



MTConnect[®] Standard
Part 4.3 – Raw Material Asset Information
Model
Version 1.8.0

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1 **1 Purpose of This Document**

2 This document, *MTCConnect Standard: Part 4.3 - Raw Material Asset Information Model*
3 of the MTCConnect Standard, establishes the rules and terminology to be used by designers
4 to describe the function and operation of *raw material* used within manufacturing and to
5 define the data that is provided by an *Agent* from a piece of equipment.

6 The data associated with these *raw material* will be retrieved from multiple sources that
7 are responsible for providing their knowledge of an *MTCConnect Asset*.

8 2 Terminology and Conventions

9 Refer to Section 2 of *MTConnect Standard Part 1.0 - Overview and Fundamentals* for a
 10 dictionary of terms, reserved language, and document conventions used in the MTConnect
 11 Standard.

12 2.1 Glossary

13 ***Agent***

14 Refers to an MTConnect Agent.

15 Software that collects data published from one or more piece(s) of equipment, orga-
 16 nizes that data in a structured manner, and responds to requests for data from client
 17 software systems by providing a structured response in the form of a *Response Doc-*
 18 *ument* that is constructed using the *semantic data models* defined in the Standard.

19 Appears in the documents in the following form: *Agent*.

20 ***Asset***

21 item, thing or entity that has potential or actual value to an organization *Ref:ISO*
 22 *55000:2014(en)*

23 Note 1 to entry: Value can be tangible or intangible, financial or non-financial,
 24 and includes consideration of risks and liabilities. It can be positive or negative
 25 at different stages of the asset life.

26 Note 2 to entry: Physical assets usually refer to equipment, inventory and prop-
 27 erties owned by the organization. Physical assets are the opposite of intangible
 28 assets, which are non-physical assets such as leases, brands, digital assets, use
 29 rights, licences, intellectual property rights, reputation or agreements.

30 Note 3 to entry: A grouping of assets referred to as an asset system could also
 31 be considered as an asset.

32

33 ***Child Element***

34 A portion of a data modeling structure that illustrates the relationship between an
 35 element and the higher-level *Parent Element* within which it is contained.

36 Appears in the documents in the following form: *Child Element*.

37 ***Component***

38 General meaning:

39 A *Structural Element* that represents a physical or logical part or subpart of a piece
40 of equipment.

41 Appears in the documents in the following form: *Component*.

42 Used in *Information Models*:

43 A data modeling element used to organize the data being retrieved from a piece of
44 equipment.

45 • When used as an XML container to organize *Lower Level* *Component* ele-
46 ments.

47 Appears in the documents in the following form: *Components*.

48 • When used as an abstract XML element. *Component* is replaced in a data
49 model by a type of *Component* element. *Component* is also an XML con-
50 tainer used to organize *Lower Level* *Component* elements, *Data Entities*, or
51 both.

52 Appears in the documents in the following form: *Component*.

53 ***Current Request***

54 A *Current Request* is a *Request* to an *Agent* to produce an *MTConnectStreams Re-*
55 *sponse Document* containing the *Observations Information Model* for a snapshot of
56 the latest *observations* at the moment of the *Request* or at a given *sequence number*.

57 ***Data Entity***

58 A primary data modeling element that represents all elements that either describe
59 data items that may be reported by an *Agent* or the data items that contain the actual
60 data published by an *Agent*.

61 Appears in the documents in the following form: *Data Entity*.

62 ***Devices Information Model***

63 A set of rules and terms that describes the physical and logical configuration for a
64 piece of equipment and the data that may be reported by that equipment.

65 Appears in the documents in the following form: *Devices Information Model*.

66 ***Equipment Metadata***

67 See *Metadata*

68 ***Information Model***

69 The rules, relationships, and terminology that are used to define how information is
70 structured.

71 For example, an information model is used to define the structure for each *MTCConnect Response Document*; the definition of each piece of information within those
72 documents and the relationship between pieces of information.
73

74 Appears in the documents in the following form: *Information Model*.

75 ***Lower Level***

76 A nested element that is below a higher level element.

77 ***Metadata***

78 Data that provides information about other data.

79 For example, *Equipment Metadata* defines both the *Structural Elements* that represent the physical and logical parts and sub-parts of each piece of equipment, the
80 relationships between those parts and sub-parts, and the definitions of the *Data Entities* associated with that piece of equipment.
81
82

83 Appears in the documents in the following form: *Metadata* or *Equipment Metadata*.

84 ***MTCConnect Agent***

85 See definition for *Agent*.

86 ***MTCConnect Asset***

87 An *MTCConnect Asset* is an *Asset* used by the manufacturing process to perform
88 tasks.

89 Note 1 to entry: An *MTCConnect Asset* relies upon an *MTCConnect Device* to
90 provide *observations* and information about itself and the *MTCConnect Device*
91 revises the information to reflect changes to the *MTCConnect Asset* during their
92 interaction. Examples of *MTCConnect Assets* are Cutting Tools, Part Information,
93 Manufacturing Processes, Fixtures, and Files.

94 Note 2 to entry: A singular `assetId` uniquely identifies an *MTCConnect Asset*
95 throughout its lifecycle and is used to track and relate the *MTCConnect Asset* to
96 other *MTCConnect Devices* and entities.

97 Note 3 to entry: *MTCConnect Assets* are temporally associated with a device and
98 can be removed from the device without damage or alteration to its primary
99 functions.

100

101 ***MTCConnect Device***

102 An *MTCConnect Device* is a piece of equipment or a manufacturing system that pro-
103 duces *observations* about itself and/or publishes data using the *MTCConnect Infor-*
104 *mation Model*.

105 ***MTCConnect Information Model***

106 See *Information Model*

107 ***MTCConnectDevices Response Document***

108 A *Response Document* published by an *MTCConnect Agent* in response to a *Probe*
109 *Request*.

110 ***MTCConnectStreams Response Document***

111 A *Response Document* published by an *MTCConnect Agent* in response to a *Current*
112 *Request* or a *Sample Request*.

113 ***observation***

114 The observed value of a property at a point in time.

115 ***Observations Information Model***

116 An *Information Model* that describes the *Streaming Data* reported by a piece of
117 equipment.

118 ***Parent Element***

119 An XML element used to organize *Lower Level* child elements that share a common
120 relationship to the *Parent Element*.

121 Appears in the documents in the following form: *Parent Element*.

122 ***Probe Request***

123 A *Probe Request* is a *Request* to an *Agent* to produce an *MTCConnectDevices Re-*
124 *sponse Document* containing the *Devices Information Model*.

125 ***raw material***

126 Crude or processed material that can be converted by manufacture, processing, or
127 combination into a new and useful product.

128 ***Request***

129 A communications method where a client software application transmits a message
130 to an *Agent*. That message instructs the *Agent* to respond with specific information.

131 Appears in the documents in the following form: *Request*.

132 ***Response Document***

133 An electronic document published by an *MTConnect Agent* in response to a *Probe*
134 *Request, Current Request, Sample Request* or *Asset Request*.

135 ***Sample Request***

136 A *Sample Request* is a *Request* to an *Agent* to produce an *MTConnectStreams Re-*
137 *sponse Document* containing the *Observations Information Model* for a set of time-
138 stamped *observations* made by *Components*.

139 ***semantic data model***

140 A methodology for defining the structure and meaning for data in a specific logical
141 way.

142 It provides the rules for encoding electronic information such that it can be inter-
143 preted by a software system.

144 Appears in the documents in the following form: *semantic data model*.

145 ***sequence number***

146 The primary key identifier used to manage and locate a specific piece of *Streaming*
147 *Data* in an *Agent*.

148 *sequence number* is a monotonically increasing number within an instance of an
149 *Agent*.

150 Appears in the documents in the following form: *sequence number*.

151 ***Streaming Data***

152 The values published by a piece of equipment for the *Data Entities* defined by the
153 *Equipment Metadata*.

154 Appears in the documents in the following form: *Streaming Data*.

155 ***Structural Element***

156 General meaning:

157 An XML element that organizes information that represents the physical and logical
158 parts and sub-parts of a piece of equipment.

159 Appears in the documents in the following form: *Structural Element*.

160 Used to indicate hierarchy of Components:

161 When used to describe a primary physical or logical construct within a piece of
162 equipment.

163 Appears in the documents in the following form: *Top Level Structural Element*.

164 When used to indicate a *Child Element* which provides additional detail describing
165 the physical or logical structure of a *Top Level Structural Element*.

166 Appears in the documents in the following form: *Lower Level Structural Element*.

167 ***Top Level***

168 *Structural Elements* that represent the most significant physical or logical functions
169 of a piece of equipment.

170 **2.2 Acronyms**

171 ***AMT***

172 The Association for Manufacturing Technology

173 ***ASTM***

174 American Society for Testing and Materials

175 **2.3 MTConnect References**

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177 sion 1.8.0.

178 [MTConnect Part 4.3] *MTConnect Standard: Part 4.3 - Raw Material Asset Information*
179 *Model*. Version 1.8.0.

180 **3 Raw Material Information Model**

181 Raw material represents the source of material for immediate use and sources of material
182 that may or may not be used during the manufacturing process.

183 The `RawMaterial Asset` holds the references to the content stored in the actual `Raw-`
184 `Material` container or derived about the `RawMaterial` by the system during opera-
185 tion.

186 **3.1 RawMaterial**

187 `RawMaterial` is an `Asset` that represents *raw material*.

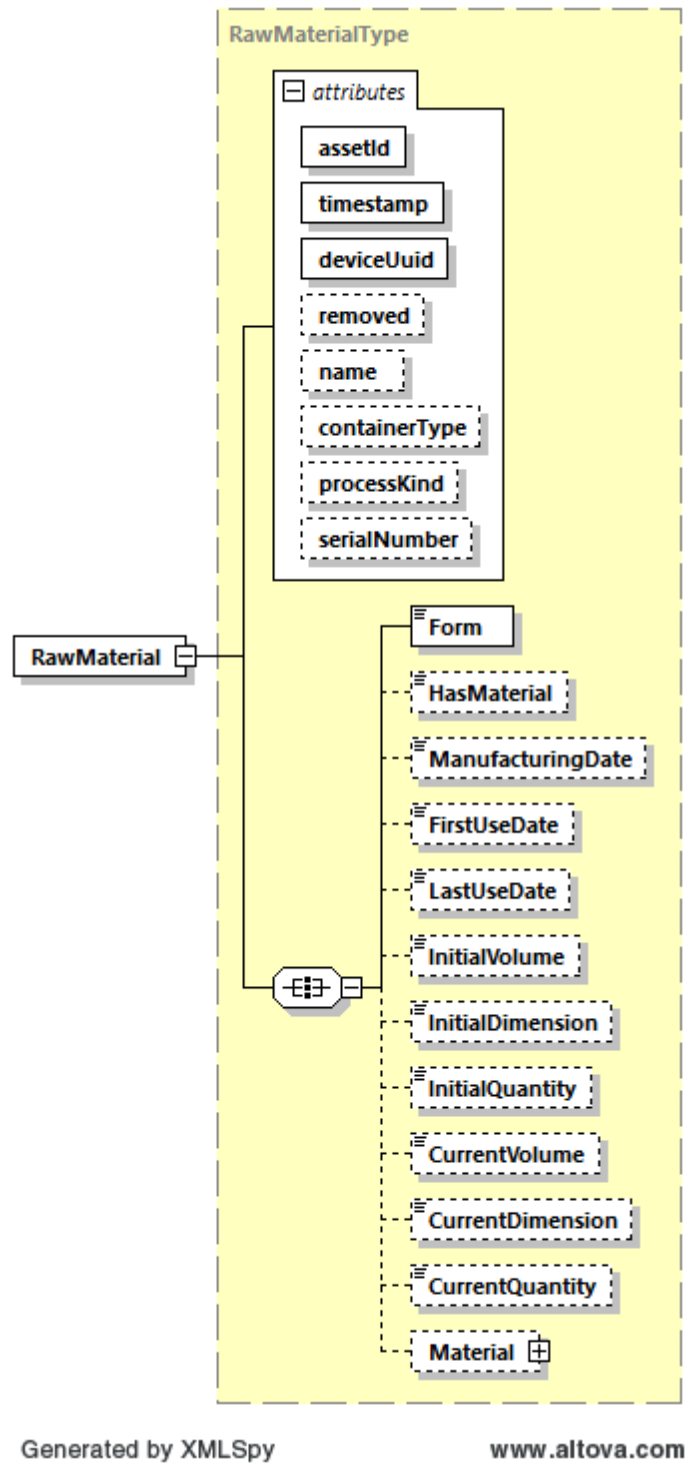


Figure 1: RawMaterial Diagram

188 3.1.1 Attributes for RawMaterial

189 *Table 1* lists the attributes for a RawMaterial element in addition to attributes inherited
190 from Asset element.

Table 1: Attributes for RawMaterial

Attribute	Description	Occurrence
name	The <i>raw material</i> name. Examples: Container1 and AcrylicContainer. The value of name MUST be a string.	0..1
containerType	The type of container holding the <i>raw material</i> . Examples: Pallet, Canister, Cartridge, Tank, Bin, Roll and Spool. The value of type MUST be a string.	0..1
processKind	The ISO process type supported by this <i>raw material</i> . Examples include: VAT_POLYMERIZATION, BINDER_JETTING, MATERIAL_EXTRUSION, MATERIAL_JETTING, SHEET_LAMINATION, POWDER_BED_FUSION, or DIRECTED_ENERGY_DEPOSITION. <i>Ref: ASTM F2792-12a</i> The value of processId MUST be a string.	0..1
serialNumber	The serial number of the <i>raw material</i> . The value of serialNumber MUST be a string.	0..1

191 3.1.2 Elements for RawMaterial

192 *Table 2* lists the elements for a RawMaterial element.

Table 2: Elements for RawMaterial

Element	Description	Occurrence
Form	The form of the <i>raw material</i> . The value MUST be BAR, SHEET, BLOCK, CASTING, POWDER, LIQUID, GEL, FILAMENT, or GAS.	1
HasMaterial	Material has existing usable volume. The value of HasMaterial MUST be boolean.	0..1
ManufacturingDate	The date the <i>raw material</i> was created. The value of ManufacturingDate MUST be reported in ISO 8601 format.	0..1
FirstUseDate	The date <i>raw material</i> was first used. The value of FirstUseDate MUST be reported in ISO 8601 format.	0..1
LastUseDate	The date <i>raw material</i> was last used. The value of LastUseDate MUST be reported in ISO 8601 format.	0..1
InitialVolume	The amount of material initially placed in <i>raw material</i> when manufactured. The value of InitialVolume MUST be reported in CUBIC_MILLIMETER.	0..1
InitialDimension	The dimension of material initially placed in <i>raw material</i> when manufactured. The value of InitialDimension MUST be reported in MILLIMETER_3D.	0..1
InitialQuantity	The quantity of material initially placed in <i>raw material</i> when manufactured. The value MUST be an integer.	0..1

Continuation of Table 2		
Element	Description	Occurrence
CurrentVolume	<p>The amount of material currently in <i>raw material</i>.</p> <p>The value of CurrentVolume MUST be reported in CUBIC_MILLIMETER.</p>	0..1
CurrentDimension	<p>The dimension of material currently in <i>raw material</i>.</p> <p>The value of CurrentDimension MUST be reported in MILLIMETER_3D.</p>	0..1
CurrentQuantity	<p>The quantity of material currently in <i>raw material</i>.</p> <p>The value MUST be an integer.</p>	0..1
Material	<p>Material used as the <i>raw material</i>.</p> <p>See <i>Section 3.2 - Material</i> for details.</p>	0..1

193 **3.2 Material**

194 Material used as the *raw material*.

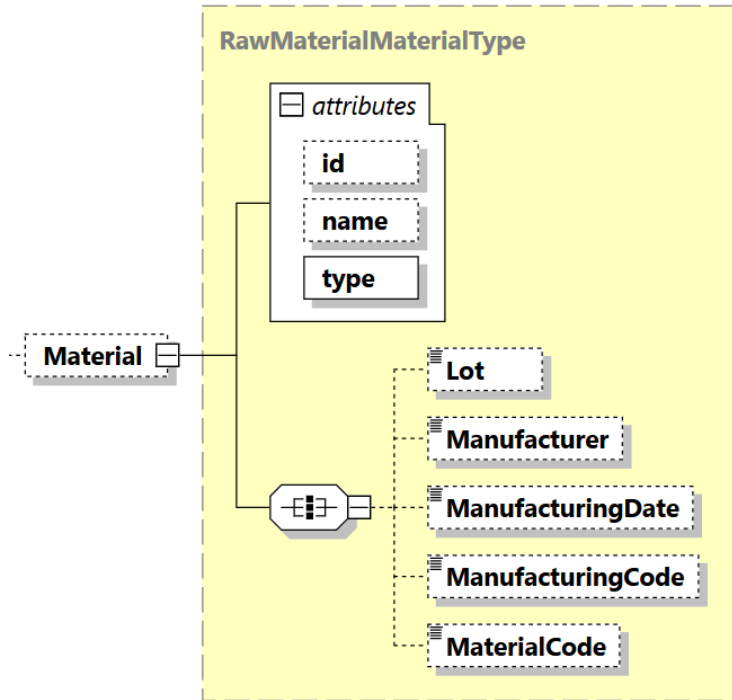


Figure 2: Material Diagram

195 **3.2.1 Attributes for Material**

196 Table 3 lists the attributes for a Material element.

Table 3: Attributes for Material

Attribute	Description	Occurrence
id	The unique identifier for the material. The value for id MUST be a string.	0..1
name	The name of the material. Examples: ULM9085, ABS, 4140. The value for name MUST be a string.	0..1

Continuation of Table 3		
Attribute	Description	Occurrence
type	The type of material. Examples: Metal, Polymer, Wood, 4140, Recycled, Prestine and Used. The value for type MUST be a string.	1

197 3.2.2 Elements for Material

198 *Table 4* lists the elements for a Material element.

Table 4: Elements for Material

Element	Description	Occurrence
Lot	The manufacturer's lot code of the material. The value for Lot MUST be a string.	0..1
Manufacturer	The name of the material manufacturer. The value for Manufacturer MUST be a string.	0..1
ManufacturingDate	The manufacturing date of the material from the material manufacturer. The value for ManufacturingDate MUST be reported in ISO 8601 format.	0..1
ManufacturingCode	The lot code of the raw feed stock for the material, from the feed stock manufacturer. The value for ManufacturingCode MUST be a string.	0..1
MaterialCode	The ASTM standard code that the material complies with. The value for MaterialCode MUST be a string.	0..1

199 Appendices

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