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Enterprise system integration –
Part 5: Business to manufacturing transactions
(IEC 62264-5:2011);
English version EN 62264-5:2012

Intégration du système de commande d'entreprise –
Partie 5: Transactions entre systèmes de gestion de commande d'entreprise et systèmes de fabrication
(CEI 62264-5:2011);
Version anglaise EN 62264-5:2012

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Anwendungsbeginn

Anwendungsbeginn für die von CENELEC am 2012-02-03 angenommene Europäische Norm als DIN-Norm ist 2012-08-01.

Nationales Vorwort

Vorausgegangener Norm-Entwurf: E DIN EN 62264-5:2009-09.

Für diese Norm ist das nationale Arbeitsgremium K 931 „Systemaspekte“ der DKE Deutsche Kommission Elektrotechnik Elektronik Informationstechnik im DIN und VDE (www.dke.de) zuständig.

Die enthaltene IEC-Publikation wurde vom SC 65E „Devices and integration in enterprise systems“ erarbeitet.

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Für den Fall einer datierten Verweisung im normativen Text bezieht sich die Verweisung immer auf die in Bezug genommene Ausgabe der Norm.

Der Zusammenhang der zitierten Normen mit den entsprechenden Deutschen Normen ergibt sich, soweit ein Zusammenhang besteht, grundsätzlich über die Nummer der entsprechenden IEC-Publikation. Beispiel: IEC 60068 ist als EN 60068 als Europäische Norm durch CENELEC übernommen und als DIN EN 60068 ins Deutsche Normenwerk aufgenommen.

Das Präsidium des DIN hat mit Präsidialbeschluss 1/2004 festgelegt, dass DIN-Normen, deren Inhalt sich auf internationale Arbeitsergebnisse der Informationsverarbeitung gründet, unter bestimmten Bedingungen allein in englischer Sprache veröffentlicht werden dürfen. Diese Bedingungen sind für die vorliegende Norm erfüllt.

Da sich die Benutzer der vorliegenden Norm der englischen Sprache als Fachsprache bedienen, wird die englische Fassung der EN 62264-5 veröffentlicht. Zu deren Abschnitt 3, der die Begriffe festlegt, wurde eine Übersetzung angefertigt und als Nationaler Anhang NA der vorliegenden Norm hinzugefügt. Für die meisten der verwendeten Begriffe existieren keine gebräuchlichen deutschen Benennungen, da sich die deutschen Anwender in der Regel ebenfalls der englischen Benennungen bedienen. Diese Norm steht nicht in unmittelbarem Zusammenhang mit Rechtsvorschriften und ist nicht als Sicherheitsnorm anzusehen.

Nationaler Anhang NA
(informativ)

3 Begriffe und Abkürzungen

3.1 Begriffe

Für die Anwendung dieses Dokuments gelten die folgenden Begriffe. Ebenso gelten die Begriffe nach IEC 62264-1, IEC 62264-2 und IEC 62264-3, sofern nicht Unterschiede in diesem Dokument ausdrücklich angegeben sind.

3.1.1
Anwendung
(en: application)
geordnete Menge physischer und virtueller Prozesse, die durch einen Vorrat an Ressourcen ausgeführt werden, deren durchgeführte Transaktionen ein bestimmtes Ziel erreichen sollen; Informationsanbieter oder Informationsnutzer führen die Aktivität aus, die mit der Transaktion im Zusammenhang steht

3.1.2
Kennzeichner
ID
(en: identifier
ID)
Information zur Kennzeichnung eines Objekts oder der Eigenschaft eines Objekts

3.1.3
Nachricht
(en: message)
strukturierte Informationseinheit mit unidirektionalem Transfer von Daten zwischen einer Sendeanwendung und einer oder mehreren Empfangsanwendungen

3.1.4
Objekttyp
(en: noun)
einer von zwei Teilen im Inhalt einer Nachricht, und zwar der Teil, der ein oder mehrere Objekte nach den in IEC 62264-1 und IEC 62264-2 definierten Objektmodellen beschreibt

3.1.5
Transaktion
(en: transaction)
Reihenfolge zusammengehörender Nachrichten, die zwischen Anwendungen ausgetauscht werden und dabei Aktivitäten der Ebene 3 oder Ebene 4 ausführen

3.1.6
Aktionstyp
(en: verb)
einer von zwei Teilen im Inhalt einer Nachricht, und zwar der Teil, der die auszuführende Aktion oder die Antwort auf eine Anforderung festlegt

3.1.7
Stellvertreterzeichen
(en: wildcard)
Information zur Kennzeichnung einer Gruppe von Objekten oder Eigenschaften von Objekten

– Leerseite –

EUROPEAN STANDARD

NORME EUROPÉENNE

EUROPÄISCHE NORM

EN 62264-5

March 2012

ICS 25.040.99; 35.100; 35.200

English version

Enterprise system integration - Part 5: Business to manufacturing transactions

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The text of document 65E/100/CDV, future edition 1 of IEC 62264-5, prepared by SC 65E, "Devices and integration in enterprise systems", of IEC TC 65, "Industrial-process measurement, control and automation" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 62264-5:2012.

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)	2012-11-03
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2015-02-03

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CENELEC [and/or CEN] shall not be held responsible for identifying any or all such patent rights.

Endorsement notice

The text of the International Standard IEC 62264-5:2011 was approved by CENELEC as a European Standard without any modification.

CONTENTS

INTRODUCTION

This part of IEC 62264 is based on the use of IEC 62264 abstract models previously defined in IEC 62264-1 and IEC 62264-2 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 of this standard. 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 business-to-manufacturing transactions and manufacturing-to-business transactions that may be used in relation to the objects that are exchanged between Level 4 and Level 3, as defined in the object models of IEC 62264-1 and IEC 62264-2. 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 62264-1 models and terminology and IEC 62264-2 object model attributes. This standard also defines transactions that specify how to exchange the objects defined in IEC 62264-1, Clause 7, IEC 62264-2 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, Maintenance Model, Material Model, Process Segment Model, Production Capability Model, Product Definition Model, Production Schedule Model, and Production Performance Model.

2 Normative references

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

IEC 62264-1, *Enterprise-control system integration – Part 1: Models and terminology*

IEC 62264-2, *Enterprise-control system integration – Part 2: Object model attributes*

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

3 Terms, definitions and abbreviations

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply. Terms, definitions and concepts expressed in IEC 62264-1, IEC 62264-2 and IEC 62264-3 apply, except where differences are explicitly stated in this document.

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

3.1.2
identifier
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, the one that represents one or more objects, as defined in IEC 62264-1 and IEC 62264-2 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, the one that 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

OAGIS – Open Applications Group Interface Standard

SYNC – Synchronized data

4 Transaction messages and verbs

4.1 General

This clause defines a common set of transactions, messages and verbs that shall be used between Level 4 and Level 3 applications to exchange the data defined in the object models of IEC 62264-1, Clause 7 and IEC 62264-2.

A transaction shall consist of a sequence of messages, where each message shall have a structure as defined in 4.2.

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

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

NOTE 1 The phrase “owner of data” is used to identify the application that has responsibility for enforcing the consistency of data.

NOTE 2 This standard does not address the case where there may be multiple systems that can act as the owner of data. In these situations, configurations 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: query/reporting, transaction processing, and data synchronization. These are defined by three different transaction models.

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.

   Example: An out-of-band agreement means that the agreement is not defined in the transaction protocol. For example: an agreement between a publisher and subscriber may be set up through configuration parameters in the applications, or an agreement may be set up dynamically through a web service agreement, or an agreement may be 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 1 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 not defined in this standard; 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 standard.

NOTE 2 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 is sent from the user of information with an identification of an object (GET Equipment), and a message is returned from the information provider with the object's information (SHOW Equipment).

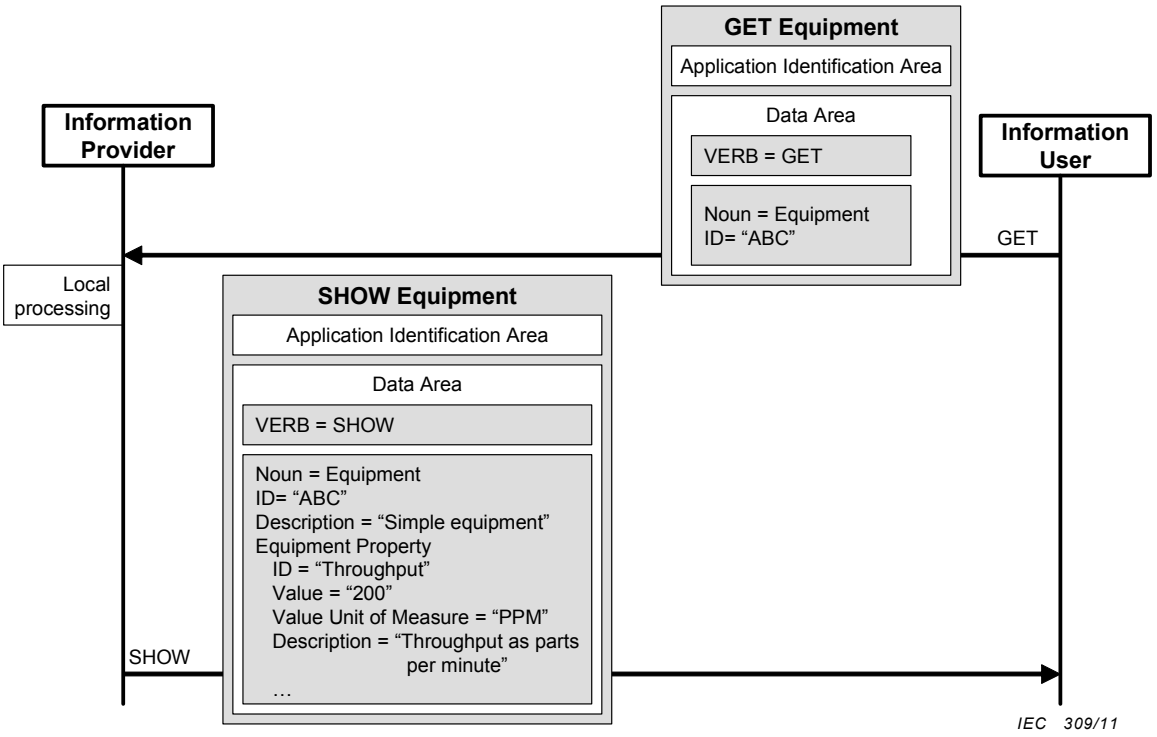


Figure 1 – Typical exchanged messages in a transaction

4.3 Message structure

4.3.1 General structure

Every message shall contain all 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*.

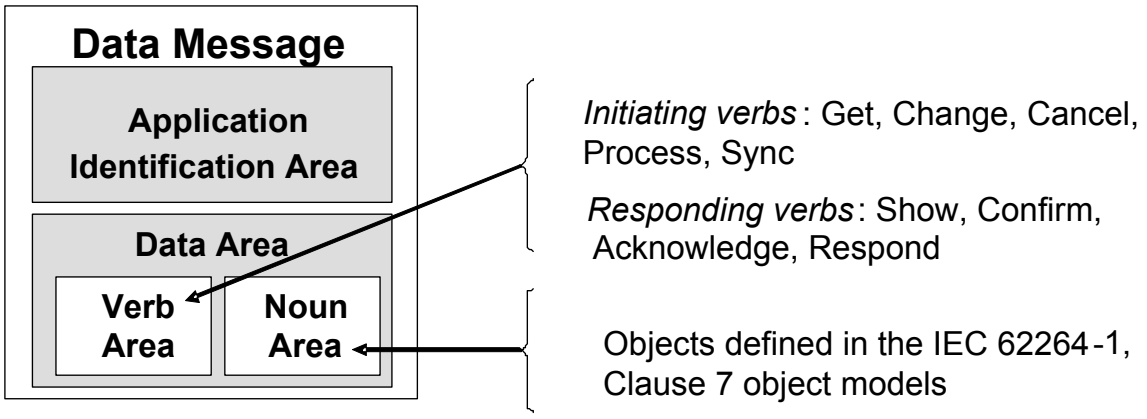


Figure 2 – Typical exchanged data set

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. 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 standard is consistent with the OAGIS specification; such that an implementation of OAGIS, using the objects defined in IEC 62264-1 and IEC 62264-2 , can conform to this standard

Dates and times shall include time zone information in order to unambiguously identify times, such as coordinated universal time or ISO 8601 CE (Common Era) calendar extended format.

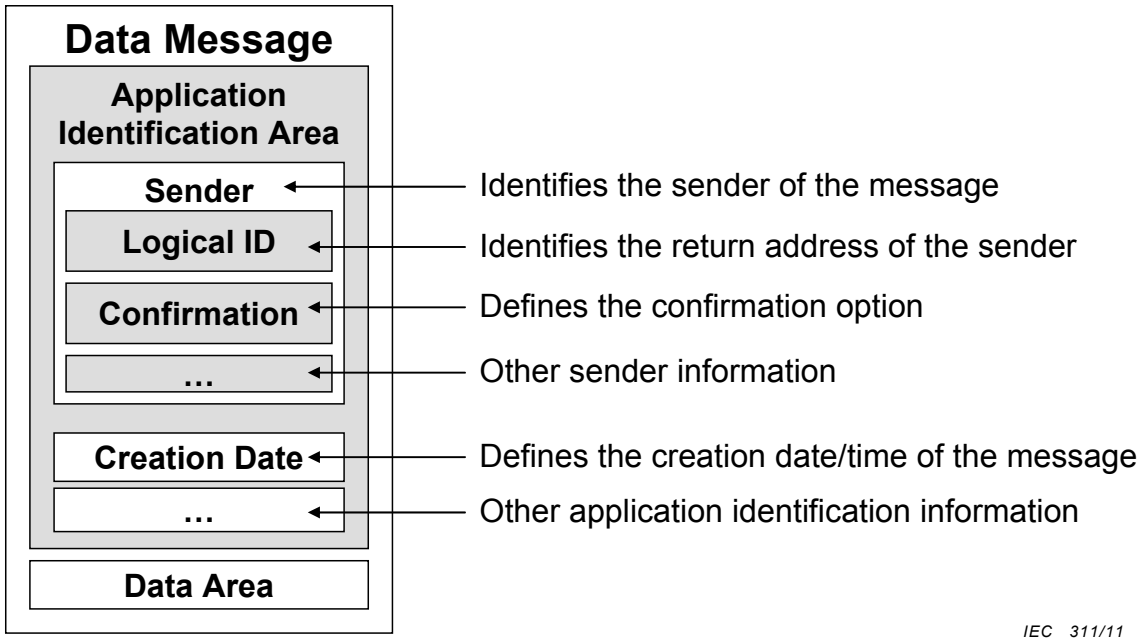


Figure 3 – Typical layout of an application identification area

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 a verb 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 standard are listed in Clause 5.

The noun area shall contain one or more nouns and associated elements. Each noun represents one or more objects defined in the IEC 62264-1 and IEC 62264-2 object models. The nouns defined in this standard are listed in Clause 6.

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

4.3.4 Message nouns

Nouns represent one or more instances of objects from the object models defined in IEC 62264-1 and IEC 62264-2 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 to identify multiple objects.

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

NOTE 2 Wildcards should be 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 Conventionnally wildcards in text strings are specified as regular expressions or limited regular expressions. In a limited regular expression a wildcard value can have the following special characters:

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

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

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

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

c) "?" – 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".

d) 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 4 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.

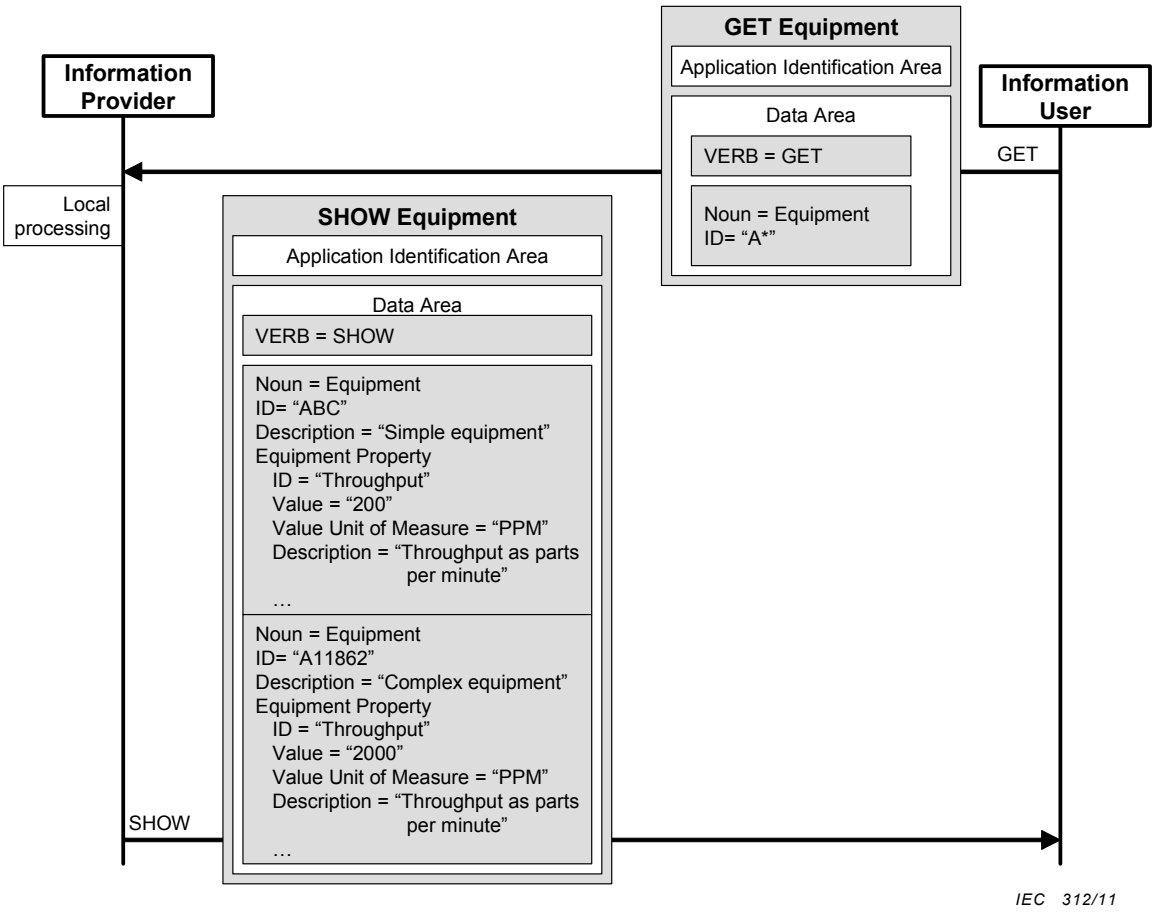


Figure 4 – GET with wildcard and SHOW response

5 Message verbs

5.1 Verbs and transaction models

The verb area of a message shall contain a verb, defined in this clause 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 shall be cancelled. If contained element IDs are specified, then only the specified contained elements for the specified noun shall be cancelled, not the noun. NOTE Not all objects have contained elements. Examples of contained elements are properties, specifications, actuals, etc.	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 shall be changed.	PUSH
CONFIRM	Confirmation response to a request.	PUSH, PULL, PUBLISH
GET	Request to a receiver for information on one or more objects. The receiver shall return a SHOW message containing all the specified attributes and all 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

Verb	Description	Transaction Model
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
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 shall be changed.	PUBLISH
SYNC DELETE	Request from the owner of the object to delete information. The specified noun shall be cancelled. If contained element IDs are specified, then only the specified contained elements for the specified noun shall be cancelled.	PUBLISH

NOTE 1 Although this standard defines the transactions and messages, this standard does not specify how the associated activities are to occur.

NOTE 2 The mechanism to set up the one-to-one association of the PUSH model is not included in this standard. Configuration and setup 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 standard. Configuration and setup 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 standard. 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 clauses 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 standard to add or remove object attributes; IEC 62264-2 defines 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 clauses 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 clauses 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.

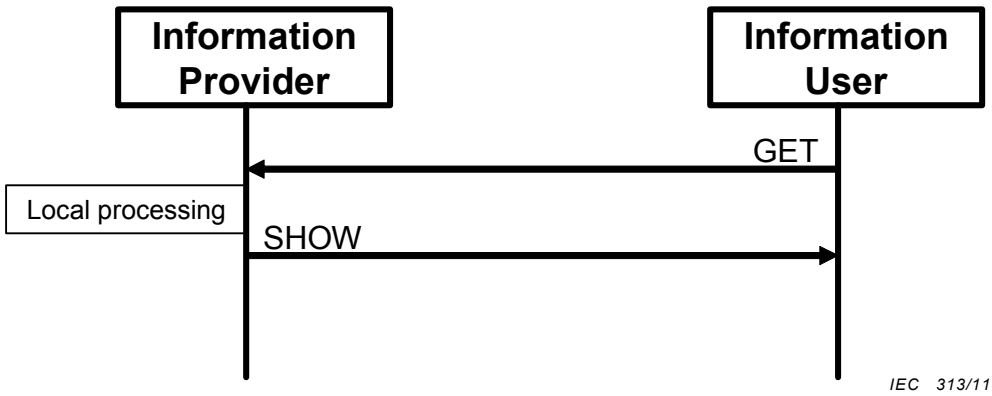


Figure 5 – GET and SHOW transaction

The GET is designed to retrieve one or more objects and any contained objects by using ID attributes.

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, for example when a property of an object is needed, then the ID of the encapsulating 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 clauses 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.

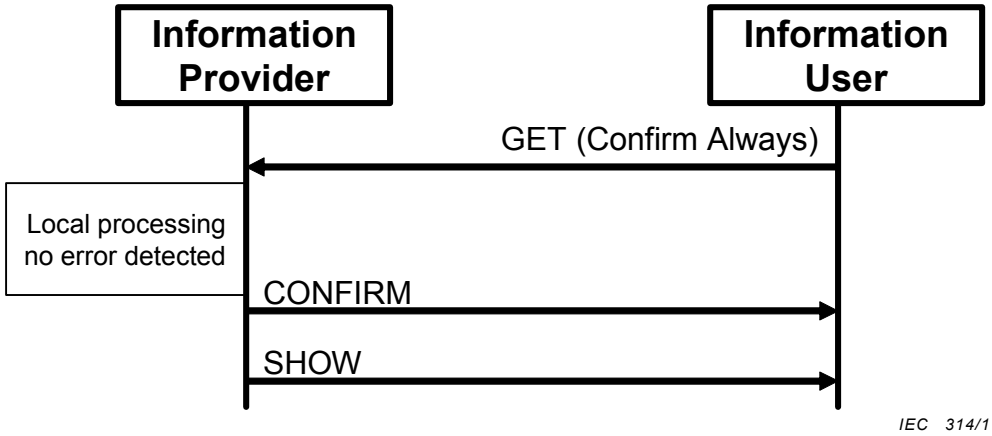
Example: GET may retrieve multiple objects such as all of the personnel classes.

NOTE GET 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 then that copy can be queried locally.

5.3 SHOW verb

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

Figure 6 illustrates a transaction with a GET message followed by a SHOW message and a CONFIRM message (because the “Confirm Always” option is specified with the example GET message).



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

Figure 6 – GET and SHOW transaction with a CONFIRM always

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. If the specified noun already exists, only the specified contained elements shall be added and processed.

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.

Example 1: The sending of a *PROCESS Production 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.

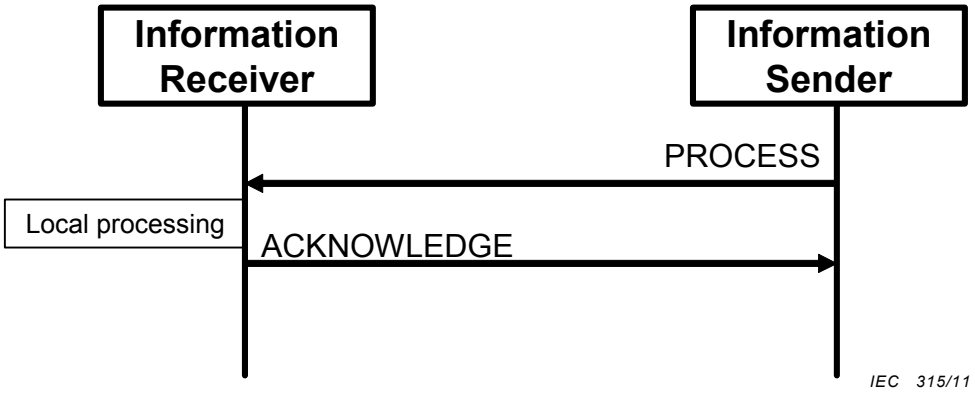
A PROCESS verb area contains an optional element with one of the following additional definitions: Never or Always (see Table 2). If the optional element is not specified, then it defaults to Never.

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 7 illustrates a PROCESS message with a response ACKNOWLEDGE message.



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

Figure 7 – PROCESS/ACKNOWLEDGE transaction

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	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 ACKNOWLEDGE. The message data area shall contain an identification of the type of modification.

Example: Figure 8 shows a message sequence from a scheduling system to an execution system. The initial PROCESS message with a production 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 it to the execution system. The execution system accepts the production schedule and returns an ACKNOWLEDGE message with an ACCEPTED flag.

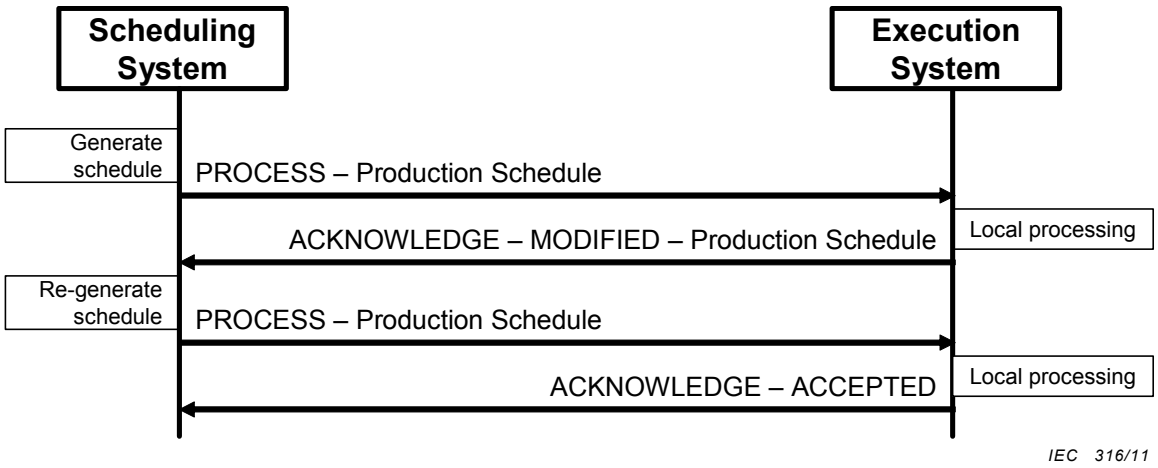


Figure 8 – Example of ACKNOWLEDGE to a process message

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 9 illustrates a CHANGE message 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.

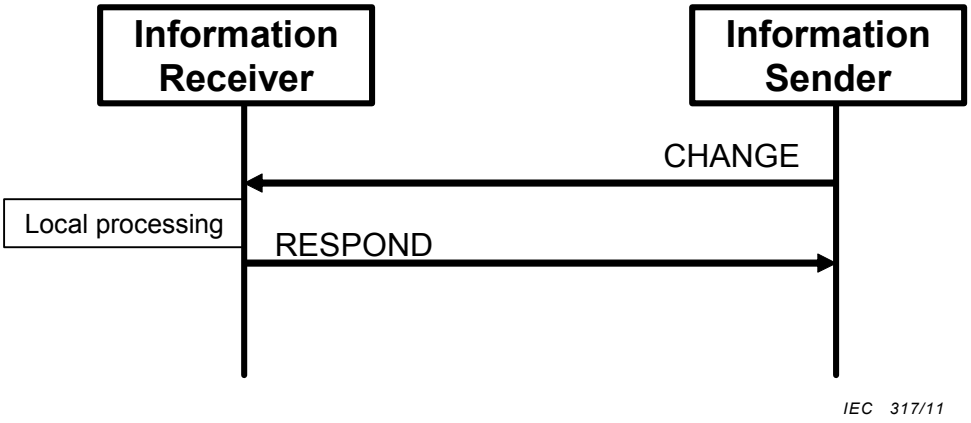


Figure 9 – CHANGE/RESPOND transaction

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 MaterialLot* 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.

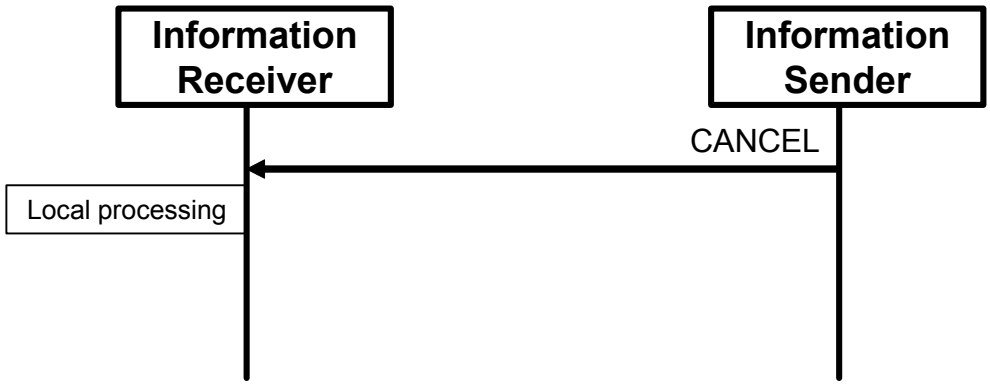


Figure 10 – CANCEL message

5.8 CONFIRM verb

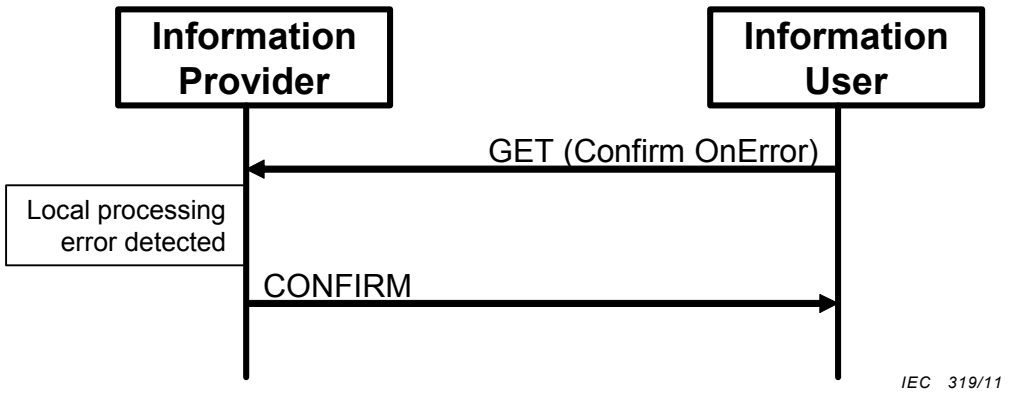
A CONFIRM verb shall be used in a CONFIRM message for confirmation of receipt and processing of any message other than the CONFIRM, RESPOND, or ACKNOWLEDGE messages. See Figure 11 for an example of confirmation with detected errors.

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.

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.



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

Figure 11 – Example of a GET message with Confirm OnError

The CONFIRM message:

a) Identifies the initiating message being confirmed.

b) Indicates the status of the processing of the message.

c) Includes a description of the error if the status indicates a processing error.

If an error occurs in the processing of the initiating message by the receiving application and the sender set the confirmation element to either *OnError* or *Always*, then the receiving application shall provide a CONFIRM message. If no confirmation option was specified, then the default value is *Confirm Never*.

Error handling at the application layer is provided through the confirmation element in the application identification area. Specific error codes or error text are not defined in this standard 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.

An additional error description, code, or text associated with objects in the noun area may be contained in the noun area, as indicated in the Application Identification Area, as shown in Figure 12.

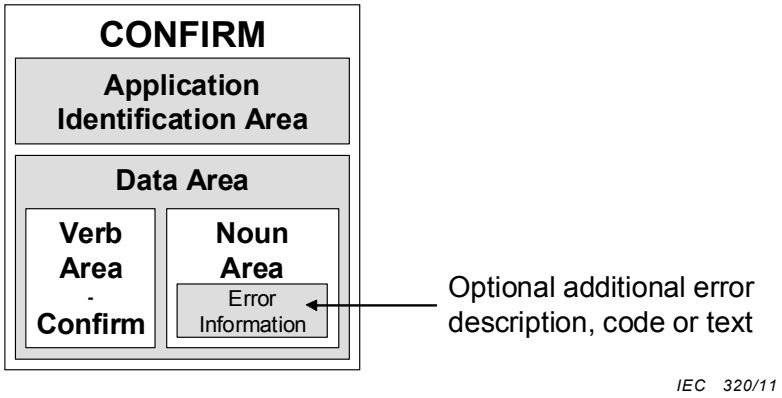


Figure 12 – Confirm Message

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

NOTE 2 There should only be one application that sends SYNC messages for any specific element of information.

Example 1: A human resources system may provide personnel capability information; however, a training system may provide the Qualification Test Specification information pertaining to the personnel capability object.

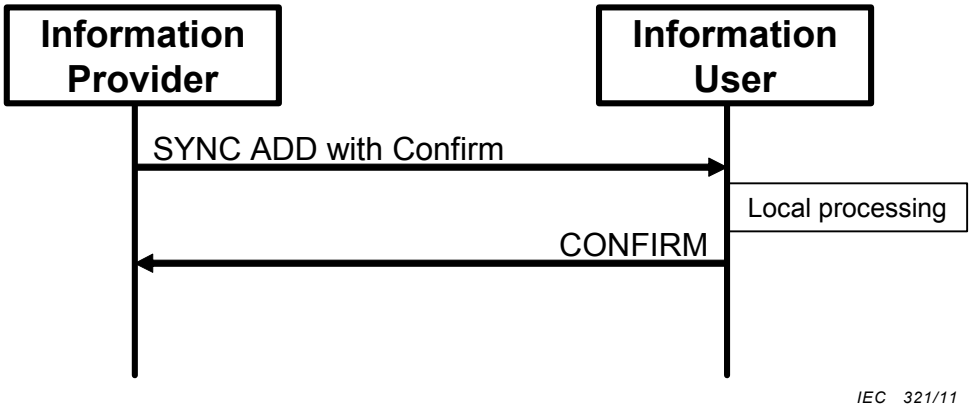
The owner of the information sends the SYNC message.

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, as shown in Figure 13. 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.



Example: A SYNC ADD on a *QA TEST SPECIFICATION* object indicates the definition of a new QA Test Specification.

Figure 13 – SYNC ADD transaction with confirmation

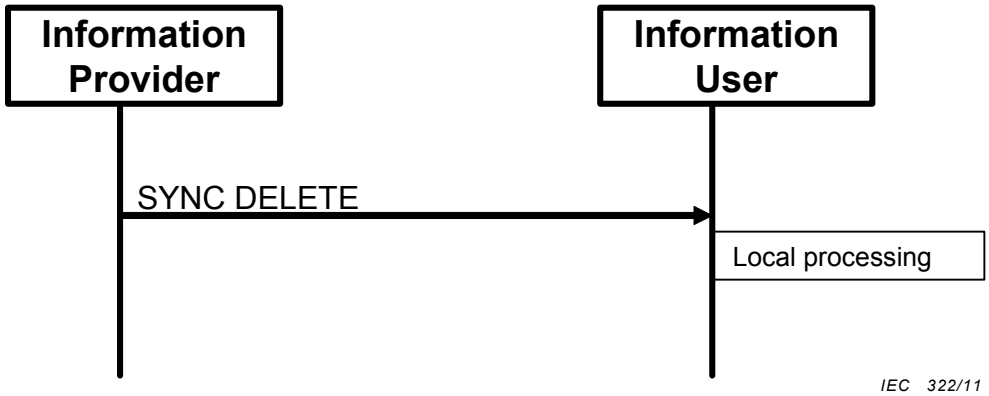
5.12 SYNC CHANGE verb

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, as shown in Figure 14. The SYNC DELETE message shall include the object instances deleted. The specific elements to be deleted are defined in Clause 6.



NOTE A SYNC DELETE message only indicates that the provider has deleted the information from publication. The information may 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.

Figure 14 – SYNC DELETE transaction with no confirmation

6 Message nouns

6.1 General

This clause 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 Transaction service profile

The message contents of a transaction service 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 6.12 and Clause 7 for the definition of the object and compliance information.

NOTE The transaction service profile is a method to interactively determine what verbs and nouns are supported by an application.

6.2.2 Personnel class

The Personnel Class noun contains the following objects as defined in IEC 62264-2:

- Personnel Class
- Personnel Class Property

6.2.3 Person

The Person noun contains the following objects as defined in IEC 62264-2:

- Person
- Person Property
- Qualification Test Result

6.2.4 Qualification test specification

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

- Qualification Test Specification

6.2.5 Equipment class

The Equipment Class noun contains the following objects as defined in IEC 62264-2:

- Equipment Class
- Equipment Class Property

6.2.6 Equipment

The Equipment noun contains the following objects as defined in IEC 62264-2:

- Equipment
- Equipment Property
- Equipment Capability Test Result

6.2.7 Equipment capability test specification

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

- Equipment Capability Test Specification

6.2.8 Maintenance request

The Maintenance Request noun contains the following object as defined in IEC 62264-2:

- Maintenance Request

6.2.9 Maintenance work order

The Maintenance Work Order noun contains the following object as defined in IEC 62264-2:

- Maintenance Work Order

6.2.10 Maintenance response

The Maintenance Response noun contains the following object as defined in IEC 62264-2:

- Maintenance Response

6.2.11 Material class

The Material Class noun contains the following objects as defined in IEC 62264-2:

- Material Class
- Material Class Property

6.2.12 Material definition

The Material Definition noun contains the following objects as defined in IEC 62264-2:

– Material Definition
– Material Definition Property

6.2.13 Material lot

The Material Lot noun contains the following objects as defined in IEC 62264-2:

– Material Lot
– Material Lot Property
– QA Test Result

6.2.14 Material sublot

The Material Sublot noun contains the following objects as defined in IEC 62264-2:

– Material Sublot
– Material Sublot Property
– QA Test Result

NOTE In IEC 62264-1 and IEC 62264-2, material sublots do not have unique properties or quality test results. Implementation of this model should allow material sublots to have unique properties and quality test results.

Example: Sublot specific properties may be unique RFIDs (Radio Frequency ID) for each sublot or maximum temperature indicators for each sublot.

6.2.15 QA test Specification

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

– QA Test Specification

6.2.16 Process segment

The Process Segment noun contains the following objects as defined in IEC 62264-2:

– Process Segment
– Process Segment Parameter
– Personnel Segment Specification
– Equipment Segment Specification
– Material Segment Specification
– Process Segment Dependency
– Personnel Segment Specification Property
– Equipment Segment Specification Property
– Material Segment Specification Property

6.2.17 Production capability

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

– Production Capability
– Personnel Capability
– Equipment Capability
– Material Capability

- Process Segment Capability
- Personnel Capability Property
- Equipment Capability Property
- Material Capability Property

6.2.18 Product definition

The Product Definition noun contains the following objects as defined in IEC 62264-2:

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

6.2.19 Production schedule

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

- Production Schedule
- Production Request
- Segment Requirement
- Requested Segment Response
- Production Parameter
- Personnel Requirement
- Equipment Requirement
- Material Produced Requirement
- Material Consumed Requirement
- Consumable Expected
- Personnel Requirement Property
- Equipment Requirement Property
- Material Produced Requirement Property
- Material Consumed Requirement Property
- Consumable Expected Property

6.2.20 Production performance

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

- Production Performance
- Production Response
- Segment Response
- Production Data

- Personnel Actual
- Equipment Actual
- Material Produced Actual
- Material Consumed Actual
- Consumable Actual
- Personnel Actual Property
- Equipment Actual Property
- Material Produced Actual Property
- Material Consumed Actual Property
- Consumable 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, as identified by the dotted collections in Figure 15.

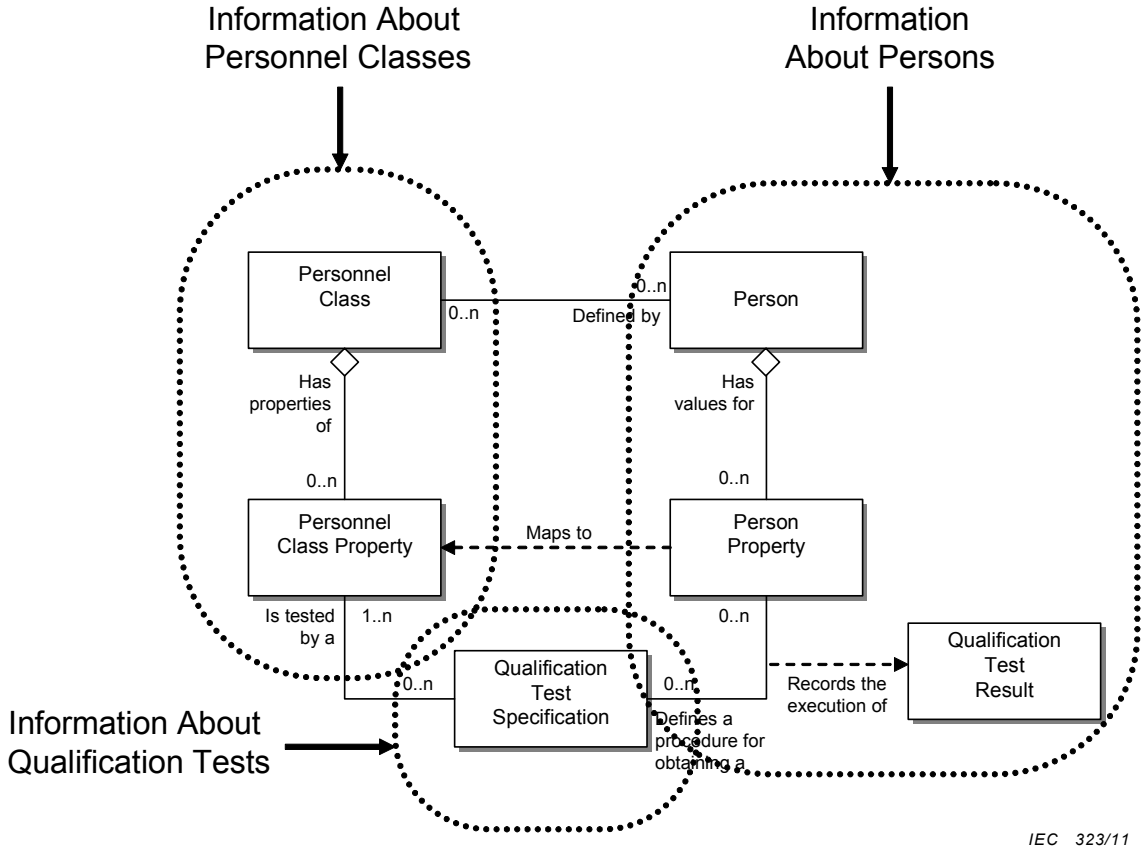


Figure 15 – Object grouping for the personnel model

Example: Messages may be: Get Personnel Class, Get Person, Get Qualification Test

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 contains 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 Object(s) Specified
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 to *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 a 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 a 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 Object(s) Specified
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*, a 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 1 To return all *Personnel Classes*, specify a "*" 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 Object(s) Specified
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 the class. EXAMPLE 2: To return a single property, specify the single Personnel *Class Property ID* in the property wildcard. EXAMPLE 3: To return all *Personnel Class* properties, specify a "*" as the property wildcard. EXAMPLE 4: To return a single *Personnel Class*, specify the *Personnel Class* ID in the wildcard. EXAMPLE 5: To return all *Personnel Classes*, specify a "*" 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 contains the IDs of the personnel classes the person belongs to.

6.3.5 Person verb actions

Actions performed on a person object 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 Object(s) Specified
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 Object(s) Specified
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*, specify a "*" 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 Object(s) Specified
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, specify the property in the property wildcard. EXAMPLE 2: To return all properties, specify a "*" as the property wildcard. EXAMPLE 3: To return a single *Person*, specify the *Person ID* in the wildcard. EXAMPLE 4: To return all *Persons*, specify a "*" 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 object are defined in Table 9.

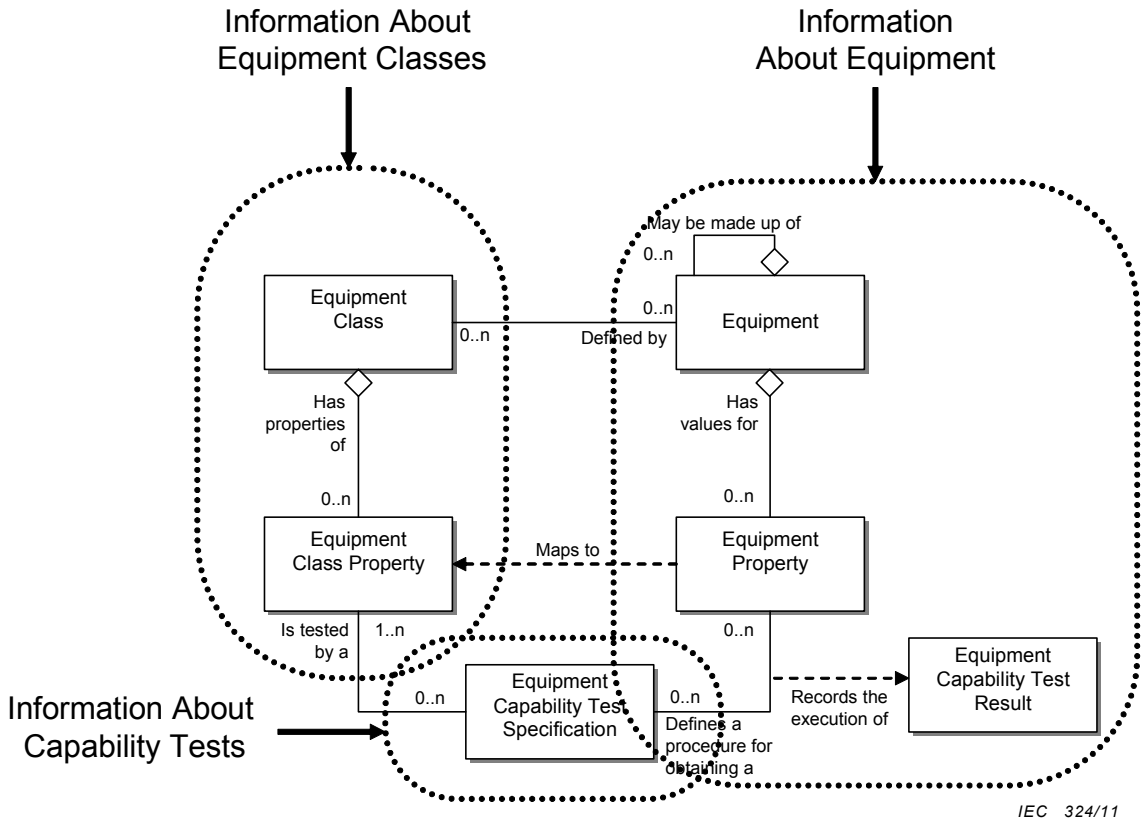
Table 9 – Qualification test specification verb actions

Value of Qualification Test ID	Verb Action on Object(s) Specified
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*, specify a "*" 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 Equipment model

6.4.1 Equipment model elements

The message definitions assume that information may be accessed from any of three starting points: equipment class, equipment, or equipment capability test, as identified by the dotted collections in Figure 16.



Example: Messages may be: Get Equipment Class, Get Equipment, Get Equipment Capability Test.

Figure 16 – Object grouping for the equipment model

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 equipment 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 equipment 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 Object(s) Specified
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 a 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 Object(s) Specified
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*, a 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 1: To return all *Equipment Classes*, specify a "*" 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 Object(s) Specified
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 2: To return a single property, specify the *Equipment Class Property* ID in the property wildcard. EXAMPLE 3: To return all *Equipment Class Properties*, specify a "*" as the property wildcard. EXAMPLE 4: To return a single *Equipment Class*, specify the ID in the wildcard ID. EXAMPLE 5: To return all *Equipment Classes*, specify a "*" 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 object 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 Object(s) Specified
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, 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* 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*.
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

Value of Equipment ID	Value of Equipment Property ID	Equipment Property Value	Verb Action on Object(s) Specified
			the specified property value. **SYNC ADD**: Shall define a request that the receiver is to add the specified *Equipment*, a 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 wildcard and the IDs of *Equipment Classes* of each *Equipment*. EXAMPLE 1: To return all *Equipment*, specify a "*" 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 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 wildcard.
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 wildcard, and for each class return all *Equipment Properties* that match the property wildcards, and the IDs of *Equipment Classes* of to the *Equipment*. EXAMPLE 2: To return a single property, specify the *Equipment Property* ID in the property wildcard. EXAMPLE 3: To return all *Equipment* properties, specify a "*" as the property wildcard. EXAMPLE 4: To return a single *Equipment*, specify the *Equipment* ID in the wildcard. EXAMPLE 5: To return all *Equipment*, specify a "*" 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 *Equipment Property* wildcard of all *Equipment* that matches 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 *Equipment Property* wildcard of all *Equipment* that match the 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 test verb actions

The actions performed on an equipment capability test specification object are defined in Table 12.

Table 12 – Equipment capability test specification verb actions

Capability Test ID	Verb Action on Object(s) Specified
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 *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 *Capability Tests*, specify a "*" 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 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 *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 *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 *Capability Tests* matching the wildcard.

6.5 Maintenance model

6.5.1 Maintenance model elements

The message definitions assume that information on Maintenance Requests, Maintenance Responses, and Maintenance Work Orders may be sent separately, as shown in Figure 17.

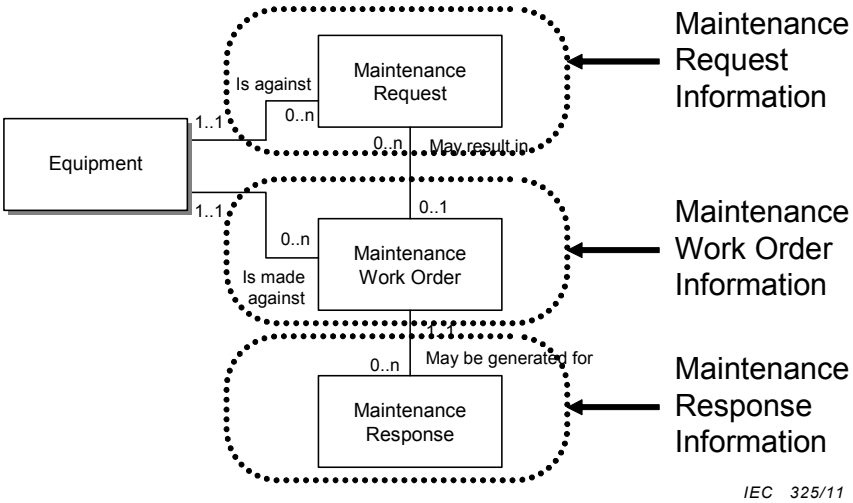


Figure 17 – Object grouping for the maintenance model

6.5.2 Maintenance request verbs

All verbs shall be valid for a maintenance request noun.

NOTE A request for maintenance is represented as a maintenance request. A maintenance request is made against specific equipment. There may be many outstanding maintenance requests against a piece of equipment.

6.5.3 Maintenance request verb actions

The actions performed on a maintenance request are defined in Table 13.

Table 13 – Maintenance request verb actions

Maintenance Request ID	Verb Action on Object(s) Specified
IDs specified	**GET**: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Maintenance Requests* and IDs of the associated *Maintenance Work Orders*. **PROCESS**: Shall define a request that the receiver is to add *Maintenance Requests*. Defines suggested IDs for the *Maintenance Requests*, values for the attributes and IDs of the associated *Maintenance Work Orders*. The receiver adds the *Maintenance Requests* 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 *Maintenance Requests*. 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 *Maintenance Requests*. **SYNC ADD**: Shall define a request that the receiver is to add the specified *Maintenance Requests*. **SYNC CHANGE**: Shall define a request that the receiver is to change the specified attributes of the *Maintenance Requests*. **SYNC DELETE**: Shall define a request that the receiver is to delete the specified *Maintenance Requests*.
<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 *Maintenance Requests* identified by the wildcard and IDs of the associated *Maintenance Work Orders*. EXAMPLE: To return all *Maintenance Requests*, specify a "*" as the wildcard. **PROCESS**: Error. **CHANGE**: Shall define a request that the receiver is to change all specified attributes of all *Maintenance Requests* 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 *Maintenance Requests* matching the wildcard. **SYNC ADD**: Error. **SYNC CHANGE**: Shall define a request that the receiver is to change all specified attributes of all *Maintenance Requests* matching the wildcard. **SYNC DELETE**: Shall define a request that the receiver is to delete all *Maintenance Requests* matching the wildcard.

6.5.4 Maintenance response verbs

All verbs shall be valid for a maintenance response noun.

NOTE A maintenance response is the response to a maintenance request.

6.5.5 Maintenance response verb actions

The actions performed on a maintenance response are defined in Table 14.

Table 14 – Maintenance response verb actions

Maintenance Response ID	Verb Action on Object(s) Specified
IDs specified	**GET**: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Maintenance Responses* and IDs of the associated *Maintenance Work Orders*. **PROCESS**: Shall define a request that the receiver is to add a *Maintenance Response*. Defines a suggested ID for the *Maintenance Response*, values for the attributes and IDs of the associated *Maintenance Work Orders*. The receiver adds the *Maintenance Response* and assigns an ID. 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 *Maintenance Responses*. 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 *Maintenance Responses*. **SYNC ADD**: Shall define a request that the receiver is to add the specified *Maintenance Response*. **SYNC CHANGE**: Shall define a request that the receiver is to change the specified attributes of the *Maintenance Responses*. **SYNC DELETE**: Shall define a request that the receiver is to delete the specified *Maintenance 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 of all *Maintenance Responses* identified by the wildcard and IDs of the associated *Maintenance Work Orders*. EXAMPLE: To return all *Maintenance Responses*, specify a "*" as the wildcard. **PROCESS**: Error. **CHANGE**: Shall define a request that the receiver is to change all specified attributes of all *Maintenance Responses* 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 *Maintenance Responses* matching the wildcard. **SYNC ADD**: Error. **SYNC CHANGE**: Shall define a request that the receiver is to change all specified attributes of all *Maintenance Responses* matching the wildcard. **SYNC DELETE**: Shall define a request that the receiver is to delete all *Maintenance Responses* matching the wildcard.

6.5.6 Maintenance work order verbs

All verbs shall be valid for a maintenance work order noun.

NOTE Work done against a maintenance request is represented as a maintenance work order. Zero or more maintenance work orders may be generated from a maintenance request.

6.5.7 Maintenance work order verb actions

The actions performed on a maintenance work order are defined in Table 15.

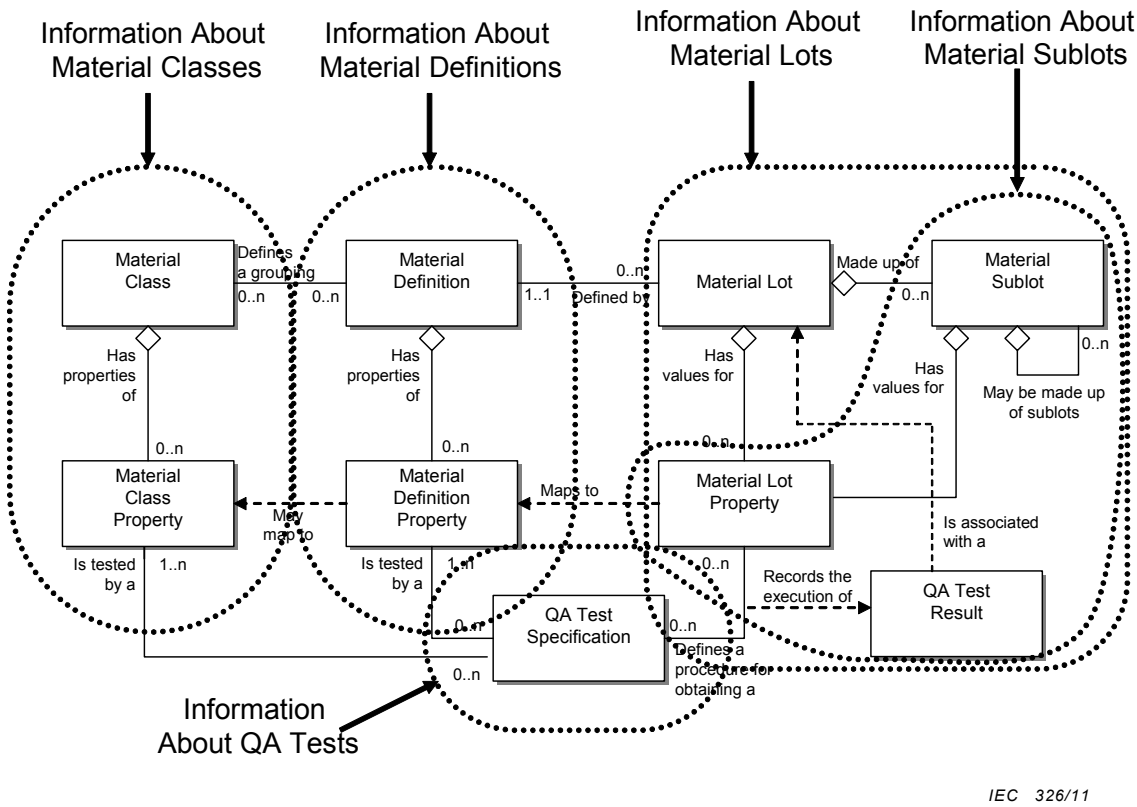
Table 15 – Maintenance work order verb actions

Maintenance Request ID	Verb Action on Object(s) Specified
IDs specified	**GET**: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *Maintenance Work Orders* and IDs of the associated *Maintenance Requests* and *Maintenance Responses*. **PROCESS**: Shall define a request that the receiver is to add *Maintenance Work Orders*. Defines suggested IDs for the *Maintenance Work Orders*, values for the attributes and IDs of the associated *Maintenance Requests* and *Maintenance Responses*. The receiver adds the *Maintenance Work Orders* 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 *Maintenance Work Orders*. 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 *Maintenance Work Orders*. **SYNC ADD**: Shall define a request that the receiver is to add the specified *Maintenance Work Orders*. **SYNC CHANGE**: Shall define a request that the receiver is to change the specified attributes of the *Maintenance Work Orders*. **SYNC DELETE**: Shall define a request that the receiver is to delete the specified *Maintenance Work Orders*.
<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 *Maintenance Work Orders* identified by the wildcard and IDs of the associated *Maintenance Requests* and *Maintenance Responses*. EXAMPLE: To return all MAINTENANCE WORK ORDERs, specify a "*" as the wildcard. **PROCESS**: Error. **CHANGE**: Shall define a request that the receiver is to change all specified attributes of all *Maintenance Work Orders* 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 *Maintenance Work Orders* matching the wildcard. **SYNC ADD**: Error. **SYNC CHANGE**: Shall define a request that the receiver is to change all specified attributes of all *Maintenance Work Orders* matching the wildcard. **SYNC DELETE**: Shall define a request that the receiver is to delete all *Maintenance Work Orders* matching the 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 QA tests, as identified by the dotted collections in Figure 18.



Example: Messages may be Get Material Class, Get Material Lot, Get QA Test.

Figure 18 – Object grouping for the material model

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

Value of Material Class ID	Value of Material Class Property ID	Material Class Property Value	Verb Action on Object(s) Specified
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 a 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*.

Value of Material Class ID	Value of Material Class Property ID	Material Class Property Value	Verb Action on Object(s) Specified
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*, a 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 1: To return all *Material Classes*, specify a "*" 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.

Value of Material Class ID	Value of Material Class Property ID	Material Class Property Value	Verb Action on Object(s) Specified
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 2: To return a single property, specify the MATERIAL CLASS property ID in the property wildcard. EXAMPLE 3: To return all *Material Class Properties*, specify a "*" as the property wildcard. EXAMPLE 4: To return a single *Material Class*, specify the *Material Class* ID in the wildcard. EXAMPLE 5: To return all *Material Classes*, specify a "*" 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 definition 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

Actions performed on the material definition objects are defined in Table 17.

Table 17 – Material definition verb actions

Value of Material Definition ID	Value of Material Definition Property ID	Material Definition Property Value	Verb Action on Object(s) Specified
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*.

Value of Material Definition ID	Value of Material Definition Property ID	Material Definition Property Value	Verb Action on Object(s) Specified
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*, a 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 1: To return all *Material Definitions*, specify a "*****" 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.

Value of Material Definition ID	Value of Material Definition Property ID	Material Definition Property Value	Verb Action on Object(s) Specified
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* IONS 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 the *Material Definitions*. EXAMPLE 2: To return a single property, specify the *Material Definition Property* ID in the property wildcard. EXAMPLE 3: To return all *Material Definition Properties*, specify a "*" as the property wildcard. EXAMPLE 4: To return a *Material Definition*, specify the *Material Definition* ID in the wildcard. EXAMPLE 5: To return all *Material Definitions*, specify a "*" 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 object are defined in Table 18.

Table 18 – Material lot verb actions

Value of Material Lot ID	Value of Material Lot Property ID	Material Lot Property Value	Verb Action on Object(s) Specified
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 QA 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 QA 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*.

Value of Material Lot ID	Value of Material Lot Property ID	Material Lot Property Value	Verb Action on Object(s) Specified
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 QA 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 QA Test Results associated with the properties. EXAMPLE 1: To return all *Material Lots*, specify a "*" 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.

Value of Material Lot ID	Value of Material Lot Property ID	Material Lot Property Value	Verb Action on Object(s) Specified
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 QA Test Results associated with the properties. EXAMPLE 2: To return a single property, specify the *Material Lot Property* ID in the property wildcard. EXAMPLE 3: To return all *Material Lot Properties*, specify a "*" as the property wildcard. EXAMPLE 4: To return a single *Material Lot*, specify the *Material Lot* ID in the wildcard. EXAMPLE 5: To return all *Material Lots*, specify a "*" 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

Value of Material Sublot ID	Value of Material Sublot Property ID	Material Sublot Property Value	Verb Action on Object(s) Specified
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 QA 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 QA 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*.

Value of Material Sublot ID	Value of Material Sublot Property ID	Material Sublot Property Value	Verb Action on Object(s) Specified
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 QA 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 QA Test Results associated with the properties. EXAMPLE 1: To return all *Material Sublots*, specify a "*" 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.

Value of Material Sublot ID	Value of Material Sublot Property ID	Material Sublot Property Value	Verb Action on Object(s) Specified
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 QA Test Results associated with the properties. EXAMPLE 2: To return a single property, specify the *Material Sublot Property* ID in the property wildcard. EXAMPLE 3: To return all *Material Sublot Properties*, specify a "*" as the property wildcard. EXAMPLE 4: To return a single *Material Sublot*, specify the *Material Sublot* ID in the wildcard. EXAMPLE 5: To return all *Material Sublots*, specify a "*" 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 QA test specification verbs

All verbs shall be valid for a QA Test Specification noun.

NOTE This contains information about QA 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 QA test specification verb actions

The actions performed on a QA test specification object are defined in Table 20.

Table 20 – QA test verb actions

QA Test ID	Returns
IDs specified	**GET**: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the *QA 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 *QA Test Specifications*. The message defines suggested IDs for the *QA Test Specifications*, values for the attributes and IDs of *Material Class Properties* and *Material Definition Properties* referenced by the *QA Test Specifications*. The receiver adds the *QA 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 *QA 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 *QA Test Specifications*. **SYNC ADD**: Shall define a request that the receiver is to add the specified *QA Test Specifications* and list of *Material Class Properties* and *Material Definition Properties* referenced. **SYNC CHANGE**: Shall define a request that the receiver is to change the specified attributes of the *QA 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 *QA 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 *QA Test Specifications* identified by the 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 *QA Test Specifications* specify a "*" as the wildcard. **PROCESS**: Error. **CHANGE**: Shall define a request that the receiver is to change the specified attributes of all *QA Test Specifications* matching the wildcard and a 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 *QA Test Specifications* matching the wildcard. **SYNC ADD**: Error. **SYNC CHANGE**: Shall define a request that the receiver is to change the specified attributes of all *QA Test Specifications* matching the 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 *QA Test Specifications* matching the 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 is identified by the dotted collection in Figure 19.

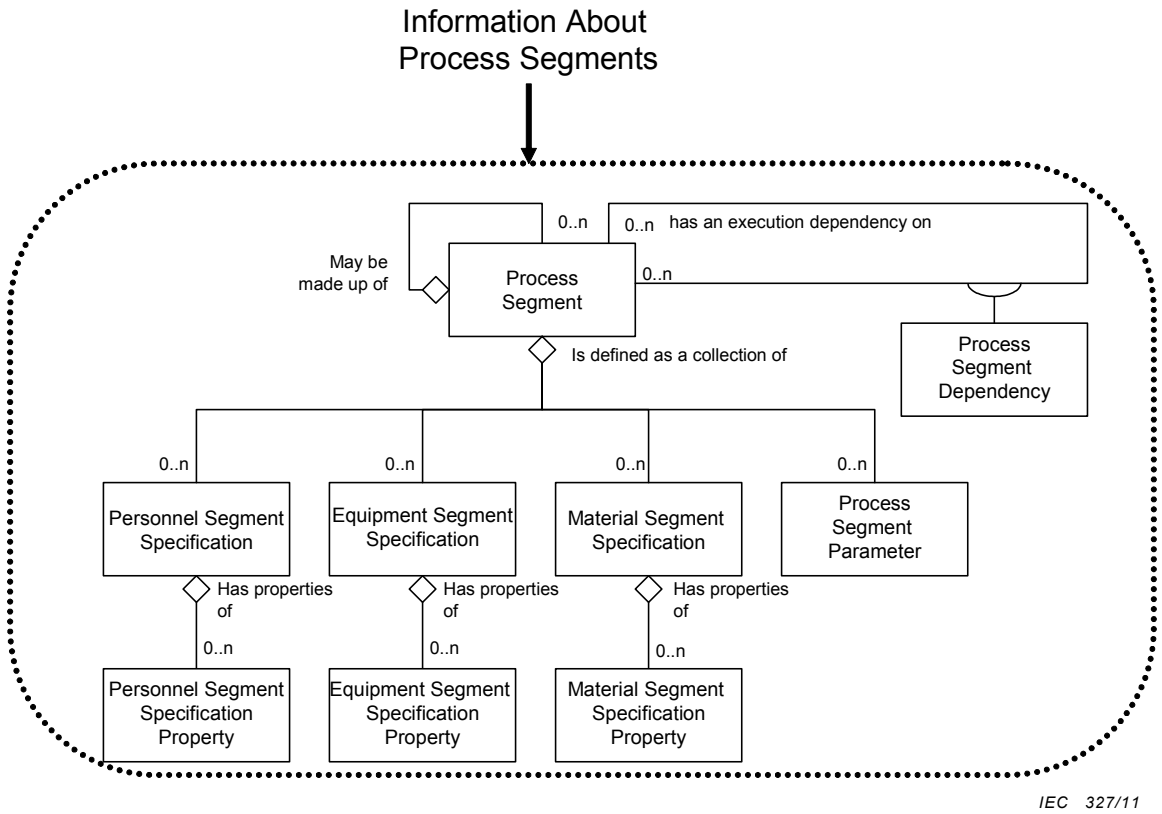


Figure 19 – Object grouping for the process segment model

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 a production 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, equipment, and material specification information.

6.7.3 Process segment verb actions

The actions performed on a process segment object are defined in Table 21.

Table 21 – Process segment verb actions

Process Segment ID	Verb Action on Object(s) Specified
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 element 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*, specify a "*" 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 Production capability model

6.8.1 Production capability model elements

The message definitions assume that production capability information may be accessed from one starting point, a production capability, is identified by the dotted collection in Figure 20.

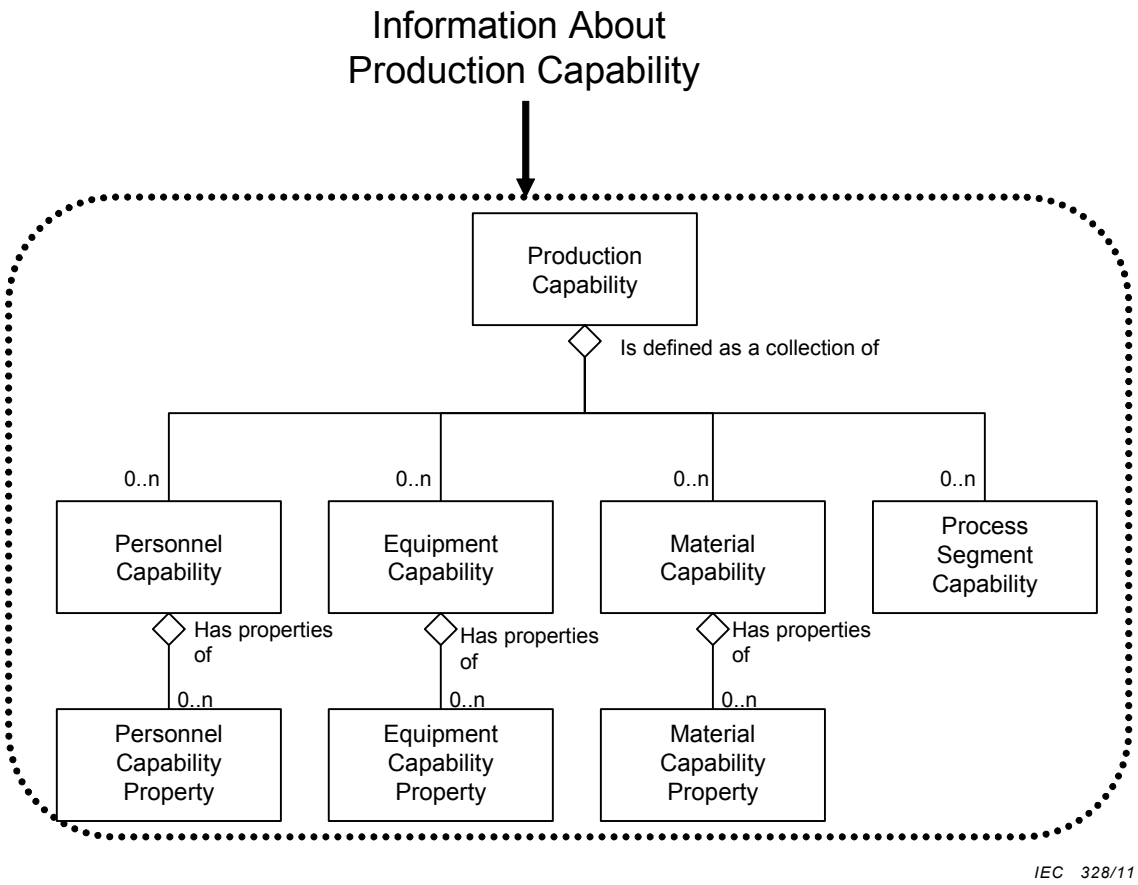


Figure 20 – Object grouping for the production capability model

6.8.2 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.

6.8.3 Production capability verb actions

The actions performed on a production capability object are defined in Table 22.

Table 22 – Production Capability verb actions

Production Capability ID	Verb Action on Object(s) Specified
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 match 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 may 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 element 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 may 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 may 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 may 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 may define a removed process capability due to line shutdown or personnel reassignment.

Production Capability ID	Verb Action on Object(s) Specified
<not specified>	**GET**: Shall define a request that the receiver is to return, in a SHOW message, all attributes and contained elements of *Production 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 *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 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 *Production Capabilities* identified by the information specified in the CANCEL message. See Table 23 for details. If contained element 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 23 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 23 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 23 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 *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 element 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.

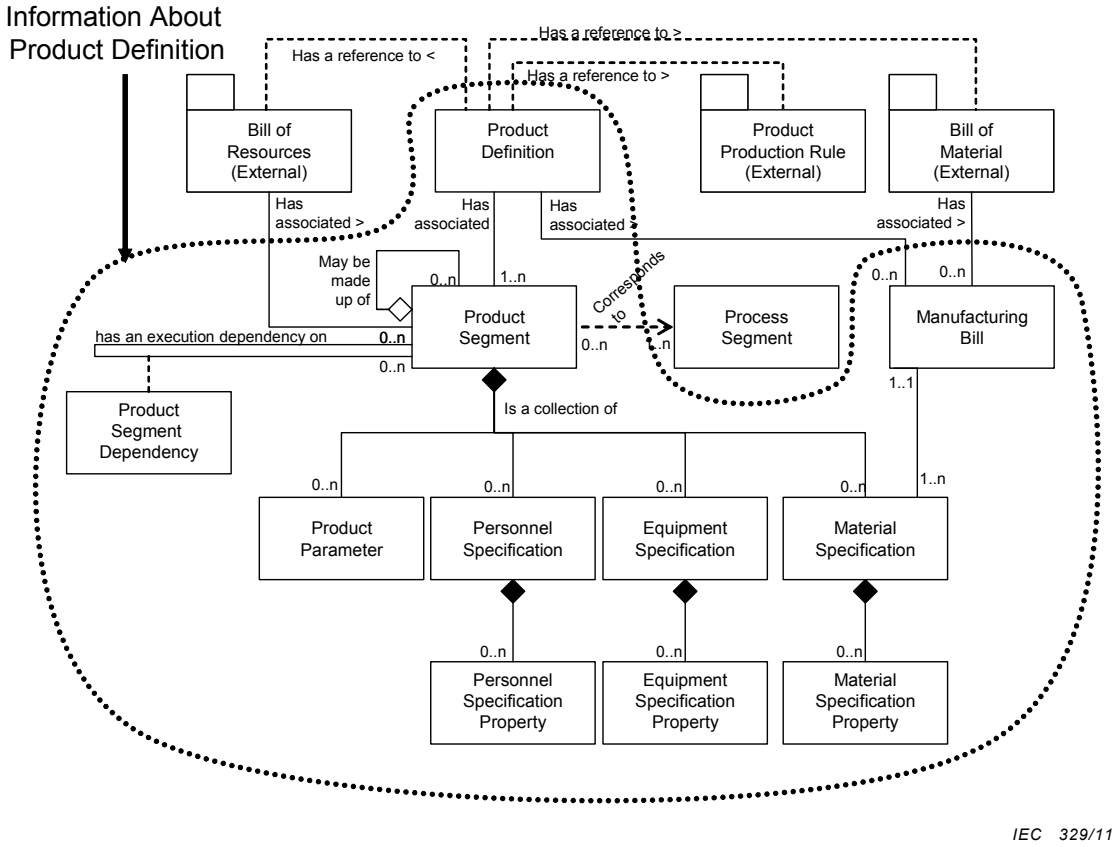
Table 23 – Production capability element definitions for GET and no ID messages

Production Capability Element	Returns
Start Time	Specifies production capability information for the specified start time. If not specified then the responder selects the *Start Time*.
End Time	Specifies production capability information for the specified end time. If not specified then the responder selects the *End Time*.
Location	Specifies production capability information for the specified location (e.g. a process cell, work center, production line, area, site, …). If not specified then the responder selects the *Location*.
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 Capability* ID. If included, then it specifies that the *Process Segment Capability* is returned for the specified process segment.
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 Capability / 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 Capability / 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 Capability / 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 / 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 Capability / 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 Capability / 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 Capability / Material Capability*.
Process Segment 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 Capability / Material Capability*.

6.9 Product definition model

6.9.1 Production definition model elements

The message definitions assume that product definition information may be accessed from one starting point, a product definition is identified by the dotted collection in Figure 21.



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

Figure 21 – Object grouping for the product defintion model

6.9.2 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.

6.9.3 Product definition verb actions

The actions performed on a product definition object are defined in Table 24.

Table 24 – Product definition verb actions

Product Definition ID	Verb Action on Object(s) Specified
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 element IDs are specified, then only the specified contained elements for the specified *Product Definitions* are to be cancelled, 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 wildcard. EXAMPLE: To return all *Product Definitions*, specify a "*" 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 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 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 wildcard. **SYNC DELETE**: Shall define a request that the receiver is to delete all *Product Definitions* matching the wildcard.

6.10 Production schedule model

6.10.1 Production schedule model element

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 22.

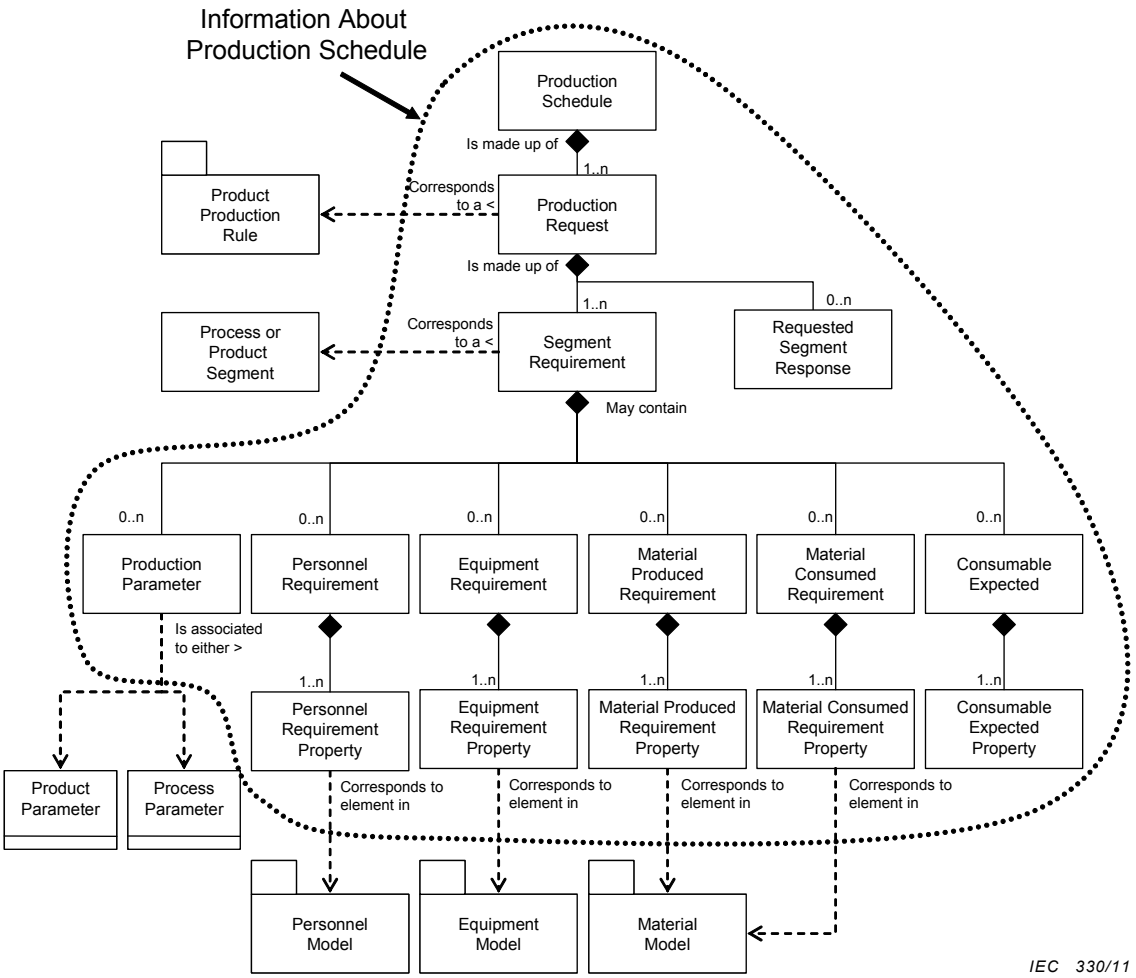


Figure 22 – Object grouping for the production schedule model

6.10.2 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.

6.10.3 Production schedule verb actions

The actions performed on a production schedule object are defined in Table 25.

Table 25 – Production schedule verb actions

Production Schedule ID	Verb Action on Object(s) Specified
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 may 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 element 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 may 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 may 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 may 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 may define a removed *Production Schedule* due to line shutdown or personnel reassignment.

Production Schedule ID	Verb Action on Object(s) Specified
<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 26 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 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 *Production Schedules* based on the information specified in the CANCEL message. See Table 26 for details. If contained element 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 26 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 26 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 26 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 *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 element 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 meaning of production schedule elements for messages are defined in Table 26. If none of the production schedule element definitions are specified, then the responding application may use information in the application identification area to determine which information to return.

Table 26 – Production Schedule element definitions for GET and no ID messages

Production Schedule Element	Returns
Start Time	Specifies the production schedule information for the specified start time. If not specified, then the responder selects the *Start Time*.
End Time	Specifies the production schedule information for the specified end time. If not specified, then the responder selects the *End Time*.
Location	Specifies the production schedule information for the specified location (e.g. a process cell, work center, production line, area, site, …). If not specified, then the responder selects the *Location*.
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. If not specified, then the responder selects the product production rule.

6.11 Production performance model

6.11.1 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 23.

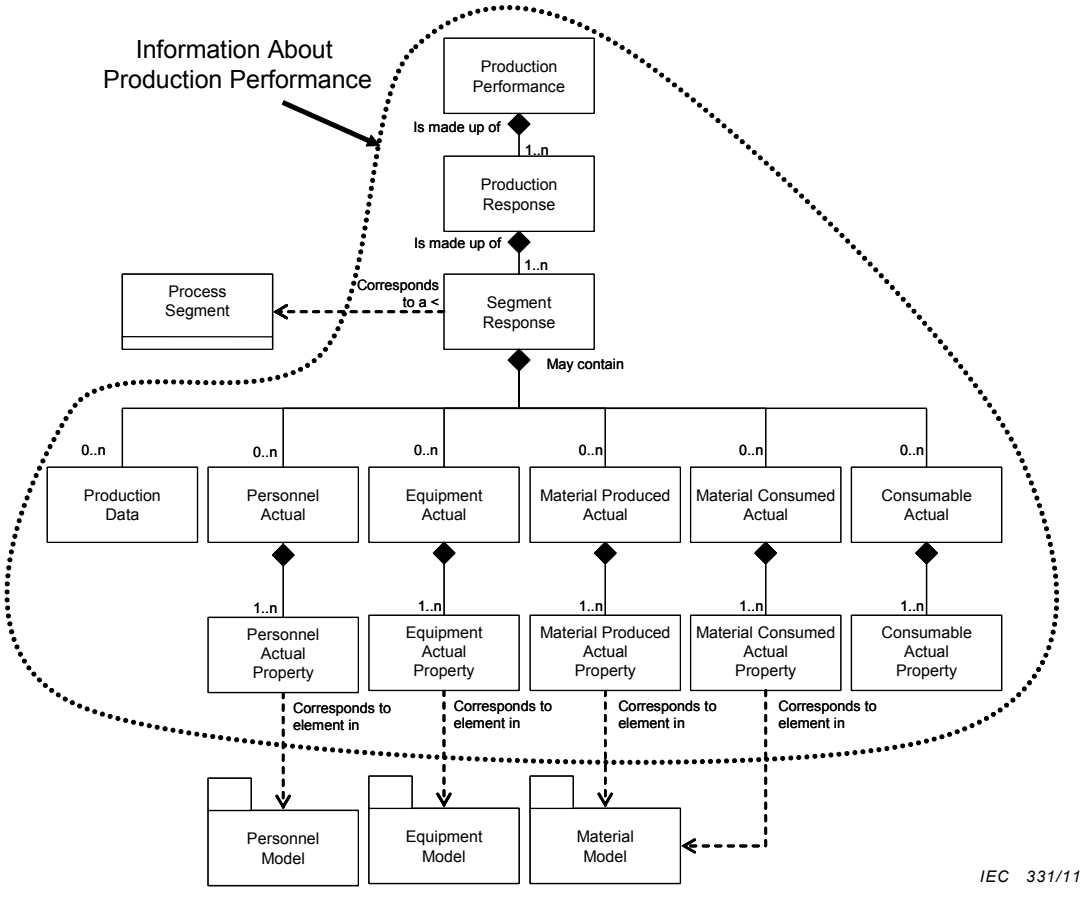


Figure 23 – Object grouping for the production performance model

6.11.2 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 message may involve values in multiple fields. Each field definition restricts the returned information.

6.11.3 Production performance verb actions

The actions performed on a production performance object are defined in Table 27.

Table 27 – Production Performance verb actions

Production Performance ID	Verb Action on Object(s) Specified
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 may 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 element 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 may define 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 may 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 may 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.

Production Performance ID	Verb Action on Object(s) Specified
<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 28 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 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 *Production 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 *Production Performances* based on the information specified in the CANCEL message. See Table 28 for details. If contained element 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 28 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 28 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 28 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 *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 element 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 28 – Production Performance definitions for GET and no ID messages

Production Performance Element	Returns
Start Time	Specifies production performance information for the specified start time. If not specified, then the responder selects the *Start Time*.
End Time	Specifies production performance information for the specified end time. If not specified, then the responder selects the *End Time*.
Location	Specifies production performance information for the specified location (e.g. a process cell, work center, production line, area, site, …). If not specified, then the responder selects the *Location*.
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.

6.12 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 a noun associated element. Applications supporting this standard should 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 24.

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 standard.

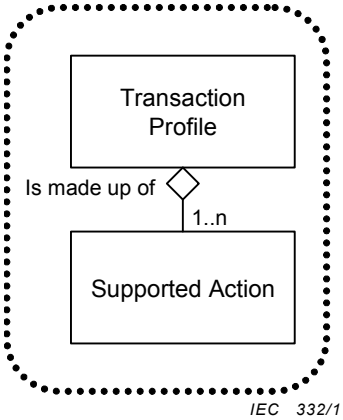


Figure 24 – Transaction profile model

A transaction profile is a container object with no standard attributes. 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 29 lists the standard attributes for a supported action.

Table 29 – Supported action attributes

Attribute Name	Description	Example
Verb	Identifies the verb in the verb-noun action. Valid values are: GET, PROCESS, CHANGE, CANCEL, SYNC ADD, SYNC CHANGE, and SYNC DELETE.	PROCESS SYNC ADD
Noun	Identifies the noun in the verb-noun action.	MATERIAL LOT PRODUCTION SCHEDULE
Information User	Indicates if the application can act as an information user. NOTE This is defined for GET and SYNC messages.	TRUE FALSE
Information Provider	Indicates if the application can act as an information provider. NOTE This is defined for GET and SYNC messages	TRUE FALSE
Information Sender	Indicates if the application can act as an information Sender. NOTE This is defined for PROCESS, CHANGE, and CANCEL messages.	TRUE FALSE
Information Receiver	Indicates if the application can act as an information Receiver. NOTE This is defined for PROCESS, CHANGE, and CANCEL messages	TRUE 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. NOTE Not all verb-noun combinations define wildcard properties.	TRUE FALSE

The GET verb shall be valid for a transaction profile noun.

Table 30 defines the action for each verb.

Table 30 – 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 30 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 they conform 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 shall be conformed to.

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

Suppliers of applications shall use Table 31 or an equivalent to document their supported transactions.

Suppliers of applications shall document if the application can perform the role of the information user, if the application can perform the role of the 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 31 – Supported verb-noun actions

Noun	Verb						
	GET , SHOW	PROCESS, ACKNOWLEDGE	CHANGE, RESPOND	CANCEL	SYNC ADD	SYNC CHANGE	SYNC DELETE
Personnel Class							
Person							
Qualification Test							
Equipment Class							
Equipment							
Capability Test							
Maintenance Request							
Maintenance Work Order							
Maintenance Response							
Material Class							
Material Definition							
Material Lot							
Material Sublot							
QA Test							
Process Segment							
Production Capability							
Product Definition							
Production Schedule							
Production Performance							
Transaction Profile							

NOTE 1 IEC 62264-2, Clause 5 defines how to document conformance for the specific objects and attributes supported.

NOTE 2 The bands in Table 31 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 32 is an example of a 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 32 – Vendor conformance example

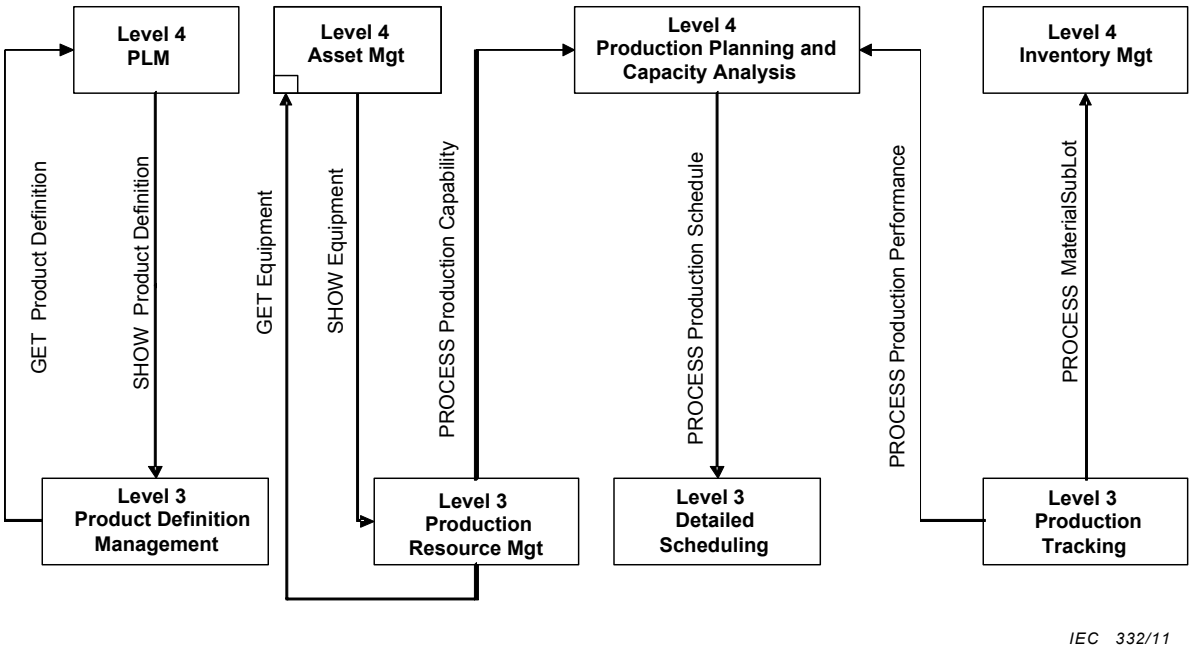
Noun	Verb						
	GET, SHOW	PROCESS, ACKNOW-LEDGE	CHANGE, RESPOND	CANCEL	SYNC ADD	SYNC CHANGE	SYNC DELETE
Personnel Class							
Person							
Qualification Test							
Equipment Class							
Equipment							
Capability Test							
Maintenance Request							
Maintenance Work Order							
Maintenance Response							
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
QA Test	User, Provider, Object wildcard, Property wildcard	Sender, Receiver	Sender, Receiver, Object wildcard, Property wildcard	Sender, Receiver, Object wildcard, Property wildcard	User	User	User
Process Segment							
Production Capability							
Product Definition							
Production Schedule							
Production Performance							
Transaction Profile	Provider						

Annex A
(informative)

Transaction models and business scenario examples

A.1 Coordinating activities

The following example 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 standard.



NOTE Communicaton within Levels 3 or 4 are not shown because they are in the scope of this standard.

Figure A.1 – Coordination of planning and operations processes

The diagram of Figure A.1 is based on the following 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) 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.

A.2 Usage scenarios

The following clauses define typical usage scenarios that could be implemented using the transactions defined in this standard. The scenarios are based on the coordinating processes model of Clause A.1. The scenarios combine a set of transactions.

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

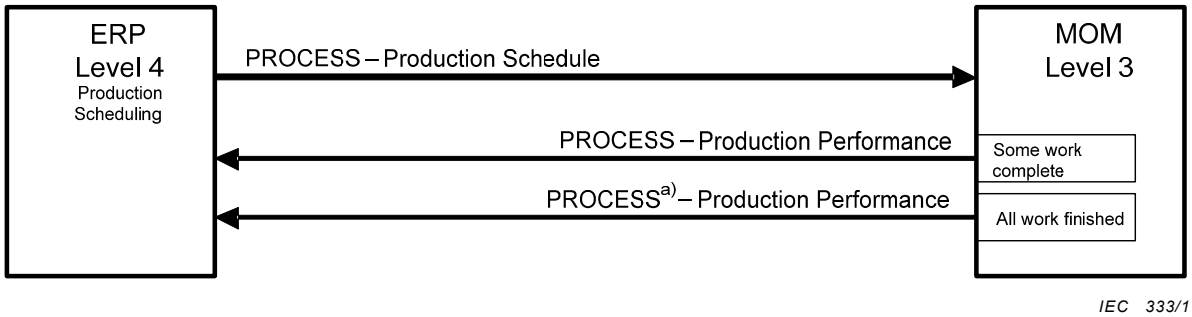
A.3 Production schedule and production performance

A.3.1 Push model

a) The last PROCESS production performance message contains a flag to indicate that the message is the final production performance for the associated production schedule.

Figure A.2 shows a push model which is based on the following scenario assumptions.

a) ERP pushes production schedule to MOM for processing when schedules are released.
b) MOM pushes production performance to ERP for processing as work is completed.



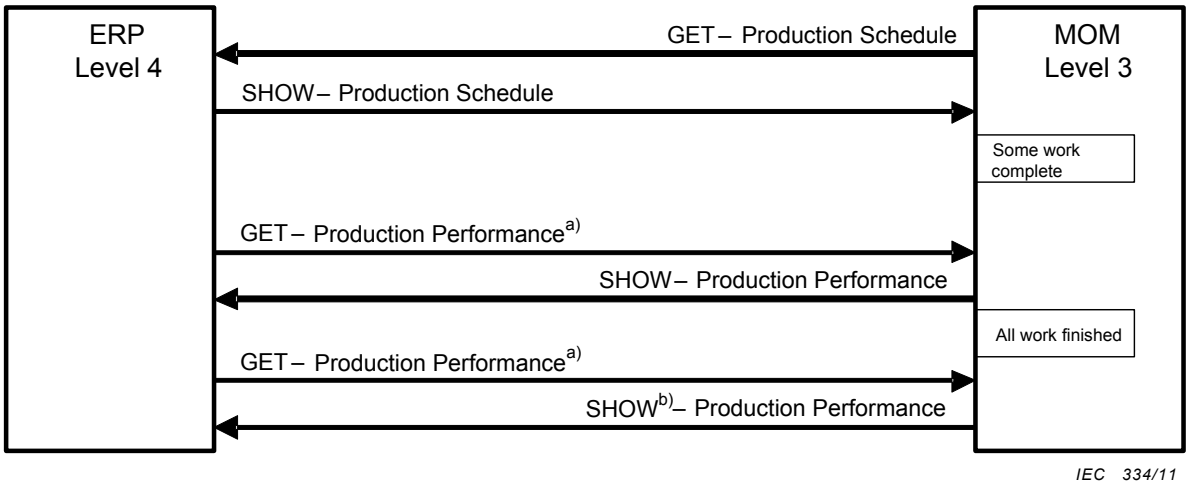
a) The last PROCESS production performance message contains a flag to indicate that the message is the final production performance for the associated production schedule.

Figure A.2 – Push model – Production schedule and production performance

A.3.2 Pull model

Figure A.3 shows a pull model which is based on the following scenario assumptions.

a) MOM requests production schedules from ERP on a regular schedule.
b) ERP requests production performance from MOM on a regular schedule.



a) The GET production performance message contains an identification of a production schedule (Production Performance / Production Schedule ID)

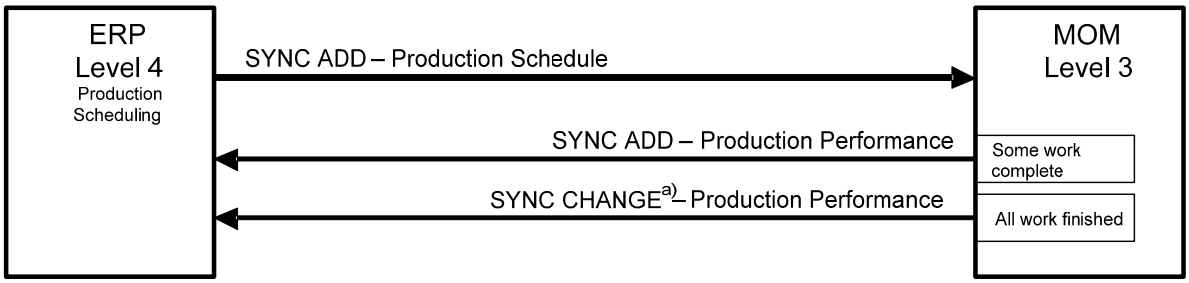
b) The last SHOW production performance message contains a flag to indicate that the message is the final production performance for the associated production schedule.

Figure A.3 – Pull model – Production schedule and production performance

A.3.3 Publish model

Figure A.4 shows a publish model which is based on the following scenario assumptions.

a) MOM subscribes to production schedules.
b) ERP subscribes to production performances.
c) ERP publishes production schedule.
d) MOM publishes initial production performance with a SYNC ADD message.
e) MOM publishes subsequent production 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 production performance for the associated production schedule.

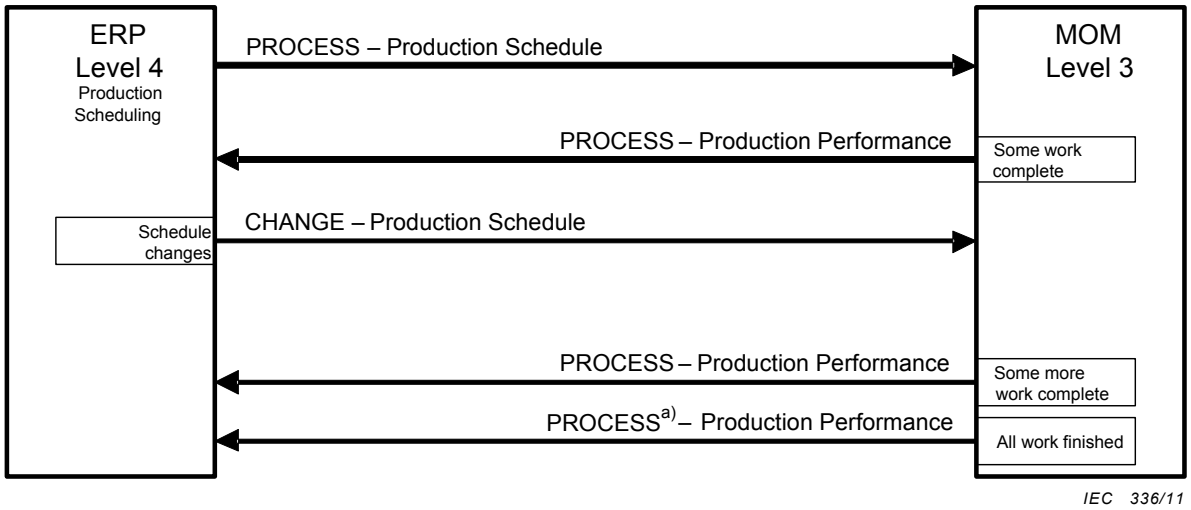
Figure A.4 – Publish model – Production schedule and production performance

A.4 Production schedule changes

A.4.1 Push model

Figure A.5 shows a push model which is based on the following scenario assumptions:

a) ERP sends production schedule to MOM for processing.
b) MOM sends production performance to ERP for processing.
c) ERP makes changes to schedule and sends to MOM for processing.



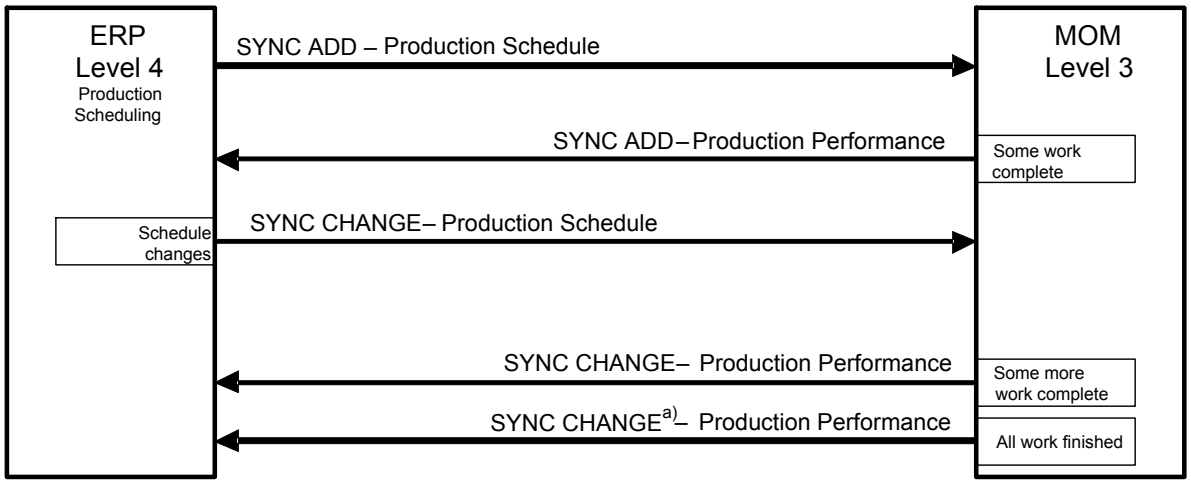
a) The last PROCESS production performance message contains a flag to indicate that the message is the final production performance for the associated production schedule.

Figure A.5 – Push model – Production schedule changes

A.4.2 Publish model

Figure A.6 shows a publish model which is based on the following scenario assumptions:

a) MOM subscribes to production schedules.
b) ERP subscribes to production performances.
c) ERP publishes production schedule.
d) MOM publishes initial production performance with a SYNC ADD message.
e) ERP changes schedule and republishes with SYNC CHANGE.
f) MOM publishes subsequent production 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 production performance for the associated production schedule.

Figure A.6 – Publish model – Production schedule changes

A.5 Production schedule cancelled

A.5.1 Push model

Figure A.7 shows a push model which is based on the following scenario assumptions:

a) ERP sends production schedule to MOM for processing.

b) ERP cancels the schedule before actual production starts, and sends CANCEL of the schedule to MOM.

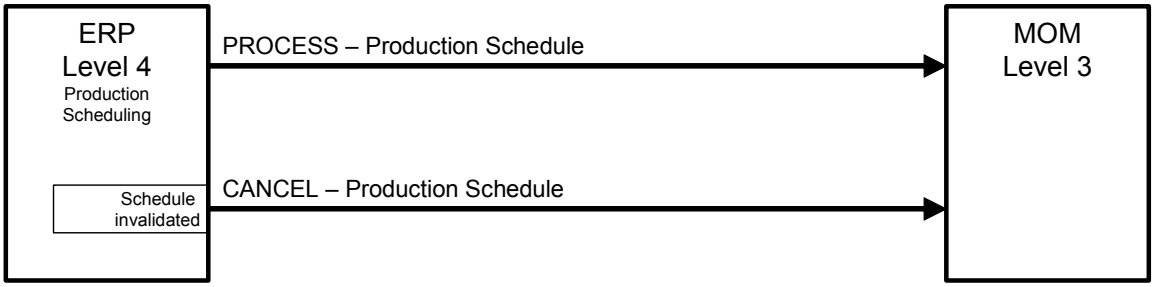


Figure A.7 – Push model – Production schedule cancelled

A.5.2 Push and pull model

Figure A.8 shows a push and pull model which is based on the following scenario assumptions:

a) MOM requests production schedule from ERP.

b) ERP cancels schedule before actual production starts and sends CANCEL of schedule to MOM.

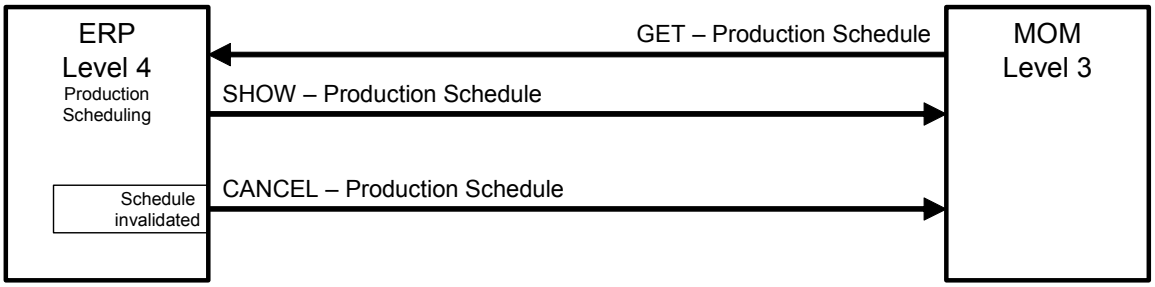


Figure A.8 – Push and pull model – Schedule cancelled

A.6 Daily production performance

A.6.1 Push model

Figure A.9 shows a push model which is based on the following scenario assumptions:

a) MOM sends daily production performance to ERP.

b) The scope of the production performance (which production lines, etc.) and timing of the publication (daily, weekly, time published) is not defined in a message. It is determined to in an out-of-band agreement.

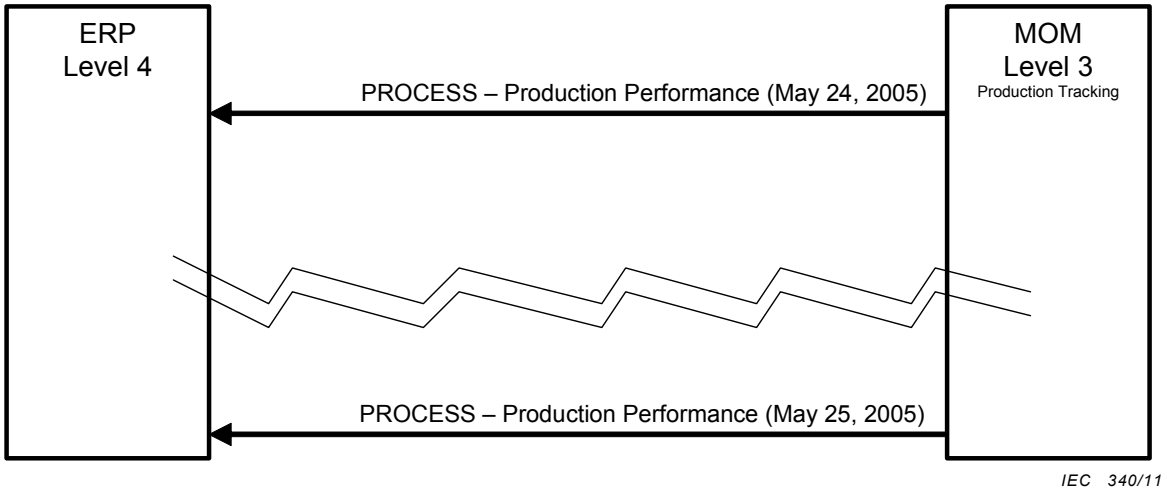


Figure A.9 – Push model – Daily production performance

A.6.2 Pull model

Figure A.10 shows a push model which is based on the following scenario assumptions:

ERP requests production performance from MOM on a daily schedule.

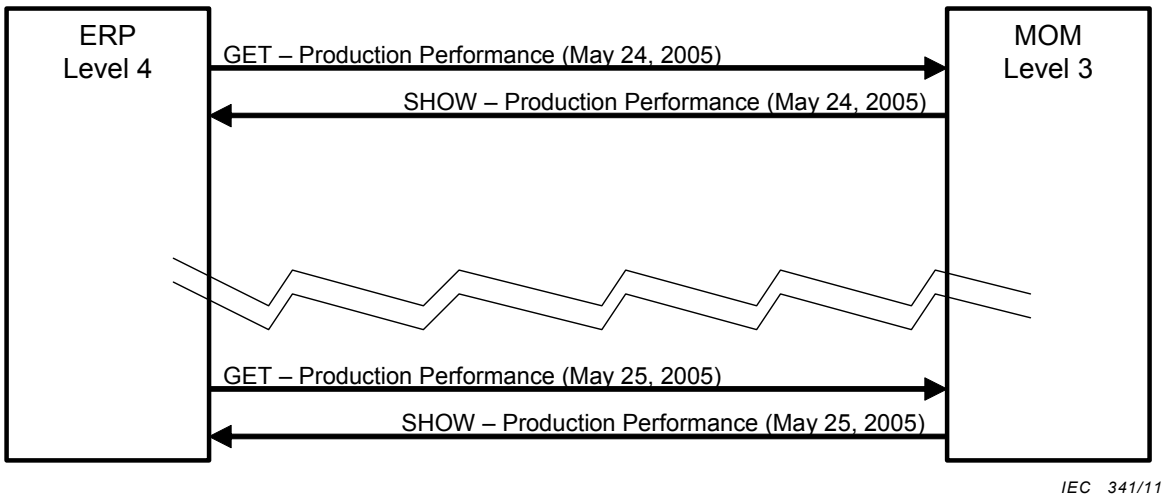


Figure A.10 – Pull model – Daily production performance

A.6.3 Publish model

Figure A.11 shows a publish model which is based on the following scenario assumptions.

a) ERP subscribes to daily production performance from MOM.

b) MOM publishes daily production performance.

c) The scope of the production performance (which production lines, etc…) and the timing of the publication (daily, weekly, time published) are not defined in a message. They are determined in an out-of-band agreement.

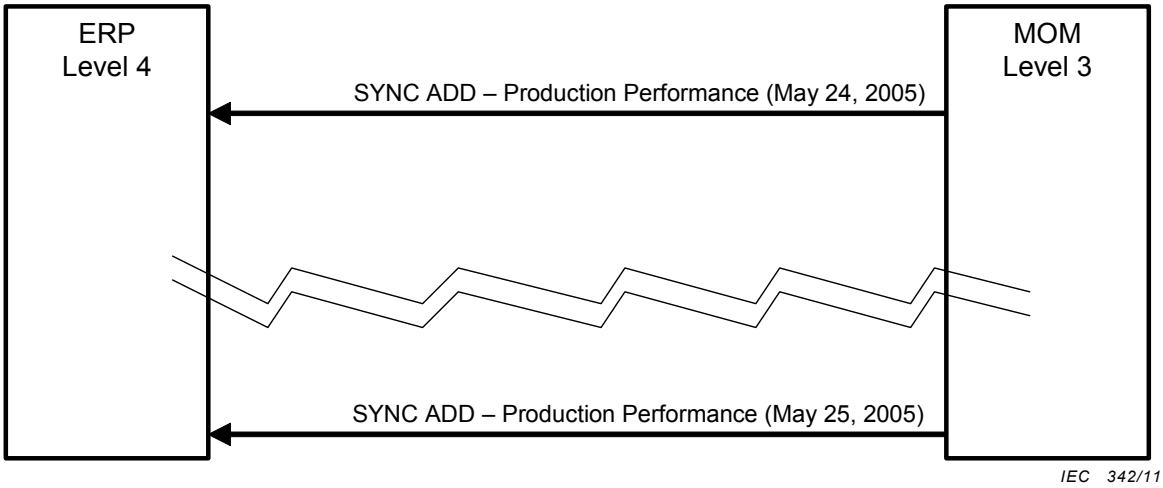


Figure A.11 – Publish model – Daily production schedule

A.7 Production Schedule based on production capability

A.7.1 Pull and push model

Figure A.12 shows a pull and push model which is based on the following scenario assumptions.

a) ERP requests production capability for the planning period.
b) MOM responds with a production capability to ERP.
c) ERP sends production schedule to MOM for processing.
d) MOM sends production performance to ERP reflecting partial order completion.
e) MOM sends production performance to ERP reflecting completion of order.

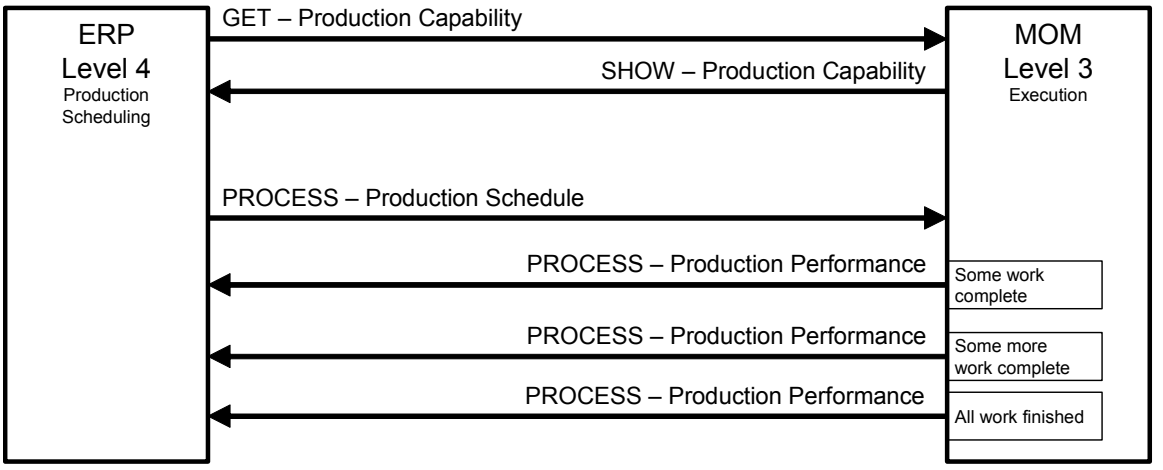


Figure A.12 – Pull and push model – Production capability and production schedule

A.7.2 Publish and push model

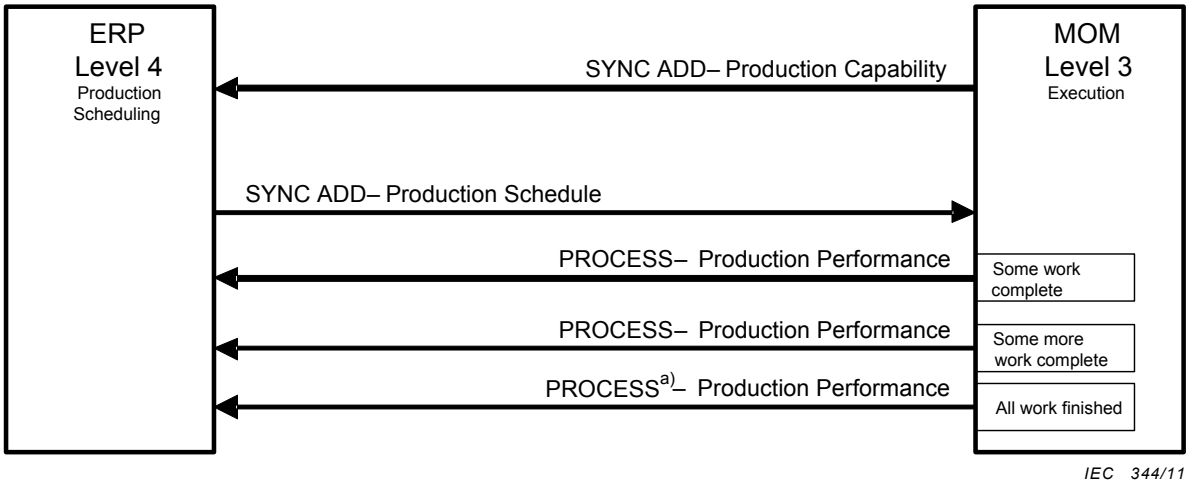
Figure 13 shows a publish and push model which is based on the following scenario assumptions.

a) ERP subscribes to production capability.
b) MOM subscribes to production schedules.
c) MOM publishes production capability on a regular schedule, for example every two days,
d) ERP generates a production schedule and publishes it.

e) MOM sends production performance to ERP reflecting partial order completion.

f) MOM sends production performance to ERP reflecting partial order completion.

g) MOM sends production performance to ERP reflecting completion of order.



a) The last PROCESS message contains a flag to indicate that the message is the final production performance for the associated production schedule.

Figure A.13 – Publish and push model – Production capability and production schedule

A.8 Production schedule changes

A.8.1 Push and pull model

Figure A.14 shows a push and pull model which is based on the following scenario assumptions.

a) ERP sends production schedule to MOM for processing.

b) MOM sends production performance to ERP for processing.

c) ERP requests production capability from MOM.

d) MOM responds with a production capability to ERP.

e) ERP makes changes to the production schedule and sends it to MOM for processing.

f) MOM sends production performance to ERP reflecting partial order completion.

g) MOM sends production performance to ERP reflecting completion of order.

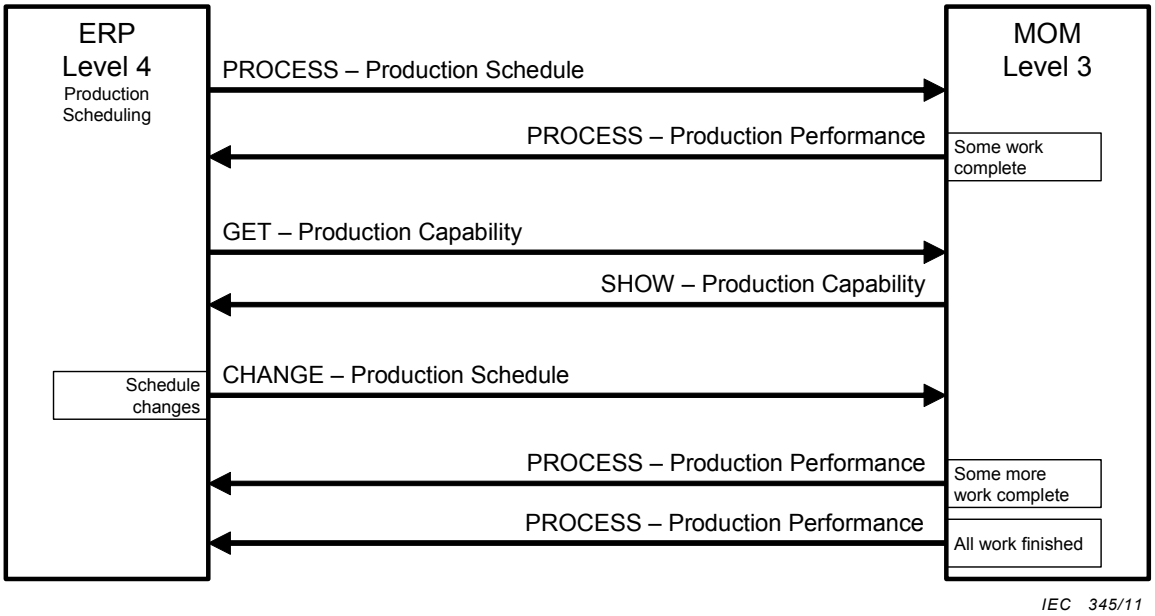
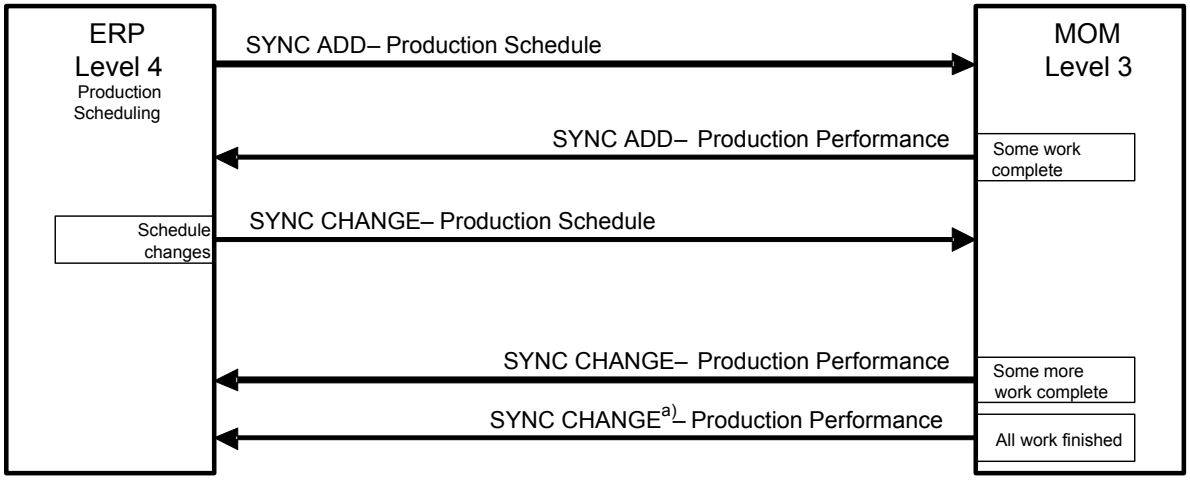


Figure A.14 – Push and pull model – Schedule changes

A.8.2 Publish model

Figure A.15 – Publish model – Schedule changes after capability changes

a) MOM subscribes to production schedules.
b) ERP subscribes to production performances.
c) ERP publishes a production schedule.
d) MOM publishes an initial production 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 production 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 production performance for the associated production schedule.

Figure A.15 – Publish model – Schedule changes after capability changes

A.9 Material quantity changed

A.9.1 Push model

Figure A.16 shows a push model which is based on the following scenario assumptions.

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 the ERP as material is consumed.
d) ERP sends CANCEL when material lot is no longer available.

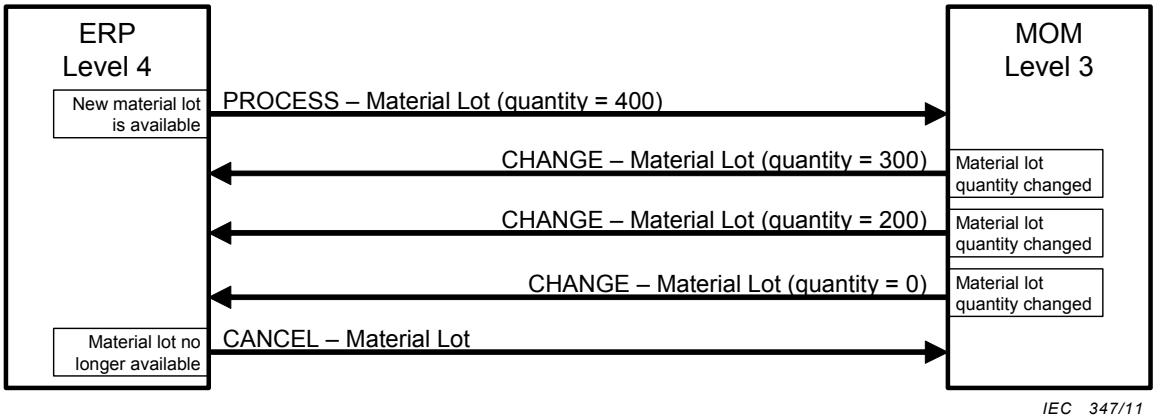


Figure A.16 – Push model – Material lot added, material lot quantity changed

A.9.2 Publish and push model

Figure A.17 shows a publish and push model which is based on the following scenario assumptions.

a) ERP publishes material lot information; MOM subscribes.
b) MOM sends quantity changes in material lot to the ERP.
c) ERP sends SYNC DELETE when the material lot is no longer available.

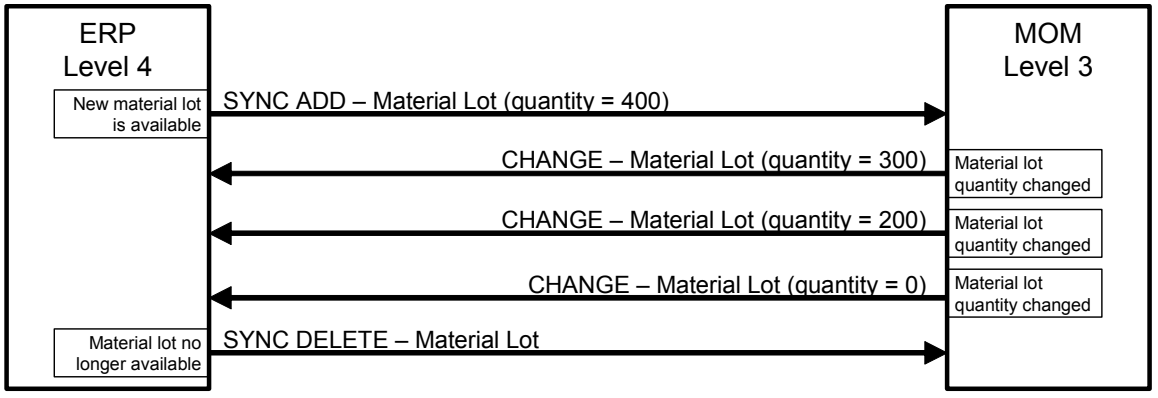


Figure A.17 – Publish and push model – Material quantity changes IEC 348/11

A.9.3 Push and pull model

Figure A.18 shows a publish model which is based on the following scenario assumptions.

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.

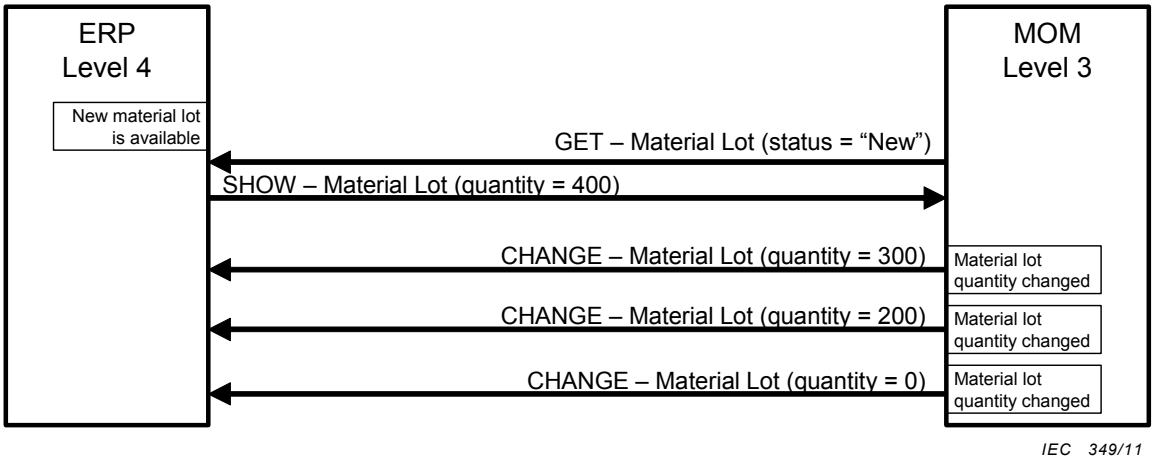


Figure A.18 – Push and pull model – Material quantity changes

Annex B
(informative)

Questions on the use of transactions

B.1 Different 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 should 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 may 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.

B.2 Type of 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.

B.3 Rollbacks

Question

How are rollbacks handled?

Answer

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

B.4 CONFIRM

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 may be required when the information is a critical piece of information that must be shared with a limited number of subscribers.

However, it should be used with care because

a) if many clients are subscribed, the publisher may 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 may not be much it can do.

B.5 Two phase commit

Question

How would you handle a two phase commit?

Answer

Several transactions of this standard 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 occur, 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.

B.6 Confirmation of GET message

Question

Why would you 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.

B.7 Query mechanism

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.

B.8 Nouns

Question

How were the nouns determined?

Answer

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 therefore 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.

B.9 CONFIRM response

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 C
(informative)

Patterns for Verbs

C.1 Patterns

The following tables define a 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 standard.

C.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 C.1, Table C.2 and Table C.3. The specific rules for the GET verb for a specific noun are described within each noun's clause of this standard. When the nouns include other associated elements, such as limiting parameters, then the verb actions are described within each noun's clause of this standard.

Table C.1 – GET message with object ID is specified

Access specification for attributes of objects that make up the noun		**Action for GET verb**
Noun has property objects	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 property objects 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 property objects, 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 property objects, and ID or IDs of the associated objects with the specified object.
Noun has no property objects but has contained objects		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 C.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 property objects	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 property objects, 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 property objects that match the property wildcards, and ID or IDs of the associated objects with the objects.
Noun has no property objects but has contained objects		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 and the IDs of the objects associated with the objects.

Table C.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.

C.3 Actions for PROCESS verb

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

Table C.4 – PROCESS message with Object ID specified

Access specification for attributes of objects that make up the noun		Action for PROCESS verb
Noun has property objects	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 property objects. 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 property objects, and values for the properties. The receiver adds the specified objects and property objects and assigns IDs. The assigned IDs are returned in the ACKNOWLEDGE message.
Noun has no property objects but has contained objects		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 are defined in Table C.5.

Table C.5 – PROCESS message with no object ID

Access specification for attributes of objects that make up the noun		Action for PROCESS verb
Noun has property objects	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 property objects but has contained objects		Error for identified resource objects. Not an error for objects that may be identified by time specifications (Capability, Schedule, Performance).

C.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 C.6.

Table C.6 – CHANGE message with object ID

Access specification for attributes of objects that make up the noun		Action for CHANGE verb
Noun has property objects	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 property objects 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 property objects but has contained objects		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 C.7.

Table C.7 – CHANGE message with wildcard object ID

Access specification for attributes of objects that make up the noun		Action for CHANGE verb
Noun has property objects	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 property objects and no contained objects		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.

C.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 C.8.

Table C.8 – CANCEL message with object ID

Access specification for attributes of objects that make up the noun		Action for CANCEL verb
Noun has property objects	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 property objects for the specified objects.
	Property IDs and value are specified	Defines a request that the receiver is to cancel the specified property objects of the specified objects that have the specified property value.
Noun has no property objects but has contained objects		Defines a request that the receiver is to cancel the specified objects. If contained element 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 C.9.

Table C.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 property objects	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 property objects matching the property wildcard of all objects that match the object wildcard.
Noun has no property objects but has contained objects		Defines a request that the receiver is to cancel all objects matching the object wildcard.

C.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 C.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 C.10 – SYNC message with object ID

Access specification for attributes of objects that make up the noun		Action for SYNC verb
Noun has property objects	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 the list of the specified property objects.
	Property IDs and value are specified	Defines a request that the receiver is to add, change, or cancel the specified objects, the list of property objects and property values.
Noun has no property objects but has contained objects		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 C.11.

Table C.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 property objects	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 property objects but has contained objects		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 D
(informative)

General rules for identifying nouns from object models

D.1 Patterns

This annex defines the general pattern that was applied to define nouns based on the UML models defined in ISO/IEC 19501.

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

D.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*, *Product Definitions*, *Production Schedules*, and *Production 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 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 *Production Request* and the context of the *Production Schedule* does not have sufficient information to handle or process the *Segment Requirement*.

Figure D.1 illustrates the composite relationships within the Production 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.

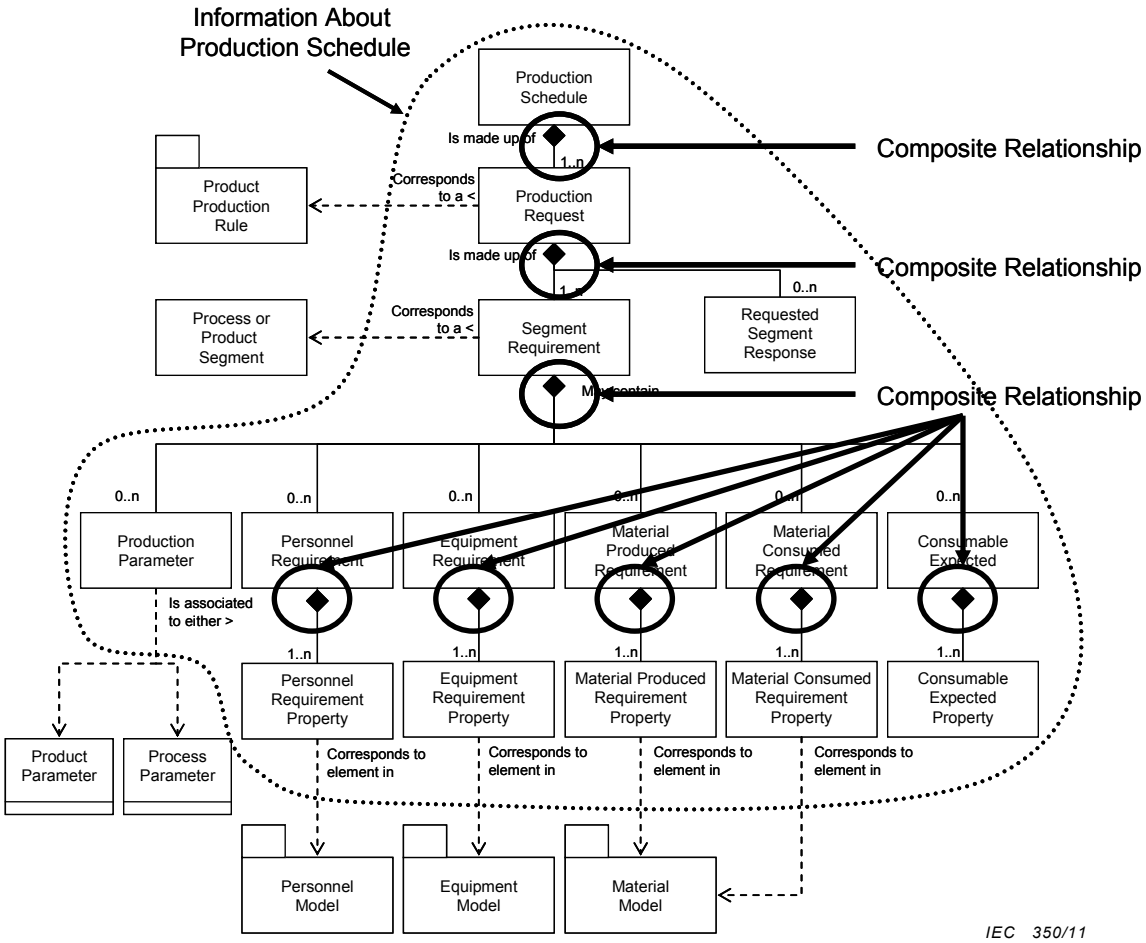


Figure D.1 – Object model with composite relationships

D.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 part of one of the objects of the association. Examples of these are *Qualification test Result*, *Equipment Capability Test Results*, and *QA Test Results*. In these cases a decision based on expected business case use patterns was made on which NOUN the object is to be included 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 D.2 illustrates the case where there are no composite relationships in the object model, and in which the expected business use is the exchange of separate objects.

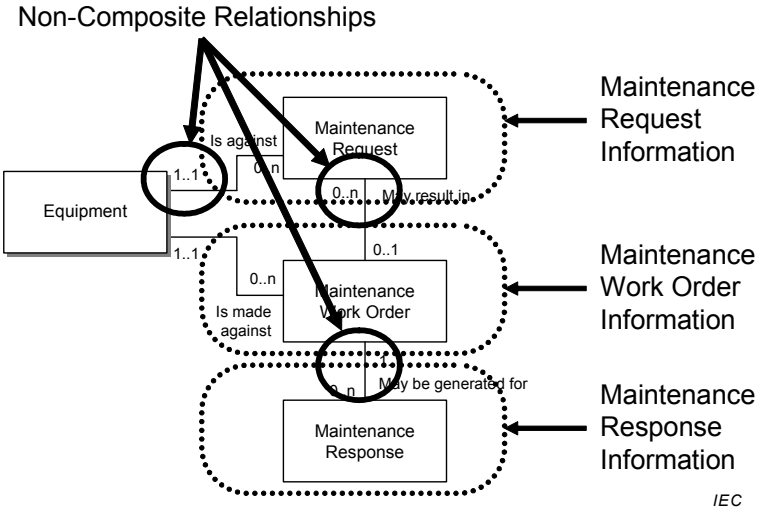


Figure D.2 – Object model with non composite relationships

Figure D.3 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 QA Test Specifications. An associated object, such as a QA Test Result, is placed in the Material Lot and Material Sublot nouns based on the expected use of the object.

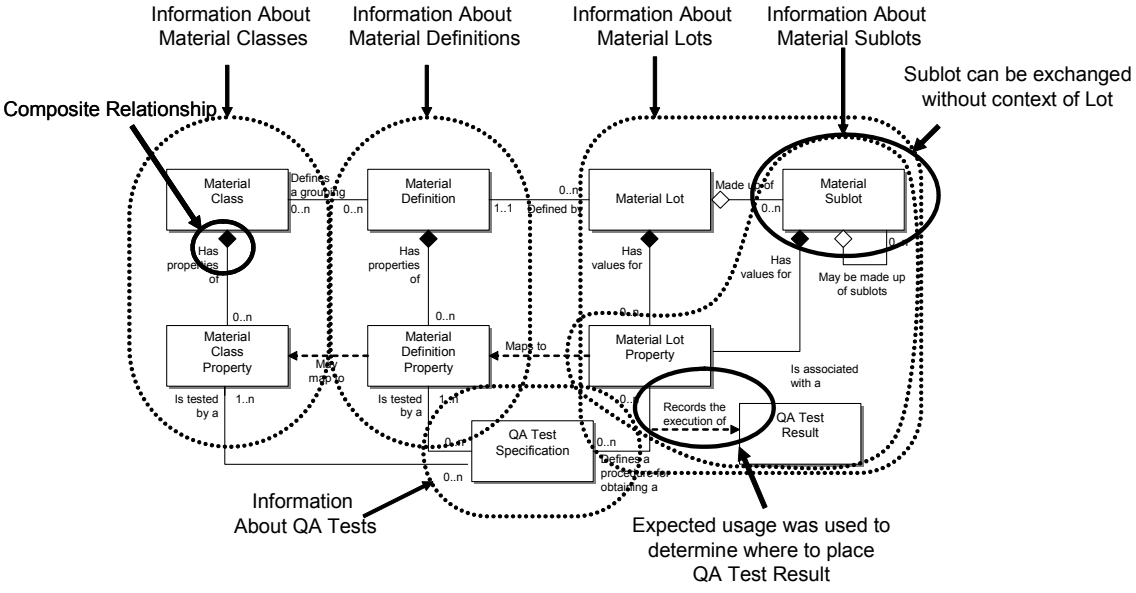


Figure D.3 – Example of multiple composite objects

Bibliography

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*

OAGIS – (Open Applications Group Integration Specification) – see www.openapplications.org

OASIS PPS *(Production Planning and Scheduling) – Part 1: Core Elements – see http://docs.oasis-open.org/pps/v1.0/pps-core-elements-1.0.html*

OASIS PPS *(Production Planning and Scheduling) – Part 2: Transaction Messages – see http://docs.oasis-open.org/pps/v1.0/pps-transaction-messages-1.0.html*

OASIS PPS *(Production Planning and Scheduling) – Part 3: Profile Specifications – see http://docs.oasis-open.org/pps/v1.0/pps-profile-specifications-1.0.html*

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 When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

Publication	Year	Title	EN/HD	Year
IEC 62264-1	–	Enterprise-control system integration – Part 1: Models and terminology	EN 62264-1	–
IEC 62264-2	–	Enterprise-control system integration – Part 2: Object model attributes	EN 62264-2	–
IEC 62264-3	–	Enterprise-control system integration – Part 3 Activity models of manufacturing operations management	EN 62264-3	–