5, of ISO/TC 184 "Automation systems and integration" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62264-5:2016.

The following dates are fixed:

- latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement   (dop)   2017-05-25

- latest date by which the national standards conflicting with the document have to be withdrawn   (dow)   2019-11-25

This document supersedes EN 62264-5:2012

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The text of the International Standard IEC 62264-5:2016 was approved by CENELEC as a European Standard without any modification.

Annex ZA
(normative)

Normative references to international publications
with their corresponding European publications

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

NOTE 1   When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2   Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu.

Publication	Year	Title	EN/HD	Year
IEC 62264-2	2013	Enterprise-control system integration - Part 2: Objects and attributes for enterprise-control system integration	EN 62264-2	2013
IEC 62264-3	-	Enterprise-control system integration - Part 3: Activity models of manufacturing operations management	EN 62264-3	-
IEC 62264-4	-	Enterprise-control system integration - Part 4: Object model attributes for manufacturing operations management integration	EN 62264-4	-
ISO/IEC 19501	-	Information technology - Open Distributed Processing - Unified Modeling Language (UML) Version 1.4.2	-	-
ISO 8601	-	Data elements and interchange formats - Information interchange - Representation of dates and times	-	-

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 5: Business to manufacturing transactions

FOREWORD

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International Standard IEC 62264-5 has been prepared by subcommittee 65E: Devices and integration in enterprise systems, of IEC technical committee 65: Industrial-process measurement, control and automation and ISO SC5, JWG 5, of ISO technical committee 184: Automation systems and integration.

It is published as a double logo standard.

This second edition cancels and replaces the first edition published in 2011. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

The addition of transaction rules for objects defined in IEC 62264-4: Job, Job List, Job Response, Job Response List, Work Alert Definition, Work Alert, Work Calendar Definition, Work Calendar, Work Capability Work Directive, Work Master, Work Performance, Work Record, Work Schedule, Workflow Specification Node Type, Workflow Specification.

The text is based on the following documents:

CDV	Report on voting
65E/459/CDV	65E/493/RVC

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 […] P members out of […] having cast a vote.

This publication has been drafted in accordance with the ISO/IEC Directives, IEC 62264-2.

The list of all the parts of the IEC 62264 series, under the general title *Enterprise-control system integration*, can be found on the IEC website.

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

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC website 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.

IMPORTANT – The 'colour inside' logo on the cover page of this publication indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

This part of IEC 62264 is based on the use of IEC 62264 abstract models previously defined in IEC 62264-2 and IEC 62264-4 combined with verbs to define a transaction model for information exchange. It is recognized that other non-IEC 62264-5 transaction protocols are possible and are not deemed invalid as a result. Transactions occur at all levels within the enterprise and between enterprise partners, and are related to both required and actual activities, but the focus of this part of IEC 62264 is the interface between enterprise/business systems and manufacturing systems.

This standard defines transactions that are exchanged between Level 4 and Level 3, and within Level 3 as defined in the object models of IEC 62264-2 and IEC 62264-4. Models are introduced which provide descriptions of the transactions and explanations of the required transaction processing behaviour.

Technology specific implementations to provide this behaviour are not defined in this standard. This part of IEC 62264 has the intent of providing insight into the level of work required to construct transactional exchanges.

ENTERPRISE-CONTROL SYSTEM INTEGRATION –

Part 5: Business to manufacturing transactions

1   Scope

This part of IEC 62264 defines transactions in terms of information exchanges between applications performing business and manufacturing activities associated with Levels 3 and 4. The exchanges are intended to enable information collection, retrieval, transfer and storage in support of enterprise-control system integration. This part of IEC 62264 is consistent with the IEC 62264-2 and IEC 62264-4 object models attributes. This standard also defines transactions that specify how to exchange the objects defined in IEC 62264-2, IEC 62264-4 and this standard. Other uses of the transaction model are not defined in this part.

The models covered in this standard are:

– Personnel model

– Equipment model

– Physical asset model

– Material model

– Process segment model

– Operations capability model

– Operations definition mode

– Operations schedule model

– Operations performance model

– Resource relationship network model

– Work capability model

– Work definition model

– Work schedule model

– Job list model

– Work performance model

– Workflow specification model

– Work calendar

– Work record

– Work alert model

2   Normative references

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

IEC 62264-2:2013, *Enterprise-control system integration – Part 2: Object and attributes for enterprise-control system integration*

IEC 62264-3, *Enterprise-control system integration – Part 3: Activity models of manufacturing operations management*

IEC 62264-4, *Enterprise-control system integration – Part 4: Object model attributes for manufacturing operations management integration*

ISO/IEC 19501, *Information technology – Open Distributed Processing – Unified Modeling Language (UML) Version 1.4.2*

ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*

3　Terms, definitions, abbreviations, and conventions

3.1　Terms and definitions

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

3.1.1
application
ordered set of physical and logical system processes, performed by a set of resources that conduct a set of transactions intended to accomplish a definite objective performing the activity of an information provider or information user involved in a transaction

EXAMPLE　HMIs, data historians, MES and LIMs software are examples of applications.

3.1.2
ID
information to identify an object or a property of an object

3.1.3
message
structured information unit conveyed in a one-way transfer of data between one sending application to one or more receiving applications

3.1.4
noun
one of two parts in the content of a message, which represents one or more objects, as defined in the IEC 62264-2 and IEC 62264-4 object models

3.1.5
transaction
sequence of related messages that are exchanged among applications performing Level 3 or Level 4 activities

3.1.6
verb
one of two parts in the content of a message, which defines the action to be performed, or the response to a request

3.1.7
wildcard
information to identify a collection of objects or properties of objects

3.2　Abbreviations

ERP　　　　Enterprise Resource Planning

HMI　　　　Human-machine interface

LIM　　　　Laboratory information management

MES　　　　Manufacturing Execution System

MOM   Manufacturing Operations Management

OAGIS   Open Applications Group Interface Standard

PLM   Product Lifecycle Management

SYNC   Synchronized data

UTC   Universal coordinated time

3.3 Conventions

Uppercase words are used to identify the verbs in a transaction message, to differentiate them from verbs in the sentences.

EXAMPLE 1   GET for the get verb used in a transaction message.

Italics and uppercase letters are used to emphasize the 62264 specific meaning of terms. They are used for the following cases:

- names of objects used in exchanged data, including all parts of a compound name
- parts of messages
- verb/noun message examples

EXAMPLE 2   *GET Equipment* for the get verb used with an equipment object.

Uppercase words are used to identify transaction models.

EXAMPLE 3   PUSH transaction for PROCESS, CHANGE, and CANCEL verbs

4   Transaction messages and verbs

4.1 General

Clause 4 defines a common set of transactions, messages and verbs that should be used between Level 4 and Level 3, and among Level 3, applications to exchange the data defined in the object models of IEC 62264-2 and IEC 62264-4.

A transaction shall consist of a sequence of messages, where each message shall have a structure as defined in 4.3.

Messages shall contain both a noun and a verb area. The information conveyed in a message shall be contained in the noun area of a message while the actions associated with the information shall be contained in the verb area.

The role of an application initiating a transaction shall determine the set of verbs to be used in conducting the transaction. These transaction models are described in 4.2.

Three different transaction models are defined:

1) A PULL model where a user of data requests the data from a provider of the data.
2) A PUSH model where a provider of data requests an action (processing, changing, or cancelling) on the data by another user.
3) A PUBLISH model where the owner of data publishes it to users (subscribers) of the data.

NOTE The phrase "owner of data" is used to identify the application that has responsibility for enforcing the consistency of data.

This standard does not address the case where there may be multiple systems that can act as the owner of data. In these situations configuration should be set up so that one master owner of the data should be designated, with other systems performing the role of data users.

4.2   Transaction models

There are three classes of actions provided by the verb set: data synchronization, transaction processing, and query/reporting. Each is defined in a different transaction model:

a) A PULL model where a user of data requests information from an information provider. This model is used for query/reporting.

   Information provider applications listen for GET messages and respond with SHOW messages to complete the transaction.

   Information user applications send GET messages.

   1) Requests for information are sent through GET messages.

   2) A GET message describes the scope of the requested information.

   3) A SHOW message returns the information.

b) A PUSH model where a sender of information sends new or changed information to the receiver to process requests. This model is used for transaction processing.

   Receiver applications listen for PROCESS, CHANGE, or CANCEL messages.

   Sender applications send PROCESS, CHANGE, and CANCEL messages.

   1) New information is pushed to the receiver through a PROCESS message. Responses may be returned to the sender through an ACKNOWLEDGE message.

   2) Changes to information are pushed to the receiver through a CHANGE message. Responses may be returned to the sender through a RESPOND message.

   3) Information to be removed is pushed to the receiver through a CANCEL message.

c) A PUBLISH model where the provider of data publishes it to users (subscribers) of the data. This model is used for data synchronization.

   Subscriber applications receive SYNC messages.

   Publisher applications send SYNC messages.

   1) The publisher sends SYNC messages containing new, changed, or deleted information to subscribers.

   2) A subscriber receives SYNC messages containing new, changed, or deleted information.

   The timing of the publication and scope of the published information is not defined in a message. It is determined by an out-of-band agreement between the publisher and subscriber, therefore there is no SUBSCRIBE message defined in this standard.

   NOTE 1   An out-of-band agreement means that the agreement is not defined in the transaction protocol.

   EXAMPLE   An agreement between a publisher and subscriber that is set up through configuration parameters in the applications, or an agreement that is set up dynamically through a web service agreement, or an agreement that is set up through a third party application.

A single application may support one or more transaction models and the application may take on multiple roles (sender, receiver, provider, and user).

NOTE 2   The transactions are based on the assumption that the exchanged information (noun) is contained in a message of some form. The exact form of the messages is undefined in this specification; for example, the messages could be tab delimited files, XML files, electronic mail messages, or data in a named pipe. The exact form of the transport mechanism for the sending, receiving, listening, and publishing of messages is not defined in this specification.

NOTE 3   The transaction message models do not imply any specific architecture or mechanism for transporting the messages.

The transactions assume the ability to send an empty or nearly empty message that identifies either a specific object (typically by ID), a list of specific objects (by a list of IDs), or a class of objects (by wildcard or property value definition).

Figure 1 illustrates the exchange of messages in a typical transaction, where a message (*GET Equipment)* is sent from an information user with an identification of an object (*Equipment*), and a message (*Show Equipment)* is returned from the information provider with the object's information (*Equipment*).
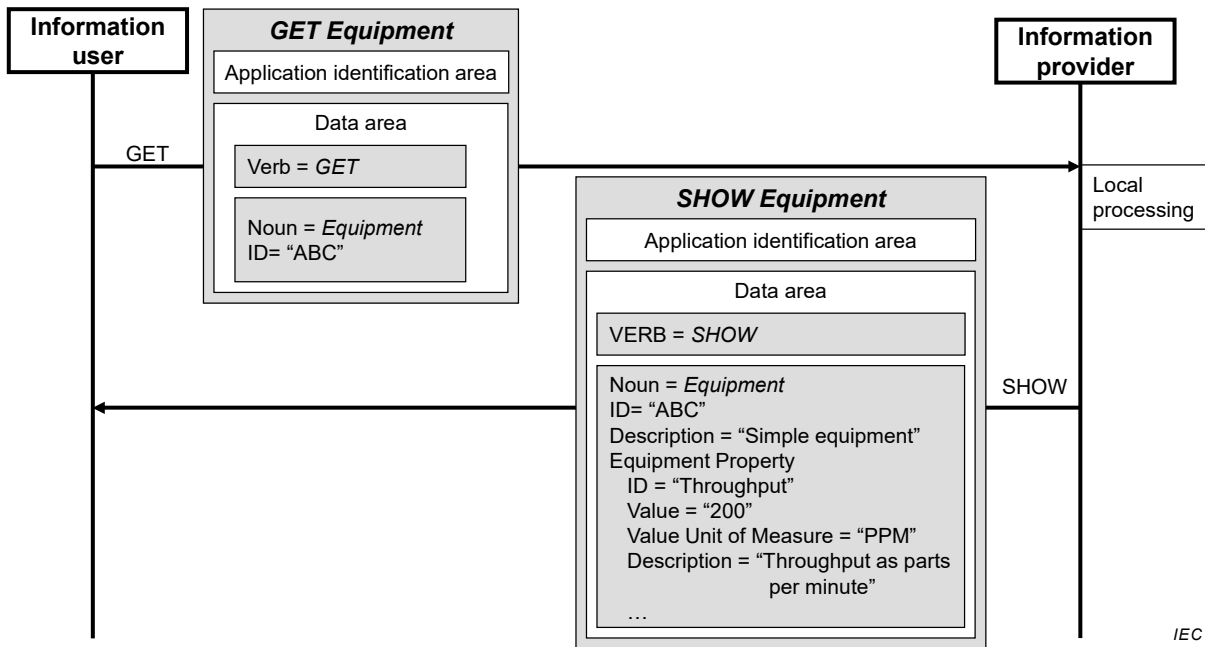
Figure 1 – Typical exchanged messages in a transaction

4.3 Message structure

4.3.1 General structure

Every message shall contain the information required to identify the source of the message and the type of the message. There shall be two main areas in a message, as shown in Figure 2, an application identification area and a data area. Within the data area there shall be a verb area and a noun area.
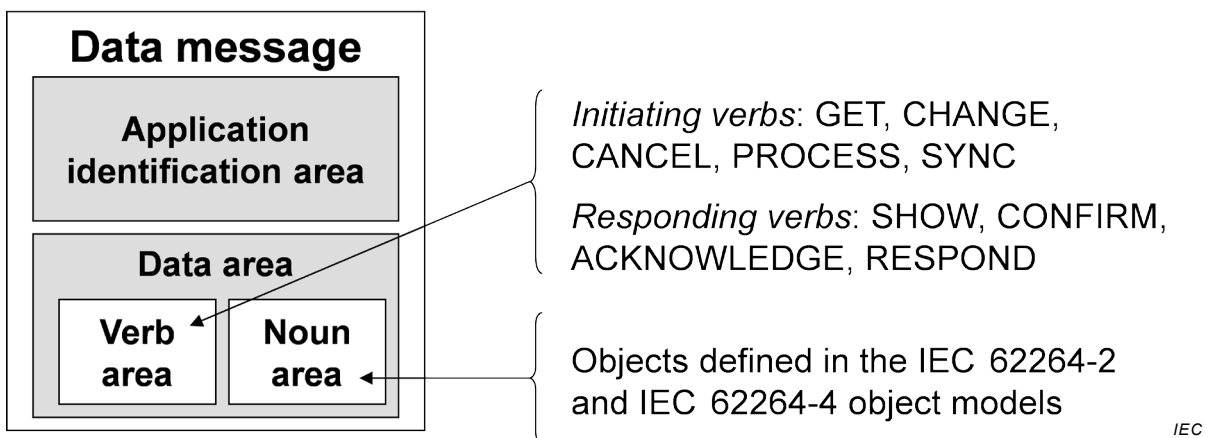
Figure 2 – Typical exchanged data set

4.3.2 Application identification area

The application identification area shall carry information that a receiving application uses to handle a message. The application identification area is used for the application layer of communication, such as indicating a required confirmation of message processing. This information typically includes the electronic address of the sender, an indication of the confirmation requirement, and the date and time the message was created. The application identification area may also include other information required for identification and authentication of the messages, such as a transaction ID. Figure 3 illustrates a typical layout for an application identification area.

NOTE   See the OAGIS (Open Applications Group Integration Specification) 9.0 specification for a format for the application identification area. The data exchange model defined in this document is consistent with the OAGIS specification, such that an implementation of OAGIS, using the objects defined in IEC 62264-2 and IEC 62264-4, can conform to this part of the standard.

Dates and times shall include time information in order to unambiguously identify times, such as universal coordinated time (UTC) or ISO 8601 CE (Common Era) calendar extended format. A time zone specification of the time is optional, and if missing the time shall be represented as UTC.
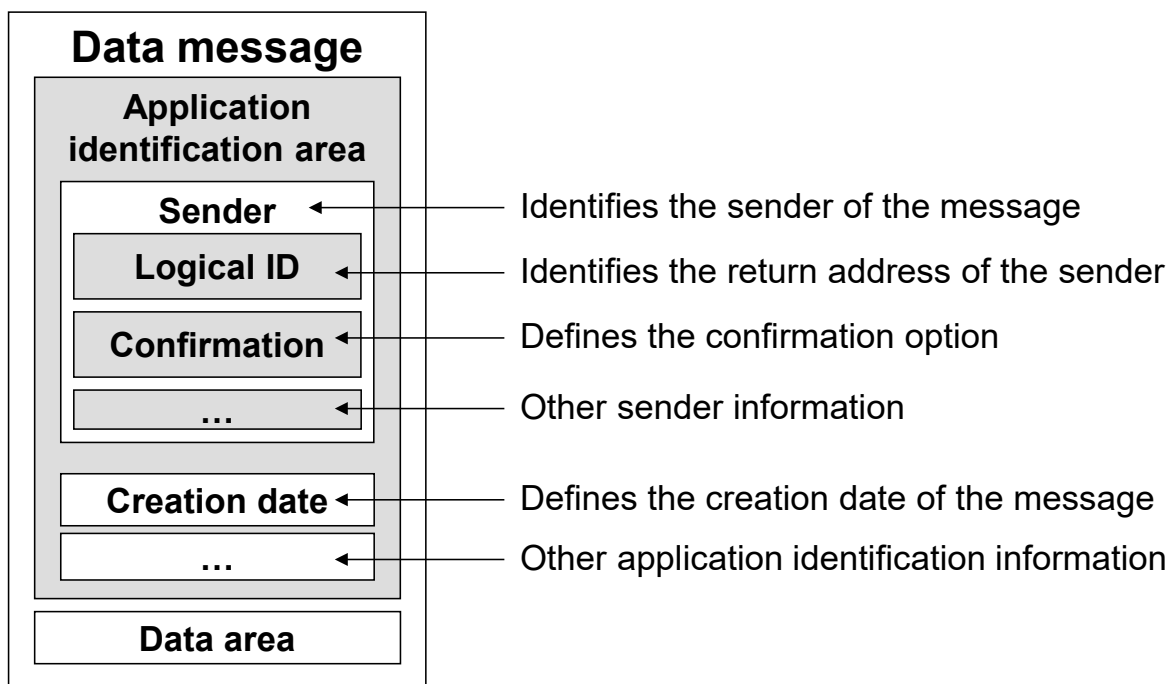
Figure 3 – Typical layout of an application identification area

4.3.3 Data area

The data area in a message shall contain a verb area and a noun area.

The verb area shall contain verbs and associated elements that represent the actions to be performed by the receiving application, or the response to a request by the sending application. The verbs defined in this part of the standard are listed in Clause 5.

The noun area shall contain nouns and associated elements that represent one or more objects defined in the IEC 62264-2 and IEC 62264-4 object models. The nouns defined in this part of the standard are listed in Clause 6.

The verb-noun combinations define messages that are intended to have a unique and unambiguous meaning.

4.3.4 Message nouns

Nouns represent one or more objects from the object models defined in IEC 62264-2 and IEC 62264-4 that have been grouped together for use with messages.

EXAMPLE A *Material Definition* noun is a composition of a *Material Definition* object instance with its *Material Definition Property* object instances.

4.3.5 Wildcard

The noun may contain a wildcard string used to identify multiple objects.

NOTE 1 Wildcards apply to the ID of a property, not to the value of the properties.

NOTE 2 Wildcards are used with care if combined with lists of object IDs or property IDs. In the case of errors a confirmation message may not have sufficient information to determine the exact error.

NOTE 3 A common convention for specifying wildcards in text strings is as regular expressions (as defined in ISO/IEC 9945-2). Regular expressions are widely supported in programming languages, text processing programs, advanced text editors, and some other programs. Regular expression support is part of the standard library of many programming languages, including Java and Python[1], is built into the syntax of others, including Perl and ECMAScript[2], and is supported by many commonly available libraries.

NOTE 4 Wildcards could also be implemented using limited regular expressions. In a limited regular expression a wildcard string can have the following special characters:

"*" Indicates zero or more characters, any character is acceptable.

EXAMPLE 1 The wildcard "ABC*" would match "ABC", "ABCD", "ABCDEF", "ABC@4!*", but not "ABDDEF".

"%" Indicates one or more characters, any character is acceptable.

EXAMPLE 2 The wildcard "ABC%" would match "ABCD", "ABCDEF", "ABC^4^*", but not "ABC".

"?" Indicates zero or one characters at the specified position, any character is acceptable.

EXAMPLE 3 The wildcard "ABC?" would match "ABCX", "ABCD", "ABC!", "ABC", but not "ABCDE" or "ABDC".

The character following a "\" is considered a literal character, not a wildcard character.

EXAMPLE 4 An object ID of "ABC*" defines the object ID as "ABC*".

EXAMPLE 5 A property ID of "\\\\USM 123" defines the property ID "\\USM 123".

NOTE 5 Two consecutive backslash characters, i.e. "\\" are interpreted to be a single backslash character "\".

Figure 4 illustrates a GET/SHOW transaction with a wildcard specified. The provider of the information returns a list of objects matching the wildcard specification.

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[1] Java and Python are examples of a suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of these product(s).

[2] Perl and ECMAScript are examples of a suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by ISO or IEC of these product(s).
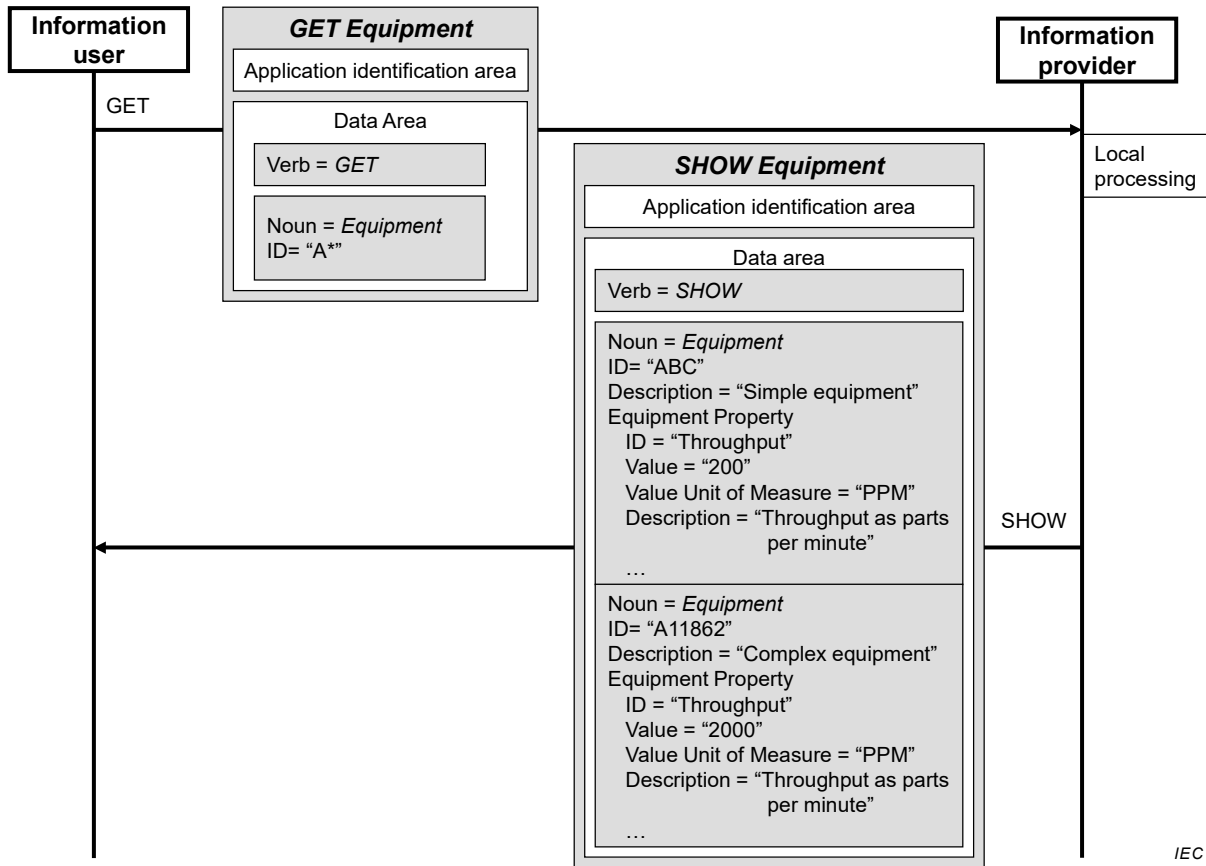
Figure 4 – GET with wildcard and SHOW response

5 Message verbs

5.1 Verbs and transaction models

The verb area of a message shall contain a verb, defined in Clause 5 and listed in Table 1.

Table 1 – Defined verbs

Verb	Description	Transaction model
ACKNOWLEDGE	Acknowledgement of a PROCESS request. The noun may contain assigned IDs and other information to inform the sender of the PROCESS message of the IDs of any created objects. EXAMPLE A PROCESS message sent with a *Material Lot* may return the ID assigned to the lot by the receiving system.	PUSH
CANCEL	Request to a receiver to remove information. The specified noun's information shall be cancelled. If contained elements IDs are specified, then only the specified contained elements for the specified noun shall be cancelled, not the noun itself. NOTE 1 This does not indicate that the information is deleted, just that it is no longer available for GET, CHANGE and SYNC messages. NOTE 2 Not all objects have contained elements. Examples of contained elements are properties, specifications, actuals, etc. EXAMPLE A property object for a *Material Class* noun is a contained element.	PUSH
CHANGE	Request to a receiver to change information. The specified attributes and contained elements of the noun shall be changed. If no IDs of contained elements are specified, only the specified attributes of the noun shall be changed. NOTE See IEC 62264-2 and IEC 62264-4 for definitions of object attributes.	PUSH
CONFIRM	Confirmation response to a request.	PUSH, PULL, PUBLISH
GET	Request to an information provider for information on one or more objects. The information provider shall return a SHOW message containing each of the specified attributes and each of the specified contained elements of the specified nouns. If no attribute or contained element is specified in the noun area, then all attributes and/or contained elements shall be returned. When wildcards are applied to the noun and property IDs, it shall be possible to further filter the information to be returned by specifying a value for one or more attributes of the noun. Only objects whose attributes match the specified value (out of the list of objects matching the wildcards applied to noun and property IDs) shall be returned. EXAMPLE To get all the *Material Lots* with Status = "New", the wildcard "*" would be specified for the *Material Lot* ID and the "New" value would be specified for the Status attribute.	PULL
PROCESS	Request to a receiver to process new information. A new noun shall be added. If the specified noun already exists, only the specified contained elements shall be added.	PUSH
RESPOND	Response to a CHANGE message request. The noun may contain proposed or alternate information that was used in place of the CHANGE noun information. EXAMPLE A CHANGE message sent with an updated *Material Lot* status of "OK" may return a RESPOND with a different status of "OUT OF SPEC" because of business rules in the receiver of the CHANGE message.	PUSH
SHOW	Response to a GET message.	PULL

Verb	Description	Transaction model
SYNC ADD	Request from the owner of the object to add information. A new noun shall be added. If the specified noun already exists, only the specified contained elements shall be added.	PUBLISH
SYNC CHANGE	Request from the owner of the object to change information. The specified attributes and contained elements of the noun shall be changed. If no IDs of contained elements are specified, only the specified attributes of the noun shall be changed.	PUBLISH
SYNC DELETE	Request from the owner of the object to delete information. The specified noun shall be cancelled. If contained elements IDs are specified, then only the specified contained elements for the specified noun shall be cancelled.	PUBLISH

NOTE 1   The processes on either side of the messages are not defined in this document.

NOTE 2   The mechanism to set up the one-to-one association of the PUSH model is not included in this part. Configuration and set up are implementation specific and would be defined in conforming specifications.

NOTE 3   The mechanism to set up the one-to-one association of the PULL model is not included in this part. Configuration and set up are implementation specific and would be defined in conforming specifications.

NOTE 4   The mechanism used for subscribing in the PUBLISH model is not included in this part. Subscribing mechanisms are implementation specific and would be defined in conforming specifications.

NOTE 5   Contained elements are object properties or other contained elements as described in 6.2.

NOTE 6   Different methods are possible to specify objects. Such methods depend on the specific noun as well as on the specific verb used, and are specified in the subclauses for each object type.

NOTE 7   The entity receiving the PROCESS message may perform further processing of the added information.

NOTE 8   There is no ability defined in this part of the standard to add or remove object attributes; IEC 62264-2 and IEC 62264-4 define the object attributes.

NOTE 9   Additional information returned in a SHOW message, (as a response to a GET message) (e.g. IDs of referenced objects) is specified in the subclauses for each object type.

NOTE 10   Additional information changed by the CHANGE and SYNC CHANGE messages (e.g. IDs of referenced objects) is specified in the subclauses for each object type.

NOTE 11   Objects can be specified by specific values of their ID or by using wildcards.

5.2   GET verb

The GET verb shall be used in a GET message to communicate a request for information on an object or list of objects.

The response to the GET message is a SHOW message. Figure 5 illustrates the GET/SHOW transaction.
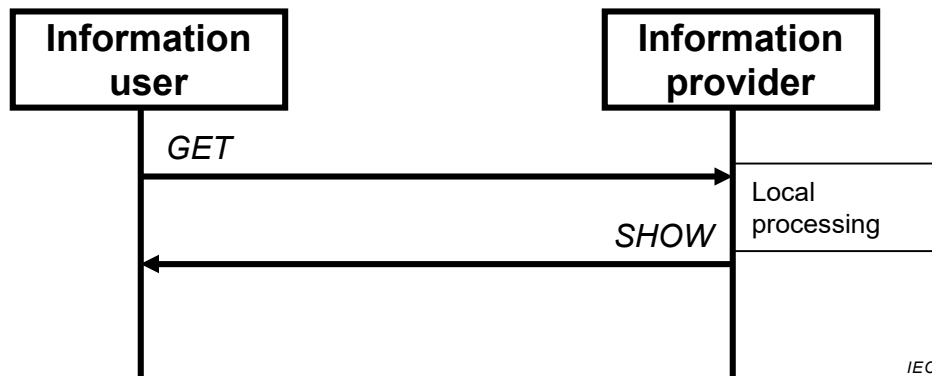
Figure 5 – GET and SHOW transaction

The GET verb is designed to retrieve one or more objects and any contained elements by using the ID attribute.

Within a GET message, the ID of the requested object is passed to the provider of the information. Where a single ID is not sufficient identification to identify the subset of information requested, such as when only a property of an object is needed, then the ID of the top level object, and the ID or value of the encapsulated object (the property) is passed to the provider of the data. The identifying IDs are specified in the ID sections for each object type.

When a wildcard definition is used in the ID, then the GET returns a list of objects matching the wildcard specification.

EXAMPLE   The GET verb may retrieve multiple objects such as all of the personnel classes.

NOTE   A GET verb with a wildcard provides a very limited query capability. The transactions are not intended to provide a complete query/reporting capability as normally seen in a database system. If additional query capability is needed, then the GET/SHOW transaction can be used to create copies of all data, and that copy can then be queried locally.

5.3   SHOW verb

The SHOW verb shall be used in a SHOW message when responding to a GET message.

5.4   PROCESS verb

The PROCESS verb shall be used in a PROCESS message to request processing of the associated noun by the receiving application. A PROCESS message is sent to an entity that can process the object. In a typical exchange scenario a PROCESS message is considered to be the equivalent of a formal command.

NOTE   A PROCESS verb is often the equivalent of a command to add an object, but usually the receiving entity does further processing of the information. The PROCESS verb is sent to the owner of the information. A SYNC ADD message is usually sent out by the receiver of the PROCESS message, after processing, to inform any other users of the information that there has been new information added.

EXAMPLE 1   The sending of a *PROCESS Operations Schedule* message to a site indicates that the schedule is to be executed.

EXAMPLE 2   The sending of a *PROCESS Equipment* message indicates that a new equipment item is to be added to a master equipment database. The receiver of the PROCESS message may then send out a *SYNC ADD Equipment* message to indicate that the master equipment database was updated.

A PROCESS verb area contains an optional element with one of the following additional definitions: Never or Always (see Table 2). If the optional element is not specified, then it defaults to Never.

Table 2 – Acknowledge request options

Name	Description
Never	No ACKNOWLEDGE message requested.
Always	Always send an ACKNOWLEDGE message.

5.5   ACKNOWLEDGE verb

The ACKNOWLEDGE verb shall be used in an ACKNOWLEDGE message to indicate an application's receipt of a PROCESS request. The response to a PROCESS message is an ACKNOWLEDGE message. The ACKNOWLEDGE message may return the original or modified data. Figure 6 illustrates a PROCESS message with the "acknowledge always" option, and with a response ACKNOWLEDGE message.
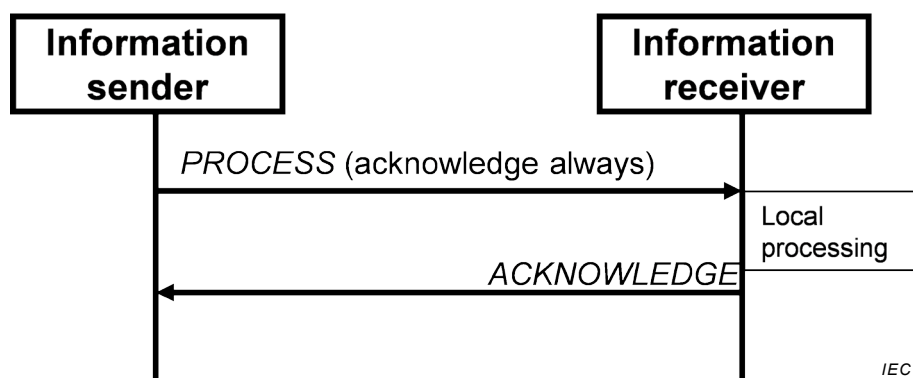
**Figure 6 – PROCESS/ACKNOWLEDGE transaction
with an "acknowledge always" option**

EXAMPLE 1   Sending of an *ACKNOWLEDGE Operations Schedule* message, where a *PROCESS Operations Schedule* message has been received and the corresponding business application acknowledges the receipt of the *Operations Schedule* and responds with an acceptance.

An ACKNOWLEDGE verb area contains an element with one of the following additional definitions: Accepted, Rejected, or Modified (see Table 3).

Table 3 – Acknowledge element

Acknowledge element value	Definition
ACCEPTED	The information was accepted by the receiver of the information and was processed according to the business rules of the receiver.
REJECTED	The information was rejected by the receiver of the information and was not processed by the receiver. The message data area shall contain an identification of the reason for rejection.
MODIFIED	The information was accepted by the receiver of the information but was modified for correct processing; the modified data shall be returned with the ACKNOWLEDGE. The message data area shall contain an identification of the type of modification.

EXAMPLE 2   Figure 7 shows a message sequence from a scheduling system to an execution system. The initial PROCESS message with an *Operations Schedule* is received and an ACKNOWLEDGE message with a MODIFIED flag was returned with a new proposed schedule. The scheduling system re-generates a schedule and resends to the execution system. The execution system accepts the *Operations Schedule* and returns an ACKNOWLEDGE message with an ACCEPTED flag.
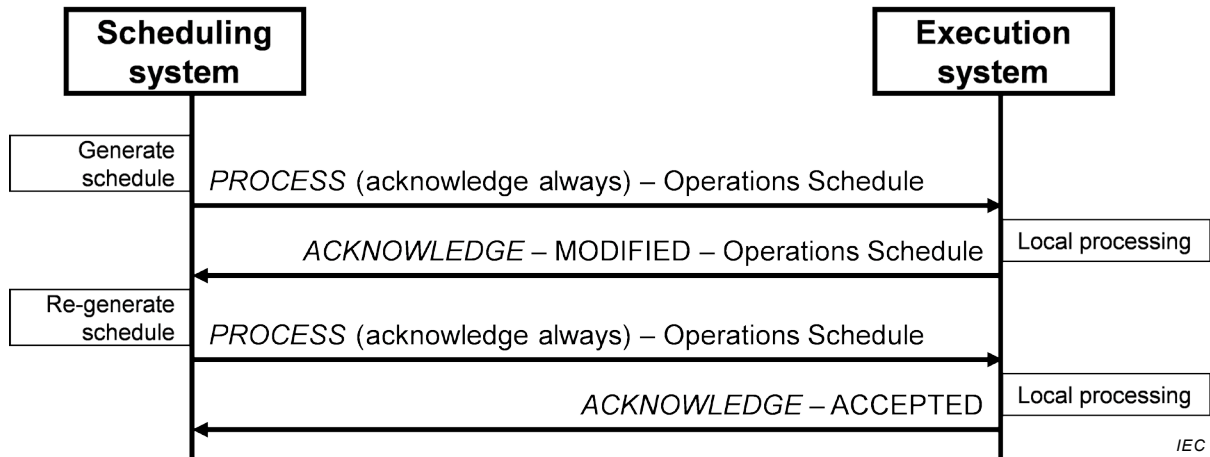
Figure 7 – Example of ACKNOWLEDGE to a PROCESS message

5.6   CHANGE verb

The CHANGE verb shall be used in a CHANGE message when the sender of the message is sending a request for the data to be changed. The noun area contains the new data. Figure 8 illustrates a CHANGE message with a "respond always" option and with a RESPOND message.

EXAMPLE   Sending of a *CHANGE Person* message, where the personnel information, such as a qualification test, is changed by a system that is not the owner of the personnel model data.
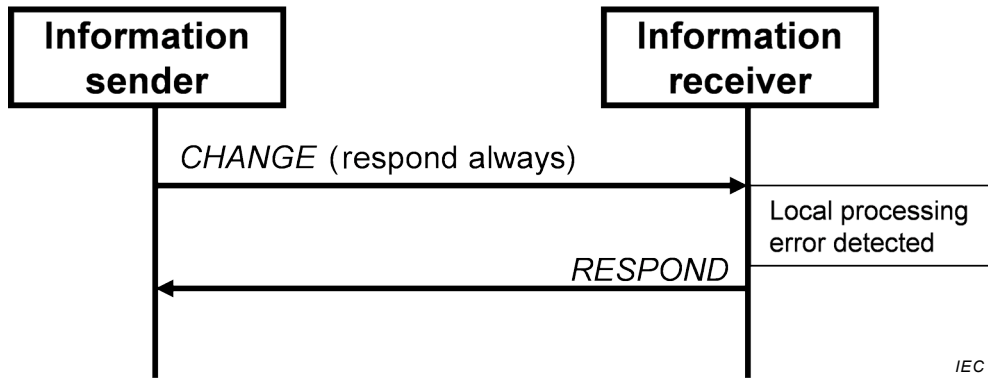
Figure 8 – CHANGE/RESPOND transaction with a "respond always" option

A CHANGE verb area contains an optional element with one of the following additional definitions: Never or Always (see Table 4). If the optional element is not specified, then it defaults to Never.

Table 4 – Respond options

Name	Description
Never	No RESPOND message requested.
Always	Always send a RESPOND message.

5.7   CANCEL verb

The CANCEL verb shall be used in a CANCEL message when the sender of the CANCEL message is sending a request for the data to be cancelled.

EXAMPLE   Sending of a *CANCEL Material Lot* message*,* where an application indicates that a *Material Lot* is no longer valid (or available), but the application that is sending the CANCEL message is not the owner of the material model data.

NOTE   Because the CANCEL is not sent by the owner of the data, the data are not necessarily deleted. The sender is indicating that the sender no longer needs the data.
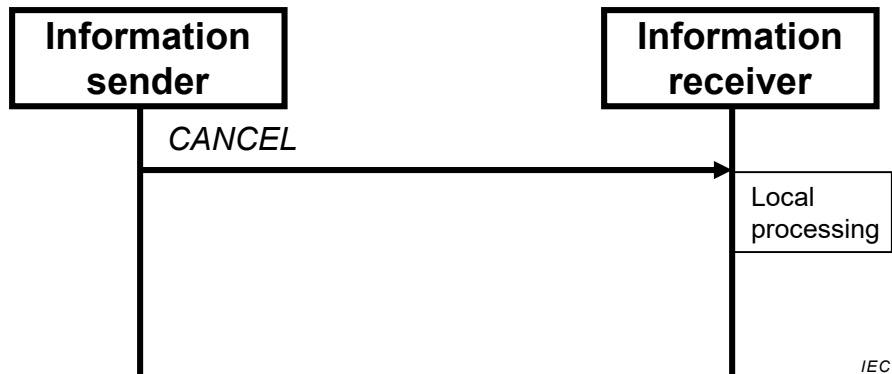
Figure 9 – CANCEL message

5.8   CONFIRM verb

A CONFIRM verb shall be used in a CONFIRM message for confirmation of receipt and processing of any message other than the CONFIRM, RESPOND, or ACKNOWLEDGE messages. See Figure 11 for an example of confirmation with detected errors.

Figure 10 illustrates a transaction with a GET message followed by a SHOW message and a CONFIRM message (because of the "confirm always" option specified with the GET message).
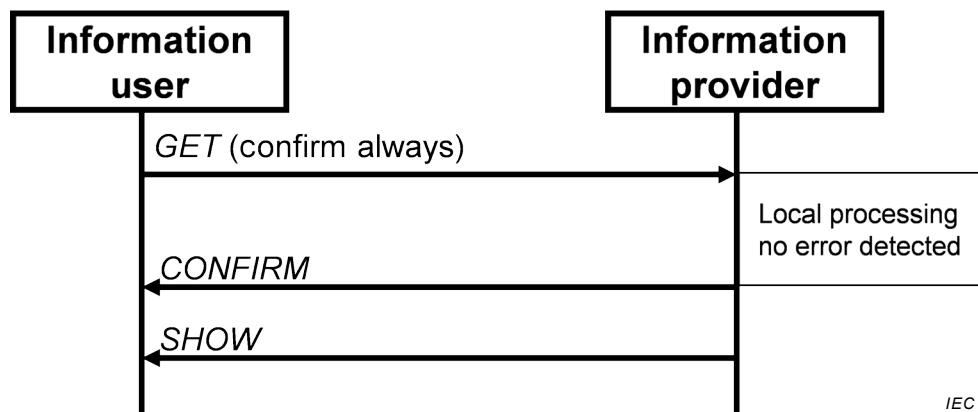
Figure 10 – GET and SHOW transaction with a "confirm always"

NOTE 1   The order of arrival of the CONFIRM message, SHOW message, and any other response message is not defined in this standard.

Confirmation is an option controlled by the sending business application. It is a request to the receiving application to send back a confirmation message to the sender of the initiating message. If the optional element is not specified, then it defaults to Never.

A confirmation request, specified in the application identification area, has the values defined in Table 5.

Table 5 – Confirmation request options

Name	Description
Never	No confirmation requested.
OnError	Send back a confirmation only if an error has occurred.
Always	Always send a confirmation regardless of the local processing.
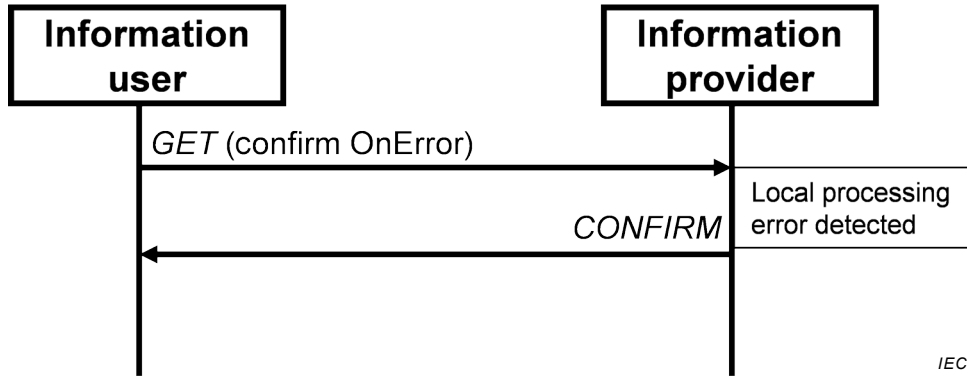
Figure 11 – Example of a GET message with "confirm OnError"

NOTE 2   The order of arrival of the CONFIRM message and any other response message is not defined in this standard.

The CONFIRM message:

1) identifies the initiating message being confirmed;

2) indicates the status of the processing of the message;

3) includes a description of the error if the status indicates a processing error if requested.

If an error occurs in the processing of the initiating message by the receiving application and the sender sets the confirmation element to either OnError or Always, then the receiving application shall provide a CONFIRM message.

Error handling at the application layer is through the confirmation element in the application identification area. Specific error codes or error text are not defined in this part and are implementation specific.

The application error handling is in addition to any communication layer error handling that may be provided by the infrastructure framework, web service, or middleware.

Additional error description, code, or text associated with objects in the noun area may be contained in the noun area, as shown in Figure 12.
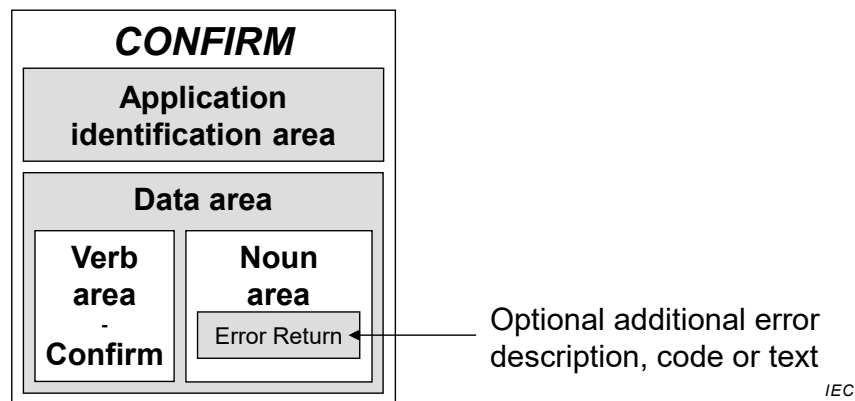
Figure 12 – CONFIRM message

5.9　RESPOND verb

The RESPOND verb shall be used in a RESPOND message to signify the application receipt and processing of a CHANGE message. The RESPOND message is used when responding to a CHANGE message. The RESPOND message may return the original or modified data.

A RESPOND verb area contains an element with one of the following additional definitions: Accepted, Rejected, or Modified (see Table 6).

Table 6 – Respond element

Respond element value	Definition
ACCEPTED	The information was accepted by the receiver of the information and was changed according to the business rules of the receiver.
REJECTED	The information was rejected by the receiver of the information and was not changed by the receiver. The message data area shall contain an identification of the reason for rejection.
MODIFIED	The information was accepted by the receiver of the information but was modified for correct processing and the modified data were returned with the RESPOND. The message data area shall contain an identification of the type of modification.

5.10　SYNC verb

The SYNC verb shall be used in a SYNC message when the owner of the data is publishing the information or change in information to subscribers.

NOTE SYNC is short for synchronize, and implies synchronized or aligned data; it does not mean synchronous communications.

There should only be one application that sends SYNC messages for any specific element of information.

EXAMPLE 1　A human resources system can provide *Personnel Capability* information; however, a training system can provide the *Qualification Test Specification* pertaining to the *Personnel Capability*.

The owner of the information sends the SYNC message.

The SYNC message shall contain one of the following modifiers in the verb area: ADD, CHANGE, or DELETE.

EXAMPLE 2　This verb is commonly used when mass changes are necessary, such as when an ERP publishes an item master to multiple MES systems, or when a publish and subscribe mechanism is used as a company's integration architecture.

5.11 SYNC ADD verb

A SYNC ADD verb shall be sent by the owner of the information and indicates that the owner of the information has added new information. The SYNC ADD message shall include the object instances added and the values of all attributes of these objects. The specific elements to be added are defined in Clause 6. See Figure 13 for an example of a SYNC ADD with a CONFIRM response.
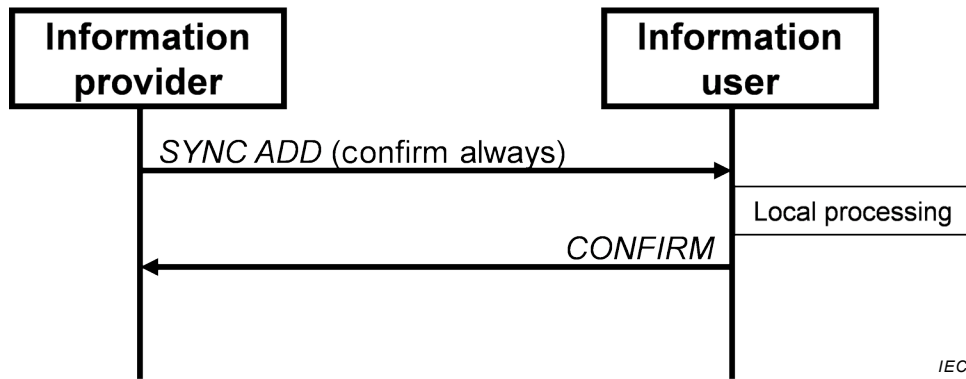
Figure 13 – SYNC ADD transaction with confirmation

EXAMPLE   A SYNC ADD on a *Material Test Specification* noun indicates the definition of a new *Material Test Specification* object.

5.12 SYNC CHANGE verb

A SYNC CHANGE verb is sent by the owner of the information and is used to disseminate information on changed objects to subscribed users. The SYNC CHANGE message shall include the object instances changed with the values of the attributes changed. The specific elements to be changed are defined in Clause 6.

EXAMPLE   A SYNC CHANGE message with a *Material Class* object indicates a change in the *Material Class* or a property of the *Material Class* and the new value.

5.13 SYNC DELETE verb

A SYNC DELETE verb is sent by the owner of the information and indicates that the provider of the information has deleted the information. The SYNC DELETE message shall include the object instances deleted.

See Figure 14 for an example of a SYNC DELETE with no response. The specific elements to be deleted are defined in Clause 6.
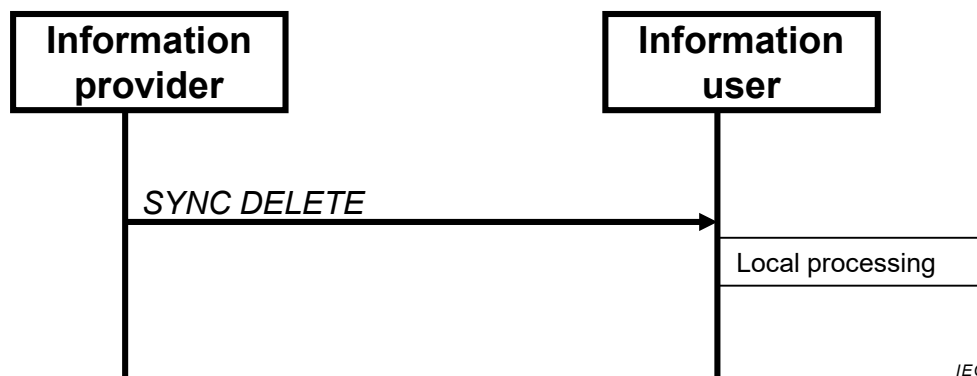
Figure 14 – SYNC DELETE transaction with no confirmation

NOTE A SYNC DELETE message only indicates that the provider has deleted the information from publication. The information can still be archived or retained in accordance with business policies, but just not available for further publishing. The information user has the responsibility to determine the correct action, such as retaining or archiving their information.

5.14 Verb actions and the use of IDs

The verbs GET, CHANGE, CANCEL, PROCESS, and SYNC, have different meaning and responses based on the values of ID attributes in the noun object. The specific rules for each verb/noun combination are defined in Clause 6. IDs may be specified, not specified, or contain wildcard values. The action in each case is defined in the noun's verb action clause. Where there are multiple IDs in a noun/object, each row in the noun's verb action table defines one valid combination of ID values.

6 Message nouns

6.1 General

Clause 6 defines the contents of the noun area in a message that shall be used by verbs to identify information exchanged.

6.2 Defined message contents

6.2.1 Equipment

The *Equipment* noun can contain the following objects as defined in IEC 62264-2:

- Equipment
- Equipment Property
- Equipment Capability Test Result
- Equipment Asset Mapping

6.2.2 Equipment Capability Test Specification

The *Equipment Capability Test Specification* noun contains the following object as defined in IEC 62264-2:

- Equipment Capability Test Specification

6.2.3 Equipment Class

The *Equipment Class* noun can contain the following objects as defined in IEC 62264-2:

- Equipment Class
- Equipment Class Property

6.2.4 Job List

The *Job List* noun can contain the following objects as defined in IEC 62264-4:

- Job Order
- Job List
- Job Order Parameter
- Personnel Requirement
- Equipment Requirement
- Physical Asset Requirement
- Material Requirement

- Personnel Requirement Property
- Equipment Requirement Property
- Physical Asset Requirement Property
- Material Requirement Property

6.2.5 Job Response

The *Job Response* noun contains the following objects as defined in IEC 62264-4:

- Job Response
- Job Response Data
- Personnel Actual
- Equipment Actual
- Physical Asset Actual
- Material Actual
- Personnel Actual Property
- Equipment Actual Property
- Physical Asset Actual Property
- Material Actual Property

6.2.6 Job Response List

The Job Response List noun contains the following objects as defined in IEC 62264-4:

- Job Response List
- Job Response
- Job Response Data
- Personnel Actual
- Equipment Actual
- Physical Asset Actual
- Material Actual
- Personnel Actual Property
- Equipment Actual Property
- Physical Asset Actual Property
- Material Actual Property

6.2.7 Material Class

The *Material Class* noun can contain the following objects as defined in IEC 62264-2:

- Material Class
- Material Class Property

6.2.8 Material Definition

The *Material Definition* noun can contain the following objects as defined in IEC 62264-2:

- Material Definition
- Material Definition Property

6.2.9　Material Lot

The *Material Lot* noun can contain the following objects as defined in IEC 62264-2:

- Material Lot
- Material Lot Property
- Material Test Result

6.2.10　Material Sublot

The *Material Sublot* noun can contain the following objects as defined in IEC 62264-2:

- Material Sublot
- Material Lot Property
- Material Test Result

EXAMPLE　Sublot specific properties may be unique RFIDs (radio frequency ID) for each sublot or maximum temperature indicators for each sublot.

6.2.11　Material Test Specification

The *Material Test Specification* noun can contain the following object as defined in IEC 62264-2:

- Material Test Specification

6.2.12　Operations Capability

The *Operations Capability* noun can contain the following objects as defined in IEC 62264-2:

- Operations Capability
- Process Segment Capability
- Personnel Capability
- Equipment Capability
- Physical Asset Capability
- Material Capability
- Personnel Capability Property
- Equipment Capability Property
- Physical Asset Capability Property
- Material Capability Property

6.2.13　Operations Definition

The *Operations Definition* noun can contain the following objects as defined in IEC 62264-2:

- Operations Definition
- Operations Segment
- Operations Segment Dependency
- Operations Material Bill
- Operations Material Bill Item
- Parameter Specification
- Personnel Specification
- Equipment Specification

- Physical Asset Specification
- Material Specification
- Personnel Specification Property
- Equipment Specification Property
- Physical Asset Specification Property
- Material Specification Property

6.2.14 Operations Schedule

The *Operations Schedule* noun can contain the following objects as defined in IEC 62264-2:

- Operations Schedule
- Operations Request
- Segment Requirement
- Requested Segment Response
- Segment Parameter
- Personnel Requirement
- Equipment Requirement
- Physical Asset Requirement
- Material Requirement
- Personnel Requirement Property
- Equipment Requirement Property
- Physical Asset Requirement Property
- Material Requirement Property

6.2.15 Operations Performance

The *Operations Performance* noun can contain the following objects as defined in IEC 62264-2:

- Operations Performance
- Operations Response
- Segment Response
- Segment Data
- Personnel Actual
- Equipment Actual
- Physical Asset Actual
- Material Actual
- Personnel Actual Property
- Equipment Actual Property
- Physical Asset Actual Property
- Material Actual Property

6.2.16 Person

The *Person* noun can contain the following objects as defined in IEC 62264-2:

- Person

- Person Property
- Qualification Test Result

6.2.17 Personnel Class

The *Personnel Class* noun can contain the following objects as defined in IEC 62264-2:

- Personnel Class
- Personnel Class Property

6.2.18 Physical Asset

The *Physical Asset* noun can contain the following objects as defined in IEC 62264-2:

- Physical Asset
- Physical Asset Property
- Physical Asset Capability Test Result
- Equipment Asset Mapping

6.2.19 Physical Asset Class

The *Physical Asset Class* noun can contain the following objects as defined in IEC 62264-2:

- Physical Asset Class
- Physical Asset Class Property

6.2.20 Physical Asset Capability Test Specification

The *Physical Asset Capability Test Specification* noun contains the following object as defined in IEC 62264-2:

- Physical Asset Capability Test Specification

6.2.21 Process Segment

The *Process Segment* noun can contain the following objects as defined in IEC 62264-2:

- Process Segment
- Process Segment Parameter
- Personnel Segment Specification
- Equipment Segment Specification
- Physical Asset Segment Specification
- Material Segment Specification
- Process Segment Dependency
- Personnel Segment Specification Property
- Equipment Segment Specification Property
- Physical Asset Segment Specification Property
- Material Segment Specification Property

6.2.22 Resource Relationship Network

The *Resource Relationship Network* noun can contain the following objects as defined in IEC 62264-4:

- Resource Relationship Network

- Resource Network Connection
- Resource Network Connection Property
- To Resource Reference
- To Resource Reference Property
- From Resource Reference
- From Resource Reference Property

6.2.23 Resource Relationship Network Connection Type

The *Resource Relationship Network Connection Type* noun can contain the following objects as defined in IEC 62264-4:

- Resource Network Connection Type
- Resource Network Connection Type Property

6.2.24 Qualification Test Specification

The *Qualification Test Specification* noun contains the following object as defined in IEC 62264-2:

- Qualification Test Specification

6.2.25 Transaction Profile

The message contents of a *Transaction Profile* returns all supported verb/noun combinations, if the combination is supported as a receiver, if it is supported as a sender, and if wildcards are supported. See 6.20 and Clause 7 for the definition of the object and compliance information.

NOTE   The *Transaction Profile* is a method to interactively determine what verbs and nouns are supported by an application.

6.2.26 Work Alert Definition

The *Work Alert Definition* noun can contain the following objects as defined in IEC 62264-4:

- Work Alert Definition
- Work Alert Definition Property

6.2.27 Work Alert

The *Work Alert* noun can contain the following objects as defined in IEC 62264-4:

- Work Alert
- Work Alert Property

6.2.28 Work Calendar Definition

The *Work Calendar Definition* noun can contain the following objects in IEC 62264-4:

- Work Calendar Definition
- Work Calendar Definition Entry
- Work Calendar Definition Property

6.2.29 Work Calendar

The *Work Calendar* noun can contain the following objects in IEC 62264-4:

- Work Calendar

- Work Calendar Entry
- Work Calendar Property

6.2.30 Work Capability

The *Work Capability* noun contains the following objects as defined in IEC 62264-4:

- Work Capability
- Work Master Capability
- Personnel Capability
- Equipment Capability
- Physical Asset Capability
- Material Capability
- Personnel Capability Property
- Equipment Capability Property
- Physical Asset Capability Property
- Material Capability Property

6.2.31 Work Directive

The *Work Directive* noun contains the following objects as defined in IEC 62264-4:

- Work Directive
- Workflow Specification
- Parameter Specification
- Personnel Specification
- Equipment Specification
- Physical Asset Specification
- Material Specification
- Personnel Specification Property
- Equipment Specification Property
- Physical Asset Specification Property
- Material Specification Property

6.2.32 Work Master

The *Work Master* noun contains the following objects as defined in IEC 62264-4:

- Work Master
- Workflow Specification
- Parameter Specification
- Personnel Specification
- Equipment Specification
- Physical Asset Specification
- Material Specification
- Personnel Specification Property
- Equipment Specification Property
- Physical Asset Specification Property

- Material Specification Property

6.2.33 Work Performance

The *Work Performance* noun contains the following objects as defined in IEC 62264-4:

- Work Performance
- Work Response
- Job Response
- Job Response Data
- Personnel Actual
- Equipment Actual
- Physical Asset Actual
- Material Actual
- Personnel Actual Property
- Equipment Actual Property
- Physical Asset Actual Property
- Material Actual Property

6.2.34 Work Record

The *Work Record* noun contains the following objects as defined in IEC 62264-4:

- Work Record
- All subobjects in a Work Record as defined in IEC 62264-4

6.2.35 Work Schedule

The *Work Schedule* noun contains the following objects as defined in IEC 62264-4:

- Work Schedule
- Work Request
- Job Order Parameter
- Personnel Requirement
- Equipment Requirement
- Physical Asset Requirement
- Material Requirement
- Personnel Requirement Property
- Equipment Requirement Property
- Physical Asset Requirement Property
- Material Requirement Property

6.2.36 Workflow Specification

The *Workflow Specification* noun contains the following objects as defined in IEC 62264-4:

- Workflow Specification
- Workflow Specification Node
- Workflow Specification Node Property
- Workflow Specification Connection

- Workflow Specification Connection Property

6.2.37 Workflow Specification Type

The *Workflow Specification Type* noun contains the following objects as defined in IEC 62264-4:

- Workflow Specification Type
- Workflow Specification Node Type
- Workflow Specification Node Type Property
- Workflow Specification Connection Type
- Workflow Specification Connection Type Property

6.2.38 Production specific models

6.2.38.1 Production models

Production specific information is described in IEC 62264-2:2013, Annex A. The transaction definitions of the production specific information are defined in Annex A of this part. Subclauses 6.2.38.2 to 6.2.38.5 define the set of message nouns that should be used by verbs to identify information exchanged between Level 4 and Level 3 systems as defined in the production object models of IEC 62264-2.

The production specific models are specialized subsets of the operations models with alternative object names for purposes of backward compatibility. New implementations should use the operations models.

6.2.38.2 Production Capability

The *Production Capability* noun contains the following objects as defined in IEC 62264-2:

- Production Capability
- Personnel Capability
- Equipment Capability
- Physical Asset Capability
- Material Capability
- Process Segment Capability
- Personnel Capability Property
- Equipment Capability Property
- Physical Asset Capability Property
- Material Capability Property

6.2.38.3 Product Definition

The *Product Definition* noun may contain the following objects as defined in IEC 62264-2:

- Product Definition
- Product Segment
- Product Segment Dependency
- Manufacturing Bill
- Parameter Specification
- Personnel Specification
- Equipment Specification

- Physical Asset Specification

- Material Specification

- Personnel Specification Property

- Equipment Specification Property

- Physical Asset Specification Property

- Material Specification Property

6.2.38.4 Production Schedule

The *Production Schedule* noun may contain the following objects as defined in IEC 62264-2:

- Production Schedule

- Production Request

- Segment Requirement

- Requested Segment Response

- Production Parameter

- Personnel Requirement

- Equipment Requirement

- Physical Asset Requirement

- Material Requirement

- Personnel Requirement Property

- Equipment Requirement Property

- Physical Asset Requirement Property

- Material Requirement Property

- Product Parameter

- Process Parameter

6.2.38.5 Production Performance

The *Production Performance* noun may contain the following objects as defined in IEC 62264-2:

- Production Performance

- Production Response

- Segment Response

- Production Data

- Personnel Actual

- Equipment Actual

- Physical Asset Actual

- Material Actual

- Personnel Actual Property

- Equipment Actual Property

- Physical Asset Actual Property

- Material Actual Property

6.3   Personnel model

6.3.1   Personnel model elements

The message definitions assume that information may be accessed from any of three starting points: *Personnel Class*, *Person*, or *Qualification Test Specification*, as identified by the dotted collections in Figure 15, in the overlay to the object model defined in IEC 62264-2 using the UML notation defined in ISO/IEC 19501.
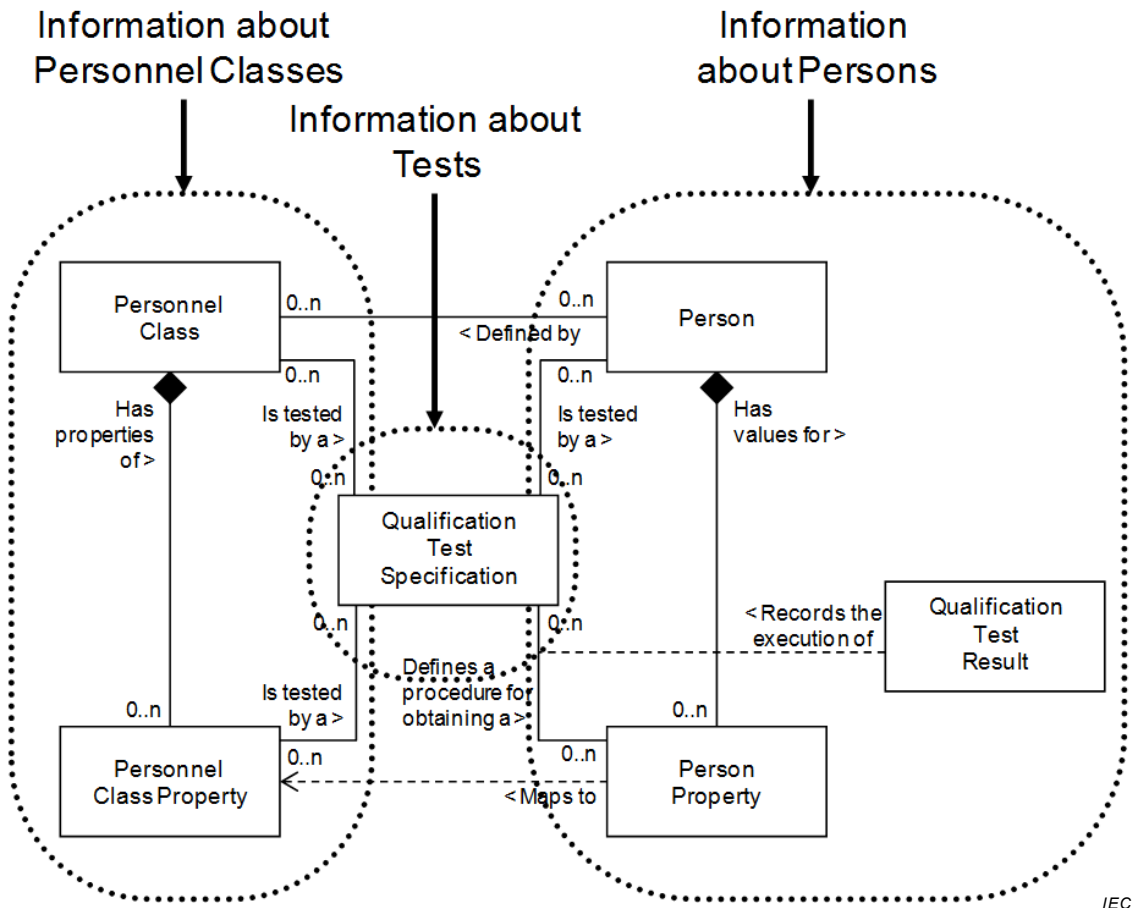
Figure 15 – Object grouping for the personnel model

EXAMPLE   Messages can be: *GET Personnel Class*, *GET Person*, *GET Qualification Test Specification*.

6.3.2   Personnel Class verbs

All verbs shall be valid for a *Personnel Class* noun.

A *Personnel Class* message contains information about *Personnel Classes*, or *Personnel Classes* and their *Personnel Class Properties*. The returned information does not contain the *person* objects associated with the *Personnel Class*, but does contain the IDs of the persons belonging to the class.

6.3.3   Personnel Class verb actions

Table 7 defines verb actions and the use of IDs and values for the *Personnel Class*.

Table 7 – Personnel Class verb actions

Value of Personnel Class ID	Value of Personnel Class Property ID	Personnel Class Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Personnel Classes*, all properties and their attributes, and the list of *Person IDs* of the *Personnel Classes*. PROCESS: Shall define a request that the receiver is to add *Personnel Classes*. The IDs define suggested IDs for the *Personnel Classes*. The receiver adds the *Personnel Classes* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified *Personnel Classes* shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified *Personnel Classes*. SYNC ADD: Shall define a request that the receiver is to add the specified *Personnel Classes*. SYNC CHANGE: The specified attributes of the specified *Personnel Classes* shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Personnel Classes*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Personnel Classes*, all of the specified *Personnel Class* properties, and the list of *Person IDs* of the *Personnel Classes*. PROCESS: Shall define a request that the receiver is to add *Personnel Classes*. The ID defines suggested IDs for the *Personnel Classes* and list of properties. The receiver adds the *Personnel Classes* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Personnel Classes*. SYNC ADD: Shall define a request that the receiver is to add the *Personnel Classes* and list of *Personnel Class Properties*. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Personnel Class Properties*.

Value of Personnel Class ID	Value of Personnel Class Property ID	Personnel Class Property value	Verb action on noun
IDs specified	IDs specified	Property value specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Personnel Classes* where the *Personnel Class Property* value matches the specified property value, all of the specified *Personnel Class properties*, and the list of *Person IDs*. PROCESS: Shall define a request that the receiver is to add *Personnel Classes*. The IDs define suggested IDs for the *Personnel Classes* and properties, and values for the properties. The receiver adds the *Personnel Classes* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Personnel Classes* to the property values specified. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Personnel Classes* that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified *Personnel Classes*, list of properties and property values. SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Personnel Classes* to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Personnel Class Properties* of the specified *Personnel Classes* that have the specified property values.
Wildcard specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Personnel Classes* that match the wildcard and the list of *Person IDs* of each *Personnel Class*. EXAMPLE To return all *Personnel Classes*, a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Personnel Classes* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Personnel Classes* matching the wildcard.

Value of Personnel Class ID	Value of Personnel Class Property ID	Personnel Class Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Personnel Classes* that match the wildcard, and for each class return all *Personnel Class Properties* that match the property wildcards, and the list of *Person IDs* of to the class.
			EXAMPLE 1 To return a single property, the single *Personnel Class Property* ID can be specified in the property wildcard.
			EXAMPLE 2 To return all *Personnel Class* properties, a "*" can be specified as the property wildcard.
			EXAMPLE 3 To return a single *Personnel Class*, the *Personnel Class ID* can be specified in the wildcard.
			EXAMPLE 4 To return all *Personnel Classes*, a "*" can be specified as the wildcard.
			PROCESS: Error.
			CHANGE: Error (no property values are specified).
			CANCEL: Shall define a request that the receiver is to cancel all properties matching the property wildcard of all *Personnel Classes* that match the wildcard.
			SYNC ADD: Error.
			SYNC CHANGE: Error (no property values are specified).
			SYNC DELETE: Shall define a request that the receiver is to delete all properties that match the property wildcard of all *Personnel Classes* that match the wildcard.

6.3.4   Person verbs

All verbs shall be valid for a *Person* noun.

NOTE   This contains information about *persons* and their *Person Properties*. The returned information does not contain the *Personnel Class* objects associated with the person, but does contain the IDs of the *Personnel Classes* the person belongs to.

6.3.5   Person verb actions

The actions performed on a *Person* noun are defined in Table 8.

Table 8 – Person verb actions

Value of Person ID	Value of Person Property ID	Person Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Persons*, all properties and their attributes, and the list of *Personnel Class IDs* of the *Persons*.
			PROCESS: Shall define a request that the receiver is to add *Persons*. The message defines suggested IDs for the *Persons*. The receiver adds the *Persons* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.
			CHANGE: The specified attributes of the specified *Persons* shall be changed.
			CANCEL: Shall define a request that the receiver is to cancel the specified *Persons*.
			SYNC ADD: Shall define a request that the receiver is to add the specified *Persons*.
			SYNC CHANGE: The specified attributes of the specified *Persons* shall be changed.
			SYNC DELETE: Shall define a request that the receiver is to delete the specified *Persons*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Persons*, all of the specified *Person Properties*, and the list of *Personnel Class IDs* of the *Persons*.
			PROCESS: Shall define a request that the receiver is to add *Persons*. The ID defines suggested IDs for the *Persons* and list of properties. The receiver adds the *Persons* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.
			CHANGE: Error (no property values are specified).
			CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Persons*.
			SYNC ADD: Shall define a request that the receiver is to add the *Persons* and list of *Person Properties*.
			SYNC CHANGE: Error (no property values are specified).
			SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Person Properties*.

Value of Person ID	Value of Person Property ID	Person Property value	Verb action on noun
IDs specified	IDs specified	Property Value Specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Persons* where the *Person Property* value matches the specified property value, all of the specified *Person* properties, and the list of *Personnel Class IDs*. PROCESS: Shall define a request that the receiver is to add *Persons*. The ID defines suggested IDs for the *Persons* and properties, and values for the properties. The receiver adds the *Persons* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Persons* to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Persons* that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified *Persons*, list of properties and property values. SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Persons* to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Person Properties* of the specified *Persons* that have the specified property value.
Wildcard specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Persons* that match the wildcard and the list of *Personnel Class IDs* of each *Person*. EXAMPLE To return all *Persons*, a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Persons* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Persons* matching the wildcard.

Value of Person ID	Value of Person Property ID	Person Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Persons* that match the wildcard, and for each *Person* return all *Person Properties* that match the property wildcards, and the list of *Personnel Class IDs* of to the *Person*.
			EXAMPLE 1 To return a single property, the property can be specified in the property wildcard.
			EXAMPLE 2 To return all properties, a "*" can be specified as the property wildcard.
			EXAMPLE 3 To return a single *Person*, the *Person ID* can be specified in the wildcard.
			EXAMPLE 4 To return all *Persons*, "*" can be specified as the wildcard.
			PROCESS: Error.
			CHANGE: Error (no property values are specified).
			CANCEL: Shall define a request that the receiver is to cancel all properties matching the property wildcard of all *Persons* that match the wildcard.
			SYNC ADD: Error.
			SYNC CHANGE: Error (no property values are specified).
			SYNC DELETE: Shall define a request that the receiver is to delete all properties that match the property wildcard of all *Persons* that match the wildcard.

6.3.6   Qualification Test Specification verbs

All verbs shall be valid for a *Qualification Test Specification* noun.

NOTE   This contains information about qualification tests. The returned information contains the identification of the tested *Personnel Class Properties*, and the identification of the *Person Properties*.

6.3.7   Qualification Test Specification verb actions

The actions performed on a *Qualification Test Specification* noun are defined in Table 9.

Table 9 – Qualification Test Specification verb actions

Value of Qualification Test ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Qualification Test Specifications*, the IDs of *Personnel Class Properties* referenced by the test, and the IDs of all *Person Properties* referenced by the test.
	PROCESS: Shall define a request that the receiver is to add *Qualification Test Specifications*. The message defines suggested IDs for the *Qualification Test Specifications*, values for the attributes and IDs of *Personnel Class Property* and *Person Property* referenced by the *Qualification Test*. The receiver adds the *Qualification Test Specifications* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.
	CHANGE: Shall define a request that the receiver is to change the specified attributes of the *Qualification Test Specifications* and IDs of *Personnel Class Properties* and *Person Properties* referenced. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel the specified *Qualification Test Specifications*.
	SYNC ADD: Shall define a request that the receiver is to add the specified *Qualification Test Specifications* and IDs of *Personnel Class Properties* and *Person Properties* referenced.
	SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes of the *Qualification Test Specifications* and IDs of *Personnel Class Properties* and *Person Properties* referenced.
	SYNC DELETE: Shall define a request that the receiver is to delete the specified *Qualification Test Specifications*.
<not specified>	GET: Error.
	PROCESS: Error.
	CHANGE: Error.
	CANCEL: Error.
	SYNC ADD: Error.
	SYNC CHANGE: Error.
	SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of all *Qualification Test Specifications* identified by the wildcard, the IDs of *Personnel Class Properties* referenced, and the IDs of *Person Properties* referenced by the tests.
	EXAMPLE To return all *Qualification Test Specifications*, a "*" can be specified as the wildcard.
	PROCESS: Error.
	CHANGE: Shall define a request that the receiver is to change the specified attributes of all *Qualification Test Specifications* matching the wildcard ID and IDs of *Personnel Class Properties* referenced, and the IDs of *Person Properties* referenced. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel all *Qualification Test Specifications* matching the wildcard ID.
	SYNC ADD: Error.
	SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes of all *Qualification Test Specifications* matching the wildcard ID and IDs of *Personnel Class Properties* referenced, and the IDs of *Person Properties* referenced.
	SYNC DELETE: Shall define a request that the receiver is to delete all *Qualification Test Specifications* matching the wildcard ID.

6.4 Role based equipment model

6.4.1 Role based equipment model elements

The message definitions assume that information may be accessed from any of three starting points: *Equipment Class*, E*quipment*, or E*quipment Capability Test*, as identified by the dotted collections in Figure 16, in the overlay to the object model defined in IEC 62264-2 using the UML notation defined ISO/IEC 19501.
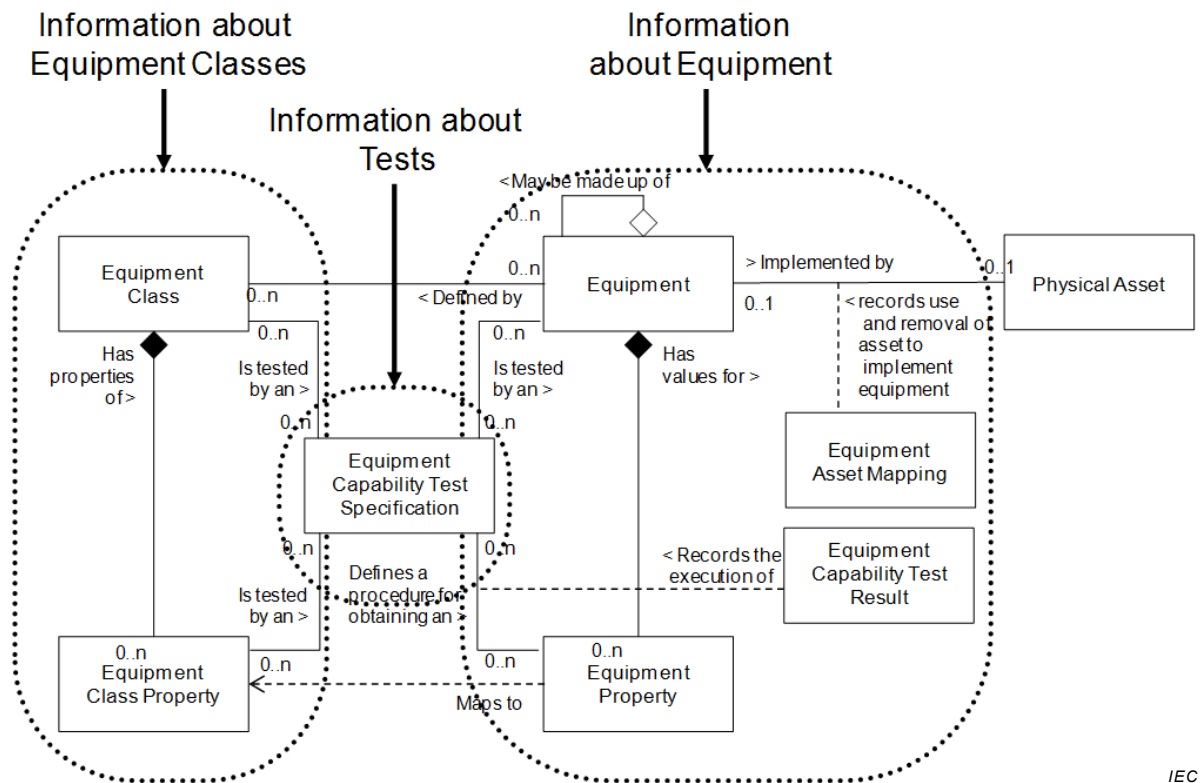
Figure 16 – Object grouping for the role based equipment model

EXAMPLE　　Messages can be: *GET Equipment Class*, *GET Equipment*, *GET Equipment Capability Test*.

6.4.2 Equipment Class verbs

All verbs shall be valid for an *Equipment Class* noun.

NOTE　This contains information about *Equipment Classes*, or *Equipment Classes* and their *Euipment Class Properties*. The returned information does not contain the *Equipment* objects associated with the *Equipment Class*, but only the IDs of the equipment belonging to the class.

6.4.3 Equipment Class verb actions

The actions performed on E*quipment Class* objects are defined in Table 10.

Table 10 – Equipment Class verb actions

Value of Equipment Class ID	Value of Equipment Class Property ID	Equipment Class Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Equipment Classes*, all properties and their attributes, and the IDs of *Equipment* that are members of each *Equipment Class*. PROCESS: Shall define a request that the receiver is to add *Equipment Classes*. The message defines suggested IDs for the *Equipment Classes*. The receiver adds the *Equipment Classes* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified *Equipment Classes* shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified *Equipment Classes*. SYNC ADD: Shall define a request that the receiver is to add the specified *Equipment Classes*. SYNC CHANGE: The specified attributes of the specified *Equipment Classes* shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Equipment Classes*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Equipment Classes*, all of the specified *Equipment Class Properties*, and the IDs of *Equipment* that are members of each *Equipment Class*. PROCESS: Shall define a request that the receiver is to add *Equipment Classes*. The message defines suggested IDs for the *Equipment Classes* and properties. The receiver adds the *Equipment Classes* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Equipment Classes*. SYNC ADD: Shall define a request that the receiver is to add the *Equipment Classes* and list of *Equipment Class Properties*. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Equipment Class Properties*.

Value of Equipment Class ID	Value of Equipment Class Property ID	Equipment Class Property value	Verb action on noun
IDs specified	IDs specified	Property value specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Equipment Classes* where the *Equipment Class Property* value matches the specified property value, all of the specified *Equipment Class Properties*, and the IDs of *Equipment* that are members of each *Equipment Class*.
			PROCESS: Shall define a request that the receiver is to add *Equipment Classes*. The message defines suggested IDs for the *Equipment Classes* and properties, and values for the properties. The receiver adds the *Equipment Classes* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.
			CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Equipment Classes* to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
			CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Equipment Classes* that have the specified property value.
			SYNC ADD: Shall define a request that the receiver is to add the specified *Equipment Classes*, list of properties and property values.
			SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Equipment Classes* to the specified values.
			SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Equipment Class Properties* of the specified *Equipment Classes* that have the specified property value.
Wildcard specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Equipment Classes* that match the wildcard ID and the IDs of *Equipment* that are members of each *Equipment Class*.
			EXAMPLE To return all *Equipment Classes*, a "*" can be specified as the wildcard.
			PROCESS: Error.
			CHANGE: Error (no property values are specified).
			CANCEL: Shall define a request that the receiver is to cancel all *Equipment Classes* matching the wildcard ID.
			SYNC ADD: Error.
			SYNC CHANGE: Error (no property values are specified).
			SYNC DELETE: Shall define a request that the receiver is to delete all *Equipment Classes* matching the wildcard ID.

Value of Equipment Class ID	Value of Equipment Class Property ID	Equipment Class Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Equipment Classes* that match the wildcard IDs, and for each class return all *Equipment Class Properties* that match the property wildcards, and the IDs of *Equipment* that are members of each *Equipment Class*. EXAMPLE 1 To return a single property, the *Equipment Class Property* ID can be specified in the property wildcard. EXAMPLE 2 To return all *Equipment Class Properties*, a "*"can be specified as the property wildcard. EXAMPLE 3 To return a single *Equipment Class*, the ID can be specified in the wildcard ID. EXAMPLE 4 To return all *Equipment Classes*, a "*"can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Equipment Class Properties* matching the property wildcard of all *Equipment Classes* that match the wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Equipment Class Properties* matching the property wildcard of all *Equipment Classes* that match the wildcard.

6.4.4   Equipment verbs

All verbs shall be valid for an *Equipment* noun.

NOTE   This contains information about *Equipment* and the *Equipment Properties*. The returned information does not contain the *Equipment Class* objects associated with the *Equipment*, but only the IDs of the *Equipment Classes* the *Equipment* belongs to.

6.4.5   Equipment verb actions

The actions performed on an *Equipment* noun are defined in Table 11.

Table 11 – Equipment verb actions

Value of Equipment ID	Value of Equipment Property ID	Equipment Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Equipment*, all properties and their attributes, all *Equipment Asset Mappings* and the IDs of the *Equipment Classes* of the *Equipment*. PROCESS: Shall define a request that the receiver is to add *Equipment*. The ID defines a suggested ID for the *Equipment*. The receiver adds the *Equipment* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified *Equipment* and/or the *Equipment Asset Mappings* shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified *Equipment*. SYNC ADD: Shall define a request that the receiver is to add the specified *Equipment*. SYNC CHANGE: The specified attributes of the specified *Equipment* shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Equipment*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Equipment*, all of the specified *Equipment Properties*, and the IDs of *Equipment Classes* of the *Equipment*. PROCESS: Shall define a request that the receiver is to add *Equipment*. The ID defines suggested IDs for the *Equipment* and properties. The receiver adds the *Equipment* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Equipment*. SYNC ADD: Shall define a request that the receiver is to add the *Equipment* and list of *Equipment Properties*. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Equipment Properties*.

Value of Equipment ID	Value of Equipment Property ID	Equipment Property value	Verb action on noun
IDs specified	IDs specified	Property value specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Equipment* where the *Equipment Property* value matches the specified property value, all of the specified *Equipment Properties*, and the IDs of *Equipment Classes*. PROCESS: Shall define a request that the receiver is to add *Equipment*. The message defines suggested IDs for the *Equipment* and properties, and values for the properties. The receiver adds the *Equipment* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Equipment* to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Equipment* that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified *Equipment*, list of properties and property values. SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Equipment* to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Equipment Properties* of the specified *Equipment* that have the specified property value.
Wildcard specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Equipment* that matches the ID wildcard and the IDs of *Equipment Classes* of each *Equipment* and all *Equipment Asset Mappings*. EXAMPLE To return all *Equipment*, a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Equipment* matching the ID wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Equipment* matching the ID wildcard.

Value of Equipment ID	Value of Equipment Property ID	Equipment Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Equipment* that matches the ID wildcard, and for each class return all *Equipment Properties* that match the property ID wildcards, and the IDs of *Equipment Classes* of to the *Equipment*. EXAMPLE 1　To return a single property, the *Equipment Property* ID can be specified in the property ID wildcard. EXAMPLE 2　To return all *Equipment* properties, a "*"can be specified as the property ID wildcard. EXAMPLE 3　To return a single *Equipment*, the *Equipment* ID can be specified in the ID wildcard. EXAMPLE 4　To return all *Equipment*, a "*"can be specified as the ID wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all properties matching the *Equipment Property* ID wildcard of all *Equipment* that matches the ID wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all properties that match the *Equipment Property* ID wildcard of all *Equipment* that match the ID wildcard.

6.4.6　Equipment Capability Test Specification verbs

All verbs shall be valid for an *Equipment Capability Test Specification* noun.

NOTE　This contains information about capability tests. The returned information contains the identification of the tested *Equipment Class Properties*, and the identification of the *Equipment Properties*.

6.4.7　Equipment Capability Test Specification verb actions

The actions performed on an *Equipment Capability Test Specification* noun are defined in Table 12.

Table 12 – Equipment Capability Test Specification verb actions

Capability Test ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Equipment Capability Test Specifications*, the IDs of *Equipment Class Properties* referenced by the test, and the IDs of all *Equipment Properties* referenced by the test.
	PROCESS: Shall define a request that the receiver is to add *Equipment Capability Test Specifications*. Defines suggested IDs for the *Equipment Capability Test Specifications*, values for the attributes and IDs of *Equipment Class Properties* and *Equipment Properties* referenced by the *Equipment Capability Test Specifications*. The receiver adds the *Equipment Capability Test Specifications* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.
	CHANGE: Shall define a request that the receiver is to change the specified attributes of the *Equipment Capability Test Specifications* and IDs of *Equipment Class Properties* and *Equipment* properties referenced. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel the specified *Equipment Capability Test Specifications*.
	SYNC ADD: Shall define a request that the receiver is to add the specified *Equipment Capability Test Specifications* and IDs *Equipment Class Properties* and *Equipment Properties* referenced.
	SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes of the *Equipment Capability Test Specifications* and IDs of *Equipment Class Properties* and *Equipment Properties* referenced.
	SYNC DELETE: Shall define a request that the receiver is to delete the specified *Equipment Capability Test Specifications*.
<not specified>	GET: Error.
	PROCESS: Error.
	CHANGE: Error.
	CANCEL: Error.
	SYNC ADD: Error.
	SYNC CHANGE: Error.
	SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of all *Equipment Capability Tests* identified by the wildcard, the IDs of *Equipment Class Properties* referenced, and the IDs of *Equipment Properties* referenced by the tests.
	EXAMPLE To return all *Equipment Capability Tests*, a "*" can be specified as the wildcard.
	PROCESS: Error.
	CHANGE: Shall define a request that the receiver is to change all specified attributes of all *Equipment Capability Tests* matching the wildcard and IDs of *Equipment Class Properties* and *Equipment Properties* referenced. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel all *Equipment Capability Tests* matching the wildcard.
	SYNC ADD: Error.
	SYNC CHANGE: Shall define a request that the receiver is to change all specified attributes of all *Equipment Capability Tests* matching the wildcard and IDs of *Equipment Class Properties* and *Equipment Properties* referenced.
	SYNC DELETE: Shall define a request that the receiver is to delete all *Equipment Capability Tests* matching the wildcard shall be deleted.

6.5   Physical Asset model

6.5.1   Physical Asset model elements

The message definitions assume that information may be accessed from any of three starting points: *Physical Asset Class*, *Physical Asset*, or *Physical Asset Capability Test*, as identified

by the dotted collections in Figure 17, in the overlay to the object model defined in IEC 62264-2 using the UML notation defined ISO/IEC 19501.
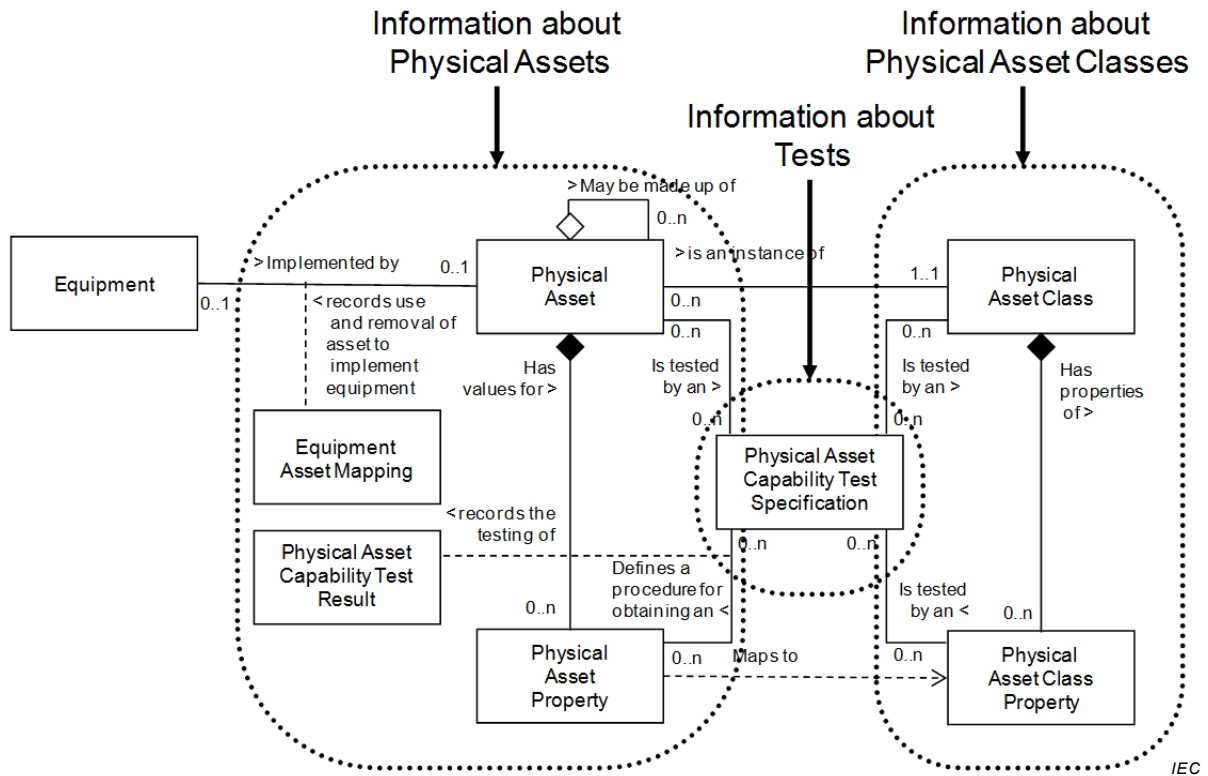
Figure 17 – Object grouping for the Physical Asset model

EXAMPLE   Messages can be: *GET Physical Asset Class*, *GET Physical Asset*, *GET Physical Asset Capability Test*.

6.5.2   Physical Asset Class verbs

All verbs shall be valid for a *Physical Asset Class* noun.

NOTE   This contains information about *Physical Asset Classes*, or *Physical Asset Classes* and their *Physical AssetA Class Properties*. The returned information does not contain the *Physical Asse* objects associated with the *Physical Asset Class*, but only the IDs of the *Physical Asset* belonging to the class.

6.5.3   Physical Asset Class verb actions

The actions performed on *Physical Asset Class* objects are defined in Table 13.

Table 13 – Physical Asset Class verb actions

Physical Asset Class ID	Physical Asset Class Property ID	Physical Asset Class Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Physical Asset Classes*, all properties and their attributes, and the IDs of *Physical Asset* that are members of each *Physical Asset Class*. PROCESS: Shall define a request that the receiver is to add *Physical Asset Classes*. The message defines suggested IDs for the *Physical Asset Classes*. The receiver adds the *Physical Asset Classes* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified *Physical Asset Classes* shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified *Physical Asset Classes*. SYNC ADD: Shall define a request that the receiver is to add the specified *Physical Asset Classes*. SYNC CHANGE: The specified attributes of the specified *Physical Asset Classes* shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Physical Asset Classes*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Physical Asset Classes*, all of the specified *Physical Asset Class Properties*, and the IDs of *Physical Asset* that are members of each *Physical Asset Class*. PROCESS: Shall define a request that the receiver is to add *Physical Asset Classes*. The message defines suggested IDs for the *Physical Asset Classes* and properties. The receiver adds the *Physical Asset Classes* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Physical Asset Classes*. SYNC ADD: Shall define a request that the receiver is to add the *Physical Asset Classes* and list of *Physical Class Properties*. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Physical Class Properties*.

Physical Asset Class ID	Physical Asset Class Property ID	Physical Asset Class Property value	Verb action on noun
IDs specified	IDs specified	Property value specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Physical Asset Classes* where the *Physical Asset Class Property* value matches the specified property value, all of the specified *Physical Asset Class Properties*, and the IDs of *Physical Asset* that are members of each *Physical Asset Class*.

PROCESS: Shall define a request that the receiver is to add *Physical Asset Classes*. The message defines suggested IDs for the *Physical Asset Classes* and properties, and values for the properties. The receiver adds the *Physical Asset Classes* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.

CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Physical Asset Classes* to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.

CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Physical Asset Classes* that have the specified property value.

SYNC ADD: Shall define a request that the receiver is to add the specified *Physical Asset Classes*, list of properties and property values.

SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Physical Asset Classes* to the specified values.

SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Physical Asset Class Properties* of the specified *Physical Asset Classes* that have the specified property value. |
| Wildcard specified | *not specified* | *not specified* | GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Physical Asset Classes* that match the wildcard ID and the IDs of *Physical Asset* that are members of each *Physical Asset Class*.

EXAMPLE   To return all *Physical Asset Classes*, a "*" can be specified as the wildcard.

PROCESS: Error.

CHANGE: Error (no property values are specified).

CANCEL: Shall define a request that the receiver is to cancel all *Physical Asset Classes* matching the wildcard ID.

SYNC ADD: Error.

SYNC CHANGE: Error (no property values are specified).

SYNC DELETE: Shall define a request that the receiver is to delete all *Physical Asset Classes* matching the wildcard ID. |

Physical Asset Class ID	Physical Asset Class Property ID	Physical Asset Class Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Physical Asset Classes* that match the wildcard IDs, and for each class return all *Physical Asset Class Properties* that match the property ID wildcards, and the IDs of *Physical Asset* that are members of each *Physical Asset Class*. EXAMPLE 1 To return a single property, the *Physical Asset Class Property* ID can be specified in the property ID wildcard. EXAMPLE 2 To return all *Physical Asset Class Properties*, a "*"can be specified as the property ID wildcard. EXAMPLE 3 To return a single *Physical Asset Class*, the ID can be specified in the wildcard ID. EXAMPLE 4 To return all *Physical Asset Classes*, a "*"can be specified as the ID wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Physical Asset Class Properties* matching the property ID wildcard of all *Physical Asset Classes* that match the ID wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Physical Asset Class Properties* matching the property ID wildcard of all *Physical Asset Classes* that match the ID wildcard.

6.5.4   Physical Asset verbs

All verbs shall be valid for a *Physical Asset* noun.

NOTE   This contains information about *Physical Asset* and the *Physical Asset Properties*. The returned information does not contain the *Physical Asset Class* objects associated with the *Physical Asset*, but only the IDs of the *Physical Asset Classes* the *Physical Asset* belongs to.

6.5.5   Physical Asset verb actions

The actions performed on a *Physical Asset* noun are defined in Table 14.

Table 14 – Physical Asset verb actions

Physical Asset ID	Physical Asset Property ID	Physical Asset Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Physical Asset*, all properties and their attributes, all *Equipment Asset Mappings*, and the IDs of the *Physical Asset Classes* of the *Physical Asset*. PROCESS: Shall define a request that the receiver is to add a *Physical Asset*. The ID defines a suggested ID for the *Physical Asset*. The receiver adds the *Physical Asset* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified *Physical Asset* and/or the *Physical Asset Mappings* shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified *Physical Asset*. SYNC ADD: Shall define a request that the receiver is to add the specified *Physical Asset*. SYNC CHANGE: The specified attributes of the specified *Physical Asset* shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Physical Asset*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Physical Asset*, all of the specified *Physical Asset Properties*, and the IDs of *Physical Asset Classes* of the *Physical Asset*. PROCESS: Shall define a request that the receiver is to add a *Physical Asset*. The ID defines suggested IDs for the *Physical Asset* and properties. The receiver adds the *Physical Asset* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Physical Asset*. SYNC ADD: Shall define a request that the receiver is to add the *Physical Asset* and list of *Physical Asset Properties*. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Physical Asset Properties*.

Physical Asset ID	Physical Asset Property ID	Physical Asset Property value	Verb action on noun
IDs specified	IDs specified	Property value specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Physical Asset* where the *Physical Asset Property* value matches the specified property value, all of the specified *Physical Asset Properties*, and the IDs of *Physical Asset Classes*. PROCESS: Shall define a request that the receiver is to add a *Physical Asset*. The message defines suggested IDs for the *Physical Asset* and properties, and values for the properties. The receiver adds the *Physical Asset* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Physical Asset* to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Physical Asset* that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified *Physical Asset*, list of properties and property values. SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Physical Asset* to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Physical Asset Properties* of the specified *Physical Asset* that have the specified property value.
Wildcard specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Physical Asset* that matches the ID wildcard and the IDs of *Physical Asset Classes* of each *Physical Asset* and all *Equipment Asset Mappings*. EXAMPLE To return all *Physical Asset*, a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Physical Asset* matching the ID wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Physical Asset* matching the ID wildcard.

Physical Asset ID	Physical Asset Property ID	Physical Asset Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Physical Asset* that matches the ID wildcard, and for each class return all *Physical Asset Properties* that match the property ID wildcards, as well as the IDs of *Physical Asset Classes* of the *Physical Asset*. EXAMPLE 1 To return a single property, the *Physical Asset Property* ID can be specified in the property ID wildcard. EXAMPLE 2 To return all *Physical Asset* properties, a "*"can be specified as the property ID wildcard. EXAMPLE 3 To return a single *Physical Asset*, the *Physical Asset* ID can be specified in the ID wildcard. EXAMPLE 4 To return all *Physical Asset*, a "*"can be specified as the ID wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all properties matching the *Physical Asset Property* ID wildcard of all *Physical Asset* that matches the ID wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all properties that match the *Physical Asset Property* ID wildcard of all *Physical Asset* that match the ID wildcard.

6.5.6   Physical Asset Capability Test Specification verbs

All verbs shall be valid for a *Physical Asset Capability Test Specification* noun.

NOTE   This contains information about capability tests. The returned information contains the identification of the tested *Physical Asset Class Properties*, and the identification of the *Physical Asset Properties*.

6.5.7   Physical Asset Capability Test Specification verb actions

The actions performed on a *Physical Asset Capability Test Specification* noun are defined in Table 15.

Table 15 – Physical Asset capability Test Specification verb actions

Capability Test ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Physical Asset Capability Test Specifications*, the IDs of *Physical Asset Class Properties* referenced by the test, and the IDs of all *Physical Asset Properties* referenced by the test.

PROCESS: Shall define a request that the receiver is to add *Physical Asset Capability Test Specifications*. Defines suggested IDs for the *Physical Asset Capability Test Specifications*, values for the attributes and IDs of *Physical Asset Class Properties* and *Physical Asset Properties* referenced by the *Physical Asset Capability Test Specifications*. The receiver adds the *Physical Asset Capability Test Specifications* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.

CHANGE: Shall define a request that the receiver is to change the specified attributes of the *Physical Asset Capability Test Specifications* and IDs of *Physical Asset Class Properties* and *Physical Asset* properties referenced. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.

CANCEL: Shall define a request that the receiver is to cancel the specified *Physical Asset Capability Test Specifications*.

SYNC ADD: Shall define a request that the receiver is to add the specified *Physical Asset Capability Test Specifications* and IDs *Physical Asset Class Properties* and *Physical Asset Properties* referenced.

SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes of the *Physical Asset Capability Test Specifications* and IDs of *Physical Asset Class Properties* and *Physical Asset Properties* referenced.

SYNC DELETE: Shall define a request that the receiver is to delete the specified *Physical Asset Capability Test Specifications*. |
| <not specified> | GET: Error.

PROCESS: Error.

CHANGE: Error.

CANCEL: Error.

SYNC ADD: Error.

SYNC CHANGE: Error.

SYNC DELETE: Error. |
| Wildcard specified | GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of all *Capability Tests* identified by the ID wildcard, the IDs of *Physical Asset Class Properties* referenced, and the IDs of *Physical Asset Properties* referenced by the tests.

EXAMPLE   To return all *Capability Tests*, a "*" can be specified as the wildcard.

PROCESS: Error.

CHANGE: Shall define a request that the receiver is to change all specified attributes of all *Capability Tests* matching the ID wildcard and IDs of *Physical Asset Class Properties* and *Physical Asset Properties* referenced. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.

CANCEL: Shall define a request that the receiver is to cancel all *Capability Tests* matching the ID wildcard.

SYNC ADD: Error.

SYNC CHANGE: Shall define a request that the receiver is to change all specified attributes of all *Capability Tests* matching the ID wildcard and IDs of *Physical Asset Class Properties* and *Physical Asset Properties* referenced.

SYNC DELETE: Shall define a request that the receiver is to delete all *Capability Tests* matching the ID wildcard. |

6.6   Material model

6.6.1   Material model elements

The message definitions assume that information may be accessed from any of five starting points: *Material Class*, *Material Definition*, *Material Lot*, *Material Sublot*, or *Material Test*

Specifications, as identified by the dotted collections in Figure 18, in the overlay to the object model defined in IEC 62264-2 using the UML notation defined ISO/IEC 19501.
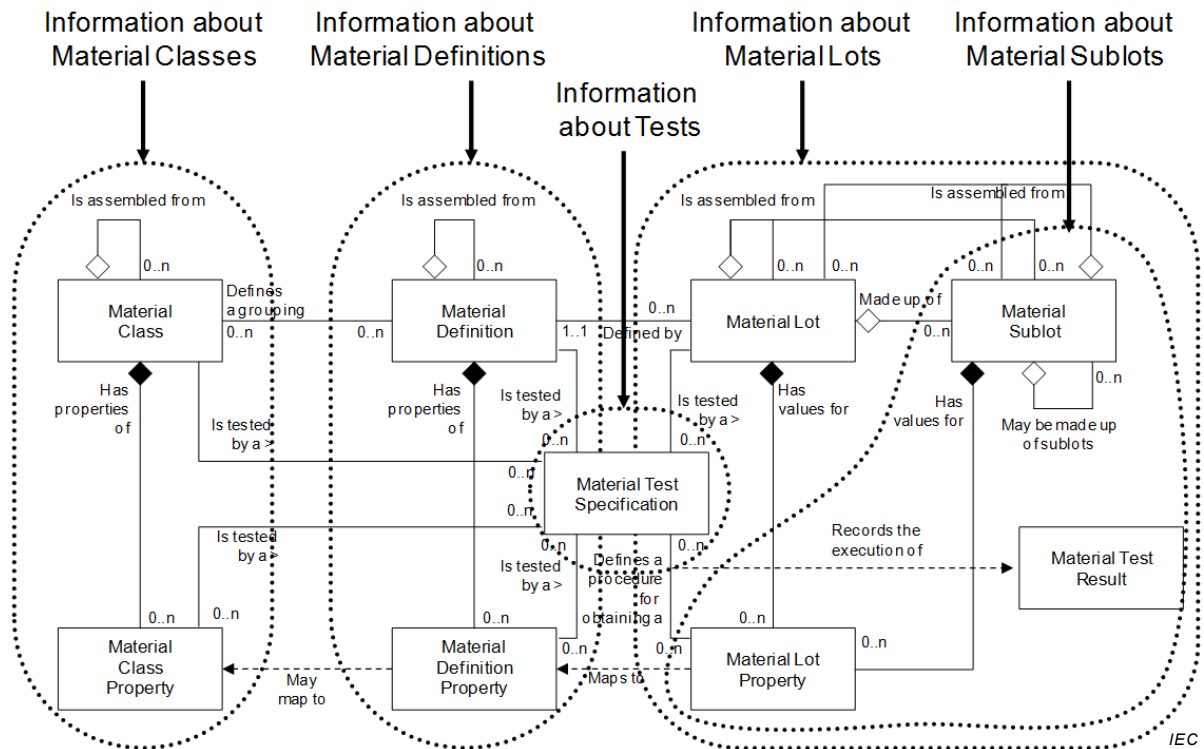
Figure 18 – Object grouping for the material model

EXAMPLE   Messages can be *GET Material Class*, *GET Material Lot*, *GET Material Test Result*.

6.6.2   Material Class verbs

All verbs shall be valid for a *Material Class* noun.

NOTE   This contains information about *Material Classes*, or *Material Classes* and their *Material Class Properties*. The returned information does not contain the *Material Definitions* associated with the *Material Class*, but only the IDs of the *Material Definitions* belonging to the class.

6.6.3   Material Class verb actions

The actions performed on *Material Class* objects are defined in Table 16.

Table 16 – Material Class verb actions

Material Class ID	Material Class Property ID	Material Class Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Classes*, all properties and their attributes, and the IDs of *Material Definitions* of the *Material Class*. PROCESS: Shall define a request that the receiver is to add *Material Classes*. The ID defines suggested IDs for the *Material Classes*. The receiver adds the *Material Classes* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified *Material Classes* shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified *Material Classes*. SYNC ADD: Shall define a request that the receiver is to add the specified *Material Classes*. SYNC CHANGE: The specified attributes of the specified *Material Classes* shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Material Classes*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Classes*, all of the specified *Material Class Properties*, and the IDs of *Material Definitions* of the *Material Class*. PROCESS: Shall define a request that the receiver is to add *Material Classes*. The message defines suggested IDs for the *Material Classes* and list of properties. The receiver adds the *Material Classes* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Material Classes*. SYNC ADD: Shall define a request that the receiver is to add the *Material Classes* and list of *Material Class Properties*. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Material Class Properties* for the specified *Material Classes*.

Material Class ID	Material Class Property ID	Material Class Property value	Verb action on noun
IDs specified	IDs specified	Property value specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Classes* where the *Material Class Property* value matches the specified property value, all of the specified *Material Class Properties*, and the IDs of *Material Definitions* of the *Material Class*. PROCESS: Shall define a request that the receiver is to add *Material Classes*. The message defines suggested IDs for the *Material Classes* and properties, and values for the properties. The receiver adds the *Material Classes* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Material Classes* to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Material Classes* that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified *Material Classes*, list of properties and property values. SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Material Classes* to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Material Class Properties* of the specified *Material Classes* that have the specified property value.
Wildcard specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Material Classes* that match the wildcard and the IDs of *Material Definitions* of the *Material Class*. EXAMPLE To return all *Material Classes*, a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Material Classes* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Material Classes* matching the wildcard.

Material Class ID	Material Class Property ID	Material Class Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Material Classes* that match the wildcard, and for each class return all *Material Class Properties* that match the property wildcards, and the IDs of *Material Definitions* of the *Material Class*.
			EXAMPLE 1 To return a single property, the *Material Class* property ID can be specified in the property wildcard.
			EXAMPLE 2 To return all *Material Class Properties*, a "*" can be specified as the property wildcard.
			EXAMPLE 3 To return a single *Material Class*, the *Material Class* ID can be specified in the wildcard.
			EXAMPLE 4 To return all *Material Classes*, a "*" can be specified as the wildcard.
			PROCESS: Error.
			CHANGE: Error (no property values are specified).
			CANCEL: Shall define a request that the receiver is to cancel all properties matching the *Material Class Property* wildcard of all *Material Classes* that match the wildcard.
			SYNC ADD: Error.
			SYNC CHANGE: Error (no property values are specified).
			SYNC DELETE: Shall define a request that the receiver is to delete all properties that match the *Material Class Property* wildcard of all *Material Classes* that match the wildcard.

6.6.4   Material Definition verbs

All verbs shall be valid for a *Material Definition* noun.

NOTE   This contains information about *Material Definitions*, or *Material Definitions* and their *Material Definitions properties*. The returned information does not contain the *Material Lots* associated with the *Material Definition*, but only the IDs of the *Material Lots*.

6.6.5   Material Definition verb actions

The actions performed on the *Material Definition* objects are defined in Table 17.

Table 17 – Material Definition verb actions

Material Definition ID	Material Definition Property ID	Material Definition Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Definitions*, all properties and their attributes, the IDs of *Material Lots* of the *Material Definitions*, and the IDS of *Material Classes* of the *Material Definitions*.
			PROCESS: Shall define a request that the receiver is to add *Material Definitions*. The message defines suggested IDs for the *Material Definitions*. The receiver adds the *Material Definitions* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.
			CHANGE: The specified attributes of the specified *Material Definitions* shall be changed.
			CANCEL: Shall define a request that the receiver is to cancel the specified *Material Definitions*.
			SYNC ADD: Shall define a request that the receiver is to add the specified *Material Definitions*.
			SYNC CHANGE: The specified attributes of the specified *Material Definitions* shall be changed.
			SYNC DELETE: Shall define a request that the receiver is to delete the specified *Material Definitions*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Definitions*, all of the specified *Material Definition Properties*, the IDs of *Material Lots* of the *Material Definitions*, and the IDs of *Material Classes* of the *Material Definitions*.
			PROCESS: Shall define a request that the receiver is to add *Material Definitions*. The message defines suggested IDs for the *Material Definitions* and properties. The receiver adds *Material Definitions* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.
			CHANGE: Error (no property values are specified).
			CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Material Definitions*.
			SYNC ADD: Shall define a request that the receiver is to add the *Material Definitions* and list *Material Definition Properties.*
			SYNC CHANGE: Error (no property values are specified).
			SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Material Definition Properties*.

Material Definition ID	Material Definition Property ID	Material Definition Property value	Verb action on noun
IDs specified	IDs specified	Property value specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Definitions* where the *Material Definition Property* value matches the specified property value, all of the specified *Material Definition Properties*, and the IDs of *Material Lots* of the *Material Definitions* and IDs of *Material Classes*. PROCESS: Shall define a request that the receiver is to add *Material Definitions*. The message defines suggested IDs for the *Material Definitions* and properties, and values for the properties. The receiver adds the *Material Definitions* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Material Definitions* to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Material Definitions* that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified *Material Definitions*, list of properties and property values. SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Material Definitions* to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Material Definition Properties* of the specified *Material Definitions* that have the specified property value.
Wildcard specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Material Definitions* that match the wildcard, the IDs of *Material Lots* of the *Material Definitions*, and the IDs of *Material Classes* of each *Material Definition*. EXAMPLE To return all *Material Definitions*, a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Material Definitions* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Material Definitions* matching the wildcard.

Material Definition ID	Material Definition Property ID	Material Definition Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Material Definitions* that match the wildcard, and for each class return the IDs of *Material Lots* of the *Material Definitions* and all *Material Definition Properties* that match the property wildcards, and the IDs of *Material Classes* of to the *Material Definitions*.
			EXAMPLE 1 To return a single property, the *Material Definition Property* ID can be specified in the property wildcard.
			EXAMPLE 2 To return all *Material Definition Properties*, a "*" can be specified as the property wildcard.
			EXAMPLE 3 To return a *Material Definition*, the *Material Definition* ID can be specified in the wildcard.
			EXAMPLE 4 To return all *Material Definitions*, a "*" can be specified as the wildcard.
			PROCESS: Error.
			CHANGE: Error (no property values are specified).
			CANCEL: Shall define a request that the receiver is to cancel all *Material Definition Properties* matching the property wildcard of all *Material Definitions* that match the wildcard.
			SYNC ADD: Error.
			SYNC CHANGE: Error (no property values are specified).
			SYNC DELETE: Shall define a request that the receiver is to delete all *Material Definition properties* that match the property wildcard of all *Material Definitions* that match the wildcard.

6.6.6   Material Lot verbs

All verbs shall be valid for a *Material Lot* noun.

6.6.7   Material Lot verb actions

The actions performed on a *Material Lot* noun are defined in Table 18.

Table 18 – Material Lot verb actions

Material Lot ID	Material Lot Property ID	Material Lot Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Lots*, all properties and their attributes, the IDs of *Material Sublots* of the *Material Lots*, the ID of the *Material Definition* of the *Material Lots*, and the list of *Material Test Results* associated with the properties. PROCESS: Shall define a request that the receiver is to add *Material Lots*. The message defines suggested IDs for the *Material Lots*. The receiver adds the *Material Lots* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified *Material Lots* shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified *Material Lots*. SYNC ADD: Shall define a request that the receiver is to add the specified *Material Lots*. SYNC CHANGE: The specified attributes of the specified *Material Lots* shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Material Lots*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Lots*, all of the specified *Material Lot Properties*, the IDs of *Material Sublots* of the *Material Lots*, the ID of the *Material Definition* of the *Material Lot*, and the list of *Material Test Results* associated with the properties. PROCESS: Shall define a request that the receiver is to add *Material Lots*. The message defines suggested IDs for the *Material Lots* and list of properties. The receiver adds the *Material Lots* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Material Lots*. SYNC ADD: Shall define a request that the receiver is to add the *Material Lots* and list of *Material Lot Properties*. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Material Lot Properties*.

Material Lot ID	Material Lot Property ID	Material Lot Property value	Verb action on noun
IDs specified	IDs specified	Property value specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Lots* where the *Material Lot Property* value matches the specified property value, all of the specified *Material Lot Properties*, the IDs of *Material Sublots* of the *Material Lots*, the ID of the *Material Definition*, and the list of *Material Test Results* associated with the properties.

PROCESS: Shall define a request that the receiver is to add *Material Lots*. The message defines suggested IDs for the *Material Lots* and properties, and values for the properties. The receiver adds the *Material Lots* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.

CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Material Lots* to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.

CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Material Lots* that have the specified property value.

SYNC ADD: Shall define a request that the receiver is to add the specified *Material Lots*, list of properties and property values.

SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Material Lots* to the specified values.

SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Material Lot Properties* of the specified *Material Lots* that have the specified property value. |
| Wildcard specified | *not specified* | *not specified* | GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Material Lots* that match the wildcard the IDs of *Material Sublots* of the *Material Lots*, the ID of the *Material Definition* of each *Material Lot*, and the list of *Material Test Results* associated with the properties.

EXAMPLE To return all *Material Lots*, a "*" can be specified as the wildcard.

PROCESS: Error.

CHANGE: Error (no property values are specified).

CANCEL: Shall define a request that the receiver is to cancel all *Material Lots* matching the wildcard.

SYNC ADD: Error.

SYNC CHANGE: Error (no property values are specified).

SYNC DELETE: Shall define a request that the receiver is to delete all *Material Lots* matching the wildcard. |

Material Lot ID	Material Lot Property ID	Material Lot Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Material Lots* that match the wildcard, and for each *Material Lot* return all *Material Lot Properties* that match the property wildcards, the IDs of *Material Sublots* of the *Material Lots*, the ID of the *Material Definition* of to the *Material Lot*, and the list of *Material Test Results* associated with the properties.

EXAMPLE 1 To return a single property, the *Material Lot Property* ID can be specified in the property wildcard.

EXAMPLE 2 To return all *Material Lot Properties*, a "*"can be specified as the property wildcard.

EXAMPLE 3 To return a single *Material Lot*, the *Material Lot* ID can be specified in the wildcard.

EXAMPLE 4 To return all *Material Lots*, a "*"can be specified as the wildcard.

PROCESS: Error.

CHANGE: Error (no property values are specified).

CANCEL: Shall define a request that the receiver is to cancel all *Material Lot Properties* matching the wildcard of all *Material Lots* that match the *Material Lot* wildcard.

SYNC ADD: Error.

SYNC CHANGE: Error (no property values are specified).

SYNC DELETE: Shall define a request that the receiver is to delete all properties that match the *Material Lot* property wildcard of all *Material Lots* that match the *Material Lot* wildcard. |

6.6.8   Material Sublot verbs

All verbs shall be valid for a *Material Sublot* noun.

6.6.9   Material Sublot verb actions

The actions performed on a *Material Sublot* are defined in Table 19.

Table 19 – Material Sublot verb actions

Material Sublot ID	Material Sublot Property ID	Material Sublot Property value	Verb action on noun
IDs specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Sublots*, all properties and their attributes, the IDs of *Material Sublots* of the *Material Sublot*, the ID of the *Material Definition* of the *Material Sublot*, and the list of *Material Test Results* associated with the properties. PROCESS: Shall define a request that the receiver is to add *Material Sublots*. The message defines suggested IDs for the *Material Sublots*. The receiver adds the *Material Sublots* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified *Material Sublots* shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified *Material Sublots*. SYNC ADD: Shall define a request that the receiver is to add the specified *Material Sublots*. SYNC CHANGE: The specified attributes of the specified *Material Sublots* shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Material Sublots*.
IDs specified	IDs specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Sublots*, all of the specified *Material Sublot Properties*, the IDs of *Material Sublots* of the *Material Sublot*, the ID of the *Material Definition* of the *Material Sublot*, and the list of *Material Test Results* associated with the properties. PROCESS: Shall define a request that the receiver is to add *Material Sublots*. The message defines suggested IDs for the *Material Sublots* and properties. The receiver adds the *Material Sublots* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified *Material Sublots*. SYNC ADD: Shall define a request that the receiver is to add the *Material Sublots* and list of *Material Sublot Properties*. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Material Sublot Properties*.

Material Sublot ID	Material Sublot Property ID	Material Sublot Property value	Verb action on noun
IDs specified	IDs specified	Property value specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified *Material Sublots* where the *Material Sublot Property* value matches the specified property value, all of the specified *Material Sublot Properties*, the IDs of *Material Sublots* of the *Material Sublot*, the ID of the *Material Definition*, and the list of *Material Test Results* associated with the properties. PROCESS: Shall define a request that the receiver is to add *Material Sublots*. The message defines suggested IDs for the *Material Sublots* and properties, and values for the properties. The receiver adds the *Material Sublots* and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the values of the specified properties for the specified *Material Sublots* to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified properties of the *Material Sublots* that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified *Material Sublots*, list of properties and property values. SYNC CHANGE: Shall define a request that the receiver is to change the values of the specified list of properties for the specified *Material Sublots* to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of *Material Sublot Properties* of the specified *Material Sublots* that have the specified property value.
Wildcard specified	*not specified*	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and properties about the *Material Sublots* that match the wildcard, the IDs of *Material Sublots* of the *Material Sublot*, the ID of the *Material Definition* of each *Material Sublot*, and the list of *Material Test Results* associated with the properties. EXAMPLE To return all *Material Sublots*, a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel all *Material Sublots* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all *Material Sublots* matching the wildcard.

Material Sublot ID	Material Sublot Property ID	Material Sublot Property value	Verb action on noun
Wildcard specified	Wildcard specified	*not specified*	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Material Sublots* that match the wildcard, and for each sublot return all *Material Sublot Properties* that match the property wildcards, the ID of the *Material Definition* of to the *Material Sublot*, and the list of *Material Test Results* associated with the properties.
			EXAMPLE 1 To return a single property, the *Material Sublot Property* ID can be specified in the property wildcard.
			EXAMPLE 2 To return all *Material Sublot Properties*, a "*" can be specified as the property wildcard.
			EXAMPLE 3 To return a single *Material Sublot*, the *Material Sublot* ID can be specified in the wildcard.
			EXAMPLE 4 To return all *Material Sublots* a "*" can be specified as the wildcard.
			PROCESS: Error.
			CHANGE: Error (no property values are specified).
			CANCEL: Shall define a request that the receiver is to cancel all *Material Sublot Properties* matching the property wildcard of all *Material Sublots* that match the wildcard.
			SYNC ADD: Error.
			SYNC CHANGE: Error (no property values are specified).
			SYNC DELETE: Shall define a request that the receiver is to delete all *Material Sublot Properties* that match the property wildcard of all *Material Sublots* that match the wildcard.

6.6.10   Material Test Specification verbs

All verbs shall be valid for a *Material Test Specification* noun.

NOTE   This contains information about material tests. The returned information contains the identification of the tested *Material Definition Properties*, *Material Class Properties*, and the identification of the tested *Material Lot Properties*.

6.6.11   Material Test Specification verb actions

The actions performed on a *Material Test Specification* noun are defined in Table 20.

Table 20 – Material Test Specification verb actions

Material Test Specification ID	Returns
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Material Test Specifications*, the IDs of *Material Class Properties* referenced by the test, the IDs of all *Material Definition Properties* referenced by the tests, and the IDs of *Material Lots* and *Material Sublots* referenced by the tests. PROCESS: Shall define a request that the receiver is to add *Material Test Specifications*. The message defines suggested IDs for the *Material Test Specifications*, values for the attributes and IDs of *Material Class Properties* and *Material Definition Properties* referenced by the *Material Test Specifications*. The receiver adds the *Material Test Specifications* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes of the *Material Test Specifications* and IDs of *Material Class Properties* and *Material Definition Properties* referenced. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Material Test Specifications*. SYNC ADD: Shall define a request that the receiver is to add the specified *Material Test Specifications* and list of *Material Class Properties* and *Material Definition Properties* properties referenced. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes of the *Material Test Specifications* and list of *Material Class Properties* and *Material Definition Properties* referenced. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Material Test Specifications*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of all *Material Test Specifications* identified by the ID wildcard, the IDs of *Material Class Properties* referenced by the test, the IDs of all *Material Definition Properties* referenced by the tests, and the IDs of *Material Lots* and *Material Sublots* referenced by the tests. EXAMPLE To return all *Material Test Specifications* a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Shall define a request that the receiver is to change the specified attributes of all *Material Test Specifications* matching the ID wildcard and list of *Material Class Properties* and *Material Definition Properties* referenced. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel all *Material Test Specifications* matching the ID wildcard. SYNC ADD: Error. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes of all *Material Test Specifications* matching the ID wildcard and list of *Material Class Properties* and *Material Definition Properties* referenced. SYNC DELETE: Shall define a request that the receiver is to delete all *Material Test Specifications* matching the ID wildcard.

6.7   Process Segment model

6.7.1   Process Segment model elements

The message definitions assume that *Process Segment* information may be accessed from one starting point, a *Process Segment*, as identified by the dotted collection in Figure 19, in the overlay to the object model defined in IEC 62264-2 using the UML notation defined ISO/IEC 19501.
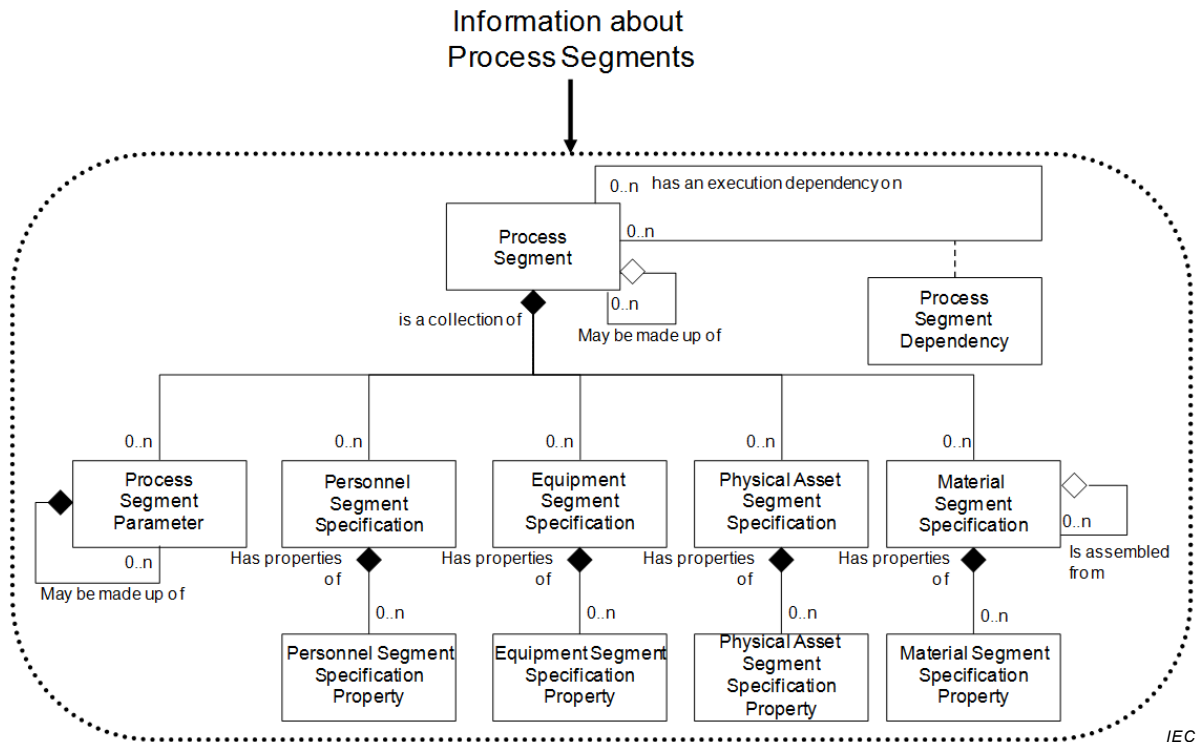
Figure 19 – Object grouping for the Process Segment model

6.7.2   Process Segment verbs

All verbs shall be valid for a *Process Segment* noun. The object grouping for *Process Segment* is illustrated in Figure 19.

NOTE 1   A *Process Segment* is a logical grouping of personnel resources, equipment resources, and material required to carry out an operations step. A *Process Segment* usually defines the needed classes of personnel, equipment, and material, but it may define specific resources, such as specific equipment needed. A *Process Segment* may define the quantity of the resource needed.

NOTE 2   The *Process Segment* model is hierarchical with *Process Segments* containing *Process Segments* and personnel specification, equipment specification, and material specification information.

6.7.3   Process Segment verb actions

The actions performed on a *Process Segment* noun are defined in Table 21.

Table 21 – Process Segment verb actions

Process Segment ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes, parameters, specifications and properties about the *Process Segments*. PROCESS: Shall define a request that the receiver is to add *Process Segments*. The message defines suggested IDs for the *Process Segments*, values for the attributes, parameters, specifications and properties. The receiver adds the *Process Segments* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes, parameters, specifications, and properties of the *Process Segments*. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Process Segments*. If contained elements IDs are specified, then only the specified contained elements for the specified *Process Segments* are to be cancelled, not the *Process Segments*. SYNC ADD: Shall define a request that the receiver is to add the specified *Process Segments*, attributes, parameters, specifications and properties. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes, parameters, specifications, and/or properties of the *Process Segments*. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Process Segments*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes, parameters, specifications, and properties about all *Process Segments* identified by the wildcard. EXAMPLE To return all *Process Segments*, a "*" can be specified as the wildcard. PROCESS: Error. CHANGE: Shall define a request that the receiver is to change all specified attributes, parameters, specifications, and properties of all *Process Segments* matching the wildcard. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel all *Process Segments* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Shall define a request that the receiver is to change all specified attributes, parameters, specifications, and properties of all *Process Segments* matching the wildcard. SYNC DELETE: Shall define a request that the receiver is to delete all *Process Segments* matching the wildcard.

6.8   Operations Capability model

6.8.1   Operations Capability model elements

The message definitions assume that *Operations Capability* information may be accessed from one starting point, an *Operations Capability*, as identified by the dotted collection in Figure 20, in the overlay to the object model defined in IEC 62264-2 using the UML notation defined ISO/IEC 19501.
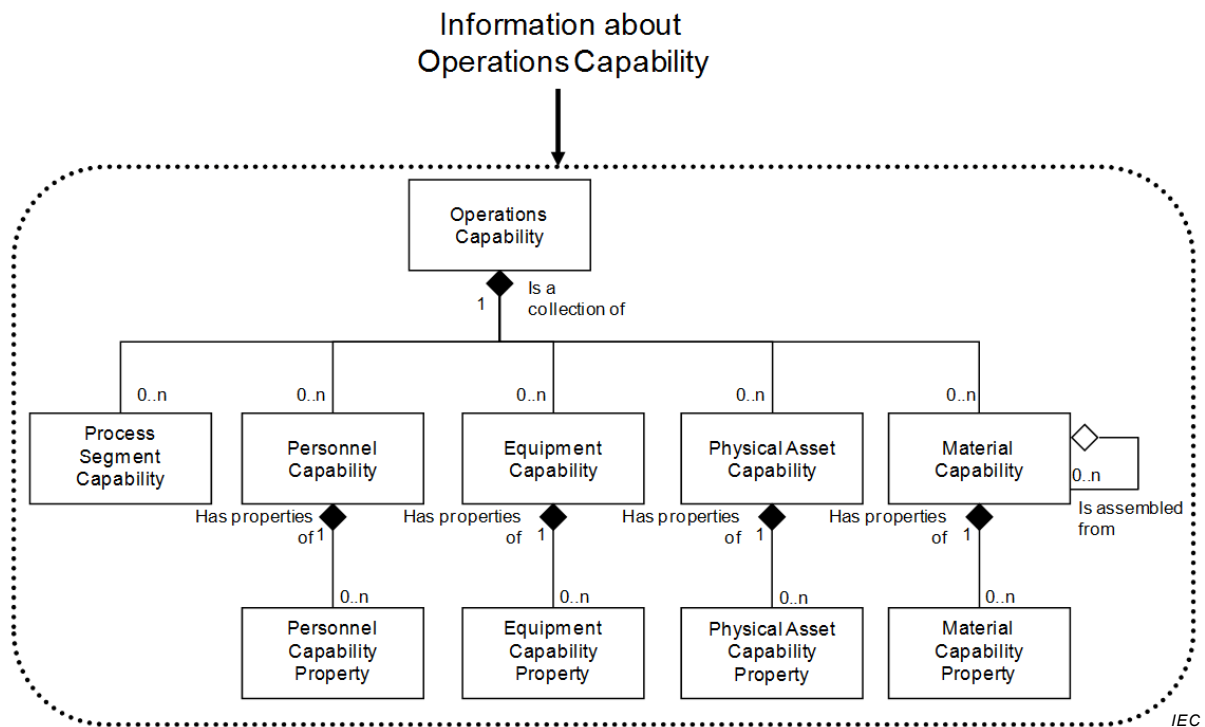
Figure 20 – Object grouping for the Operations Capability model

6.8.2   Operations Capability verbs

All verbs shall be valid for an *Operations Capability* noun.

NOTE 1   The *Operations Capability* information is the collection of information about all operations resources for selected timeframes. This is made up of information about equipment, physical assets, material, personnel, and *Process Segments*. It describes the names, terms, statuses, and quantities of which the manufacturing control system has knowledge. The presumption is that a Level 3 function is the owner of the *Operations Capability* information.

NOTE 2   The *Operations Capability* model is hierarchical with *Operations Capabilities* containing *Process Segment Capabilities* and personnel, equipment, and material capability information.

NOTE 3   *Operations Capability* is a snapshot in time of the available, unattainable, or committed capability.

Specifying the information to be returned from a GET may involve values in multiple fields. Each field definition restricts the returned information.

6.8.3   Operations Capability verb actions

The actions performed on an *Operations Capability* noun are defined in Table 22.

Table 22 – Operations Capability verb actions

Operations Capability ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Operations Capabilities* that matches the IDs. PROCESS: Shall define a request that the receiver is to add new *Operations Capabilities*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Operations Capabilities*. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. EXAMPLE 1 A CHANGE can define an updated *Operations Capability* due to line slowdown or personnel unavailability. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Operations Capabilities*. If contained elements IDs are specified, then only the specified contained elements for the specified *Operations Capability* are to be cancelled, not the *Operations Capability*. EXAMPLE 2 A CANCEL can define a removed process capability due to line shutdown or personnel reassignment. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Operations Capabilities*. EXAMPLE 3 A SYNC ADD sent every day can define *Operations Capability* for the next day. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Operations Capabilities*. EXAMPLE 4 A SYNC CHANGE can define a new *Operations Capability* due to line slowdown or personnel unavailability. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Operations Capabilities*. EXAMPLE 5 A SYNC DELETE can define a removed process capability due to line shutdown or personnel reassignment.
<not specified>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of a *Operations Capabilities* identified by the information specified in the GET message. See Table 23 for details. PROCESS: Shall define a request that the receiver is to add new *Operations Capabilities*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Operations Capabilities* identified by the information specified in the CHANGE message. See Table 23 for details. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Operations Capabilities* identified by the information specified in the CANCEL message. See Table 23 for details. If contained elements IDs are specified, then only the specified contained elements for the specified *Operations Capability* are to be cancelled, not the *Operations Capability*. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Operations Capabilities* identified by the information specified in the SYNC message. See Table 23 for details. SYNC CHANGE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Operations Capabilities* identified by the information specified in the SYNC message. See Table 23 for details. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Operations Capabilities* identified by the information specified in the SYNC message. See Table 23 for details.

Operations Capability ID	Verb action on noun
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Operations Capabilities* that match the wildcard. PROCESS: Error CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Operations Capabilities* that match the wildcard. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Operations Capabilities* that match the wildcard. If contained elements IDs are specified, then only the specified contained elements for the specified *Operations Capability* are to be cancelled, not the *Operations Capability*. SYNC ADD: Error. SYNC CHANGE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Operations Capabilities* that match the wildcard. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Operations Capabilities* that match the wildcard.

Table 23 – Operations Capability element definitions for GET verb

Operations Capability element	Returns
Start Time	Specifies *Operations Capability* information for times after, including the start time. If not specified then the responder selects the *Start Time*.
End Time	Specifies *Operations Capability* information for times before, including the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies *Operations Capability* information for the specified scope in the role based equipment hierarchy. (e.g. a process cell, work center, production line, area, site,etc.). If not specified then the responder selects the *Hierarchy Scope*.
Capability Type	Specifies the type of *Operations Capability* information to be returned. If not specified, then the responder selects the *Capability Type* information returned.
Personnel Capability / Personnel Class ID	May specify a wildcard or a *Personnel Class* ID. If included, then it specifies the *Personnel Class(es)* for the returned *Personnel Capability*.
Personnel Capability / Person ID	May specify a wildcard or a *Person* ID. If included, then it specifies the person(s) for the returned *Personnel Capability*.
Equipment Capability / Equipment Class ID	May specify a wildcard or an *Equipment Class* ID. If included, then it specifies the *Equipment Class(es)* for the returned *Equipment Capability*.
Equipment Capability / Equipment ID	May specify a wildcard or an *Equipment* ID. If included, then it specifies the equipment for the returned *Equipment Capability*.
Physical Asset Capability / Physical Asset ID	May specify a wildcard or a *Physical Asset* ID. If included, then it specifies the *Physical Assets* for the returned *Physical Asset Capability*.
Physical Asset Capability / Physical Asset Class ID	May specify a wildcard or a *Physical Asset Class* ID. If included, then it specifies the *Physical Asset Class(es)* for the returned *Physical Asset Class Capability*.
Material Capability / Material Class ID	May specify a wildcard or a *Material Class* ID. If included, then it specifies the *Material Class(es)* for the returned *Material Capability*.
Material Capability / Material Definition ID	May specify a wildcard or a *Material Definition* ID. If included, then it specifies the *Material Definitions(s)* for the returned *Material Capability*.
Material Capability / Material Lot ID	May specify a wildcard or a *Material Lot* ID. If included, then it specifies the *Material Lot(s)* for the returned *Material Capability*.
Material Capability / Material SubLot ID	May specify a wildcard or a *Material Sublot* ID. If included, then it specifies the *Material Sublot(s)* for the returned *Material Capability*.
Process Segment Capability ID	May contain a wildcard or a *Process Segment* ID. If included, then it specifies that *Process Segment Capability* should only be returned for the specified *Process Segment*.

Operations Capability element	Returns
Process Segment Capability / Personnel Class ID	May specify a wildcard or a *Personnel Class* ID. If included, then it specifies the *Personnel Class(es)* for the returned *Process Segment / Personnel Capability*.
Process Segment Capability / Person ID	May specify a wildcard or a *Person* ID. If included, then it specifies the person(s) for the returned *Process Segment / Personnel Capability*.
Process Segment Capability / Equipment Class ID	May specify a wildcard or an *Equipment Class* ID. If included, then it specifies the *Equipment Class(es)* for the returned *Process Segment / Equipment Capability*.
Process Segment Capability / Equipment ID	May specify a wildcard or an *Equipment* ID. If included, then it specifies the equipment for the returned *Equipment Capability*.
Process Segment Capability / Physical Asset Class ID	May specify a wildcard or a *Physical Asset Class* ID. If included, then it specifies the *Physical Asset Class(es)* for the returned *Process Segment / Physical Asset Capability*.
Process Segment Capability / Physical Asset ID	May specify a wildcard or a *Physical Asset* ID. If included, then it specifies the *Physical Asset* for the returned *Physical Asset Capability*.
Process Segment Capability / Material Class ID	May specify a wildcard or a *Material Class* ID. If included, then it specifies the *Material Class(es)* for the returned *Process Segment / Material Capability*.
Process Segment Capability / Material Definition ID	May specify a wildcard or a *Material Definition* ID. If included, then it specifies the *Material Definitions(s)* for the returned *Process Segment / Material Capability*.
Process Segment Capability / Material Lot ID	May specify a wildcard or a *Material Lot* ID. If included, then it specifies the *Material Lot(s)* for the returned *Process Segment / Material Capability*.
Process Segment Capability / Material Sublot ID	May specify a wildcard or a *Material Sublot* ID. If included, then it specifies the *Material Sublot(s)* for the returned *Process Segment / Material Capability*.

6.9   Operations Definition model

6.9.1   Operations Definition model elements

The message definitions assume that *Operations Definition* information may be accessed from one starting point, an *Operations Definition*, as identified by the dotted collection in Figure 21, in the overlay to the object model defined in IEC 62264-2 using the UML notation defined ISO/IEC 19501.
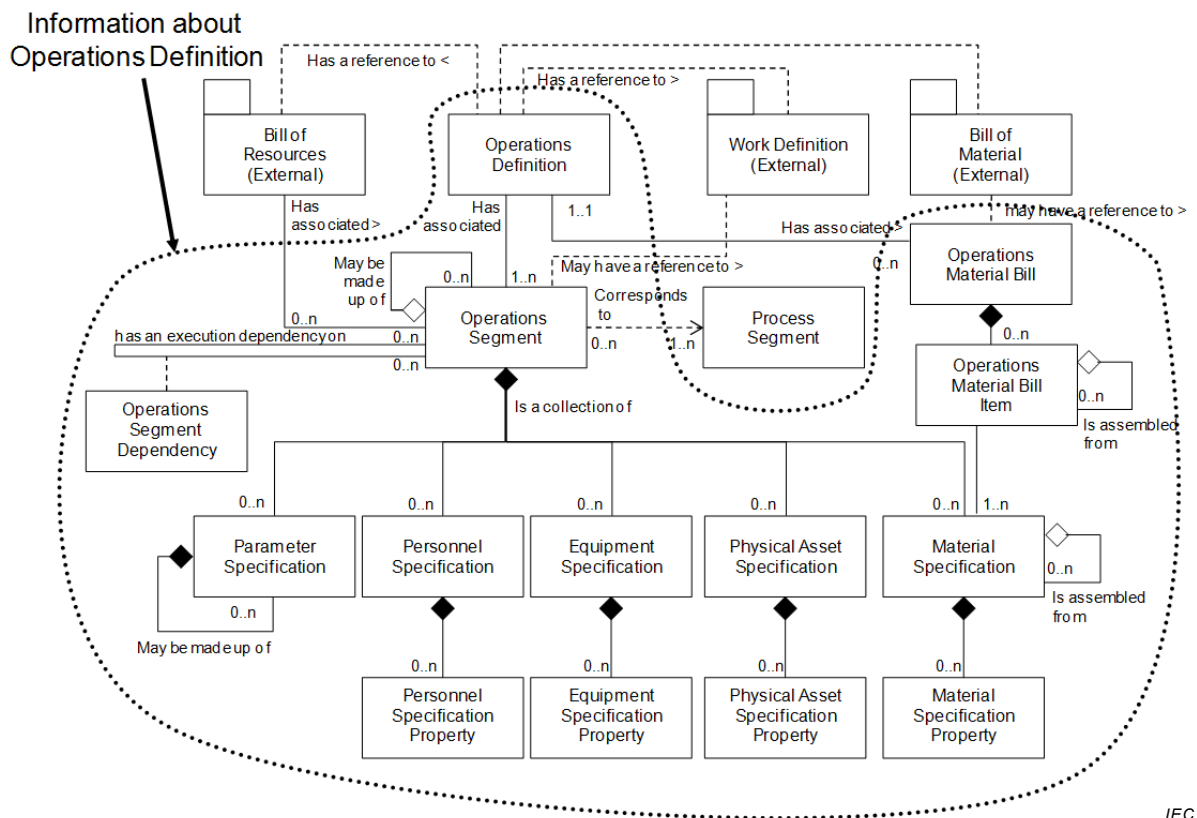
Figure 21 – Object grouping for the Operations Definition model

NOTE   If *Operations Segments* are to be exchanged, such as the exchange of a library of operations segments that are used in many products, then an *Operations Definition* can be used as a container with an ID and Version for the *Operations Segments*.

6.9.2   Operations Definition verbs

All verbs shall be valid for an *Operations Definition* noun.

NOTE   An *Operations Definition* contains a listing of the exchanged information about operations, such as production of a product, or performing a maintenance activity. The information is used in a set of *Operations Segments*. An *Operations Definition* has a reference to an operations bill of materials, a *Work Definition*, and a bill of resources. It contains the *Operations Manufacturing Bill* and the *Operations Segment Definitions*.

6.9.3   Operations Definition verb actions

The actions performed on an *Operations Definition* noun are defined in Table 24.

Table 24 – Operations Definition verb actions

Operations Definition ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Operations Definitions*.
	PROCESS: Shall define a request that the receiver is to add *Operations Definitions*. The message defines suggested IDs for the *Operations Definitions* and values for the attributes and contained elements. The receiver adds the *Operations Definitions* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.
	CHANGE: Shall define a request that the receiver is to change the specified attributes and/or contained elements of the *Operations Definitions*. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel the specified *Operations Definitions*. If contained elements IDs are specified, then only the specified contained elements for the specified *Operations Definitions* are to be cancelled, not the *Operations Definitions*.
	SYNC ADD: Shall define a request that the receiver is to add the specified *Operations Definitions* with contained elements.
	SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and/or contained elements of the *Operations Definitions*.
	SYNC DELETE: Shall define a request that the receiver is to delete the specified *Operations Definitions*.
\<not specified\>	GET: Error.
	PROCESS: Error.
	CHANGE: Error.
	CANCEL: Error.
	SYNC ADD: Error.
	SYNC CHANGE: Error.
	SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Operations Definitions* matching the wildcard.
	EXAMPLE To return all *Operations Definitions*, a "*" can be specified as the wildcard.
	PROCESS: Error.
	CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of all *Operations Definitions* matching the wildcard. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel all *Operations Definitions* matching the wildcard.
	SYNC ADD: Error.
	SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and/or contained elements of all *Operations Definitions* matching the wildcard.
	SYNC DELETE: Shall define a request that the receiver is to delete all *Operations Definitions* matching the wildcard.

6.10   Operations Schedule model

6.10.1   Operations Schedule model elements

The message definitions assume that *Operations Schedule* information may be accessed from one starting point, an *Operations Schedule*, as identified by the dotted collection in Figure 22, in the overlay to the object model defined in IEC 62264-2 using the UML notation defined ISO/IEC 19501.

Figure 22 – Object grouping for the Operations Schedule model

6.10.2   Operations Schedule verbs

All verbs shall be valid for an *Operations Schedule* noun.

NOTE   An *Operations Schedule* contains a set of *Operations Requests*; each request can specify production of a main product, an inventory operation, a maintenance operation, or a testing operation. The presumption is that a Level 4 function is the provider of the *Operations Schedule* information.

Specifying the information to be returned from a GET may involve values in multiple fields. Each field definition restricts the returned information.

6.10.3   Operations Schedule verb actions

The actions performed on an *Operations Schedule* noun are defined in Table 25.

Table 25 – Operations Schedule verb actions

Operations Schedule ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Operations Schedules* that match the IDs. PROCESS: Shall define a request that the receiver is to add new *Operations Schedules*. Any assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Operations Schedules* that match the IDs. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. EXAMPLE 1 A CHANGE can define a changed *Operations Schedule* due to line slowdown or personnel unavailability. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Operations Schedules* that match the IDs. If contained elements IDs are specified, then only the specified contained elements for the specified *Operations Schedule* are to be cancelled, not the *Operations Schedule*. EXAMPLE 2 A CANCEL can define a removed *Operations Schedule* due to line shutdown or personnel reassignment. SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of the *Operations Schedules*. EXAMPLE 3 A SYNC ADD sent every day can define *Operations Schedules* for the next day. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Operations Schedules* that match the IDs. EXAMPLE 4 A SYNC CHANGE can change an *Operations Schedule* due to line slowdown or personnel unavailability. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of the *Operations Schedules* that match the IDs. EXAMPLE 5 A SYNC DELETE can define a removed *Operations Schedule* due to line shutdown or personnel reassignment.
<not specified>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Operations Schedules* based on the information specified in the GET message. See Table 26 for details. PROCESS: Shall define a request that the receiver is to add new *Operations Schedules*. Any assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Operations Schedules* based on the information specified in the CHANGE message. See Table 26 for details. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Operations Schedules* based on the information specified in the CANCEL message. See Table 26 for details. If contained elements IDs are specified, then only the specified contained elements for the specified *Operations Schedule* are to be cancelled, not the *Operations Schedule*. SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of the *Operations Schedules* based on the information specified in the SYNC message. See Table 26 for details. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Operations Schedules* based on the information specified in the SYNC message. See Table 26 for details. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of the *Operations Schedules* based on the information specified in the SYNC message. See Table 26 for details.

Operations Schedule ID	Verb action on noun
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Operations Schedules* that match the wildcard.
	PROCESS: Error.
	CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Operations Schedules* that match the wildcard. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Operations Schedules* that match the wildcard. If contained elements IDs are specified, then only the specified contained elements for the specified *Operations Schedule* are to be cancelled, not the *Operations Schedule*.
	SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of the *Operations Schedules* that match the wildcard.
	SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Operations Schedules* that match the wildcard.
	SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of the *Operations Schedules* that match the wildcard.

The meanings of *Operations Schedule* elements for a GET verb are defined in Table 26.

Table 26 – Operations Schedule element definitions for GET verb

Operations Schedule element	Returns
Start Time	Specifies the *Operations Schedule* information for times after, including the start time. Should be specified in the GET, otherwise the responder selects the *Start Time*.
End Time	Specifies the *Operations Schedule* information for times before, including the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies the *Operations Schedule* information for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site, etc.). If not specified then the responder selects the *Hierarchy Scope*.
Process Segment / Work Definition	Specifies one or more *Process Segments* and the *Work Definition* identifying the product, and returns the schedules for the specified products.
Operations Type	Specifies the operations type to be returned. Should be specified in the GET, otherwise the responder selects the *Operations Type*.

6.11   Operations Performance model

6.11.1   Operations Performance model elements

The message definitions assume that *Operations Performance* information may be accessed from one starting point, an *Operations Performance*, as identified by the dotted collection in Figure 23, in the overlay to the object model defined in IEC 62264-2 using the UML notation defined ISO/IEC 19501.
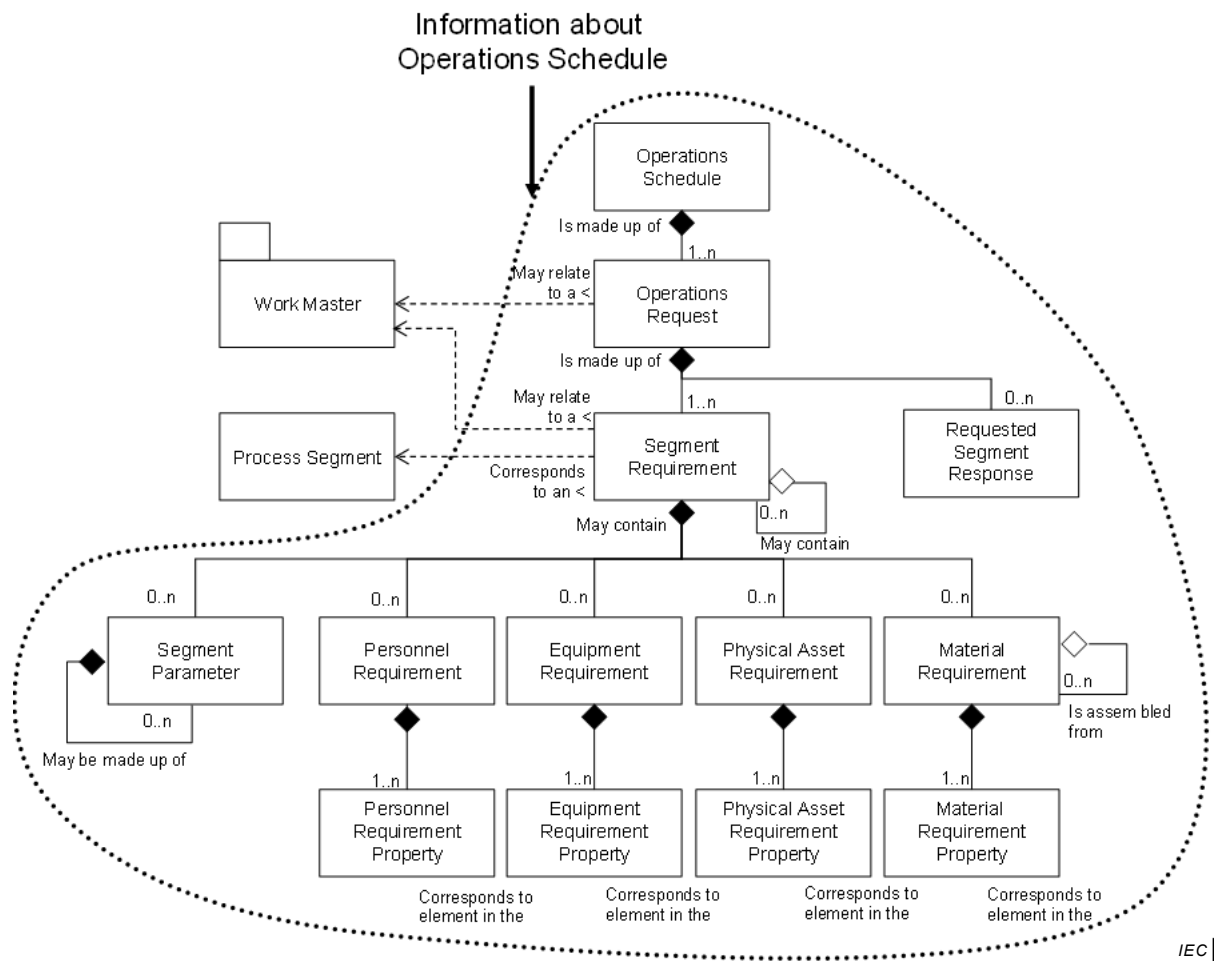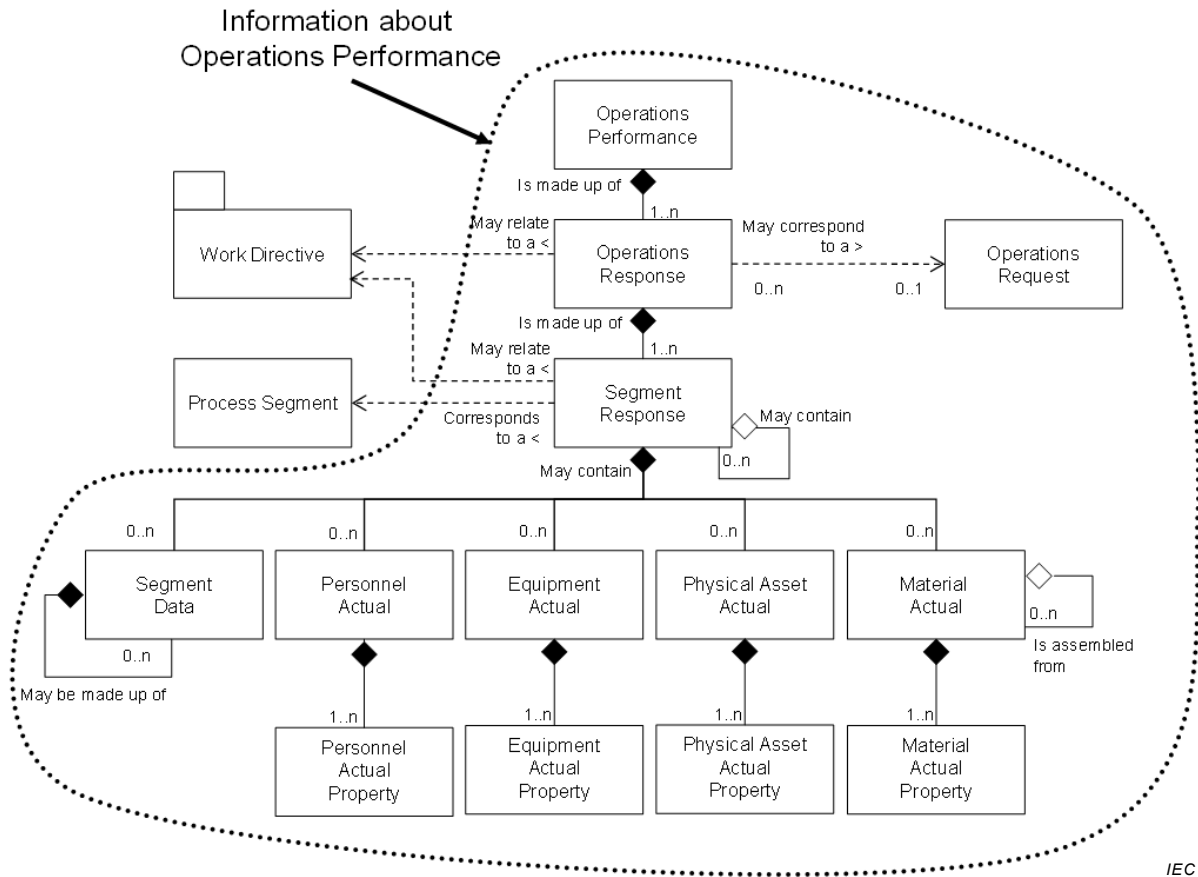
Figure 23 – Object grouping for the Operations Performance model

6.11.2 Operations Performance verbs

All verbs shall be valid for an *Operations Performance* noun.

NOTE 1   An *Operations Performance* contains a set of *Operations Responses*. *Operations Responses* contain the items reported back to the business system, at the end of an operation or during an operation. The presumption is that a Level 3 function is the owner of the *Operations Performance* information.

NOTE 2   *Operations Performance* is a snapshot, in time, of operation execution.

Specifying the information to be returned from a GET may involve values in multiple fields. Each field definition restricts the returned information.

6.11.3 Operations Performance verb actions

The actions performed on an *Operations Performance* noun are defined in Table 27.

Table 27 – Operations Performance verb actions

Operations Performance ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Operations Performances* that match the IDs. PROCESS: Shall define a request that the receiver is to add new *Operations Performances*. Any assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Operations Performances* that match the IDs. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. EXAMPLE 1 A CHANGE can define a changed *Operations Performance* due to late results or recalculation of material use. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of *Operations Performances* that match the IDs. If contained elements IDs are specified, then only the specified contained elements for the specified *Operations Performance* are to be cancelled, not the *Operations Performance*. EXAMPLE 2 A CANCEL can define a removed *Operations Performances* due to incorrectly collected use and production information, or information sent before it was verified. SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of *Operations Performances*. EXAMPLE 3 A SYNC ADD sent every day can define *Operations Performance* for the previous day. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Operations Performances* that match the IDs. EXAMPLE 4 A SYNC CHANGE can change an *Operations Performance* due to incorrectly collected use and production information, or information sent before it was verified. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Operations Performances* that match the IDs.
\<not specified\>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of *Operations Performances* based on the information specified in the GET message. See Table 28 for details. PROCESS: Shall define a request that the receiver is to add new *Operations Performances* based on the information specified in the GET message. See Table 28 for details. Any assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Operations Performances* based on the information specified in the GET message. See Table 28 for details. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of *Operations Performances* based on the information specified in the CANCEL message. See Table 28 for details. If contained elements IDs are specified, then only the specified contained elements for the specified *Operations Performance* are to be cancelled, not the *Operations Performance*. SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of *Operations Performances* based on the information specified in the SYNC message. See Table 28 for details. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Operations Performances* based on the information specified in the SYNC message. See Table 28 for details. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Operations Performances* based on the information specified in the SYNC message. See Table 28 for details.

Operations Performance ID	Verb action on noun
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Operations Performances* that match the wildcard. PROCESS: Error. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Operations Performances* that match the wildcard. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of *Operations Performances* that match the wildcard. If contained elements IDs are specified, then only the specified contained elements for the specified *Operations Performance* are to be cancelled, not the *Operations Performance*. SYNC ADD: Error. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Operations Performances* that match the wildcard. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Operations Performances* that match the wildcard.

Table 28 – Operations Performance definitions for GET verb

Operations Performance element	Returns
Start Time	Specifies *Operations Performance* information for times after, including the start time. Should be specified in the GET, otherwise the responder selects the *Start Time*.
End Time	Specifies *Operations Performance* information for times before, including the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies *Operations Performance* information for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site,etc.). If not specified then the responder selects the *Hierarchy Scope*.
Operations Performance / Operations Schedule ID	Specifies the *Operations Performance* information associated with the specified *Operations Schedule*.
Operations Performance / Operations Response / Operations Request ID	Specifies the *Operations Performance* information associated with the specified *Operations Request*.
Operations Performance / Operations Response / Operations Definition ID	Specifies the *Operations Performance* information associated with the specified *Operations Definition.*
Operations Performance / Operations Response / Segment Response / Process Segment ID	Specifies the *Operations Performance* information associated with the specified *Process Segment.*
Operations Performance / Operations Response / Segment Response / Operations Segment ID	Specifies the *Operations Performance* information associated with the specified *Operations Segment*.

6.12   Resource Relationship Network model

6.12.1   Resource Relationship Network model elements

The message definitions assume that *Resource Relationship Network* information may be accessed from two starting points, a *Resource Relationship Network* and a *Resource Relationship Network Type*, as identified by the dotted collection in Figure 24, in the overlay to the object model defined in IEC 62264-4 using the UML notation defined ISO/IEC 19501.
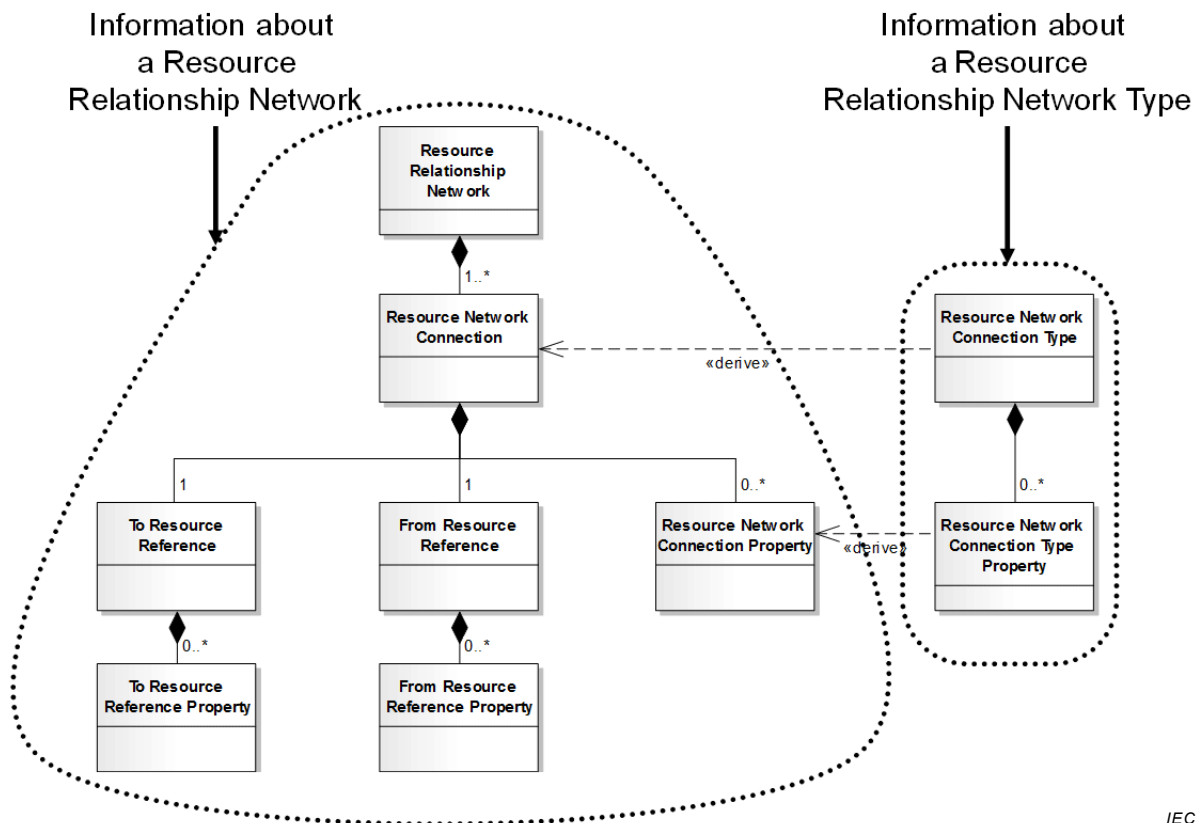
Figure 24 – Object grouping for the Resource Relationship Network model

6.12.2   Resource Relationship Network verbs

All verbs shall be valid for a *Resource Relationship Network* noun.

6.12.3   Resource Relationship Network verb actions

The actions performed on a *Resource Relationship Network* noun are defined in Table 29.

Table 29 – Resource Relationship Network verb actions

Resource Relationship Network ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of *Resource Relationship Networks*. PROCESS: Shall define a request that the receiver is to add *Resource Relationship Networks*. The message defines suggested IDs for the *Resource Relationship Networks*, values for the attributes and subobjects. The receiver adds the *Resource Relationship Networks* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Resource Relationship Networks.* The assumption is the new *Resource Relationship Network* is the complete network definition and that the previous *Resource Relationship Network* is canceled and the new *Resource Relationship Network* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Resource Relationship Networks*. SYNC ADD: Shall define a request that the receiver is to add the specified *Resource Relationship Networks*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Resource Relationship Networks*. The assumption is the new *Resource Relationship Network* is the complete network definition and that the previous *Resource Relationship Network* is deleted and the new *Resource Relationship Network* is added. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Resource Relationship Networks*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Resource Relationship Networks* identified by the wildcard. PROCESS: Error. CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel all *Resource Relationship Networks* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete all *Resource Relationship Networks* matching the wildcard.

6.12.4 Resource Relationship Connection Type verbs

All verbs shall be valid for a *Resource Relationship Connection Type* noun.

6.12.5 Resource Relationship Connection Type verb actions

The actions performed on a *Resource Relationship Connection Type* noun are defined in Table 30.

Table 30 – Resource Relationship Connection Type verb actions

Resource Relationship Connection Type ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of *Resource Relationship Connection Types*. PROCESS: Shall define a request that the receiver is to add *Resource Relationship Connection Types*. The message defines suggested IDs for the *Resource Relationship Connection Types*, values for the attributes and subobjects. The receiver adds the *Resource Relationship Connection Types* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Resource Relationship Connection Types.* The assumption is the new *Resource Relationship Connection Type* is the complete type definition and that the previous *Resource Relationship Connection Type* is cancelled and the new *Resource Relationship Connection Type* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Resource Relationship Connection Types*. SYNC ADD: Shall define a request that the receiver is to add the specified *Resource Relationship Connection Types*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Resource Relationship Connection Types*. The assumption is the new *Resource Relationship Connection Type* is the complete type definition and that the previous *Resource Relationship Connection Type* is deleted and the new *Resource Relationship Connection Type* is added. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Resource Relationship Connection Types*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Resource Relationship Connection Types* identified by the wildcard. PROCESS: Error. CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel all *Resource Relationship Connection Types* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete all *Resource Relationship Connection Types* matching the wildcard.

6.13 Work Alerts

6.13.1 Work Alert model elements

The message definitions assume that *Work Alert* information may be accessed from two starting points, a *Work Alert Definition* and a *Work Alert*, as identified by the dotted collection in Figure 25, in the overlay to the object model defined in IEC 62264-4 using the UML notation defined ISO/IEC 19501.
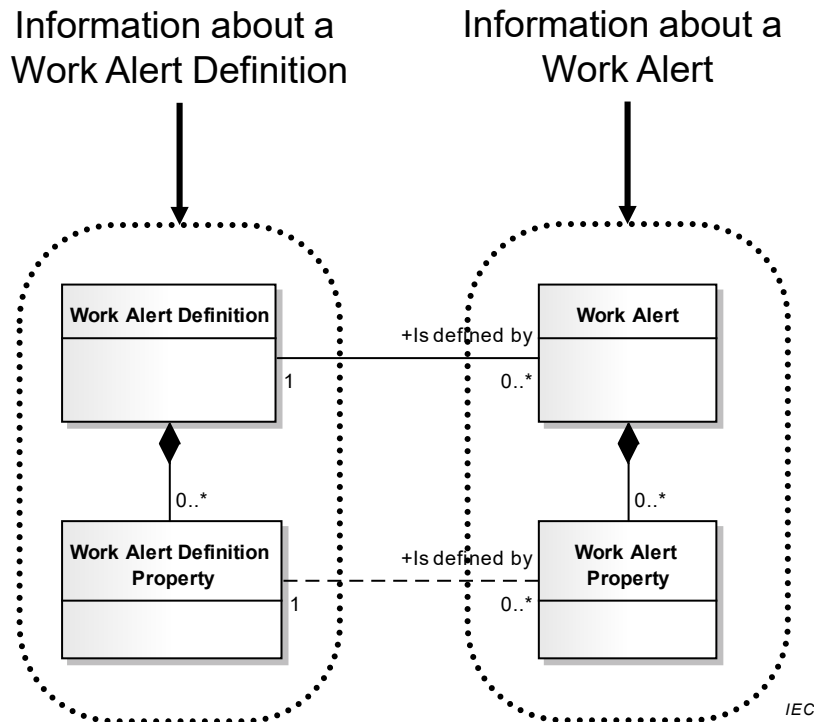
Figure 25 – Object grouping for the Work Alert model

6.13.2 Work Alert Definition verbs

All verbs shall be valid for a *Work Alert Definition* noun.

Specifying the information to be returned from a GET may involve values in multiple fields. Each field definition restricts the returned information.

The additional attributes defined in Table 31 shall be defined for *Work Alerts Definitions* for purposes of GET transaction support.

Table 31 – Work Alert Definition additional attributes

Attribute Name	Description
Hierarchy Scope	Identifies where the exchanged information fits within the role based equipment hierarchy.

6.13.3 Work Alert Definition actions

The actions performed on a *Work Alert Definition* noun are defined in Table 32. The additional attributes for the GET verb for *Work Alert Definition* are defined in Table 33.

Table 32 – Work Alert Definition verb actions

Work Alert Definition ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Work Alert Definition* that matches the IDs. PROCESS: Shall define a request that the receiver is to add new *Work Alert Definitions*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Work Alert Definitions*. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Work Alert Definitions*. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Work Alert Definitions*. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Work Alert Definitions*. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Alert Definitions*.
<not specified>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of a *Work Alert Definition* identified by the information specified in the GET message. See Table 363 for details. PROCESS: Shall define a request that the receiver is to add new *Work Alert Definitions*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Work Alert Definitions* identified by the information specified in the CHANGE message. See Table 363 for details. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Work Alert Definitions* identified by the information specified in the CANCEL message. See Table 363 for details. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of the *Work Alert Definitions* identified by the information specified in the SYNC message. See Table 363 for details. SYNC CHANGE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Work Alert Definitions* identified by the information specified in the SYNC message. See Table 363 for details. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Work Alert Definitions* identified by the information specified in the SYNC message. See Table 363 for details.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Work Alert Definitions* that match the wildcard. PROCESS: Error CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel the specified *Work Alert Definitions* that match the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Alert Definitions* that match the wildcard.

Table 33 – Work Alert Definition element definitions for GET verb

Work Alert element	Returns
Hierarchy Scope	Specifies *Work Alert Definition* information for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site, etc.). If not specified then the responder selects the *Hierarchy Scope*.
Priority	Specifies *Work Alert Definition* information for the specified priority. If not specified then the responder returns all priority alerts.
Category	Specifies *Work Alert Definition* information for the specified category. If not specified then the responder returns all category alerts.

6.13.4 Work Alert verbs

All verbs shall be valid for a *Work Alert* noun.

Specifying the information to be returned from a GET may involve values in multiple fields. Each field definition restricts the returned information.

The additional attributes defined in Table 34 shall be defined for *Work Alerts* for purposes of GET transaction support. The additional attributes for the GET verb for *Work Alert* are defined in Table 35.

Table 34 – Work Alert Definition additional attributes

Attribute name	Description
Start Time	The starting time for the associated *Work Alert*, if applicable.
End Time	The ending time for the associated *Work Schedule*, if applicable.
Hierarchy Scope	Identifies where the exchanged information fits within the role based equipment hierarchy.

6.13.5 Work Alert verb actions

The actions performed on a *Work Alert* noun are defined in Table 35. The unique options for the GET verb are defined in Table 36.

Table 35 – Work Alert verb actions

Work Alert ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Work Alert* that matches the IDs.
	PROCESS: Shall define a request that the receiver is to add new *Work Alerts*. Any assigned IDs are returned in the ACKNOWLEDGE message.
	CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Work Alerts*. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Work Alerts*.
	SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Work Alerts*.
	SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Work Alerts*.
	SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Alerts*.

Work Alert ID	Verb action on noun
\<not specified\>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of a *Work Alert* identified by the information specified in the GET message. See Table 36 for details. PROCESS: Shall define a request that the receiver is to add new *Work Alerts*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Work Alerts* identified by the information specified in the CHANGE message. See Table 36 for details. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Work Alerts* identified by the information specified in the CANCEL message. See Table 36 for details. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Work Alerts* identified by the information specified in the SYNC message. See Table 36 for details. SYNC CHANGE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Work Alerts* identified by the information specified in the SYNC message. See Table 36 for details. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Work Alerts* identified by the information specified in the SYNC message. See Table 36 for details.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Work Alerts* that match the wildcard. PROCESS: Error CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel the specified *Work Alerts* that match the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Alerts* that match the wildcard.

Table 36 – Work Alert element definitions for GET verb

Work Alert Element	Returns
Start Time	Specifies *Work Alert* information with *Timestamps* after, including the start time. If not specified then the responder selects the *Start Time*.
End Time	Specifies *Work Alert* information with *Timestamps* before, including the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies *Work Alert* information for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site, etc.). If not specified then the responder selects the *Hierarchy Scope*.
Priority	Specifies *Work Alert* information for the specified priority. If not specified then the responder returns all priority alerts.
Category	Specifies *Work Alert* information for the specified category. If not specified then the responder returns all category alerts.

6.14   Work Calendar

6.14.1   Work Calendar elements

The message definitions assume that *Work Calendar* information may be accessed from two starting points; a *Work Calendar Definition* and a *Work Calendar*, as identified by the dotted collection in Figure 26, in the overlay to the object model defined in IEC 62264-4 using the UML notation defined ISO/IEC 19501.
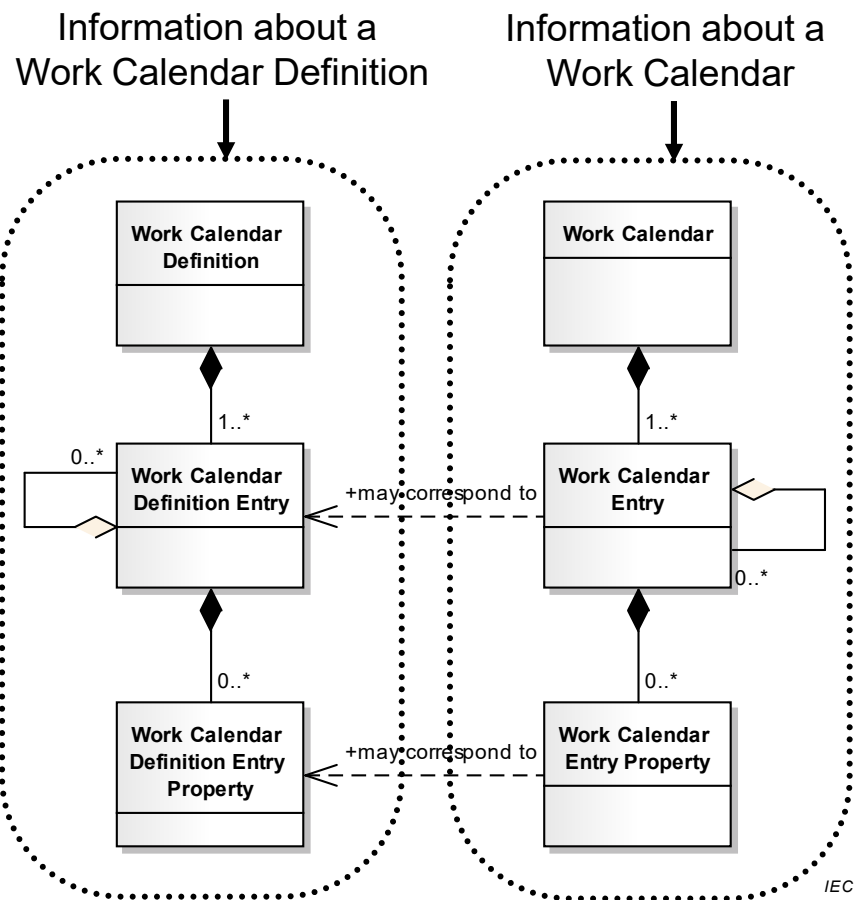
Figure 26 – Object grouping for the Work Calendar model

6.14.2 Work Calendar Definition verbs

All verbs shall be valid for a *Work Calendar Definition* noun.

6.14.3 Work Calendar Definition actions

The actions performed on a *Work Calendar Definition* noun are defined in Table 37.

Table 37 – Work Calendar Definition verb actions

Work Calendar Definition ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Work Calendar Definition* that matches the IDs. PROCESS: Shall define a request that the receiver is to add new *Work Calendar Definitions*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Work Calendar Definitions*. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Work Calendar Definitions*. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Work Calendar Definitions*. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Work Calendar Definitions*. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Calendar Definitions*.
<not specified>	GET: Error. PROCESS: Shall define a request that the receiver is to add new *Work Calendar Definitions*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Work Calendar Definitions* that match the wildcard. PROCESS: Error CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel the specified *Work Calendar Definitions* that match the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Calendar Definitions* that match the wildcard.

6.14.4   Work Calendar verbs

All verbs shall be valid for a *Work Calendar* noun.

6.14.5   Work Calendar actions

The actions performed on a *Work Calendar* noun are defined in Table 38.

Table 38 – Work Calendar verb actions

Work Calendar ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Work Calendar* that matches the IDs. PROCESS: Shall define a request that the receiver is to add new *Work Calendar*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Work Calendar*. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Work Calendars*. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Work Calendars*. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Work Calendars*. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Calendar*.
<not specified>	GET: Error. PROCESS: Shall define a request that the receiver is to add new *Work Calendar*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Work Calendars* that match the wildcard. PROCESS: Error CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel the specified *Work Calendars* that match the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Calendar* that match the wildcard.

6.15 Work Capability model

6.15.1 Work Capability model elements

The message definitions assume that *Work Capability* information may be accessed from one starting point, a *Work Capability*, as identified by the dotted collection in Figure 27, in the overlay to the object model defined in IEC 62264-4 using the UML notation defined ISO/IEC 19501.

Information about a
Work Capability
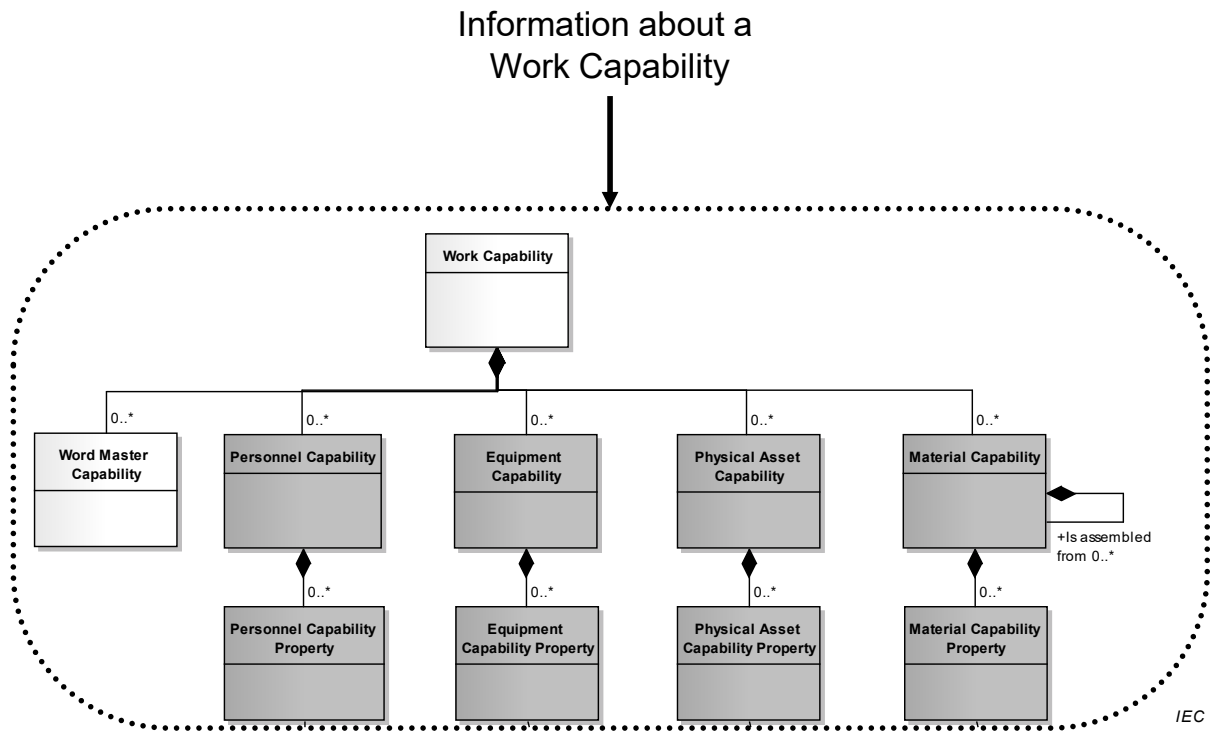
Figure 27 – Object grouping for the Work Capability model

6.15.2   Work Capability verbs

All verbs shall be valid for a *Work Capability* noun.

NOTE   *Work Capability* is a snapshot in time of the available, unattainable, or committed capability.

Specifying the information to be returned from a GET may involve values in multiple fields. Each field definition restricts the returned information.

6.15.3   Work Capability verb actions

The actions performed on a *Work Capability* noun are defined in Table 39. The additional attributes for the GET verb for *Work Capability* are defined in Table 40.

Table 39 – Work Capability verb actions

Work Capability ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Work Capabilities* that match the IDs. PROCESS: Shall define a request that the receiver is to add new *Work Capabilities*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Work Capabilities*. The assumption is that the new *Work Capability* is the complete type definition, that the previous *Work Capability* is cancelled, and that the new *Work Capability* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Work Capabilities*. If contained elements IDs are specified, then only the specified contained elements for the specified *Work Capability* are to be cancelled, not the *Work Capability*. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Work Capabilities*. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Work Capabilities*. The assumption is the new *Work Capability* is the complete type definition and that the previous *Work Capability* is deleted and the new *Work Capability* is added. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Work Capabilities*.
<not specified>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of a *Work Capabilities* identified by the information specified in the GET message. See Table 40 for details. PROCESS: Shall define a request that the receiver is to add new *Work Capabilities*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Work Capabilities* identified by the information specified in the CHANGE message. See Table 40 for details. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Work Capabilities* identified by the information specified in the CANCEL message. See Table 40 for details. If contained elements IDs are specified, then only the specified contained elements for the specified *Work Capability* are to be cancelled, not the *Work Capability*. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Work Capabilities* identified by the information specified in the SYNC message. See Table 40 for details. SYNC CHANGE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Work Capabilities* identified by the information specified in the SYNC message. See Table 40 for details. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Work Capabilities* identified by the information specified in the SYNC message. See Table 40 for details.

Work Capability ID	Verb action on noun
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Work Capabilities* that match the wildcard.
	PROCESS: Error
	CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Work Capabilities* that match the wildcard. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Work Capabilities* that match the wildcard. If contained elements IDs are specified, then only the specified contained elements for the specified *Work Capability* are to be cancelled, not the *Work Capability*.
	SYNC ADD: Error.
	SYNC CHANGE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Work Capabilities* that match the wildcard.
	SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Work Capabilities* that match the wildcard.

Table 40 – Work Capability element definitions for GET verb

Work Capability Element	Returns
Start Time	Specifies *Work Capability* information for times after, including the start time. If not specified then the responder selects the *Start Time*.
End Time	Specifies *Work Capability* information for times before, including the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies *Work Capability* information for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site,etc.) If not specified then the responder selects the *Hierarchy Scope*.
Capability Type	Specifies the type of *Work Capability* information to be returned. If not specified, then the responder selects the *Capability Type* information returned.
Personnel Capability / Personnel Class ID	May specify a wildcard or a *Personnel Class* ID. If included, then it specifies the *Personnel Class(es)* for the returned *Personnel Capability*.
Personnel Capability / Person ID	May specify a wildcard or a *Person* ID. If included, then it specifies the person(s) for the returned *Personnel Capability*.
Equipment Capability / Equipment Class ID	May specify a wildcard or an *Equipment Class* ID. If included, then it specifies the *Equipment Class(es)* for the returned *Equipment Capability*.
Equipment Capability / Equipment ID	May specify a wildcard or an *Equipment* ID. If included, then it specifies the equipment for the returned *Equipment Capability*.
Physical Asset Capability / Physical Asset ID	May specify a wildcard or a *Physical Asset* ID. If included, then it specifies the *Physical Assets* for the returned *Physical Asset Capability*.
Physical Asset Capability / Physical Asset Class ID	May specify a wildcard or a *Physical Asset Class* ID. If included, then it specifies the *Physical Asset Class(es)* for the returned *Physical Asset Class Capability*.
Material Capability / Material Class ID	May specify a wildcard or a *Material Class* ID. If included, then it specifies the *Material Class(es)* for the returned *Material Capability*.
Material Capability / Material Definition ID	May specify a wildcard or a *Material Definition* ID. If included, then it specifies the *Material Definitions(s)* for the returned *Material Capability*.
Material Capability / Material Lot ID	May specify a wildcard or a *Material Lot* ID. If included, then it specifies the *Material Lot(s)* for the returned *Material Capability*.
Material Capability / Material SubLot ID	May specify a wildcard or a *Material Sublot* ID. If included, then it specifies the *Material Sublot(s)* for the returned *Material Capability*.
Work Master Capability ID	May contain a wildcard or a *Work Master ID*. If included, then it specifies that *Work Master Capability* should only be returned for the specified *Process Segment*.

Work Capability Element	Returns
Work Master Capability / Personnel Capability / Personnel Class ID	May specify a wildcard or a *Work Master* ID. If included, then it specifies the *Personnel Class(es)* for the returned *Work Master / Personnel Capability*.
Work Master Capability / Personnel Capability / Person ID	May specify a wildcard or a *Person* ID. If included, then it specifies the person(s) for the returned *Work Master / Personnel Capability*.
Work Master Capability / Equipment Capability / Equipment Class ID	May specify a wildcard or an *Equipment Class* ID. If included, then it specifies the *Equipment Class(es)* for the returned *Work Master / Equipment Capability*.
Work Master Capability / Equipment Capability / Equipment ID	May specify a wildcard or an *Equipment* ID. If included, then it specifies the *Equipment* for the returned *Equipment Capability*.
Work Master Capability / Physical Asset Capability / Physical Asset Class ID	May specify a wildcard or a *Physical Asset Class* ID. If included, then it specifies the *Physical Asset Class(es)* for the returned *Work Master / Physical Asset Capability*.
Work Master Capability / Physical Asset Capability / Physical Asset ID	May specify a wildcard or a *Physical Asset* ID. If included, then it specifies the *Physical Asset* for the returned *Physical Asset Capability*.
Work Master Capability / Material Capability / Material Class ID	May specify a wildcard or a *Material Class* ID. If included, then it specifies the *Material Class(es)* for the returned *Work Master / Material Capability*.
Work Master Capability / Material Capability / Material Definition ID	May specify a wildcard or a *Material Definition* ID. If included, then it specifies the *Material Definitions(s)* for the returned *Work Master / Material Capability*.
Work Master Capability / Material Capability / Material Lot ID	May specify a wildcard or a *Material Lot* ID. If included, then it specifies the *Material Lot(s)* for the returned *Work Master / Material Capability*.
Work Master Capability / Material Capability / Material Sublot ID	May specify a wildcard or a *Material Sublot* ID. If included, then it specifies the *Material Sublot(s)* for the returned *Work Master / Material Capability*.

6.16   Work Definition model

6.16.1   Work Definition model elements

The message definitions assume that Work Definition information may be accessed from two starting points, a *Work Master* and a *Work Directive*, as identified by the dotted collection in Figure 28, in the overlay to the object model defined in IEC 62264-4 using the UML notation defined ISO/IEC 19501.
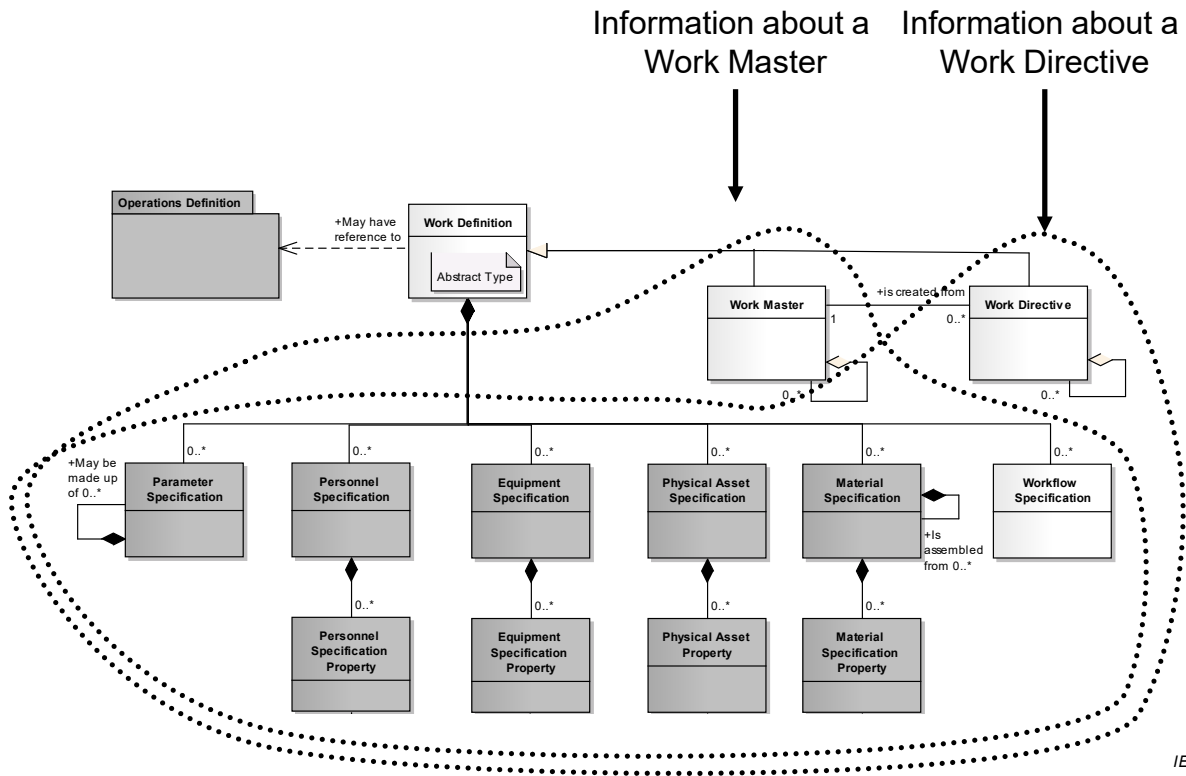
Figure 28 – Object grouping for the Work Definition model

6.16.2 Work Master verbs

All verbs shall be valid for a *Work Master* noun.

6.16.3 Work Master verb actions

The actions performed on a *Work Master* noun are defined in Table 41.

Table 41 – Work Master verb actions

Work Master ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of *Work Masters*. PROCESS: Shall define a request that the receiver is to add *Work Masters*. The message defines suggested IDs for the *Work Masters*, values for the attributes and subobjects. The receiver adds the *Work Masters* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Work Masters*. The assumption is the new *Work Master* is the complete type definition and that the previous *Work Master* is canceled and the new *Work Master* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Work Masters*. SYNC ADD: Shall define a request that the receiver is to add the specified *Work Masters*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Work Masters*. The assumption is the new *Work Master* is the complete type definition and that the previous *Work Master* is deleted and the new *Work Master* is added. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Masters*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Work Masters* identified by the wildcard. PROCESS: Error. CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel all *Work Masters* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete all *Work Masters* matching the wildcard.

6.16.4   Work Directive verbs

All verbs shall be valid for a *Work Directive* noun.

6.16.5   Work Directive verb actions

The actions performed on a *Work Directive* noun are defined in Table 42.

Table 42 – Work Directive verb actions

Work Directive ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of *Work Directives*. PROCESS: Shall define a request that the receiver is to add *Work Directives*. The message defines suggested IDs for the *Work Directives*, values for the attributes and subobjects. The receiver adds the *Work Directives* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Work Directives*. The assumption is the new *Work Directive* is the complete type definition and that the previous *Work Directive* is canceled and the new *Work Directive* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Work Directives*. SYNC ADD: Shall define a request that the receiver is to add the specified *Work Directives*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Work Directives*. The assumption is the new *Work Directive* is the complete type definition and that the previous *Work Directive* is deleted and the new *Work Directive* is added. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Directives*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Work Directives* identified by the wildcard. PROCESS: Error. CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel all *Work Directives* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete all *Work Directives* matching the wildcard.

6.17   Work Record

6.17.1   Work Record elements

The message definitions assume that *Work Record* information may be accessed from one starting point, a *Work Record*, as identified by the dotted collection in Figure 29, in the overlay to the object model defined in IEC 62264-4 using the UML notation defined ISO/IEC 19501.

Information about a
Work Record →

Figure 29 – Object grouping for the Work Record model

6.17.2   Work Record verbs

All verbs shall be valid for a *Work Record* noun.

6.17.3   Work Record verb actions

The actions performed on a *Work Record* noun are defined in Table 43.

Table 43 – Work Record verb actions

Work Record ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Work Record* that match the IDs. PROCESS: Shall define a request that the receiver is to add new *Work Records*. Any assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Work Records* that match the IDs. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of *Work Records* that match the IDs. If contained elements IDs are specified, then only the specified contained elements for the specified *Work Record* are to be cancelled, not the *Work Record*. SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of *Work Record*. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Work Records* that match the IDs. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Work Records* that match the IDs.
\<not specified\>	GET: Error. PROCESS: Shall define a request that the receiver is to add new *Work Records* based on the information specified in the GET message. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Error. PROCESS: Error CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error

6.18 Work Schedule model

6.18.1 Work Schedule elements

The message definitions assume that *Work Schedule* information may be accessed from two starting points, a *Work Schedule* and a *Job List*, as identified by the dotted collection in Figure 30, in the overlay to the object model defined in IEC 62264-4 using the UML notation defined ISO/IEC 19501.

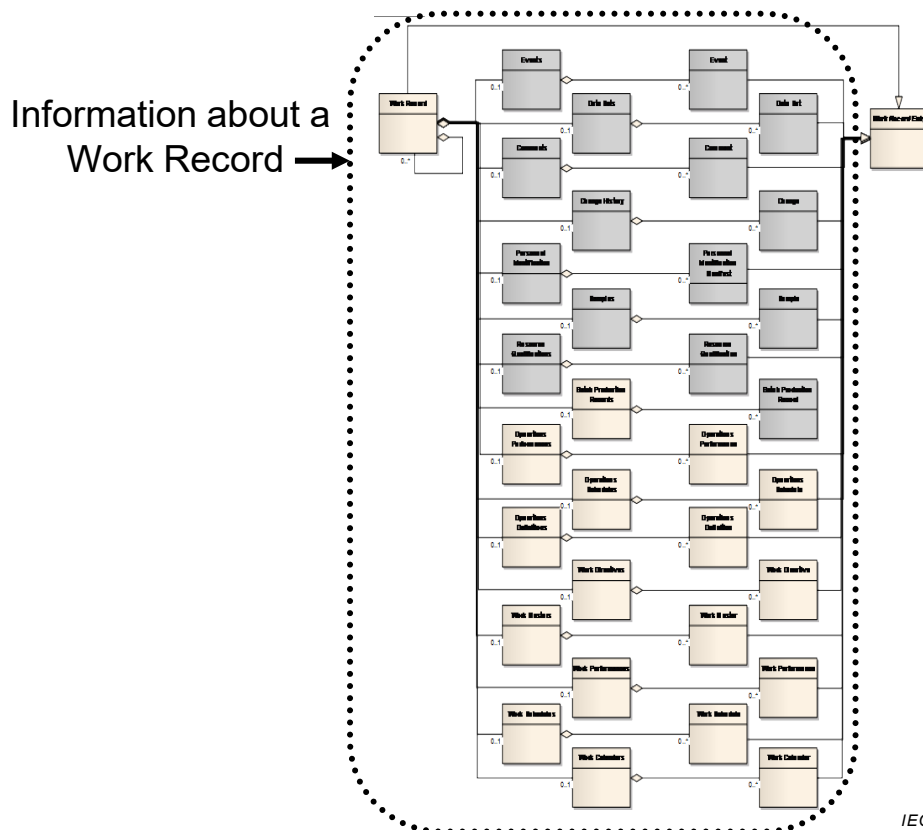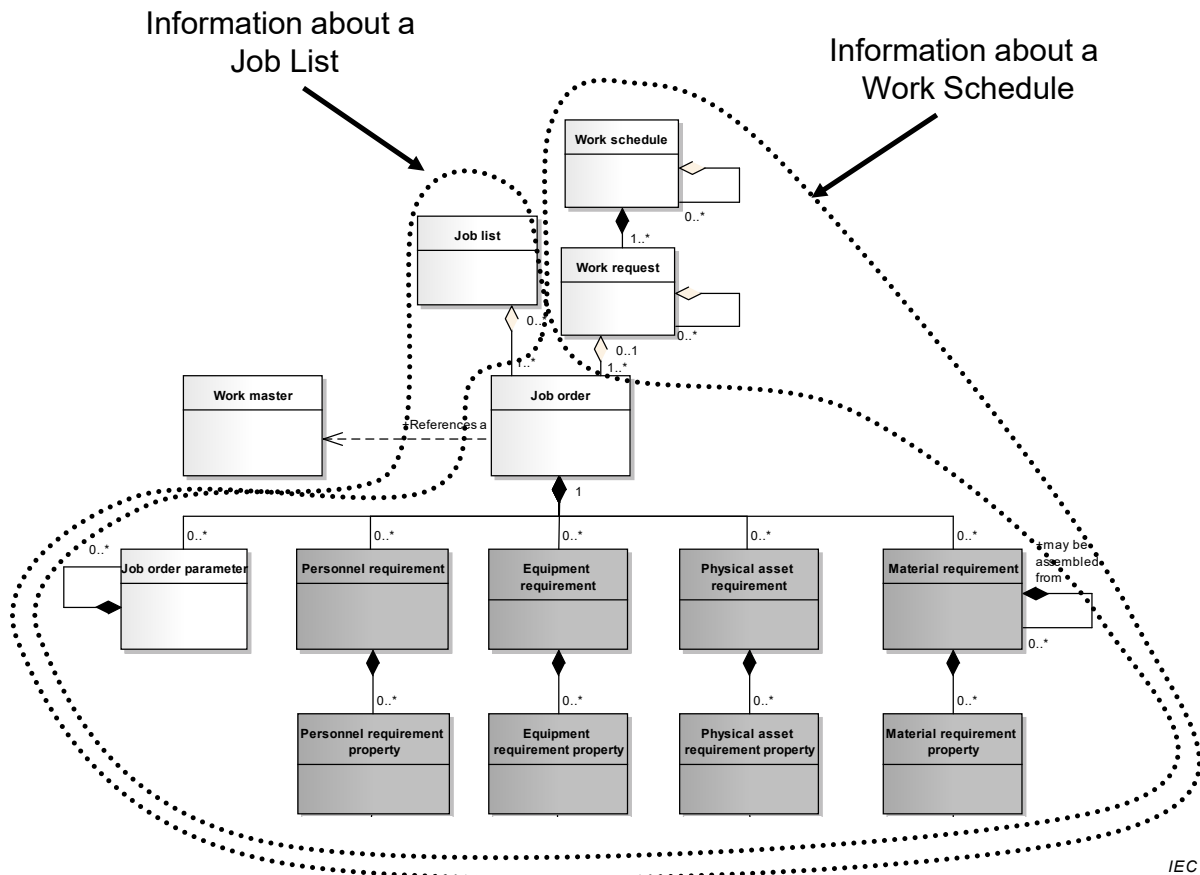**Figure 30 – Object grouping for the Work Schedule model**

6.18.2 Work Schedule verbs

All verbs shall be valid for a *Work Schedule* noun.

6.18.3 Work Schedule verb actions

The actions performed on a *Work Schedule* noun are defined in Table 44.

Table 44 – Work Schedule verb actions

Workflow Schedule ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of a *Work Schedule*. See Table 46 for additional selection criteria. PROCESS: Shall define a request that the receiver is to add *Work Schedules*. The message defines suggested IDs for the *Work Schedules*, values for the attributes and subobjects. The receiver adds the *Work Schedules* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Work Schedules.* The assumption is the new *Work Schedule* is the complete type definition and that the previous *Work Schedule* is canceled and the new *Work Schedule* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Work Schedules*. SYNC ADD: Shall define a request that the receiver is to add the specified *Work Schedules*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Work Schedules*. The assumption is the new *Work Schedule* is the complete type definition and that the previous *Work Schedule* is deleted and the new *Work Schedule* is added. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Schedules*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Work Schedules* identified by the wildcard. See Table 46 for additional selection criteria. PROCESS: Error. CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel all *Work Schedules* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete all *Work Schedules* matching the wildcard.

6.18.4 Job List verbs

All verbs shall be valid for a *Job List* noun.

6.18.5 Job List verb actions

The actions performed on a *Job List* noun are defined in Table 45.

Table 45 – Job List verb actions

Job List ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of a *Job List*. See Table 46 for additional selection criteria. PROCESS: Shall define a request that the receiver is to add *Job Lists*. The message defines suggested IDs for the *Job Lists*, values for the attributes and subobjects. The receiver adds the *Job Lists* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Job Lists.* The assumption is the new *Job List* is the complete type definition and that the previous *Job List is* cancelled and the new *Job List* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Job Lists*. SYNC ADD: Shall define a request that the receiver is to add the specified *Job Lists*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Job Lists*. The assumption is the new *Job List* is the complete type definition and that the previous *Job List is* cancelled and the new *Job List* is added. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Job Lists*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Job Lists* identified by the wildcard. See Table 46 for additional selection criteria. PROCESS: Error. CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel all *Job Lists* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete all *Job Lists* matching the wildcard.

Table 46 – Work Schedule and Job List element definitions for GET verb

Work Alert Element	Returns
Work Type	Specifies either the *Work Schedule* or *Job List* information with *Work Types* that match the specified work type. If not specified then the responder selects the *Work Types*.
Start Time	Specifies either *Work Schedule* or *Job List* information with *Start Times* after, including the start time. If not specified then the responder selects the *Start Time*.
End Time	Specifies either *Work Schedule* or Job List information with *End Times* before, including the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies either the *Work Schedule* or *Job List* information with *Start Times* for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site, etc.). If not specified then the responder selects the *Hierarchy Scope*.

6.19 Work Performance model

6.19.1 Work Performance elements

The message definitions assume that *Work Performance* information may be accessed from three starting points, a *Work Performance,* a *Job Response List* and a *Job Response* as identified by the dotted collection in Figure 31, in the overlay to the object model defined in IEC 62264-4 using the UML notation defined ISO/IEC 19501.
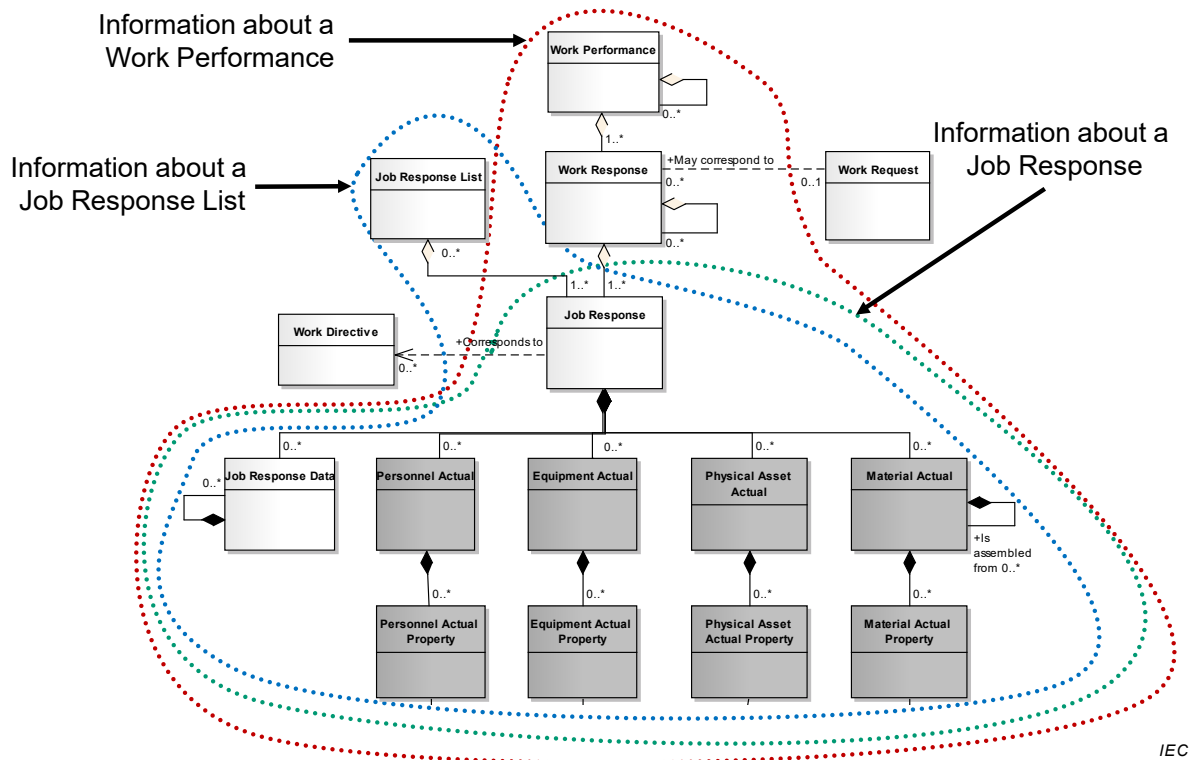
Figure 31 – Object grouping for the Work Performance model

6.19.2 Work Performance verbs

All verbs shall be valid for a *Work Performance* noun.

6.19.3 Work Performance verb actions

The actions performed on a *Work Performance* noun are defined in Table 47. The additional attributes for the GET verb for *Work Performance* are defined in Table 48.

Table 47 – Work Performance verb actions

Work Performance ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of a *Work Performance*. See Table 52 for additional selection criteria. PROCESS: Shall define a request that the receiver is to add *Work Performances*. The message defines suggested IDs for the *Work Performances*, values for the attributes and subobjects. The receiver adds the *Work Performances* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Work Performances*. The assumption is the new *Work Performance is* the complete type definition and that the previous *Work Performance is* cancelled and the new *Work Performance* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Work Performances*. SYNC ADD: Shall define a request that the receiver is to add the specified *Work Performances*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Work Performances*. The assumption is the new *Work Performance is* the complete type definition and that the previous *Work Performance is* deleted and the new *Work Performance* is added. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Work Performances*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Work Performances* identified by the wildcard. See Table 52 for additional selection criteria. PROCESS: Error. CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel all *Work Performances* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete all *Work Performances* matching the wildcard.

Table 48 – Work Performance element definitions for GET verb

Work Performance element	Returns
Work Type	Specifies *Work Performance* information with *Work Types* that match the specified work type. If not specified then the responder selects the *Work Types*.
Start Time	Specifies *Work Performance* information with *Start Times* after, including the start time. If not specified then the responder selects the *Start Time*.
End Time	Specifies *Work Performance* information with *End Times* before, including the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies *Work Performance* information with *Start Times* for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site, etc.). If not specified then the responder selects the *Hierarchy Scope*.

6.19.4   Job Response verbs

All verbs shall be valid for a *Job Response* noun.

6.19.5   Job Response verb actions

The actions performed on a *Job Response* noun are defined in Table 49. The unique actions for a GET message are defined in Table 50.

Table 49 – Job Response verb actions

Job Response ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of a *Job Response*. See Table 52 for additional selection criteria. PROCESS: Shall define a request that the receiver is to add *Job Responses*. The message defines suggested IDs for the *Job Responses*, values for the attributes and subobjects. The receiver adds the *Job Responses* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Job Responses*. The assumption is the new *Job Response* is the complete type definition and that the previous *Job Response* is cancelled and the new *Job Response* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Job Responses*. SYNC ADD: Shall define a request that the receiver is to add the specified *Job Responses*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Job Responses*. The assumption is the new *Job Response* is the complete type definition and that the previous *Job Response is* deleted and the new *Job Response* is added. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Job Responses*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.

Job Response ID	Verb action on noun
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Job Responses* identified by the wildcard. See Table 52 for additional selection criteria.
	PROCESS: Error.
	CHANGE: Error.
	CANCEL: Shall define a request that the receiver is to cancel all *Job Responses* matching the wildcard.
	SYNC ADD: Error.
	SYNC CHANGE: Error.
	SYNC DELETE: Shall define a request that the receiver is to delete all *Job Responses* matching the wildcard.

Table 50 – Job response element definitions for GET verb

Work Performance element	Returns
Work Type	Specifies *Job Response* information with *Work Types* that match the specified work type. If not specified then the responder selects the *Work Types*.
Start Time	Specifies *Job Response* information with *Start Times* after, and including the start time. If not specified then the responder selects the *Start Time*.
End Time	Specifies either *Job Response* information with *End Times* before, and including, the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies *Job Response* information with *Start Times* for the specified scope in the role based equipment hierarchal. (e.g. A process cell, work center, production line, area, site, …). If not specified then the responder selects the *Hierarchy Scope*.

6.19.6 Job Response List verbs

All verbs shall be valid for a *Job Response List* noun.

6.19.7 Job Response List verb actions

The actions performed on a *Job Response List* noun are defined in Table 51. The additional attributes for the GET verb for *Job Response List* are defined in Table 52.

Table 51 – Job Response List verb actions

Job Response List ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of a *Job Response List*. See Table 52 for additional selection criteria. PROCESS: Shall define a request that the receiver is to add *Job Responses*. The message defines suggested IDs for the *Job Response*, values for the attributes and subobjects. The receiver adds the *Job Responses* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Job Responses*. The assumption is the new *Job Response is* the complete type definition and that the previous *Job Response is* cancelled and the new *Job Response* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Job Responses*. SYNC ADD: Shall define a request that the receiver is to add the specified *Job Responses*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Job Responses*. The assumption is the new *Job Response is* the complete type definition and that the previous *Job Response is* deleted and the new *Job Response* is added. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Job Responses*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Job Responses* identified by the wildcard. See Table 52 for additional selection criteria. PROCESS: Error. CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel all *Job Responses* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete all *Job Responses* matching the wildcard.

Table 52 – Job Response List element definitions for GET verb

Job Response List element	Returns
Work Type	Specifies *Job Response List* information with *Work Types* that match the specified work type. If not specified then the responder selects the *Work Types*.
Start Time	Specifies *Job Response List* information with *Start Times* after, including the start time. If not specified then the responder selects the *Start Time*.
End Time	Specifies either *Job Response List* information with *End Times* before, including the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies *Job Response List* information with *Start Times* for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site, etc.). If not specified then the responder selects the *Hierarchy Scope*.

6.20 Workflow Specification model

6.20.1 Workflow Specification elements

The message definitions assume that *Workflow Specification* information may be accessed from two starting points, a *Workflow Specification* and a *Workflow Specification Type*, as identified by the dotted collection in Figure 32, in the overlay to the object model defined in IEC 62264-4 using the UML notation defined ISO/IEC 19501.
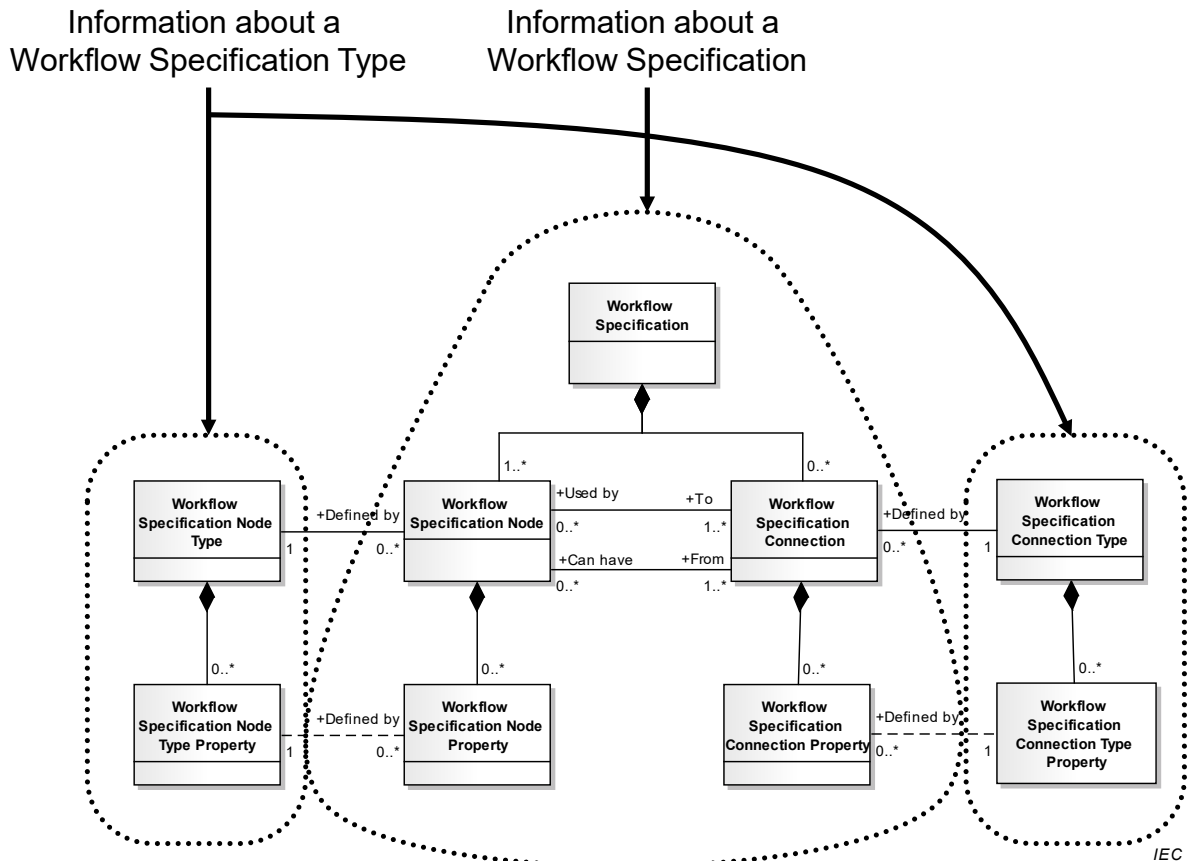
Figure 32 – Object grouping for the Workflow Specification model

6.20.2 Workflow Specification verbs

All verbs shall be valid for a *Workflow Specification* noun.

6.20.3　Workflow Specification verb actions

The actions performed on a *Workflow Specification* noun are defined in Table 53.

Table 53 – Workflow Specification verb actions

Workflow Specification ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of *Workflow Specification*. PROCESS: Shall define a request that the receiver is to add *Workflow Specification*. The message defines suggested IDs for the *Workflow Specification*, values for the attributes and subobjects. The receiver adds the *Workflow Specification* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Workflow Specification*. The assumption is the new *Workflow Specification* is the complete definition and that the previous *Workflow Specification* is canceled and the new *Workflow Specification* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Workflow Specifications*. SYNC ADD: Shall define a request that the receiver is to add the specified *Workflow Specifications*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Workflow Specifications*. The assumption is the new *Workflow Specification* is the complete definition and that the previous *Workflow Specification* is deleted and the new *Workflow Specification* is added SYNC DELETE: Shall define a request that the receiver is to delete the specified *Workflow Specifications*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Workflow Specifications* identified by the wildcard. PROCESS: Error. CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel all *Workflow Specifications* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete all *Workflow Specifications* matching the wildcard.

6.20.4　Workflow Specification Type

A *Workflow Specification Type* shall be defined as a collection of *Workflow Specification Node Types* and *Workflow Specification Connection Types*, with an attribute of ID, for purposes of supporting transactions.

6.20.5   Workflow Specification Type verbs

All verbs shall be valid for a *Workflow Specification Type* noun. A *Workflow Specification Type* is a combination of *Workflow Specification Node Types* and *Workflow Specification Connection Types*.

6.20.6   Workflow Specification Type verb actions

The actions performed on a *Workflow Specification Type* noun are defined in Table 54.

Table 54 – Workflow Specification Type verb actions

Workflow Specification Type ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects of a *Workflow Specification Type*. PROCESS: Shall define a request that the receiver is to add *Workflow Specification Type*. The message defines suggested IDs for the *Workflow Specification Type*, values for the attributes and subobjects. The receiver adds the *Workflow Specification Type* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Workflow Specification Type*. The assumption is the new *Workflow Specification Type* is the complete definition and that the previous *Workflow Specification Type* is canceled and the new *Workflow Specification Type* is added. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified *Workflow Specification Type*. SYNC ADD: Shall define a request that the receiver is to add the specified *Workflow Specification Type*, attributes and subobjects. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and subobjects of the *Workflow Specification Types*. The assumption is that the new *Workflow Specification Type* is the complete definition and that the previous *Workflow Specification Type* is deleted and the new *Workflow Specification* added. SYNC DELETE: Shall define a request that the receiver is to delete the specified *Workflow Specification Types*.
<not specified>	GET: Error. PROCESS: Error. CHANGE: Error. CANCEL: Error. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and subobjects about all *Workflow Specification Types* identified by the wildcard. PROCESS: Error. CHANGE: Error. CANCEL: Shall define a request that the receiver is to cancel all *Workflow Specification Types* matching the wildcard. SYNC ADD: Error. SYNC CHANGE: Error. SYNC DELETE: Shall define a request that the receiver is to delete all *Workflow Specification Types* matching the wildcard.

6.21   Transaction Profile

A *Transaction Profile* contains a definition of the verb and noun combinations supported by an application. The *Transaction Profile* provides a method for applications to query another application to determine the verb-noun combinations it supports. A *Transaction Profile* is itself a noun. Applications supporting this standard shall support use of the GET and SHOW verbs with *Transaction Profiles*. The objects for a *Transaction Profile* exchange are identified by the dotted collection in Figure 33, in the overlay to the object model using the UML notation defined ISO/IEC 19501.

NOTE   The *Transaction Profile* information can also be exchanged at application setup time. The mechanism for accomplishing the exchange at setup time is not defined in this part of IEC 62264.
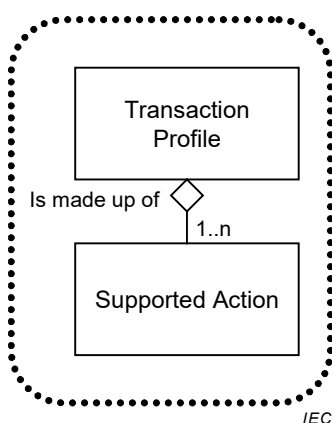
Figure 33 – Transaction Profile model

A *Transaction Profile* is a container object. A *Transaction Profile* is made up of 1 or more *Supported Actions*. Each *Supported Action* documents a single verb-noun combination supported by an application. Table 55 lists the attributes of a *Transaction Profile*.

Table 55 – Attributes of Transaction Profile

Attribute name	Description	Examples
ID	A unique identification of a *Transaction Profile*.	77262
Description	Optional description of the *Transaction Profile*.	From Ajax

Table 56 lists the attributes of a *Supported Action*.

Table 56 – Attributes of Supported Action

Attribute name	Description	Examples
ID	A unique identification of a *Supported Action*.	77262
Verb	Identifies the verb in the verb-noun action.	PROCESS
	Valid values are: GET, PROCESS, CHANGE, CANCEL, SYNC ADD, SYNC CHANGE, and SYNC DELETE.	SYNC ADD
Noun	Identifies the noun in the verb-noun action.	MATERIAL LOT
		OPERATIONS SCHEDULE
Information User	Indicates if the application can act as an information user.	TRUE
	NOTE This is defined for only GET and SYNC messages.	FALSE
Information Provider	Indicates if the application can act as an information provider.	TRUE
	NOTE This is defined for only GET and SYNC messages	FALSE
Information Sender	Indicates if the application can act as an information Sender.	TRUE
	NOTE This is defined for PROCESS, CHANGE, and CANCEL messages.	FALSE
Information Receiver	Indicates if the application can act as an information receiver.	TRUE
	NOTE This is defined for only PROCESS, CHANGE, and CANCEL messages	FALSE
Object Wildcards Supported	Indicates if wildcards are supported for object identification.	TRUE
		FALSE
Property Wildcards Supported	Indicates if wildcards are supported for property identification.	TRUE
	NOTE Wildcard properties are not defined for all verb-noun combinations.	FALSE

The GET verb shall be valid for a *Transaction Profile* noun.

Table 57 defines the action for each verb.

Table 57 – Transaction Profile verb actions

Verb	Action on object(s) specified
GET	Shall define a request that the receiver is to return, in a SHOW message, all supported verb/noun combinations and the attributes used to define the combinations.
PROCESS	Error
CHANGE	Error
CANCEL	Error
SYNC ADD	Error
SYNC CHANGE	Error
SYNC DELETE	Error

7   Completeness, compliance and conformance

7.1   Completeness

The number of transactions supported, as defined in Table 58, shall determine the degree of completeness of a specification or application.

7.2   Compliance

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

a) the use of the terminology defined in this part;

b) the use of the protocol for each supported transaction;

c) a statement of the degree to which the specification conforms partially or totally to definitions and transaction names.

In the event of partial compliance, areas of non-compliance shall be explicitly identified.

7.3   Conformance

Any assessment of the degree of conformance of an application shall be qualified by the following:

a) documentation of the transactions, as listed in Table 7 through Table 28,

b) documentation of the transaction rules conformed to.

In the event of partial conformance, areas of non-conformance shall be explicitly identified.

Suppliers of applications shall use Table 58 or an equivalent to document their supported transactions.

Suppliers of applications shall document if the application can perform the role of information user, if the application can perform the role of information provider, if the application can perform the role of information sender, and if the application can perform the role of information receiver.

Suppliers shall document their support for wildcards in the appropriate transactions.

Table 58 – Supported verb-noun actions

Verb Noun	GET, SHOW	PROCESS, ACKNOWL EDGE	CHANGE, RESPOND	CANCEL	SYNC ADD	SYNC CHANGE	SYNC DELETE
Personnel Class							
Person							
Qualification Test							
Equipment Class							
Equipment							
Capability Test							
Physical Asset Class							
Physical Asset							
Physical Asset Test							
Material Class							
Material Definition							
Material Lot							
Material Sublot							
Material Test							
Process Segment							
Operations Capability							
Operations Definition							
Operations Schedule							
Operations Performance							
Resource Relationship Network							
Work Definition							
Work Specification							
Work Schedule							
Work Performance							
Work Capability							
Work Alerts							
Work Calendar Definition							
Work Calendar							
Work Record							
Job List							
Job Response							
Transaction Profile							

NOTE   The rows in Table 58 indicate related sets of nouns. It is likely that applications that support one noun in a set will support the other nouns in the set.

EXAMPLE   Table 59 is an example of a hypothetical vendor offering that supports exchanges about material information. The example application can act as user or provider of the data for PUSH and PULL transactions but only as a user (subscriber) for PUBLISH transactions.

Table 59 – Vendor conformance example

Verb \\ Noun	GET, SHOW	PROCESS, ACKNOWLEDGE	CHANGE, RESPOND	CANCEL	SYNC ADD	SYNC CHANGE	SYNC DELETE
Material Class	User, Provider, Object wildcard, Property wildcard	Sender, Receiver	Sender, Receiver, Object wildcard, Property wildcard	Sender, Receiver, Object wildcard, Property wildcard	User	User	User
Material Definition	User, Provider, Object wildcard, Property wildcard	Sender, Receiver	Sender, Receiver, Object wildcard, Property wildcard	Sender, Receiver, Object wildcard, Property wildcard	User	User	User
Material Lot	User, Provider, Object wildcard, Property wildcard	Sender, Receiver	Sender, Receiver, Object wildcard, Property wildcard	Sender, Receiver, Object wildcard, Property wildcard	User	User	User
Material Sublot	User, Provider, Object wildcard, Property wildcard	Sender, Receiver	Sender, Receiver, Object wildcard, Property wildcard	Sender, Receiver, Object wildcard, Property wildcard	User	User	User
Material Test	User, Provider, Object wildcard, Property wildcard	Sender, Receiver	Sender, Receiver, Object wildcard, Property wildcard	Sender, Receiver, Object wildcard, Property wildcard	User	User	User
Transaction Profile	Provider						

Annex A
(informative)

Production operations transactions

A.1   Product Definition model

A.1.1   Product Definition model elements

The message definitions assume that *Product Definition* information may be accessed from one starting point, a *Product Definition*, as identified by the dotted collection in Figure A.1.

Figure A.1 – Object grouping for the Product Definition model

A.1.2   Product Definition verbs

All verbs shall be valid for a *Product Definition* noun.

NOTE   A *Product Definition* contains a listing of the exchanged information about a product. The information is used in a set of *Product Segments*. A *Product Definition* has a reference to a bill of materials, a product production rule, and a bill of resources. It contains the manufacturing bill and the product segment definitions.

A.1.3   Product Definition verb actions

The actions performed on a *Product Definition* noun are defined in Table A.1.

Table A.1 – Product Definition verb actions

Product Definition ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Product Definitions*.
	PROCESS: Shall define a request that the receiver is to add *Product Definitions*. The message defines suggested IDs for the *Product Definitions* and values for the attributes and contained elements. The receiver adds the *Product Definitions* and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.
	CHANGE: Shall define a request that the receiver is to change the specified attributes and/or contained elements of the *Product Definitions*. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel the specified *Product Definitions*. If contained elements IDs are specified, then only the specified contained elements for the specified *Product Definitions* are to be canceled, not the *Product Definitions*.
	SYNC ADD: Shall define a request that the receiver is to add the specified *Product Definitions* with contained elements.
	SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and/or contained elements of the *Product Definitions*.
	SYNC DELETE: Shall define a request that the receiver is to delete the specified *Product Definitions*.
<not specified>	GET: Error.
	PROCESS: Error.
	CHANGE: Error.
	CANCEL: Error.
	SYNC ADD: Error.
	SYNC CHANGE: Error.
	SYNC DELETE: Error.
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Product Definitions* matching the ID wildcard.
	EXAMPLE To return all *Product Definitions*, a "*" can be specified as the wildcard.
	PROCESS: Error.
	CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of all *Product Definitions* matching the ID wildcard. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	CANCEL: Shall define a request that the receiver is to cancel all *Product Definitions* matching the ID wildcard.
	SYNC ADD: Error.
	SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and/or contained elements of all *Product Definitions* matching the ID wildcard.
	SYNC DELETE: Shall define a request that the receiver is to delete all *Product Definitions* matching the ID wildcard.

A.2   Production Schedule model

A.2.1   Production Schedule model elements

The message definitions assume that *Production Schedule* information may be accessed from one starting point, a *Production Schedule*, as identified by the dotted collection in Figure A.2.
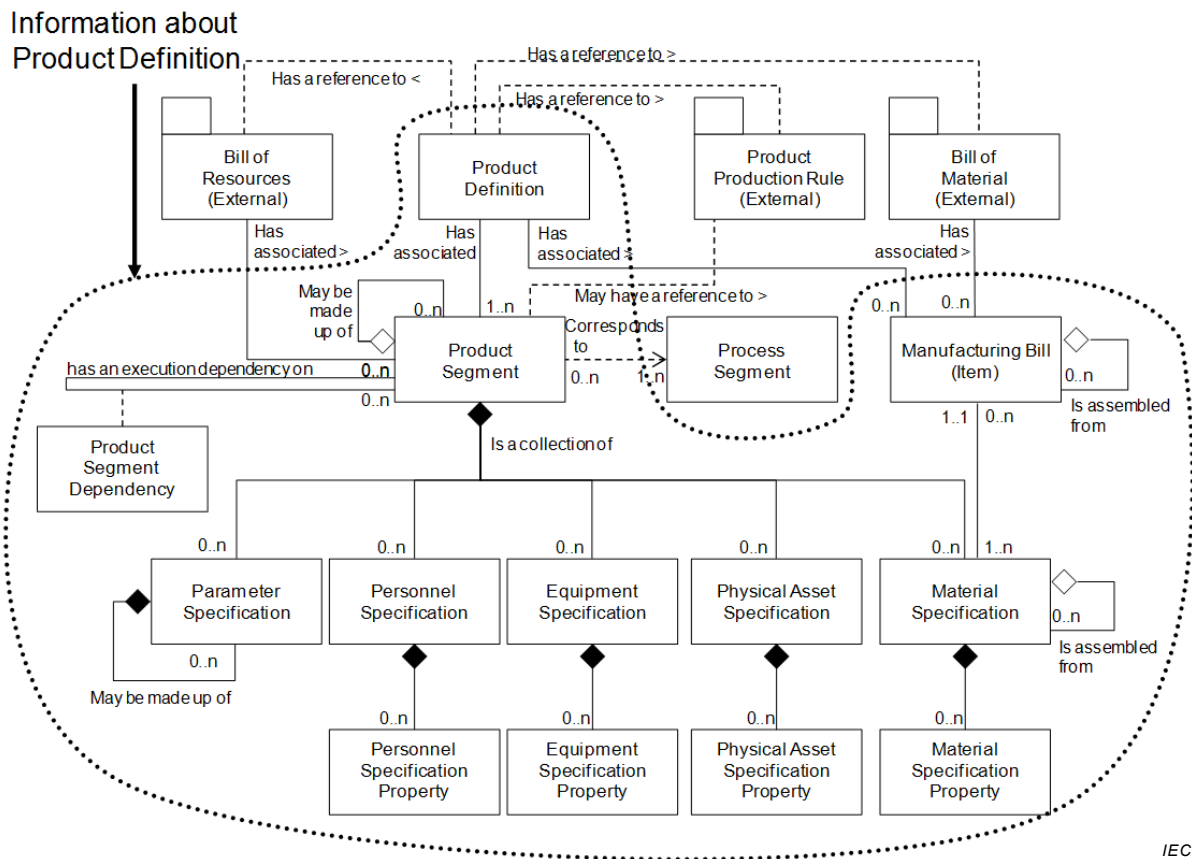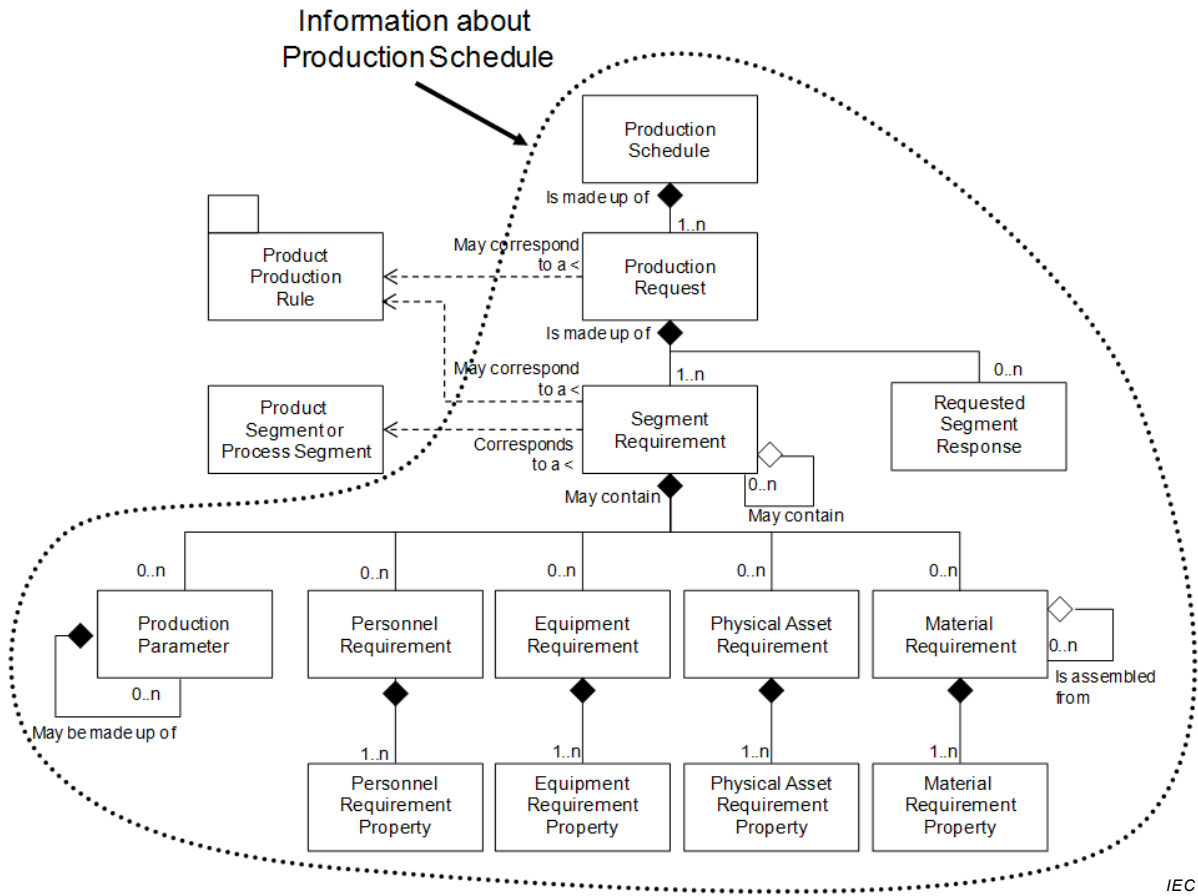
Figure A.2 – Object grouping for the Production Schedule model

A.2.2   Production Schedule verbs

All verbs shall be valid for a *Production Schedule* noun.

NOTE   A *Production Schedule* contains a set of *Production Requests*, each request specifying production of a main product. The presumption is that a Level 4 function is the provider of the *Production Schedule* information.

Specifying the information to be returned from a GET may involve values in multiple fields. Each field definition restricts the returned information.

A.2.3   Production Schedule verb actions

The actions performed on a *Production Schedule* noun are defined in Table A.2.

Table A.2 – Production Schedule verb actions

Production Schedule ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Production Schedules* that match the IDs. PROCESS: Shall define a request that the receiver is to add new *Production Schedules*. Any assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Production Schedules* that match the IDs. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. EXAMPLE 1 A CHANGE can define a changed *Production Schedule* due to line slowdown or personnel unavailability. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Production Schedules* that match the IDs. If contained elements IDs are specified, then only the specified contained elements for the specified *Production Schedule* are to be cancelled, not the *Production Schedule*. EXAMPLE 2 A CANCEL can define a removed *Production Schedule* due to line shutdown or personnel reassignment SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of the *Production Schedules*. EXAMPLE 3 A SYNC ADD sent every day can define *Production Schedules* for the next day. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Production Schedules* that match the IDs. EXAMPLE 4 A SYNC CHANGE can change a *Production Schedule* due to line slowdown or personnel unavailability. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of the *Production Schedules* that match the IDs. EXAMPLE 5 A SYNC DELETE can define a removed *Production Schedule* due to line shutdown or personnel reassignment.
<not specified>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Production Schedules* based on the information specified in the GET message. See Table A.3 for details. PROCESS: Shall define a request that the receiver is to add new *Production Schedules*. Any assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Production Schedules* based on the information specified in the CHANGE message. See Table A.3 for details. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Production Schedules* based on the information specified in the CANCEL message. See Table A.3 for details. If contained elements IDs are specified, then only the specified contained elements for the specified *Production Schedule* are to be cancelled, not the *Production Schedule*. SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of the *Production Schedules* based on the information specified in the SYNC message. See Table A.3 for details. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Production Schedules* based on the information specified in the SYNC message. See Table A.3 for details. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of the *Production Schedules* based on the information specified in the SYNC message. See Table A.3 for details.

Production Schedule ID	Verb action on noun
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Production Schedules* that match the wildcard. PROCESS: Error CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Production Schedules* that match the wildcard. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Production Schedules* that match the wildcard. If contained elements IDs are specified, then only the specified contained elements for the specified *Production Schedule* are to be cancelled, not the *Production Schedule.* SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of the *Production Schedules* that match the wildcard. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of the *Production Schedules* that match the wildcard. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of the *Production Schedules* that match the wildcard.

The meanings of *Production Schedule* elements for a GET verb are defined in Table A.3.

Table A.3 – Production Schedule element definitions for GET verb

Production Schedule Element	Returns
Start Time	Specifies the *Production Schedule* information for times after, including the start time. Should be specified in the GET, otherwise the responder selects the *Start Time*.
End Time	Specifies the *Production Schedule* information for times before, including the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies the *Production Schedule* information for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site, etc.). If not specified then the responder selects the *Hierarchy Scope*.
Production Segment / Product Production Rule	Specifies one or more product segments and the *Product Production Rule* identifying the product, and returns the schedules for the specified products.

A.3 Production Performance model

A.3.1 Production Performance model elements

The message definitions assume that *Production Performance* information may be accessed from one starting point, a *Production Performance*, as identified by the dotted collection in Figure A.3.
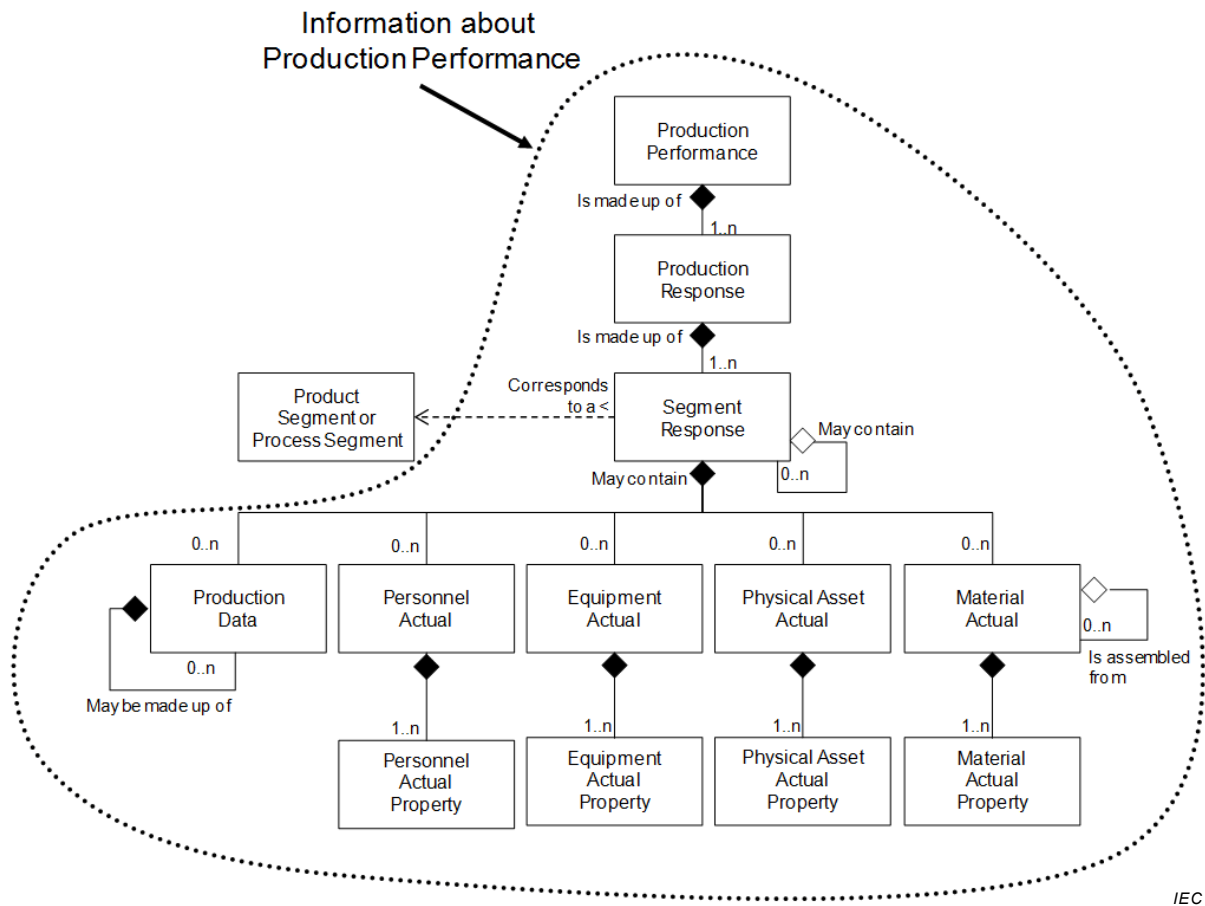
Figure A.3 – Object grouping for the Production Performance model

A.3.2 Production Performance verbs

All verbs shall be valid for a *Production Performance* noun.

NOTE 1   A *Production Performance* contains a set of *Production Responses*. *Production Responses* contain the items reported back to the business system, at the end of production or during production. The presumption is that a Level 3 function is the owner of the *Production Performance* information.

NOTE 2   *Production Performance* is a snapshot, in time, of production.

Specifying the information to be returned from a GET may involve values in multiple fields. Each field definition restricts the returned information.

A.3.3 Production Performance verb actions

The actions performed on a *Production Performance* noun are defined in Table A.4.

Table A.4 – Production Performance verb actions

Production Performance ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Production Performances* that match the IDs. PROCESS: Shall define a request that the receiver is to add new *Production Performances*. Any assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Production Performances* that match the IDs. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. EXAMPLE 1 A CHANGE can define a changed *Production Performance* due to late results or recalculation of material use. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of *Production Performances* that match the IDs. If contained elements IDs are specified, then only the specified contained elements for the specified *Production Performance* are to be cancelled, not the *Production Performance*. EXAMPLE 2 A CANCEL can define a removed *Production Performances* due to incorrectly collected use and production information, or information sent before it was verified. SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of *Production Performances*. EXAMPLE 3 A SYNC ADD sent every day can define *Production Performance* for the previous day. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Production Performances* that match the IDs. EXAMPLE 4 A SYNC CHANGE can change a *Production Performance* due to incorrectly collected use and production information, or information sent before it was verified. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Production Performances* that match the IDs.
<not specified>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of *Production Performances* based on the information specified in the GET message. See Table A.5 for details. PROCESS: Shall define a request that the receiver is to add New *Production Performances* based on the information specified in the GET message. See Table A.5 for details. Any assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Production Performances* based on the information specified in the GET message. See Table A.5 for details. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of *Production Performances* based on the information specified in the CANCEL message. See Table A.5 for details. If contained elements IDs are specified, then only the specified contained elements for the specified *Production Performance* are to be cancelled, not the *Production Performance*. SYNC ADD: Shall define a request that the receiver is to add the specified attributes and contained elements of *Production Performances* based on the information specified in the SYNC message. See Table A.5 for details. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Production Performances* based on the information specified in the SYNC message. See Table A.5 for details. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Production Performances* based on the information specified in the SYNC message. See Table A.5 for details.

Production Performance ID	Verb action on noun
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Production Performances* that match the wildcard. PROCESS: Error. CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Production Performances* that match the wildcard. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of *Production Performances* that match the wildcard. If contained elements IDs are specified, then only the specified contained elements for the specified *Production Performance* are to be cancelled, not the *Production Performance*. SYNC ADD: Error. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Production Performances* that match the wildcard. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Production Performances* that match the wildcard.

Table A.5 – Production Performance definitions for GET verb

Production Performance Element	Returns
Start Time	Specifies *Production Performance* information for times after, and including the start time. Should be specified in the GET, otherwise the responder selects the *Start Time*.
End Time	Specifies *Production Performance* information for times before, and including, the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies *Production Performance* information for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site, etc.). If not specified then the responder selects the *Hierarchy Scope*.
Production Performance / Production Schedule ID	Specifies the *Production Performance* information associated with the specified Production Schedule.
Production Performance / Production Response / Production Request ID	Specifies the *Production Performance* information associated with the specified production request.
Production Performance / Production Response / Product Production Rule ID	Specifies the *Production Performance* information associated with the specified product production rule.
Production Performance / Production Response / Segment Response / Process Segment ID	Specifies the *Production Performance* information associated with the specified Process Segment.
Production Performance / Production Response / Segment Response / Product Segment ID	Specifies the *Production Performance* information associated with the specified product segment.

A.4   Production Capability model

A.4.1   Production Capability model elements

The message definitions assume that *Production Capability* information may be accessed from one starting point, a *Production Capability*, as identified by the dotted collection in Figure A.4.
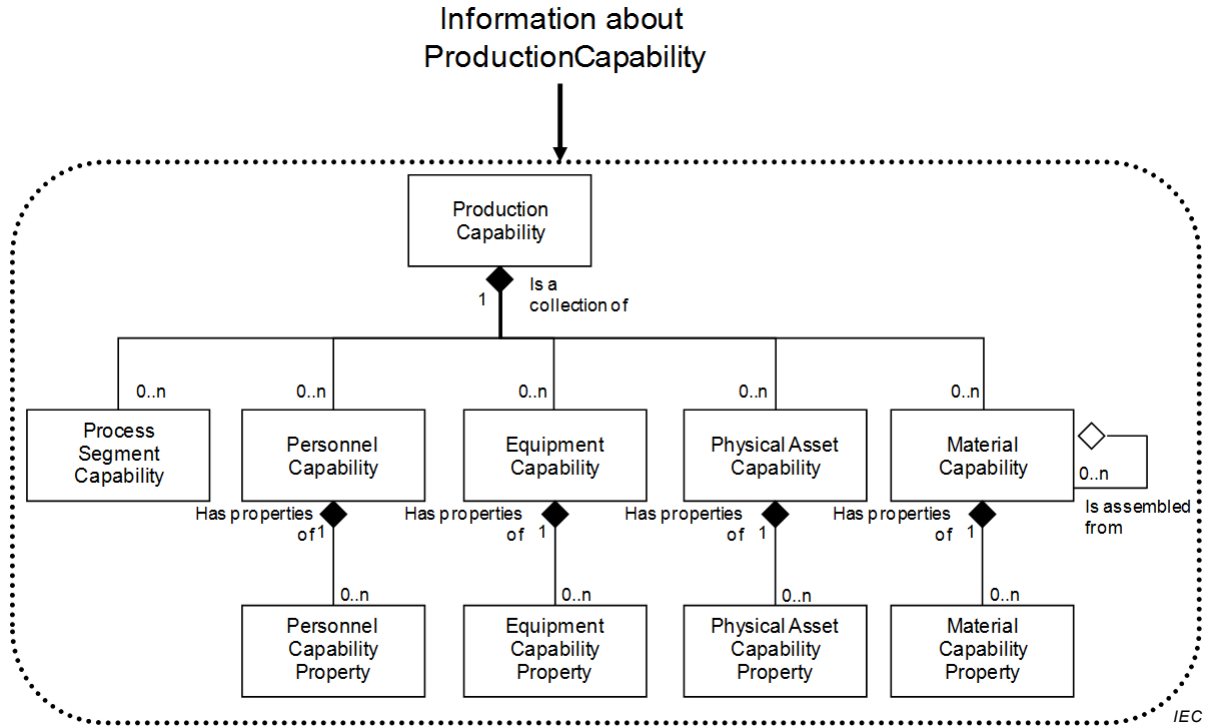
Figure A.4 – Object grouping for the Production Capability model

A.4.2   Production Capability verbs

All verbs shall be valid for a *Production Capability* noun.

NOTE 1   The *Production Capability* information is the collection of information about all production resources for selected timeframes. This is made up of information about equipment, material, personnel, and *Process Segments*. It describes the names, terms, statuses, and quantities of which the manufacturing control system has knowledge. The presumption is that a Level 3 function is the owner of the *Production Capability* information.

NOTE 2   The *Production Capability* model is hierarchical with production capabilities containing *Process Segment* capabilities and personnel, equipment, and material capability information.

NOTE 3   *Production Capability* is a snapshot in time of the available, unattainable, or committed capability.

Specifying the information to be returned from a GET may involve values in multiple fields. Each field definition restricts the returned information.

A.4.3   Production Capability verb actions

The actions performed on a *Production Capability* noun are defined in Table A.6.

Table A.6 – Production Capability verb actions

Production Capability ID	Verb action on noun
IDs specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the *Production Capabilities* that matches the IDs. PROCESS: Shall define a request that the receiver is to add new *Production Capabilities*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Production Capabilities*. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. EXAMPLE 1 A CHANGE can define an updated *Production Capability* due to line slowdown or personnel unavailability. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Production Capabilities*. If contained elements IDs are specified, then only the specified contained elements for the specified *Production Capability* are to be cancelled, not the *Production Capability*. EXAMPLE 2 A CANCEL can define a removed process capability due to line shutdown or personnel reassignment. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Production Capabilities*. EXAMPLE 3 A SYNC ADD sent every day can define Production Capability for the next day. SYNC CHANGE: Shall define a request that the receiver is to change the specified attributes and contained elements of *Production Capabilities*. EXAMPLE 4 A SYNC CHANGE can define a new *Production Capability* due to line slowdown or personnel unavailability. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Production Capabilities*. EXAMPLE 5 A SYNC DELETE can define a removed process capability due to line shutdown or personnel reassignment.
<not specified>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of a *Production Capabilities* identified by the information specified in the GET message. See Table A.7 for details. PROCESS: Shall define a request that the receiver is to add new *Production Capabilities*. Any assigned IDs are returned in the ACKNOWLEDGE message. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Production Capabilities* identified by the information specified in the CHANGE message. See Table A.7 for details. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Production Capabilities* identified by the information specified in the CANCEL message. See Table A.7 for details. If contained elements IDs are specified, then only the specified contained elements for the specified *Production Capability* are to be cancelled, not the *Production Capability*. SYNC ADD: Shall define a request that the receiver is to define the specified attributes and contained elements of *Production Capabilities* identified by the information specified in the SYNC message. See Table A.7 for details. SYNC CHANGE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Production Capabilities* identified by the information specified in the SYNC message. See Table A.7 for details. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Production Capabilities* identified by the information specified in the SYNC message. See Table A.7 for details.

Production Capability ID	Verb action on noun
Wildcard specified	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all *Production Capabilities* that match the wildcard. PROCESS: Error. CHANGE: Shall define a request that the receiver is to change specified attributes and contained elements of the *Production Capabilities* that match the wildcard. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data. CANCEL: Shall define a request that the receiver is to cancel the specified attributes and contained elements of the *Production Capabilities* that match the wildcard. If contained elements IDs are specified, then only the specified contained elements for the specified *Production Capability* are to be cancelled, not the *Production Capability*. SYNC ADD: Error. SYNC CHANGE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Production Capabilities* that match the wildcard. SYNC DELETE: Shall define a request that the receiver is to delete the specified attributes and contained elements of *Production Capabilities* that match the wildcard.

Table A.7 – Production Capability element definitions for GET verb

Production Capability Element	Returns
Start Time	Specifies *Production Capability* information for times after, including the start time. If not specified then the responder selects the *Start Time*.
End Time	Specifies *Production Capability* information for times before, including the end time. If not specified then the responder selects the *End Time*.
Hierarchy Scope	Specifies *Production Capability* information for the specified scope in the role based equipment hierarchy (e.g. a process cell, work center, production line, area, site, etc.). If not specified then the responder selects the *Hierarchy Scope*.
Capability Type	Specifies the type of *Production Capability* information to be returned. If not specified, then the responder selects the *Capability Type* information returned.
Personnel Capability / Personnel Class ID	May specify a wildcard or a *Personnel Class* ID. If included, then it specifies the personnel class(es) for the returned *Personnel Capability*.
Personnel Capability / Person ID	May specify a wildcard or a *Person* ID. If included, then it specifies the person(s) for the returned *Personnel Capability*.
Equipment Capability / Equipment Class ID	May specify a wildcard or an *Equipment Class* ID. If included, then it specifies the equipment class(es) for the returned *Equipment Capability*.
Equipment Capability / Equipment ID	May specify a wildcard or an *Equipment* ID. If included, then it specifies the equipment for the returned *Equipment Capability*.
Material Capability / Material Class ID	May specify a wildcard or a *Material Class* ID. If included, then it specifies the *Material Class(es)* for the returned *Material Capability*.
Material Capability / Material Definition ID	May specify a wildcard or a *Material Definition* ID. If included, then it specifies the *Material Definitions(s)* for the returned *Material Capability*.
Material Capability / Material Lot ID	May specify a wildcard or a *Material Lot* ID. If included, then it specifies the *Material Lot(s)* for the returned *Material Capability*.
Material Capability / Material SubLot ID	May specify a wildcard or a *Material Sublot* ID. If included, then it specifies the *Material Sublot(s)* for the returned *Material Capability*.
Process Segment Capability ID	May contain a wildcard or a *Process Segment* ID. If included, then it specifies that *Process Segment Capability* should only be returned for the specified *Process Segment*.
Process Segment Capability / Personnel Capability / Personnel Class ID	May specify a wildcard or a *Personnel Class* ID. If included, then it specifies the *Personnel class(es)* for the returned *Process Segment / Personnel Capability*.
Process Segment Capability / Personnel Capability / Person ID	May specify a wildcard or a *Person* ID. If included, then it specifies the person(s) for the returned *Process Segment / Personnel Capability*.

Production Capability Element	Returns
Process Segment Capability / Equipment Capability / Equipment Class ID	May specify a wildcard or an *Equipment Class* ID. If included, then it specifies the equipment class(es) for the returned *Process Segment / Equipment Capability*.
Process Segment Capability / Equipment Capability / Equipment ID	May specify a wildcard or an *Equipment* ID. If included, then it specifies the equipment for the returned *Equipment Capability*.
Process Segment Capability / Material Capability / Material Class ID	May specify a wildcard or a *Material Class* ID. If included, then it specifies the *Material Class(es)* for the returned *Process Segment / Material Capability*.
Process Segment Capability / Material Capability / Material Definition ID	May specify a wildcard or a *Material Definition* ID. If included, then it specifies the *Material Definitions(s)* for the returned *Process Segment / Material Capability*.
Process Segment Capability / Material Capability / Material Lot ID	May specify a wildcard or a *Material Lot* ID. If included, then it specifies the *Material Lot(s)* for the returned *Process Segment / Material Capability*.
Process Segment Capability / Material Capability / Material Lot ID	May specify a wildcard or a *Material Sublot* ID. If included, then it specifies the *Material Sublot(s)* for the returned *Process Segment / Material Capability*.

Annex B
(informative)

Transaction models and business scenario examples

B.1 Coordinating activities

Figure B.1 shows a typical set of correlated transactions to coordinate activities for production planning and scheduling and manufacturing operations that may be implemented using various transactions defined in this part of IEC 62264.
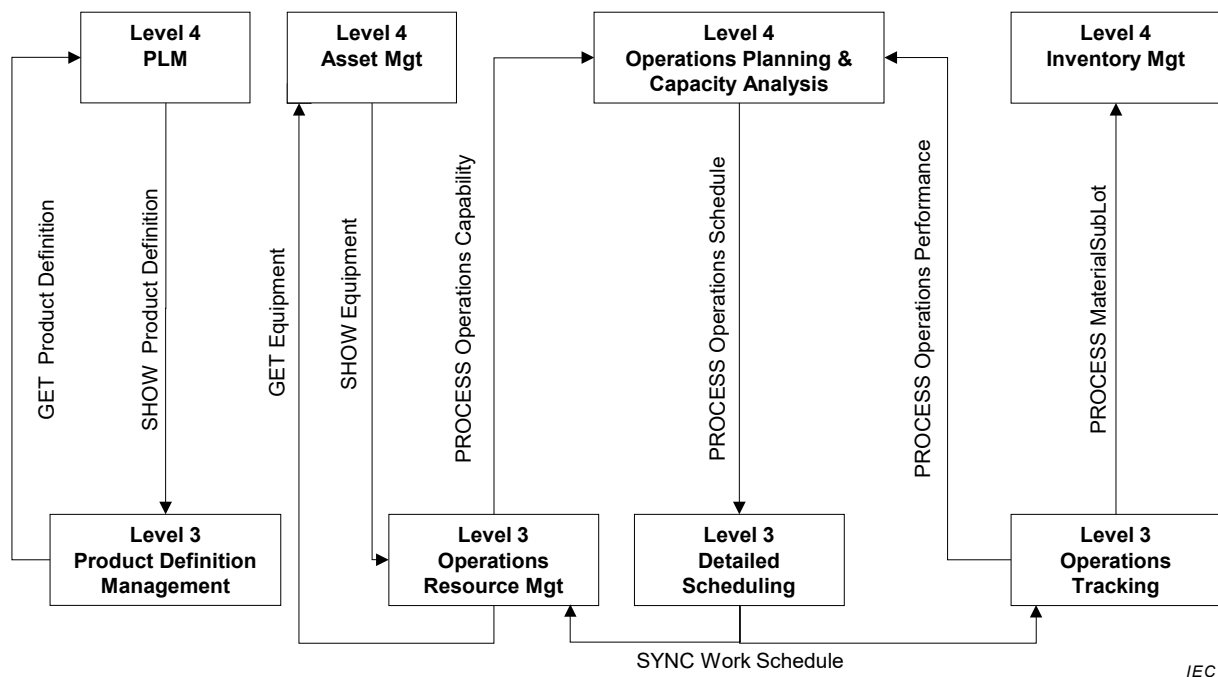

Figure B.1 – Coordinating planning and operations processes

Business process assumptions:

a) *Master Product Definition* information is contained in a Level 4 PLM (*Product Lifecycle Management*) application.

b) Level 3 *Production Definition Management* obtains current routing / recipe information from the PLM application by using a *GET Production Definition / SHOW Production Definition* transaction set.

c) Master equipment information is contained in a Level 4 *Asset Management* application.

d) Level 3 *Production Resource Management* obtains equipment information from the asset management application using a *GET Equipment / SHOW Equipment* transactions set.

e) A Level 4 application manages *Production Planning* and *Capacity Analysis* activities.

f) Level 3 *Production Resource Management* manages *Production Capability* information.

g) Level 3 *Production Resource Management* pushes *Production Capability* information to the Level 4 Production Planning and Capacity Analysis application.

h) The Level 4 *Production Planning* and *Capacity Analysis* application pushes the *Production Schedule* information to Level 3 *Detailed Scheduling* using a *PROCESS Production Schedule* transaction.

i) Level 3 *Production Tracking* pushes *Production Performance* information (material produced and resources used) to *Production Planning* and *Capacity Analysis* using a

> *PROCESS Production Performance* transaction and pushes *Material Sublot* information to a Level 4 *Inventory Management* application using a *PROCESS Material Sublot* transaction.

j) The Level 3 *Detailed Scheduling* application publishes *Work Schedules* that are used in Level 3 resource management and tracking applications.

B.2   Usage scenarios

Clauses B.3 to B.9 define typical usage scenarios that could be implemented using the transactions defined in this part of IEC 62264. The scenarios are based on the coordinating processes model of Clause B.1. The scenarios combine a set of transactions.

Enterprise Resource Planning (ERP) represents a typical Level 4 business system in these scenarios. Manufacturing Operations Management (MOM) represents a typical Level 3 manufacturing system. The arrows indicate a message between the applications.

B.3   Operations Schedule and Operations Performance

B.3.1   Push model

A push model scenario is shown in Figure B.2. The scenario assumptions are:

a) ERP pushes an *Operations Schedule* to MOM for processing when schedules are released.

b) MOM pushes an *Operations Performance* to ERP for processing as work is completed.
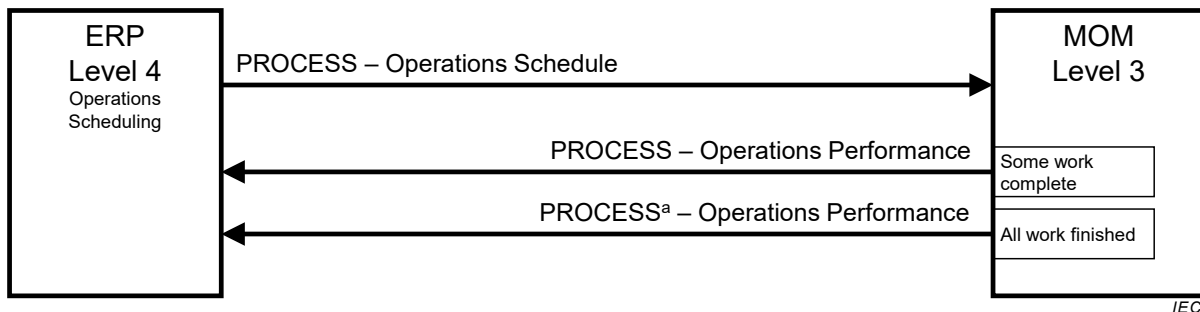
a The last *PROCESS Operations Performance* message contains a flag to indicate that the message is the final *Operations Performance* for the associated *Operations Schedule*.

Figure B.2 – Push model: Operations Schedule and Operations Performance

B.3.2   Pull model

A pull model scenario is shown in Figure B.3. The scenario assumptions are:

a) MOM requests *Operations Schedules* from ERP on a regular schedule.

b) ERP requests *Operations Performance* from MOM on a regular schedule.

a   The GET *Operations Performance* message contains an identification of an *Operations Schedule* (*Operations Performance / Operations Schedule ID*).
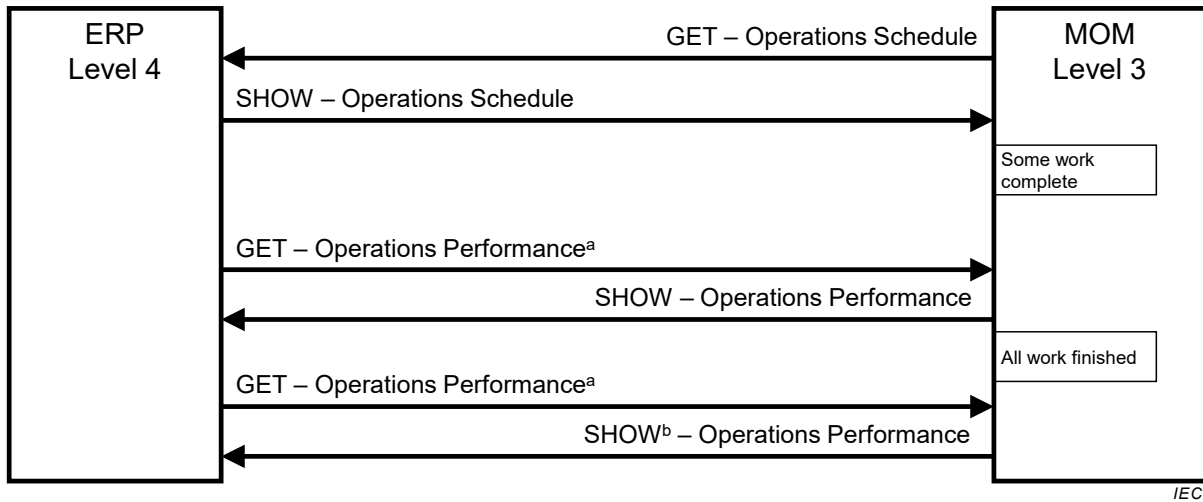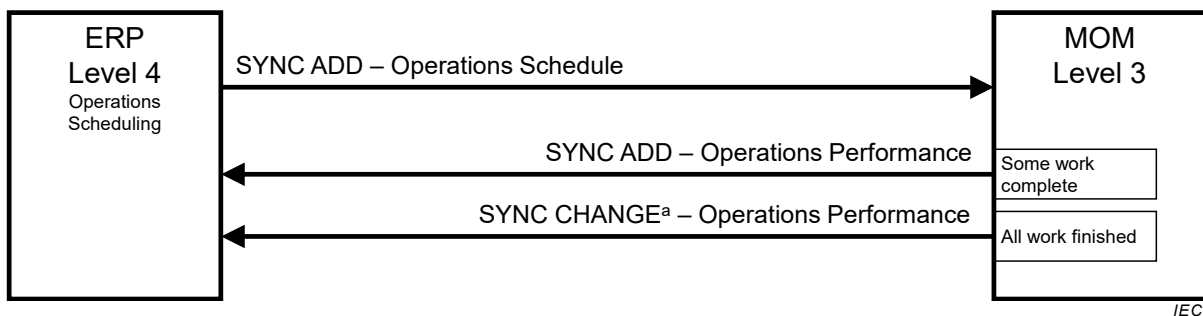
b   The last *SHOW Operations Performance* message contains a flag to indicate that the message is the final *Operations Performance* for the associated *Operations Schedule*.

Figure B.3 – Pull model: Operations Schedule and Operations Performance

B.3.3   Publish model

A publish model scenario is shown in Figure B.4. The scenario assumptions are:

a) MOM subscribes to *Operations Schedules*.

b) ERP subscribes to *Operations Performances*.

c) ERP publishes an *Operations Schedule*.

d) MOM publishes an initial *Operations Performance* with a SYNC ADD message.

e) MOM publishes subsequent *Operations Performances* for the schedule with SYNC CHANGE messages.

a   The last SYNC CHANGE message contains a flag to indicate that the message is the final *Operations Performance* for the associated *Operations Schedule*.

Figure B.4 – Publish model: Operations Schedule and Operations Performance

B.4   Operations Schedule changes

B.4.1   Push model

A push model scenario is shown in Figure B.5. The scenario assumptions are:

a) ERP sends an *Operations Schedule* to MOM for processing.

b) MOM sends an *Operations Performance* to ERP for processing.

c) ERP makes change to the schedule and sends to MOM for processing.

a The last PROCESS *Operations Performance* message contains a flag to indicate that the message is the final *Operations Performance* for the associated *Operations Schedule.*

Figure B.5 – Push model: Operations Schedule changes

B.4.2   Publish model

A publish model scenario is shown in Figure B.6. The scenario assumptions are:

a) MOM subscribes to *Operations Schedules*.

b) ERP subscribes to *Operations Performances*.

c) ERP publishes an *Operations Schedule*.

d) MOM publishes an initial *Operations Performance* with a SYNC ADD message.

e) ERP changes the schedule and republishes with SYNC CHANGE.

f) MOM publishes subsequent *Operations Performances* for the schedule with SYNC CHANGE messages.

a The last SYNC CHANGE message contains a flag to indicate that the message is the final *Operations Performance* for the associated *Operations Schedule*.
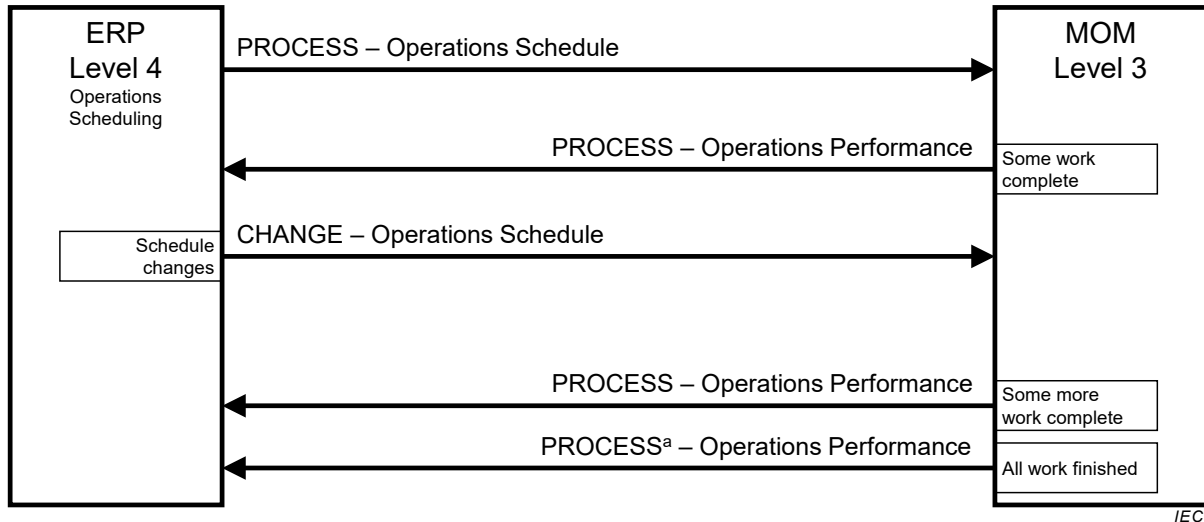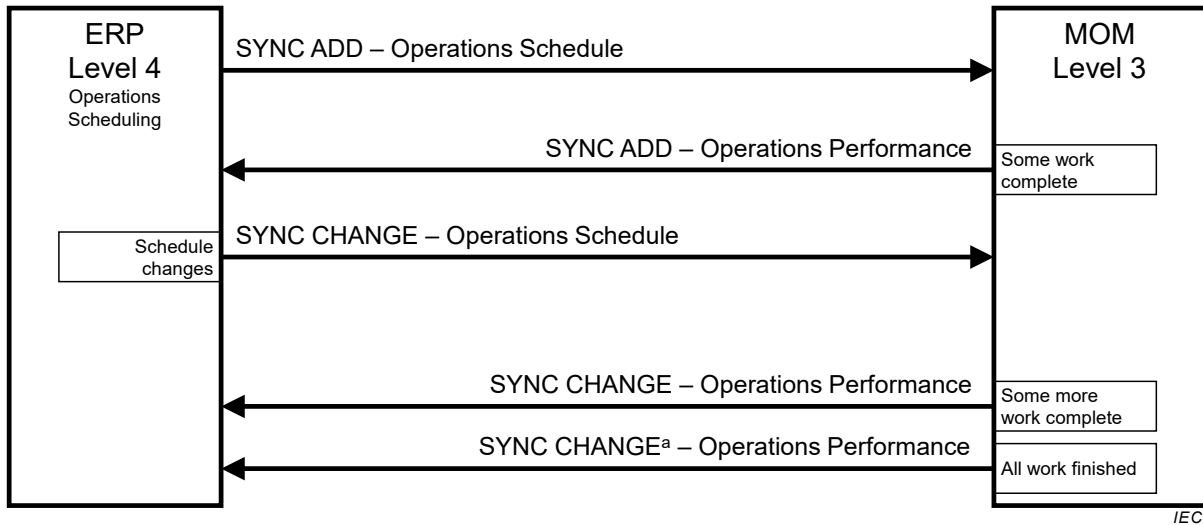
Figure B.6 – Publish model: With schedule changes

B.5 Operations Schedule cancelled

B.5.1 Push model

A push model scenario is shown in Figure B.7. The scenario assumptions are:

a) ERP sends an *Operations Schedule* to MOM for processing.

b) ERP cancels the schedule before actual operations start, and sends CANCEL of schedule to MOM.
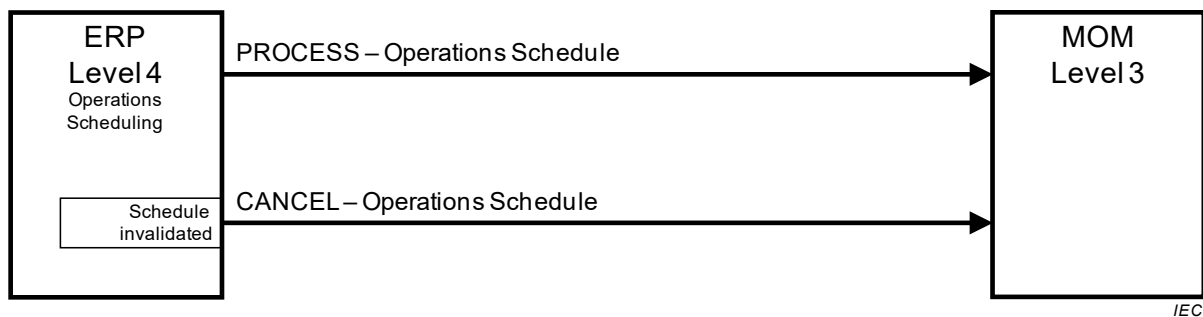
Figure B.7 – Push model: Operations Schedule cancelled

B.5.2 Push and pull model

A combined push and pull model scenario is shown in Figure B.8. The scenario assumptions are:

a) MOM requests an *Operations Schedule* from ERP.

b) ERP cancels the schedule before actual operations start, and sends CANCEL of schedule to MOM.
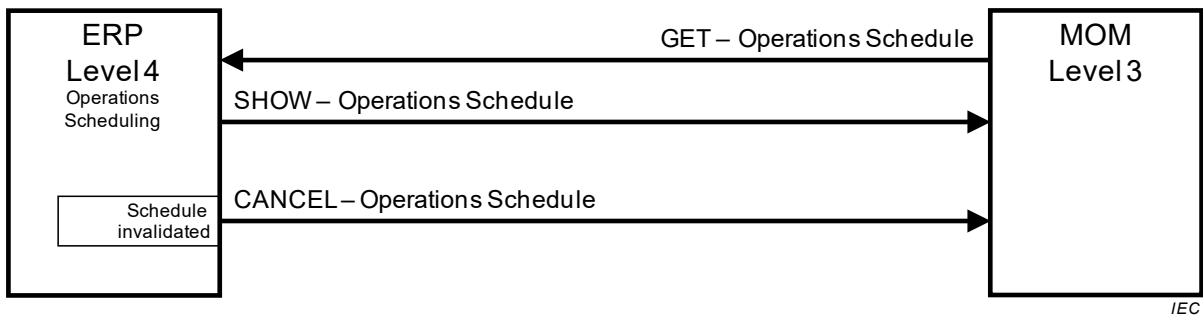
Figure B.8 – Push and pull model: Schedule cancelled

B.6   Daily Operations Performance

B.6.1   Push model

A push model of daily operations is shown in Figure B.9. The scenario assumptions are:

a) MOM sends daily *Operations Performance* to ERP.

b) The scope of the *Operations Performance* (which production lines, etc…) and timing of the publication (daily, weekly, time published) are not defined in a message. It is determined in an out-of-band agreement.
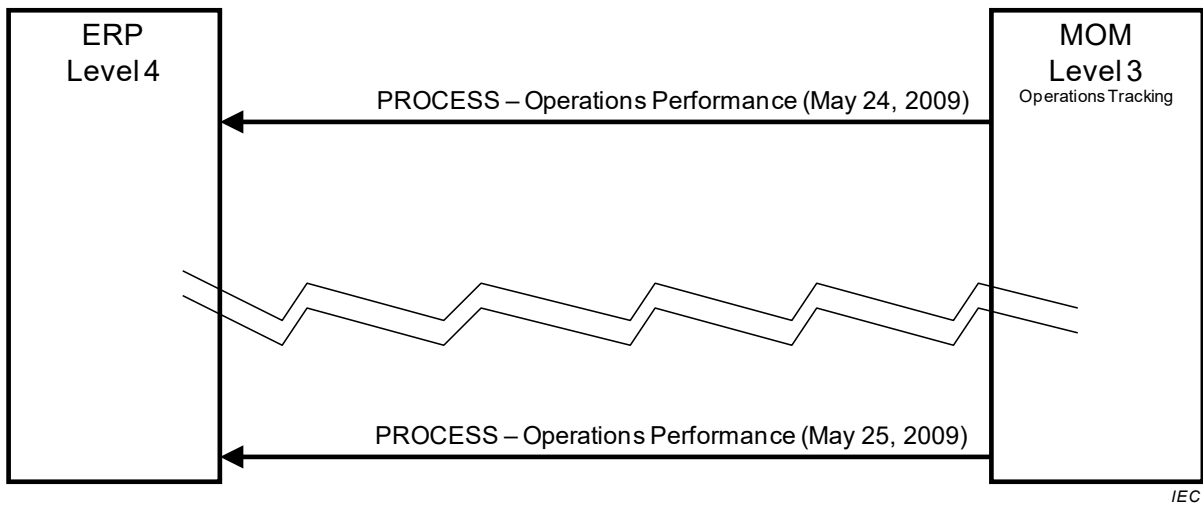
Figure B.9 – Push model: Daily Operations Performance

B.6.2   Pull model

A pull model scenario of daily operations is shown in Figure B.10. The scenario assumptions are:

a) ERP requests *Operations Performance* from MOM on a daily schedule.
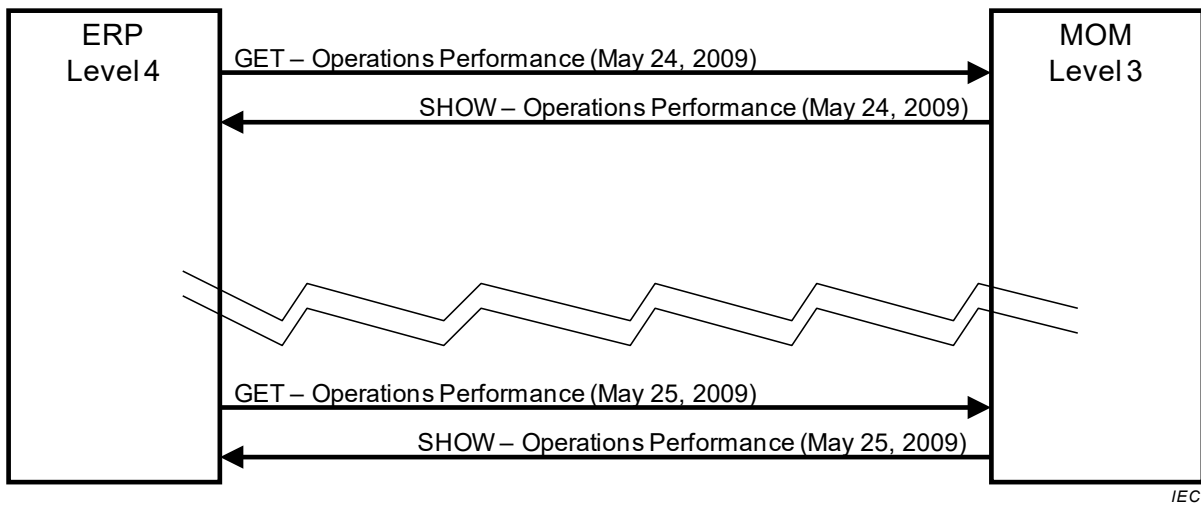
Figure B.10 – Pull model: Daily Operations Performance

B.6.3 Publish model

A publish model scenario of daily operations is shown in Figure B.11. The scenario assumptions are:

a) ERP subscribes to daily *Operations Performance* from MOM.

b) MOM publishes daily *Operations Performance*.

c) The scope of *Operations Performance* (which production lines, etc...) and timing of the publication (daily, weekly, time published) are not defined in a message. It is determined in an out-of-band agreement.
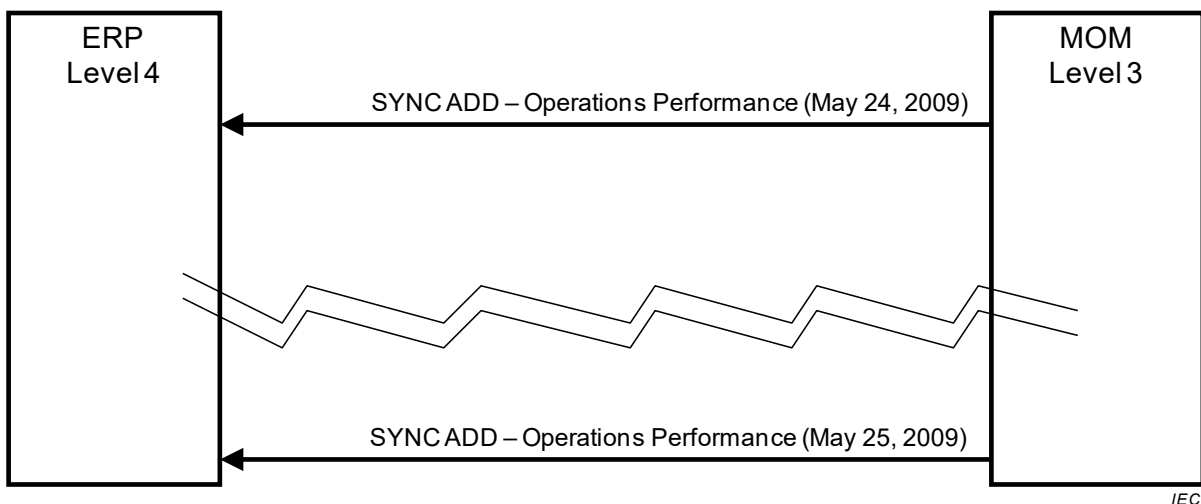
Figure B.11 – Publish model: Daily Operations Schedule

B.7 Operations Schedule based on Operations Capability

B.7.1 Pull and push model

A combined push and pull model scenario of daily operations is shown in Figure B.12. The scenario assumptions are:

a) ERP requests an *Operations Capability* for the planning period.

b) MOM responds with an *Operations Capability* to ERP.

c) ERP sends an *Operations Schedule* to MOM for processing.

d) MOM sends an *Operations Performance* to ERP reflecting the first part of partial order completion.

e) MOM sends an *Operations Performance* to ERP reflecting the second part of partial order completion.

f) MOM sends an *Operations Performance* to ERP reflecting the last part of the order.
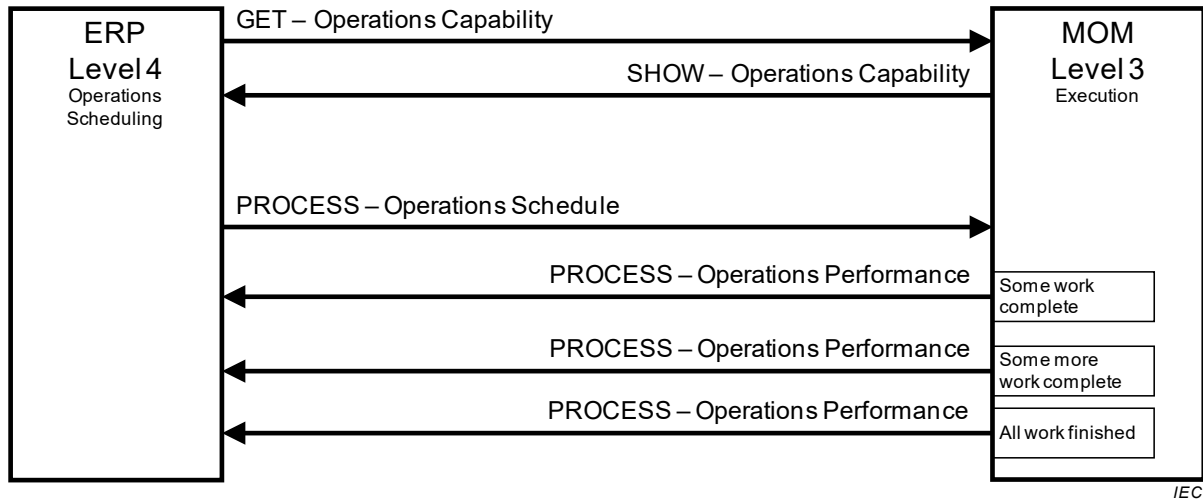
Figure B.12 – Pull and push model: Operations Capability and Operations Schedule

B.7.2   Publish and push model

A combined publish and push model scenario is shown in Figure B.13. The scenario assumptions are:

a) ERP subscribes to an *Operations Capability*.

b) MOM subscribes to *Operations Schedules*.

c) MOM publishes *Operations Capability* on a regular schedule, for example every 2 days.

d) ERP generates an *Operations Schedule* and publishes it.

e) MOM sends one *Operations Performance* to ERP reflecting partial order completion.

f) MOM sends another *Operations Performance* to ERP reflecting additional partial order completion.

g) MOM sends an *Operations Performance* to ERP reflecting completion of order.
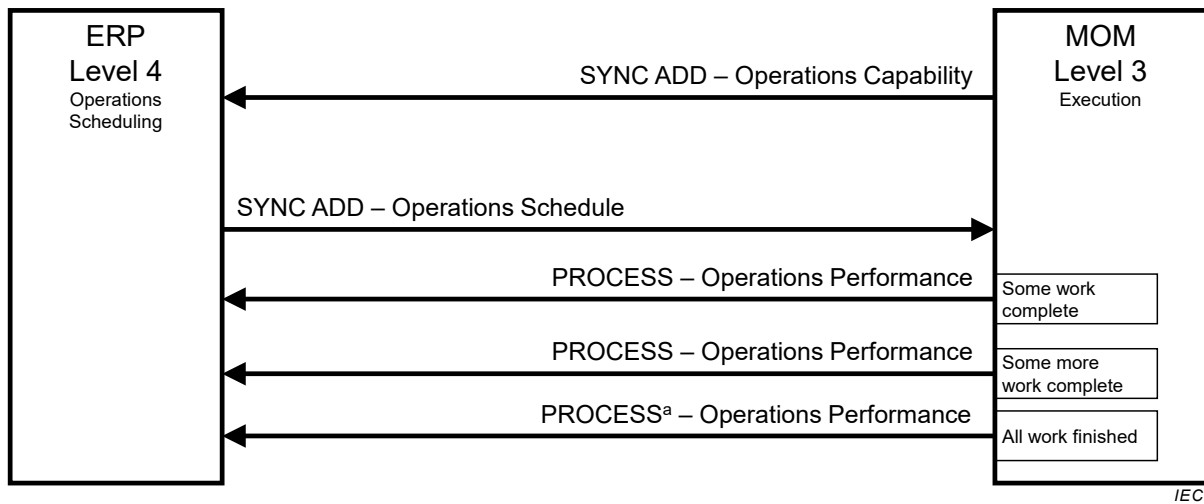
a The last PROCESS message contains a flag to indicate that the message is the final *Operations Performance* for the associated *Operations Schedule*.

Figure B.13 – Publish and push model: Operations Capability and Operations Schedule

B.8   Operations Schedule changes

B.8.1   Push and pull model

A combined push and pull schedule scenario is shown in Figure B.14. The scenario assumptions are:

a) ERP sends an *Operations Schedule* to MOM for processing.

b) MOM sends an *Operations Performance* to ERP for processing.

c) ERP requests an *Operations Capability* from MOM.

d) MOM responds with an *Operations Capability* to ERP.

e) ERP makes change to the *Operations Schedule* and sends to MOM for processing.

f) MOM sends an *Operations Performance* to ERP reflecting partial order completion.

g) MOM sends an *Operations Performance* to ERP reflecting completion of order.
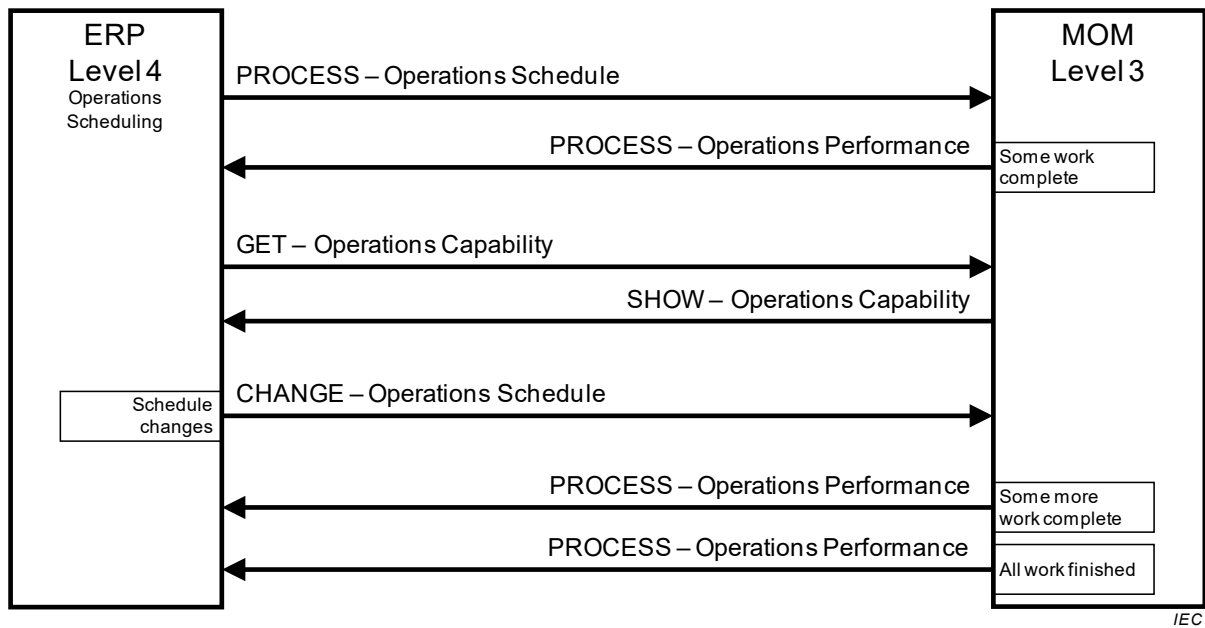
Figure B.14 – Push and pull model: Schedule changes

B.8.2   Publish model

A publish model scenario for schedules and performance is shown in Figure B.15. The scenario assumptions are:

a) MOM subscribes to *Operations Schedules*.

b) ERP subscribes to *Operations Performances*.

c) ERP publishes an *Operations Schedule*.

d) MOM publishes an initial *Operations Performance* with a SYNC ADD message.

e) ERP changes the schedule based on initial work done and republished with a SYNC CHANGE.

f) MOM publishes subsequent *Operations Performances* for the schedule with SYNC CHANGE messages.
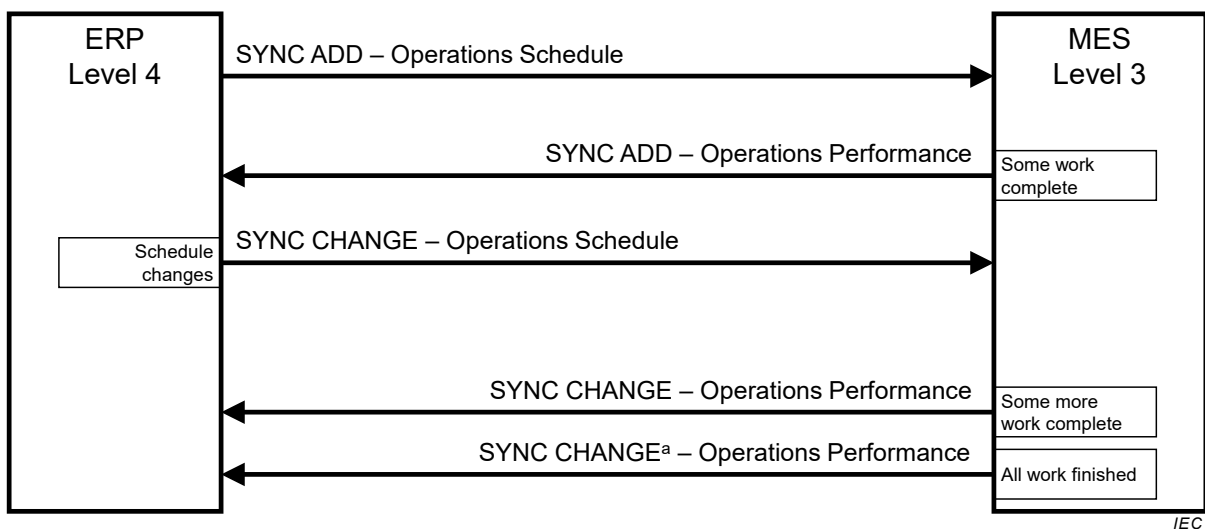
a   The last SYNC CHANGE message contains a flag to indicate that the message is the final *Operations Performance* for the associated *Operations Schedule*.

Figure B.15 – Publish model: Schedule changes after capability changes

B.9 Material quantity changed

B.9.1 Push model

A push model scenario for push model changes is shown in Figure B.16. The scenario assumptions are:

a) Consumable material arrives at the facility and is entered into the ERP.

b) ERP sends *Material Lot* information to MOM for processing.

c) MOM sends quantity changes in *Material Lot* to ERP as material is consumed.

d) ERP sends CANCEL when *Material Lot* is no longer available.
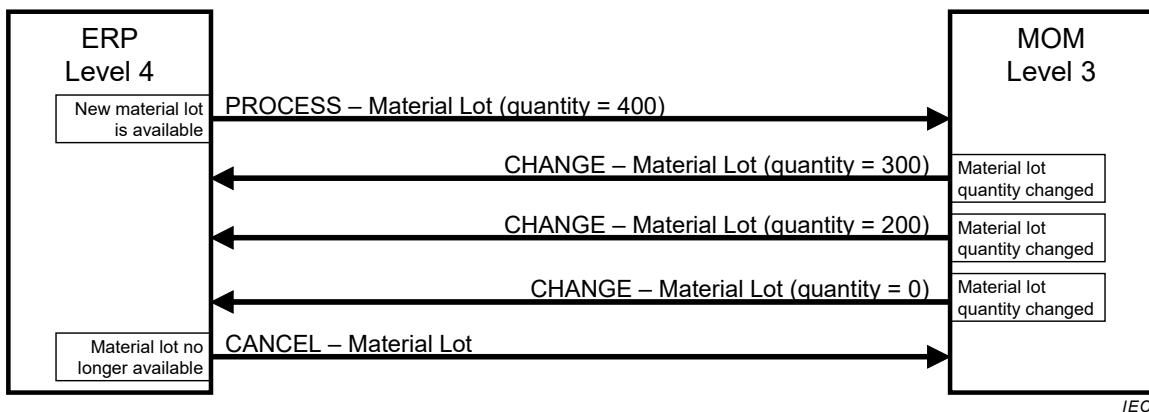
Figure B.16 – Push model: Material Lot added, Material Lot quantity changed

B.9.2 Publish and push model

A combined publish and push model scenario for material quantity changes is shown in Figure B.17. The scenario assumptions are:

a) ERP publishes *Material Lot* information; MOM subscribes.

b) MOM sends quantity changes in *Material Lot* to ERP.

c) ERP sends SYNC DELETE when *Material Lot* is no longer available.
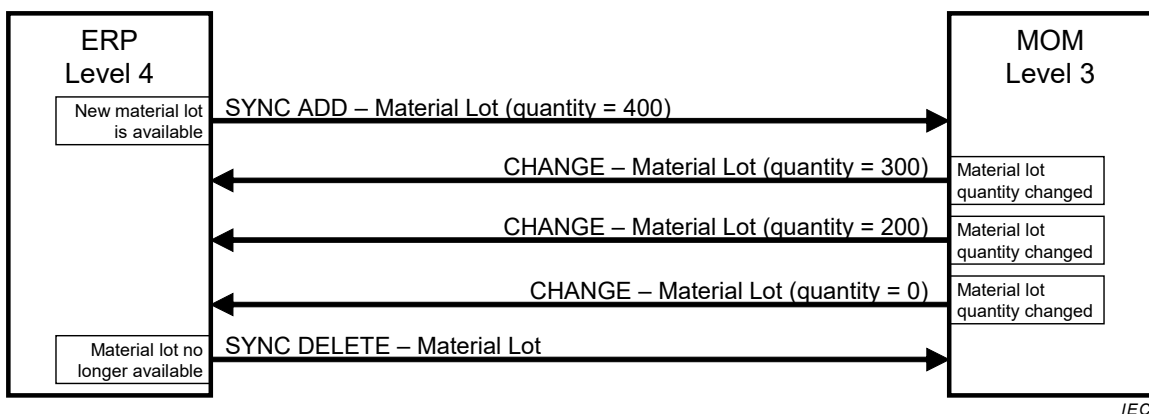
Figure B.17 – Publish and push model: Material quantity changes

B.9.3 Push and pull model

A combined push and pull model scenario for material quantity is shown in Figure B.18. The scenario assumptions are:

a) MOM periodically requests *Material Lot* information for new *Material Lots* from ERP.

b) ERP responds with information on new *Material Lots*. (There may be multiple *Material Lots* in a single SHOW message.)

c) MOM pushes quantity changes in *Material Lots* to ERP.
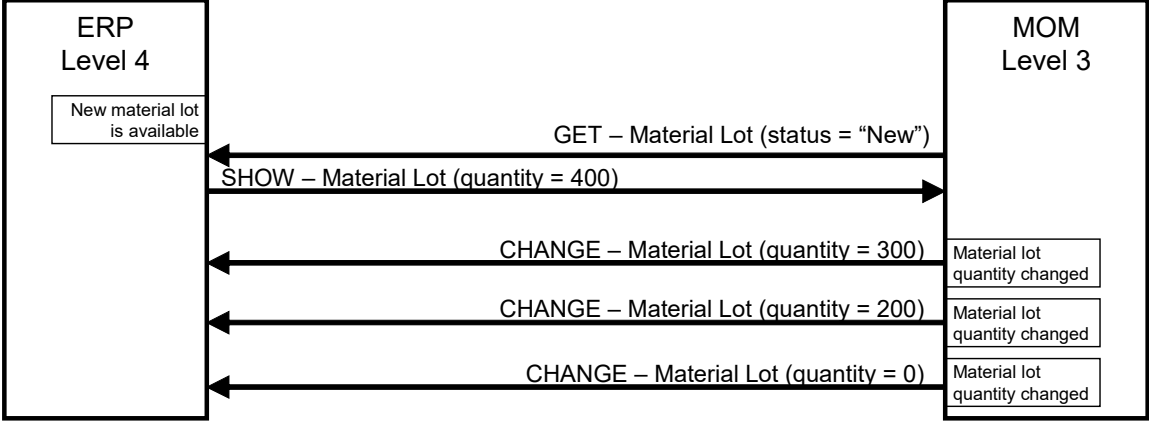
Figure B.18 – Push and pull model: Material quantity changes

Annex C
(informative)

Questions on the use of transactions

C.1 IDs

QUESTION: Different systems will have different IDs for the same objects. The GET verb and others use IDs to identify the object. Which ID is used and how does any translation occur?

ANSWER: On a project basis there can be an agreement on which system's ID to use. The translation can occur on either side or in a middleware system.

This gets even more interesting when there are more than two systems. In that situation it can be beneficial to designate a system as the repository of the mapping information, and to allow exchanging of the alternate names as properties of the object.

For example, if there is a maintenance system, production system, and business system which all have knowledge of the same object, but each have different IDs, then one system can maintain properties of "Maintenance ID", "Production ID", and "Business ID". The GET verb can be used with a specified property name to return the global ID and each mapping.

C.2 Transactions

QUESTION: Are these database or message transactions?

ANSWER: This standard defines message transactions between cooperating systems, and not database transactions. It is unfortunate that the term "transaction" is used to mean different things in different contexts.

C.3 Rollbacks

QUESTION: How are rollbacks handled?

ANSWER: The owner of the data would handle any rollbacks. Each transaction can have a CONFIRM set, and the receiver of the response would be responsible for determining what action to take.

C.4 CONFIRM verb

QUESTION: Why should CONFIRM be used in a SYNC?

ANSWER: Typically CONFIRM is not used with SYNC, but in some situations this may be required and the transaction definition allows its use. It can be required when the information is a critical piece of information that can be shared with a limited number of subscribers.

However, care should be taken, because:

a) If many clients are subscribed, the publisher can be overwhelmed by the CONFIRM messages.
b) Unless linked to the subscribe mechanism, the publisher will not be able to know if any client failed to confirm the SYNC.
c) Even if a publisher detects that one client failed to properly process the SYNC message (either sent a CONFIRM error message or sent nothing) there can not be much it can do.

C.5 Two phase commit

QUESTION: How would you handle a two phase commit?

ANSWER: Several transactions of this part of IEC 62264 could be part of a larger business transaction that are collectively either all completed, or all rolled back. The two phase commit is a form of this in which a set of transactions are encapsulated in a larger transaction. If no errors are received from the set of transactions, then they are all committed, and the larger transaction completes. If errors occurred, then none of them are committed and the transactions are rolled back. Two phase commit is usually an element of the implementation architecture and there are several standards that refer to these.

C.6   Confirm on GET

QUESTION: Why use confirmation on a GET message, when a SHOW is the standard response?

ANSWER: A confirmation is not required, but if there were an error on the request this would provide an indication of the error. This is normally expected when a GET is sent for objects that are not understood by the receiving application. A GET that returns no objects in the SHOW would not normally be considered an error.

C.7   General query

QUESTION: Why doesn't the standard support a general query mechanism on the GET message?

ANSWER: The transaction definitions were not intended to provide a complete query mechanism for remote data, such as SQL or XML query access, but only as a mechanism to share data between loosely coupled systems with different internal data storage structures. If complete query capability is needed, then the transactions can be used to create local databases and local query mechanisms can be used.

C.8   Nouns

QUESTION: How were the nouns determined?

The nouns were identified as those objects that were not composites of another object. For example, Equipment was used as a noun, but the equipment properties are composite objects within the equipment and they were not made nouns. This decision was made in order to limit the number of messages so that it would be easier to build and verify complying applications.

C.9   CONFIRM on any verb

QUESTION: Is CONFIRM allowed for any verb?

ANSWER: The CONFIRM response is permitted for any message, but is not recommended for SYNC verbs. A CONFIRM may be used with PROCESS or CHANGE messages. These have specific response messages of ACKNOWLEDGE and RESPOND that contain modified data, however the CONFIRM message contains any specific error messages.

Annex D
(informative)

Patterns for verbs

D.1   Patterns

The following tables define the general pattern that was applied to create the rules used to define the requirements for verbs when applied to specific nouns.

The same general pattern could be applied to other nouns and/or objects not defined in this standard, but those specifications are outside the scope of this part of the standard.

D.2   Actions for GET verb

There is a general pattern for the GET verb in which a noun (one or more objects) is included with either an object identifier for the primary object, an identifier of an associated property, and/or a value for the property which is defined in Table D.1. The specific rules for the GET verb for a specific noun are described within each noun's clause. When the nouns include other associated elements, such as limiting parameters, then the verb actions are described within each noun's clause. Table D.2 defines the pattern used for wildcards in the *Object ID*. Table D.3 defines the pattern when no ID is specified.

Table D.1 – GET message with Object ID specified

Access specification for attributes of objects that make up the noun		Action for GET verb
Noun has properties	Property ID is not specified	Defines a request that the receiver is to return, in a SHOW message, all attributes about the specified objects, all properties and their attributes, and ID or IDs of the associated objects with the specified object.
	Property IDs are specified	Defines a request that the receiver is to return, in a SHOW message, all attributes about the specified objects, all of the specified properties, and ID or IDs of the associated objects with the specified object.
	Property IDs and value are specified	Defines a request that the receiver is to return, in a SHOW message, all attributes about the specified objects where the specified property object value matches the specified property value, all of the specified properties, and ID or IDs of the associated objects with the specified object.
Noun has no properties but has contained elements		Defines a request that the receiver is to return, in a SHOW message, all attributes and contained elements of the specified object, IDs of the objects associated with the specified objects.

Table D.2 – GET message with wildcard in Object ID

Access specification for attributes of objects that make up the noun		Action for GET verb
Noun has properties	Property ID is not specified	Defines a request that the receiver is to return, in a SHOW message, all attributes and properties about the objects that match the object wildcard, all of the specified properties, and ID or IDs of the associated objects with the objects.
	Wildcard is specified as Property ID	Defines a request that the receiver is to return, in a SHOW message, all attributes of the objects that match the object wildcard, and for each object return all properties that match the property wildcards, and ID or IDs of the associated objects with the objects.
Noun has no properties but has contained elements		Defines a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all objects identified by the object wildcard, IDs of the objects associated with the objects.

Table D.3 – GET message with no Object ID specified

Access specification for attributes of objects that make up the noun	Action for GET verb
<null>	Defines a request that the receiver is to return, in a SHOW message, all attributes and contained elements of all objects.

D.3   Actions for PROCESS verb

The general pattern for the actions taken on a PROCESS message when an *Object ID* is specified is defined in Table D.4.

Table D.4 – PROCESS message with Object ID specified

Access specification for attributes of objects that make up the noun		Action for PROCESS verb
Noun has properties	Property ID is not specified	Defines a request that the receiver is to add the specified objects. The message defines suggested IDs for the specified objects. The receiver adds the specified objects and assigns IDs. The assigned IDs are returned in the ACKNOWLEDGE message.
	Property IDs are specified	Defines a request that the receiver is to add the specified objects. The message defines suggested IDs for the specified objects and properties. The receiver adds the specified objects and properties and assigns IDs. The assigned IDs are returned in the ACKNOWLEDGE message.
	Property IDs and value are specified	Defines a request that the receiver is to add the specified objects. The message defines suggested IDs for the specified objects and properties, and values for the properties. The receiver adds the specified objects and properties and assigns IDs. The assigned IDs are returned in the ACKNOWLEDGE message.
Noun has no properties but has contained elements		Defines a request that the receiver is to add the specified objects. The message defines suggested IDs for the specified objects, values for the attributes and IDs of the object associated with the specified objects. The receiver adds the specified objects and assigns IDs. The assigned IDs are returned in the ACKNOWLEDGE message.

The general pattern for actions taken on a PROCESS message when no *Object ID* is specified is defined in Table D.5.

Table D.5 – PROCESS message with no Object ID

Access specification for attributes of objects that make up the noun		Action for PROCESS verb
Noun has properties	Property ID is not specified	Error for identified resource objects. Not an error for objects that may be identified by time specifications (Capability, Schedule, Performance).
	Wildcard is specified as Property ID	Error for identified resource objects. Not an error for objects that may be identified by time specifications (Capability, Schedule, Performance).
Noun has no properties but has contained elements		Error for identified resource objects. Not an error for objects that may be identified by time specifications (Capability, Schedule, Performance).

D.4   Actions for CHANGE message

The general pattern for actions taken on a CHANGE message when the *Object ID* is specified is defined in Table D.6.

Table D.6 – CHANGE message with Object ID

Access specification for attributes of objects that make up the noun		Action for CHANGE verb
Noun has properties	Property ID is not specified	The specified attributes of the specified object are to be changed.
	Property IDs are specified	The specified properties and attributes of the specified object are to be changed.
	Property IDs and value are specified	Defines a request that the receiver is to change the values of the specified properties for the specified objects to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
Noun has no properties but has contained elements		Defines a request that the receiver is to change the specified attributes and contained elements of the specified objects and IDs of objects associated with the specified objects. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.

The general pattern for actions taken on a CHANGE message when the *Object ID* is a wildcard is defined in Table D.7.

Table D.7 – CHANGE message with wildcard Object ID

Access specification for attributes of objects that make up the noun		Action for CHANGE verb
Noun has properties	Property ID is not specified	Defines a request that the defined attributes for all objects matching the wildcard are to be changed to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
	Wildcard is specified as Property ID	Defines a request that the defined attributes for all objects matching the wildcard and all properties matching the wildcard property ID are to be changed to the specified values. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.
Noun has no properties but no contained elements		Defines a request that the receiver is to change the specified attributes and contained elements of all objects matching the object wildcard, and IDs of objects associated with the objects. A RESPOND message may be used to communicate agreement, disagreement, or changes made to the CHANGE message data.

D.5   Actions for CANCEL message

The general pattern for actions taken on a CANCEL message when the *Object ID* is specified is defined in Table D.8.

Table D.8 – CANCEL message with Object ID

Access specification for attributes of objects that make up the noun		Action for CANCEL verb
Noun has properties	Property ID is not specified	Defines a request that the receiver is to cancel the specified objects.
	Property IDs are specified	Defines a request that the receiver is to cancel the specified properties for the specified objects.
	Property IDs and value are specified	Defines a request that the receiver is to cancel the specified properties of the specified objects that have the specified property value.
Noun has no properties but has contained elements		Defines a request that the receiver is to cancel the specified objects. If contained elements IDs are specified, then only the specified contained elements for the specified objects are to be cancelled, not the specified objects.

The general pattern for actions taken on a CHANGE message when the *Object ID* is a wildcard is defined in Table D.9.

Table D.9 – CANCEL message with wildcard in Object ID

Access specification for attributes of objects that make up the noun		Action for CANCEL verb
Noun has properties	Property ID is not specified	Error for identified resource objects. Not an error for objects that may be identified by time specifications (Capability, Schedule, Performance).
	Wildcard is specified as Property ID	Defines a request that the receiver is to cancel all properties matching the property wildcard of all objects that match the object wildcard.
Noun has no properties but has contained elements		Defines a request that the receiver is to cancel all objects matching the object wildcard.

D.6   Actions for SYNC message

The general pattern for actions taken on a SYNC message when the *Object ID* is specified is defined in Table D.10. A SYNC message may be a SYNC ADD to define new information, SYNC CHANGE to change existing information, and SYNC DELETE to delete information.

Table D.10 – SYNC message with Object ID

Access specification for attributes of objects that make up the noun		Action for SYNC verb
Noun has properties	Property ID is not specified	Defines a request that the receiver is to add (SYNC ADD), delete (SYNC DELETE) or change (SYNC CHANGE) the specified objects.
	Property IDs are specified	Defines a request that the receiver is to add, change, or delete the specified objects and list of the specified properties.
	Property IDs and value are specified	Defines a request that the receiver is to add, change, or cancel the specified objects, list of properties and property values.
Noun has no properties but has contained elements		Defines a request that the receiver is to add, change, or delete the specified attributes and contained elements of the specified objects and IDs of objects associated with the specified objects.

The general pattern for actions taken on a SYNC message when the *Object ID* contains a wildcard specification is defined in Table D.11.

Table D.11 – SYNC message with wildcard in Object ID

Access specification for attributes of objects that make up the noun		Action for SYNC verb
Noun has properties	Property ID is not specified	SYNC ADD: Error. SYNC DELETE: Defines a request that the receiver is to delete all objects matching the object wildcard. SYNC CHANGE: Defines a request that the receiver is to change all object attributes for all objects matching the object wildcard
	Wildcard is specified as Property ID	SYNC ADD: Error. SYNC DELETE: Defines a request that the receiver is to delete all object properties matching the property wildcard for all objects matching the object wildcard. SYNC CHANGE: Defines a request that the receiver is to change all object properties matching the property wildcard for all objects matching the object wildcard.
Noun has no properties but has contained elements		SYNC ADD: Error. SYNC DELETE: Defines a request that the receiver is to delete all objects matching the wildcard ID. SYNC CHANGE: Defines a request that the receiver is to change the specified attributes and contained elements of the specified objects and IDs of objects associated with the specified objects.

Annex E
(informative)

General rules for identifying nouns from object models

E.1   Patterns

Clauses E.2 to E.3 define the general pattern that was applied to define nouns based on the UML models defined in this standard.

The same general pattern could be applied to other nouns and/or objects not defined in this standard, but those specifications are outside the scope of this part.

E.2   Hierarchical object model

Object models that follow a hierarchical structure have a single top object that contains a composite of other objects.

Examples of hierarchical object models are *Process Segments*, *Operations Definitions*, *Operations Schedules*, and *Operations Performance*.

When the top level object is a composite, and the child objects are only relevant in the context of the top level object, then a NOUN is identified with the top level object. If the child objects are also composite objects, then they are included as the top level NOUN.

The name of the NOUN is the same as the name of the top level object.

This rule is based on the assumption that exchanging the child objects would not be effective, because they require the context of the parent object.

For example, exchanging just a *Segment Requirement* without the context of the *Operations Request* and the context of the *Operations Schedule* does not provide sufficient information to enable the handling or processing of the *Segment Requirement*.

Figure E.1 illustrates the composite relationships within the *Operations Schedule*. Because all objects in the model are in the composite hierarchy, except for associations to objects in other models (process or product segment), there is only one NOUN defined for this model.
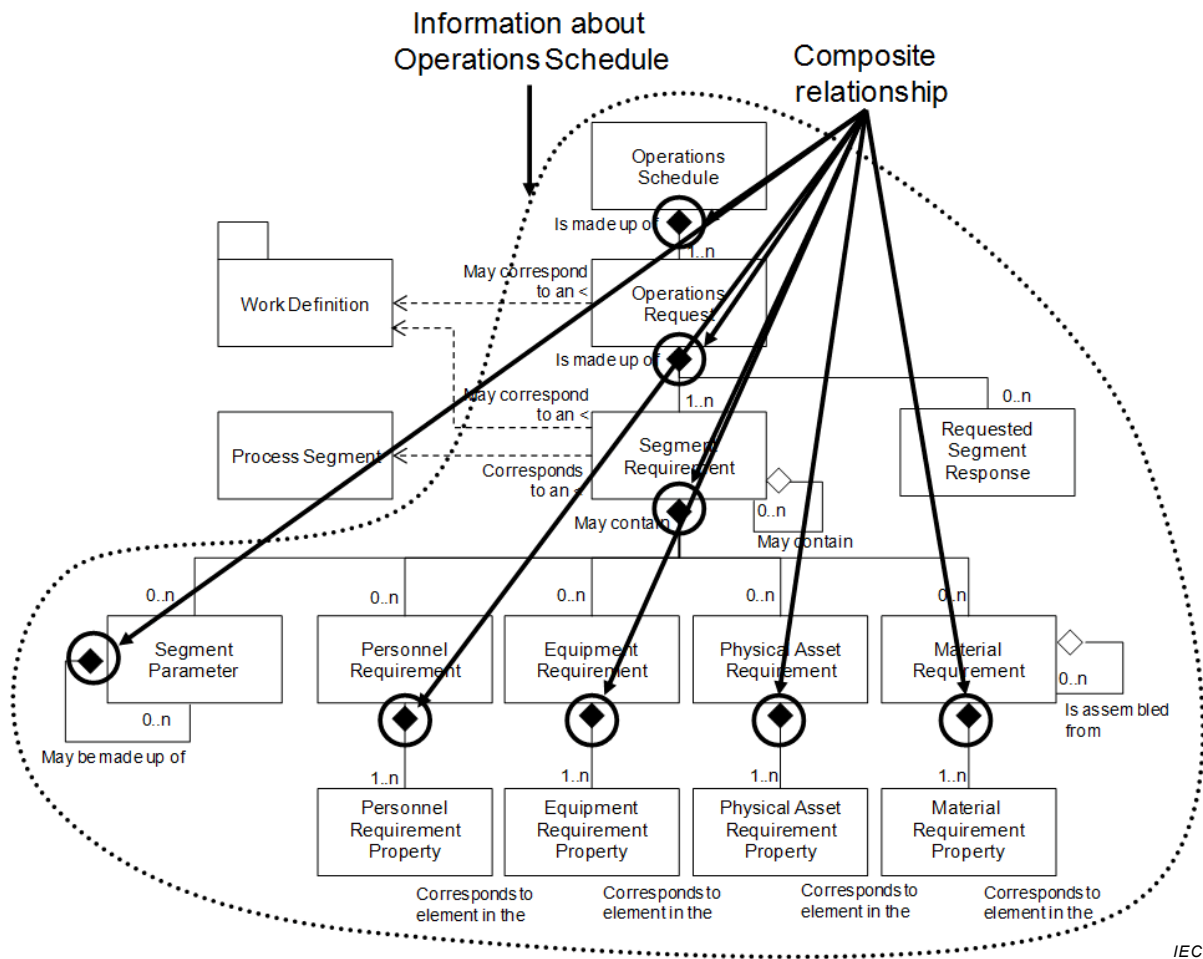
Figure E.1 – Object model with composite relationships

E.3 Non-hierarchical object model

Object models that do not have a hierarchical structure will generally have multiple NOUNS defined. Examples of non-hierarchical object models are *Personnel*, *Material* and *Equipment*.

Within non-hierarchical object models there may be sub-models that have composite relationships. In this case the same rule is applied to the composite object as for a hierarchical object model previously defined, and the NOUN corresponds to the parent object.

In cases where a child object, such as *Material Sublot*, may have sufficient context to be exchanged separately, then the child object is also defined as a NOUN.

Objects which are associated with an association between other objects were defined as part of one of the objects of the association. Examples of these are *Qualification Test Result*, *Equipment Capability Test Results*, and *Material Test Results*. In these cases a decision based on expected business case use patterns was made on which NOUN to include the object in. For example, the expected business uses for the test results were that the test results would be more commonly exchanged with the property value rather than associated with the test specification.

The name of the NOUN is the name of the object.

Figure E.2 illustrates the case where there are composite relationships and associated objects in the object model. In this situation a noun is defined for each object that stands

alone or contains other objects in a composite relationship, and five separate nouns are defined for *Material Classes, Material Definitions, Material Lots, Material Sublots*, and *Material Test Specifications*. An associated object, such as a *Material Test Result*, is placed in the *Material Lot* and *Material Sublot* nouns based on the expected use of the object.
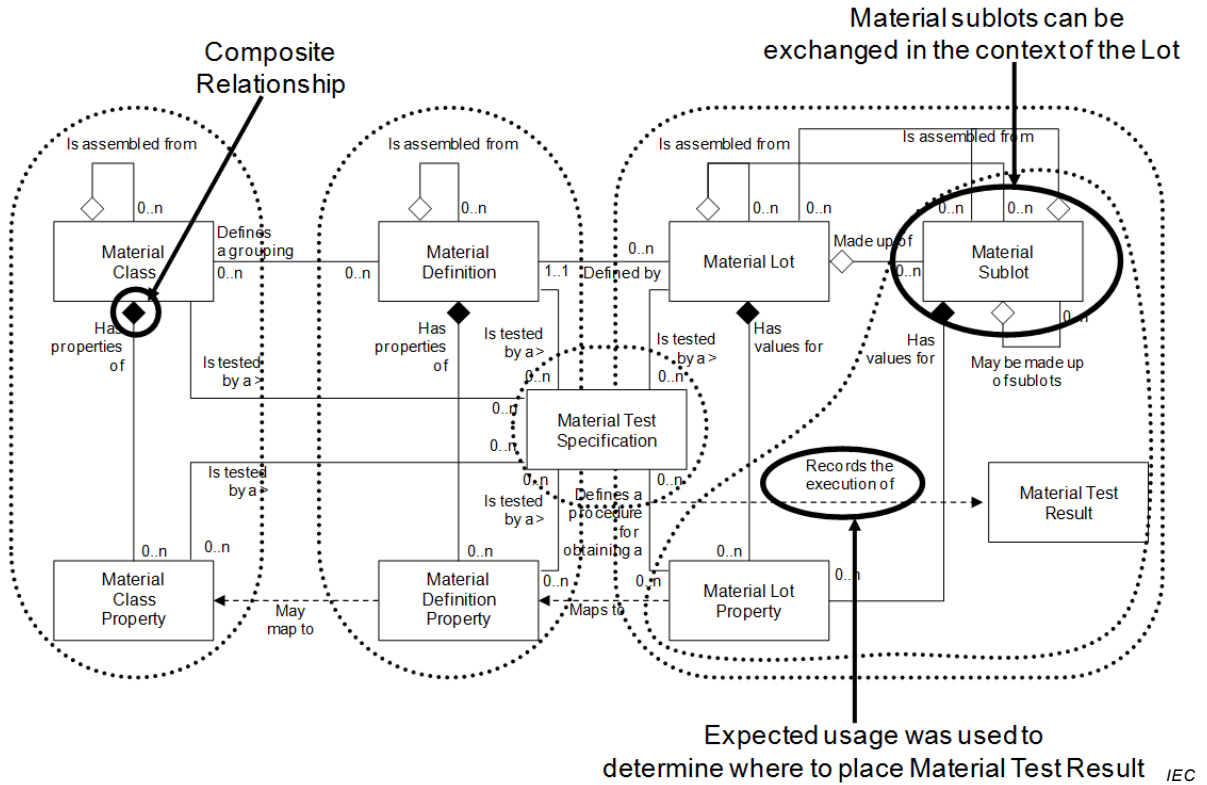

Figure E.2 – Example of multiple composite objects

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