



Business To Manufacturing Markup Language

B2MML – Operations Definition

Version 0500 – March 2011

Operations Definition Schema Documentation



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Change History:

Change	Date	Person	Description
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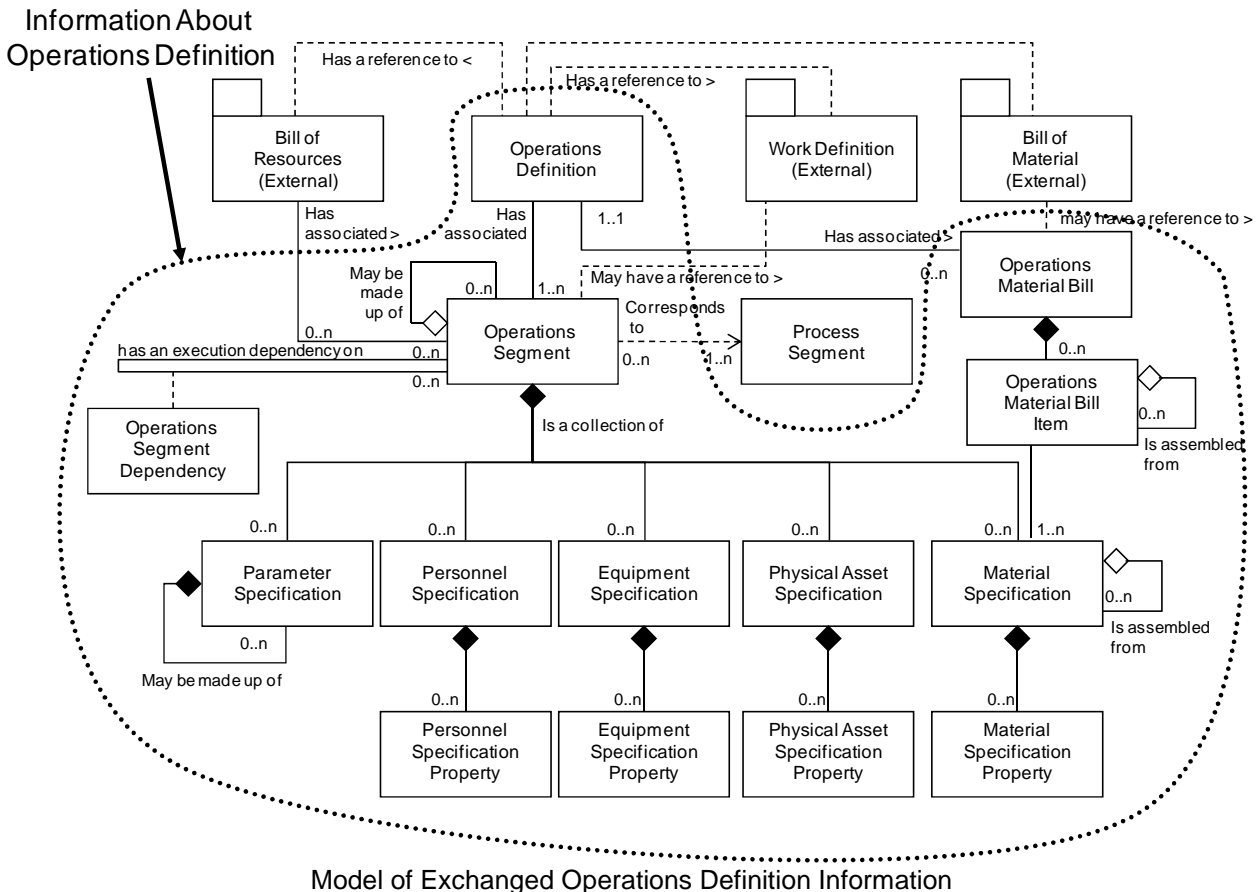
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1 Schema Scope

This document defines the information about the definition of operations information that may be exchanged between business systems and manufacturing operations systems. This information is based on the data models and attributes defined in the ANSI/ISA 95.00.02 Enterprise/Control System Integration standard. Contact ISA (The Instrumentation, System, and Automation Society) for copies of the standard. Additional information on the standard is available at www.isa.org.

1.1 Key Information Assumptions

The data represented in these schemas is derived from the UML model below. This model is defined in the ANSI/ISA 95.00.02 standard. The information model in the figure below is hierarchical with references to, but does not include, the bill of materials and the bill of resources. The key assumption is that the information will be accessed by an Operations Definition.



This schema uses a common schema for definition of elements that are used in multiple schemas, such as ID, Description, and Value. See the document defining the Common schema for definition of the common elements.



1.2 Key Use Assumptions

The model only defines the exchanged information and does not define the use of the information or encapsulation of the information in any defining transactions.

1.3 Type Definitions

The XML schema uses a model that defines simple and complex data types for each element. The data types all follow the convention of a suffix of “Type” added to the element name. Elements that have the same name in other B2MML schemas are also prefixed with “Op” to uniquely identify the extension group.

Schema definition:

```
<xsd:element name = "OpPersonnelSpecification" type = " OpPersonnelSpecificationType"/>

<xsd:complexType name = "OpPersonnelSpecificationType">
  <xsd:sequence>
    <xsd:element name = "PersonnelClassID" type = "PersonnelClassIDType"
      minOccurs = "0" />
    ...
  </xsd:sequence>
</xsd:complexType>
```

The method is a modification of the “Venetian Blind Model”, defined in the book Professional XML Schemas, 2001, published by WROX (ISBN 1-861005-47-4). It makes all of the type names global and usable in user derived works, without a loss of context or additional information required to identify the element as of being of the same type as related B2MML elements

1.4 OperationsDefinition

The main structuring element of the schema definition is OperationsDefinition. OperationsDefinition is the container object for exchanged information and includes references to the Work Definitions, Bill Of Materials, and Bill Of Resources. The term Work Definitions is used in ANSI/ISA-95.00.01 to indicate the information that used within operations, such as assembly instructions, flow sheets, or recipes. Additional information exists in the bill of materials, bill of resources, and manufacturing operations systems, but is not defined in the exchange schemas.

1.5 ManufacturingBill

A manufacturing bill identifies a material or material class that is needed for operations. The manufacturing bill includes all uses of the material in production of the product, while the operations segment’s material specification defines just the amount used.

For example: a manufacturing bill may identify 55 Type C left threaded screws, where 20 are used in one operations segment, 20 in another operations segment, and 15 used in a third operations segment.

ManufacturingBill elements define materials that make up the manufacturing bill. These materials may be identified by material class or by material definition.

1.6 OperationsSegment

The operations segment information defines what personnel, equipment, physical asset, or material resources are required for execution of the operations segment. It does this by defining the classes of resources, or in some cases the exact instance of a resource required. For example, an assembly segment



may require 1 assembler for 2 hours, and 1 assembly machine for 2 hours. In some industries the exact assembly machine may have to be specified, such as "AssemblyMachine#1".

A operations segment also defines parameters that may be specified when the segment is executed, such as a color specification or manufacturing options.

1.6.1 PersonnelSpecification

PersonnelSpecification elements define the personnel resources, by class or instance, required for production of the product within a operations segment. Such as 2 hours of a painter for a paint segment for a lot size of one widget.

1.6.2 EquipmentSpecification

EquipmentSpecification elements define the equipment resources, by class or instance, required for production of the product within a operations segment. Such as 2 hours for a paint station for a lot size of one widget.

1.6.3 PhysicalAssetSpecification

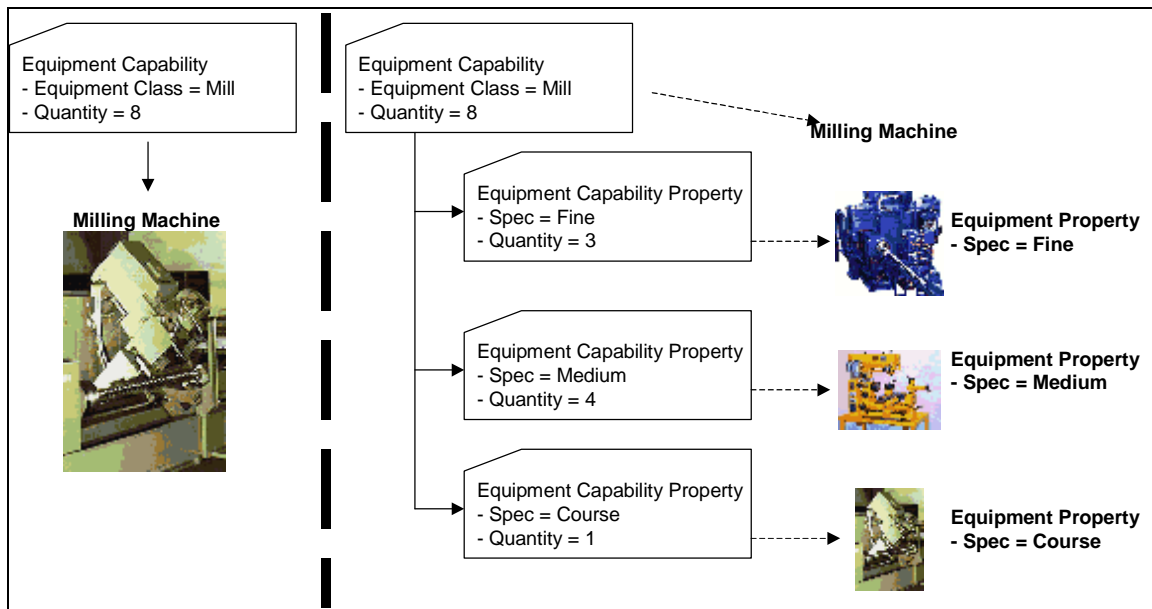
PhysicalAssetSpecification elements define the physical assets resources, by class or instance, required for operations. Such as 2 hours for a paint station for a lot size of one widget.

1.6.4 MaterialSpecification

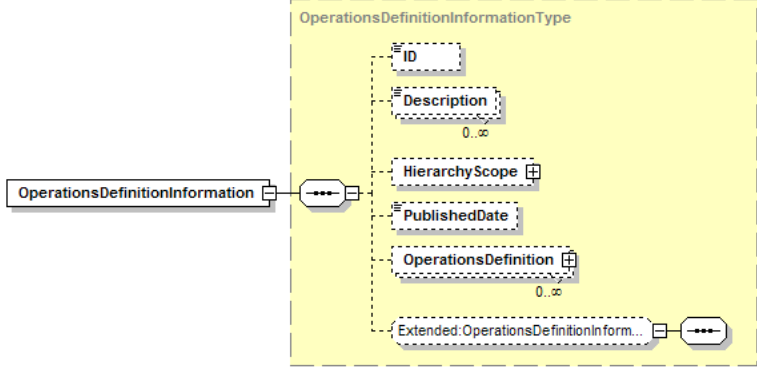
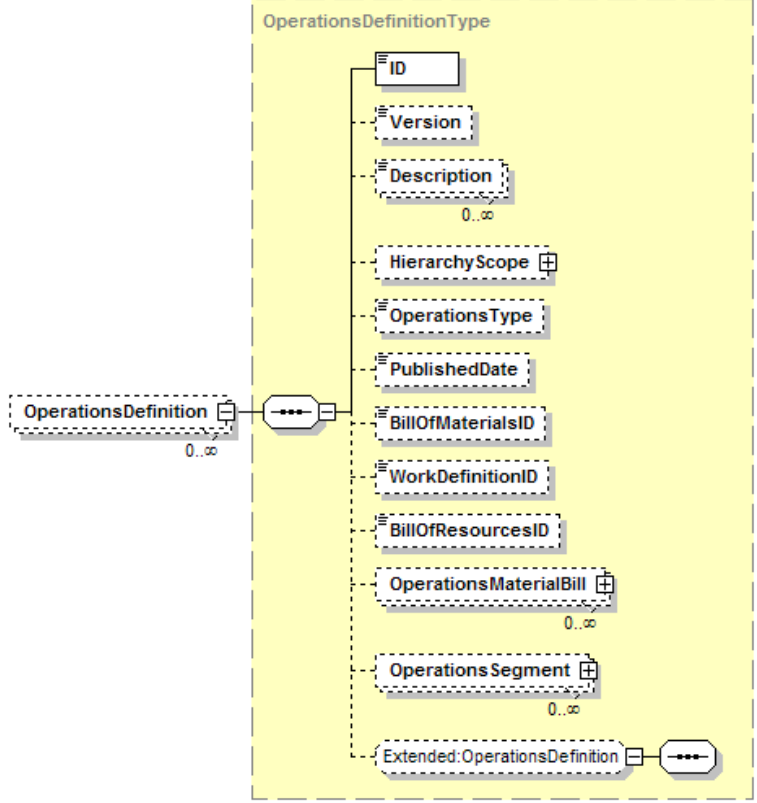
MaterialSpecification elements define the material resources, by material class or material definition, required for production of the product within a operations segment. Such as 30 Kg of cooking oil (material class) required for the cooking segment for a lot size of 50 Kg.

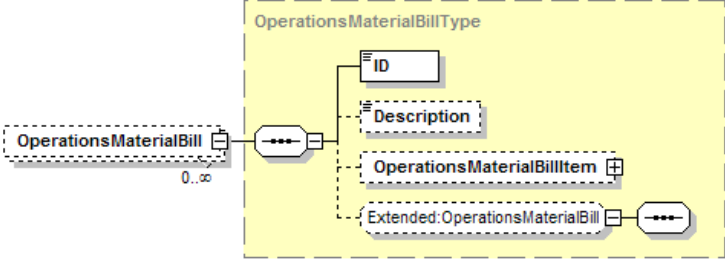
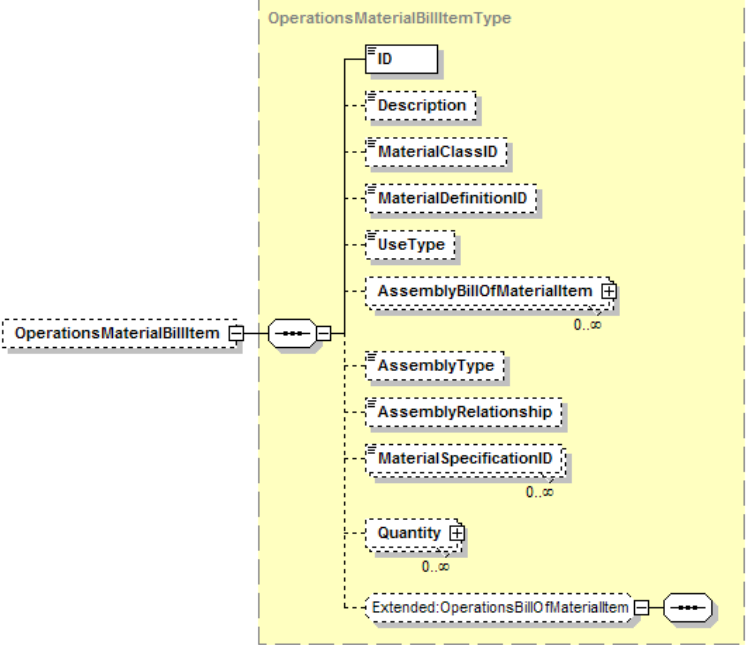
1.7 Resource Identification

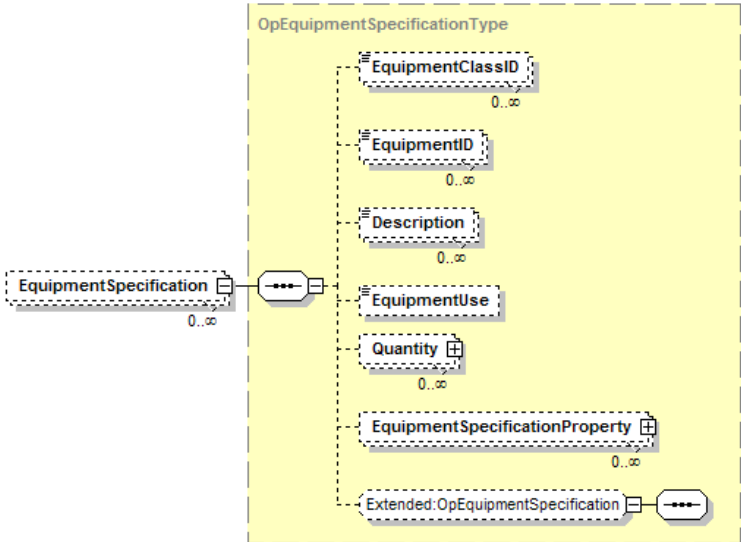
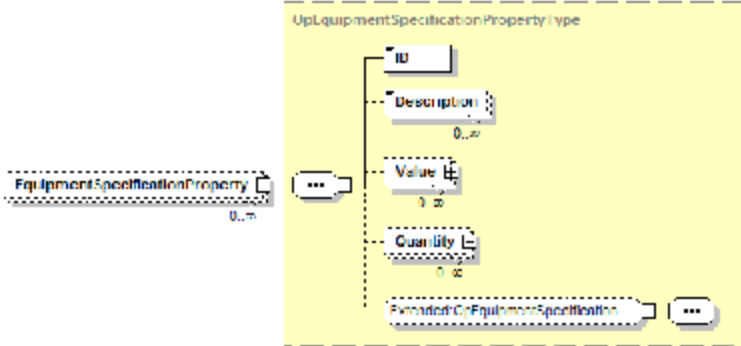
The schemas follow the ANSI/ISA-95 standard by defining resources by class ID or instance ID, or by defining them by class ID and a property value that is used to define a subset of the resource. For example, the figure below illustrates that a segment may require a certain number of milling machine, an equipment class. Other segments may require a subset of milling machine, such as "Fine" milling machines only. In the first case the class name, "Mill", is sufficient to identify the resource required. In the second case the class name, "Mill", and property name and value, "Spec" and "Fine", define the required resource.

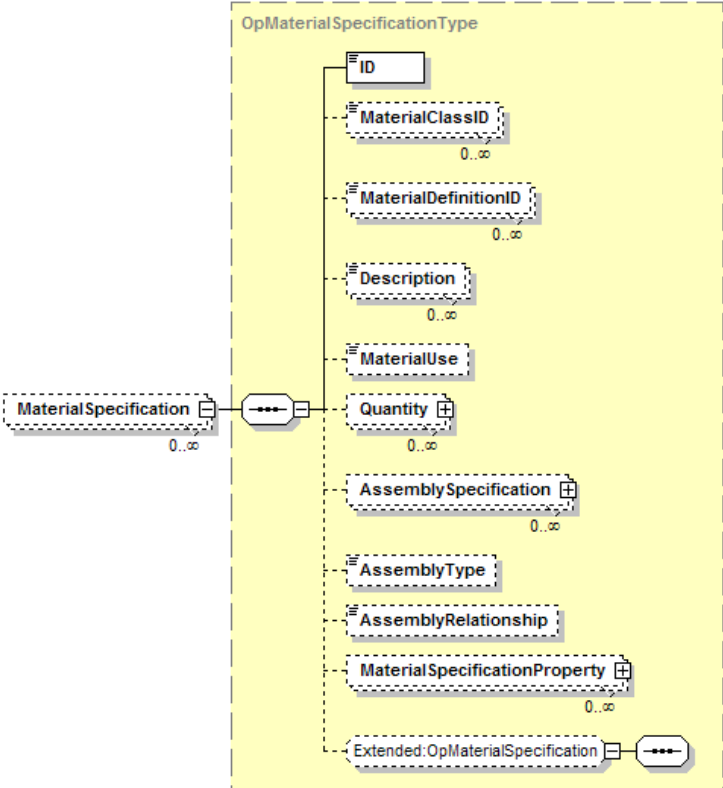
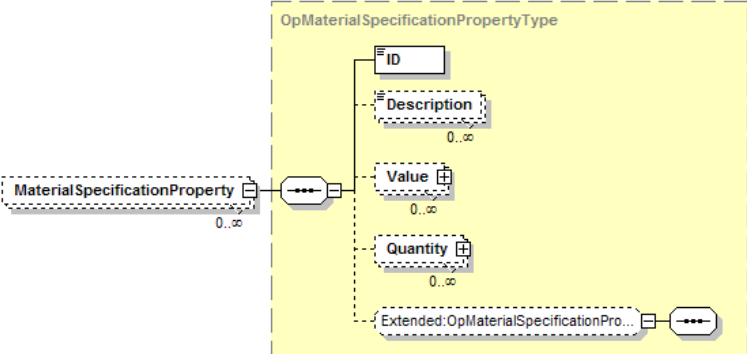


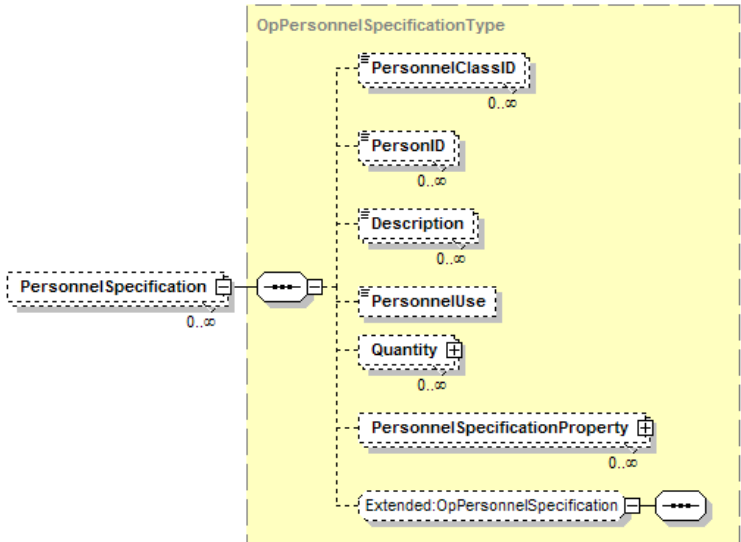
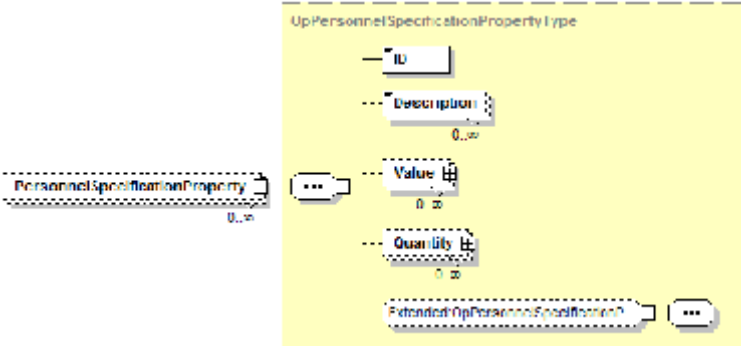
2 Element Definitions

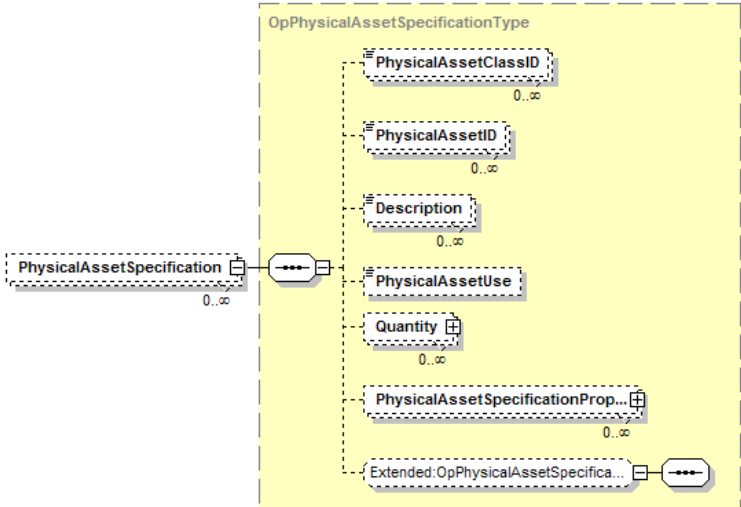
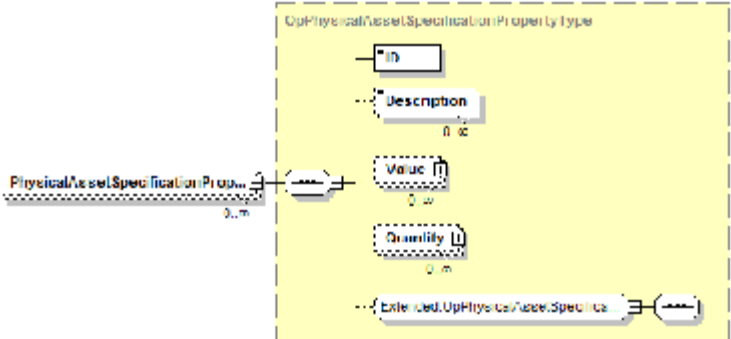
Element/Type	Description
OperationsDefinitionInformation <i>OperationsDefinitionInformationType</i>	<p>Contains a list of operation definitions. Includes the hierarchy scope of the information, and the date of publication of the information.</p> 
OperationsDefinition <i>OperationsDefinitionType</i>	<p>Contains an operations definition. Includes the hierarchy scope of the information, the date of publication of the information, the list of materials in the manufacturing bill, the identification of the bill material, the identification of the bill of resources, and the definition of operations segments.</p> 

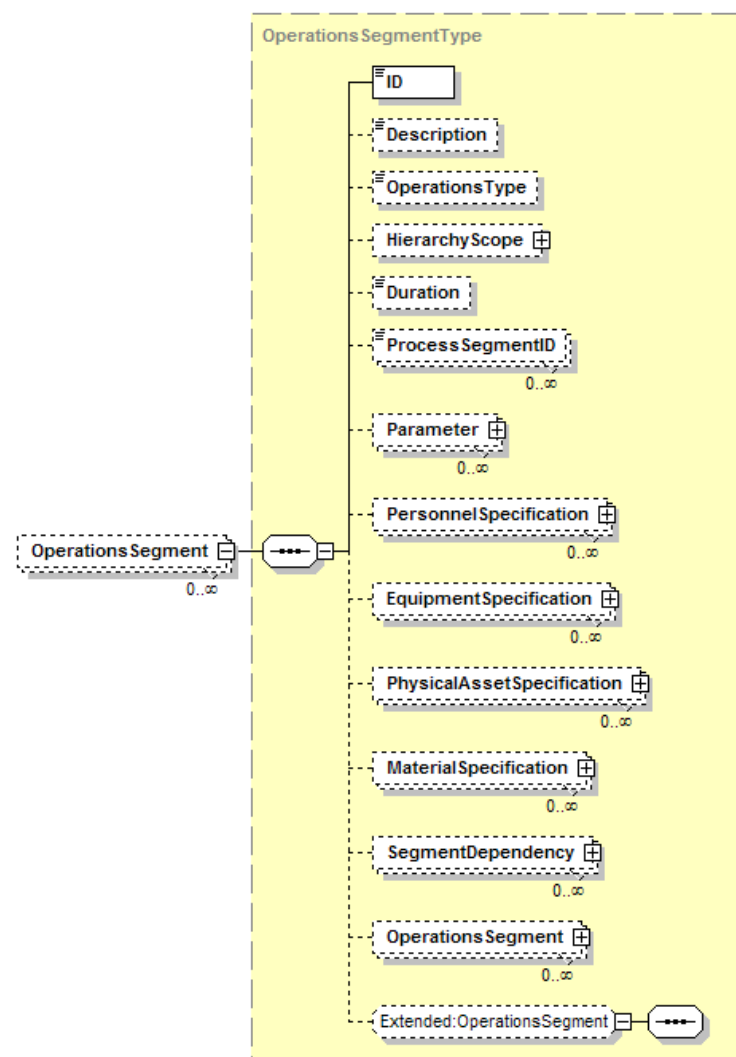
Element/Type	Description
OperationsMaterialBill <i>OperationsMaterialBillType</i>	<p>Contains the list of operations material bill items.</p> 
OperationsMaterialBillItem <i>OperationsMaterialBillItemType</i>	<p>Contains a definition of a material bill item, including the quantity of the material needed, an identification of the material class or definition, any assembly bil of material items, and the corresponding bill of material ID.</p> <p>A OperationsMaterialBillItem element may have a set of contained AssemblyBillOfMaterialItem elements to support hierarchical material bills.</p> 

Element/Type	Description
EquipmentSpecification <i>OpEquipmentSpecificationType</i>	<p>Contains a definition of the equipment resources required for the operations segment. Includes the identification of the class or instance of the resources, the quantity of the resource, and the property specification if required to identify the resource.</p> 
EquipmentSpecificationProperty <i>OpEquipmentSpecificationPropertyType</i>	<p>Contains a definition of a equipment property required for the operations segment, including the quantity of the resource, and a value used to identify the subset of the class.</p> 

Element/Type	Description
MaterialSpecification <i>OpMaterialSpecificationType</i>	<p>Contains a definition of the material resources required for the operations segment. Includes the identification of the class or instance of the resources, the quantity of the resource, the use (consumed, produced), any specification assemblies, and the property specification if required to identify the resource.</p> <p>A ManufacturingSpecification element may have a set of contained AssemblySpecification elements to support hierarchical manufacturing bills.</p> 
MaterialSpecificationProperty <i>OpMaterialSpecificationPropertyType</i>	<p>Contains a definition of a material property required for the operations segment, including the quantity of the resource, and a value used to identify the subset of the class.</p> 

Element/Type	Description
PersonnelSpecification OpPersonnelSpecificationType	<p>Contains a definition of the personnel resources required for the operations segment. Includes the identification of the class or instance of the resources, the quantity of the resource, and the property specification if required to identify the resource.</p> 
PersonnelSpecificationProperty OpPersonnelSpecificationPropertyType	<p>Contains a definition of a personnel property required for the operations segment, including the quantity of the resource, and a value used to identify the subset of the class.</p> 

Element/Type	Description
PhysicalAssetSpecification <i>OpPhysicalAssetSpecificationType</i>	<p>Contains a definition of the physical asset resources required for the operations segment. Includes the identification of the class or instance of the resources, the quantity of the resource, and the property specification if required to identify the resource.</p> 
PhysicalAssetSpecificationProperty <i>OpPhysicalAssetSpecificationPropertyType</i>	<p>Contains a definition of a physical asset property required for the operations segment, including the quantity of the resource, and a value used to identify the subset of the class.</p> 

Element/Type	Description
OperationsSegment <i>OperationsSegmentType</i>	<p>Contains a definition of an operations segment, including the quantity of resources required for the segment (per unit of production), an estimated duration of the segment, an identification of the corresponding process segment, parameters associated with the segment, the segment dependencies, and any encapsulated segments. May also contain application specific elements.</p>  <pre> classDiagram class OperationsSegmentType { ID Description OperationsType HierarchyScope Duration ProcessSegmentID Parameter PersonnelSpecification EquipmentSpecification PhysicalAssetSpecification MaterialSpecification SegmentDependency OperationsSegment ExtendedOperationsSegment } class OperationsSegment { } OperationsSegment "0..∞" -- "0..∞" OperationsSegmentType </pre> <p>The diagram illustrates the structure of the OperationsSegmentType class. It is a container class that includes the following attributes and relationships:</p> <ul style="list-style-type: none"> ID: A unique identifier for the segment. Description: A textual description of the segment. OperationsType: The type of operations performed. HierarchyScope: The scope of the segment within the hierarchy. Duration: The estimated duration of the segment. ProcessSegmentID: The ID of the process segment. Parameter: Parameters associated with the segment. PersonnelSpecification: Specification for personnel required. EquipmentSpecification: Specification for equipment required. PhysicalAssetSpecification: Specification for physical assets required. MaterialSpecification: Specification for materials required. SegmentDependency: Dependencies on other segments. OperationsSegment: Encapsulated segments (0..∞). Extended:OperationsSegment: Extended encapsulated segments (0..∞). <p>The OperationsSegment class is associated with OperationsSegmentType (0..∞ to 0..∞).</p>

3 Transaction Elements

The following elements are defined to support the ISA 95 Part 5 transactions, using the transaction data types defined in the B2MML-Common.xsd schema.

Operations Definition Information Elements	Description
GetOperationsDefinitionInformation	Get <i>OperationsDefinitionInformation</i> definitions.
ShowOperationsDefinitionInformation	Returned information from the <i>GetOperationsDefinitionInformation</i> message.
ProcessOperationsDefinitionInformation	Process <i>OperationsDefinitionInformation</i> definitions.
AcknowledgeOperationsDefinitionInformation	Returned status from the <i>ProcessOperationsDefinitionInformation</i> message.
ChangeOperationsDefinitionInformation	Change <i>OperationsDefinitionInformation</i> definitions.
RespondOperationsDefinitionInformation	Returned status from the <i>ChangeOperationsDefinitionInformation</i> message.
CancelOperationsDefinitionInformation	Cancel <i>OperationsDefinitionInformation</i> definitions.
SyncOperationsDefinitionInformation	Published <i>OperationsDefinitionInformation</i> definitions.

Operations Definition Elements	Description
GetOperationsDefinition	Get a <i>OperationsDefinition</i> definition.
ShowOperationsDefinition	Returned information from the <i>GetOperationsDefinition</i> message.
ProcessOperationsDefinition	Process a <i>OperationsDefinition</i> definition.
AcknowledgeOperationsDefinition	Returned status from the <i>ProcessOperationsDefinition</i> message.
ChangeOperationsDefinition	Change a <i>OperationsDefinition</i> definition.
RespondOperationsDefinition	Returned status from the <i>ChangeOperationsDefinition</i> message.
CancelOperationsDefinition	Cancel a <i>OperationsDefinition</i> definition.
SyncOperationsDefinition	Published <i>OperationsDefinition</i> definition.

4 Diagram Convention

The schema diagrams using the following convention to illustrate the structure of the schema elements, the type of the elements and attributes, and the rules for optional elements and repetition.

