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IPC-2577

Sectional Requirements for Supply Chain Communication of Manufacturing Quality Assessment - Product Data eXchange (PDX)

Proposed Standard for Ballot

IPC-2577

February 2005

A standard developed by IPC

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- Contain simple (simplified) language
- Just include spec information
- Focus on end product performance
- Include a feedback system on use and problems for future improvement

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IPC-2577

PDX

– Quality Assessment

Sectional Requirements for Supply Chain Communication of Manufacturing Quality Assessment – Product Data eXchange (PDX)

A standard developed by the Product Manufacturing Quality Exchange Task Group (2-15d) of the Supply Chain Communication Subcommittee (2-15) of IPC.

The IPC-2577 standard defines an XML encoding scheme that captures the setting and updating of quality goals, communicating and responding to quality excursions and reporting actual data from manufacturing and repair operations.

Users of this standard are encouraged to participate in the development of future revisions.

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Acknowledgment

Any document involving a complex technology draws material from a vast number of sources. While the principal members of the Product Manufacturing Quality Exchange Task Group (2-15d) of the Supply Chain Communication Subcommittee (2-15) are shown below, it is not possible to include all of those who assisted in the evolution of this standard. To each of them, the members of the IPC extend their gratitude.

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Sectional Requirements for Supply Chain Communication of Manufacturing Quality Assessment – Product Data eXchange (PDX)

Introduction

The IPC-2571 document provides introductory and explanatory information about this standard and includes other elements that are also required or available. The IPC-2571 dictates the required package structure and XML format for information exchange using any of the subsequent IPC-257x standards such as this one (IPC-2577). In any such exchange, a Product Data eXchange package must be defined which contains at a minimum a single pdx.xml file. This file in turn is required to contain a single ProductDataeXchangePackage element, and may contain any number of other elements from this specification. The Product Data eXchange package may optionally contain or refer to related external files (see IPC-2571 documentation).

This standard (IPC-2577) covers the sectional requirements for the exchange of Product Quality information resulting from manufacturing, assembly, test, repair and failure tracking. Quality Metrics are also defined and the actual metric can be exchanged between parties.

1 SCOPE

This standard (IPC-2577) defines an XML encoding scheme that allows business partners to set and update quality goals, communicate and respond to quality excursions, and report actual data from manufacturing and repair operations. Information represented in this standard includes such things as: quality metrics and goals, manufacturing quality results and failure tracking data, parametric data, quality performance, repair detail and corrective actions.

1.1 Focus and intent

This standard facilitates the exchange of manufacturing & repair information between supply chain partners that supports warranty tracking, product excursion containment, and product quality functions.

The generic format requirements are provided in a series of standards focused on printed board manufacturing, assembly, and inspection testing. This standard series consists of a generic standard (IPC-2571) that contains all the general requirements and this quality standard (IPC-2577) as an element inside the IPC-2571. There are four sectional standards that are focused on the XML quality details used to define and report information in the area of quality performance and detailed process information.

1.2 Business Objectives

Any IPC-2577 quality file is composed of a high level element PDX structure (IPC-2571) that contains any of the following IPC-2577 subelements:

QualityMetrics – Defines the different quality performance Metrics and actual measurements,

QualityIssues – Defines the different quality Issues that arose during production,

CorrectiveActions – Defines the different Corrective Actions that address the related issues,

Repair/Failure Analysis – Defines the different instances where failures occurred and the repair steps to correct the issue and/or the disposition.

Listed below are the Main Elements in the Quality Specification. There are four use cases currently defined that address several Quality exchanges. There must be at least one use case defined. Multiple cases can be included in one file. Each case has its unique role so it would be impractical to see all use cases included in one transmission.

1.2.1 Quality Metrics

In this use case scenario, information is exchanged between supply chain partners to set key parameters for the other data exchange scenarios. It defines elements related to the data exchange of performance metrics, which could be collected by product, line, cell, workstation, etc. This scenario allows for actual measurements to be reported against the goals. This scenario is defined as a unidirectional exchange.

Use case: Establish parameters for capturing production volume metrics and communicating the quality codes, values & descriptions. Update the parameters for capturing production volume metrics and quality codes, values & descriptions.

Business Objective: To understand the quality data being transferred between the contracting company and the contractee it is necessary to agree in advance on, the volume measurements will be taken, the level of data to be passed and the content (or values) within the data. The “quality data exchange metrics set-up and actuals” definition allows a contractor to set the data criteria for the contractee. Using this standard the contractor can:

- Establish and update the data volume measurements used to support product production;
- Define the values and description of the quality codes being exchanged from the contractee. These quality codes can be used within any entity of the data being exchanged. Examples of these quality codes would be failure/repair codes, test codes, cross-reference values etc. These quality codes support both production processing and repair processing.

1.2.2 Quality Issues

In this use case scenario, information is exchanged between supply chain partners to communicate production issues. It defines elements related to the data exchange of product non-conformance, or other issues that require resolution. These quality issues could be collected by product, line, cell, workstation, etc. This scenario allows for actual issues to be reported or product service requests (PSRs) to be initiated.

Use Case: Respond to Quality Issues – Symptoms and Problems

Business Objective: To provide bilateral data exchange to communicate and provide feedback resolution for quality issues. This data exchange can be initiated by either the contractor or the contractee and both can play either of the actor roles depending on who is responsible for the corrective action.

1.2.3 Corrective Actions

In this use case scenario, information is exchanged between supply chain partners to communicate a corrective action (or actions) to open issues. It defines elements related to the data exchange of resolution of open quality issues. The corrective action(s) can address the product, line, cell, workstation, employee training, etc. This scenario allows for resolution to reference multiple actual issues that were reported or product service requests (PSRs). This scenario is defined as a unidirectional exchange.

Use Case: Respond to Quality Issues by Correction Actions

Business Objective: To monitor product health to proactively prevent product excursions and drive corrective actions, and to utilize the data to drive continuous improvement and next generation improvements.

The standard is setup to enable the exchange to support various levels of business and product maturity. As an example, data exchange content could vary by production type.

The cross reference of related issues is available to enable a linkage between an issue and the corrective action data. As an example:

- This would permit the tracking of a failure in a manufacturing line to a corrective action / repair from another supplier. i.e. a hard drive reported as the failure cause on a systems integration line could be tracked back to the corrective action/repair record of the hard drive.

1.2.4 Repair/Failure Analysis

In this use case scenario (ProductRepairAndFailureData), repair and failure analysis information is exchanged between business partners. The information may include product related repair and failure analysis details concerning individual product instances. The standard supports test, failure and environmental data, which can be cross-referenced to other supply chain partners.

Use Case: To capture a final disposition, failure analysis, root cause and component usage data from repair providers. Communicate repair and/or failure information about a product to support the control of the repair process and the lowering of the repair costs.

Business Objective: To provide a data exchange to communicate failure and repair data from repair providers. In this standard the data receiver is expecting a data exchange for each repaired item or group of repaired items. This data could include:

- identification of the product (individual or quantity driven);
- disposition of the product;
- failure and repair codes associated with each incident for the product;
- identification of sub-assemblies (or components) repaired or replaced;
- failure and repair codes associated with the sub assemblies;
- test data associated with the failure or repair of the product and/or sub-assembly;
- Cross-reference data for the product (i.e. RMA Number, PO, Master Event Number etc..).

The Repair Quality Data exchange standard supports a flexible ongoing feed of repair and failure data in which the level of data being communicated is negotiated between the company (such as an EMS) requesting the data (contractor) and the repair provider(s) (contractee) performing the failure analysis and repair.

From a manufacturing standpoint this standard can support a production line in which finished products are being integrated to create a new product to be sent to an end customer (e.g. Building a server). As testing is performed on the integrated products any failure data associated with the sub-assembly would be sent to a repair provider contracted to repair the sub-assembly. Any failure or repair quality data captured by the repair provider would be sent to the EMS where aggregation and trend analysis could take place.

This flexible standard can also be used for post customer support. If a customer sends a defective product to a repair provider this standard would allow:

- The customer to send failure or repair information found at the customer site to the repair provider. This could lower cost of the repair to the contractor by providing the repair provider has an understanding of the failure that was found at the customer site.
- Once completing the repair, the repair provider could send quality data about the repair to the EMS.
- The EMS could use the data from the two repair providers to support failure/repair trend analysis. They could also use the data to manage the business relationship with their contracted repair providers.

2 APPLICABLE DOCUMENTS

2.1 Introduction

There are relationships to other standard initiatives. The following documents contain provisions, which, through reference in this text, constitute provisions of this standard. All documents are subject to revision. Parties who make agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the documents. These include the following:

2.1.1 IPC 2500 CAMX Series

The CAMX Series standard (IPC 2500's) describes printed boards and printed board assemblies in various definitions from a graphical representation (CAD), a manufacturing representation (CAM), machine recipes, machine messages, ERP and MES interfaces, Supply Chain communications (PDX).

Please also refer to the IPC-2501 document for introductory and explanatory information about this standard. IPC-2501 also includes other elements that are required or used by this standard which dictates the required package structure and xml format for information exchange using any of the subsequent IPC-25xx standards such as this one. This standard describes message transport mechanisms that are based upon an architecture whereby a single logical middleware server (the Message Broker) exchanges messages among Clients in a Domain.

The Product Data eXchange (PDX) standard (IPC-257x series), is intended for high-level supply chain communication of product definition, product build, and production reporting data.

IPC-T-50	Terms and Definitions for Interconnecting and Packaging Electronic Circuits
IPC-2501	Definition for Web-Based Exchange of XML Data
IPC 2511	Generic Computer Aided Manufacturing Descriptions for Printed Boards and Printed Board Assembly
IPC-2541	Generic Requirements for Electronics Manufacturing Shop-Floor Equipment Communication Messages (CAMX)
IPC-2547	Sectional Requirements for Shop-Floor Equipment Communication Messages (CAMX) for Printed Circuit Board Test, Inspection and Rework
IPC-2571	Generic Requirements for Electronics Manufacturing Supply Chain Communication – Product Data eXchange (PDX)
IPC-2576	Sectional Requirements for Electronics Manufacturing Supply Chain Communication of As-Built Product Data - Product Data eXchange (PDX)

- IPC-2578 Sectional Requirements for Electronics Manufacturing Supply Chain Communication of Bill of Material and Product Design Configuration Data – Product Data eXchange
- IPC-2581 Generic Requirements for Printed Board Assembly Products Manufacturing Description Data and Transfer Methodology

2.1.2 RosettaNet

RosettaNet is dedicated to the development and deployment of standard electronic business interfaces to align the processes between supply chain partners on a global basis. See <http://www.rosettanet.org>

PIP-7C6 Cluster 7 – Manufacturing, Segment 7C: Distribute Product Quality Event Data

2.2 Documentation conventions

The XML file format standard and the XML Schema definition language standard, as defined the by World Wide Web Consortium (W3C), have been adopted by IPC for use in the IPC-2500 series of standards.

In addition to the text based schema notation this document provides graphical representation of the structure of the file format. The XML diagrams are designed to effectively illustrate the structure and cardinality of elements and attributes that make up any IPC-258X file. The notation in the graphics does not provide a complete visualization of the schema definition for the file format, but it does provide a good top down overview. Should there be any conflict between the graphical notation and the schema notation, the authoritative definition is the schema notation.

2.3 Notation

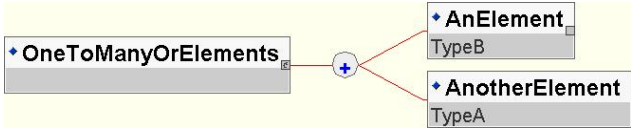
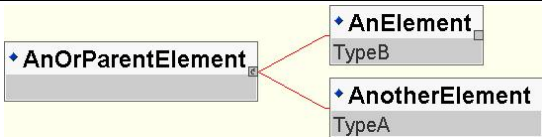
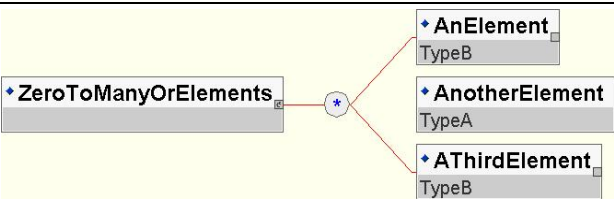
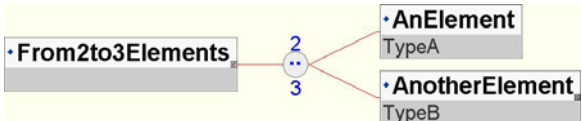
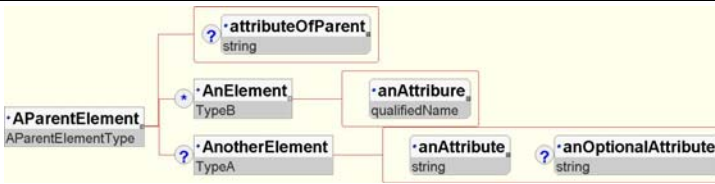
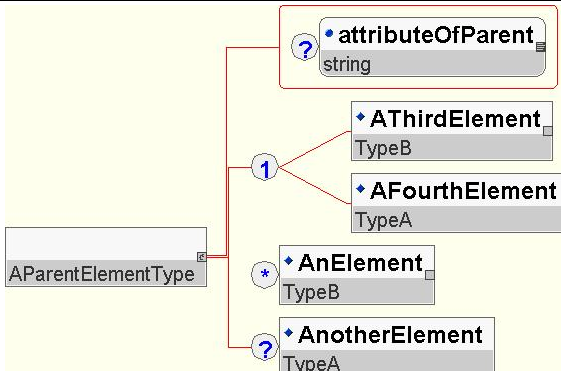
Although the data would be contained in a single file, the file can have different purposes as described in Section 4. The XML schema used for this standard follows the notations set forth by the W3C and is as follows:

- element – Element appears exactly one time
- element ? – Element may appear 0 or 1 time
- element * – Element may appear 0 or more times
- element + – Element may appear 1 or more times

Table 1 provides an overview of the graphical notation used in the document.

Table 1 Graphical Notation Overview

This diagram depicts an element named AnElement that is of type TypeB. There is one attribute, named anAttribute, that is of type double. The attribute is required.	
Example: <AnElement anAttribute="14.44e-3"/> Note that all attribute values must be enclosed in quotes, regardless of type.	
This diagram depicts an element with two attributes. The attribute anAttribute is required. The "?" in the circle indicates that the second attribute, anOptionalAttribute, is optional. Both attributes are of type string.	

Examples: <pre><AnotherElement anAttribute="red" anOptionalAttribute="a string" /> <AnotherElement anAttribute="blue" /></pre>	
The element OneToManyOrElements is the parent of an unordered list of one or more instances of the elements AnElement and AnotherElement. The "+" indicates the occurrence is one to many and the angled lines indicate this is a choice relationship (" ") between the children elements.	 The diagram shows a parent element box labeled "OneToManyOrElements" connected by a line with a "+" sign to a choice bubble (a circle with a vertical line). This bubble branches into two child element boxes: "AnElement" (TypeB) and "AnotherElement" (TypeA).
< OneToManyOrParentElement>...	
The absence of an occurrence bubble declares that one and only one occurrence are allowed. The AnOrParentElement can have one of AnElement or AnotherElement as a child element.	 The diagram shows a parent element box labeled "AnOrParentElement" connected by a line to a choice bubble. This bubble branches into two child element boxes: "AnElement" (TypeB) and "AnotherElement" (TypeA).
The '*' in the occurrence bubble indicates the choice is from 0 to many.	 The diagram shows a parent element box labeled "ZeroToManyOrElements" connected by a line with a "*" sign to a choice bubble. This bubble branches into three child element boxes: "AnElement" (TypeB), "AnotherElement" (TypeA), and "AThirdElement" (TypeB).
This diagram depicts an element, From2to3Elements. The element has no type and no attributes. It can have 2 to 3 sub-elements of either AnElement or AnotherElement.	 The diagram shows a parent element box labeled "From2to3Elements" connected by a line to an occurrence bubble (a circle with a vertical line and a range "2..3"). This bubble branches into two child element boxes: "AnElement" (TypeA) and "AnotherElement" (TypeB).
This diagram depicts an element, AParentElement, of type AParentElementType. This element has one attribute, attributeOfParent, which is optional. The lines with square corners indicate that occurrences of AnElement and AnotherElement must appear in the order by the illustration on the right where the top element is addressed first and AnotherElement is addressed secondly.	 The diagram shows a parent element box labeled "AParentElement" (AParentElementType) with an attribute box "attributeOfParent" (string) connected by a line with a "?" sign. Below the parent box, there are two child element boxes: "AnElement" (TypeB) and "AnotherElement" (TypeA), both connected by lines with square corners and "?" signs. To the right, there are two attribute boxes: "anAttribute" (qualifiedName) and "anOptionalAttribute" (string), both connected by lines with square corners and "?" signs.
This diagram depicts a type, AParentElementType, that contains a sequence starting with one of AThirdElement or AFourth element followed by 0-n AnElement and an optional final AnotherElement.	 The diagram shows a parent element box labeled "AParentElementType" connected by a line to a sequence bubble (a circle with a vertical line and a "1" inside). This bubble branches into two child element boxes: "AThirdElement" (TypeB) and "AFourthElement" (TypeA). Below these, there is a child element box "AnElement" (TypeB) connected by a line with a "*" sign, and a final child element box "AnotherElement" (TypeA) connected by a line with a "?" sign.

3 GRAPHICAL REPRESENTATION AND XML STRUCTURE

XML Document Type Definitions (DTDs) of the elements in this standard are contained in IPC2571. A Document Type Definition (DTD) is a standard for describing the structure of information. A DTD describes a standard for a whole class of documents. The standard describes the possible arrangement of tags and text in a valid XML-document (or message). A DTD might also be viewed as an agreement on a common vocabulary for a particular application domain (like the Electronics Manufacturing) that involves exchanging documents or messages.

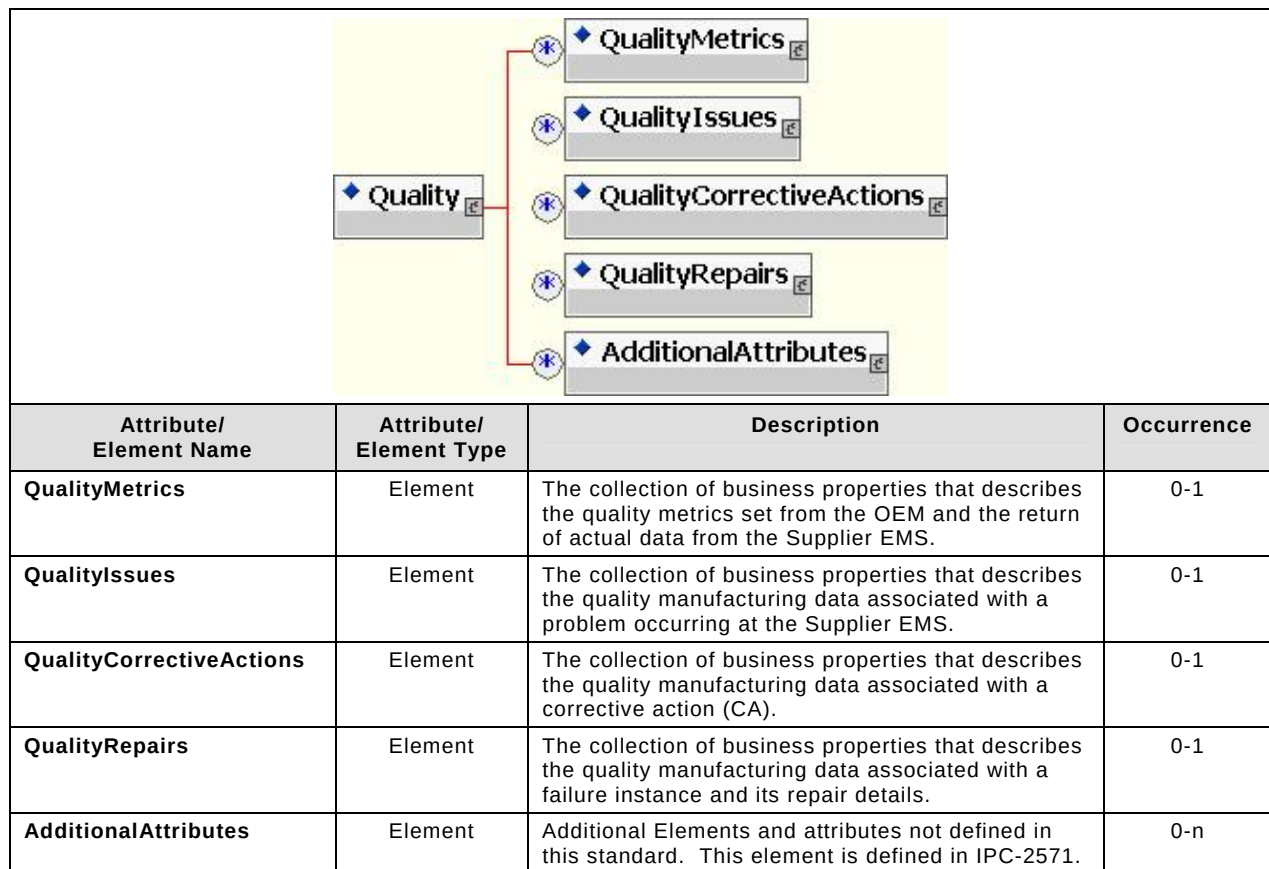
3.1 Quality – The Quality Tree

This is the first major element after the ProductDataeXchange that defines the quality tree of quality definition structures. Sub-elements under Quality define the individual four scenarios, as described earlier, for quality reporting and Supply Chain Communications.

3.1.1 XML Glossary – Quality Tree

3.1.1.1 Element: Quality

Description: The collection of business properties that describes the quality data sent from the Repair Provider to the Supply Chain including the supply chain from and to partners.

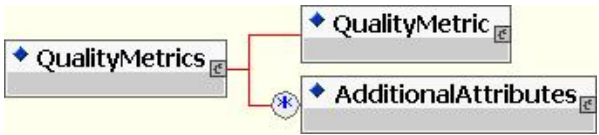


3.2 Quality – Quality Metrics

3.2.1 XML Glossary – Quality Metrics

3.2.1.1 Element: QualityMetrics

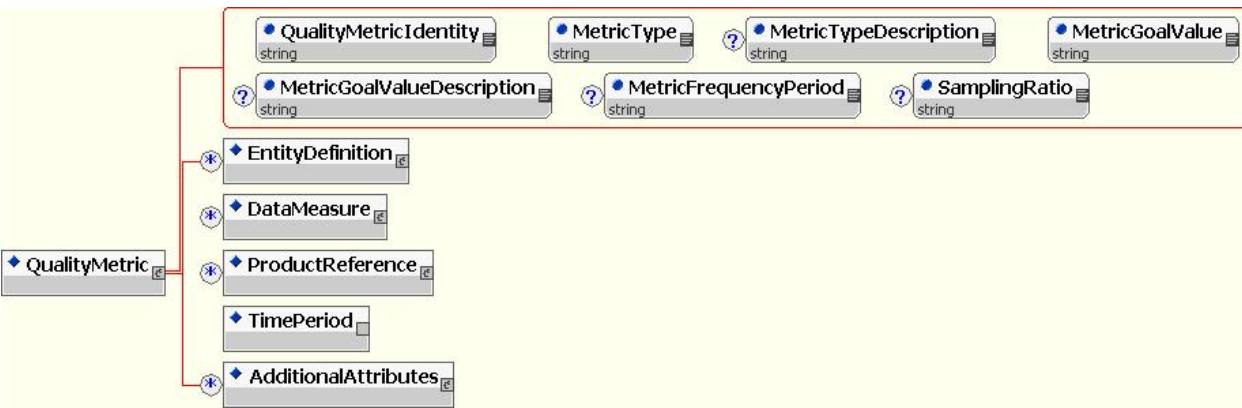
Description: Defines a group of quality metric goals and its volume data for the defined metric.



Attribute/ Element Name	Attribute/ Element Type	Description	Occurrence
QualityMetric	Element	Defines a specific quality metric goal and can contain recorded volume data.	1-n
AdditionalAttributes	Element	Additional Elements and attributes not defined. This element is defined in IPC-2571.	0-n

3.2.1.2 Element: QualityMetric

Description: Defines the metric name and parameters for capturing quality goals and recorded volume data.

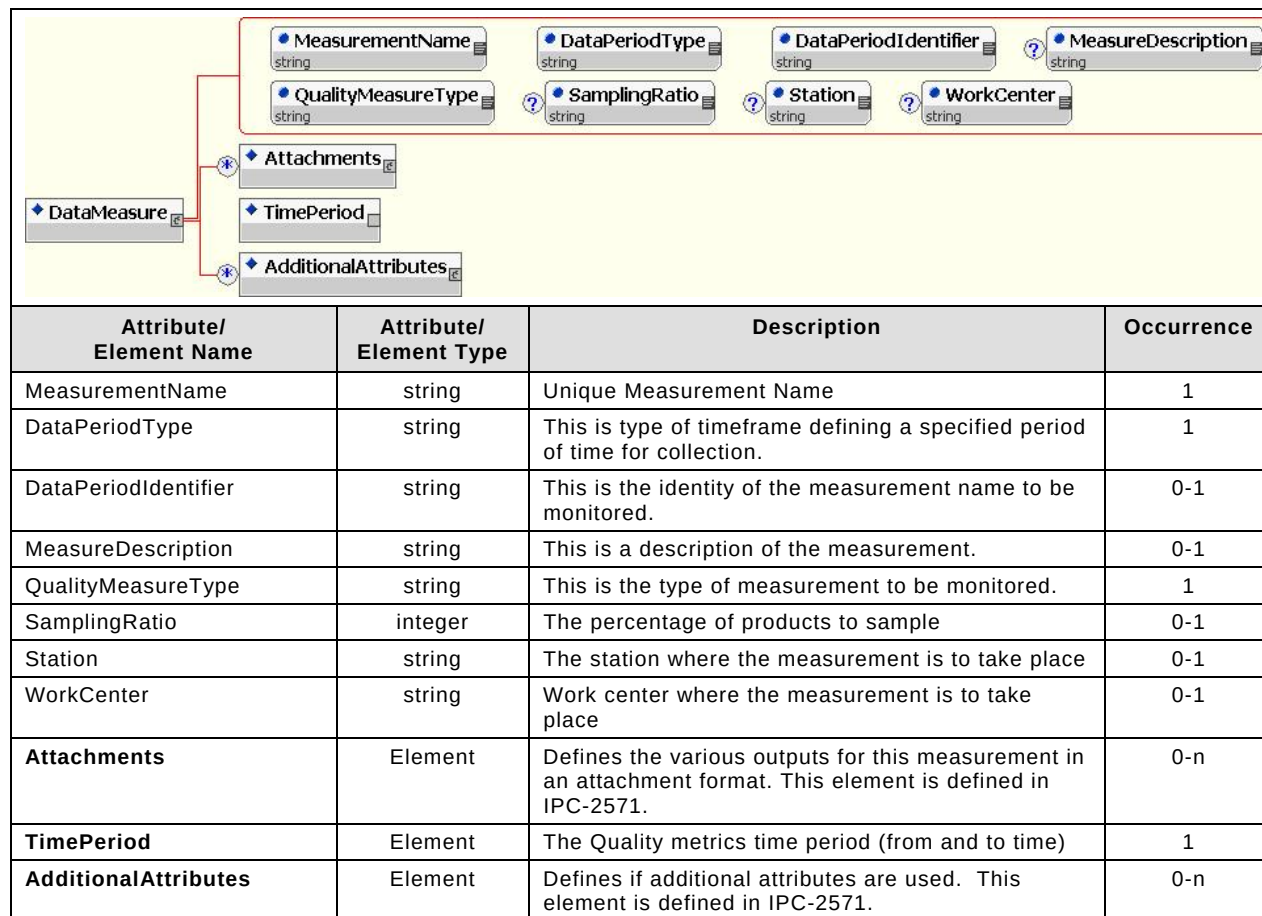


Attribute/ Element Name	Attribute/ Element Type	Description	Occurrence
QualityMetricIdentity	string	The identity of the metric to be collected at the current entity or product.	1
MetricType	string	The metric type to be collected at the current entity	1
MetricTypeDescription	string	Metric type description	0-1
MetricGoalValue	string	The metric goal value associated with the metric type	1
MetricGoalValueDescription	string	Metric goal value description value associated with the metric type	0-1
MetricFrequencyPeriod	string	The period of time that this Metric goal is slated to be used. Examples are Quarterly, monthly, weekly, daily, per shift, etc.	0-1
Sampling Ratio	integer	The percentage of products to sample at a time.	0-1
EntityDefinition	Element	Defines if data will be captured or not at certain entity level. Also defines the entity that the quality codes defined will be associated	0-1

DataMeasure	Element	Defines the measurement name and parameters for capturing quality volume data	0-n
ProductReference	Element	Defines the measurement name and parameters for capturing quality volume data	0-1
TimePeriod	Element	The Quality metrics time period (from and to time)	1
AdditionalAttributes	Element	Defines if additional attributes are used. This element is defined in IPC-2571.	0-n

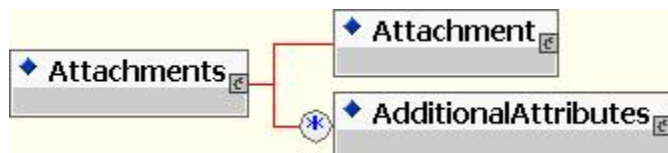
3.2.1.3 Element: DataMeasure

Description: Defines the measurement name and parameters for capturing quality volume data.



3.2.1.4 Element: Attachments

Description: Defines the various outputs for this measurement in an attachment format. This element is defined in IPC-2571.



3.2.1.5 Element: TimePeriod

Description: The segment of time with a defined start and end.

Attribute/ Element Name	Attribute/ Element Type	Description	Occurrence
beginDateTime.DateTime Stamp	dateTime	Start date-time of data parameters	1
endDateTime.DateTime Stamp	dateTime	End date-time of data parameters	0-1
plantShift	string	Name of a plant's shift timeframe.	0-1

3.2.1.6 Element: EntityDefinition

Description: Defines if data will be captured or not at certain entity level. Also defines the entity that the metrics as defined will be associated.

Attribute/ Element Name	Attribute/ Element Type	Description	Occurrence
EntityName	string	Defines the entity at which data should be captured (examples are Line, Cell, Category)	0-1
EntityComment	string	Comment or description about the Entity	0-1
Station	string	The station where the measurement is to take place	0-1
WorkCenter	string	Work center where the measurement is to take place or has taken place.	0-1
AdditionalAttributes	Element	Additional Elements and attributes not defined. This element is defined in IPC-2571.	0-n