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# Standardization documents – Metanorma – Document metamodel

THE CALENDARING AND SCHEDULING CONSORTIUM

TC VCARD

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# **CALCONNECT STANDARD**

## **WORKING DRAFT**

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## FOREWORD

The Calendaring and Scheduling Consortium (“CalConnect”) is a global non-profit organization with the aim to facilitate interoperability of collaborative technologies and tools through open standards.

CalConnect works closely with international and regional partners, of which the full list is available on our website (<https://www.calconnect.org/about/liaisons-and-relationships>).

The procedures used to develop this document and those intended for its further maintenance are described in the CalConnect Directives.

In particular the different approval criteria needed for the different types of CalConnect documents should be noted. This document was drafted in accordance with the editorial rules of the CalConnect Directives.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CalConnect shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be provided in the Introduction.

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This document was prepared by Technical Committee *VCARD*.

# INTRODUCTION

## General

Standardization documents are documents created to express a set of normalized requirements, often themselves created through a process of standardization.

Standardization documents play a crucial role in today's activities. Rule-based enforcements from the organization of markets, conformance of products to the compliance of regulation and requirements, all depend on content expressed through standardization documents.

## Challenges

The process of generating standardization documents is increasingly problematic due to the increased work burden on standardization bodies.

Often, concerns are raised over both the efficiency and the effectiveness of the workflows around generating standardization documents in those bodies and elsewhere. Some practices include:

- Rigorous and detailed rules around document structure articulated by standardization bodies are being manually validated by the editorial teams, with mixed and often inconsistent results.
- Editing of documents substantially revolves around standardizing use of particular software, instead of requirements, with all the problems that conflating document structure and presentation introduce.
- The authoring and editorial processes spend significant amounts of time on formatting rather than document content, and is vulnerable to error.
- Existing exchange mechanisms for documents have been claimed to focus on document appearance, rather than document structure, and so do not alleviate the formatting burden on the editorial process.
- standardization bodies often demand vastly different workflows that take different inputs. Submitting identical content or cross-publishing to more than one standardization organization requires replicating a significant amount of work.

## Data-centric approach

The Metanorma document metamodel aims to treat a standardization document as a set of standardized data structures, used to enable an end-to-end standardization document production process.

The process is centered around the Metanorma document model, designed to focus on semantics and encompasses core similarities between standardization documents of different standardization bodies.

This approach has the following benefits:

- The approach enables an end-to-end, author-to-publishing workflow, with well-managed data artefacts along each stage, that editorial bodies can exercise appropriate control over. This allows document management processes to be centered around data.
- The semantic nature of the document metamodel (and its specialized models) abstracts away presentation, such as layout and formatting. This allows the authoring and editorial to focus on content.
- The structural and content requirements around standardization documents can be fully captured in the document model, and can therefore be subject to formal validation.
- The document model can be highly similar across different standardization documents, and therefore the content in such documents can be easily repurposed for different standardization bodies with minimal effort.

## Compatibility

The document metamodel in this standard has been designed to reflect the needs and expressiveness of existing standardization processes, requirements and outputs of the following standardization bodies:

- ISO and IEC ([ISO/IEC DIR 1](#), [ISO/IEC DIR 2:2018](#))
- ITU ([TTP](#), [ATP](#))
- CalConnect ([CC10001](#), [CC10002](#))
- IETF ([RFC 7749](#), [RFC 7991](#))
- OGC ([OGC 05-020r26](#))
- NIST (...)
- China standards (national, local, industry, social group) ([GB/T 1.1-2009](#))

In many cases, the document model also enables alignment with capabilities of existing document production tools. The document metamodel has already been adopted by a number of standardization bodies listed above.

# 1. SCOPE

This document provides the Metanorma document metamodel for standardization documents and describes its alignment to standardization processes.

The document metamodel relies on models from the following standards:

- [ISO 6900](#)--, where modelling of bibliographies and bibliographic citations form part of the reference model in this standard;
- [ISO 36010](#)--, where modelling of textual content (at the block and inline level), and of changes to documents, form part of the reference model in this standard.

Implementation of the metamodel and serialization formats are out of scope of this document.

The derivation and mapping of the reference model to representation formats is out of scope of this document.

While this document provides example profiles for the ISO/IEC and CalConnect standards in [Appendix A](#) and [Appendix B](#), prescription of profiles of the document metamodel for particular standardization bodies is out of scope of this document.



## 2. NORMATIVE REFERENCES

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

- ISO 639 (all parts), *Codes for the representation of names of languages*
- ISO 8601, *Data elements and interchange formats – Information interchange – Representation of dates and times*
- ISO/IEC 10118 (all parts), *Information technology – Security techniques*
- ISO/IEC 14888 (all parts), *Information technology – Security techniques*
- ISO 15924, *Information and documentation – Codes for the representation of names of scripts*
- ISO/IEC Guide 2, *Standardization and related activities – General vocabulary*
- ISO 6900:–, *Information and documentation – Bibliographic reference model and serialization*
- ISO 36010:–, *Lightweight document – Document metamodel*
- IETF RFC 3986, *Uniform Resource Identifier (URI): Generic Syntax*

## 3. TERMS AND DEFINITIONS

For the purposes of this document, the following terms and definitions apply.

### 3.1. standardizing body

body that has recognized activities in standardization

[SOURCE: 4.3]

### 3.2. document

medium with information recorded on or in it

[SOURCE: 3.1 NOTE 2]

### 3.3. standardization document

document that provides rules, guidelines or characteristics for activities or their results

Note 1 to entry: Documents such as standards, technical specifications, codes of practice and regulations are considered part of this term.

Note 2 to entry: This term closely corresponds to “normative document” defined in 3.1.

### 3.4. class

structure containing a description of an entity in terms of its components

### 3.5. subclass

*class* (Clause 3.4) which inherits from another class its component descriptions, and optionally adds to them its own component descriptions

### 3.6. document metamodel

formal specification of the structure of a document model in terms of its components and their arrangement, expressed through *classes* (Clause 3.4)

### 3.7. document model

formal specification of the structure of a document in terms of its components and their arrangement, expressed through *classes* (Clause 3.4)

### 3.8. standards model

*document model* (Clause 3.7) for *standardization documents* (Clause 3.3)

### 3.9. paragraph

subdivision of running text, normally run on throughout, that is separated from text before and after by a change of line and stands below any chapters or sections (Clause 3.12)

[SOURCE: ISO 5127:2017, Clause 3.5.8.07]

### 3.10. block

*paragraph* (Clause 3.9)-level grouping of text

### 3.11. inline element

grouping of text that can be contained within a *paragraph* (Clause 3.9), including plain strings

### 3.12. section

hierarchical subdivision of a document, consisting of one or more *blocks* (Clause 3.10), and/or one or more sections

### 3.13. identifier

a character, or group of characters, used to identify or name an item of data and possibly to indicate certain properties of that item

[SOURCE: [714-21-07](#)]

### 3.14. term

expression with a particular meaning that is part of the specialized vocabulary of a field

## 4. STRUCTURE

The Metanorma document metamodel is expressed hierarchically.

- At its base is a `BasicDocument` model ([ISO 36010:--](#)), which expresses the structure of generic documents.
- The `BasicDocument` model is specialized as a *Standards Document* structure, conveying the structure particular to standardization documents as a class.
- The `StandardDocument` model is further specialized into models specific to particular standards.
- Specific standards models can form the basis in turn of other standards models.

### EXAMPLE

The document model for the Chinese National Standard (“GB Standard”), as described in [GB/T 1.1-2009](#), is structurally modelled after ISO documents, explicitly described as a localization of the 2004 version of [ISO/IEC DIR 2:2004](#). Therefore, the Chinese National Standard model is best expressed as a specialization of the ISO Standards model.

Specialization of a model consists of:

- Adding classes to a base model.
- Changing attributes of a base model class. This is not restricted to adding attributes, as is the case in typical entity subclassing; it can also include removing attributes from a class, changing their obligation and cardinality, and changing their type, including changing enumerations. Attributes can be overruled at any level; for example, standards-specific models routinely enhance the bibliographic model at the base of the hierarchy.
- For reasons of clarity, renaming classes and attributes is avoided in specialization.

The classes involved in the document model are of three classes:

- Sections ([basicsection](#), [Clause 7](#))
- Blocks (paragraph-level groupings of text) ([basicblock](#), [Clause 11](#))
- Inline elements (groupings of text smaller than a paragraph, including plain strings) ([inline](#))

In the document metamodel, the classes are in a strict hierarchical relation:

- Documents consist of sections, which consist of blocks, which consist of inline elements.

- Sections can be nested within sections (e.g. clauses and subclauses)
- Blocks can be nested within blocks (e.g. nested lists).
- Inline elements can be embedded within other inline elements (e.g. bold + italics).

However, sections are not Standards Document model expected to be siblings of blocks, nor blocks of inline elements. For example, a list (block) is not expected to occur next to inline text within a paragraph. For that reason, paragraphs cannot contain other block elements, such as lists or tables.

NOTE This constraint is inherited from lightweight text markup, and is not present in XML-based schemas like HTML, TEI-C, or DocBook. It helps to simplify the document model significantly, and while it sacrifices some expressive potential, the difference is minor, particularly with regards to the rendering of paragraphs.

The **BasicDocument** model contains the bulk of the blocks and inline elements in the Metanorma model; that model is documented separately ([ISO 36010:--](#)), and is not discussed further here. The Standards Model and the standard-specific models mostly deal with the organization of sections within a standards document. However, because Metanorma inherits from the **BasicDocument** model, specialization in Metanorma can customize Basic Document classes, as well as classes specific to Metanorma.

The document metamodel depends on the [ISO 6900:--](#) citation model for its expression of bibliographic references and citations.

## 5. STANDARDS DOCUMENT MODEL

The StandardDocument model extends the BasicDocument modelling of the document by requiring the following specific types of section:

- An optional *boilerplate* section, intended to appear at the front of the document. It consists of content addressing *copyright*, *license*, *legal*, and *feedback* concerns (each modelled as Standard Hierarchical Sections: [Clause 7](#)).
- Zero or more optional *preface* sections (Standard Hierarchical Sections: [Clause 7](#)).
- One or more *sections* (Standard Hierarchical Sections).
- Zero or more *annexes* (Standard Hierarchical Sections).
- Zero or more *bibliographies* (Standard References Sections: [Clause 8](#)).

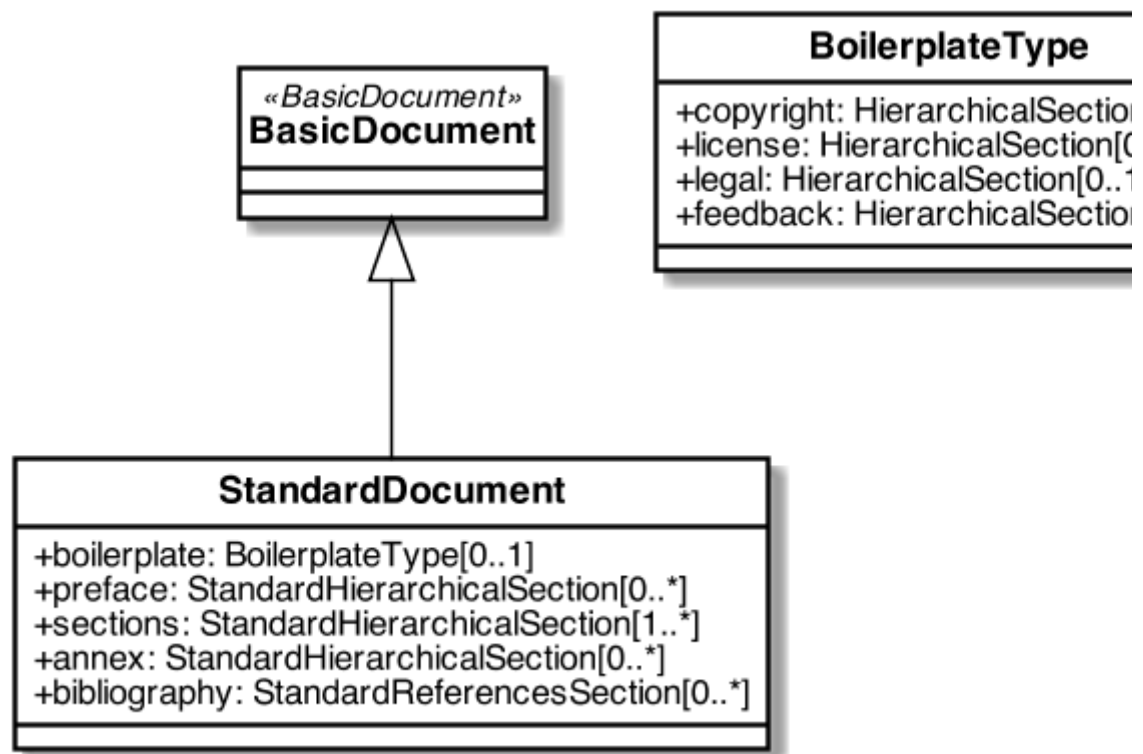


Figure 1 – Standards Document model: Document

## 6. METADATA AND BIBLIOGRAPHIC INFORMATION MODELS

Bibliographic information appears in two places in Metanorma, following the `BasicDocument` model: document citations under Standard References Sections: [Clause 8](#), and document metadata (`bibdata`) as a root element of the document.

The modelling of `bibitem` (document citations) follows the *BibliographicItem* class in [ISO 6900:--](#), and readers are referred to that specification. The *BibliographicItem* class is intended to capture document citations, and to be applicable to any document type, without any further specialization; that is because a document can cite documents of any type.

The modelling of citations is not intended to vary between different standardizing bodies, as well as standardization documents and other types of documents.

The modelling of `bibdata` (document metadata) likewise follows the *BibliographicItem* class in [ISO 6900:--](#). The type of `bibdata` is expected to be standard.

The `bibdata` class inherits from `Relation` the ability to extend `metadtaa` with metadata specific to a document class; this information is modelled in `BibDataExtensionType`, and is contained in `bibdata/ext`. The following extension points are modelled as generically applicable for all standards under the Metanorma model:

- the document type (already modelled in the `BasicDocument` model), which is populated with free text. It is assumed that particular specializations of the document model will substitute their own enumerations of particular subclasses of document, which will be more granular.
- zero or more structured identifiers. These identifiers correspond to the canonical identifiers issued by the Standards Definition Organization, but are semantically marked up for the various components of that identifier. The structure given here is meant to be applicable to all standards, but it can always be customized for a specific standardizing body. This information should all be represented elsewhere in the document metadata, but is replicated in the identifier:
  - `type`: type of identifier, used to differentiate different instances of structured identifier generated for different purposes
  - `agency`: one or more abbreviations identifying the Standards Developing Organizations involved in producing this standard, and treated as a namespace for the identifier
  - `class`: an optional abbreviation identifying the subclass of standard or other document
  - `docnumber`: a number or other identifier for the document, issued by the standardizing body



- partnumber: an optional part number for the document; includes sub-part numbers if applicable
- edition: an optional string giving the edition of the standard
- version: an optional string giving the version of the standard (within the edition). Includes the document stage that a draft has reached, e.g. “FDIS” under ISO
- supplementtype: an abbreviation for the type of supplement to a standard that this document represents, if applicable
- supplementnumber: an abbreviation for the number or other primary identifier of supplement to a standard that this document represents, if applicable
- year: an optional string giving the date (typically year) that this particular edition of the standard was published
- language: an optional abbreviation identifying the language of the standard

## 7. SECTION MODELS

The `StandardDocument` model extends the `BasicDocument` modelling of sections by specialising the `BasicSection` class as follows:

- All sections in a `StandardDocument` model are instances of the `StandardSection` class, which is a subclass of `BasicSection`.
- The `StandardSection` class indicates its status as normative or informative explicitly, through the `status` attribute. (This attribute has been added because it is overtly specified in [ISO/IEC DIR 2:2018](#), but the normative status of individual sections in a standard is pertinent to any standards document.)
- Sections in a standards document fall into two categories: Clause Sections, which are numbered, and form part of the main flow of the document, and Content sections (Standard Hierarchical Sections), which are optionally not numbered, and which lie outside the main flow of the document.
- Four Content sections are defined with distinct names, as they recur in standardization documents and have distinct semantics: Abstract, Foreword, Introduction, and Acknowledgments. Specializations of the model may define other such sections.
- Clause Sections are by default hierarchical (but see [Clause 9](#)). The subclauses of Clauses are themselves Clause Sections; they continue the hierarchical numbering of Clause Sections at deeper hierarchical levels. The subclauses of Content sections are `StandardSections`, and need not be numbered.
- Both Content Sections and Clause Sections can have a `type`, which allows them to be semantically classified into recurring categories, which may be processed and rendered differently. Indicative values include: executive-summary, errata, methods, requirements, tests, reagents, tests.
- Annexes and Clause Sections are modelled in the same way in the `StandardDocument` model. However they are expected to be numbered differently, and to be rendered as separate sequences.

Although it is difficult to capture in a container-based model, the `StandardDocument` model requires “hanging paragraphs” to be avoided: a Clause section in particular should contain either blocks or subsections, but not both. This is a requirement in [ISO/IEC DIR 2:2018](#), but the need to reference text in clauses unambiguously by clause number makes the avoidance of hanging paragraphs desirable for standardization documents in general. The requirement is less pressing for Content sections (which are unnumbered), and Annexes (as exemplified in [ISO/IEC DIR 2:2018](#) itself.)

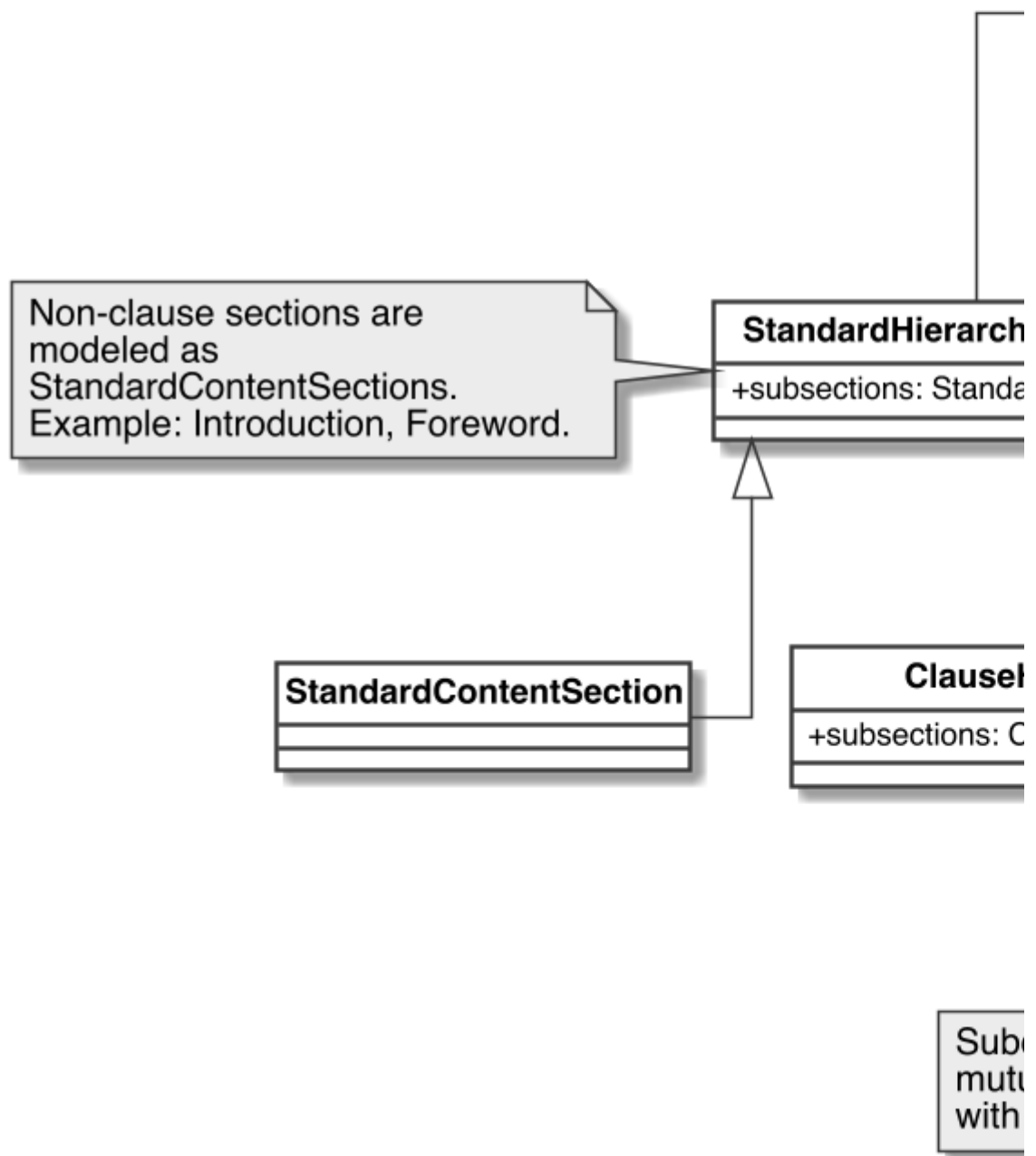


Figure 2 – Standards Document model: Section



## 8. REFERENCES SECTION

Standard References Sections are a subclass of `StandardSection`.

Like the References Sections of the `BasicDocument` model ([basicsection](#)), they are leaf nodes which contain zero or more bibliographical references (as modelled in [ISO 6900:--](#)), along with any prefatory text.

## 9. TERMS SECTION AND DEFINITION SECTION

The StandardDocument model models two further subclasses of Clause Sections:

- *Definition Sections* consist of one or more Definition lists (see [ISO 36010:--](#)), and are used to define symbols and abbreviations used in the remainder of the document. They can also be used as glossaries, with simple definitions, in contrast to the more elaborate definitions given in Terms Sections.
- *Terms Sections* give elaborated definitions of terms used in the document; they are intended to align to the structure of terms in [ISO/IEC DIR 2:2018](#). Term Sections consist of zero or more Terms; *Terms* in turn are composed of the following elements:

id	An optional identifier for the term, to be used in cross-references.
preferred	One or more names under which the term being defined is canonically known.
admitted	Zero or more names which are acceptable synonyms for the term being defined.
related	Zero or more names which are related to the term being defined. Each has a type, indicating how the term is related; permitted values are compare (for “see also” references to terms), contrast (for terms that illuminate the term definition as what it is not), see (if this is a deprecated term, to reference the preferred term)
deprecates	Zero or more names which are deprecated synonyms for the term being defined.
domain	An optional semantic domain for the term being defined, in case the term is ambiguous between several semantic domains.
grammar	Zero or more abbreviations giving grammatical information about the term (e.g. part of speech, gender)
definition	The definition of the term applied in the current document.
note	Zero or more notes about the term.
example`	Zero or more examples of how the term is to be used.
source	Zero or more bibliographical sources for the term. These include the origin of the term, which is its bibliographical citation (as defined in <a href="#">ISO 6900:--</a> ); the status of the definition (whether identical to the definition given in the origin cited, or modified); and, if the definition is modified, a description of the modification to the definition applied for this document.

Both types of section can include prefatory text; in the case of Definition Sections, each Definition list can be preceded by prefatory text. Both types of section are leaf nodes, and cannot contain subclauses of their own: nested Terms or Definition Sections are modelled as Clause Sections with subclauses, terminating in Definition and Terms clauses.

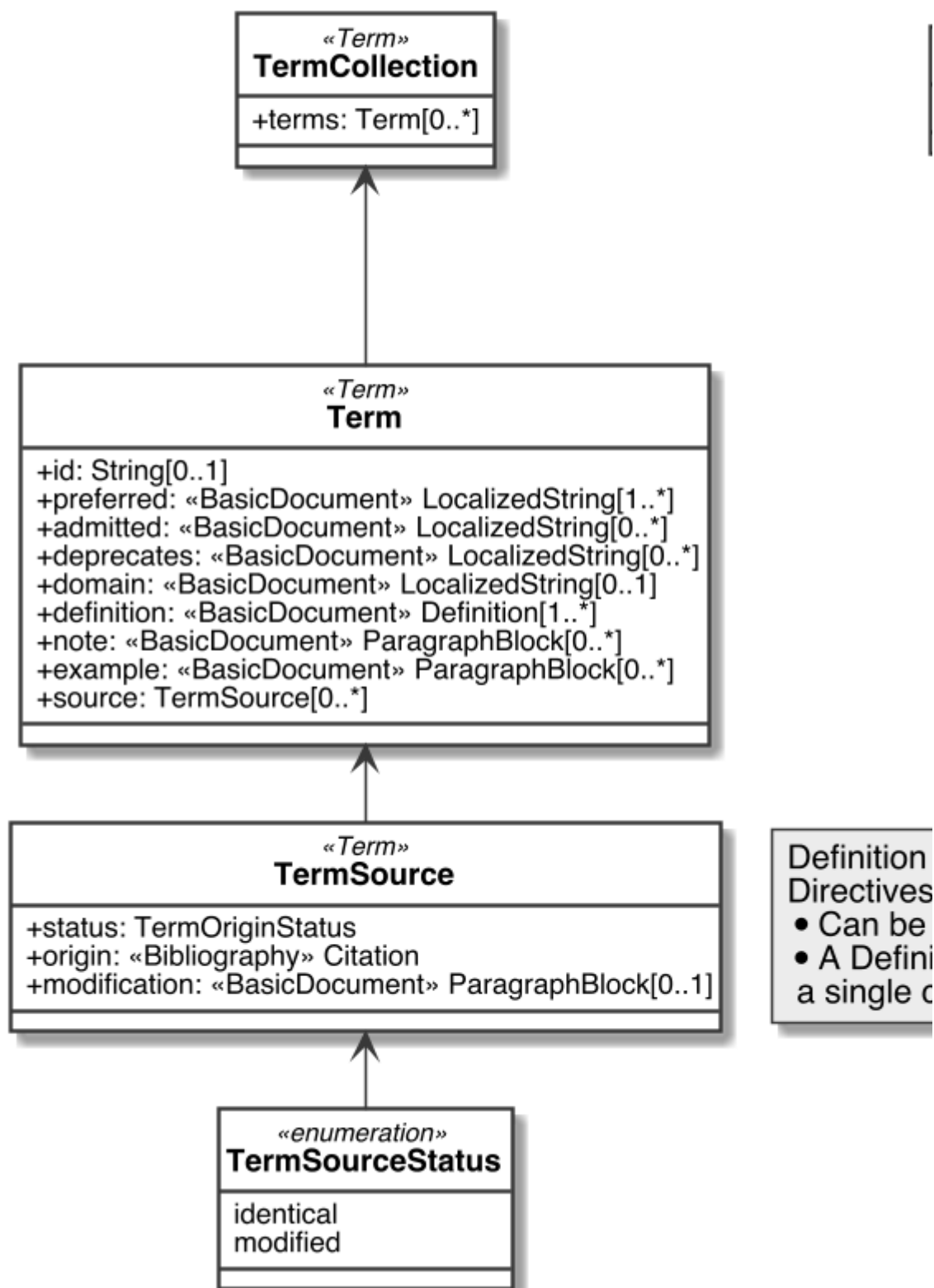


Figure 3 – Standards Document model: Term Section and Definition Section



## 10. INLINE ELEMENTS

There is no difference in the modelling of inline element models between the `BasicDocument` model and the `StandardDocument` model.

Specializations and profiles of the `StandardDocument` model may specialize the modelling of inline elements.

## 11. BLOCK

There is no difference in the modelling of blocks between the `BasicDocument` model and the `StandardDocument` model.

Specializations and profiles of the `StandardDocument` model may specialize the modelling of blocks.

## 12. DATA TYPES

There is no difference in the modelling of data types between the `BasicDocument` model and the `StandardDocument` models.

Specializations and profiles of the `StandardDocument` model may specialize the modelling of data types.

# APPENDIX A (NORMATIVE) ISO STANDARD DOCUMENT MODEL PROFILE

## A.1. General

The `ISOStandardDocument` model is given here as an exemplar of the application of Metanorma modelling to a particular standard.

## A.2. Document, Section

The `ISOStandardDocument` model extends the `StandardDocument` modelling of the document by requiring the following specific types of section:

- A *Preface*, consisting of a mandatory *Foreword* (a `BasicSection`: `basicsection`), and an optional *Introduction* (a `ClauseSection`: `Clause 7`, since an ISO Introduction can optionally have numbered subsections).
- One or more Clause Sections (`Clause 7`).
- Zero or more Annexes (`Clause 7`).

Annexes in the `ISOStandardDocument` can optionally contain one or more *Appendixes*, which can be thought of as annexes of the annex section.

NOTE Appendixes are not defined in [ISO/IEC DIR 2:2018](#), but they appear in the companion standard [ISO/IEC DIR 1](#). For example, Annex SL of [ISO/IEC DIR 1](#) includes Appendix 1, Appendix 2, and Appendix 3; Appendix 2 “High level structure, identical core text, common terms and core definitions” itself contains an Introduction and 10 clauses, including a Terms clause.

The `ISOStandardDocument` model document also includes zero or more `termSources` elements, giving the citations for the documents that the Terms Section draws on for its definitions and repertoire of terms.

The `ISOStandardDocument` model document uses ISO-specific extensions to the [ISO 6900](#):-- metadata about a document ([Appendix A.4](#)).

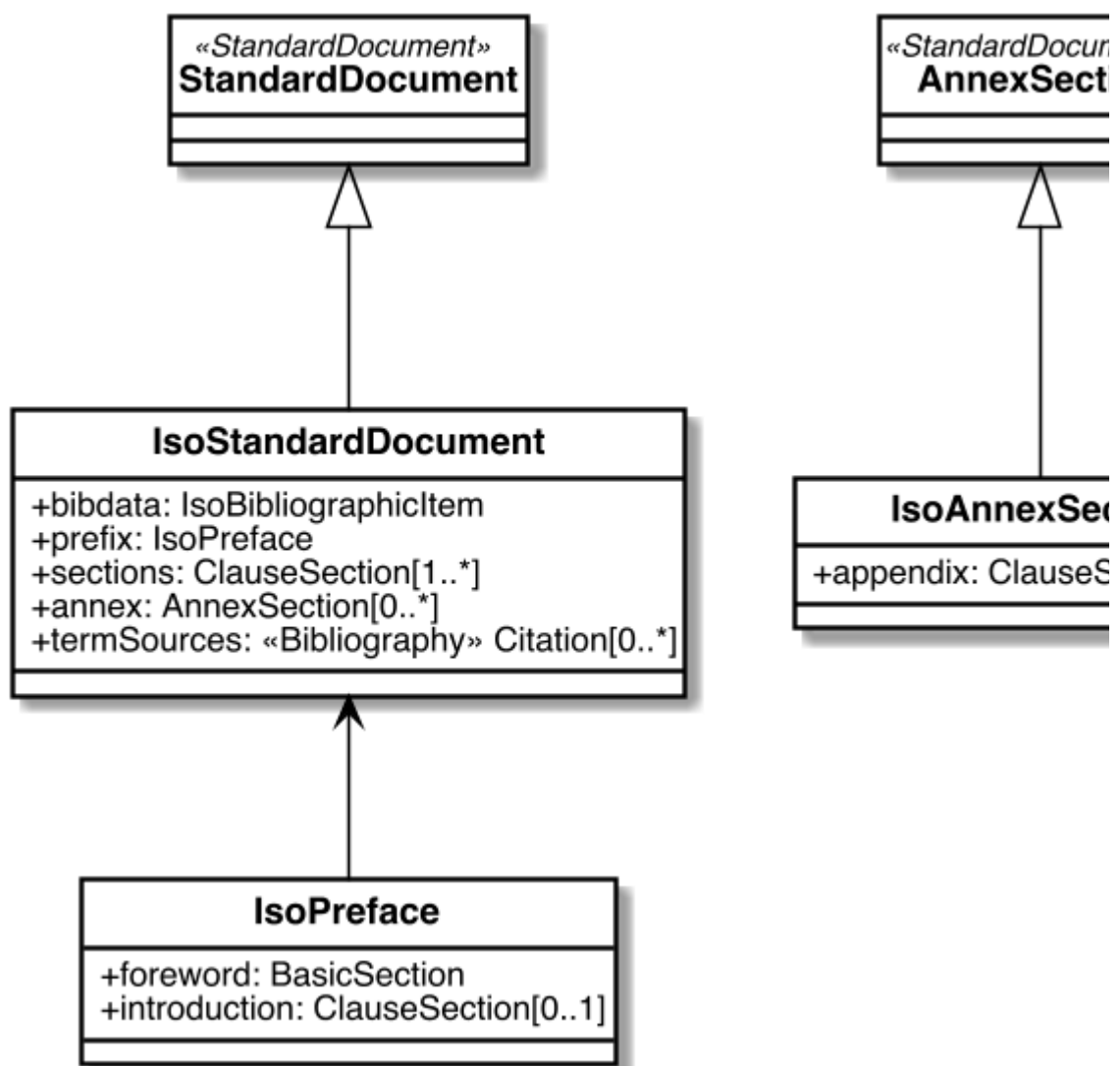


Figure A.1 – ISO Standard Document model: Document

### A.3. Block

The ISOStandardDocument model extends the StandardDocument modelling of blocks for one block definition:

- The types that an Admonition can belong to are overridden to belong to the following set prescribed in [ISO/IEC DIR 2:2018](#): *Danger, Caution, Warning, Important, Safety Precaution*.

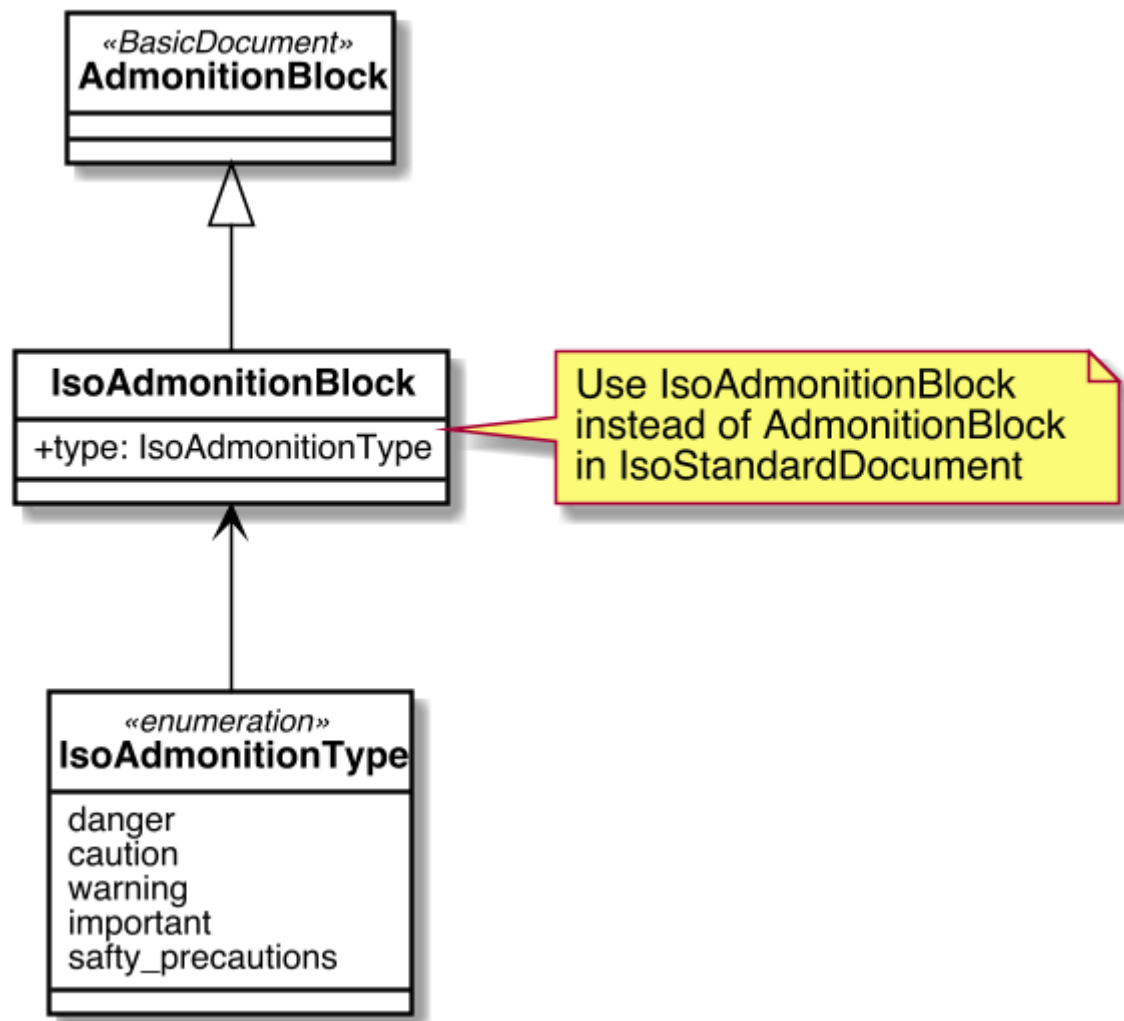


Figure A.2 – ISO Standard Document model: Block

## A.4. Bibliography

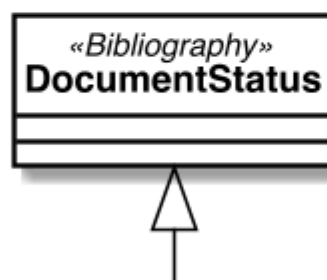
We note here the ISOStandardDocument overrides of the ISO 6900:-- bibliographic model; although the contents of ISO 6900:-- are out of scope of this document, its customization for a specific standard are in scope.

ISO 6900:-- is intended as a highly generic model, and custom bibliographic elements would impede the reuse of bibliographic entries between standards. However, it is useful for the metadata describing the current document (bibdata: ISO 36010:--) to be enriched to provide metadata relevant to the standard class.

The bibliographic modelling of ISO documents is enriched compared to ISO 6900:-- as follows:

- The document identifier is refined to contain three optional parts: a project number, a part number, and a technical committee document number.

- The document title is broken down into an optional Introductory component, a mandatory Main component, and an optional Part component.
- The document type is constrained to be one of the following: *International Standard*, *Technical Specification*, *Technical Report*, *Publicly Available Specification*, *International Workshop Agreement*, *Guide*.
- The document status is broken down into an ISO Document Stage code ([ISO International harmonized stage codes](#)), an ISO Document Substage code ([ISO International harmonized stage codes](#)), and an Iteration number.
- The editorial group responsible for the document is defined with four components: a mandatory Technical Committee, an optional Subcommittee, an optional Workgroup, and an optional Secretariat. The Technical Committee, Subcommittee and Workgroup, in turn, are instances of the ISO Subgroup class, defined as having a name, an optional type, and an optional number.
- The document has one or more International Classification for Standards classifications [ISO International Classification for Standards](#). The ICS classification is defined as a code, and an optional text explaining the code.
- The document has zero or more source URIs.
- The document has an optional abstract.
- The document has an optional “All Parts” boolean attribute, indicating whether the bibliographic description applies across all Part documents under the same project number (which makes it a multi-document description).



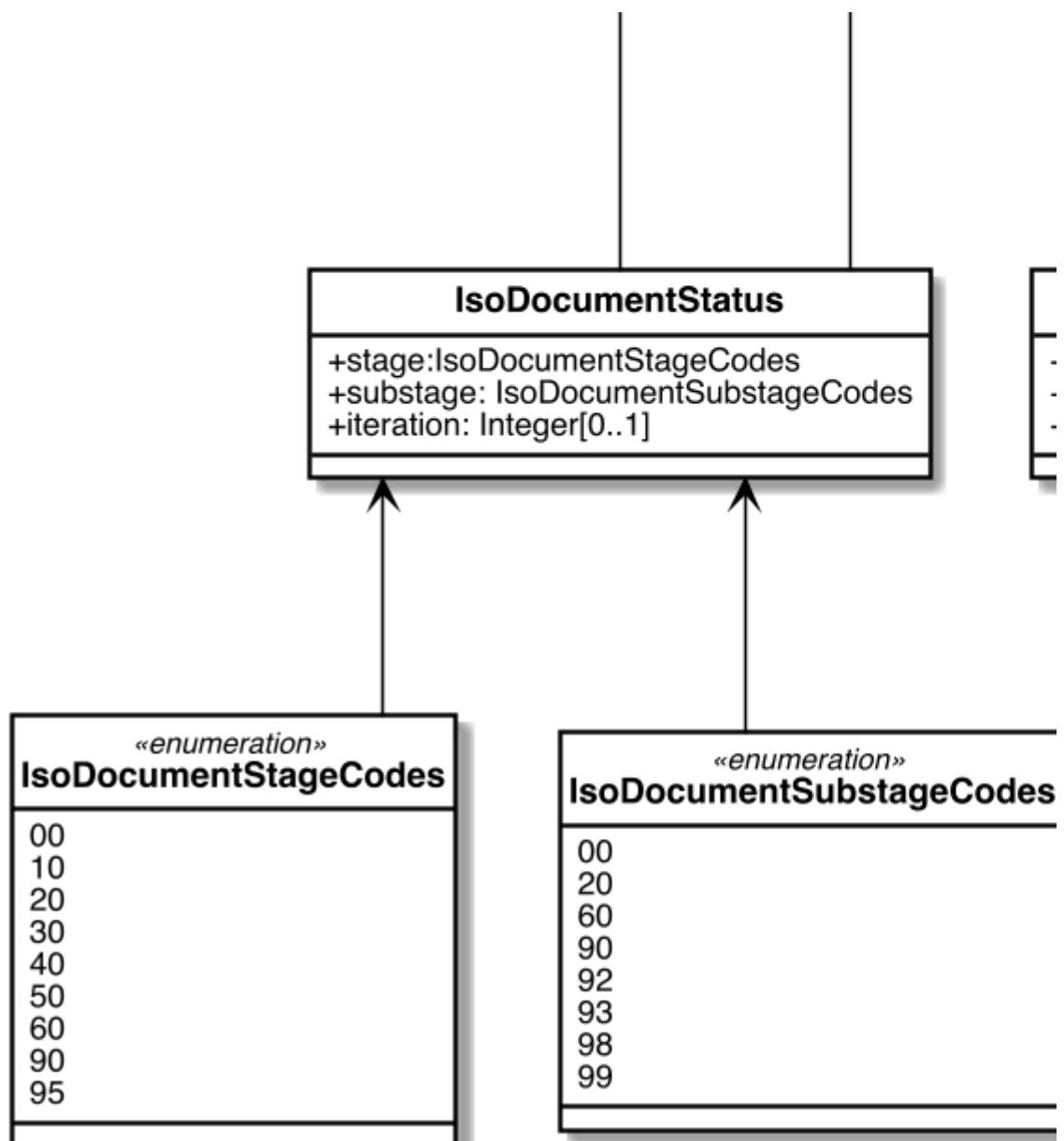


Figure A.3 – ISO Standard Document model: Bibliography



# APPENDIX B (NORMATIVE) CSD STANDARD DOCUMENT MODEL PROFILE

## B.1. General

The *CSD Standard Document* model is given here as an exemplar of the application of Metanorma modelling to a particular standard (standards published by the Calendaring and Scheduling Consortium).

## B.2. Document, Section

The *CSD Standard Document* model extends the `StandardDocument` modelling of the document by requiring the following specific types of section:

- An optional *Foreword* (a Standards Hierarchical Section: [Clause 7](#)).
- An optional *Introduction* (a Standards Hierarchical Section: [Clause 7](#)).
- One or more Clause Sections ([Clause 7](#)).
- Zero or more Annexes ([Clause 7](#)).

## B.3. Block

The *CSD Standard Document* model extends the `StandardDocument` modelling of blocks for one block definition:

- The definition of Figure is altered to allow Ascii art as an option for its content, as a string (`pre`). As with Sourcecode ([basicsourcecode](#)), the string should be treated as pre-formatted text, with whitespace treated as significant.

## B.4. Inline Elements

The *CSD Standard Document* model extends the `StandardDocument` modelling of inline elements by one element:

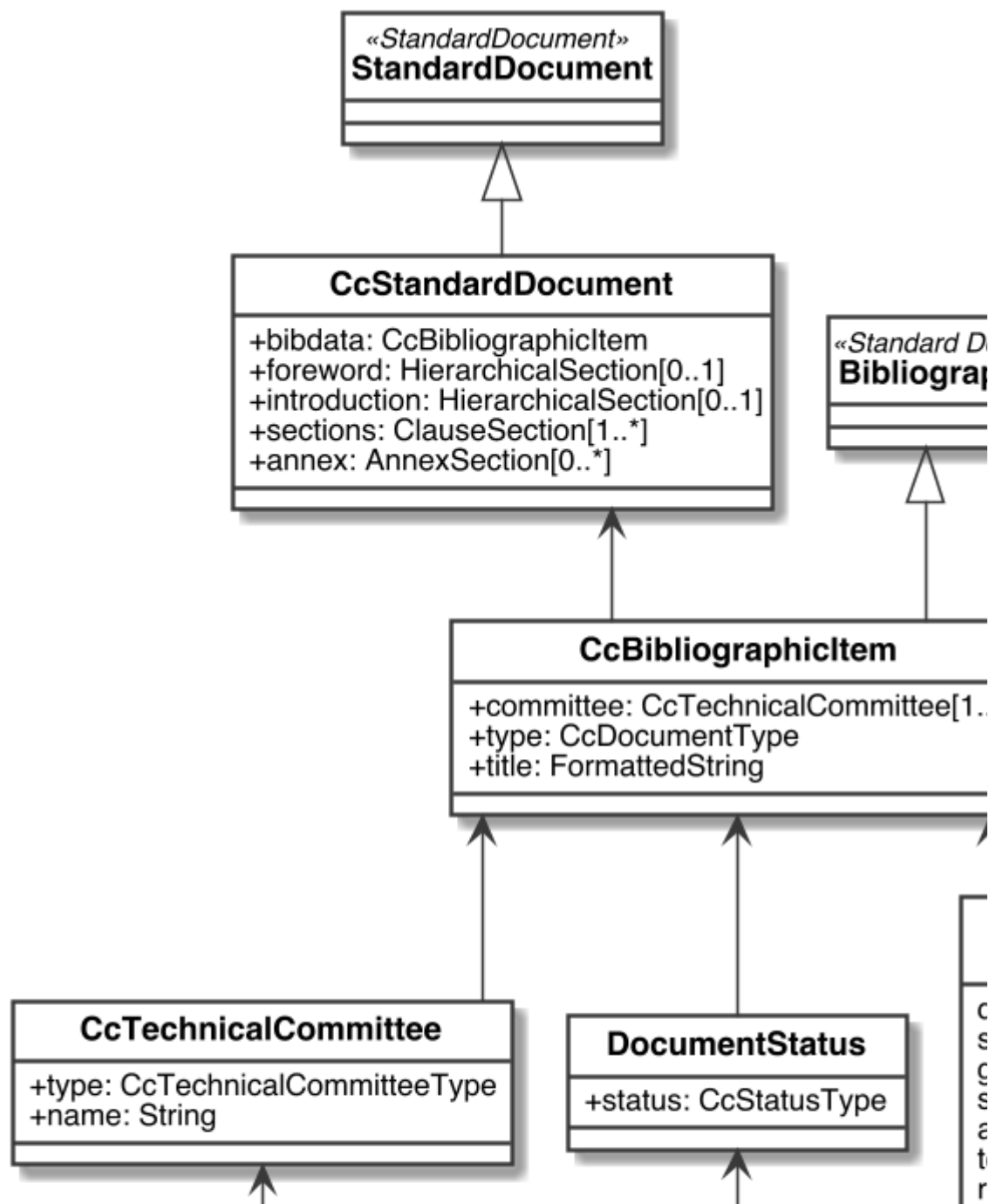
- The `keyword` element is added as a subclass of Text Element ([textelements](#)). The element is used to represent code keywords, as with `code` in HTML, and should be rendered in monospace.

## B.5. Bibliography

The provisos which apply to ISO bibliographic entries ([Appendix A.4](#)) also apply here.

The bibliographic modelling of CSD documents is enriched compared to ISO 6900:-- as follows:

- The document type is constrained to be one of the following: *Code, Presentation, Proposal, Standard, Report*.
- The document status is constrained to be one of the following: *Proposal, Working Draft, Committee Draft, Final Draft, Published, Withdrawn*.
- The editorial group responsible for the document is defined with a single components: a mandatory Technical Committee. The Technical Committee has a type of either *Technical* or *Provisional*.



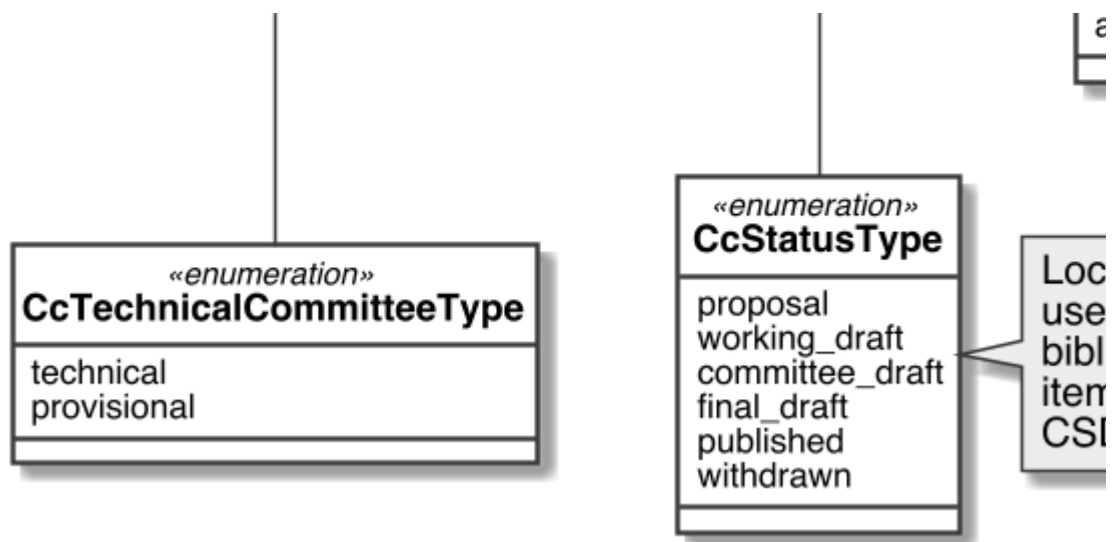


Figure B.1 – CSD Standard Document model

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