

INTERNATIONAL STANDARD

ISO/IEC
8613-10

First edition
1991-06-01

Information processing — Text and office systems — Office Document Architecture (ODA) and interchange format —

Part 10: Formal specifications

*Traitement de l'information — Bureautique — Architecture des documents de
bureau (ODA) et format d'échange —*

Partie 10: Spécifications formelles



Reference number
ISO/IEC 8613-10 : 1991 (E)

Foreword

ISO (the International Organization for Standardization) and IEC (the International Electrotechnical Commission) form the specialized system for worldwide standardization. National bodies that are members of ISO or IEC participate in the development of International Standards through technical committees established by the respective organization to deal with particular fields of technical activity. ISO and IEC technical committees collaborate in fields of mutual interest. Other international organizations, governmental and non-governmental, in liaison with ISO and IEC, also take part in the work.

In the field of information technology, ISO and IEC have established a joint technical committee, ISO/IEC JTC 1. Draft International Standards adopted by the joint technical committee are circulated to national bodies for voting. Publication as an International Standard requires approval by at least 75 % of the national bodies casting a vote.

International Standard ISO/IEC 8613-10 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology*.

Development of this International Standard has been in parallel with

- ECMA 101 : 1985, *Office document architecture*;
- CCITT Recommendation T.37 (1984): *Document interchange protocol for the telematic services*;
- CCITT Recommendations in the T.410 series (1988): *Open Document Architecture (ODA) and Interchange format*.

ISO 8613 consists of the following parts, under the general title *Information processing — Text and office systems — Office Document Architecture (ODA) and interchange format*:

- *Part 1: Introduction and general principles*
- *Part 2: Document structures*
- *Part 4: Document profile*
- *Part 5: Office document interchange format (ODIF)*
- *Part 6: Character content architectures*
- *Part 7: Raster graphics content architectures*
- *Part 8: Geometric graphics content architectures*;
- *Part 10: Formal specifications.*

NOTE — At present, there are no parts 3 and 9.

Further parts may be added to this International Standard.

Annex A of this part of ISO/IEC 8613 is for information only.

Information processing — Text and office systems — Office Document Architecture (ODA) and interchange format —

Part 10: Formal specifications

1 Scope

The purpose of ISO 8613 is to facilitate the interchange of documents.

In the context of ISO 8613, documents are considered to be items such as memoranda, letters, invoices, forms and reports, which may include pictures and tabular material. The content elements used within the documents may include graphic characters, geometric graphics elements and raster graphics elements, all potentially within one document.

NOTE — ISO 8613 is designed to allow for extensions, including typographical features, colour, spreadsheets and additional types of content such as sound.

ISO 8613 applies to the interchange of documents by means of data communications or the exchange of storage media.

It provides for the interchange of documents for either or both of the following purposes:

- to allow presentation as intended by the originator;
- to allow processing such as editing and reformatting.

The composition of a document in interchange can take several forms:

- formatted form, allowing presentation of the document;
- processable form, allowing processing of the document;
- formatted processable form, allowing both presentation and processing.

ISO 8613 also provides for the interchange of ODA information structures used for the processing of interchanged documents.

Furthermore, ISO 8613 allows for the interchange of documents containing one or more different types of content such as character text, images, graphics and sound.

This part of ISO/IEC 8613

- specifies a formal description technique appropriate for describing the technical specifications of the document structures (ISO 8613-2), the document profile (ISO 8613-4) and the content architectures (ISO 8613-6, -7 and -8);

4 Syntax and semantics of the specification language

This clause describes the formal description technique used for the formal specifications.

NOTE — A tutorial on this formal description technique is given in annex A.

4.1 Basic concepts

ISO 8613 describes document structures, the document profile and the content architectures in terms of abstract information constructs which are drawn from the following structural categories:

- An ODA construct may be an **atomic** construct, e.g. an attribute name or a natural number within an object identifier.
- An ODA construct may be a **composite** construct, i.e. may consist of other constructs. With respect to their interrelationship, three kinds of composition are distinguished. An ODA construct may be
 - a) a **set**;
 - b) a **function** (mapping);
 - c) a **sequence** (list, string);

of other ODA constructs.

For example, a specific layout description is a set (of constituents), a constituent is a nomination (see below) which is a function or mapping (from attribute names onto attribute values), and an attribute value of 'subordinates' or of 'object identifier' is a sequence (of atomic natural numbers).

It is these very structures which are captured by the language used for the formal specifications of ISO 8613. The language used is called IMCL, *Information Modelling by Composition Language*. The semantics of the specification language consist of the following abstract elements:

- the universe which is a non-empty set of **entities** of the following kinds:
 - a) constructs;
 - b) spots;
 - c) spotsets (i.e. sets of spots);
 - d) the entity UNDEF ("undefined");
- functions from the universe to the universe, that is, operators on entities of the universe;
- predicates in the universe, that is, predicates on entities of the universe.

A **construct** is an information object which is one of the following:

- an atomic construct or **atom**, for short;
- a composite construct or **compound**, for short, which may be
 - a) a **collection**, which is an unordered set of component constructs;
 - b) a **nomination**, which is a function that can be regarded as an unordered set of ordered pairs where each pair consists of a *name* and a *value*;
 - c) a **catenation**, which is a sequence of component constructs.

The special terminology for composite constructs is to distinguish them from other sets, functions or sequences.

In order to be able to address components in constructs of arbitrary compositional structure, the concept of a **spot** is introduced. This concept is an abstract counterpart for the intuitive idea associated with pointing into an information structure at some position and saying "here". However, in general the "here" is not identified uniquely by the component construct as such (e.g. in a word, the same letter may occur several times), but rather by the context in which it appears. To deal conceptually with the idea of "here" requires a way to identify contexts.

The concept of a spot allows the distinction to be made between a considered construct and its position within a comprising composite construct of which it is a component. For example, the character string "data" (a catenation) has the component constructs 'd', 'a' and 't'. Whereas 'd' and 't' appear at one spot each, the 'a' appears at two spots, namely at the second and at the fourth position counted from the front end. So, "data" has four

NOTE 3: The terminal symbols used in this production rule have the usual semantics of first-order predicate logic: not is the logical negation, and, or, xor (exclusive or), impl (implies) and iff (if and only if) are the usual logical connectors, $\forall$ (for all) and $\exists$ (exists) are the logical quantifiers.

prime-formula ::=

[parameter-part] predicate-symbol-part ...
[parameter-part predicate-symbol-part ...] ... [parameter-part]

predicate-symbol-part ::=

upper-case-letter [$\equiv$ letter [$\equiv$ digit]... [$\equiv$ lower-case-letter [$\equiv$ letter [$\equiv$ digit]...]
= | $\neq$ |<|>| $\geq$ | $\leq$ | $\in$ | $\notin$ | $\hat{=}$ | $\subset$ | $\supset$ | $\supseteq$

NOTE 4: The semantics of the terminal symbols ($=$, $\neq$, ... $\supseteq$) in this production rule are specified in 4.3.

term ::=

var |
constant |
operator-term |
explicit-composition-term |
conditional-term |
extensional-collection-term |
extensional-spotset-term |
spot-selection-term |
(term)

var ::=

lower-case-letter [$\equiv$ letter [$\equiv$ digit]... [$\equiv$ subscript-digit]...

constant ::=

standard-constant |
nonstandard-constant

standard-constant ::=

UNDEF |
empty-constant |
number-atom-constant

empty-constant ::=

[] -. empty collection .- |
[:] -. empty nomination .- |
[$\rightarrow$] -. empty catenation .- |
< > -. empty spotset .-

number-atom-constant ::=

[+ $\equiv$ | - $\equiv$] digit [$\equiv$ digit]... [$\equiv$. $\equiv$ digit [$\equiv$ digit]...

nonstandard-constant ::=

' $\equiv$ character [$\equiv$ character]... $\equiv$ ' -. restriction on apostrophe occurrence .-

operator-term ::=

[parameter-part] operator-symbol-part ...
[parameter-part operator-symbol-part ...]... [parameter-part]

operator-symbol-part ::=

upper-case-letter [$\equiv$ upper-case-letter [$\equiv$ digit [$\equiv$ _]...]
^ | + | - | * | / | \cup | \cap | \setminus | // | . | * | \downarrow | \uparrow

NOTE 5: The semantics of the terminal symbols (^, +, ... $\uparrow$) in this production rule are specified in 4.4.

explicit-composition-term ::=

[term [; term]...] -. collection .- |
[term : term [; term : term]...] -. nomination .- |
[$\rightarrow$ term [$\rightarrow$ term]... $\rightarrow$] -. catenation .- |
" $\equiv$ character [$\equiv$ character]... $\equiv$ " -. catenation of characters, restriction on quote occurrence .-

4.3 Predicate symbols with built-in semantics

A sequence of predicate-symbol-parts is referred to as a **predicate symbol**. For each n-ary predicate symbol there is an n-ary predicate on the universe of the specification language, i.e. an n-ary relation on entities of the universe. Some predicate symbols have built-in semantics which are introduced by the following.

NOTE — The predicate-symbol-parts are syntactically distinguished from operator-symbol-parts and variables.

True	means	the valid fact (something stated as being true)
False	means	the invalid fact (something stated as being false)
IsAtom(t)	means	t is an atomic construct or atom, for short
IsNat(t)	means	t is a natural number (1, 2, ...; zero excluded)
IsInt(t)	means	t is an integer number (... -2, -1, 0, 1, 2, ...)
IsReal(t)	means	t is a real number
IsCol(t)	means	t is a collection
IsNom(t)	means	t is a nomination
IsCat(t)	means	t is a catenation
IsSpotset(t)	means	t is a spotset
IsSingle(t)	means	t is a singleton spotset
$t_1 = t_2$	means	t_1 is equal to t_2 (all entities)
$t_1 \neq t_2$	means	<u>not</u> $t_1 = t_2$
$t_1 < t_2$	means	t_1 is less than t_2 (numbers)
$t_1 \leq t_2$	means	t_1 is less than or equal to t_2
$t_1 > t_2$	means	t_1 is greater than t_2
$t_1 \geq t_2$	means	t_1 is greater than or equal to t_2
$t_1 \in t_2$	means	t_1 is element of t_2 (collections)
$t_1 \notin t_2$	means	<u>not</u> $t_1 \in t_2$
$t_1 \hat{\in} t_2$	means	t_1 is singleton spotset and subset of t_2 (spotsets)
$t_1 \subset t_2$	means	t_1 is subset of t_2 (collections or spotsets)
$t_1 \subseteq t_2$	means	t_1 is subset of or equal to t_2 (collections or spotsets)
$t_1 \supset t_2$	means	t_2 is subset of t_1 (collections or spotsets)
$t_1 \supseteq t_2$	means	t_2 is subset of or equal to t_1 (collections or spotsets)

The unary predicate symbols mean predicates for expressing that an entity belongs to a certain class or "type" of entities, i.e. has a particular property. The binary predicate symbols refer to predicates which indicate whether or not a particular relationship holds for two entities.

4.4 Operator symbols with built-in semantics

A sequence of operator-symbol-parts is referred to as an **operator symbol**. For each n-ary operator symbol there is an n-ary operator or function from the universe to the universe of the specification language, i.e., a mapping from n-ary tuples of entities onto entities of the universe. Some operator symbols have built-in semantics which are introduced by the following.

NOTE — The operator-symbol-parts are syntactically distinguished from predicate-symbol-parts and variables. For all operators it holds that the result is UNDEF, if a parameter term does not meet the requirement stated below.

$C\ t$	If t denotes a singleton spotset, $C\ t$ denotes the component construct at the spot given by t .
$N\ t$	If t denotes a singleton spotset of a spot that is a component of a nomination ("immediately inward" of a nomination is the formal term), then $N\ t$ denotes the name construct of the component as it is within the nomination.
$F\ t$	If t denotes a set of exactly one spot immediately inward of a catenation spot, $F\ t$ denotes the front part of this catenation up to but excluding the component given by t (catenation of components with lower position than t).

$[\rightarrow m_1 \rightarrow m_2 \rightarrow m_3 \rightarrow]$	If m_i denote constructs, the whole term denotes the catenation which contains the constructs m_i as components — also referred to as members — in the indicated sequence. (This is an example for explicit-composition-term)
"ODA Part 2"	Denotes the catenation $[\rightarrow 'O' \rightarrow 'D' \rightarrow 'A' \rightarrow ' ' \rightarrow 'P' \rightarrow 'a' \rightarrow 'r' \rightarrow 't' \rightarrow ' ' \rightarrow '2' \rightarrow]$. A string of characters enclosed in quotes denotes the catenation of those characters. A pair of quotes in the string stands for a single one in the catenation. (This is an example for explicit-composition-term)
$[\rightarrow]$	Denotes the empty catenation. (This is an example for empty-constant)
$< >$	Denotes the empty spotset. (This is an example for empty-constant)
IF formula THEN t_1 ELSE t_2	If t_1 and t_2 are terms, the whole term denotes the same as t_1 or t_2 , depending on whether the formula is True or False, respectively. (This is an example for conditional-term)
$[var \mid \text{formula}]$	Denotes the collection of all constructs var which satisfy the formula. (This is an example for extensional-collection-term)
$< var \mid \text{formula} >$	Denotes the spotset which is the union of all singleton spotsets var which satisfy the formula. (This is an example for extensional-spotset-term)
$t < var \parallel \text{formula} >$	If t denotes a (possibly empty) spotset, the whole term denotes the union of all singleton spotsets var which contain a spot taken from t and for which the formula is True. (This is an example for spot-selection-term) Three elliptic notations are provided for frequently occurring spot-selection-clauses:
$t < \text{formula} >$	If a variable var is not introduced explicitly, the abbreviated term $t < \text{formula} >$ is evaluated for the standard variable xs (singleton set of the spot under examination or examination spot, for short). (This is an example for spot-selection-term)
$t < n_1, n_2, \dots >$	If the formula has the structure $N \text{ } var = n_1 \text{ } \underline{or} \text{ } N \text{ } var = n_2 \text{ } \underline{or} \dots$ where n_i are name-specifications, the formula may be abbreviated as a list of name-specifications. (This is an example for spot-selection-term)
$t.n \quad t \downarrow n \quad t \cdot n \quad t \uparrow n$	If there is only one name-specification n used for spot selection, an elliptic-spot-selection-term is provided as an abbreviation of special spot-selection-terms (ending with $\cdot, \cdot$ etc.). The n stands for $<N \text{ } xs = n>$ (see name qualification in programming languages). (This is an example for elliptic-spot-selection-term)

4.6 Notational simplifications

The common notational simplifications for successive logical quantifications can be used. The following examples explain these "short-hand" notations which are usually applied in first-order predicate logic:

The expression	$\forall x(\forall y(\exists z(\text{formula})))$
may be written as	$\forall x \forall y \exists z (\text{formula})$
or even as	$\forall x, y \exists z (\text{formula})$

A further abbreviation is used to help emphasize the "essential part" of a quantified formula:

The expression	$\forall x(x \in m \text{ } \underline{impl} \text{ } \text{formula})$
may be written as	$\forall x \in m (\text{formula})$
and	$\exists x(x \in m \text{ } \underline{and} \text{ } \text{formula})$
may be written as	$\exists x \in m (\text{formula})$

This notation can be combined with the previous one:

The expression	$\forall x(x \in m \text{ } \underline{impl} \text{ } \forall y(\exists z(z \in p \text{ } \underline{and} \text{ } \text{formula})))$
----------------	--

5 Structure of the formal specifications

This clause outlines the general concepts for the formal specifications. Those terms which are used at several places throughout the formal specifications are contained in clause 6.

Formally speaking, each of these formal specifications is a single formula in first-order predicate logic. This formula, being given near the beginning of each formal specification, is called the overall formula. The formula consists of other formulae which are connected by and:

formula₁ and formula₂ and formula₃ and ... formula_n

In the present context, each of these formulae is called a "definition" and identified through a unique reference number. A definition defines either a concept used in the narrative part of ISO 8613 or a concept which has a subsidiary function in the network of definitions in that it has been separated and "encapsulated" to render other definitions more readable.

The definitions are grouped into several subclauses. For example, within the formal specifications of the document structures the definitions relating to the sets of constituents are contained in 7.1, those relating to constituents in 7.2 and those relating to attributes in 7.3. In addition, concepts which are not used in the formal specification but are used in the text of the ISO 8613-2 are defined in 7.5.

The "factorization" of definitions is only for the convenience of authors and readers; it does not in any way impair the formal rigidity of the approach.

Variables occurring in the definitions are always bound by universal ($\forall$) or existential ($\exists$) quantifiers. Therefore, once a value has been chosen for a variable it has to be retained throughout the scope of the quantifier wherever the variable appears.

All predicates apart from those pertaining to the specification language are defined using the same format. For unary predicates the format is:

$\forall \text{variable} (\text{predicate-symbol}(\text{variable}) \text{ iff formula})$

A similar format is applied for n-ary predicates. There, the variables have been placed around the predicate symbol in a "natural" way, e.g. $(id)IsIdContIn(b)$ is expected to be read as "*id* is an identifier of a content portion in the basic object *b*".

A "predicate" in first-order predicate logic is a propositional pattern where some places are left free for the insertion of individual entities. An example is the pattern "... is greater than ...". Once the free places have been occupied by entities, the pattern becomes a proposition for which the "truth value" can be evaluated. The proposition "5 is greater than 2" evaluates to True, whereas the propositions "3 is greater than 5" and "a Mercedes is greater than SC 18" evaluate to False. Note that a proposition may never evaluate to an undefined truth value.

A unary predicate is a pattern with only one free parameter place. Its definition is evaluated by substituting an individual entity for the parameter. This yields a proposition on the left-hand side of the iff and transforms the whole expression in parentheses into a proposition.

A uniform format has also been adopted for the definition of most operators. It relies on the conditional-term of the specification language:

$\forall \text{variable} (\text{operator-symbol}(\text{variable}) = \text{IF formula THEN term ELSE UNDEF})$

An "operator" is a term pattern where some places are left free for the insertion of individual entities. An example is the pattern "... plus ...". Once the free places have been occupied by entities, the pattern becomes a term, i.e. an expression which evaluates to or denotes an individual entity. The term "5 plus 2" denotes the entity 7, whereas the term "WG 3 plus SC 18" denotes the entity which is represented by UNDEF in the formal specification language. Therefore, a term evaluates to "undefined", if the operator is not defined for the inserted entities.

It should be noted that the formal specifications cannot be applied *directly* to the Office Document Interchange Format (ISO 8613-5) and the reader should not necessarily expect to see any direct correspondences. The formal specifications are based on the textual description of the concepts of ISO 8613 and do not necessarily reflect the ODIF encoding of ODA documents. Those clauses in ISO 8613 which specify the ODIF encoding usually impose additional rules for the make-up of the interchanged data stream. These additional rules are considered outside of the scope of the formal specifications: The ODIF encoding specifies these additional rules formally and there is therefore no need for repeating these additional rules in FODA.

6 Commonly used definitions

This clause contains those definitions which are not specific to the formal specification of the document structures, the document profile or one of the content architectures only.

Semiinformal Description 1.1

Predicate "is a non-empty collection"

An entity *col* is a non-empty collection (set of constructs) if it is a collection which is not empty.

Definition 1.1

- 1 $\forall col$
- 2 $(\text{IsNeCol}(col) \text{ iff}$
- 3 $\text{IsCol}(col) \text{ and } col \neq []_o)$

Semiinformal Description 1.2

Predicate "is a non-empty nomination"

An entity *nom* is a non-empty nomination (mapping of names onto constructs) if it is a nomination which is not empty.

Definition 1.2

- 1 $\forall nom$
- 2 $(\text{IsNeNom}(nom) \text{ iff}$
- 3 $\text{IsNom}(nom) \text{ and } nom \neq [:]_o)$

Semiinformal Description 1.3

Predicate "is a non-empty catenation"

An entity *cat* is a non-empty catenation (sequence of constructs) if it is a catenation which is not empty.

Definition 1.3

- 1 $\forall cat$
- 2 $(\text{IsNeCat}(cat) \text{ iff}$
- 3 $\text{IsCat}(cat) \text{ and } cat \neq [\rightarrow]_o)$

Semiinformal Description 1.4

Predicate "is an empty collection"

An entity *col* is an empty collection if it contains no components.

Definition 1.4

- 1 $\forall col$
- 2 $(\text{IsEmptyCol}(col) \text{ iff}$
- 3 $col = []_o)$

Semiformal Description 1.9

Predicate “is a pair of positive integers”

A pair of positive integers is a catenation of two positive integers.

Definition 1.9

```

1   $\forall q$ 
2   $({}_o \text{IsPairOfPosInt}(q) \text{ iff}$ 
3     $\exists l, r$ 
4     $({}_1 q = [ \rightarrow l \rightarrow r \rightarrow ] \text{ and } \text{IsNat}(l) \text{ and } \text{IsNat}(r)_1)_o$ 

```

Semiformal Description 1.10

Predicate “is an octet string”

An octet string is an atomic construct in the formal specification.

Definition 1.10

```

1   $\forall v$ 
2   $({}_o \text{IsOctetString}(v) \text{ iff}$ 
3     $\text{IsAtom}(v)_o$ 

```

Semiformal Description 1.11

Function “position from the front end”

PF returns the position number of the indicated component, the count beginning with the first component and ending at and including the considered component. The operand p is required to denote a set of exactly one spot immediately inward of a catenation.

Definition 1.11

```

1   $\forall p$ 
2   $({}_o \text{PF}(p) =$ 
3    IF  $\text{IsSingle}(p) \text{ and } \text{IsCat}(C \ p \bullet)$ 
4    THEN  $\text{LENGTH}^{1.16}(\text{F } p) + 1$ 
5    ELSE UNDEF $_o$ )

```

Semiformal Description 1.12

Function “position from the rear end”

PR returns the position number of the indicated component, the count beginning with the last component and ending at and including the considered component. The operand p is required to denote a set of exactly one spot immediately inward of a catenation.

Definition 1.12

```

1   $\forall p$ 
2   $({}_o \text{PR}(p) =$ 
3    IF  $\text{IsSingle}(p) \text{ and } \text{IsCat}(C \ p \bullet)$ 
4    THEN  $\text{LENGTH}^{1.16}(\text{R } p) + 1$ 
5    ELSE UNDEF $_o$ )

```

Semiformal Description 1.17

Function "collection of component constructs"

COLC returns the collection of the component constructs at the spots of the (possibly empty) spotset ss .

Definition 1.17

```

1   $\forall ss$ 
2  ( ${}_0$  COLC ( $ss$ ) =
3    IF IsSpotset( $ss$ )
4    THEN [ $g | \exists p \in ss (g = C p)$ ]
5    ELSE UNDEF ${}_0$ )

```

Semiformal Description 1.18

Function "name set of a nomination"

NAMS returns the name set of the given nomination n , i.e. the collection of names of the components of the nomination.

Definition 1.18

```

1   $\forall n$ 
2  ( ${}_0$  NAMS( $n$ ) =
3    IF IsNom( $n$ )
4    THEN [ $m | \exists p \in \sim n \bullet (m = N p)$ ]
5    ELSE UNDEF ${}_0$ )

```

Semiformal Description 1.19

Predicate "is the placeholder for any attribute value"

An entity v is the placeholder for the value of a defaultable attribute if it is the atom with this particular interpretation.

NOTE — The term 'placeholder for any attribute value' is not an ISO 8613 attribute value but a construct which is introduced to achieve consistency throughout the formal specifications and to distinguish between mandatory and defaultable attributes or parameters. The actual value is dependent on the respective attribute and the defaulting rules and will be determined during the processing of a document (editing process, layout process, imaging process) whenever a value for a defaultable attribute or parameter is needed.

Definition 1.19

```

1   $\forall v$ 
2  ( ${}_0$  IsPlaceholder( $v$ ) iff
3     $v = \text{'placeholder for any attribute value'}$  ${}_0$ )

```

Semiformal Description 1.20

Predicate "is an ISO 6937 minimal subrepertoire string"

An ISO 6937 minimal subrepertoire string is a catenation of ISO 6937 minimal subrepertoire characters.

Definition 1.20

```

1   $\forall v$ 
2  ( ${}_0$  IsISO6937MSSString( $v$ ) iff
3    IsNeCat1.3( $v$ ) and  $\forall m \in \sim v \bullet (\text{IsISO6937MSCharacter}^{1.21}(C m))$  ${}_0$ )

```

Semiformal Description 1.25

Predicate "is a positive real number"

A positive real number is a real number whose value is greater than zero.

Definition 1.25

- 1 $\forall v$
- 2 $(\text{IsPosReal}(v) \text{ iff}$
- 3 $\text{IsReal}(v) \text{ and } v > 0.0_0)$

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and ... IsBasicLayoutObjectClassDescription^{2.35}(*cst*) ...
and ... IsBasicObjectClassDescription^{2.36}(*cst*) ...
and ... IsObjectClassDescription^{2.37}(*cst*) ...
and ... IsRootDescription^{2.38}(*cst*) ...
and ... IsLogicalRootDescription^{2.39}(*cst*) ...
and ... IsCompositeLogicalObjectDescription^{2.40}(*cst*) ...
and ... IsBasicLogicalObjectDescription^{2.41}(*cst*) ...
and ... IsLogicalObjectDescription^{2.42}(*cst*) ...
and ... IsLayoutRootDescription^{2.43}(*cst*) ...
and ... IsPageSetDescription^{2.44}(*cst*) ...
and ... IsCompositePageDescription^{2.45}(*cst*) ...
and ... IsBasicPageDescription^{2.46}(*cst*) ...
and ... IsPageDescription^{2.47}(*cst*) ...
and ... IsFrameDescription^{2.48}(*cst*) ...
and ... IsBlockDescription^{2.49}(*cst*) ...
and ... IsLayoutObjectDescription^{2.50}(*cst*) ...
and ... IsCompositeObjectDescription^{2.51}(*cst*) ...
and ... IsBasicObjectDescription^{2.52}(*cst*) ...
and ... IsCompositeLayoutObjectDescription^{2.53}(*cst*) ...
and ... IsBasicLayoutObjectDescription^{2.54}(*cst*) ...
and ... IsObjectDescription^{2.55}(*cst*) ...
and ... IsContentPortionDescription^{2.56}(*cst*) ...
and ... IsCharacterContentPortionDescription^{2.57}(*cst*) ...
and ... IsRasterGraphicsContentPortionDescription^{2.58}(*cst*) ...
and ... IsGeometricGraphicsContentPortionDescription^{2.59}(*cst*) ...
and ... IsLayoutStyle^{2.60}(*cst*) ...
and ... IsPresentationStyle^{2.61}(*cst*) ...

-.attributes: -

and ... IsAttributeSet^{2.62}(*as*) ...
and ... IsProfileAttributeSetPart2^{2.63}(*as*) ...
and ... IsBindingsValueExpression^{2.64}(*v*) ...
and ... IsStringExpression^{2.65}(*v*) ...
and ... IsAtomicStringExpression^{2.66}(*v*) ...
and ... IsStringFunction^{2.67}(*v*) ...
and ... IsNumericExpression^{2.68}(*v*) ...
and ... IsNumericFunction^{2.69}(*v*) ...
and ... IsObjectOrObjectClassIdExpression^{2.70}(*v*) ...
and ... IsObjectOrObjectClassSelectionFunction^{2.71}(*v*) ...
and ... IsBindingReferenceExpression^{2.72}(*v*) ...
and ... IsBindingReference^{2.73}(*v*) ...
and ... IsBindingName^{2.74}(*v*) ...
and ... IsBindingSelectionFunction^{2.75}(*v*) ...
and ... IsCurrentInstanceFunction^{2.76}(*v*) ...
and ... IsObjectTypeValue^{2.77}(*v*) ...
and ... IsLogicalObjectId^{2.78}(*v*) ...
and ... IsLayoutObjectId^{2.79}(*v*) ...
and ... IsObjectId^{2.80}(*v*) ...
and ... IsLogicalObjectClassId^{2.81}(*v*) ...
and ... IsLayoutObjectClassId^{2.82}(*v*) ...
and ... IsObjectClassId^{2.83}(*v*) ...
and ... IsSeqOfObjectClassId^{2.84}(*v*) ...
and ... IsConstructionExpression^{2.85}(*v*) ...
and ... IsConstructionType^{2.86}(*v*) ...

and ... (*slog*)IsContainedIn^{2.141}(*slay*) ...
and ... (*id*)IsClassIdImSubIn^{2.142}(*gco*) ...
and ... (*id*)IsIdImSubIn^{2.143}(*sco*) ...
and ... (*id*)IsIdContIn^{2.144}(*b*) ...
and ... (*idq*)IsSeqClassIdImSubIn^{2.145}(*gco*) ...
and ... (*idq*)CoveredBy^{2.146}(*r*) ...
and ... (*id*)OccursIn^{2.147}(*m*) ...
and ... (*go*)IsInitialGenericIn^{2.148}(*gos*) ...
and ... (*so*)IsInitialSpecificIn^{2.149}(*sos*) ...
and ... (*lgo*)DescribesClassImSubOf^{2.150}(*hgo*) ...
and ... (*lgo*)DescribesClassSubOf^{2.151}(*hgo*)In(*g*) ...
and ... (*lso*)DescribesImSubOf^{2.152}(*hso*) ...
and ... (*cont*)DescribesContPortOf^{2.153}(*b*)

NOTE — Other predicates or operators which are used here, but are defined in clause 6, are not listed here.

In principle a given interchange set may be verified to conform to ISO 8613 by establishing

$\mathcal{AS} \text{ impl IsInterchangeSet}^{2.1}(-.\text{this-term-})$

where $\mathcal{AS}$ stands for the conjugation of all axioms and definitions and the argument of IsInterchangeSet stands for a formal expression (a term) which denotes the particular interchange set in question. If the extended overall formula yields True, the document description conforms to ISO 8613, if False, it does not. An undefined result is impossible.

Semiformal Description 2.3

Predicate "is a document description" (2.3)

An entity *doc* is a document description if it is a document profile *prof* (5) or if it is an entity which is processable, formatted processable or formatted (5-6), according to the value of the document profile attribute 'document architecture class' (7-13), with a 'resource document' specified in the profile if any 'resource' is specified in the document (14-15).

Definition 2.3

$$\begin{aligned}
 &1 \quad \forall doc \\
 &2 \quad ({}_0 \text{IsDocumentDescription}(doc) \text{ iff} \\
 &3 \quad \exists prof \\
 &4 \quad ({}_1 \text{IsDocumentProfilePart}^{2.20}(prof) \text{ and} \\
 &5 \quad ({}_2 doc = [prof] \text{ or } \text{IsProcessable}^{2.4}(doc) \text{ or} \\
 &6 \quad \text{IsFormattedProcessable}^{2.5}(doc) \text{ or } \text{IsFormatted}^{2.6}(doc) {}_2) \text{ and} \\
 &7 \quad doc \neq [prof] \text{ impl} \\
 &8 \quad ({}_3 ({}_4 C \sim prof \bullet \text{'document architecture class'} = \text{'processable'} \text{ iff} \\
 &9 \quad \text{IsProcessable}^{2.4}(doc) {}_4) \text{ and} \\
 &10 \quad ({}_5 C \sim prof \bullet \text{'document architecture class'} = \text{'formatted processable'} \text{ iff} \\
 &11 \quad \text{IsFormattedProcessable}^{2.5}(doc) {}_5) \text{ and} \\
 &12 \quad ({}_6 C \sim prof \bullet \text{'document architecture class'} = \text{'formatted'} \text{ iff} \\
 &13 \quad \text{IsFormatted}^{2.6}(doc) {}_6) \text{ and} \\
 &14 \quad \forall cst \in doc \\
 &15 \quad ({}_7 \text{'resource'} \in \text{NAMS}^{1.18}(cst) \text{ impl } \text{'resource document'} \in \text{NAMS}^{1.18}(prof) {}_7) {}_3) {}_1) {}_0)
 \end{aligned}$$

Semiformal Description 2.5

Predicate "is formatted processable" (2.3.6, 2.3.11, 8.2)

An entity *doc* is formatted processable if it is a collection of constituents consisting of a document profile *prof* along with a document body *doby* (4,5) which includes (possibly empty) constituent sets *glog*, *slog*, *glay*, *slay*, *laystys* and *prestys* (6). Attributes in the document profile indicate the presence of a specific logical description, the specific layout description, the generic layout description (these three sets are always present) and of (optionally) a generic logical description, layout style set and presentation style set (7-15). If the value of the profile attribute 'generic logical structure' is 'complete generator set', the specific logical description *slog* is completely described by the generic logical description *glog* (16,17). If the value of the profile attribute 'generic layout structure' is 'complete generator set', the specific layout description *slay* is completely described by the generic layout description *glay* (18,19). The specific logical description is contained in the specific layout description (20). The profile attribute 'document architecture class' has the value 'formatted processable' (21). The document profile and the document body satisfy the constraints imposed by the content architectures (22-24).

Definition 2.5

1 $\forall doc$
2 $(\circ \text{IsFormattedProcessable}(doc) \text{ iff}$
3 $\exists prof, doby, glog, slog, glay, slay, laystys, prestys$
4 $(\downarrow doc = [prof] \cup doby \text{ and}$
5 $\text{IsDocumentProfilePart}^{2.20}(prof) \text{ and } \text{IsDocumentBody}^{2.7}(doby) \text{ and}$
6 $doby = glog \cup slog \cup glay \cup slay \cup laystys \cup prestys \text{ and}$
7 $'\text{specific logical structure}' \in \text{NAMS}^{1.18}(prof) \text{ and } \text{IsSpecificLogicalDescription}^{2.13}(slog) \text{ and}$
8 $'\text{specific layout structure}' \in \text{NAMS}^{1.18}(prof) \text{ and } \text{IsSpecificLayoutDescription}^{2.14}(slay) \text{ and}$
9 $'\text{generic layout structure}' \in \text{NAMS}^{1.18}(prof) \text{ and } \text{IsGenericLayoutDescription}^{2.11}(glay) \text{ and}$
10 $(\downarrow '\text{generic logical structure}' \in \text{NAMS}^{1.18}(prof) \text{ iff}$
11 $(\downarrow \text{IsNeCol}^{1.1}(glog) \text{ and } \text{IsGenericLogicalDescription}^{2.10}(glog)_s)_2) \text{ and}$
12 $(\downarrow '\text{layout styles}' \in \text{NAMS}^{1.18}(prof) \text{ iff}$
13 $(\downarrow \text{IsNeCol}^{1.1}(laystys) \text{ and } \text{IsLayoutStyleSet}^{2.15}(laystys)_s)_4) \text{ and}$
14 $(\downarrow '\text{presentation styles}' \in \text{NAMS}^{1.18}(prof) \text{ iff}$
15 $(\downarrow \text{IsNeCol}^{1.1}(prestys) \text{ and } \text{IsPresentationStyleSet}^{2.16}(prestys)_7)_6) \text{ and}$
16 $(\downarrow C \sim prof \bullet '\text{generic logical structure}' = '\text{complete generator set}' \text{ impl}$
17 $(slog) \text{IsCompletelyDescribedBy}^{2.136}(glog)_s) \text{ and}$
18 $(\downarrow C \sim prof \bullet '\text{generic layout structure}' = '\text{complete generator set}' \text{ impl}$
19 $(slay) \text{IsCompletelyDescribedBy}^{2.136}(glay)_s) \text{ and}$
20 $(slog) \text{IsContainedIn}^{2.141}(slay) \text{ and}$
21 $C \sim prof \bullet '\text{document architecture class}' = '\text{formatted processable}' \text{ and}$
22 $\text{SatisfiesCharacterContentArchitectureConstraints}^{2.17}(prof, doby) \text{ and}$
23 $\text{SatisfiesRasterGraphicsContentArchitectureConstraints}^{2.18}(prof, doby) \text{ and}$
24 $\text{SatisfiesGeometricGraphicsContentArchitectureConstraints}^{2.19}(prof, doby)_1)_0)$

Definition 2.7

$\forall doby$
 $(\text{IsDocumentBody}(doby) \text{ iff}$
 $\exists glog, slog, glay, slay, laystys, prestys$
 $(_1 doby = glog \cup slog \cup glay \cup slay \cup laystys \cup prestys \text{ and}$
 $(_2 \text{IsNeCol}^{1.1}(glog) \text{ impl } \text{IsGenericLogicalDescription}^{2.10}(glog)_2) \text{ and}$
 $(_3 \text{IsNeCol}^{1.1}(slog) \text{ impl } \text{IsSpecificLogicalDescription}^{2.13}(slog)_3) \text{ and}$
 $(_4 \text{IsNeCol}^{1.1}(slay) \text{ impl } \text{IsSpecificLayoutDescription}^{2.14}(slay)_4) \text{ and}$
 $(_5 \text{IsNeCol}^{1.1}(glay) \text{ impl } \text{IsGenericLayoutDescription}^{2.11}(glay)_5) \text{ and}$
 $(_6 \text{IsNeCol}^{1.1}(laystys) \text{ impl } \text{IsLayoutStyleSet}^{2.15}(laystys)_6) \text{ and}$
 $(_7 \text{IsNeCol}^{1.1}(prestys) \text{ impl } \text{IsPresentationStyleSet}^{2.16}(prestys)_7) \text{ and}$
 $(_8 \text{IsNeCol}^{1.1}(slog) \text{ and } \text{IsNeCol}^{1.1}(glog)_8) \text{ impl } (slog) \text{IsDescribedBy}^{2.135}(glog)_8) \text{ and}$
 $(_{10} \text{IsNeCol}^{1.1}(slay) \text{ and } \text{IsNeCol}^{1.1}(glay)_{11}) \text{ impl } (slay) \text{IsDescribedBy}^{2.135}(glay)_{10}) \text{ and}$
 $\forall cst \in (glog \cup slog) (_{12} \forall x \in \sim cst. (N x = \text{'layout style'}) \text{ impl}$
 $(_{13} \exists ls \in laystys (C \sim ls. \text{'layout style identifier'} = C x)_{13})_{12}) \text{ and}$
 $\forall cst \in (glog \cup slog \cup glay \cup slay) (_{14} \forall x \in \sim cst. (N x = \text{'presentation style'}) \text{ impl}$
 $(_{15} \exists ps \in prestys (C \sim ps. \text{'presentation style identifier'} = C x)_{15})_{14}) \text{ and}$
 $\forall cst \in laystys (_{16} \forall y \in \sim cst.$
 $(_{17} (_{18} \text{IsObjectClassId}^{2.83}(C y) \text{ impl}$
 $(_{19} \exists go \in glay (C \sim go. \text{'object class identifier'} = C y)_{19})_{18}) \text{ and}$
 $(_{20} \text{IsLayoutCatName}^{2.112}(C y) \text{ impl}$
 $(_{21} \exists ls \in laystys (C \sim ls. \text{'layout category'} = C y)_{21})_{20}) \text{ and}$
 $\forall l, r$
 $(_{22} (_{23} N y = \text{'same layout object'} \text{ and } C y = [\rightarrow l \rightarrow r \rightarrow] \text{ and } \text{IsObjectClassId}^{2.83}(r)_{24}) \text{ impl}$
 $(_{25} \exists go \in glay (C \sim go. \text{'object class identifier'} = r)_{25})_{23}) \text{ and}$
 $(_{26} (_{27} N y = \text{'same layout object'} \text{ and } C y = [\rightarrow l \rightarrow r \rightarrow] \text{ and } \text{IsLayoutCatName}^{2.112}(r)_{27}) \text{ impl}$
 $(_{28} \exists ls \in laystys (C \sim ls. \text{'layout category'} = r)_{28})_{26})_{22})_{17})_{16}) \text{ and}$
 $\forall a \in \sim glay \dots \text{'logical source'}$
 $(_{29} \exists go \in glog (C \sim go. \text{'object class identifier'} = C a)_{29}) \text{ and}$
 $\forall a \in \sim slay \dots \text{'balance'}$
 $(_{30} C a \neq \text{'null'} \text{ impl}$
 $\forall b \in \sim (C a). (_{31} \exists so \in slay (C \sim so. \text{'object identifier'} = b)_{31})_{30}) \text{ and}$
 $\forall a \in \sim glay \dots \text{'balance'}$
 $(_{32} C a \neq \text{'null'} \text{ impl}$
 $\forall b \in \sim (C a). (_{33} \exists go \in glay (C \sim go. \text{'object class identifier'} = b)_{33})_{32}) \text{ and}$
 $\forall cst \in slay$
 $(_{34} ([\text{'imaging order'}, \text{'subordinates'}] \subset \text{NAMS}^{1.18}(cst)) \text{ impl}$
 $[x \mid x \in \sim cst. \text{'imaging order'}] = [y \mid y \in \sim cst. \text{'subordinates'}]_{34})_1)$

Semiformal Description 2.10

Predicate "is a generic logical description" (2.3.12, 3.5.6)

An entity *glog* is a generic logical description if it is a generic description containing only logical object class descriptions and content portion descriptions (4-6). For a content portion description the attribute 'content identifier logical' is present and its value is a generic logical identifier.

Definition 2.10

1 $\forall glog$
 2 $(\circ \text{IsGenericLogicalDescription}(glog) \text{ iff}$
 3 $\text{IsGenericDescription}^{2.8}(glog) \text{ and}$
 4 $\forall cst \in glog$
 5 $(\text{IsLogicalObjectClassDescription}^{2.25}(cst) \text{ or}$
 6 $(\text{IsContentPortionDescription}^{2.56}(cst) \text{ and}$
 7 $\text{'content identifier logical'} \in \text{NAMS}^{1.18}(cst) \text{ and}$
 8 $\text{IsLogicalObjectClassId}^{2.81}(C \sim cst \bullet \text{'content identifier logical'})_2)_1)_\circ$

Semiformal Description 2.11

Predicate "is a generic layout description" (2.3.12)

An entity *glay* is a generic layout description if it is a generic description containing only layout object class descriptions and content portion descriptions (4-6). For a content portion description the attribute 'content identifier layout' is present and its value is a generic layout identifier.

Definition 2.11

1 $\forall glay$
 2 $(\circ \text{IsGenericLayoutDescription}(glay) \text{ iff}$
 3 $\text{IsGenericDescription}^{2.8}(glay) \text{ and}$
 4 $\forall cst \in glay$
 5 $(\text{IsLayoutObjectClassDescription}^{2.32}(cst) \text{ or}$
 6 $(\text{IsContentPortionDescription}^{2.56}(cst) \text{ and}$
 7 $\text{'content identifier layout'} \in \text{NAMS}^{1.18}(cst) \text{ and}$
 8 $\text{IsLayoutObjectClassId}^{2.82}(C \sim cst \bullet \text{'content identifier layout'})_2)_1)_\circ$

Semiformal Description 2.14

Predicate "is a specific layout description" (2.3.12, 3.3.1, 5.4.2.1)

An entity *slay* is a specific layout description if it is a specific description containing only layout object descriptions and content portion descriptions (4-6). For a content portion description the attribute 'content identifier layout' is present and its value is a specific layout identifier (7-8). The immediate subordinates of the layout root or a page set are page sets and/or pages (9-11). The immediate subordinates of a composite page are frames and/or blocks (12-15). The immediate subordinates of a frame are frames and/or blocks (16-19). If blocks are immediate subordinates of a constituent, the attribute 'balance' must not be specified for this constituent (15, 19), otherwise it must be present or it is defaulted.

Definition 2.14

- 1 $\forall \text{slay}$
- 2 $(\text{IsSpecificLayoutDescription}(\text{slay}) \text{ iff}$
- 3 $\text{IsSpecificDescription}^{2.12}(\text{slay}) \text{ and}$
- 4 $\forall \text{cst} \in \text{slay}$
- 5 $(\text{IsLayoutObjectDescription}^{2.50}(\text{cst}) \text{ or}$
- 6 $(\text{IsContentPortionDescription}^{2.56}(\text{cst}) \text{ and}$
- 7 $\text{'content identifier layout'} \in \text{NAMS}^{1.18}(\text{cst}) \text{ and}$
- 8 $\text{IsLayoutObjectId}^{2.79}(\text{C} \sim \text{cst} \cdot \text{'content identifier layout'}) \text{ and}$
- 9 $(\text{IsLayoutRootDescription}^{2.43}(\text{cst}) \text{ or } \text{IsPageSetDescription}^{2.44}(\text{cst}) \text{ and}$
- 10 $\forall \text{so} \in \text{IMSUB}^{2.154}(\text{cst}, \text{slay})$
- 11 $(\text{IsPageSetDescription}^{2.44}(\text{so}) \text{ or } \text{IsPageDescription}^{2.47}(\text{so}) \text{ and}$
- 12 $(\text{IsCompositePageDescription}^{2.45}(\text{cst}) \text{ impl}$
- 13 $\forall \text{so} \in \text{IMSUB}^{2.154}(\text{cst}, \text{slay})$
- 14 $(\text{IsFrameDescription}^{2.48}(\text{so}) \text{ and } \text{'balance'} \in \text{NAMS}^{1.18}(\text{cst}) \text{ or}$
- 15 $(\text{IsBlockDescription}^{2.49}(\text{so}) \text{ and } \text{'balance'} \notin \text{NAMS}^{1.18}(\text{cst}) \text{ and}$
- 16 $(\text{IsFrameDescription}^{2.48}(\text{cst}) \text{ impl}$
- 17 $\forall \text{so} \in \text{IMSUB}^{2.154}(\text{cst}, \text{slay})$
- 18 $(\text{IsFrameDescription}^{2.48}(\text{so}) \text{ and } \text{'balance'} \in \text{NAMS}^{1.18}(\text{cst}) \text{ or}$
- 19 $(\text{IsBlockDescription}^{2.49}(\text{so}) \text{ and } \text{'balance'} \notin \text{NAMS}^{1.18}(\text{cst})) \text{ and}$

Semiformal Description 2.15

Predicate "is a layout style set" (2.3.5)

An entity *laystys* is a layout style set if it is a non-empty collection of layout styles (3,4) whose identifiers are unique within that collection (5-7).

Definition 2.15

- 1 $\forall \text{laystys}$
- 2 $(\text{IsLayoutStyleSet}(\text{laystys}) \text{ iff}$
- 3 $\text{IsNeCol}^{1.1}(\text{laystys}) \text{ and}$
- 4 $\forall \text{cst} \in \text{laystys} (\text{IsLayoutStyle}^{2.60}(\text{cst})) \text{ and}$
- 5 $\forall x, y \in \text{laystys}$
- 6 $(x \neq y \text{ impl}$
- 7 $\text{C} \sim x \cdot \text{'layout style identifier'} \neq \text{C} \sim y \cdot \text{'layout style identifier'})$

7.2 Constituents

In constituents, the values of defaultable attributes need not be specified explicitly — as opposed to mandatory or non-mandatory attributes. In these cases the formal specification provides a placeholder for the value which is either specified elsewhere in the document description or specified in the International Standard as the default value (5.1.2.4). Such a “dummy value” is formally defined as satisfying the predicate *IsPlaceholder*^{1,19}.

Semiformal Description 2.20

Predicate “is a document profile of Part 2” (ISO 8613-4, 5.2)

(The formal specification of the document profile has only been carried out here, as far as it is necessary for the formal specification of the document structures described in ISO 8613-2.)

A document profile is a set of profile attributes (as far as required for ISO 8613-2). The attribute 'document architecture class' is a mandatory attribute (4) and its value is either 'formatted', 'processable' or 'formatted processable'. If the value of the attribute 'document architecture class' is 'processable', and the attributes 'generic layout structure' and 'specific logical structure', but not 'specific layout structure' are specified, the value of the attribute 'generic layout structure' is 'complete generator set' (6-10). If the value of the attribute 'document architecture class' is 'formatted processable', and the attributes 'generic layout structure', 'specific logical structure' and 'specific layout structure' are specified, the value of the attribute 'generic layout structure' is 'complete generator set' (11-15). If the value of the attribute 'document architecture class' is 'formatted', and the attributes 'generic layout structure' and 'specific layout structure', but not 'specific logical structure' and 'generic logical structure' are specified, the value of the attribute 'generic layout structure' is either 'partial generator set' or 'factor set' (16-21).

Definition 2.20

- 1 $\forall prof$
- 2 $({}_0 \text{IsDocumentProfilePart2}(prof) \text{ iff}$
- 3 $\text{IsProfileAttributeSetPart2}^{2.63}(prof) \text{ and}$
- 4 $'document\ architecture\ class' \in \text{NAMS}^{1.18}(prof) \text{ and}$
- 5 $C \sim prof \cdot 'document\ architecture\ class' \in ['formatted'; 'processable'; 'formatted\ processable'] \text{ and}$
- 6 $({}_1 ({}_2 C \sim prof \cdot 'document\ architecture\ class' = 'processable' \text{ and}$
- 7 $'specific\ logical\ structure' \in \text{NAMS}^{1.18}(prof) \text{ and}$
- 8 $'specific\ layout\ structure' \notin \text{NAMS}^{1.18}(prof) \text{ and}$
- 9 $({}_3 'generic\ layout\ structure' \in \text{NAMS}^{1.18}(prof) \text{ impl}$
- 10 $C \sim prof \cdot 'generic\ layout\ structure' = 'complete\ generator\ set' {}_3) {}_2) \text{ or}$
- 11 $({}_4 C \sim prof \cdot 'document\ architecture\ class' = 'formatted\ processable' \text{ and}$
- 12 $'specific\ logical\ structure' \in \text{NAMS}^{1.18}(prof) \text{ and}$
- 13 $'specific\ layout\ structure' \in \text{NAMS}^{1.18}(prof) \text{ and}$
- 14 $'generic\ layout\ structure' \in \text{NAMS}^{1.18}(prof) \text{ and}$
- 15 $C \sim prof \cdot 'generic\ layout\ structure' = 'complete\ generator\ set' {}_4) \text{ or}$
- 16 $({}_5 C \sim prof \cdot 'document\ architecture\ class' = 'formatted' \text{ and}$
- 17 $'specific\ logical\ structure' \notin \text{NAMS}^{1.18}(prof) \text{ and}$
- 18 $'generic\ logical\ structure' \notin \text{NAMS}^{1.18}(prof) \text{ and}$
- 19 $'specific\ layout\ structure' \in \text{NAMS}^{1.18}(prof) \text{ and}$
- 20 $({}_6 'generic\ layout\ structure' \in \text{NAMS}^{1.18}(prof) \text{ impl}$
- 21 $C \sim prof \cdot 'generic\ layout\ structure' \in ['partial\ generator\ set'; 'factor\ set'] {}_6) {}_5) {}_1) {}_0)$

Semiformal Description 2.23

Predicate "is a composite logical object class description" (3.5.6)

A composite logical object class description is a logical root class description or an attribute set (nomination) which may contain the attributes 'application comments', 'bindings', 'default value lists', 'generator for subordinates', 'layout style', 'object class identifier', 'object type', 'protection', 'resource', 'user-readable comments' and 'user-visible name'. The attributes 'object class identifier' and 'object type' are both required and have a logical object class identifier and a 'composite logical object' as respective values (14-15). None of the attribute values is defaultable (13).

Definition 2.23

1 $\forall cst$
2 $(_0 \text{ IsCompositeLogicalObjectClassDescription}(cst) \text{ iff}$
3 $\text{ IsLogicalRootClassDescription}^{2.22}(cst) \text{ or}$
4 $(_1 \text{ IsAttributeSet}^{2.62}(cst) \text{ and}$
5 $\text{ NAMS}^{1.18}(cst) \supseteq [\text{'object class identifier'; 'object type'}] \text{ and}$
6 $\text{ NAMS}^{1.18}(cst) \subseteq [\text{'application comments'; 'bindings';}$
7 $\text{'default value lists'; 'generator for subordinates';}$
8 $\text{'layout style'; 'object class identifier';}$
9 $\text{'object type'; 'protection';}$
10 $\text{'resource'; 'user-readable comments';}$
11 $\text{'user-visible name'}] \text{ and}$
12 $\forall a \in \sim cst.$
13 $(_2 \text{ not IsPlaceholder}^{1.19}(C a) \text{ and}$
14 $(_3 N a = \text{'object class identifier'} \text{ impl } \text{ IsLogicalObjectClassId}^{2.81}(C a) \text{) } _3 \text{ and}$
15 $(_4 N a = \text{'object type'} \text{ impl } C a = \text{'composite logical object'} \text{) } _4 \text{) } _2 \text{) } _1 \text{) } _0$

Semiformal Description 2.26

Predicate "is a layout root class description" (3.5.7)

A layout root class description is an attribute set (nomination) which may contain the attributes 'application comments', 'balance', 'bindings', 'default value lists', 'generator for subordinates', 'object class identifier', 'object type', 'resource', 'user-readable comments' and 'user-visible name'. The attributes 'object class identifier' and 'object type' are both required and have 0 and 'document layout root' as their respective values (16-17). None of the attribute values is defaultable (11). The value of 'balance' is either 'null' or a sequence of immediately subordinate object class identifiers. In the latter case, the attribute 'generator for subordinates' must be specified.

NOTE — The required correspondance between these object class identifiers and the value of 'generator for subordinates' (5.4.2.1) can only be checked during the layout process.

Definition 2.26

1 $\forall cst$
2 $({}_0 \text{IsLayoutRootClassDescription}(cst) \text{ iff}$
3 $\text{IsAttributeSet}^{2.62}(cst) \text{ and}$
4 $\text{NAMS}^{1.18}(cst) \supseteq [\text{'object class identifier'; 'object type'}] \text{ and}$
5 $\text{NAMS}^{1.18}(cst) \subseteq [\text{'application comments'; 'balance';}$
6 $\text{'bindings'; 'default value lists';}$
7 $\text{'generator for subordinates'; 'object class identifier';}$
8 $\text{'object type'; 'resource';}$
9 $\text{'user-readable comments'; 'user-visible name'}] \text{ and}$
10 $\forall a \in {}^{\sim}cst.$
11 $({}_1 \text{not IsPlaceholder}^{1.19}(C a) \text{ and}$
12 $({}_2 N a = \text{'balance'} \text{ impl}$
13 $({}_3 C a = \text{'null'} \text{ or}$
14 $({}_4 \text{'generator for subordinates'} \in \text{NAMS}^{1.18}(cst) \text{ and}$
15 $\forall so \in C {}^{\sim}cst. \text{'balance'} \bullet ((C so) \text{IsClassIdImSubIn}^{2.142}(cst)) {}_4)_3)_2) \text{ and}$
16 $({}_5 N a = \text{'object class identifier'} \text{ impl } C a = [\rightarrow 0 \rightarrow] {}_5) \text{ and}$
17 $({}_6 N a = \text{'object type'} \text{ impl } C a = \text{'document layout root'} {}_6)_1) \text{ and}$
18 $\text{not } (cst) \text{DescribesClassImSubOf}^{2.150}(cst) {}_0)$

Semiformal Description 2.28

Predicate "is a composite page class description" (3.5.7)

A composite page class description is an attribute set (nomination) which may contain the attributes 'application comments', 'balance', 'bindings', 'colour', 'default value lists', 'dimensions', 'generator for subordinates', 'medium type', 'object class identifier', 'object type', 'page position', 'resource', 'transparency', 'user-readable comments' and 'user-visible name'. The attributes 'object class identifier' and 'object type' are both required and have a layout object class identifier and a 'composite or basic page' as respective values (21, 22). None of the attribute values is defaultable (14). The value of 'balance' is either 'null' or a sequence of immediately subordinate object class identifiers. In the latter case, the attribute 'generator for subordinates' must be specified.

NOTE — The required correspondance between these object class identifiers and the value of 'generator for subordinates' (5.4.2.1) can only be checked during the layout process.

The sub-parameters 'rule A', 'rule B' or 'variable page height' may not be specified for the attribute 'dimensions' (19, 20).

Definition 2.28

1 $\forall cst$
2 $({}_0 \text{IsCompositePageClassDescription}(cst) \text{ iff}$
3 $\text{IsAttributeSet}^{2.62}(cst) \text{ and}$
4 $\text{NAMS}^{1.18}(cst) \supseteq [\text{'object class identifier'; 'object type'}] \text{ and}$
5 $\text{NAMS}^{1.18}(cst) \subseteq [\text{'application comments'; 'balance';}$
6 $\text{'bindings'; 'colour';}$
7 $\text{'default value lists'; 'dimensions';}$
8 $\text{'generator for subordinates'; 'medium type';}$
9 $\text{'object class identifier'; 'object type';}$
10 $\text{'page position'; 'resource';}$
11 $\text{'transparency'; 'user-readable comments';}$
12 $\text{'user-visible name'}] \text{ and}$
13 $\forall a \in \sim cst.$
14 $({}_1 \text{not IsPlaceholder}^{1.19}(C a) \text{ and}$
15 $({}_2 N a = \text{'balance'} \text{ impl}$
16 $({}_3 C a = \text{'null'} \text{ or}$
17 $({}_4 \text{'generator for subordinates'} \in \text{NAMS}^{1.18}(cst) \text{ and}$
18 $\forall so \in C \sim cst. \text{'balance'} \cdot ((C so) \text{IsClassIdImSubIn}^{2.142}(cst)) {}_4)_3)_2 \text{ and}$
19 $({}_5 N a = \text{'dimensions'} \text{ impl}$
20 $({}_6 \forall b \in a. \cdot ({}_7 N b \notin [\text{'rule A'; 'rule B'; 'variable page height'}] {}_7)_6)_5 \text{ and}$
21 $({}_8 N a = \text{'object class identifier'} \text{ impl IsLayoutObjectClassId}^{2.82}(C a) {}_8 \text{ and}$
22 $({}_9 N a = \text{'object type'} \text{ impl } C a = \text{'composite or basic page'} {}_9)_1)_0$

Semiformal Description 2.30

Predicate "is a frame class description" (3.5.7)

A frame class description is an attribute set (nomination) which may contain the attributes 'application comments', 'balance', 'bindings', 'border', 'colour', 'default value lists', 'dimensions', 'generator for subordinates', 'layout path', 'logical source', 'object class identifier', 'object type', 'permitted categories', 'position', 'resource', 'transparency', 'user-readable comments' and 'user-visible name'. The attributes 'object class identifier' and 'object type' are both required and have a layout object class identifier and 'frame' as respective values (22-23). None of the attribute values is defaultable (15). The value of 'balance' is either 'null' or a sequence of immediately subordinate object class identifiers. In the latter case, the attribute 'generator for subordinates' must be specified.

NOTE: The required correspondance between these object class identifiers and the value of 'generator for subordinates' (5.4.2.1) can only be checked during the layout process.

The sub-parameter 'variable page height' may not be specified for the attribute 'dimensions'.

Definition 2.30

1 $\forall cst$
2 $({}_0 \text{IsFrameClassDescription}(cst) \text{ iff}$
3 $\text{IsAttributeSet}^{2.62}(cst) \text{ and}$
4 $\text{NAMS}^{1.18}(cst) \supseteq [\text{'object class identifier'; 'object type'}] \text{ and}$
5 $\text{NAMS}^{1.18}(cst) \subseteq [\text{'application comments'; 'balance';}$
6 $\text{'bindings'; 'border';}$
7 $\text{'colour'; 'default value lists';}$
8 $\text{'dimensions'; 'generator for subordinates';}$
9 $\text{'layout path'; 'logical source';}$
10 $\text{'object class identifier'; 'object type';}$
11 $\text{'permitted categories'; 'position';}$
12 $\text{'resource'; 'transparency';}$
13 $\text{'user-readable comments'; 'user-visible name'}] \text{ and}$
14 $\forall a \in {}^{\sim}cst.$
15 $({}_1 \text{not IsPlaceholder}^{1.19}(C a) \text{ and}$
16 $({}_2 N a = \text{'balance'} \text{ impl}$
17 $({}_3 C a = \text{'null'} \text{ or}$
18 $({}_4 \text{'generator for subordinates'} \in \text{NAMS}^{1.18}(cst) \text{ and}$
19 $\forall so \in C {}^{\sim}cst. \text{'balance'} \bullet ((C so) \text{IsClassIdImSubIn}^{2.142}(cst)) {}_4)_2) \text{ and}$
20 $({}_5 N a = \text{'dimensions'} \text{ impl}$
21 $({}_6 \forall b \in a. \bullet ({}_7 N b \neq \text{'variable page height'} {}_7)_6)_5) \text{ and}$
22 $({}_8 N a = \text{'object class identifier'} \text{ impl IsLayoutObjectClassId}^{2.82}(C a) {}_8) \text{ and}$
23 $({}_9 N a = \text{'object type'} \text{ impl } C a = \text{'frame'} {}_9)_1)_0$

Semiformal Description 2.33

Predicate "is a composite object class description" (3.5.6, 3.5.7)

A composite object class description is either a composite logical object class description or a composite layout object class description.

Definition 2.33

- 1 $\forall cst$
- 2 $(\text{IsCompositeObjectClassDescription}(cst) \text{ iff}$
- 3 $\text{IsCompositeLogicalObjectClassDescription}^{2.23}(cst) \text{ or}$
- 4 $\text{IsCompositeLayoutObjectClassDescription}^{2.34}(cst)_o)$

Semiformal Description 2.34

Predicate "is a composite layout object class description" (3.5.7)

A composite layout object class description is either a layout root class description or a page set class description or a composite page class description or a frame class description.

Definition 2.34

- 1 $\forall cst$
- 2 $(\text{IsCompositeLayoutObjectClassDescription}(cst) \text{ iff}$
- 3 $\text{IsLayoutRootClassDescription}^{2.26}(cst) \text{ or}$
- 4 $\text{IsPageSetClassDescription}^{2.27}(cst) \text{ or}$
- 5 $\text{IsCompositePageClassDescription}^{2.28}(cst) \text{ or}$
- 6 $\text{IsFrameClassDescription}^{2.30}(cst)_o)$

Semiformal Description 2.35

Predicate "is a basic layout object class description" (3.5.7)

A basic layout object class description is either a basic page class description or a block class description.

Definition 2.35

- 1 $\forall cst$
- 2 $(\text{IsBasicLayoutObjectClassDescription}(cst) \text{ iff}$
- 3 $\text{IsBasicPageClassDescription}^{2.29}(cst) \text{ or}$
- 4 $\text{IsBlockClassDescription}^{2.31}(cst)_o)$

Semiformal Description 2.36

Predicate "is a basic object class description" (3.5.6, 3.5.7)

A basic object class description is either a basic logical object class description or a basic layout object class description.

Definition 2.36

- 1 $\forall cst$
- 2 $(\text{IsBasicObjectClassDescription}(cst) \text{ iff}$
- 3 $\text{IsBasicLogicalObjectClassDescription}^{2.24}(cst) \text{ or}$
- 4 $\text{IsBasicLayoutObjectClassDescription}^{2.35}(cst)_o)$

Semiformal Description 2.39

Predicate "is a logical root description" (3.2.1)

A logical root description is an attribute set (nomination) which contains the attributes 'application comments', 'bindings', 'object identifier', 'object type', 'protection', 'subordinates', 'user-readable comments', 'user-visible name' and, optionally, the attributes 'layout style', 'default value lists', and 'object class'. The attributes 'object class' and 'object identifier' have a logical object class identifier and 3 as their respective values (15-16). The attribute 'object type' has 'document logical root' as its value (17-18). If the value of the attribute 'object type' is defaulted the attribute 'object class' must be present (19).

Definition 2.39

1 $\forall cst$
2 $({}_o \text{IsLogicalRootDescription}(cst) \text{ iff}$
3 $\text{IsAttributeSet}^{2.62}(cst) \text{ and}$
4 $\text{NAMS}^{1.18}(cst) \supseteq [\text{'application comments'; 'bindings';}$
5 $\text{'object identifier'; 'object type';}$
6 $\text{'protection'; 'subordinates';}$
7 $\text{'user-readable comments'; 'user-visible name'}] \text{ and}$
8 $\text{NAMS}^{1.18}(cst) \subseteq [\text{'application comments'; 'bindings';}$
9 $\text{'default value lists'; 'layout style';}$
10 $\text{'object class'; 'object identifier';}$
11 $\text{'object type'; 'protection';}$
12 $\text{'subordinates'; 'user-readable comments';}$
13 $\text{'user-visible name'}] \text{ and}$
14 $\forall a \in \sim cst.$
15 $({}_1 ({}_2 N a = \text{'object class'} \text{ impl } \text{IsLogicalObjectClassId}^{2.31}(C a) {}_2) \text{ and}$
16 $({}_3 N a = \text{'object identifier'} \text{ impl } C a = [\rightarrow 3 \rightarrow] {}_3) \text{ and}$
17 $({}_4 N a = \text{'object type'} \text{ impl}$
18 $({}_5 C a = \text{'document logical root'} \text{ or } \text{IsPlaceholder}^{1.19}(C a) {}_5) {}_1) \text{ and}$
19 $({}_6 \text{IsPlaceholder}^{1.19}(C \sim cst. \text{'object type'}) \text{ impl } \text{'object class'} \in \text{NAMS}^{1.18}(cst) {}_6) {}_0)$

Semiformal Description 2.41

Predicate “is a basic logical object description” (3.2.3)

A basic logical object description is an attribute set (nomination) which contains the attributes 'application comments', 'bindings', 'content architecture class', 'object identifier', 'object type', 'protection', 'user-readable comments', 'user-visible name' and, optionally, the attributes 'layout style', 'content portions', 'content generator', 'presentation style' and 'object class'. The attributes 'object class' and 'object identifier' have a logical object class identifier and a logical object identifier as respective values (16, 17). The attribute 'object type' has 'basic logical object' as its value (18, 19). At least one of the attributes 'object class', 'content portions' and 'content generator' must be specified for this constituent (20). If the value of the attribute 'object type' is defaulted the attribute 'object class' must be present (21).

Definition 2.41

- 1 $\forall cst$
- 2 $({}_0 \text{IsBasicLogicalObjectDescription}(cst) \text{ iff}$
- 3 $\text{IsAttributeSet}^{2.62}(cst) \text{ and}$
- 4 $\text{NAMS}^{1.18}(cst) \supseteq [\text{'application comments'}; \text{'bindings'};$
- 5 $\text{'content architecture class'}; \text{'object identifier'};$
- 6 $\text{'object type'}; \text{'protection'};$
- 7 $\text{'user-readable comments'}; \text{'user-visible name'}] \text{ and}$
- 8 $\text{NAMS}^{1.18}(cst) \subseteq [\text{'application comments'}; \text{'bindings'};$
- 9 $\text{'content architecture class'}; \text{'content generator'};$
- 10 $\text{'content portions'}; \text{'layout style'};$
- 11 $\text{'object class'}; \text{'object type'};$
- 12 $\text{'object identifier'}; \text{'presentation style'};$
- 13 $\text{'protection'}; \text{'user-readable comments'};$
- 14 $\text{'user-visible name'}] \text{ and}$
- 15 $\forall a \in \sim cst.$
- 16 $({}_1 ({}_2 N a = \text{'object class'} \text{ impl } \text{IsLogicalObjectClassId}^{2.81}(C a) {}_2) \text{ and}$
- 17 $({}_3 N a = \text{'object identifier'} \text{ impl } \text{IsLogicalObjectId}^{2.78}(C a) {}_3) \text{ and}$
- 18 $({}_4 N a = \text{'object type'} \text{ impl}$
- 19 $({}_5 C a = \text{'basic logical object'} \text{ or } \text{IsPlaceholder}^{1.19}(C a) {}_5) {}_1) \text{ and}$
- 20 $({}_6 \text{NAMS}^{1.18}(cst) \cap [\text{'content portions'}; \text{'object class'}; \text{'content generator'}] \neq [] {}_6) \text{ and}$
- 21 $({}_7 \text{IsPlaceholder}^{1.19}(C \sim cst. \text{'object type'}) \text{ impl } \text{'object class'} \in \text{NAMS}^{1.18}(cst) {}_7) {}_0)$

Semiformal Description 2.42

Predicate “is a logical object description” (3.2.2, 3.2.3, 5.3.5.4)

A logical object description is either a basic logical object description or a composite logical object description. The “binding value”, if specified, is a collection of catenations with two components where the second one is a bindings value expression.

Definition 2.42

- 1 $\forall cst$
- 2 $({}_0 \text{IsLogicalObjectDescription}(cst) \text{ iff}$
- 3 $({}_1 \text{IsBasicLogicalObjectDescription}^{2.41}(cst) \text{ or}$
- 4 $\text{IsCompositeLogicalObjectDescription}^{2.40}(cst) {}_1) \text{ and}$
- 5 $\forall a \in \sim cst.$
- 6 $({}_2 ({}_3 N a = \text{'bindings'} \text{ and } \text{not } \text{IsPlaceholder}^{1.19}(C a) {}_3) \text{ impl}$
- 7 $({}_4 \text{IsNeCol}^{1.1}(C a) \text{ and}$
- 8 $\forall b \in (C a) \exists l, r$
- 9 $({}_5 b = [\rightarrow l \rightarrow r \rightarrow] \text{ and } \text{IsBindingsValueExpression}^{2.64}(r) {}_5) {}_2) {}_0)$

Semiformal Description 2.44

Predicate "is a page set description" (3.3.1.2)

A page set description is an attribute set (nomination) which contains the attributes 'application comments', 'balance', 'bindings', 'object identifier', 'object type', 'subordinates', 'user-readable comments', 'user-visible name' and, optionally, the attributes 'default value lists' and 'object class'. The attributes 'object class' and 'object identifier' have a layout object class identifier and a layout object identifier as respective values (17-18). The attribute 'object type' has 'page set' as its value. If the value of the attribute 'object type' is defaulted the attribute 'object class' must be present (21). The value of the attribute 'balance' is either 'null' or a sequence of immediately subordinate object identifiers (14-16).

Definition 2.44

1 $\forall cst$
2 $({}_0 \text{IsPageSetDescription}(cst) \text{ iff}$
3 $\text{IsAttributeSet}^{2.62}(cst) \text{ and}$
4 $\text{NAMS}^{1.18}(cst) \supseteq [\text{'application comments'}; \text{'balance'};$
5 $\text{'bindings'}; \text{'object identifier'};$
6 $\text{'object type'}; \text{'subordinates'};$
7 $\text{'user-readable comments'}; \text{'user-visible name'}] \text{ and}$
8 $\text{NAMS}^{1.18}(cst) \subseteq [\text{'application comments'}; \text{'balance'};$
9 $\text{'bindings'}; \text{'default value lists'};$
10 $\text{'object class'}; \text{'object identifier'};$
11 $\text{'object type'}; \text{'subordinates'};$
12 $\text{'user-readable comments'}; \text{'user-visible name'}] \text{ and}$
13 $\forall a \in {}^{\sim}cst.$
14 $({}_1 ({}_2 N a = \text{'balance'} \text{ impl}$
15 $({}_3 \text{IsPlaceholder}^{1.19}(C a) \text{ or } C a = \text{'null'} \text{ or}$
16 $\forall so \in C {}^{\sim}cst. \text{'balance'} \bullet ((C so) \text{IsIdImSubIn}^{2.143}(cst)) {}_3)_2) \text{ and}$
17 $({}_4 N a = \text{'object class'} \text{ impl } \text{IsLayoutObjectClassId}^{2.82}(C a) {}_4) \text{ and}$
18 $({}_5 N a = \text{'object identifier'} \text{ impl } \text{IsLayoutObjectId}^{2.79}(C a) {}_5) \text{ and}$
19 $({}_6 N a = \text{'object type'} \text{ impl}$
20 $({}_7 C a = \text{'page set'} \text{ or } \text{IsPlaceholder}^{1.19}(C a) {}_7)_6)_1) \text{ and}$
21 $({}_8 \text{IsPlaceholder}^{1.19}(C {}^{\sim}cst \bullet \text{'object type'}) \text{ impl } \text{'object class'} \in \text{NAMS}^{1.18}(cst) {}_8)_0)$

Semiformal Description 2.46

Predicate "is a basic page description" (3.3.1.3)

A basic page description is an attribute set (nomination) which contains the attributes 'application comments', 'bindings', 'colour', 'content architecture class', 'dimensions', 'medium type', 'object identifier', 'object type', 'page position', 'presentation attributes', 'transparency', 'user-readable comments', 'user-visible name' and, optionally, the attributes 'content portions', 'presentation style', and 'object class'. The attributes 'object class' and 'object identifier' have a layout object class identifier and a layout object identifier as respective values (22, 23). The attribute 'object type' has 'composite or basic page' as its value. At least one of the attributes 'object class' and 'content portions' must be specified for this constituent (26). If the value of the attribute 'object type' is defaulted the attribute 'object class' must be present (27). The sub-parameters 'rule A' or 'rule B' may not be specified for the attribute 'dimensions' (20, 21).

Definition 2.46

1 $\forall cst$
2 $({}_o \text{IsBasicPageDescription}(cst) \text{ iff}$
3 $\text{IsAttributeSet}^{2.62}(cst) \text{ and}$
4 $\text{NAMS}^{1.18}(cst) \supseteq [\text{'application comments'; 'bindings';}$
5 $\text{'colour'; 'content architecture class';}$
6 $\text{'dimensions'; 'medium type';}$
7 $\text{'object identifier'; 'object type';}$
8 $\text{'page position'; 'presentation attributes';}$
9 $\text{'transparency'; 'user-readable comments';}$
10 $\text{'user-visible name'}] \text{ and}$
11 $\text{NAMS}^{1.18}(cst) \subseteq [\text{'application comments'; 'bindings';}$
12 $\text{'colour'; 'content architecture class';}$
13 $\text{'content portions'; 'dimensions';}$
14 $\text{'medium type'; 'object class';}$
15 $\text{'object identifier'; 'object type';}$
16 $\text{'page position'; 'presentation attributes';}$
17 $\text{'presentation style'; 'transparency';}$
18 $\text{'user-readable comments'; 'user-visible name'}] \text{ and}$
19 $\forall a \in \sim cst.$
20 $({}_1 ({}_2 N a = \text{'dimensions'} \text{ impl } ({}_3 \text{IsPlaceholder}^{1.19}(C a) \text{ or}$
21 $({}_4 \forall b \in a \dots ({}_5 N b \notin [\text{'rule A'; 'rule B'}])))) \text{ and}$
22 $({}_6 N a = \text{'object class'} \text{ impl } \text{IsLayoutObjectClassId}^{2.82}(C a)) \text{ and}$
23 $({}_7 N a = \text{'object identifier'} \text{ impl } \text{IsLayoutObjectId}^{2.79}(C a)) \text{ and}$
24 $({}_8 N a = \text{'object type'} \text{ impl}$
25 $({}_9 C a = \text{'composite or basic page'} \text{ or } \text{IsPlaceholder}^{1.19}(C a))) \text{ and}$
26 $({}_{10} \text{NAMS}^{1.18}(cst) \cap [\text{'content portions'; 'object class'}] \neq []) \text{ and}$
27 $({}_{11} \text{IsPlaceholder}^{1.19}(C \sim cst. \text{'object type'}) \text{ impl } \text{'object class'} \in \text{NAMS}^{1.18}(cst)))$

Semiformal Description 2.47

Predicate "is a page description" (3.3.1.3)

A page description is either a composite page description or a basic page description.

Definition 2.47

1 $\forall cst$
2 $({}_o \text{IsPageDescription}(cst) \text{ iff}$
3 $\text{IsCompositePageDescription}^{2.45}(cst) \text{ or } \text{IsBasicPageDescription}^{2.46}(cst)$

Semiformal Description 2.49

Predicate "is a block description" (3.3.1.5)

A block description is an attribute set (nomination) which contains the attributes 'application comments', 'bindings', 'border', 'colour', 'content architecture class', 'dimensions', 'object identifier', 'object type', 'position', 'transparency', 'user-readable comments', 'user-visible name' and, optionally, the attributes 'content portions', 'presentation attributes', 'presentation style' and 'object class'. The attributes 'object class' and 'object identifier' have a layout object class identifier and a layout object identifier as respective values (22, 23). The attribute 'object type' has 'block' as its value. At least one of the attributes 'object class' and 'content portions' must be specified for this constituent (26). If the value of the attribute 'object type' is defaulted the attribute 'object class' must be present (27). The sub-parameters 'rule A', 'rule B' or 'variable page height' may not be specified for the attribute 'dimensions' (19-21).

Definition 2.49

1 $\forall cst$
2 $({}_0 \text{IsBlockDescription}(cst) \text{ iff}$
3 $\text{IsAttributeSet}^{2.62}(cst) \text{ and}$
4 $\text{NAMS}^{1.18}(cst) \supseteq [\text{'application comments'; 'bindings';}$
5 $\text{'border'; 'colour';}$
6 $\text{'content architecture class'; 'dimensions';}$
7 $\text{'object identifier'; 'object type';}$
8 $\text{'position'; 'transparency';}$
9 $\text{'user-readable comments'; 'user-visible name'}] \text{ and}$
10 $\text{NAMS}^{1.18}(cst) \subseteq [\text{'application comments'; 'bindings';}$
11 $\text{'border'; 'colour';}$
12 $\text{'content architecture class'; 'content portions';}$
13 $\text{'dimensions'; 'object class';}$
14 $\text{'object identifier'; 'object type';}$
15 $\text{'position'; 'presentation attributes';}$
16 $\text{'presentation style'; 'transparency';}$
17 $\text{'user-readable comments'; 'user-visible name'}] \text{ and}$
18 $\forall a \in \sim cst.$
19 $({}_1 N a = \text{'dimensions'} \text{ impl } ({}_3 \text{IsPlaceholder}^{1.19}(C a) \text{ or}$
20 $({}_4 \forall b \in a \dots$
21 $({}_5 N b \notin [\text{'rule A'; 'rule B'; 'variable page height'}])) \text{ and}$
22 $({}_6 N a = \text{'object class'} \text{ impl } \text{IsLayoutObjectClassId}^{2.82}(C a)) \text{ and}$
23 $({}_7 N a = \text{'object identifier'} \text{ impl } \text{IsLayoutObjectId}^{2.79}(C a)) \text{ and}$
24 $({}_8 N a = \text{'object type'} \text{ impl}$
25 $({}_9 C a = \text{'block'} \text{ or } \text{IsPlaceholder}^{1.19}(C a))) \text{ and}$
26 $({}_{10} \text{NAMS}^{1.18}(cst) \cap [\text{'content portions'; 'object class'}] \neq []) \text{ and}$
27 $({}_{11} \text{IsPlaceholder}^{1.19}(C \sim cst. \text{'object type'}) \text{ impl } \text{'object class'} \in \text{NAMS}^{1.18}(cst)_{11})_0)$

Semiformal Description 2.53

Predicate "is a composite layout object description" (3.3)

A composite layout object description is either a layout root description or a page set description or a composite page description or a frame description.

Definition 2.53

- 1 $\forall cst$
- 2 $({}_o \text{IsCompositeLayoutObjectDescription}(cst) \text{ iff}$
- 3 $\text{IsLayoutRootDescription}^{2.43}(cst) \text{ or}$
- 4 $\text{IsPageSetDescription}^{2.44}(cst) \text{ or}$
- 5 $\text{IsCompositePageDescription}^{2.45}(cst) \text{ or}$
- 6 $\text{IsFrameDescription}^{2.48}(cst)_o)$

Semiformal Description 2.54

Predicate "is a basic layout object description" (3.3)

A basic layout object description is either a basic page description or a block description.

Definition 2.54

- 1 $\forall cst$
- 2 $({}_o \text{IsBasicLayoutObjectDescription}(cst) \text{ iff}$
- 3 $\text{IsBasicPageDescription}^{2.46}(cst) \text{ or}$
- 4 $\text{IsBlockDescription}^{2.49}(cst)_o)$

Semiformal Description 2.55

Predicate "is an object description" (3.2, 3.3)

An object description is either a logical object description or a layout object description.

Definition 2.55

- 1 $\forall cst$
- 2 $({}_o \text{IsObjectDescription}(cst) \text{ iff}$
- 3 $\text{IsLogicalObjectDescription}^{2.42}(cst) \text{ or}$
- 4 $\text{IsLayoutObjectDescription}^{2.50}(cst)_o)$

Semiformal Description 2.59

Predicate "is a geometric graphics content portion description" (3.1.3)

A geometric graphics content portion description is considered an atomic construct in the formal specification of the document structure. It is formally defined in the formal specification of the geometric graphics content architecture.

Definition 2.59

- 1 $\forall cont$
- 2 $({}_o \text{IsGeometricGraphicsContentPortionDescription}(cont) \text{ iff}$
- 3 $\text{IsAtom}(cont)_o)$

Semiformal Description 2.60

Predicate "is a layout style" (2.3.5)

A layout style is an attribute set (nomination) which contains the attribute 'layout style identifier' and, optionally, the attributes 'application comments', 'block alignment', 'concatenation', 'fill order', 'indivisibility', 'layout category', 'layout object class', 'new layout object', 'offset', 'same layout object', 'separation', 'synchronization', 'user-readable comments' and 'user-visible name'. The attributes 'layout object class' and 'layout style identifier' have a layout object class identifier and a layout style identifier as their respective values (15-16). None of the attribute values is defaultable (14).

Definition 2.60

- 1 $\forall cst$
- 2 $({}_o \text{IsLayoutStyle}(cst) \text{ iff}$
- 3 $\text{IsAttributeSet}^{2.62}(cst) \text{ and}$
- 4 $\text{NAMS}^{1.18}(cst) \supseteq [\text{'layout style identifier'}] \text{ and}$
- 5 $\text{NAMS}^{1.18}(cst) \subseteq [\text{'application comments'}; \text{'block alignment'};$
- 6 $\text{'concatenation'}; \text{'fill order'};$
- 7 $\text{'indivisibility'}; \text{'layout category'};$
- 8 $\text{'layout object class'}; \text{'layout style identifier'};$
- 9 $\text{'new layout object'}; \text{'offset'};$
- 10 $\text{'same layout object'}; \text{'separation'};$
- 11 $\text{'synchronization'}; \text{'user-readable comments'};$
- 12 $\text{'user-visible name'}] \text{ and}$
- 13 $\forall a \in {}^{\sim}cst.$
- 14 $({}_1 \text{ not IsPlaceholder}^{1.19}(C\ a) \text{ and}$
- 15 $({}_2 N\ a = \text{'layout object class'} \text{ impl IsLayoutObjectClassId}^{2.82}(C\ a)_2) \text{ and}$
- 16 $({}_3 N\ a = \text{'layout style identifier'} \text{ impl IsLayoutStyleId}^{2.107}(C\ a)_3)_1)$

Semiformal Description 2.61

Predicate "is a presentation style" (2.3.5)

A presentation style is an attribute set (nomination) which contains the attribute 'presentation style identifier' and, optionally, the attributes 'border', 'colour', 'presentation attributes', 'transparency', 'user-readable comments' and 'user-visible name'. The attribute 'presentation style identifier' has a presentation style identifier as its values (11). None of the attribute values is defaultable (10).

Definition 2.61

```

1   $\forall cst$ 
2  ( $\text{IsPresentationStyle}(cst)$  iff
3     $\text{IsAttributeSet}^{2.62}(cst)$  and
4     $\text{NAMS}^{1.18}(cst) \supseteq [\text{'presentation style identifier'}]$  and
5     $\text{NAMS}^{1.18}(cst) \subseteq [\text{'border'};$ 
6      'presentation attributes'; 'presentation style identifier';
7      'transparency'; 'user-readable comments';
8      'user-visible name'] and
9     $\forall a \in \sim cst.$ 
10   ( $\text{not IsPlaceholder}^{1.19}(C\ a)$  and
11      $\text{N } a = \text{'presentation style identifier'}$  impl  $\text{IsPresentationStyleId}^{2.117}(C\ a)$ .)

```

7.3 Attributes

Semiformal Description 2.62

Predicate "is an attribute set" (clause 5)

In this definition the attribute names are linked with the ranges of the attribute values.

Definition 2.62

1 $\forall as$
2 $(_0 \text{IsAttributeSet}(as) \text{ iff}$
3 $(_1 \text{IsNeNom}^{1.2}(as) \text{ and}$
4 $\forall a \in \sim as.$
5 $(_2 ($
6 $(_3 N a = \text{'alternative representation'} \text{ impl}$
7 $\text{IsAlternativeCharacterSetsString}^{2.128}(C a)_3) \text{ and}$
8 $(_4 N a = \text{'application comments'} \text{ impl}$
9 $\text{IsOctetString}^{1.10}(C a)_4) \text{ and}$
10 $(_5 N a = \text{'balance'} \text{ impl}$
11 $(_6 \text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsBalanceValue}^{2.101}(C a)_6) \text{ and}$
12 $(_7 N a = \text{'bindings'} \text{ impl}$
13 $(_8 \text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsBindingsValue}^{2.96}(C a)_8) \text{ and}$
14 $(_9 N a = \text{'block alignment'} \text{ impl}$
15 $(_{10} \text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsBlockAlignmentValue}^{2.108}(C a)_{10}) \text{ and}$
16 $(_{11} N a = \text{'border'} \text{ impl}$
17 $(_{12} \text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsBorderValue}^{2.100}(C a)_{12}) \text{ and}$
18 $(_{13} N a = \text{'coding attributes'} \text{ impl}$
19 $(_{14} \text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsCodingAttributesValue}^{2.129}(C a)_{14}) \text{ and}$
20 $(_{15} N a = \text{'colour'} \text{ impl}$
21 $(_{16} \text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsColourValue}^{2.104}(C a)_{16}) \text{ and}$
22 $(_{17} N a = \text{'concatenation'} \text{ impl}$
23 $(_{18} \text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsConcatenationValue}^{2.109}(C a)_{18}) \text{ and}$
24 $(_{19} N a = \text{'content architecture class'} \text{ impl}$
25 $(_{20} \text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsContentArchitectureClassValue}^{2.88}(C a)_{20}) \text{ and}$
26 $(_{21} N a = \text{'content generator'} \text{ impl}$
27 $\text{IsStringExpression}^{2.65}(C a)_{21}) \text{ and}$
28 $(_{22} N a = \text{'content identifier layout'} \text{ impl}$
29 $\text{IsLayoutContentPortionId}^{2.118}(C a)_{22}) \text{ and}$
30 $(_{23} N a = \text{'content identifier logical'} \text{ impl}$
31 $\text{IsLogicalContentPortionId}^{2.119}(C a)_{23}) \text{ and}$
32 $(_{24} N a = \text{'content information'} \text{ impl}$
33 $\text{IsContentInformationValue}^{2.124}(C a)_{24}) \text{ and}$
34 $(_{25} N a = \text{'content portions'} \text{ impl}$
35 $\text{IsSeqOfDiffNnInt}^{1.22}(C a)_{25}) \text{ and}$
36 $(_{26} N a = \text{'default value lists'} \text{ impl}$
37 $\text{IsDefaultValueListsValue}^{2.97}(C a)_{26}) \text{ and}$
38 $(_{27} N a = \text{'dimensions'} \text{ impl}$
39 $(_{28} \text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsDimensionsValue}^{2.99}(C a)_{28}) \text{ and}$
40 $(_{29} N a = \text{'fill order'} \text{ impl}$
41 $(_{30} \text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsFillOrderValue}^{2.110}(C a)_{30}) \text{ and}$
42 $(_{31} N a = \text{'generator for subordinates'} \text{ impl}$
43 $\text{IsConstructionExpression}^{2.85}(C a)_{31}) \text{ and}$
44 $(_{32} N a = \text{'imaging order'} \text{ impl}$
45 $\text{IsSeqOfDiffNnInt}^{1.22}(C a)_{32}) \text{ and}$
46 $(_{33} N a = \text{'indivisibility'} \text{ impl}$

- 46 (34 IsPlaceholder^{1.19}(C a) or IsLayoutObjectReference^{2.111}(C a) ₃₄) and
 47 (35 N a = 'layout category' impl
 48 (36 IsPlaceholder^{1.19}(C a) or C a = 'null' or
 49 IsLayoutCatName^{2.112}(C a) ₃₆) and
 50 (37 N a = 'layout object class' impl
 51 (38 IsPlaceholder^{1.19}(C a) or C a = 'null' or
 52 IsLayoutObjectClassId^{2.82}(C a) ₃₈) and
 53 (39 N a = 'layout path' impl
 54 (40 IsPlaceholder^{1.19}(C a) or IsLayoutPathValue^{2.102}(C a) ₄₀) and
 55 (41 N a = 'layout style' impl
 56 IsLayoutStyleId^{2.107}(C a) ₄₁) and
 57 (42 N a = 'layout style identifier' impl
 58 IsLayoutStyleId^{2.107}(C a) ₄₂) and
 59 (43 N a = 'logical source' impl
 60 IsLogicalObjectClassId^{2.81}(C a) ₄₃) and
 61 (44 N a = 'medium type' impl
 62 (45 IsPlaceholder^{1.19}(C a) or IsMediumTypeValue^{2.105}(C a) ₄₅) and
 63 (46 N a = 'new layout object' impl
 64 (47 IsPlaceholder^{1.19}(C a) or IsLayoutObjectReference^{2.111}(C a) ₄₇) and
 65 (48 N a = 'object class identifier' impl
 66 IsObjectClassId^{2.83}(C a) ₄₈) and
 67 (49 N a = 'object class' impl
 68 IsObjectClassId^{2.83}(C a) ₄₉) and
 69 (50 N a = 'object identifier' impl
 70 IsObjectId^{2.80}(C a) ₅₀) and
 71 (51 N a = 'object type' impl
 72 (52 IsPlaceholder^{1.19}(C a) or IsObjectTypeValue^{2.77}(C a) ₅₂) and
 73 (53 N a = 'offset' impl
 74 (54 IsPlaceholder^{1.19}(C a) or IsOffsetValue^{2.114}(C a) ₅₄) and
 75 (55 N a = 'page position' impl
 76 (56 IsPlaceholder^{1.19}(C a) or IsPairOfNnInt^{1.8}(C a) ₅₆) and
 77 (57 N a = 'permitted categories' impl
 78 (58 IsPlaceholder^{1.19}(C a) or C a = 'null' or
 79 IsSetOfLayoutCatNames^{2.113}(C a) ₅₈) and
 80 (59 N a = 'position' impl
 81 (60 IsPlaceholder^{1.19}(C a) or IsPositionValue^{2.98}(C a) ₆₀) and
 82 (61 N a = 'presentation attributes' impl
 83 (62 IsPlaceholder^{1.19}(C a) or IsPresentationAttributesValue^{2.92}(C a) ₆₂) and
 84 (63 N a = 'presentation style' impl
 85 IsPresentationStyleId^{2.117}(C a) ₆₃) and
 86 (64 N a = 'presentation style identifier' impl
 87 IsPresentationStyleId^{2.117}(C a) ₆₄) and
 88 (65 N a = 'protection' impl
 89 (66 IsPlaceholder^{1.19}(C a) or IsProtectionValue^{2.106}(C a) ₆₆) and
 90 (67 N a = 'resource' impl
 91 IsISO6937MSSString^{1.20}(C a) ₆₇) and
 92 (68 N a = 'same layout object' impl
 93 (69 IsPlaceholder^{1.19}(C a) or IsSameLayoutObjectValue^{2.115}(C a) ₆₉) and
 94 (70 N a = 'separation' impl
 95 (71 IsPlaceholder^{1.19}(C a) or IsSeparationValue^{2.116}(C a) ₇₁) and
 96 (72 N a = 'subordinates' impl
 97 IsSeqOfDiffNnInt^{1.22}(C a) ₇₂) and
 98 (73 N a = 'synchronization' impl
 99 (74 IsPlaceholder^{1.19}(C a) or C a = 'null' or IsLogicalObjectId^{2.78}(C a) or

100 $\text{IsObjectOrObjectClassIdExpression}^{2.70}(C\ a)_{74}73) \text{ and}$
 101 $(_{75} N\ a = \text{'transparency'} \text{ impl}$
 102 $(_{76} \text{IsPlaceholder}^{1.19}(C\ a) \text{ or } \text{IsTransparencyValue}^{2.103}(C\ a)_{76}75) \text{ and}$
 103 $(_{77} N\ a = \text{'type of coding'} \text{ impl}$
 104 $\text{IsTypeOfCodingValue}^{2.120}(C\ a)_{77}) \text{ and}$
 105 $(_{78} N\ a = \text{'user-readable comments'} \text{ impl}$
 106 $(_{79} \text{IsPlaceholder}^{1.19}(C\ a) \text{ or } \text{IsCharSeq}^{2.133}(C\ a)_{79}78) \text{ and}$
 107 $(_{80} N\ a = \text{'user-visible name'} \text{ impl}$
 108 $(_{81} \text{IsPlaceholder}^{1.19}(C\ a) \text{ or } \text{IsCharSeq}^{2.133}(C\ a)_{81}80)2)1)0)$

Semiformal Description 2.63

Predicate "is a profile attribute set of Part 2"

(The formal specification of the attribute set for the document profile has only been carried out here, as far as it is necessary for the formal specification of the document structures described in ISO 8613-2.)

A profile attribute set is a non-empty nomination with the indicated value ranges for the specified attributes.

Definition 2.63

1 $\forall as$
 2 $(_0 \text{IsProfileAttributeSetPart2}(as) \text{ iff}$
 3 $\text{IsNeNom}^{1.2}(as) \text{ and}$
 4 $\forall a \in \sim as.$
 5 $(_1 (N\ a \in [\text{'generic layout structure'}; \text{'generic logical structure'}] \text{ impl}$
 6 $C\ a \in [\text{'partial generator set'}; \text{'complete generator set'}; \text{'factor set'}]) \text{ and}$
 7 $(N\ a = \text{'specific layout structure'} \text{ impl } C\ a = \text{'present'}) \text{ and}$
 8 $(N\ a = \text{'specific logical structure'} \text{ impl } C\ a = \text{'present'}) \text{ and}$
 9 $(N\ a = \text{'layout styles'} \text{ impl } C\ a = \text{'present'}) \text{ and}$
 10 $(N\ a = \text{'presentation styles'} \text{ impl } C\ a = \text{'present'}) \text{ and}$
 11 $(N\ a = \text{'document architecture class'} \text{ impl}$
 12 $C\ a \in [\text{'formatted'}; \text{'formatted processable'}; \text{'processable'}])_1)0)$

Semiformal Description 2.64

Predicate "is a bindings value expression" (5.1.3)

A bindings value expression is either a string expression or a numeric expression or an object or object class identifier expression.

Definition 2.64

1 $\forall v$
 2 $(_0 \text{IsBindingsValueExpression}(v) \text{ iff}$
 3 $\text{IsStringExpression}^{2.65}(v) \text{ or}$
 4 $\text{IsNumericExpression}^{2.68}(v) \text{ or}$
 5 $\text{IsObjectOrObjectClassIdExpression}^{2.70}(v) _0)$

Semiinformal Description 2.65

Predicate "is a string expression" (5.1.3.1)

A string expression is a sequence of one or more substring expressions.

Definition 2.65

- 1 $\forall v$
- 2 $(\text{IsStringExpression}(v) \text{ iff}$
- 3 $(\text{IsNeCat}^{1.3}(v) \text{ and}$
- 4 $\forall m \in \sim v \bullet (\text{IsAtomicStringExpression}^{2.66}(C\ m))_1)_0$

Semiinformal Description 2.66

Predicate "is an atomic string expression" (5.1.3.1)

An atomic string expression is either an octet string (string literal) or a binding reference or a nomination, where the name is a string function and the component is a numeric expression.

Definition 2.66

- 1 $\forall v$
- 2 $(\text{IsAtomicStringExpression}(v) \text{ iff}$
- 3 $\text{IsOctetString}^{1.10}(v) \text{ or } \text{IsBindingReference}^{2.73}(v) \text{ or}$
- 4 $\exists n, c$
- 5 $(v = [n : c] \text{ and}$
- 6 $\text{IsStringFunction}^{2.67}(n) \text{ and } \text{IsNumericExpression}^{2.68}(c))_0$

Semiinformal Description 2.67

Predicate "is a string function" (5.1.3.1)

A string function is one of the following: 'MAKE-STRING', 'UPPER-ALPHA', 'LOWER-ALPHA', 'UPPER-ROMAN', 'LOWER-ROMAN'.

Definition 2.67

- 1 $\forall v$
- 2 $(\text{IsStringFunction}(v) \text{ iff}$
- 3 $v \in ['MAKE-STRING', 'UPPER-ALPHA', 'LOWER-ALPHA', 'UPPER-ROMAN',$
- 4 $'LOWER-ROMAN']_0$

Semiformal Description 2.68

Predicate “is a numeric expression” (5.1.3.2)

A numeric expression is either an integer (numeric literal) or a binding reference or a nomination, where the name is a numeric function and the component is either a numeric expression (if the numeric function is 'INCREMENT' or 'DECREMENT') or an object identifier or an object or object class identifier expression (if the numeric function is 'ORDINAL').

Definition 2.68

$$\begin{array}{l}
1 \quad \forall v \\
2 \quad ({}_0 \text{IsNumericExpression}(v) \text{ iff } \\
3 \quad \text{IsInt}(v) \text{ or IsBindingReference}^{2.73}(v) \text{ or } \\
4 \quad \exists n, c \\
5 \quad ({}_1 v = [n : c] \text{ and IsNumericFunction}^{2.69}(n) \text{ and } \\
6 \quad ({}_2 n \in [\text{'INCREMENT'}, \text{'DECREMENT'}] \text{ impl } \\
7 \quad \text{IsNumericExpression}^{2.68}(c)_2) \text{ and } \\
8 \quad ({}_3 n = \text{'ORDINAL'} \text{ impl } \\
9 \quad ({}_4 \text{IsObjectId}^{2.80}(c) \text{ or IsObjectOrObjectClassIdExpression}^{2.70}(c) \text{ and } ({}_5))_4) \text{ impl }
\end{array}$$

Semiformal Description 2.69

Predicate “is a numeric function” (5.1.3.2)

A numeric function is one of the following: 'INCREMENT', 'DECREMENT', 'ORDINAL'.

Definition 2.69

```

1  ∀ v
2  (₀ IsNumericFunction(v) iff
3  v ∈ ['INCREMENT'; 'DECREMENT'; 'ORDINAL'].)

```

Semiinformal Description 2.70

Predicate “is an object or object class identifier expression” (5.1.3.3)

An object or object class identifier expression is either the selection function 'CURRENT-OBJECT' or a nomination where the name is an object or object class selection function (except 'CURRENT-OBJECT') and the component is an object or object class identifier expression (if the selection function is 'SUPERIOR-OBJECT' or 'PRECEDING-OBJECT'), or a current instance function (if the selection function is 'CURRENT-INSTANCE'). (This is a recursive definition.)

Definition 2.70

$$\begin{array}{ll}
1 & \forall v \\
2 & ({}_0 \text{IsObjectOrObjectClassIdExpression}(v) \text{ iff } \\
3 & \quad v = \text{'CURRENT-OBJECT'} \text{ or } \\
4 & \quad \exists n, c \\
5 & \quad ({}_1 v = [n : c] \text{ and } \\
6 & \quad \text{IsObjectOrObjectClassSelectionFunction}^{2.71}(n) \text{ and } \\
7 & \quad n \neq \text{'CURRENT-OBJECT'} \text{ and } \\
8 & \quad ({}_2 n \in [\text{'SUPERIOR-OBJECT'}; \text{'PRECEDING-OBJECT'}] \text{ impl } \\
9 & \quad \text{IsObjectOrObjectClassIdExpression}^{2.70}(c)_2) \text{ and } \\
10 & \quad ({}_3 n = \text{'CURRENT-INSTANCE'} \text{ impl } \text{IsCurrentInstanceFunction}^{2.76}(c)_3)_1)
\end{array}$$

Semiformal Description 2.71

Predicate "is an object or object class selection function" (5.1.3.3)

An object or object class selection function is one of the following: 'CURRENT-OBJECT', 'CURRENT-INSTANCE', 'SUPERIOR-OBJECT', 'PRECEDING-OBJECT'.

Definition 2.71

- 1 $\forall v$
- 2 $(\text{IsObjectOrObjectClassSelectionFunction}(v) \text{ iff}$
- 3 $v \in \text{'CURRENT-OBJECT'; 'CURRENT-INSTANCE'; 'SUPERIOR-OBJECT';}$
- 4 $\text{'PRECEDING-OBJECT'})$

Semiformal Description 2.72

Predicate "is a binding reference expression" (5.1.3.4)

A binding reference expression is either an object identifier or an object class identifier or a binding selection function.

Definition 2.72

- 1 $\forall v$
- 2 $(\text{IsBindingReferenceExpression}(v) \text{ iff}$
- 3 $\text{IsObjectId}^{2.80}(v) \text{ or } \text{IsObjectClassId}^{2.83}(v) \text{ or}$
- 4 $\text{IsBindingSelectionFunction}^{2.75}(v))$

Semiformal Description 2.73

Predicate "is a binding reference" (5.1.3.4)

A binding reference is a pair where the first component is a binding reference expression and the second one is a binding identifier.

Definition 2.73

- 1 $\forall v$
- 2 $(\text{IsBindingReference}(v) \text{ iff}$
- 3 $\exists l, r$
- 4 $(v = [\rightarrow l \rightarrow r \rightarrow] \text{ and}$
- 5 $\text{IsBindingReferenceExpression}^{2.72}(l) \text{ and } \text{IsBindingName}^{2.74}(r))$

Semiformal Description 2.74

Predicate "is a binding name" (5.1.3.4)

A binding name is a string of characters from the minimum subrepertoire of ISO 6937-2.

Definition 2.74

- 1 $\forall v$
- 2 $(\text{IsBindingName}(v) \text{ iff}$
- 3 $\text{ISO6937MSString}^{1.20}(v))$

Semiformal Description 2.75

Predicate "is a binding selection function" (5.1.3.4)

A binding selection function is either 'CURRENT-OBJECT' or a nomination where the name is 'SUPERIOR' or 'PRECEDING' (in this case the component is an object or object class identifier expression) or the name is 'CURRENT-INSTANCE' (in this case the component is a current instance function).

Definition 2.75

- 1 $\forall v$
- 2 $(\text{IsBindingSelectionFunction}(v) \text{ iff}$
- 3 $v = \text{'CURRENT-OBJECT'} \text{ or}$
- 4 $\exists f$
- 5 $(\text{ }_1(\text{ }_2v = [\text{'SUPERIOR'} : f] \text{ and IsObjectOrObjectClassIdExpression}^{2.70}(f) \text{ }_2) \text{ or}$
- 6 $\text{ }_3v = [\text{'PRECEDING'} : f] \text{ and IsObjectOrObjectClassIdExpression}^{2.70}(f) \text{ }_3) \text{ or}$
- 7 $\text{ }_4v = [\text{'CURRENT-INSTANCE'} : f] \text{ and IsCurrentInstanceFunction}^{2.76}(f) \text{ }_4) \text{ }_1)_0$

Semiformal Description 2.76

Predicate "is a current instance function" (3.5, 5.1)

A current instance function is a pair where the first component is either an object class identifier or an object type value, and the second one is either an object identifier or an object class identifier or an object or object class identifier expression.

Definition 2.76

- 1 $\forall v$
- 2 $(\text{IsCurrentInstanceFunction}(v) \text{ iff}$
- 3 $\exists l, r$
- 4 $(\text{ }_1v = [\rightarrow l \rightarrow r \rightarrow] \text{ and}$
- 5 $\text{ }_2\text{IsObjectClassId}^{2.83}(l) \text{ or IsObjectTypeValue}^{2.77}(l) \text{ }_2) \text{ and}$
- 6 $\text{ }_3\text{IsObjectId}^{2.80}(r) \text{ or IsObjectClassId}^{2.83}(r) \text{ or}$
- 7 $\text{IsObjectOrObjectClassIdExpression}^{2.70}(r) \text{ }_3) \text{ }_1)_0$

Semiformal Description 2.77

Predicate "is an object type value" (5.3.1.1)

An object type value is one of the following: 'basic logical object', 'block', 'composite logical object', 'document layout root', 'document logical root', 'frame', 'composite or basic page', 'page set'.

Definition 2.77

- 1 $\forall v$
- 2 $(\text{IsObjectTypeValue}(v) \text{ iff}$
- 3 $v \in [\text{'basic logical object'}; \text{'block'}; \text{'composite logical object'};$
- 4 $\text{'document layout root'}; \text{'document logical root'}; \text{'frame'};$
- 5 $\text{'composite or basic page'}; \text{'page set'}]_0$

Semiinformal Description 2.78

Predicate "is a logical object identifier" (5.3.1.2)

A logical object identifier is a sequence of non-negative integers where the first integer is 3.

Definition 2.78

- 1 $\forall v$
- 2 $(\text{IsLogicalObjectId}(v) \text{ iff}$
- 3 $\text{IsSeqOfNnInt}^{1.23}(v) \text{ and } \text{HEAD}^{1.13}(v) = 3_0)$

Semiinformal Description 2.79

Predicate "is a layout object identifier" (5.3.1.2)

A layout object identifier is a sequence of non-negative integers where the first integer is 1.

Definition 2.79

- 1 $\forall v$
- 2 $(\text{IsLayoutObjectId}(v) \text{ iff}$
- 3 $\text{IsSeqOfNnInt}^{1.23}(v) \text{ and } \text{HEAD}^{1.13}(v) = 1_0)$

Semiinformal Description 2.80

Predicate "is an object identifier" (5.3.1.2)

An object identifier is either a logical object identifier or a layout object identifier.

Definition 2.80

- 1 $\forall v$
- 2 $(\text{IsObjectId}(v) \text{ iff}$
- 3 $\text{IsLogicalObjectId}^{2.78}(v) \text{ or } \text{IsLayoutObjectId}^{2.79}(v)_0)$

Semiinformal Description 2.81

Predicate "is a logical object class identifier" (5.3.1.3)

A logical object class identifier is a sequence of non-negative integers where the first integer is 2.

Definition 2.81

- 1 $\forall v$
- 2 $(\text{IsLogicalObjectClassId}(v) \text{ iff}$
- 3 $\text{IsSeqOfNnInt}^{1.23}(v) \text{ and } \text{HEAD}^{1.13}(v) = 2_0)$

Semiinformal Description 2.82

Predicate "is a layout object class identifier" (5.3.1.3)

A layout object class identifier is a sequence of non-negative integers where the first integer is 0.

Definition 2.82

- 1 $\forall v$
- 2 $(\text{IsLayoutObjectClassId}(v) \text{ iff}$
- 3 $\text{IsSeqOfNnInt}^{1.23}(v) \text{ and } \text{HEAD}^{1.13}(v) = 0_0)$

Semiinformal Description 2.83

Predicate "is an object class identifier" (5.3.1.3)

An object class identifier is either a logical object class identifier or a layout object class identifier.

Definition 2.83

- 1 $\forall v$
- 2 $(\text{IsObjectClassId}(v) \text{ iff}$
- 3 $\text{IsLogicalObjectClassId}^{2.81}(v) \text{ or } \text{IsLayoutObjectClassId}^{2.82}(v)_0)$

Semiinformal Description 2.84

Predicate "is a sequence of object class identifiers"

Each element of a sequence of object class identifiers is an object class identifier.

Definition 2.84

- 1 $\forall v$
- 2 $(\text{IsSeqOfObjectClassId}(v) \text{ iff}$
- 3 $\text{IsCat}(v) \text{ and } \forall m \in \sim v. (\text{IsObjectClassId}^{2.83}(C\ m))_0)$

Semiinformal Description 2.85

Predicate "is a construction expression" (5.3.2.1)

A construction expression is either a construction type or a construction term.

Definition 2.85

- 1 $\forall m$
- 2 $(\text{IsConstructionExpression}(m) \text{ iff}$
- 3 $\text{IsConstructionType}^{2.86}(m) \text{ or } \text{IsConstructionTerm}^{2.87}(m)_0)$

Semiformal Description 2.86

Predicate "is a construction type" (5.3.2.1)

A construction type is a sequence of two elements where the first one is either 'sequence', 'aggregate' or 'choice' and the second one is a non-empty sequence, whose elements are construction terms.

Definition 2.86

- 1 $\forall m$
- 2 $(\text{IsConstructionType}(m) \text{ iff}$
- 3 $\exists l, q$
- 4 $(m = [\rightarrow l \rightarrow q \rightarrow] \text{ and}$
- 5 $l \in \{\text{'sequence'}, \text{'aggregate'}, \text{'choice'}\} \text{ and}$
- 6 $\text{IsNeCat}^{1.3}(q) \text{ and } \forall t \in \sim q \bullet (\text{IsConstructionTerm}^{2.87}(C t)) \text{)}_o$

Semiformal Description 2.87

Predicate "is a construction term" (5.3.2.1)

A construction term is either a sequence with one element where the element is a construction type, or a construction term is a sequence of two elements where the first one is either 'opt', 'reqrep' or 'optrep' and the second one is either an object class identifier or a construction type.

Definition 2.87

- 1 $\forall m$
- 2 $(\text{IsConstructionTerm}(m) \text{ iff}$
- 3 $(\exists q (m = [\rightarrow q \rightarrow] \text{ and } \text{IsConstructionType}^{2.86}(q)) \text{ or}$
- 4 $\exists l, q$
- 5 $(m = [\rightarrow l \rightarrow q \rightarrow] \text{ and}$
- 6 $l \in \{\text{'opt'}, \text{'reqrep'}, \text{'optrep'}\} \text{ and}$
- 7 $(\text{IsObjectClassId}^{2.83}(q) \text{ or } \text{IsConstructionType}^{2.86}(q)) \text{)}_o$

Semiformal Description 2.88

Predicate "is a content architecture class value" (5.3.4.1)

The value of the attribute 'content architecture class' is either a character content architecture class value, a raster graphics content architecture class value or a geometric graphics content architecture class value.

Definition 2.88

- 1 $\forall v$
- 2 $(\text{IsContentArchitectureClassValue}(v) \text{ iff}$
- 3 $(\text{IsCharacterContentArchitectureClassValue}^{2.89}(v) \text{ or}$
- 4 $\text{IsRasterGraphicsContentArchitectureClassValue}^{2.90}(v) \text{ or}$
- 5 $\text{IsGeometricGraphicsContentArchitectureClassValue}^{2.91}(v) \text{)}_o$

Semiinformal Description 2.89

Predicate "is a character content architecture class value" (5.3.4.1)

A character content architecture class value is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex C.

Definition 2.89

- 1 $\forall v$
- 2 $({}_o \text{IsCharacterContentArchitectureClassValue}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiinformal Description 2.90

Predicate "is a raster graphics content architecture class value" (5.3.4.1)

A raster graphics content architecture class value is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex D.

Definition 2.90

- 1 $\forall v$
- 2 $({}_o \text{IsRasterGraphicsContentArchitectureClassValue}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiinformal Description 2.91

Predicate "is a geometric graphics content architecture class value" (5.3.4.1)

A geometric graphics content architecture class value is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex E.

Definition 2.91

- 1 $\forall v$
- 2 $({}_o \text{IsGeometricGraphicsContentArchitectureClassValue}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiinformal Description 2.92

Predicate "is a presentation attributes value" (5.4.4)

The value of the attribute 'presentation attributes' is a collection where each element is either a character content presentation attribute, a raster graphics content presentation attribute or geometric graphics content presentation attribute.

Definition 2.92

- 1 $\forall v$
- 2 $({}_o \text{IsPresentationAttributesValue}(v) \text{ iff}$
- 3 $\text{IsCol}(v) \text{ and}$
- 4 $\forall a \in v$
- 5 $({}_1 \text{IsCharacterContentPresentationAttribute}^{2.93}(a) \text{ or}$
- 6 $\text{IsRasterGraphicsContentPresentationAttribute}^{2.94}(a) \text{ or}$
- 7 $\text{IsGeometricGraphicsContentPresentationAttribute}^{2.95}(a) \text{ }_1)_o)$

Semiformal Description 2.93

Predicate "is a character content presentation attribute" (5.4.4)

A character content presentation attribute is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex C.

Definition 2.93

- 1 $\forall v$
- 2 $(\text{IsCharacterContentPresentationAttribute}^{2.93}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiformal Description 2.94

Predicate "is a raster graphics content presentation attribute" (5.4.4)

A raster graphics content presentation attribute is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex D.

Definition 2.94

- 1 $\forall v$
- 2 $(\text{IsRasterGraphicsContentPresentationAttribute}^{2.94}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiformal Description 2.95

Predicate "is a geometric graphics content presentation attribute" (5.4.4)

A geometric graphics content presentation attribute is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex E.

Definition 2.95

- 1 $\forall v$
- 2 $(\text{IsGeometricGraphicsContentPresentationAttribute}^{2.95}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiformal Description 2.96

Predicate "is a bindings value" (5.3.5.4)

The value of the attribute 'bindings' is a set (3) where each element of the set is a catenation of two components (5,6). The first component is an ISO 6937 character string (6) which is unique within the set (9, 10). The second component is either an attribute value expression, an integer, a octet string or an object identifier (7, 8).

Definition 2.96

- 1 $\forall v$
- 2 $({}_0 \text{IsBindingsValue}(v) \text{ iff}$
- 3 $\text{IsNeCol}^{1.1}(v) \text{ and}$
- 4 $\forall a \in v \exists f, l$
- 5 $({}_1 a = [\rightarrow f \rightarrow l \rightarrow] \text{ and}$
- 6 $\text{IsISO6937MSSString}^{1.20}(f) \text{ and}$
- 7 $({}_2 \text{IsBindingsValueExpression}^{2.64}(l) \text{ or } \text{IsOctetString}^{1.10}(l) \text{ or}$
- 8 $\text{IsInt}(l) \text{ or } \text{IsObjectId}^{2.80}(l) {}_2)_1 \text{ and}$
- 9 $\forall p, q \in v$
- 10 $({}_3 p \neq q \text{ impl } \text{HEAD}^{1.13}(p) \neq \text{HEAD}^{1.13}(q) {}_3)_0$

Semiformal Description 2.97

Predicate "is a default value lists value" (5.3.5.5)

A value of the attribute 'default value lists' is a non-empty nomination where the name is either 'composite logical object', 'basic logical object', 'composite or basic page', 'frame' or 'block' and the component is an attribute set, whose name set depends on the name. For 'frame' or 'block' the component can also be a set of attribute sets.

Definition 2.97

$\forall v$
 $(\text{IsDefaultValueListsValue}(v) \text{ iff}$
 $\text{IsNeNom}^{1.2}(v) \text{ and}$
 $\text{NAMS}^{1.18}(v) \subseteq [\text{'composite logical object'; 'basic logical object';}$
 $\text{'composite or basic page'; 'frame'; 'block'}] \text{ and}$
 $\forall a \in \sim v.$
 $(\text{N } a = \text{'composite logical object' impl}$
 $(\text{IsAttributeSet}^{2.62}(C a) \text{ and}$
 $\text{NAMS}^{1.18}(C a) \subseteq [\text{'layout style'; 'protection'}]_s) \text{ and}$
 $(\text{N } a = \text{'basic logical object' impl}$
 $(\text{IsAttributeSet}^{2.62}(C a) \text{ and}$
 $\text{NAMS}^{1.18}(C a) \subseteq [\text{'content architecture class'; 'layout style';}$
 $\text{'presentation style'; 'protection'}]_s) \text{ and}$
 $(\text{N } a = \text{'composite or basic page' impl}$
 $(\text{IsAttributeSet}^{2.62}(C a) \text{ and}$
 $\text{NAMS}^{1.18}(C a) \subseteq [\text{'colour'; 'content architecture class'; 'dimensions'; 'medium type';}$
 $\text{'page position'; 'presentation attributes'; 'presentation style';}$
 $\text{'transparency'}]_7) \text{ and}$
 $(\text{N } a = \text{'frame' impl}$
 $(\text{IsAttributeSet}^{2.62}(C a) \text{ and}$
 $\text{NAMS}^{1.18}(C a) \subseteq [\text{'colour'; 'border'; 'dimensions'; 'layout path';}$
 $\text{'permitted categories'; 'position'; 'transparency'}]_{10}) \text{ or}$
 $(\text{IsCol}(C a) \text{ and } \forall as \in (C a)$
 $(\text{IsAttributeSet}^{2.62}(as) \text{ and}$
 $\text{NAMS}^{1.18}(as) \subseteq [\text{'colour'; 'border'; 'dimensions'; 'layout path'; 'permitted categories';}$
 $\text{'position'; 'transparency'}]_{12})_{11}) \text{ and}$
 $(\text{N } a = \text{'block' impl}$
 $(\text{IsAttributeSet}^{2.62}(C a) \text{ and}$
 $\text{NAMS}^{1.18}(C a) \subseteq [\text{'border'; 'colour'; 'content architecture class'; 'dimensions';}$
 $\text{'position'; 'presentation attributes'; 'presentation style';}$
 $\text{'transparency'}]_{13}) \text{ or}$
 $(\text{IsCol}(C a) \text{ and } \forall as \in (C a)$
 $(\text{IsAttributeSet}^{2.62}(as) \text{ and}$
 $\text{NAMS}^{1.18}(as) \subseteq [\text{'border'; 'colour'; 'content architecture class'; 'dimensions';}$
 $\text{'position'; 'presentation attributes'; 'presentation style';}$
 $\text{'transparency'}]_{17})_{16})_{14})_{13})_{11})_{10})$

Semiformal Description 2.98

Predicate "is a position value" (5.4.1.1)

The value of the attribute 'position' is a nomination where the name is either 'fixed position' or 'variable position' and the component is a nomination again (4-7, 10, 11). For the name 'fixed position' the names are 'horizontal position' or 'vertical position' and the components are non-negative integers (6-9). For 'variable position' the names are 'offset', 'separation', 'alignment' and 'fill order' (10-12). For 'offset' the component is a nomination, where the names are 'leading offset', 'trailing offset', 'left-hand offset' and 'right-hand offset' and the components are non-negative integers (14-19). For 'separation' the component is also a nomination, where the names are 'leading edge', 'trailing edge' and 'centre separation' and the components are non-negative integers (20-25). For 'alignment' the component is either 'right-hand aligned', 'centred' or 'left-hand aligned' (26-28). For 'fill order' the component is either 'normal order' or 'reverse order' (29-31). The parameters and sub-parameters are independently defaultable (9, 15, 19, 21, 27, 30).

Definition 2.98

1 $\forall v$
 2 $({}_0 \text{IsPositionValue}(v) \text{ iff}$
 3 $\exists n, c$
 4 $({}_1 v = [n : c] \text{ and}$
 5 $({}_2 n \in [\text{'fixed position'}; \text{'variable position'}] \text{ and}$
 6 $({}_3 n = \text{'fixed position'} \text{ impl}$
 7 $({}_4 \text{IsNom}(c) \text{ and}$
 8 $\text{NAMS}^{1.18}(c) = [\text{'horizontal position'}; \text{'vertical position'}] \text{ and}$
 9 $\forall a \in {}^c c. (\text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsNnInt}^{1.7}(C a)) \text{ and}$
 10 $({}_5 n = \text{'variable position'} \text{ impl}$
 11 $({}_6 \text{IsNom}(c) \text{ and}$
 12 $\text{NAMS}^{1.18}(c) = [\text{'offset'}; \text{'separation'}; \text{'alignment'}; \text{'fill order'}] \text{ and}$
 13 $\forall a \in {}^c c.$
 14 $({}_7 ({}_8 N a = \text{'offset'} \text{ impl}$
 15 $({}_9 \text{IsPlaceholder}^{1.19}(C a) \text{ or}$
 16 $({}_{10} \text{IsNeNom}^{1.2}(C a) \text{ and}$
 17 $\text{NAMS}^{1.18}(C a) = [\text{'leading offset'}; \text{'trailing offset'}; \text{'left-hand offset'}$
 18 $\text{'right-hand offset'}] \text{ and}$
 19 $\forall b \in a. (\text{IsPlaceholder}^{1.19}(C b) \text{ or } \text{IsNnInt}^{1.7}(C b)) \text{ and}$
 20 $({}_{11} N a = \text{'separation'} \text{ impl}$
 21 $({}_{12} \text{IsPlaceholder}^{1.19}(C a) \text{ or}$
 22 $({}_{13} \text{IsNeNom}^{1.2}(C a) \text{ and}$
 23 $\text{NAMS}^{1.18}(C a) = [\text{'leading edge'}; \text{'trailing edge'};$
 24 $\text{'centre separation'}] \text{ and}$
 25 $\forall b \in a. (\text{IsPlaceholder}^{1.19}(C b) \text{ or } \text{IsNnInt}^{1.7}(C b)) \text{ and}$
 26 $({}_{14} N a = \text{'alignment'} \text{ impl}$
 27 $({}_{15} \text{IsPlaceholder}^{1.19}(C a) \text{ or}$
 28 $C a \in [\text{'right-hand aligned'}; \text{'centred'}; \text{'left-hand aligned'}] \text{ and}$
 29 $({}_{16} N a = \text{'fill order'} \text{ impl}$
 30 $({}_{17} \text{IsPlaceholder}^{1.19}(C a) \text{ or}$
 31 $C a \in [\text{'normal order'}; \text{'reverse order'}])$

Semiformal Description 2.99

Predicate "is a dimensions value" (5.4.1.2)

The value of the attribute 'dimensions' is a nomination of two components where the name is either 'horizontal dimension' or 'vertical dimension'. The component is a nomination again, where the name is either 'maximum size' (the corresponding component is 'applies'), 'fixed dimension' (the corresponding component is then a positive integer) or 'variable page height' (the corresponding component is any integer) or 'rule A' or 'rule B'. In the last two cases the component is once again a nomination where the name is 'minimum dimension' or 'maximum dimension' and the component is a positive integer. The parameters are independently defaultable. The sub-parameter 'variable page height' is not permitted for the parameter 'horizontal dimension'.

Definition 2.99

$$\begin{aligned}
 &1 \quad \forall v \\
 &2 \quad ({}_0 \text{IsDimensionsValue}(v) \text{ iff} \\
 &3 \quad \text{IsNeNom}^{1.2}(v) \text{ and} \\
 &4 \quad \text{NAMS}^{1.18}(v) = ['\text{horizontal dimension}'; '\text{vertical dimension}'] \text{ and} \\
 &5 \quad \forall a \in \sim v. \\
 &6 \quad ({}_1 \text{IsPlaceholder}^{1.19}(C a) \text{ or} \\
 &7 \quad ({}_2 \exists n, c \\
 &8 \quad ({}_3 C a = [n : c] \text{ and} \\
 &9 \quad n \in ['\text{fixed dimension}'; '\text{maximum size}'; '\text{variable page height}'; '\text{rule A}'; '\text{rule B}'] \text{ and} \\
 &10 \quad ({}_4 ({}_5 n = '\text{fixed dimension}' \text{ impl } \text{IsNat}(c))_5 \text{ and} \\
 &11 \quad ({}_6 n = '\text{maximum size}' \text{ impl } c = '\text{applies}')_6 \text{ and} \\
 &12 \quad ({}_7 n = '\text{variable page height}' \text{ impl } \text{IsInt}(c))_7 \text{ and} \\
 &13 \quad ({}_8 n \in ['\text{rule A}'; '\text{rule B}'] \text{ impl} \\
 &14 \quad ({}_9 \text{IsNom}(c) \text{ and} \\
 &15 \quad \text{NAMS}^{1.18}(c) \subseteq ['\text{minimum dimension}'; '\text{maximum dimension}'] \text{ and} \\
 &16 \quad \forall b \in \sim c. (\text{IsNat}(C b))_9)_4 \text{ and} \\
 &17 \quad N a = '\text{horizontal dimension}' \text{ impl } n \neq '\text{variable page height}'_3)_2)_1)_0)
 \end{aligned}$$

Semiformal Description 2.100

Predicate "is a border value" (5.4.1.3)

The value of the attribute 'border' is a nomination of up to four components where the names are either 'left-hand-edge', 'right-hand-edge', 'leading edge' or 'trailing edge'. The component is either 'null' or a nomination of up to three components, where the names are either 'border line width', 'border line type' or 'border freespace width'. The components with the name 'border line width' or 'border freespace width' are non-negative integers. The component with the name 'border line type' is one of the following: 'solid', 'dashed', 'dot', 'dash-dot', 'dash-dot-dot', 'invisible'.

Definition 2.100

```

1   $\forall v$ 
2  ( $\text{IsBorderValue}(v)$  iff
3     $\text{IsNom}(v)$  and
4     $\text{NAMS}^{1.18}(v) \subseteq [\text{'left-hand-edge'}; \text{'right-hand-edge'}; \text{'trailing edge'};$ 
5       $\text{'leading edge'}]$  and
6     $\forall a \in \sim v.$ 
7    ( $C a = \text{'null'}$  or
8      ( $\text{IsNom}(C a)$  and
9         $\text{NAMS}^{1.18}(C a) \subseteq [\text{'border line width'}; \text{'border line type'};$ 
10           $\text{'border freespace width'}]$ ) and
11       $\forall b \in a.$ 
12      ( $(N b \in [\text{'border line width'}; \text{'border freespace width'}])$  impl
13         $\text{IsNnInt}^{1.7}(C b)$ ) and
14      ( $N b = \text{'border line type'}$  impl
15         $C b \in [\text{'solid'}; \text{'dashed'}; \text{'dot'}; \text{'dash-dot'}; \text{'dash-dot-dot'}; \text{'invisible'}]_s)_2)_1)_0$ 

```

Semiformal Description 2.101

Predicate "is a balance value" (5.4.2.1)

The value of the attribute 'balance' is either 'null' or a sequence of more than one identifiers of immediately subordinate object descriptions (in the case of object descriptions) or object class descriptions (in the case of object class descriptions).

Definition 2.101

```

1   $\forall v$ 
2  ( $\text{IsBalanceValue}(v)$  iff
3     $v = \text{'null'}$  or
4    ( $\text{IsNeCat}^{1.3}(v)$  and  $\text{LENGTH}^{1.16}(v) > 1$  and
5      ( $\forall a \in \sim v. (\text{IsLayoutObjectId}^{2.79}(C a))$  or
6         $\forall a \in \sim v. (\text{IsLayoutObjectClassId}^{2.82}(C a))_2)_1)_0$ 

```

Semiformal Description 2.102

Predicate "is a layout path value" (5.4.2.2)

A layout path value is one of the following: '0°', '90°', '180°', '270°'.

Definition 2.102

```

1   $\forall v$ 
2  ( $\text{IsLayoutPathValue}(v)$  iff
3     $v \in [\text{'0°'}; \text{'90°'}; \text{'180°'}; \text{'270°'}]_0$ )

```

Semiformal Description 2.103

Predicate "is a transparency value" (5.4.3.2)

The value of the attribute 'transparency' is either 'transparent' or 'opaque'.

Definition 2.103

- 1 $\forall v$
- 2 $(\text{IsTransparencyValue}(v) \text{ iff}$
- 3 $v \in [\text{'transparent'}; \text{'opaque'}]_0)$

Semiformal Description 2.104

Predicate "is a colour value" (5.4.3.3)

The value of the attribute 'colour' is either 'colourless' or 'white'.

Definition 2.104

- 1 $\forall v$
- 2 $(\text{IsColourValue}(v) \text{ iff}$
- 3 $v \in [\text{'colourless'}; \text{'white'}]_0)$

Semiformal Description 2.105

Predicate "is a medium type value" (5.4.3.5)

The value of the attribute 'medium type' is a nomination of two components. For the name 'nominal page size' the component is a pair of positive integers, the first one specifying the horizontal, the second one the vertical dimensions of the page. For the name 'side of sheet' the component is either 'recto', 'verso' or 'unspecified'. The parameters are independently defaultable.

Definition 2.105

- 1 $\forall v$
- 2 $(\text{IsMediumTypeValue}(v) \text{ iff}$
- 3 $\text{IsNeNom}^{1.2}(v) \text{ and}$
- 4 $\text{NAMS}^{1.18}(v) = [\text{'nominal page size'}; \text{'side of sheet'}] \text{ and}$
- 5 $\forall a \in \sim v.$
- 6 $(\text{IsNominalPageSize}(a) \text{ impl}$
- 7 $(\text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsPairOfPosInt}^{1.9}(C a)_2) \text{ and}$
- 8 $(\text{IsSideOfSheet}(a) \text{ impl}$
- 9 $(\text{IsPlaceholder}^{1.19}(C a) \text{ or } C a \in [\text{'recto'}; \text{'verso'}; \text{'unspecified'}]_3)_4)_1)_0)$

Semiformal Description 2.106

Predicate "is a protection value" (5.5.1)

A protection value is either 'protected' or 'unprotected'.

Definition 2.106

- 1 $\forall v$
- 2 $(\text{IsProtectionValue}(v) \text{ iff}$
- 3 $v \in [\text{'protected'}; \text{'unprotected'}]_0)$

Semiinformal Description 2.107

Predicate "is a layout style identifier" (5.6.1)

A layout style identifier is a pair of two non-negative integers where the first integer is 4.

Definition 2.107

- 1 $\forall v$
- 2 $(\text{IsLayoutStyleId}(v) \text{ iff}$
- 3 $\text{IsPairOfNnInt}^{1.8}(v) \text{ and } \text{HEAD}^{1.13}(v) = 4_0)$

Semiinformal Description 2.108

Predicate "is a block alignment value" (5.7.1)

A block alignment value is one of the following: 'right-hand aligned', 'left-hand aligned', 'centred', 'null'.

Definition 2.108

- 1 $\forall v$
- 2 $(\text{IsBlockAlignmentValue}(v) \text{ iff}$
- 3 $v \in [\text{'right-hand aligned'; 'left-hand aligned'; 'centred'; 'null'}]_0)$

Semiinformal Description 2.109

Predicate "is a concatenation value" (5.7.2)

The value of the attribute 'concatenation' is either 'concatenated' or 'non-concatenated'.

Definition 2.109

- 1 $\forall v$
- 2 $(\text{IsConcatenationValue}(v) \text{ iff}$
- 3 $v \in [\text{'concatenated'; 'non-concatenated'}]_0)$

Semiinformal Description 2.110

Predicate "is a fill order value" (5.7.3)

The value of the attribute 'fill order' is either 'normal order' or 'reverse order'.

Definition 2.110

- 1 $\forall v$
- 2 $(\text{IsFillOrderValue}(v) \text{ iff}$
- 3 $v \in [\text{'normal order'; 'reverse order'}]_0)$

Semiinformal Description 2.111

Predicate "is a layout object reference" (5.7.4, 5.7.7)

A layout object reference is either 'object type page' or 'null' or a layout category name or a layout object class identifier.

Definition 2.111

- 1 $\forall v$
- 2 $(\text{IsLayoutObjectReference}(v) \text{ iff}$
- 3 $v \in [\text{'object type page'}; \text{'null'}] \text{ or}$
- 4 $\text{IsLayoutCatName}^{2.112}(v) \text{ or } \text{IsLayoutObjectClassId}^{2.82}(v))$

Semiinformal Description 2.112

Predicate "is a layout category name" (5.7.5)

A layout category name is a string of characters from the minimum subrepertoire of ISO 6937-2.

Definition 2.112

- 1 $\forall v$
- 2 $(\text{IsLayoutCatName}(v) \text{ iff}$
- 3 $\text{IsISO6937MSSString}^{1.20}(v))$

Semiinformal Description 2.113

Predicate "is a set of layout category names"

Each element of a set of layout category names is a layout category name.

Definition 2.113

- 1 $\forall v$
- 2 $(\text{IsSetOfLayoutCatNames}(v) \text{ iff}$
- 3 $\text{IsCol}(v) \text{ and}$
- 4 $\forall cst \in v (\text{IsLayoutCatName}^{2.112}(cst))$

Semiinformal Description 2.114

Predicate "is an offset value" (5.7.8)

The value of the attribute 'offset' is a nomination of four components with the names 'leading offset', 'trailing offset', 'left-hand offset' and 'right-hand offset'. The components are non-negative numbers. The parameters are independently defaultable.

Definition 2.114

- 1 $\forall v$
- 2 $(\text{IsOffsetValue}(v) \text{ iff}$
- 3 $\text{IsNeNom}^{1.2}(v) \text{ and}$
- 4 $\text{NAMS}^{1.18}(v) = [\text{'leading offset'}; \text{'trailing offset'}; \text{'left-hand offset'};$
- 5 $\text{'right-hand offset'}] \text{ and}$
- 6 $\forall a \in v. (\text{IsPlaceholder}^{1.19}(C a) \text{ or } \text{IsNnInt}^{1.7}(C a))$

Semiformal Description 2.115

Predicate "is a same layout object value" (5.7.9)

The value of the attribute 'same layout object' is a nomination of up to two components. For the name 'logical object' the component is either 'null', a logical object identifier or an object or object class identifier expression. If the component is not 'null' the name 'layout object' must be specified. For the name 'layout object' the component is either 'object type page', a layout object class identifier or a layout category name.

Definition 2.115

- 1 $\forall v$
- 2 $(\text{IsSameLayoutObjectValue}(v) \text{ iff}$
- 3 $\text{IsNeNom}^{1.2}(v) \text{ and}$
- 4 $\text{NAMS}^{1.18}(v) \subseteq [\text{'layout object'}; \text{'logical object'}] \text{ and}$
- 5 $\forall a \in \sim v.$
- 6 $(\text{N } a = \text{'logical object'} \text{ impl}$
- 7 $(\text{C } a = \text{'null'} \text{ or } \text{IsLogicalObjectId}^{2.78}(\text{C } a) \text{ or } \text{IsObjectOrObjectClassIdExpression}^{2.70}(\text{C } a)) \text{ and}$
- 8 $\text{C } a \neq \text{'null'} \text{ impl 'layout object'} \in \text{NAMS}^{1.18}(v) \text{ and}$
- 9 $\text{N } a = \text{'layout object'} \text{ impl}$
- 10 $(\text{C } a = \text{'object type page'} \text{ or } \text{IsLayoutObjectClassId}^{2.82}(\text{C } a) \text{ or } \text{IsLayoutCatName}^{2.112}(\text{C } a)) \text{ and}$

Semiformal Description 2.116

Predicate "is a separation value" (5.7.10)

The value of the attribute 'separation' is a nomination, i.e., a set of pairs (name, value). The name is either 'leading edge', 'trailing edge' or 'centre separation'; the value is a non-negative integer. The parameters are independently defaultable.

Definition 2.116

- 1 $\forall v$
- 2 $(\text{IsSeparationValue}(v) \text{ iff}$
- 3 $\text{IsNeNom}^{1.2}(v) \text{ and}$
- 4 $\text{NAMS}^{1.18}(v) = [\text{'leading edge'}; \text{'trailing edge'}; \text{'centre separation'}] \text{ and}$
- 5 $\forall a \in \sim v.$
- 6 $(\text{IsPlaceholder}^{1.19}(\text{C } a) \text{ or } \text{IsNnInt}^{1.7}(\text{C } a)) \text{ and}$

Semiformal Description 2.117

Predicate "is a presentation style identifier" (5.8.1)

A presentation style identifier is a pair of non-negative integers where the first integer is 5.

Definition 2.117

- 1 $\forall v$
- 2 $(\text{IsPresentationStyleId}(v) \text{ iff}$
- 3 $\text{IsPairOfNnInt}^{1.8}(v) \text{ and } \text{HEAD}^{1.13}(v) = 5 \text{ and}$

Semiformal Description 2.118

Predicate "is a layout content portion identifier" (5.9.1)

A layout content portion identifier is either a layout object identifier or a layout object class identifier whose length is greater than 1.

Definition 2.118

- 1 $\forall v$
- 2 $(\text{IsLayoutContentPortionId}(v) \text{ iff}$
- 3 $\text{IsLayoutObjectId}^{2.79}(v) \text{ or } \text{IsLayoutObjectClassId}^{2.82}(v) \text{ and}$
- 4 $\text{LENGTH}^{1.16}(v) > 1_0)$

Semiformal Description 2.119

Predicate "is a logical content portion identifier" (5.9.1)

A logical content portion identifier is either a logical object identifier or a logical object class identifier whose length is greater than 1.

Definition 2.119

- 1 $\forall v$
- 2 $(\text{IsLogicalContentPortionId}(v) \text{ iff}$
- 3 $\text{IsLogicalObjectId}^{2.78}(v) \text{ or } \text{IsLogicalObjectClassId}^{2.81}(v) \text{ and}$
- 4 $\text{LENGTH}^{1.16}(v) > 1_0)$

Semiformal Description 2.120

Predicate "is a type of coding value" (5.9.2)

The value of the attribute 'type of coding' is either a character content type of coding value, a raster graphics content type of coding value or a geometric graphics content type of coding value.

Definition 2.120

- 1 $\forall v$
- 2 $(\text{IsTypeOfCodingValue}(v) \text{ iff}$
- 3 $(\text{IsCharacterContentTypeOfCodingValue}^{2.121}(v) \text{ or}$
- 4 $\text{IsRasterGraphicsContentTypeOfCodingValue}^{2.122}(v) \text{ or}$
- 5 $\text{IsGeometricGraphicsContentTypeOfCodingValue}^{2.123}(v))_0)$

Semiformal Description 2.121

Predicate "is a character content type of coding value" (5.9.2)

A character content type of coding value is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex C.

Definition 2.121

- 1 $\forall v$
- 2 $(\text{IsCharacterContentTypeOfCodingValue}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_0)$

Semiformal Description 2.122

Predicate "is a raster graphics content type of coding value" (5.9.2)

A raster graphics content type of coding value is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex D.

Definition 2.122

- 1 $\forall v$
- 2 $({}_0 \text{IsRasterGraphicsContentTypeOfCodingValue}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_0)$

Semiformal Description 2.123

Predicate "is a geometric graphics content type of coding value" (5.9.2)

A geometric graphics content type of coding value is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex E.

Definition 2.123

- 1 $\forall v$
- 2 $({}_0 \text{IsGeometricGraphicsContentTypeOfCodingValue}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_0)$

Semiformal Description 2.124

Predicate "is a content information value" (5.9.3.1)

The value of the attribute 'content information' is either a character content information value, a raster graphics content information value or a geometric graphics content information value.

Definition 2.124

- 1 $\forall v$
- 2 $({}_0 \text{IsContentInformationValue}(v) \text{ iff}$
- 3 $({}_1 \text{IsCharacterContentInformationValue}^{2.125}(v) \text{ or}$
- 4 $\text{IsRasterGraphicsContentInformationValue}^{2.126}(v) \text{ or}$
- 5 $\text{IsGeometricGraphicsContentInformationValue}^{2.127}(v)_1)_0)$

Semiformal Description 2.125

Predicate "is a character content information value" (5.9.3.1)

A character content information value is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex C.

Definition 2.125

- 1 $\forall v$
- 2 $({}_0 \text{IsCharacterContentInformationValue}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_0)$

Semiformal Description 2.126

Predicate "is a raster graphics content information value" (5.9.3.1)

A raster graphics content information value is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex D.

Definition 2.126

- 1 $\forall v$
- 2 $(\text{IsRasterGraphicsContentInformationValue}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiformal Description 2.127

Predicate "is a geometric graphics content information value" (5.9.3.1)

A geometric graphics content information value is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex E.

Definition 2.127

- 1 $\forall v$
- 2 $(\text{IsGeometricGraphicsContentInformationValue}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiformal Description 2.128

Predicate "is an alternative character sets string" (5.9.3.2)

The value of the attribute 'alternative representation' is an atomic construct, i.e., the internal structure of the value is not considered in the formal specification of the document structure. The permitted values of this attribute depend on the value of the attribute 'alternative character sets' in the document profile.

Definition 2.128

- 1 $\forall v$
- 2 $(\text{IsAlternativeCharacterSetsString}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiformal Description 2.129

Predicate "is a coding attributes value" (5.9.4)

The value of the attribute 'coding attributes' is a collection where each element is either a character content coding attribute, a raster graphics content coding attribute or geometric graphics content coding attribute.

Definition 2.129

- 1 $\forall v$
- 2 $(\text{IsCodingAttributesValue}(v) \text{ iff}$
- 3 $\text{IsCol}(v) \text{ and}$
- 4 $\forall a \in v$
- 5 $(\text{IsCharacterContentCodingAttribute}^{2.130}(a) \text{ or}$
- 6 $\text{IsRasterGraphicsContentCodingAttribute}^{2.131}(a) \text{ or}$
- 7 $\text{IsGeometricGraphicsContentCodingAttribute}^{2.132}(a)_o)$

Semiformal Description 2.130

Predicate "is a character content coding attribute" (5.9.4)

A character content coding attribute is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex C.

Definition 2.130

- 1 $\forall v$
- 2 $({}_o \text{IsCharacterContentCodingAttribute}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiformal Description 2.131

Predicate "is a raster graphics content coding attribute" (5.9.4)

A raster graphics content coding attribute is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex D.

Definition 2.131

- 1 $\forall v$
- 2 $({}_o \text{IsRasterGraphicsContentCodingAttribute}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiformal Description 2.132

Predicate "is a geometric graphics content coding attribute" (5.9.4)

A geometric graphics content coding attribute is considered an atomic construct in the formal specification of the document structure. The permitted values are formally defined in annex E.

Definition 2.132

- 1 $\forall v$
- 2 $({}_o \text{IsGeometricGraphicsContentCodingAttribute}(v) \text{ iff}$
- 3 $\text{IsAtom}(v)_o)$

Semiformal Description 2.133

Predicate "is a character sequence"

A character sequence is a catenation of characters.

Definition 2.133

- 1 $\forall v$
- 2 $({}_o \text{IsCharSeq}(v) \text{ iff}$
- 3 $\text{IsCat}(v) \text{ and } \forall m \in \sim v \bullet (\text{IsCharacter}^{2.134}(C\ m))_o)$

Semiinformal Description 2.134

Predicate "is a character"

A character is an element of a defined character set and is considered an atomic construct in the formal specification.

Definition 2.134

- 1 $\forall z$
- 2 $(\text{IsCharacter}(z) \text{ iff } \text{IsAtom}(z))$
- 3

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7.4 Subsidiary definitions

This is the list of all definitions for predicates and functions (operators) which have been factorized from 7.2–7.3 for the sake of readability.

7.4.1 Predicates

Semiformal Description 2.135

Predicate “is described by”

An entity s is described by an entity g if s is a specific description and g is a corresponding generic description (3-5) and if each object description so in s which has an attribute 'object class' (6,7) refers to an object class description go in g (8-10) with the same value of 'object type' if specified in so (11-12). If so is a composite object description (13) and the associated go has an attribute 'generator for subordinates' (14), go specifies through its attribute 'generator for subordinates' a sequence of or a set of sequences of (subordinate) object class identifiers. Among them is that sequence of object class identifiers which is obtained from the object descriptions immediately subordinate to so (15). If so is a basic logical object description which has no attribute 'content portions' (16) (and therefore refers to a basic logical object class description go) the content portions connected with go through 'content portions' or the content obtained from go through 'content generator' (17) are regarded as the content of so . If so is a basic layout object description which has no attribute 'content portions' (18) (and therefore refers to a basic layout object class description go) the content portions connected with go through 'content portions' (19) are regarded as the content of so . (If so is a basic object description which has an attribute 'content portions', any specific content portion descriptions are allowed.)

Definition 2.135

- 1 $\forall s, g$
- 2 $(s \text{ IsDescribedBy}(g) \text{ iff}$
- 3 $(\text{IsSpecificLogicalDescription}^{2.13}(s) \text{ and } \text{IsGenericLogicalDescription}^{2.10}(g)_2)$
- 4 or
- 5 $(\text{IsSpecificLayoutDescription}^{2.14}(s) \text{ and } \text{IsGenericLayoutDescription}^{2.11}(g)_3)_1 \text{ and}$
- 6 $\forall so \in s$
- 7 $(\text{IsObjectDescription}^{2.55}(so) \text{ and } \text{'object class'} \in \text{NAMS}^{1.18}(so) \text{ impl}$
- 8 $\exists go \in g$
- 9 $(\text{IsObjectClassDescription}^{2.37}(go) \text{ and}$
- 10 $C \sim so \cdot \text{'object class'} = C \sim go \cdot \text{'object class identifier'} \text{ and}$
- 11 $(\text{'object type'} \in \text{NAMS}^{1.18}(so) \text{ impl}$
- 12 $C \sim so \cdot \text{'object type'} = C \sim go \cdot \text{'object type'}_6) \text{ and}$
- 13 $(\text{IsCompositeObjectDescription}^{2.51}(so) \text{ and}$
- 14 $\text{'generator for subordinates'} \in \text{NAMS}^{1.18}(go) \text{ impl}$
- 15 $(\text{SEQCLASSIDIMSUB}^{2.156}(s, so, C \sim so \cdot \text{'subordinates'})) \text{IsSeqClassIdImSubIn}^{2.145}(go)_8) \text{ and}$
- 16 $(\text{IsBasicLogicalObjectDescription}^{2.41}(so) \text{ and } \text{'content portions'} \notin \text{NAMS}^{1.18}(so)_{10} \text{ impl}$
- 17 $(\text{'content portions'} \in \text{NAMS}^{1.18}(go) \text{ or } \text{'content generator'} \in \text{NAMS}^{1.18}(go)_{11})_9) \text{ and}$
- 18 $(\text{IsBasicLayoutObjectDescription}^{2.54}(so) \text{ and } \text{'content portions'} \notin \text{NAMS}^{1.18}(so)_{13} \text{ impl}$
- 19 $\text{'content portions'} \in \text{NAMS}^{1.18}(go)_{12})_7)_5)_4)_6)$

Semiformal Description 2.136

Predicate "is completely described by"

An entity s is completely described by an entity g if s is described by g which is a complete generic description (4) and if each object description so in s (5,6) refers through its attribute 'object class' (7) to an object class description go in g (8-10), which has an attribute 'generator for subordinates' if it is a composite object class description (11,12). If go has the attribute 'content generator' specified, go and/or so have the attribute 'content portions' specified (14-16).

Definition 2.136

- 1 $\forall s, g$
- 2 $(s) \text{IsCompletelyDescribedBy}(g) \text{ iff}$
- 3 $(s) \text{IsDescribedBy}^{2.135}(g) \text{ and}$
- 4 $\text{IsCompleteGenericDescription}^{2.9}(g) \text{ and}$
- 5 $\forall so \in s$
- 6 $(\text{IsObjectDescription}^{2.55}(so) \text{ impl}$
- 7 $(\text{not IsBlockDescription}^{2.49}(so) \text{ impl 'object class' } \in \text{NAMS}^{1.18}(so)_2) \text{ and}$
- 8 $\text{'object class' } \in \text{NAMS}^{1.18}(so) \text{ impl}$
- 9 $\exists go \in g$
- 10 $(\text{IsObjectClassDescription}^{2.37}(go) \text{ and}$
- 11 $C \sim so \cdot \text{'object class'} = C \sim go \cdot \text{'object class identifier'} \text{ and}$
- 12 $(\text{IsCompositeObjectClassDescription}^{2.33}(go) \text{ impl}$
- 13 $\text{'generator for subordinates'} \in \text{NAMS}^{1.18}(go)_4) \text{ and}$
- 14 $(\text{'content generator'} \in \text{NAMS}^{1.18}(go) \text{ impl}$
- 15 $(\text{'content portions'} \in \text{NAMS}^{1.18}(go) \text{ or}$
- 16 $\text{'content portions'} \in \text{NAMS}^{1.18}(so))_{s,3,1,0})$

Semiformal Description 2.137

Predicate "is content connected"

An entity $csts$ is content connected if it is a collection (3) and if each content portion description $cont$ in it (4,5) is referenced at least from one basic object description or basic object class description cst (6).

Definition 2.137

- 1 $\forall csts$
- 2 $(csts) \text{IsContentConnected}(csts) \text{ iff}$
- 3 $\text{IsCol}(csts) \text{ and}$
- 4 $\forall cont \in csts$
- 5 $(\text{IsContentPortionDescription}^{2.56}(cont) \text{ impl}$
- 6 $\exists cst \in csts ((cont) \text{DescribesContPortOf}^{2.153}(cst))_{1,0})$

Semiformal Description 2.138

Predicate "is content complete"

An entity *csts* is content complete if it is a collection (3) and if for all basic object descriptions or basic object class descriptions *cst* in it (4-6) each reference out of the attribute 'content portions' (6-8) is satisfied (9-15).

Definition 2.138

```

1   $\forall cst$ 
2  ( $_0$  IsContentComplete(csts) iff
3    IsCol(csts) and
4     $\forall cst \in csts$ 
5    ( $_1$  ( $_2$  IsBasicObjectDescription2.52(cst) or
6      IsBasicObjectClassDescription2.36(cst) $_3$ ) and
7      'content portions'  $\in$  NAMS1.18(cst) $_2$ ) impl
8       $\forall r \in \sim cst \cdot \text{'content portions'}$  .
9      ( $_4$   $\exists cont \in csts$ 
10       ( $_5$  IsContentPortionDescription2.56(cont) and
11         ( $_6$  C  $\sim cont \cdot \text{'content identifier logical'}$  =
12           C  $\sim cst \cdot \langle \text{'object identifier'}, \text{'object class identifier'} \rangle // [ \rightarrow C r \rightarrow ]$ 
13           or
14           C  $\sim cont \cdot \text{'content identifier layout'}$  =
15           C  $\sim cst \cdot \langle \text{'object identifier'}, \text{'object class identifier'} \rangle // [ \rightarrow C r \rightarrow ]$   $_6$ ) $_4$ ) $_1$ ) $_0$ )

```

Semiformal Description 2.139

Predicate "is class-immediate-subordinates complete"

An entity *g* is complete with respect to the object class descriptions for immediate subordinates if it is a collection (3) and if for all composite object class descriptions *cst* in it (4,5) each reference *r* out of the value *e* of the attribute 'generator for subordinates' is satisfied (7-13).

Definition 2.139

```

1   $\forall g$ 
2  ( $_0$  IsClassImSubComplete(g) iff
3    IsCol(g) and
4     $\forall cst \in g$ 
5    ( $_1$  ( $_2$  IsCompositeObjectClassDescription2.33(cst) and
6      'generator for subordinates'  $\in$  NAMS1.18(cst) $_2$ ) impl
7      ( $_3$   $\exists e$ 
8        ( $_4$   $e = C \sim cst \cdot \text{'generator for subordinates'}$  and
9          IsConstructionExpression2.85(e) and
10          $\forall r \in [id | (id)OccursIn^{2.147}(e)]$ 
11         ( $_6$   $\exists sub \in g$ 
12           ( $_7$  IsObjectClassDescription2.37(sub) and
13             C  $\sim sub \cdot \text{'object class identifier'}$  =  $r$  $_6$ ) $_7$ ) $_4$ ) $_3$ ) $_1$ ) $_0$ )

```

Semiformal Description 2.140

Predicate "is immediate-subordinates complete"

An entity s is complete with respect to the object descriptions for immediate subordinates if it is a collection (3) and if for all composite object descriptions cst in it (4,5) each reference r out of the value of the attribute 'subordinates' (6) is satisfied (7-10).

Definition 2.140

```

1   $\forall s$ 
2  ( ${}_0$  IsImSubComplete( $s$ ) iff
3    IsCol( $s$ ) and
4     $\forall cst \in s$ 
5    ( ${}_1$  IsCompositeObjectDescription2.51( $cst$ ) impl
6       $\forall r \in \sim cst \cdot \text{'subordinates'} \cdot$ 
7      ( ${}_2 \exists sub \in s$ 
8        ( ${}_3$  IsObjectDescription2.55( $sub$ ) and
9           $C \sim sub \cdot \text{'object identifier'} =$ 
10          $C \sim cst \cdot \text{'object identifier'} // [ \rightarrow C r \rightarrow ]_3)_2)_1)_0$ )

```

Semiformal Description 2.141

Predicate "is contained in"

An entity $slay$ is contained in an entity $slog$ if $slay$ is a specific layout description, $slog$ is a specific logical description and the set of all content portion descriptions of $slog$ is a subset of all content portion descriptions of $slay$.

Definition 2.141

```

1   $\forall slay, slog$ 
2  ( ${}_0$  ( $slog$ )IsContainedIn( $slay$ ) iff
3    IsSpecificLayoutDescription2.14( $slay$ ) and
4    IsSpecificLogicalDescription2.13( $slog$ ) and
5    ALLCONT2.155( $slog$ )  $\subseteq$  ALLCONT2.155( $slay$ ) ${}_0$ )

```

Semiformal Description 2.142

Predicate "is an object class identifier for immediate subordinates"

An entity id is an object class identifier for immediate subordinates of the entity gco , if gco has an attribute 'generator for subordinates', whose value e is a "construction expression". The predicate OccursIn is True, if the object class identifier id occurs in the "construction expression" e .

Definition 2.142

```

1   $\forall id, gco$ 
2  ( ${}_0$  ( $id$ )IsClassIdImSubIn( $gco$ ) iff
3    IsAttributeSet2.62( $gco$ ) and
4     $\exists a \in \sim gco \cdot \exists e$ 
5    ( ${}_1$   $N a = \text{'generator for subordinates'}$  and  $e = C a$  and
6    IsConstructionExpression2.85( $e$ ) and ( $id$ )OccursIn2.147( $e$ ) ${}_1$ ) ${}_0$ )

```

Semiformal Description 2.143

Predicate "is an object identifier of an immediate subordinate"

An entity id is an object identifier of an immediate subordinate object of the entity sco if it is referred to (via 'subordinates') from the entity sco .

Definition 2.143

- 1 $\forall id, sco$
- 2 $(_o(id)IsIdImSubIn(sco) \text{ iff}$
- 3 $IsAttributeSet^{2.62}(sco) \text{ and}$
- 4 $\exists n \in \sim sco \cdot 'subordinates' \cdot$
- 5 $(id = C \sim sco \cdot 'object identifier' // [\rightarrow C n \rightarrow])_o)$

Semiformal Description 2.144

Predicate "is an identifier of a content portion"

An entity id is an identifier of a content portion within the entity b , if it is referred to (via 'content portions') from the entity b , i.e., if id is the identifier of b extended with one of the numbers drawn from the value of 'content portions'.

Definition 2.144

- 1 $\forall id, b$
- 2 $(_o(id)IsIdContIn(b) \text{ iff}$
- 3 $IsAttributeSet^{2.62}(b) \text{ and}$
- 4 $\exists n \in \sim b \cdot 'content portions' \cdot$
- 5 $(_1 id = C \sim b \cdot < 'object identifier', 'object class identifier' > // [\rightarrow C n \rightarrow]_1)_o)$

Semiformal Description 2.145

Predicate "is a sequence of object class identifiers for immediate subordinates"

An entity idq is a sequence of object class identifiers for immediate subordinates of the entity gco , if gco has an attribute 'generator for subordinates' (5,6), whose value e is a "construction expression". The sequence idq is one of the sequences defined by e , i.e., is covered by e .

Definition 2.145

- 1 $\forall idq, gco$
- 2 $(_o(idq)IsSeqClassIdImSubIn(gco) \text{ iff}$
- 3 $IsAttributeSet^{2.62}(gco) \text{ and}$
- 4 $\exists a \in \sim gco \cdot \exists e$
- 5 $(_1 (N a = 'generator for subordinates' \text{ and } e = C a) \text{ and}$
- 6 $IsConstructionExpression^{2.85}(e) \text{ and } (idq)CoveredBy^{2.146}(e)_1)_o)$

Semiinformal Description 2.146

Predicate "is covered by"

A sequence idq of object class identifiers is covered by the construction expression e (which defines a possibly infinite set of such sequences), if idq is one of the sequences of object class identifiers defined by e . In general, e is the value of the attribute 'generator for subordinates' of an object class description, i.e., a "construction expression".

Definition 2.146

- 1 $\forall idq, e$
- 2 $({}_o(idq)CoveredBy(e) \text{ iff}$
- 3 $IsSeqOfObjectClassId^{2.84}(idq) \text{ and}$
- 4 $IsConstructionExpression^{2.85}(e)_o)$

Semiinformal Description 2.147

Predicate "occurs in"

An object class identifier id occurs in a construction expression m if it appears at least once in the construction expression m . In general, m is the value of the attribute 'generator for subordinates' of an object class description.

Definition 2.147

- 1 $\forall id, m$
- 2 $({}_o(id)OccursIn(m) \text{ iff}$
- 3 $({}_i IsConstructionExpression^{2.85}(m) \text{ and}$
- 4 $id \in COLC^{1.17} \sim m \downarrow \langle xs \parallel IsNnInt^{1.7}(C\ xs) \rangle \cdot {}_1)_o)$

Semiinformal Description 2.148

Predicate "is initial generic constituent in"

An entity cst is an initial generic constituent in an entity g if g is a collection (3) and cst is an object class description in it (3,4) and if there is no entity k in g from which a reference via 'generator for subordinates' is made to cst (5). Note that a self-reference ($k = cst$, i.e. from the object class description cst to itself) is not permitted for initial generic constituents.

Definition 2.148

- 1 $\forall cst, g$
- 2 $({}_o(cst)IsInitialGenericIn(g) \text{ iff}$
- 3 $IsCol(g) \text{ and } cst \in g \text{ and}$
- 4 $IsObjectClassDescription^{2.37}(cst) \text{ and}$
- 5 $\text{not } \exists k \in g((cst \text{ DescribesClassImSubOf}^{2.150}(k))_o)$

Semiinformal Description 2.149

Predicate "is initial specific constituent in"

An entity *cst* is an initial specific constituent in an entity *s* if *s* is a collection (3) and *cst* is an object description in it (3,4) and if there is no other entity *k* in *s* from which a reference via 'subordinates' is made to *cst* (5). Note that a self-reference (from the object description *cst* to itself) is not possible in a specific description.

Definition 2.149

- 1 $\forall cst, s$
- 2 $(_o(cst)IsInitialSpecificIn(s) \text{ iff}$
- 3 $IsCol(s) \text{ and } cst \in s \text{ and}$
- 4 $IsObjectDescription^{2.55}(cst) \text{ and}$
- 5 $\text{not } \exists k \in s((cst)DescribesImSubOf^{2.152}(k))_o)$

Semiinformal Description 2.150

Predicate "describes a class of immediate subordinates"

The "lower" object class description *lgo* describes a class of objects which are immediate subordinates of instances of the class described by the "higher" object class description *hgo*, if the 'object class identifier' of *lgo* is referred to from *hgo* via 'generator for subordinates'.

Definition 2.150

- 1 $\forall lgo, hgo$
- 2 $(_o(lgo)DescribesClassImSubOf(hgo) \text{ iff}$
- 3 $(C \sim lgo \cdot \text{'object class identifier'})IsClassIdImSubIn^{2.142}(hgo)_o)$

Semiinformal Description 2.151

Predicate "describes a class of subordinates"

An entity *lgo* ("lower" object class description) describes a class of objects which are (not necessarily immediate) subordinates of instances of the class described by the entity *hgo* ("higher" object class description) within the entity *g*, if *g* is a generic description containing *lgo* and *hgo* (3) and if *lgo* is referred to from *hgo* via 'generator for subordinates' (4) or has an "intermediate" object class description *i* immediately superior to it, which in turn describes a class of objects subordinate to instances of the object class described by *hgo* (5,6). The recursion ends when the intermediate object class description is immediately subordinate to *hgo* (4).

Definition 2.151

- 1 $\forall lgo, hgo, g$
- 2 $(_o(lgo)DescribesClassSubOf(hgo)In(g) \text{ iff}$
- 3 $IsGenericDescription^{2.8}(g) \text{ and } lgo \in g \text{ and } hgo \in g \text{ and}$
- 4 $(_i(lgo)DescribesClassImSubOf^{2.150}(hgo) \text{ or}$
- 5 $\exists i \in g$
- 6 $((lgo)DescribesClassImSubOf^{2.150}(i) \text{ and } (i)DescribesClassSubOf^{2.151}(hgo)In(g)_i)_o)$

Semiformal Description 2.152

Predicate "describes an immediate subordinate"

The "lower" object description lso describes an object which is an immediate subordinate of the object described by the "higher" object description hso , if the 'object identifier' of lso is referred to from hso via 'subordinates'.

Definition 2.152

- 1 $\forall lso, hso$
- 2 $(_o(lso) \text{DescribesImSubOf}(hso) \text{ iff}$
- 3 $(_1 \text{IsObjectDescription}^{2.55}(lso) \text{ and}$
- 4 $\text{IsCompositeObjectDescription}^{2.51}(hso) \text{ and}$
- 5 $\exists n \in \sim hso \cdot \text{'subordinates'} \cdot$
- 6 $(C \sim lso \cdot \text{'object identifier'} = C \sim hso \cdot \text{'object identifier'} // [\rightarrow C n \rightarrow])_1)_o$

Semiformal Description 2.153

Predicate "describes a content portion"

An entity $cont$ describes a content portion of the basic object described by b or of a basic object, which is an instance of the object class described by b , if $cont$ is a content portion description and either the 'content identifier logical' or the 'content identifier layout' is referred to from b via 'content portions'.

Definition 2.153

- 1 $\forall cont, b$
- 2 $(_o(cont) \text{DescribesContPortOf}(b) \text{ iff}$
- 3 $(_1 \text{IsContentPortionDescription}^{2.56}(cont) \text{ and}$
- 4 $(\text{IsBasicObjectDescription}^{2.52}(b) \text{ or } \text{IsBasicObjectClassDescription}^{2.36}(b)) \text{ and}$
- 5 $(_2 (C \sim cont \cdot \text{'content identifier logical'}) \text{IsIdContIn}^{2.144}(b) \text{ or}$
- 6 $(C \sim cont \cdot \text{'content identifier layout'}) \text{IsIdContIn}^{2.144}(b)_2)_1)_o$

7.4.2 Functions

Semiformal Description 2.154

Function "set of immediate subordinates"

The function IMSUB is defined, if so is an attribute set with at least the attributes 'object identifier' and 'subordinates', and if for each component spot m of the value of 'subordinates' the collection sos contains a nomination cst whose component 'object identifier' is equal to the object identifier of so with the component at m having been appended (i.e., if all subordinate object descriptions are within sos).

IMSUB returns the collection of all specific object descriptions within the collection sos whose identifiers, without the last number, are equal to the object identifier of the specific object description so and whose last number of their identifiers is among the numbers of 'subordinates' in the attribute set so .

Definition 2.154

```

1   $\forall so, sos$ 
2  ( ${}_o$  IMSUB( $so, sos$ ) =
3    IF IsAttributeSet2.62( $so$ ) and
4      ['object identifier'; 'subordinates']  $\subseteq$  NAMS1.18( $so$ ) and
5       $\forall m \in (\sim so. 'subordinates'. ) \exists cst \in sos$ 
6      ( ${}_1 C \sim cst. 'object identifier' = C \sim so. 'object identifier' // [ \rightarrow C m \rightarrow ]_1$ )
7    THEN
8      COLC1.17  $\sim sos. <_2 xs \parallel F xs. 'object identifier'. <ys \parallel PR^{1.12} ys = 1 > =$ 
9         $C \sim so. 'object identifier' \text{ and}$ 
10        $C xs. 'object identifier'. <ys \parallel PR^{1.12} ys = 1 > \in$ 
11       COLC1.17  $\sim so. 'subordinates'. <_2 >$ 
12    ELSE UNDEF ${}_o$ )

```

Semiformal Description 2.155

Function "all content portions"

ALLCONT returns the collection of all content portion descriptions contained in the collection $csts$.

Definition 2.155

```

1   $\forall csts$ 
2  ( ${}_o$  ALLCONT( $csts$ ) =
3    IF IsCol( $csts$ )
4    THEN [ $cst | cst \in csts \text{ and IsContentPortionDescription}^{2.56}(cst)$ ]
5    ELSE UNDEF ${}_o$ )

```

Semiformal Description 2.156

Function "sequence of class identifiers of immediate subordinates"

The function SEQCLASSIDIMSUB is defined, if so is an attribute set (3) with at least the attributes 'object identifier' and 'subordinates' (4), if sub is equal to a catenation which extends from some component to the last component of the value of 'subordinates' (5), and if all subordinate object descriptions of so are in sos (6) and have the attribute 'object class' (7).

SEQCLASSIDIMSUB returns the sequence of object class identifiers drawn from those immediate subordinate object descriptions which are referred to using the numbers of sub along with the object identifier of so . The object class identifiers in the obtained sequence appear in the same order as their comprising object descriptions according to the catenation sub . The sequence is obtained through recursive application of the function: a sequence of one object class identifier is formed using the first component of sub (9-11) and is concatenated with the result of SEQCLASSIDIMSUB applied to the remaining rearpart of sub (14) or with the empty catenation (13) if the recursion is to end.

Definition 2.156

```

1   $\forall sos, so, sub$ 
2  ( $SEQCLASSIDIMSUB(sos, so, sub) =$ 
3   IF  $IsAttributeSet^{2.62}(so)$  and
4      $['object\ identifier'; 'subordinates'] \subseteq NAMS^{1.18}(so)$  and
5      $\exists m \in (\sim so. 'subordinates'.) (sub = [ \rightarrow C\ m \rightarrow ] // R\ m)$  and
6      $IMSUB^{2.154}(so, sos) \subseteq sos$  and
7      $\forall cst \in IMSUB^{2.154}(so, sos) ('object\ class' \in NAMS^{1.18}(cst))$ 
8   THEN
9      $[ \rightarrow$ 
10     $C \sim sos. <_1 xs \parallel C\ xs. 'object\ identifier' =$ 
11      $C \sim so. 'object\ identifier' // [ \rightarrow HEAD^{1.13}(sub) \rightarrow ]_1 >. 'object\ class' \rightarrow ] //$ 
12    IF  $LENGTH^{1.16} sub = 1$ 
13    THEN  $[ \rightarrow ]$ 
14    ELSE  $SEQCLASSIDIMSUB^{2.156}(sos, so, TAIL^{1.15}(sub))$ 
15    ELSE UNDEF0)
```

7.5 Additional terminological definitions

Semiformal Description 2.157

Predicate "is a constituent"

A constituent is either a document profile or an object class description or an object description or a content portion description or a layout style or a presentation style.

Definition 2.157

- 1 $\forall cst$
- 2 $({}_o \text{IsConstituent}(cst) \text{ iff}$
- 3 $\text{IsDocumentProfilePart}^{2.20}(cst) \text{ or}$
- 4 $\text{IsObjectClassDescription}^{2.37}(cst) \text{ or}$
- 5 $\text{IsObjectDescription}^{2.55}(cst) \text{ or}$
- 6 $\text{IsContentPortionDescription}^{2.56}(cst) \text{ or}$
- 7 $\text{IsLayoutStyle}^{2.60}(cst) \text{ or}$
- 8 $\text{IsPresentationStyle}^{2.61}(cst)_o)$

Semiformal Description 2.158

Predicate "is a page class description" (3.5.7)

A page class description is either a composite page class description or a basic page class description.

Definition 2.158

- 1 $\forall cst$
- 2 $({}_o \text{IsPageClassDescription}(cst) \text{ iff}$
- 3 $\text{IsCompositePageClassDescription}^{2.28}(cst) \text{ or } \text{IsBasicPageClassDescription}^{2.29}(cst)_o)$

Semiformal Description 2.159

Predicate "is a logical content portion description"

A logical content portion description is a content portion description where the attribute 'content identifier logical' is specified.

Definition 2.159

- 1 $\forall logcont$
- 2 $({}_o \text{IsLogicalContentPortionDescription}(logcont) \text{ iff}$
- 3 $\text{IsContentPortionDescription}^{2.56}(logcont) \text{ and 'content identifier logical' } \in \text{NAMS}^{1.18}(logcont)_o)$

Semiformal Description 2.160

Predicate "is a layout content portion description"

A layout content portion description is a content portion description where the attribute 'content identifier layout' is specified.

Definition 2.160

- 1 $\forall laycont$
- 2 $({}_o \text{IsLayoutContentPortionDescription}(laycont) \text{ iff}$
- 3 $\text{IsContentPortionDescription}^{2.56}(laycont) \text{ and 'content identifier layout' } \in \text{NAMS}^{1.18}(laycont)_o)$

Semiinformal Description 2.161

Predicate "is a logical identifier"

A logical identifier is a sequence of non-negative integers where the first integer is 2 or 3.

Definition 2.161

- 1 $\forall v$
- 2 $(_o \text{IsLogicalId}(v) \text{ iff}$
- 3 $\text{IsSeqOfNnInt}^{1.23}(v) \text{ and}$
- 4 $(_i \text{HEAD}^{1.13}(v) = 2 \text{ or } \text{HEAD}^{1.13}(v) = 3)_o)$

Semiinformal Description 2.162

Predicate "is a layout identifier"

A layout identifier is a sequence of non-negative integers where the first integer is 0 or 1.

Definition 2.162

- 1 $\forall v$
- 2 $(_o \text{IsLayoutId}(v) \text{ iff}$
- 3 $\text{IsSeqOfNnInt}^{1.23}(v) \text{ and}$
- 4 $(_i \text{HEAD}^{1.13}(v) = 0 \text{ or } \text{HEAD}^{1.13}(v) = 1)_o)$

Semiinformal Description 2.163

Predicate "is a specific identifier" (5.3.1.2)

A specific identifier is either a specific logical identifier or a specific layout identifier.

Definition 2.163

- 1 $\forall v$
- 2 $(_o \text{IsSpecificId}(v) \text{ iff}$
- 3 $\text{IsLogicalObjectId}^{2.78}(v) \text{ or } \text{IsLayoutObjectId}^{2.79}(v)_o)$

Semiinformal Description 2.164

Predicate "is a generic identifier" (5.3.1.3)

A generic identifier is either a generic logical identifier or a generic layout identifier.

Definition 2.164

- 1 $\forall v$
- 2 $(_o \text{IsGenericId}(v) \text{ iff}$
- 3 $\text{IsLogicalObjectClassId}^{2.81}(v) \text{ or } \text{IsLayoutObjectClassId}^{2.82}(v)_o)$