

AMERICAN NATIONAL STANDARD

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**Enterprise-Control System Integration –
Part 5: Business-to-Manufacturing
Transactions**

Approved 8 July 2013

ANSI/ISA-95.00.05-2013, Enterprise-Control System Integration - Part 5: Business-to-Manufacturing Transactions

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ENTERPRISE-CONTROL SYSTEM INTEGRATION -

Part 5: Business-to-Manufacturing Transactions

FOREWORD

ISA-95 is a multi-part series of standards that define enterprise-to-control system integration. This Part 5 standard defines the transactions to interface business and manufacturing activities per the following:

- Clause 4 is normative. It describes the transaction models and messages used.
- Clause 5 is normative. It describes the verbs used in the messages.
- Clause 6 is normative. It defines the message nouns, the structure of the nouns, the verbs used with the nouns, and the rules for the verbs.
- Clause 7 is normative. It describes the requirements for declarations about completeness, compliance and conformance to the standard.
- Annex A is normative. It defines the message nouns, the structure of the nouns, the verbs used with the nouns, and the rules for the verbs for production specific information
- Annex B is informative. It contains examples of sequences of transactions used to coordinate selected business activities.
- Annex C is informative. It contains a series of questions and answers regarding the use of the standard.
- Annex D is informative. It contains references to documents used in the generation of this standard
- Annex E is informative. It defines the pattern for verbs.
- Annex F is informative. It defines the general rules used for identifying nouns from object models.

As currently envisioned, ANSI/ISA-95 consists of the following standards under the general title Enterprise-Control System Integration:

- Part 1: Models and terminology
- Part 2: Objects and attributes for enterprise-control system integration
- Part 3: Models of manufacturing operations management
- Part 4: Object models and attributes of manufacturing operations management
- Part 5: Business-to-manufacturing transactions
- Part 6: Messaging service model (development begun in 2013)

INTRODUCTION

This ISA-95 Part 5 standard is based on the use of ISA-95 abstract models defined in ISA-95 Part 2 and Part 4, combined with OAGi verbs to define a transaction model for information exchange. It is recognized that other non ISA-95 Part 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 5 is the interface between enterprise/business systems and manufacturing systems. This Part 5 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, and within Level 3, as defined in the object models of ISA-95 Part 2 and Part 4. Models are introduced that provide descriptions of the transactions and explanations of the required transaction processing behavior. Technology-specific implementations to provide this behavior are not defined in this Part 5 standard. This Part 5 standard has the intent of providing insight into the level of work required to construct transactional exchanges.

Edition 3 of this Part 5 standard includes the definition of transactions for object models defined in ISA-95 Part 4.

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ENTERPRISE-CONTROL SYSTEM INTEGRATION

Part 5: Business to Manufacturing Transactions

1. Scope

This ISA-95 Part 5 standard defines transactions in terms of information exchanges between applications performing business and manufacturing activities between Levels 3 and 4, and within Level 3. The exchanges are intended to enable information collection, retrieval, transfer and storage in support of enterprise-control system integration. This Part 5 is consistent with the ISA-95 Part 2 and Part 4 object models. This Part 5 also defines transactions that specify how to exchange the objects defined in Part 2, Part 4, and this Part 5. Other uses of the transaction model are not defined in this Part 5 standard.

The models covered in this standard are: Personnel Model, Equipment Model, Physical Asset Model, Material Model, Process Segment Model, Operations Capability Model, Operations Definition Model, Operations Schedule Model, Operations Performance Model, Resource Relationship Network Model, Work Capability Model, Work Definition Model, Work Schedule Model, Job List Model, Work Performance Model, Workflow Specification Model, and Work Alert Model.

2. Normative references

The following normative documents contain provisions that, through reference in this text, constitute provisions of this ISA-95 Part 5 standard. At the time of publication, the editions indicated were valid. All normative documents are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. Members of IEC and ISO maintain registers of currently valid normative documents.

ISO/IEC 19501-1 Information Technology – Unified Modeling Language (UML)—Part 1: Specification

ANSI/ISA-95.00.01-2010 (IEC 62264-1 Mod), Enterprise-Control System Integration – Part 1: Models and Terminology

ANSI/ISA-95.00.02-2010 (IEC 62264-2 Mod), Enterprise-Control System Integration – Part 2: Object Model Attributes

ANSI/ISA-95.00.04-2012, Enterprise-Control System Integration – Part 4: Objects and Attributes for Manufacturing Operations Management Integration

3. Definitions and abbreviations

3.1 Terms and definitions

3.1.1

application

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

3.1.2**ID**

information to identify an object or a property of an object

3.1.3**message**

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

3.1.4**noun**

one of two parts in the content of a message and represents one or more objects, as defined in the ISA-95 Part 2 and Part 4 object models

3.1.5**transaction**

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

3.1.6**verb**

one of two parts in the content of a message and 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 Introduction**

This clause defines a common set of transactions, messages and verbs that should be used between Level 4 and Level 3, and among Level 3, applications to exchange the data defined in the object models of ISA-95 Part 2 and Part 4.

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

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

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

Three different transaction models are defined:

1. A PULL model where a user of data requests the data from a provider of the data.

2. A PUSH model where a provider of data requests an action (processing, changing, or canceling) on the data by another user.
3. A PUBLISH 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 configuration should be set up so that one master owner of the data should be designated, with other systems performing the role of data users.

4.2 Transaction models

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

1. 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.

- A. Requests for information are sent through GET messages.
- B. A GET message describes the scope of the requested information.
- C. A SHOW message returns the information.

2. 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.

- A. New information is pushed to the receiver through a PROCESS message. Responses may be returned to the sender through an ACKNOWLEDGE message.
- B. Changes to information are pushed to the receiver through a CHANGE message. Responses may be returned to the sender through a RESPOND message.
- C. Information to be removed is pushed to the receiver through a CANCEL message.

3. 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.

- A. The publisher sends SYNC messages containing new, changed, or deleted information to subscribers.
- B. 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 setup through configuration

parameters in the applications, or an agreement may be setup dynamically through a web service agreement, or an agreement may be setup 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 undefined in this specification; for example, the messages could be tab delimited files, XML files, electronic mail messages, or data in a named pipe. The exact form of the transport mechanism for the sending, receiving, listening, and publishing of messages is not defined in this specification.

Note 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).

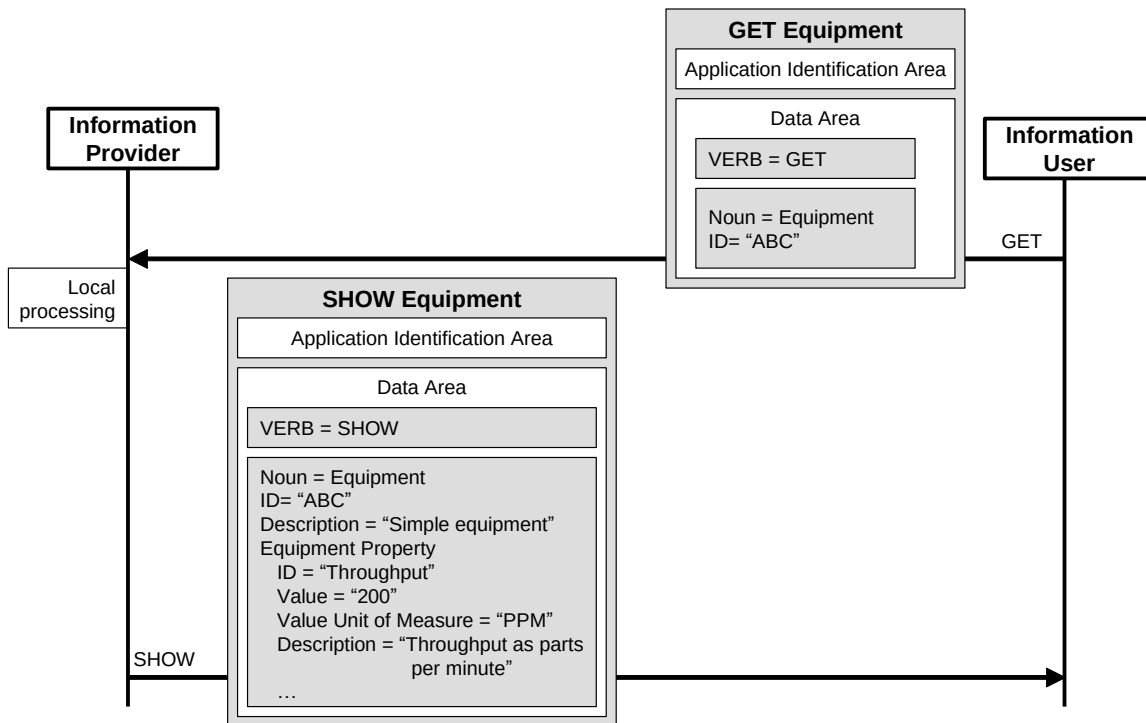


Figure 1 - Typical exchanged messages in a transaction

4.3 Message structure

4.3.1 General structure

Every message shall contain 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*.

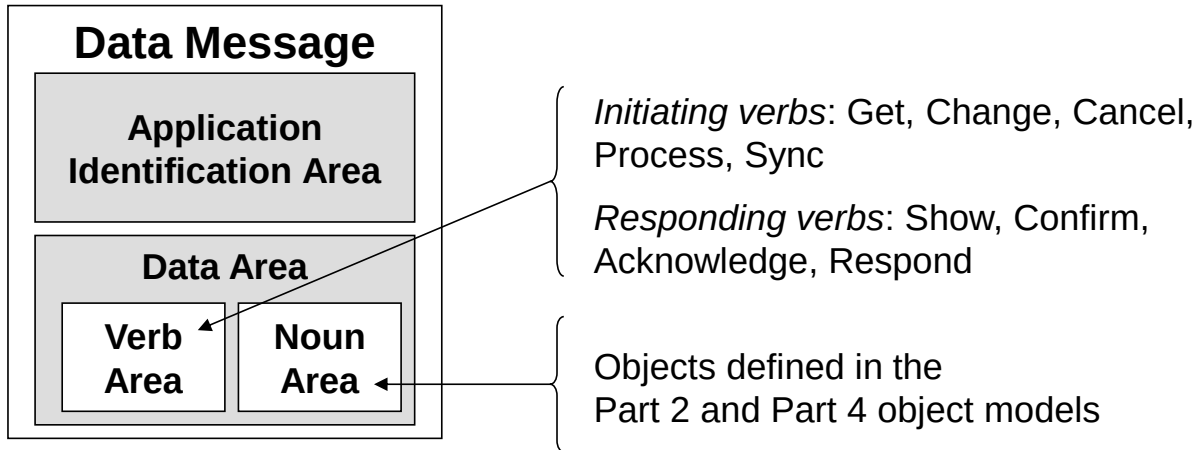


Figure 2 - Typical exchanged data set

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 document is consistent with the OAGIS specification; such that an implementation of OAGIS, using the objects defined in the Part 2 and Part 4 standards, can conform to this Part 5 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.

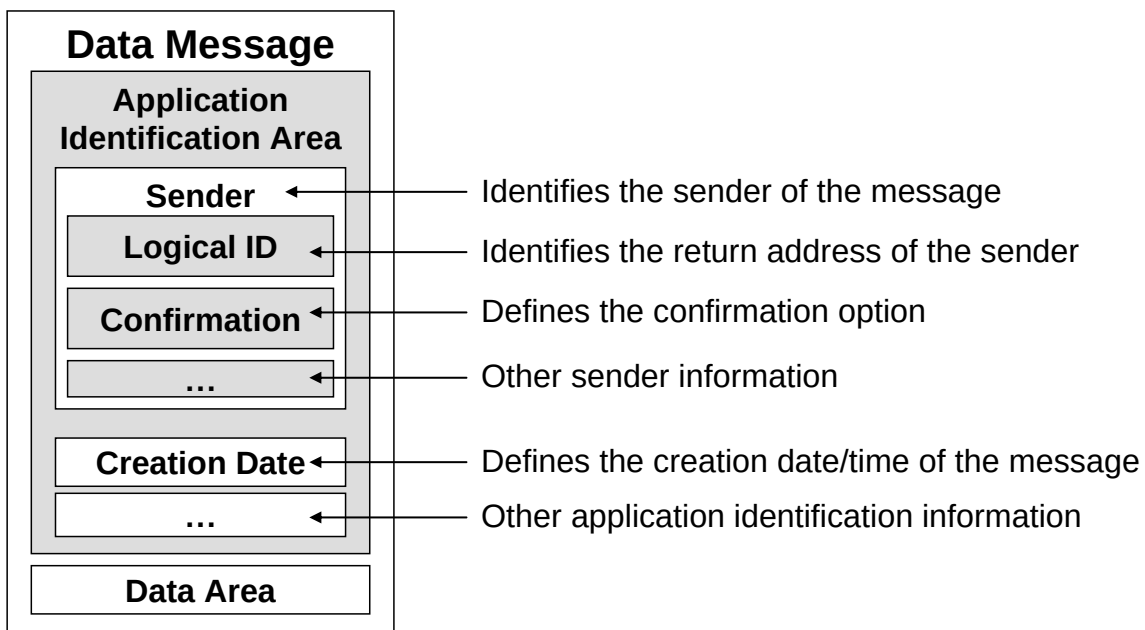


Figure 3 - Typical layout of an application identification area

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

The noun area shall contain nouns and associated elements that represent one or more objects defined in the ISA-95 Part 2 and Part 4 object models. The nouns defined in this part of the standard are listed in Clause 6.

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

4.3.4 Message nouns

Nouns represent one or more objects from the object models defined in the ISA-95 Part 1 and Part 2 standards 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 One convention for specifying wildcards in text strings is 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.

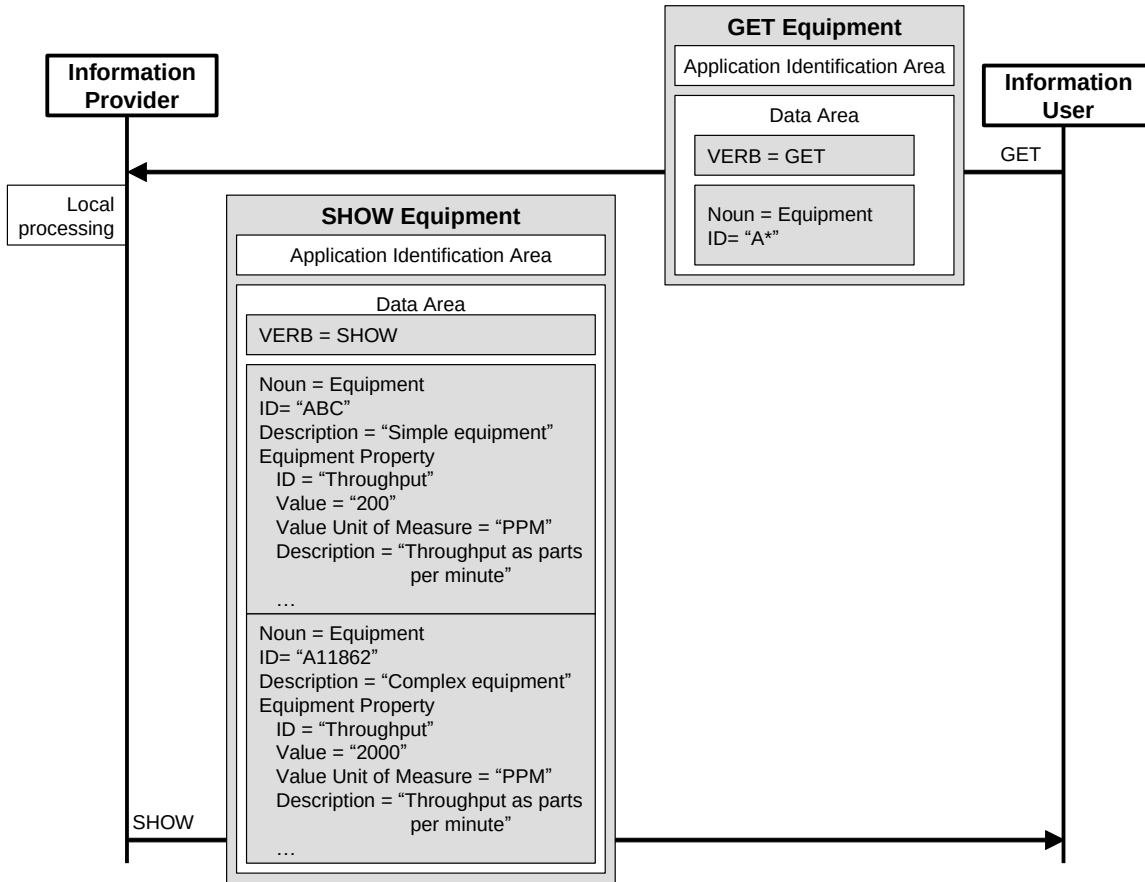


Figure 4- GET with wildcard and SHOW response

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 1 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 canceled. If contained elements IDs are specified, then only the specified contained elements for the specified noun shall be canceled, not the noun itself. 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 of the noun shall be changed.	PUSH
CONFIRM	Confirmation response to a request.	PUSH, PULL, PUBLISH
GET	Request to an information provider for information on one or more objects. The information provider shall return a SHOW message containing each of the specified attributes and each of the specified contained elements of the specified nouns. If no attribute or contained element is specified in the noun area, then all attributes and/or contained elements shall be returned. When wildcards are applied to the noun and property IDs, it shall be possible to further filter the information to be returned by specifying a value for one or more attributes of the noun. Only objects whose attributes match the specified value (out of the list of objects matching the wildcards applied to noun and property IDs) shall be returned. Example 2 To get all the Material Lots with <i>Status</i> = "New", the wildcard "*" would be specified for the Material Lot ID and the "New" value would be specified for the <i>Status</i> 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	PUSH

	shall be added.	
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 3 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 of the noun shall be changed.	PUBLISH
SYNC DELETE	Request from the owner of the object to delete information. The specified noun shall be canceled. If contained elements IDs are specified, then only the specified contained elements for the specified noun shall be canceled.	PUBLISH

- Note 1 The processes on either side of the messages are not defined in this technical specification.
- Note 2 The mechanism to set up the one-to-one association of the PUSH model is not included in this Part 5. Configuration and set up are implementation specific and would be defined in conforming specifications.
- Note 3 The mechanism to set up the one-to-one association of the PULL model is not included in this Part 5. Configuration and set up are implementation specific and would be defined in conforming specifications.
- Note 4 The mechanism used for subscribing in the PUBLISH model is not included in this Part 5. 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 Clause 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 sections for each object type.
- Note 7 The entity receiving the PROCESS message may perform further processing of the added information.
- Note 8 There is no ability defined in this Part 5 standard to add or remove object attributes; ISA-95 Part 2 and Part 4 define the object attributes.
- Note 9 Additional information returned in a SHOW message (as a response to a GET message) (e.g. IDs of referenced objects) is specified in the sections 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 sections 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.

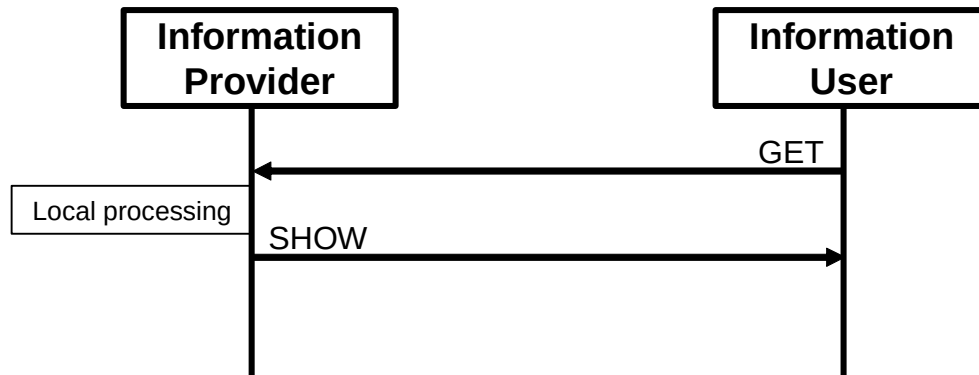


Figure 5 – GET and SHOW transaction

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

Within a GET message, the ID of the requested object is passed to the provider of the information. Where a single ID is not sufficient identification, such as 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 sections for each object type.

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

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

Note A 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 of the “Confirm Always” option specified with the GET message).

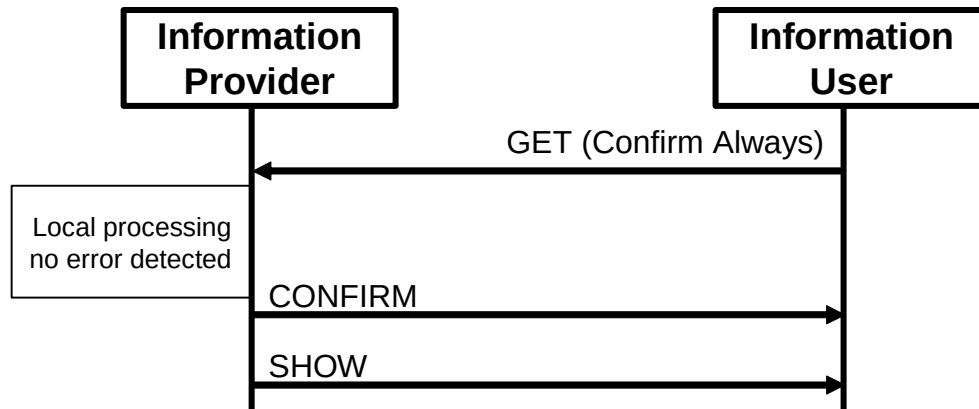


Figure 6 - GET and SHOW transaction with a CONFIRM always

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

5.4 PROCESS verb

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

Note A PROCESS verb is often the equivalent of a command to add an object, but usually the receiving entity does further processing of the information.

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

Example 2 The sending of a *PROCESS Equipment* message indicates that a new equipment item is to be added.

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.

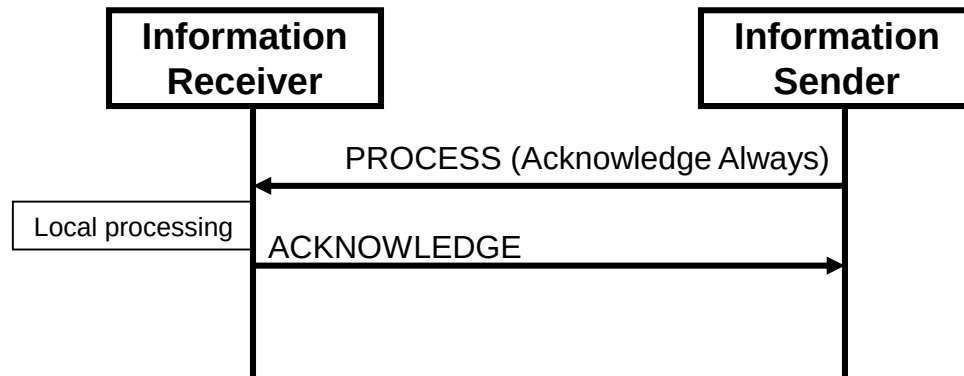


Figure 7 – PROCESS/ACKNOWLEDGE transaction

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

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

Table 3 – Acknowledge element

ACKNOWLEDGE ELEMENT	DEFINITION
ACCEPTED	The information was accepted by the receiver of the information and was processed according to the business rules of the receiver.
REJECTED	The information was rejected by the receiver of the information and was not processed by the receiver. The message data area shall contain an identification of the reason for rejection.
MODIFIED	The information was accepted by the receiver of the information but was modified for correct processing, the modified data shall be returned with the <i>ACKNOWLEDGE</i> . The message data area shall contain an identification of the type of modification.

Example 2 **Figure 8** shows a message sequence from a scheduling system to an execution system. The initial *PROCESS* message with an operations schedule is received and an *ACKNOWLEDGE* message with a *MODIFIED* flag was returned with a new proposed schedule. The scheduling system re-generates a schedule and resends to the execution system. The execution system accepts the operations schedule and returns an *ACKNOWLEDGE* message with an *ACCEPTED* flag.

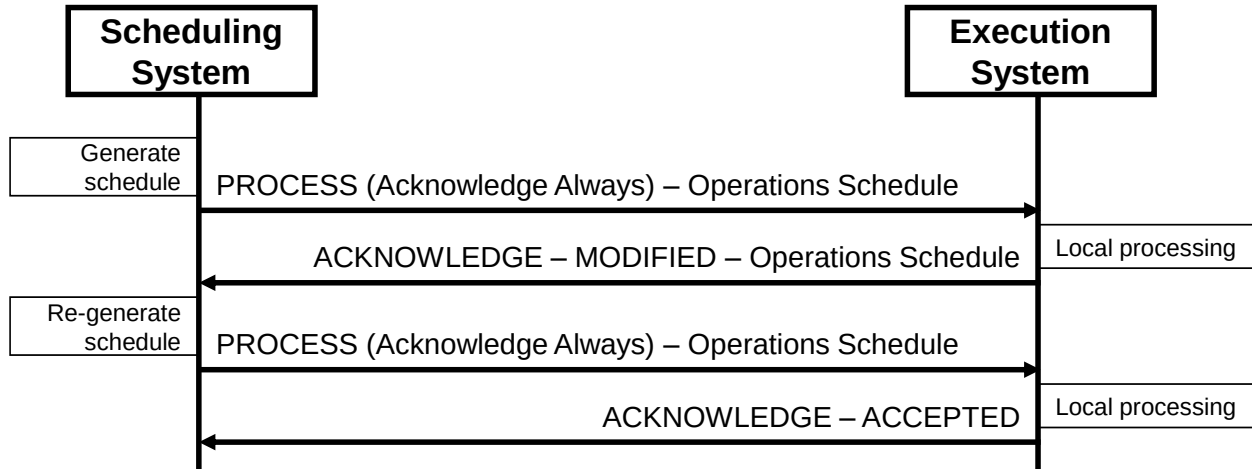


Figure 8 - Example of acknowledge to a process message

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.

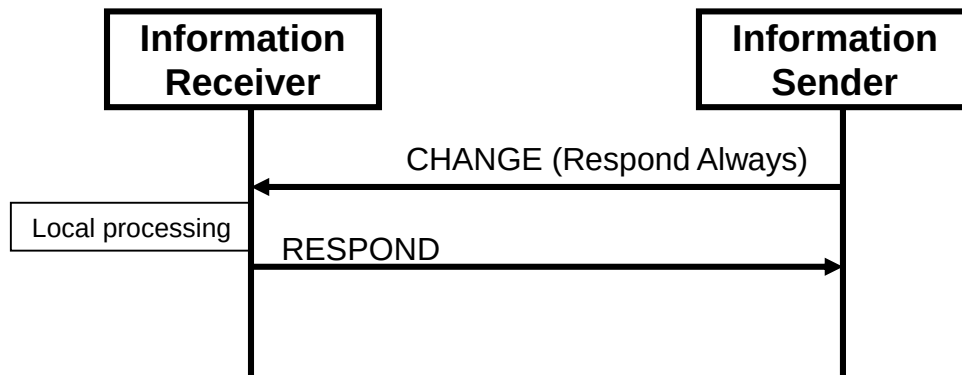


Figure 9 – CHANGE/RESPOND transaction

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 canceled.

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

Note Because the CANCEL is not sent by the owner of the data, the data are not necessarily deleted. The sender is indicating that the sender no longer needs the data.

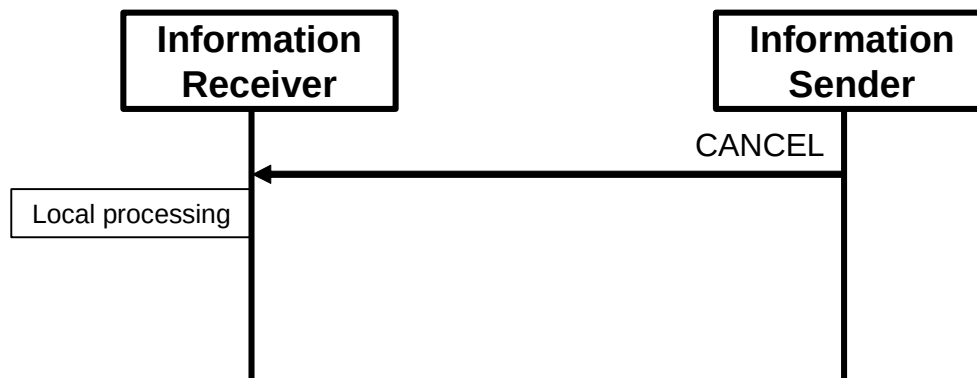


Figure 10 - CANCEL message

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. If the optional element is not specified, then it defaults to Never.

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

Table 5 – Confirmation request options

Name	Description
Never	No confirmation requested.
OnError	Send back a confirmation only if an error has occurred.
Always	Always send a confirmation regardless of the local processing.

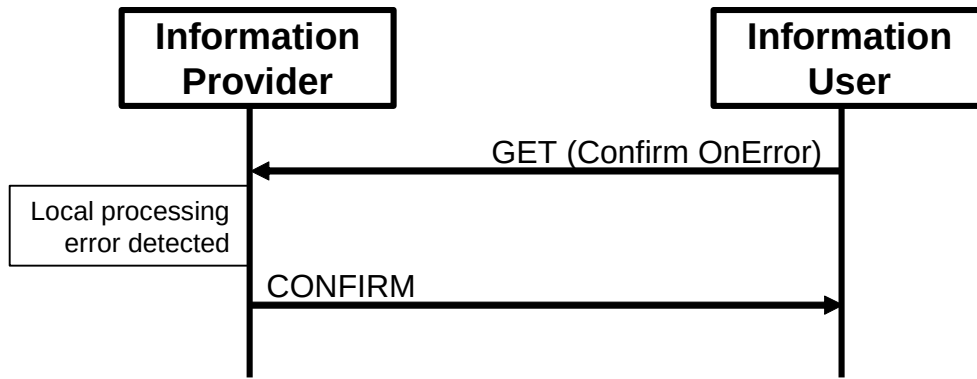


Figure 11 - Example of a GET message with Confirm OnError

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

The CONFIRM message:

1. Identifies the initiating message being confirmed.
2. Indicates the status of the processing of the message.
3. Includes a description of the error if the status indicates a processing error if requested.

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

Error handling at the application layer is through the confirmation element in the application identification area. Specific error codes or error text are not defined in this Part 5 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.

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

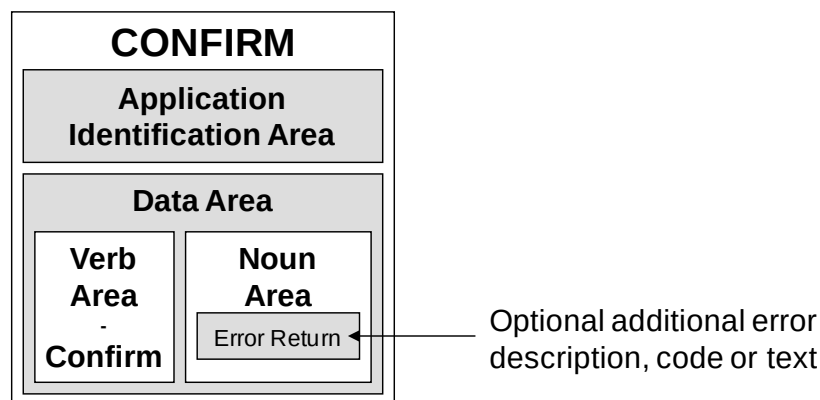


Figure 12 - Confirm Message

5.9 RESPOND verb

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

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

Table 6 – Respond element

RESPOND ELEMENT	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 item master to multiple MES systems, or when a publish and subscribe mechanism is used as a company's integration architecture.

5.11 SYNC ADD verb

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

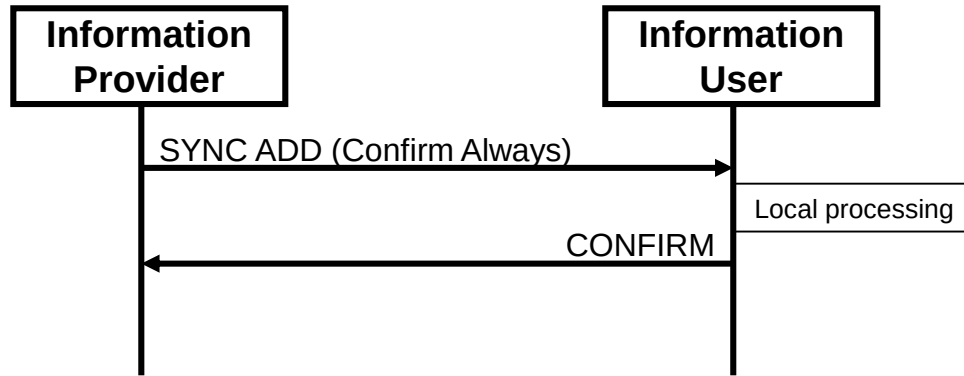


Figure 13 - SYNC ADD transaction with confirmation

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

5.12 SYNC CHANGE verb

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

Example A SYNC CHANGE message with a *MATERIAL CLASS* object indicates a change in the material class or a property of the material class and the new value.

5.13 SYNC DELETE verb

A SYNC DELETE verb is sent by the owner of the information and indicates that the provider of the information has deleted the information. The SYNC DELETE message shall include the object instances deleted. See **Figure 14** for an example of a SYNC DELETE with no response. The specific elements to be deleted are defined in Clause 6.

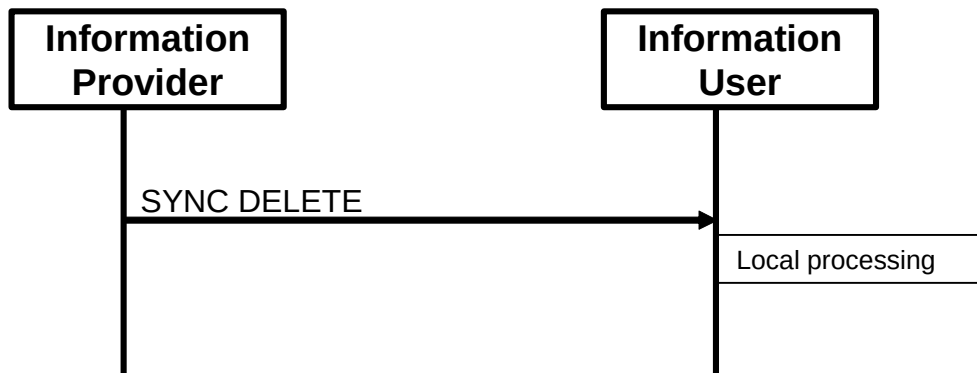


Figure 14 - SYNC DELETE transaction with no confirmation

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

6. Message nouns

6.1 Introduction

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 Equipment

The Equipment noun contains the following objects as defined in the ISA-95 Part 2 standard:

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

6.2.2 Equipment Capability Test Specification

The Equipment Capability Test Specification noun contains the following object as defined in the ISA-95 Part 2 standard:

- Equipment Capability Test Specification

6.2.3 Equipment Class

The Equipment Class noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Equipment Class
- Equipment Class Property

6.2.4 Job List

The Job List noun contains the following objects as defined in the ISA-95 Part 4 standard:

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

- Material Requirement Property

6.2.5 Material Class

The Material Class noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Material Class
- Material Class Property

6.2.6 Material Definition

The Material Definition noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Material Definition
- Material Definition Property

6.2.7 Material Lot

The Material Lot noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Material Lot
- Material Lot Property
- Material Test Result

6.2.8 Material Sublot

The Material Sublot noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Material Sublot
- Material Lot Property
- Material Test Result

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

6.2.9 Material Test Specification

The Material Test Specification noun contains the following object as defined in the ISA-95 Part 2 standard:

- Material Test Specification

6.2.10 Operations Capability

The Operations Capability noun contains the following objects as defined in the ISA-95 Part 2 standard:

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

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

6.2.11 Operations Definition

The Operations Definition noun contains the following objects as defined in the ISA-95 Part 2 standard:

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

6.2.12 Operations Schedule

The Operations Schedule noun contains the following objects as defined in the ISA-95 Part 2 standard:

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

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

6.2.13 Operations Performance

The Operations Performance noun contains the following objects as defined in the ISA-95 Part 2 standard:

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

6.2.14 Person

The Person noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Person
- Person Property
- Qualification Test Result

6.2.15 Personnel Class

The Personnel Class noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Personnel Class
- Personnel Class Property

6.2.16 Physical Asset

The Physical Asset noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Physical Asset

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

6.2.17 Physical Asset Class

The Physical Asset Class noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Physical Asset Class
- Physical Asset Class Property

6.2.18 Physical Asset Capability Test Specification

The Physical Asset Capability Test Specification noun contains the following object as defined in the ISA-95 Part 2 standard:

- Physical Asset Capability Test Specification

6.2.19 Process Segment

The Process Segment noun contains the following objects as defined in the ISA-95 Part 2 standard:

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

6.2.20 Resource Relationship Network

The Resource Relationship Network noun contains the following objects as defined in the ISA-95 Part 4 standard:

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

- From Resource Reference Property

6.2.21 Resource Relationship Network Connection Type

The Resource Relationship Network Connection Type noun contains the following objects as defined in the ISA-95 Part 4 standard:

- Resource Network Connection Type
- Resource Network Connection Property Type

6.2.22 Qualification Test Specification

The Qualification Test Specification noun contains the following object as defined in the ISA-95 Part 2 standard:

- Qualification Test Specification

6.2.23 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 Clause 6.19 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.

6.2.24 Work Alert

The Work Alert noun contains the following objects as defined in the ISA-95 Part 4 standard:

- Work Alert Definition
- Work Alert Definition Property
- Work Alert
- Work Alert Property

6.2.25 Work Capability

The Work Capability noun contains the following objects as defined in the ISA-95 Part 4 standard:

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

6.2.26 Work Directive

The Work Directive noun contains the following objects as defined in the ISA-95 Part 4 standard:

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

6.2.27 Work Master

The Work Master noun contains the following objects as defined in the ISA-95 Part 4 standard:

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

6.2.28 Work Performance

The Work Performance noun contains the following objects as defined in the ISA-95 Part 4 standard:

- Work Performance
- Work Response

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

6.2.29 Work Schedule

The Work Schedule noun contains the following objects as defined in the ISA-95 Part 4 standard:

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

6.2.30 Workflow Specification

The Workflow Specification noun contains the following objects as defined in the ISA-95 Part 4 standard:

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

6.2.31 Workflow Specification Type

The Workflow Specification Type noun contains the following objects as defined in the ISA-95 Part 4 standard:

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

6.2.32 Production Specific Models

6.2.32.1 Production Models

Production specific information is described in Annex A of Part 2. The transaction definitions of the production specific information are defined in Annex A of this Part 5. The following sections define the set of message nouns that should be used by verbs to identify information exchanged between Level 4 and Level 3 systems as defined in the production object models of Part 2.

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

6.2.32.2 Production Capability

The Production Capability noun contains the following objects as defined in the ISA-95 Part 2 standard:

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

6.2.32.3 Product Definition

The Product Definition noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Product Definition
- Product Segment
- Product Segment Dependency
- Manufacturing Bill

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

6.2.32.4 Production Schedule

The Production Schedule noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Production Schedule
- Production Request
- Segment Requirement
- Requested Segment Response
- Production Parameter
- Personnel Requirement
- Equipment Requirement
- Physical Asset Requirement
- Material Requirement
- Personnel Requirement Property
- Equipment Requirement Property
- Physical Asset Requirement Property
- Material Requirement Property
- Product Parameter
- Process Parameter

6.2.32.5 Production Performance

The Production Performance noun contains the following objects as defined in the ISA-95 Part 2 standard:

- Production Performance
- Production Response
- Segment Response

- Production Data
- Personnel Actual
- Equipment Actual
- Physical Asset Actual
- Material Actual
- Personnel Actual Property
- Equipment Actual Property
- Physical Asset Actual Property
- Material Actual Property

6.3 Personnel model

6.3.1 Personnel model elements

The message definitions assume that information may be accessed from any of three starting points: personnel class, person, or qualification test, as identified by the dotted collections in **Figure 15**.

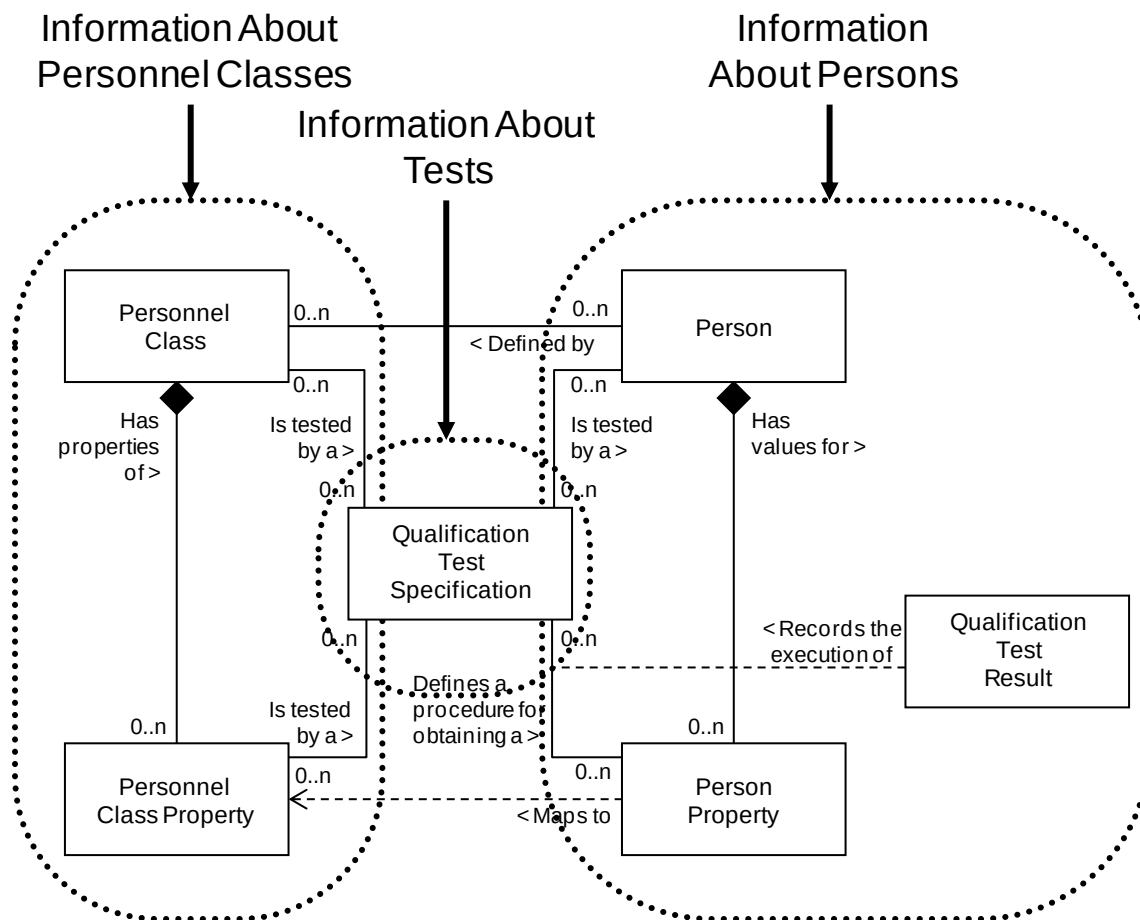


Figure 15 - Object grouping for the personnel model

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 does contain the IDs of the persons belonging to the class.

6.3.3 Personnel class verb actions

Table 7 defines verb actions and the use of IDs and values for the personnel class.

Table 7 - Personnel class verb actions

Value of Personnel Class ID	Value of Personnel Class Property ID	Personnel Class Property Value	Verb Action on Object(s) Specified
IDs specified	<i>not specified</i>	<i>not specified</i>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified <i>Personnel Classes</i>, all properties and their attributes, and the list of <i>Person IDs</i> of the <i>Personnel Classes</i>. PROCESS: Shall define a request that the receiver is to add <i>Personnel Classes</i>. The IDs define suggested IDs for the <i>Personnel Classes</i>. The receiver adds the <i>Personnel Classes</i> and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified <i>Personnel Classes</i> shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified <i>Personnel Classes</i>. SYNC ADD: Shall define a request that the receiver is to add the specified <i>Personnel Classes</i>. SYNC CHANGE: The specified attributes of the specified <i>Personnel Classes</i> shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified <i>Personnel Classes</i>.
IDs specified	IDs specified	<i>not specified</i>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified <i>Personnel Classes</i>, all of the specified <i>Personnel Class</i> properties, and the list of <i>Person IDs</i> of the <i>Personnel Classes</i>. PROCESS: Shall define a request that the receiver is to add <i>Personnel Classes</i>. The ID defines suggested IDs for the <i>Personnel Classes</i> and list of properties. The receiver adds the <i>Personnel Classes</i> and properties and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message.

Value of Personnel Class ID	Value of Personnel Class Property ID	Personnel Class Property Value	Verb Action on Object(s) Specified
			CHANGE: Error (no property values are specified). CANCEL: Shall define a request that the receiver is to cancel the specified properties for the specified <i>Personnel Classes</i>. SYNC ADD: Shall define a request that the receiver is to add the <i>Personnel Classes</i> and list of <i>Personnel Class Properties</i>. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of <i>Personnel Class</i> 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 <i>Personnel Classes</i> where the <i>Personnel Class Property</i> value matches the specified property value, all of the specified <i>Personnel Class properties</i>, and the list of <i>Person IDs</i>. PROCESS: Shall define a request that the receiver is to add <i>Personnel Classes</i>. The IDs define suggested IDs for the <i>Personnel Classes</i> and properties, and values for the properties. The receiver adds the <i>Personnel Classes</i> 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 <i>Personnel Classes</i> 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 <i>Personnel Classes</i> that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified <i>Personnel Classes</i>, 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 <i>Personnel Classes</i> to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of <i>Personnel Class Properties</i> of the specified <i>Personnel Classes</i> 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

Value of Personnel Class ID	Value of Personnel Class Property ID	Personnel Class Property Value	Verb Action on Object(s) Specified
			<i>Personnel Classes</i> that match the wildcard and the list of <i>Person IDs</i> of each <i>Personnel Class</i>. Example 1 To return all <i>Personnel Classes</i>, 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 <i>Personnel Classes</i> 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 <i>Personnel Classes</i> 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 <i>Personnel Classes</i> that match the wildcard, and for each class return all <i>Personnel Class Properties</i> that match the property wildcards, and the list of <i>Person IDs</i> of to the class. Example 2 To return a single property, specify the single <i>Personnel Class Property ID</i> in the property wildcard. Example 3 To return all <i>Personnel Class</i> properties, specify a "*" as the property wildcard. Example 4 To return a single <i>Personnel Class</i>, specify the <i>Personnel Class ID</i> in the wildcard. Example 5 To return all <i>Personnel Classes</i>, 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 <i>Personnel Classes</i> 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 <i>Personnel Classes</i> that match the wildcard.

6.3.4 Person verbs

All verbs shall be valid for a person noun.

Note This contains information about persons and their person properties. The returned information does not contain the personnel class objects associated with the person, but does contain the IDs of the personnel classes the person belongs to.

6.3.5 Person verb actions

The actions performed on a person 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	<i>not specified</i>	<i>not specified</i>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified <i>Persons</i>, all properties and their attributes, and the list of <i>Personnel Class IDs</i> of the <i>Persons</i>. PROCESS: Shall define a request that the receiver is to add <i>Persons</i>. The message defines suggested IDs for the <i>Persons</i>. The receiver adds the <i>Persons</i> and assigns IDs. The assigned IDs shall be returned in the ACKNOWLEDGE message. CHANGE: The specified attributes of the specified <i>Persons</i> shall be changed. CANCEL: Shall define a request that the receiver is to cancel the specified <i>Persons</i>. SYNC ADD: Shall define a request that the receiver is to add the specified <i>Persons</i>. SYNC CHANGE: The specified attributes of the specified <i>Persons</i> shall be changed. SYNC DELETE: Shall define a request that the receiver is to delete the specified <i>Persons</i>.
IDs specified	IDs specified	<i>not specified</i>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes about the specified <i>Persons</i>, all of the specified <i>Person</i> properties, and the list of <i>Personnel Class IDs</i> of the <i>Persons</i>. PROCESS: Shall define a request that the receiver is to add <i>Persons</i>. The ID defines suggested IDs for the <i>Persons</i> and list of properties. The receiver adds the <i>Persons</i> 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 <i>Persons</i>.

Value of Person ID	Value of Person Property ID	Person Property Value	Verb Action on Object(s) Specified
			SYNC ADD: Shall define a request that the receiver is to add the <i>Persons</i> and list of <i>Person Properties</i>. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete the specified list of <i>Person Properties</i>.
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 <i>Persons</i> where the <i>Person Property</i> value matches the specified property value, all of the specified <i>Person</i> properties, and the list of <i>Personnel Class IDs</i>. PROCESS: Shall define a request that the receiver is to add <i>Persons</i>. The ID defines suggested IDs for the <i>Persons</i> and properties, and values for the properties. The receiver adds the <i>Persons</i> 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 <i>Persons</i> 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 <i>Persons</i> that have the specified property value. SYNC ADD: Shall define a request that the receiver is to add the specified <i>Persons</i>, 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 <i>Persons</i> to the specified values. SYNC DELETE: Shall define a request that the receiver is to delete the specified list of <i>Person Properties</i> of the specified <i>Persons</i> 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 <i>Persons</i> that match the wildcard and the list of <i>Personnel Class IDs</i> of each <i>Person</i>. Example 1 To return all <i>Persons</i>, 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 <i>Persons</i> matching the wildcard.

Value of Person ID	Value of Person Property ID	Person Property Value	Verb Action on Object(s) Specified
			SYNC ADD: Error. SYNC CHANGE: Error (no property values are specified). SYNC DELETE: Shall define a request that the receiver is to delete all <i>Persons</i> matching the wildcard.
Wildcard specified	Wildcard specified	<i>not specified</i>	GET: Shall define a request that the receiver is to return, in a SHOW message, all attributes of the <i>Persons</i> that match the wildcard, and for each <i>Person</i> return all <i>Person Properties</i> that match the property wildcards, and the list of <i>Personnel Class IDs</i> of to the <i>Person</i>. Example 2 To return a single property, specify the property in the property wildcard. Example 3 To return all properties, specify a "*" as the property wildcard. Example 4 To return a single <i>Person</i>, specify the <i>Person ID</i> in the wildcard. Example 5 To return all <i>Persons</i>, 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 <i>Persons</i> 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 <i>Persons</i> 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**.