



Guide to Schematron Rules and Patterns

PMA Schematron Guide

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Chapter 1 - Introduction

1.1 - Purpose

This is an informative supplement for PMA. This guide is generated from the PMA Schematron rules and provides a consolidated reference for the business rules of this specification.

1.2 - Overview

Chapter 2 is a listing of all the numbered rules in PMA. For each rule, there is a rule description, a code description, and a code block with the Schematron rule.

Chapter 3 is a listing of abstract patterns used in PMA. The abstract patterns may be used in numbered rules or provided as reference for use in rules developed by users of PMA. Each abstract pattern has a code description and a code block with the abstract Schematron pattern.

Chapter 4 is a listing of the master PMA Schematron file with all of the imports of rules and patterns. Many of the rules and patterns listed in Chapters 3 and 4 rely on functions and variables defined in the master file.

Chapter 5 is a listing of rules that have been deleted.

1.3 - Schematron

The business rules for PMA are encoded using ISO Schematron. Schematron is a rule-based validation language that uses XML Path Language to make assertions about an XML document.

PMA uses the XSLT 2.0 implementation of Schematron by Rick Jelliffe (2010-04-14) as its reference implementation. The only available identifying descriptors for this implementation are the implementer's name and date of release. This implementation may be found at the following URL: <http://code.google.com/p/schematron/>.



Important

The Schematron rules in this specification use XSLT 2.0 query binding.

1.4 - Conformance

This guide is informative. The Schematron rules listed here are normative in the sense that they convey criteria that a document **MUST** adhere to, exactly as English may be used to convey normative criteria. It is not necessary for implementers to use the specific Schematron encoding in this specification. Implementers **MAY** use any encodings, tools, or languages desired to implement validation schemes for conformance to this specification. However, to conform to the specification, validation schemes **MUST** match the behavior of the reference Schematron implementation. That is, a validator **MUST** find a document valid *if and only if* the reference Schematron implementation would find the document valid according to PMA's Schematron rules.

Chapter 2 - Rules

All of the numbered Rules for PMA are listed in this section. These rules may depend on patterns defined in the Abstract Patterns section or on variables defined in the Schematron Schema section.

Rules identifiers are all of the format PMA-ID-XXXXX, with rule files named PMA_ID_XXXXX.sch. Any other heading indicates a supporting file that may influence a rule but is not actually a numbered rule.

2.1 - ../Rules/generalConstraints/PMA_ID_00001.sch

Rule Description

[PMA-ID-00001][Error] Regardless of the version indicated on the instance document, the validation infrastructure MUST use a version of 'ISM' that is version '201903.201909' (Version:2019-MAR Revision 2019-SEP) or later. NOTE: This is not an error of the instance document but of the validation environment itself.

Code Description

This rule uses an abstract pattern to consolidate logic. It verifies that the validation infrastructure is using the version specified in parameters.

Schematron Code

```
<?ICEA pattern?>
<!-- Notices - Distribution Notice:
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-->

<sch:pattern id="PMA-ID-00001" is-a="ValidateValidationEnvCVE">
    <sch:param name="MinVersion" value="'201903.201909'"/>
    <sch:param name="SpecToCheck" value="'ISM'"/>
    <sch:param name="pathToDocument"
        value="'../../CVE/ISM/CVEnumISMClassificationAll.xml'"/>
    <sch:param name="RuleID" value="'PMA-ID-00001'"/>
</sch:pattern>
```

2.2 - ../Rules/TDFConstraints/PMA_ID_00002.sch

Rule Description

[PMA-ID-00002][Error] pma:ProductionMetricsAssertion element must have ancestor that is a tdf:TrustedDataObject. Human Readable: PMA assertions must live within a TDO.

Code Description

The ancestor of each pma:ProductionMetricsAssertion element must be some tdf:TrustedDataObject or tdf:TrustedDataCollection.

Schematron Code

```
<?ICEA pattern?>
<!-- Notices - Distribution Notice:
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-->

<sch:pattern id="PMA-ID-00002">
    <sch:rule id="PMA-ID-00002-R1" context="pma:ProductionMetricsAssertion">
        <sch:assert test="ancestor::tdf:TrustedDataObject | ancestor::tdf:TrustedDataCollection"
                    flag="error"
                    role="error">[PMA-ID-00002][Error] pma:ProductionMetricsAssertion element must have ancestor that is a tdf:TrustedDataObject or tdf:TrustedDataCollection.
Human Readable: PMA assertions must live within a TDO/TDC.</sch:assert>
        </sch:rule>
    </sch:pattern>
```

2.3 - ../Rules/TDFConstraints/PMA_ID_00003.sch

Rule Description

[PMA-ID-00003][Error] Each TDO/TDC can have at most 1 pma:ProductionMetricsAssertion element. Human Readable: There can only be one Production Metrics Assertion Root Element per TDO/TDC.

Code Description

For each tdf:TrustedDataObject or tdf:TrustedDataCollection this rule ensures that the count of pma:ProductionMetricsAssertion element lesser than or equal to 1.

Schematron Code

```
<?ICEA pattern?>
<!-- Notices - Distribution Notice:
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-->

<sch:pattern id="PMA-ID-00003">
    <sch:rule id="PMA-ID-00003-R1"
        context="tdf:TrustedDataObject | tdf:TrustedDataCollection">
        <sch:assert test="count(child::tdf:Assertion/tdf:StructuredStatement/pma:ProductionMetricsAssertion)&lt;= 1"
            flag="error"
            role="error">[PMA-ID-00003][Error] Each TDO/TDC can have at most 1 pma:ProductionMetricsAssertion element. Human Readable: There can only be one Production
Metrics Assertion Root Element per TDO/TDC.</sch:assert>
        </sch:rule>
    </sch:pattern>
```


2.4 - ../Rules/generalConstraints/PMA_ID_00004.sch

Rule Description

[PMA-ID-00004][Warning] pma:DESVersion attribute SHOULD be specified as revision 201903.201909 (Version:2019-MAR Revision: 2019-SEP) with an optional extension.

Code Description

This rule supports extending the version identifier with an optional trailing hyphen and up to 23 additional characters. The version must match the regular expression “^201903.201909(-.{1,23})?\$”.

Schematron Code

```
<?ICEA pattern?>
<!-- Notices - Distribution Notice:
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-->

<sch:pattern id="PMA-ID-00004">
    <sch:rule id="PMA-ID-00004-R1" context="*[@pma:DESVersion]">
        <sch:assert test="matches(@pma:DESVersion, '^201903.201909(\-.{1,23})?$' )"
            flag="warning"
            role="warning">[PMA-ID-00004][Warning] pma:DESVersion attribute SHOULD be specified as version 201903.201909 (Version:2019-MAR Revision: 2019-SEP) with an
optional extension. The value provided was:
        <sch:value-of select="./@pma:DESVersion"/>
        </sch:assert>
    </sch:rule>
</sch:pattern>
```

2.5 - ../Rules/generalConstraints/PMA_ID_00005.sch

Rule Description

[PMA-ID-00005][Error] Regardless of the version indicated on the instance document, the validation infrastructure MUST use a version of 'IC-TDF' that is version '201903' (Version:2019-MAR) or later. NOTE: This is not an error of the instance document but of the validation environment itself.

Code Description

This rule uses an abstract pattern to consolidate logic. It verifies that the validation infrastructure is using the version specified in parameters.

Schematron Code

```
<?ICEA pattern?>
<!-- Notices - Distribution Notice:
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-->

<sch:pattern id="PMA-ID-00005" is-a="ValidateValidationEnvSchema">
    <sch:param name="MinVersion" value="'201903'"/>
    <sch:param name="SpecToCheck" value="'IC-TDF'"/>
    <sch:param name="pathToDocument" value="'../Schema/IC-TDF/IC-TDF.xsd'"/>
    <sch:param name="RuleID" value="'PMA-ID-00005'"/>
</sch:pattern>
```

2.6 - ../Rules/generalConstraints/PMA_ID_00006.sch

Rule Description

[PMA-ID-00006][Error] Regardless of the version indicated on the instance document, the validation infrastructure MUST use a version of 'PM' that is version '201903' (Version:2019-MAR) or later. NOTE: This is not an error of the instance document but of the validation environment itself.

Code Description

This rule uses an abstract pattern to consolidate logic. It verifies that the validation infrastructure is using the version specified in parameters.

Schematron Code

```
<?ICEA pattern?>
<!-- Notices - Distribution Notice:
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-->

<sch:pattern id="PMA-ID-00006" is-a="ValidateValidationEnvCVE">
    <sch:param name="MinVersion" value="'201903'"/>
    <sch:param name="SpecToCheck" value="'PM'"/>
    <sch:param name="pathToDocument" value="'../CVE/PM/CVEnumPMSubject.xml'"/>
    <sch:param name="RuleID" value="'PMA-ID-00006'"/>
</sch:pattern>
```

Chapter 3 - Abstract Patterns

All of the Abstract Patterns for PMA are listed in this section. These patterns may depend on variables defined in the Schematron Schema section.

3.1 - ./Lib/ValidateValidationEnvCVE.sch

Code Description

This abstract pattern checks to see if the validation environment has at least the version / revision of the CVE as of the writing of this specification. The calling rule must pass in \$MinVersion, \$SpecToCheck, \$pathToDocument, \$RuleID.

Schematron Code

```
<!--
  This abstract pattern checks to see the version of a CVE is greater than or equal to a passed in parameter.

  $MinVersion      := the version that SpecToCheck must be equal to or greater than.
  $SpecToCheck     := Name the spec whose version in the infrastructure is being checked.
  $pathToDocument  := Relative path to the document cve that has ther version string
  $RuleID          := The number of the rule in the concrete file.
-->

<sch:pattern xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
              abstract="true"
              id="ValidateValidationEnvCVE">
  <sch:rule id="ValidateValidationEnvCVE-R1" context="/">
    <sch:assert test="document($pathToDocument)//cve:CVE//@specVersion castable as xs:double and document($pathToDocument)//cve:CVE//@specVersion >= $MinVersion"
               flag="error"
               role="error">[
  <sch:value-of select="$RuleID"/>][Error] Version [
  <sch:value-of select="document($pathToDocument)//cve:CVE//@specVersion"/>] of
  <sch:value-of select="$SpecToCheck"/>found; Version [
  <sch:value-of select="$MinVersion"/>] or later is required. The latest version of
  <sch:value-of select="$SpecToCheck"/>is not being used in the validation infrastructure. Regardless of the version indicated on the instance document, the validation infrastructure needs
to use a version of
  <sch:value-of select="$SpecToCheck"/>that is version [
  <sch:value-of select="$MinVersion"/>] or later. NOTE: This is not an error of the instance document but of the validation environment itself. The incorrect value was found in
  <sch:value-of select="document-uri(document($pathToDocument))"/>
    </sch:assert>
  </sch:rule>
</sch:pattern>
```

3.2 - ./Lib/ValidateValidationEnvSchema.sch

Code Description

This abstract pattern checks to see if the validation environment has at least the version / revision of the Schema as of the writing of this specification. The calling rule must pass in \$MinVersion, \$SpecToCheck, \$pathToDocument, \$RuleID.

Schematron Code

```
<!--
  This abstract pattern checks to see the version of a Schema is greater than or equal to a passed in parameter.

  $MinVersion      := the version that SpecToCheck must be equal to or greater than.
  $SpecToCheck     := Name the spec whose version in the infrastructure is being checked.
  $pathToDocument  := Relative path to the document xsd that has ther version string
  $RuleID          := The number of the rule in the concrete file.
-->

<sch:pattern xmlns:xsl="http://www.w3.org/1999/XSL/Transform"
              abstract="true"
              id="ValidateValidationEnvSchema">
  <sch:rule id="ValidateValidationEnvSchema-R1" context="/">
    <sch:assert test="document($pathToDocument)//xsd:schema/@version castable as xs:double and document($pathToDocument)//xsd:schema/@version >= $MinVersion"
               flag="error"
               role="error">[
  <sch:value-of select="$RuleID"/>][Error] Version [
  <sch:value-of select="document($pathToDocument)//xsd:schema/@version"/>] of
  <sch:value-of select="$SpecToCheck"/>found; Version [
  <sch:value-of select="$MinVersion"/>] or later is required. The latest version of
  <sch:value-of select="$SpecToCheck"/>is not being used in the validation infrastructure. Regardless of the version indicated on the instance document, the validation infrastructure needs
to use a version of
  <sch:value-of select="$SpecToCheck"/>that is version [
  <sch:value-of select="$MinVersion"/>] or later. NOTE: This is not an error of the instance document but of the validation environment itself. The incorrect value was found in
  <sch:value-of select="document-uri(document($pathToDocument))"/>
    </sch:assert>
  </sch:rule>
</sch:pattern>
```

Chapter 4 - Schematron Schema

The top level Schematron file for PMA is in this section. This file imports all of the others and also defines many global variables they are all dependent on.

4.1 - `./PMA_XML.sch`

Code Description

This is the root file for the specifications Schematron ruleset. It loads all of the required CVEs, declares some variables, and includes all of the Rule .sch files.

Schematron Code

```
<!--UNCLASSIFIED-->
<?ICEA master?>
<!-- Notices - Distribution Notice:
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-->

<sch:schema queryBinding="xslt2"><!-- ***** -->
<!-- * Namespace declarations * -->
<!-- ***** -->

<sch:ns uri="http://www.w3.org/1999/xlink" prefix="xlink"/>
    <sch:ns uri="http://www.w3.org/2001/XMLSchema" prefix="xs"/>
    <sch:ns uri="http://www.w3.org/1999/XSL/Transform" prefix="xsl"/>
    <sch:ns uri="urn:us:gov:ic:ism" prefix="ism"/>
    <sch:ns uri="urn:us:gov:ic:pma" prefix="pma"/>
    <sch:ns uri="urn:us:gov:ic:tdf" prefix="tdf"/>
    <sch:ns uri="urn:us:gov:ic:cve" prefix="cve"/>
    <!-- ***** -->

<!-- * Abstract Rule and Pattern Includes * -->
<!-- ***** -->

<sch:include href="./Lib/ValidateValidationEnvSchema.sch"/>
    <sch:include href="./Lib/ValidateValidationEnvCVE.sch"/>
    <!--*****-->

<!-- (U) PMA Phases -->
<!--*****-->
<!--*****-->
<!-- (U) PMA ID Rules -->
<!--*****-->
<!--(U) TDFConstraints-->

<sch:include href="./Rules/TDFConstraints/PMA_ID_00002.sch"/>
    <sch:include href="./Rules/TDFConstraints/PMA_ID_00003.sch"/>
    <!--(U) generalConstraints-->

<sch:include href="./Rules/generalConstraints/PMA_ID_00001.sch"/>
    <sch:include href="./Rules/generalConstraints/PMA_ID_00004.sch"/>
    <sch:include href="./Rules/generalConstraints/PMA_ID_00005.sch"/>
    <sch:include href="./Rules/generalConstraints/PMA_ID_00006.sch"/>
    <!--*****-->

<!-- (U) PMA Phases -->
<!--*****-->
</sch:schema>

<!--UNCLASSIFIED-->
```

Chapter 5 - Removed Rules

There are no rules that have been removed for PMA.