INTERNATIONAL STANDARD

ISO/IEC 8613-11

First edition
1995-11-15

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Information technology — Open Document Architecture (ODA) and interchange format: Tabular structures and tabular layout

Technologies de l'information — Architecture de documents ouverts (ODA) et format d'échange: Structures tabulaires et disposition tabulaire

Reference number
ISO/IEC 8613-11:1995(E)

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Printed in Switzerland

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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 8613-11 was prepared by Joint Technical Committee ISO/IEC JTC 1, *Information technology,* Subcommittee SC 18, *Document processing and related communication*, in collaboration with ITU-T. The identical text is published as ITU-T Recommendation T.421.

ISO/IEC 8613 consists of the following parts, under the general title *Information technology — Open Document Architecture (ODA) and interchange format*:

- *Part 1: Introduction and general principles*
- *Part 2: Document structures*
- *Part 3: Abstract interface for the manipulation of ODA documents*
- *Part 4: Document profile*
- *Part 5: Open Document Interchange Format*
- *Part 6: Character content architectures*
- *Part 7: Raster graphics content architectures*
- *Part 8: Geometric graphics content architectures*
- *Part 9: Audio content architectures*
- *Part 10: Formal specifications*
- *Part 11: Tabular structures and tabular layout*
- *Part 12: Identification of document fragments*
- *Part 13: Spreadsheet*
- *Part 14: Temporal relationships and non-linear structures*

Annex A forms an integral part of this part of ISO/IEC 8613. Annex B is for information only.

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Introduction

This Recommendation | International Standard was prepared as a joint publication by ITU Study Group 8 and ISO/IEC Joint Technical Committee 1.

At present, the ITU-T Set of Recommendations in the T.410-Series | International Standard ISO/IEC 8613 consists of:

- Introduction and general principles;
- Document structures;
- Document profile;
- Open document interchange formats;
- Character content architectures;
- Raster graphics content architectures;
- Geometric graphics content architectures;
- Formal specification of the Open Document Architecture (FODA)

  (The formal specification is applicable to ISO/IEC 8613 only.)

Further Recommendations | International Standards may be added to this series of ITU-T Recommendations | International Standards.

Development of this series of ITU-T Recommendations | International Standards was originally in parallel with the ECMA 101 standard: *Open Document Architecture*.

This series of ITU-T Recommendations | International Standards is a new edition of the CCITT T.410-Series of Recommendations (1988) and ISO 8613 (1989).

Significant technical changes are the inclusion of the following amendments as agreed by ITU and ISO/IEC:

- Alternative Representation;
- Annex on use of MHS/MOTIS;
- Colour;
- Conformance Testing Annex;
- Document Application Profile, Proforma and Notation;
- Security;
- Streams;
- Styles;
- Tiled Raster Graphics.

In addition, a number of technical corrigenda have been applied to this Recommendation | International Standard.

This ITU-T Recommendation | International Standard contains two annexes:

- Annex A – Formal definition of tabular structures and tabular layout.
- Annex B – Examples.

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INTERNATIONAL STANDARD

ITU-T RECOMMENDATION

INFORMATION TECHNOLOGY – OPEN DOCUMENT ARCHITECTURE (ODA) AND INTERCHANGE FORMAT: TABULAR STRUCTURES AND TABULAR LAYOUT

1 Scope

The purpose of the ITU-T Recommendation T.410-Series | ISO/IEC 8613 is to facilitate the interchange of documents.

In the context of these Recommendations | International Standards, 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, raster graphic elements and geometric graphic elements, all potentially within one document.

NOTE – These Recommendations | International Standards are designed to allow for extensions, including typographical features, colour, spreadsheets and additional types of content such as sound.

In addition to the content type defined in these Recommendations | International Standards, ODA also provides for arbitrary content types to be included in documents.

These Recommendations | International Standards apply to the interchange of documents by means of data communications or the exchange of storage media.

These Recommendations | International Standards provide 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.

These Recommendations | International Standards also provide for the interchange of ODA information structures used for the processing of interchanged documents.

This Recommendation | International Standard:

- defines a document architecture, in order to allow presentation and processing of tabular material, that can be used in conjunction with the document architecture defined in ITU-T Recommendation T.412 | ISO/IEC 8613-2;
- defines two types of components, the grid logical component and the grid frame component, which are characterized by association with grids;
- defines the layout attributes and layout directive attributes, in order to allow representation of tabular layout, applicable to this document architecture;
- defines the presentation attributes, in order to allow presentation of tabular layout, applicable to the content architectures defined in ITU-T Recommendation T.416 | ISO/IEC 8613-6, ITU-T Recommendation T.417 | ISO/IEC 8613-7, and ITU-T Recommendation T.418 | ISO/IEC 8613-8;
- describes reference models of the document layout process and the document imaging process which, together with the document processing model described in ITU-T Recommendation T.412 | ISO/IEC 8613-2, determine representation and presentation of tabular layout.

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2 Normative references

The following ITU-T Recommendations and International Standards contain provisions which, through references, in this text, constitute provisions of this Recommendation | International Standard. At the time of publication, the editions indicated were valid. All Recommendations and Standards are subject to revision, and parties to agreements based on this Recommendation | International Standard are encouraged to investigate the possibility of applying the most recent edition of the Recommendations and Standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards. The Telecommunication Standardization Bureau of the ITU maintains a list of currently valid ITU-T Recommendations.

2.1 Identical Recommendations | International Standards

- ITU-T Recommendation T.411 (1993) | ISO/IEC 8613-1:1994, *Information technology – Open Document Architecture (ODA) and interchange format: Introduction and general principles.*
- ITU-T Recommendation T.412 (1993) | ISO/IEC 8613-2:1995, *Information technology – Open Document Architecture (ODA) and interchange format: Document structures.*
- ITU-T Recommendation T.414 (1993) | ISO/IEC 8613-4:1994, *Information technology – Open Document Architecture (ODA) and interchange format: Document profile.*
- ITU-T Recommendation T.415 (1993) | ISO/IEC 8613-5:1994, *Information technology – Open Document Architecture (ODA) and interchange format: Open document interchange format.*
- ITU-T Recommendation T.417 (1993) | ISO/IEC 8613-7:1994, *Information technology – Open Document Architecture (ODA) and interchange format: Raster graphics content architectures.*
- ITU-T Recommendation T.418 (1993) | ISO/IEC 8613-8:1994, *Information technology – Open Document Architecture (ODA) and interchange format: Geometric graphics content architectures.*

2.2 Paired Recommendations | International Standards equivalent in technical terms

- CCITT Recommendation X.208 (1988), *Specification of Abstract Syntax Notation One (ASN.1).*

  ISO/IEC 8824:1990, *Information technology – Open Systems Interconnection – Specification of Abstract Syntax Notation One (ASN.1).*

- CCITT Recommendation X.209 (1988), *Specification of basic encoding rules for Abstract Syntax Notation One (ASN.1).*

  ISO/IEC 8825:1990, *Information technology – Open Systems Interconnection – Specification of Basic Encoding Rules for Abstract Syntax Notation One (ASN.1).*

3 Definitions

In addition to the definitions given in ITU-T Recommendation T.411 | ISO/IEC 8613-1, the definitions listed below apply to this Recommendation | International Standard.

NOTE – The use of the symbol / is described in 5.2.

3.1 dimensions of a layout grid: The height and width of the *layout grid*, measured in scaled measurement units (SMU).

3.2 entry frame: An immediately subordinate frame to a *grid frame* which is variably positioned within the superior grid frame.

3.3 entry frame bound to a layout grid rectangle: An *entry frame* which is to be laid out within the layout grid rectangle to which it is bound.

3.4 entry object: A logical object such that its association with some *logical grid* rectangle within some logical grid is specified.

3.5 entry object occupying a logical grid rectangle: An *entry object* such that its association with this logical grid rectangle is specified.

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3.6 **grid frame**: A frame which is characterized by the capability to include a *layout grid* within it.

3.7 **grid frame component**: A variant of the composite layout component of frame type which is identified by the value 'grid frame' specified for the attribute "object type".

3.8 **grid gutter space**: A reserved area around a *layout grid line* from which entry frames are excluded.

3.9 **grid gutter space width**: The distance between the bordering lines of a *grid gutter space*, measured in scaled measurement units (SMU).

3.10 **grid interval**: An interval between two adjacent *layout grid lines* which are parallel to each other.

3.11 **grid interval dimension**: The distance between two adjacent *layout grid lines* in the same direction, measured in scaled measurement units (SMU).

3.12 **grid line**: A line forming part of a *logical grid* or *layout grid*, which runs parallel to one of the edges of the grid that includes it.

3.13 **grid logical component**: A variant of the composite logical component which is identified by the value 'grid logical' specified for the attribute "object type".

3.14 **grid logical object**: A composite logical object which is characterized by its association with a *logical grid*.

3.15 ***i*-th major / minor grid interval**: The interval between the $(i - 1)$-th and i-th *major / minor layout grid lines*.

3.16 ***i*-th major / minor layout grid line**: The *major / minor layout grid line* to which the ordinal number i is assigned.

NOTE – The numbering scheme is described in 9.1.3.

3.17 ***i*-th major / minor logical grid line**: The *major / minor logical grid line* to which the ordinal number i is assigned.

NOTE – The numbering scheme is described in 8.1.3.

3.18 **layout grid**: A rectangular area within a *grid frame* divided by two sets of parallel *layout grid lines* into one or more *layout grid locations*.

3.19 **layout grid line**: A line forming part of a *layout grid* which runs parallel to one of the edges of the layout grid.

3.20 **layout grid location**: A rectangle within a *layout grid* bounded by two pairs of adjacent *layout grid lines*.

3.21 **layout grid rectangle**: A rectangle composed of one or more *layout grid locations* within a *layout grid*.

3.22 **logical grid**: A rectangular area associated with a *grid logical object*, divided by two sets of parallel *logical grid lines* into one or more *logical grid locations*.

3.23 **logical grid line**: A line forming part of a *logical grid* which runs parallel to one of the edges of the logical grid.

3.24 **logical grid location**: A rectangle within a *logical grid* bounded by two pairs of adjacent *logical grid lines*.

3.25 **logical grid rectangle**: A rectangle composed of one or more *logical grid locations* within a *logical grid*.

3.26 **major / minor dimension of a layout grid**: The length, measured in scaled measurement units (SMU), of the edges of the *layout grid* which are parallel to the *major / minor path*.

3.27 **major / minor grid interval**: An interval between adjacent *major / minor layout grid lines*.

3.28 **major / minor layout grid line**: A *layout grid line* running parallel to the *minor / major path of the layout grid* that includes it.

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3.29 major / minor logical grid line: A *logical grid line* running parallel to the *minor / major path of the logical grid* that includes it.

3.30 major path: A direction within a *logical grid* or *layout grid* parallel to one of the edges of the grid.

3.31 major / minor size of a layout grid: The largest number assigned to a *major / minor layout grid line* within the layout grid.

3.32 major / minor size of a logical grid: The largest number assigned to a *major / minor logical grid line* within the logical grid.

3.33 minor path: A direction within a *logical grid* or *layout grid* orthogonal to the *major path* within the same grid.

3.34 reproduction of contents: A set of one or more content portion descriptions which are reproductions of the content portion descriptions associated with basic logical objects, except that they never include the attribute "content identifier – logical".

4 Abbreviations

No abbreviations are defined in this Specification.

5 Conventions

In addition to the conventions given in ITU-T Recommendation T.411 | ISO/IEC 8613-1, the following conventions are used throughout this Specification.

5.1 Content associated with a composite logical object

The *content associated with a basic logical object* refers to a collection of content portions which are referred to by the attribute "content portions" specified for the basic logical object. If a content portion is associated with a basic logical object, then the content portion description always includes the attribute "content identifier – logical".

If the layout process duplicates the content associated with a basic logical object, one or more content portions are generated (see clause 10). Those content portions, as a whole, form part of a single and complete reproduction of the source content except for their identification attributes. In particular, they never include the attribute "content identifier – logical". Hence, those content positions shall not be associated with any basic logical object, even though their source content is associated with the basic logical object.

The content associated with a composite logical object refers to the union of the content associated with the basic logical objects which are, not necessarily immediately, subordinate to the composite logical object.

More shortly, the phrase *the content of a logical object* may be used to refer to the content associated with the logical object, whether the logical object is basic or composite.

5.2 The symbol /

The symbol / between two words indicates that the two words surrounding the symbol / are two alternatives: each alternative makes the sentence including the alternatives true.

When the symbol / appears in texts, this occurrence of the symbol has its own scope. Unless a NOTE specifies a particular scope for it, its scope is confined to the paragraph that includes this occurrence of the symbol.

If the scope includes more than one occurrence of /, and if the reader selects the first alternative at the first occurrence, the text in the scope makes sense when he selects the first alternative at each subsequent occurrence throughout the scope. In the same way, if the reader selects the second alternative at the first occurrence, the text in the scope makes sense when he selects the second alternative at each subsequent occurrence throughout the scope.

Example: If the reader selects the first/second alternative at the first occurrence, the text in the scope makes sense when he selects the first/second alternative at each subsequent occurrence throughout the scope.

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6 Relationship to ITU-T Recommendation T.412 | ISO/IEC 8613-2

This Specification provides a document architecture that can be used in conjunction with the document architecture defined in ITU-T Recommendation T.412 | ISO/IEC 8613-2.

This Specification defines 14 layout attributes, 7 layout directive attributes and 3 presentation style attributes. These attributes are defined so that they may represent documents including tabular structures and tabular layout, in both their logical and layout aspects, in conjunction with a number of attributes defined in ITU-T Recommendation T.412 | ISO/IEC 8613-2.

The layout directive attributes:

- obligatory same layout objects;
- selective same layout objects,

impose constraints on the document layout process additional to the layout directive attributes defined in ITU-T Recommendation T.412 | ISO/IEC 8613-2, without affecting their definitions.

This Specification defines two additional object types, *grid logical components* and *grid frame components*.

The layout directive attributes:

- grid descriptions;
- grid frame classes;
- presentation precedence;
- supplementary line directive,

are specifiable only for grid logical components.

The attributes "grid descriptions" and "grid frame classes" are for control of the placement of variably positioned frames within immediately superior grid frames. They never affect the definitions of any layout directive attributes defined in ITU-T Recommendation T.412 | ISO/IEC 8613-2.

The attribute "presentation precedence" is for control of the order in which the document layout process lays out basic logical objects. This attribute may affect such layout directive attributes as "same layout object" and "concatenation", whose definitions depend on the sequential logical order in specific logical structures. The conjunction of the attribute "presentation precedence" and such attributes may result in unexpected layout, unless the originator generates documents taking interaction between these attributes into consideration.

The attribute "supplementary line directive" is for control of the imaging process to image supplementary lines within grid frames in addition to ordinary grid lines. It never affects the definitions of any layout directive attributes defined in ITU-T Recommendation T.412 | ISO/IEC 8613-2.

This Specification defines a set of particular rules to determine position and dimensions of frames which are immediately subordinate to grid frames. For other frames, the rules defined in ITU-T Recommendation T.412 | ISO/IEC 8613-2 are valid without any changes.

The rest of the attributes defined in this Specification are for the representation of these positioning and dimensioning rules for frames. In particular, the attribute "position" is re-defined in this Specification so that it may provide necessary functions to control placement of frames within immediately superior grid frames.

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7 Features of tabular structures and tabular layout

This clause provides a description of the chief features of tabular structures and tabular layout which are in the scope of the document architecture defined in this Specification.

Tabular structures involving some or all of those features are represented in accordance with this document architecture, and those structures are embedded into logical and layout structures of documents represented in accordance with the document architecture of ITU-T Recommendation T.412 | ISO/IEC 8613-2.

Further, the reference model of the document layout process described in this Specification may generate specific layout structures including tabular structures, evaluating those tabular structures embedded into logical structures and generic layout structures.

Thereafter, the reference model of the document imaging process described in this Specification may present tabular structures involved in such specific layout structures as human perceptible tabular layout on rendition media.

This Specification introduces new attributes to cover those features of tabular structures and tabular layout. At the end of each subclause of this clause, those attributes which are related to the feature described in the sub-clause will be listed as **Related attributes**.

Only for illustration in this clause, the following terminology is introduced:

- *table cell*: a rectangular area within a table edged with table lines;
- *table entry*: a piece of content laid out within a table cell;
- *table line*: a visible or invisible line delimiting table entries distributed within a table.

The framework of tabular layout consists of a set of table lines which intersect one another so that the framework shall provide two-dimensional allocation of table cells. Each table entry is laid out within a respective table cell.

7.1 Content types and inner structures of table entries

A table shall allow table entries to contain various types of content, such as character texts, pictures and so forth.

Further, a table shall allow table entries to have an inner structure, such as a picture with a caption, more than one paragraph and so forth.

Related attributes: "grid description"

7.2 Dimensions of tables, rows and columns

The dimensions of a table (height, width), of a row (height), and a column (width) may be specified in one of the following ways:

- the dimension concerned shall be a specified absolute value;
- it shall expand to an area available for its presentation;
- it shall be a minimum value necessary for its presentation.

Additionally, the height of a row and the width of a column may be specified as:

- the dimension concerned shall be in proportion to the dimensions of other particular rows or columns.

Related attributes: "grid dimensions", "grid interval dimensions"

7.3 Placement of tables

A table may be aligned within the area available for placement in the horizontal and vertical directions:

- the table may be aligned on the left or right, or centred;
- the table may be aligned at the top or bottom, or centred;
- every combination of alignment in the horizontal and vertical directions shall be allowed.

Related attributes: "grid position"

7.4 Spanning cells

A table cell spanning more than one row and more than one column shall be allowed to appear at an arbitrary position within a table.

Related attributes: "grid description"

7.5 Placement of table entries

7.5.1 Gutter space around table lines

A gutter space, from which any table entries are to be excluded, may be reserved around a table line.

Related attributes: "gutters"

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7.5.2 Offset of table entries

Offsets of a table entry from the edges of the table cell within which the table entry is laid out shall be specifiable.

Related attributes: "grid position"

7.5.3 Alignment of a table entry within a table cell

A table entry may be aligned within a table cell arbitrarily in the horizontal and vertical directions:

- the table entry may be aligned on the left or the right, or centred;
- the table entry may be aligned at the top or bottom, or centred;
- every combination of alignment in the horizontal and vertical directions shall be allowed.

Related attributes: "position"

7.5.4 Reference line alignment

A table entry may provide an alignment point. If such table entries are in a row or a column, they may be aligned so that all of the alignment points shall be lined up on a reference line in the direction of the row or column. Two of the most typical examples of reference line alignment are *alignment around decimal points* and *base line alignment*.

Related attributes: "reference line alignment – major / minor", "frame alignment point", "block alignment point", "alignment point"

In addition, a table entry involved in reference line alignment may be indented from the reference line concerned.

Related attributes: "indent – major / minor"

After this alignment, the entire set of table entries may be aligned on the left or the right, or centred, within the row or column.

Related attributes: "position"

7.6 Split of tables

When a table overflows such an area available for its presentation as a page, a page column, frame and so forth, the table may or may not split into two or more fragments each of which is presented within an individual available area. Further, each fragment of the table may be presented in a different way: for example, the first fragment includes the area for a table title; the last fragment includes the area for notes; the intermediate fragments include neither.

Related attributes: "grid frame classes"

7.6.1 Direction of table split

When splitting of a table is allowed, it may occur in the horizontal and / or vertical direction:

- a table may be split only at table lines delimiting rows;
- a table may be split only at table lines delimiting columns;
- a table may be split both at table lines delimiting rows and at table lines delimiting columns; in this case, the order of presentation of fragments shall be taken into consideration.

Related attributes: "indivisibility", "presentation precedence"

Furthermore, in all the cases, the table shall not be split at an unsuitable table line, such as a horizontal table line immediately following box headings.

Related attributes: "same layout object", "selective same layout objects"

7.6.2 Repetition of headings

When a table is split, such headings within the table as box headings may be repeated within each fragment of the table.

Related attributes: "obligatory same layout objects"

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7.7 Rendition of table lines

The method of rendition of a table line shall be determined for each individual line segment composing the table line. For example, if a segment of the table line is within a spanning cell or the stub of the table (the leftmost column for row headings), the line segment shall be rendered invisible.

Related attributes: "grid lines"

7.8 Supplementary lines

In addition to table lines, some supplementary lines may be presented:

- a diagonal line may divide the top left table cell into two triangles;
- a reference line may be rendered visible.

Related attributes: "supplementary lines, supplementary line directive"

8 Grid logical components

A *grid logical component* is a variant of a composite logical component. Any of the attributes applicable to composite logical components are also applicable to a grid logical component. In this Specification, particularly in the **Constituents** clauses of the attribute definitions, grid logical components and ordinary composite logical components may be collectively referred to as "composite logical components".

A grid logical component is identified by the value 'grid logical' specified for the attribute "object type", and a grid logical object is characterized by the association with a *logical grid*.

Unless the attribute "grid frame classes" is applied to a grid logical object, the layout process shall deal with the grid logical object as an ordinary composite logical object. Hence, those layout directive attributes proper to the grid logical component, namely "grid description", "presentation precedence" and "supplementary lines" shall never affect the layout of documents.

8.1 Logical grids

8.1.1 Logical grid lines and logical grid locations

The underlying area of a logical grid is a rectangle within an imaginary plane. This underlying rectangle is dissected by two sets of parallel lines. Each set of parallel lines runs parallel to one of two adjacent edges of the underlying rectangle. The lines and divisions so created comprise the logical grid (see Figure 1).

Such a line is called a *logical grid line*, and a division is called a *logical grid location*.

A logical grid line / location may be simply referred to as a *grid line / location* when it is obvious from the context that it is a logical grid line / location rather than a *layout grid line / location*, and vice versa (see 9.1.1 and 9.1.7).

8.1.2 Major and minor paths

The terms *major path* and *minor path* denote the two orthogonal directions within a logical grid which are parallel to the edges of the underlying rectangle.

Conventionally, a logical grid is considered to be upright: the major path is the vertically downward direction, and the minor path is the horizontally rightward direction (see Figure 1).

8.1.3 Major and minor logical grid lines

Every logical grid line runs parallel to either the major or minor path.

A logical grid line running parallel to the minor / major path of a logical grid is called a *major / minor logical grid line*. Within a logical grid, every major / minor logical grid line is identified by an ordinal number (see Figure 1):

a) the number 0 is assigned to the major / minor logical grid line which is the first in the direction of the major / minor path;

b) the major / minor logical grid line with number $n + 1$ is adjacent to the major / minor logical grid line with number n in the direction of the major / minor path.

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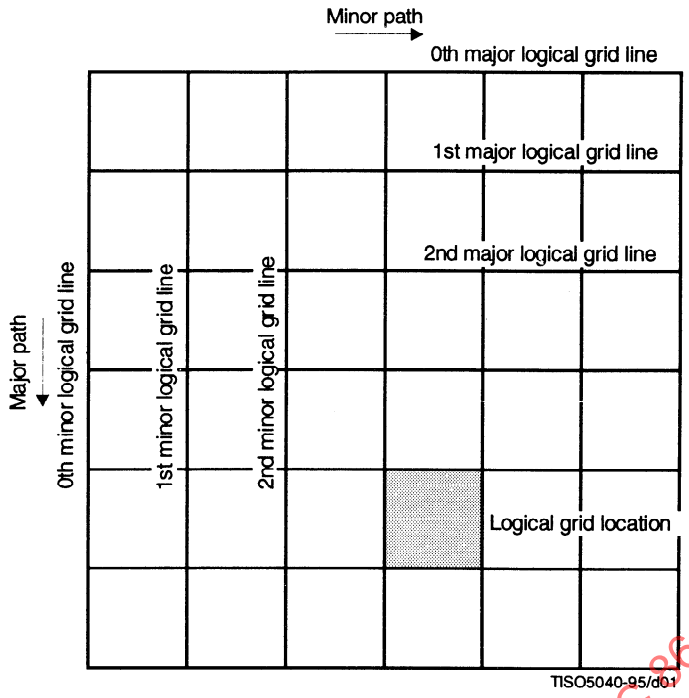


Figure 1 – Logical grid

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8.1.4 Major and minor sizes of a logical grid

The *major / minor size* of a logical grid is defined as the largest ordinal number assigned to a major / minor grid line within the logical grid.

The major / minor size of a logical grid is specified by the parameter "major / minor size" of the attribute "grid description" applied to the grid logical object with which the logical grid is associated.

Since a logical grid is conventionally considered to be upright, its major / minor size corresponds to the number of rows / columns within it.

8.1.5 Logical coordinates

Each intersection point of the logical grid is represented by a *logical coordinate pair: major logical coordinate* and *minor logical coordinate*.

The major / minor logical coordinate of the point is the ordinal number assigned to the major / minor logical grid line on which the point is located.

Additionally, the special value 'last' may be specified for the major / minor logical coordinate. This value specifies that the point is located on the last major / minor logical grid line, to which the largest ordinal number is assigned.

8.1.6 Logical grid rectangles

If one or more logical grid locations comprise a rectangle within a logical grid, the rectangle is called a *logical grid rectangle*. Hence, a logical grid rectangle is edged with a pair of major logical grid lines and a pair of minor logical grid lines.

The smallest logical grid rectangle is a single logical location.

A logical grid rectangle may be called simply a *grid rectangle* when it is obvious from the context that it is a logical grid rectangle rather than a *layout grid rectangle*, and vice versa (see 9.1.7).

8.2 Association of entry objects with logical grid rectangles

A logical object subordinate to a grid logical object may be associated with a logical grid rectangle within the logical grid associated with the grid logical object (see Figure 2). Such a logical object is called an *entry object* occupying that logical grid rectangle. An entry object is not necessarily an immediate subordinate of the grid logical object.

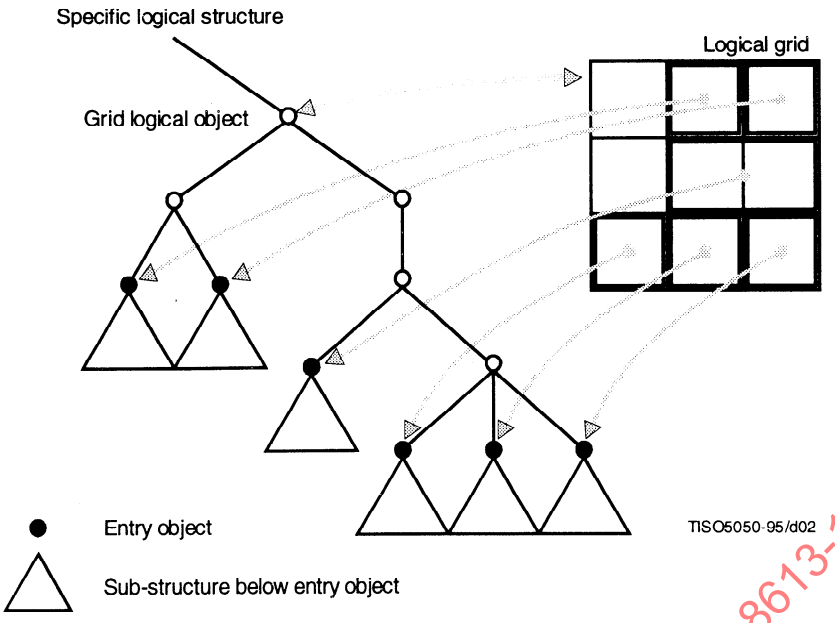


Figure 2 – Association of entry objects with logical grid rectangles

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These associations between entry objects and logical grid rectangles are specified by the parameter "entry-location association" of the attribute grid description applied to the grid logical object with which the logical grid is associated (see 12.2.2).

In addition, the associations between entry objects and logical grid rectangles affect the order in which the layout process lays out the content of those basic logical objects that are subordinate to the logical grid object. Therefore, if a grid frame is superior to another grid frame, their effects on this processing order of their common subordinate basic logical objects shall be compatible (see 13.5).

9 Grid frame components

A *grid frame component* can be any frame except a lowest level frame component. Any of the attributes applicable to frame components except the attribute "permitted categories" are also applicable to a grid frame component. In this Specification, particularly in the **Constituents** clauses of the attribute definitions, grid frame components and ordinary frame components may be collectively referred to as "frame components".

A grid frame component is identified by the value 'grid frame' specified for the attribute "object type", and a grid frame is characterized by the capability to contain a layout grid within it.

A grid frame contains a layout grid whenever the object description for the grid frame specifies the attribute "grid interval dimensions". Conversely, without the attribute "grid interval dimensions", the grid frame does not contain a layout grid.

If a grid frame does not contain a layout grid, the imaging process shall deal with the grid frame as if it were an ordinary frame, and shall not present any layout grid lines within it.

When the layout process reach a grid logical object description specifying the attribute "grid frame classes", the layout process identifies one or more grid frames within the specific layout structure under construction, in accordance with this attribute. Those identified grid frames are called *grid frames referred to* by the grid logical object (see 9.2).

The layout process generates a layout grid within each referenced grid frame. This layout grid includes the same number of major / minor grid lines (see 9.1.1) as the logical grid associated with the grid logical object does.

9.1 Layout grid

9.1.1 Layout grid lines

A *layout grid* is composed of a finite number of lines, called *layout grid lines*. Each layout grid line has its own position, length and direction within the grid frame containing the layout grid.

Layout grid lines within a grid frame satisfy the following constraints:

- every layout grid line shall be parallel with one of the edges of the grid frame;
- no layout grid line shall fall within the border free space of the grid frame;
- every layout grid line shall have its ends located on the same pair of orthogonal grid lines.

Thus, in ordinary cases, a layout grid is a rectangle divided by a finite number of horizontal and vertical lines, each of which has its ends on opposite edges of the rectangle (see Figure 3).

Two layout grid lines may be located at the same position within the grid frame (see 12.1.4). Further, if the layout grid lines running in one of the two directions are all located at the same position, then the length of the layout grid lines in the orthogonal direction shall be zero. In such degenerate cases, where some layout grid line has no positive length, a layout grid is either a line segment or a single point.

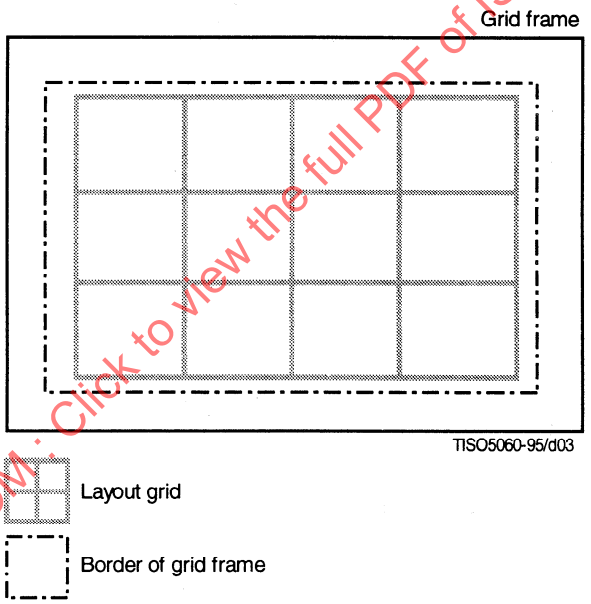


Figure 3 – Layout grid

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9.1.2 Major and minor paths

The terms *major path* and *minor path* denote two specified directions within a grid frame which are orthogonal to each other. Further, the major / minor path is parallel with one of the edges of the grid frame.

The attribute "major / minor path" specifies the direction of the major / minor path (see 12.1.8 and 12.1.9).

9.1.3 Major and minor layout grid lines

A layout grid line running in the direction of the minor / major path is called a *major / minor layout grid line*.

Major / minor layout grid lines within a grid frame are identified by successive ordinal numbers assigned to them (see Figure 4).

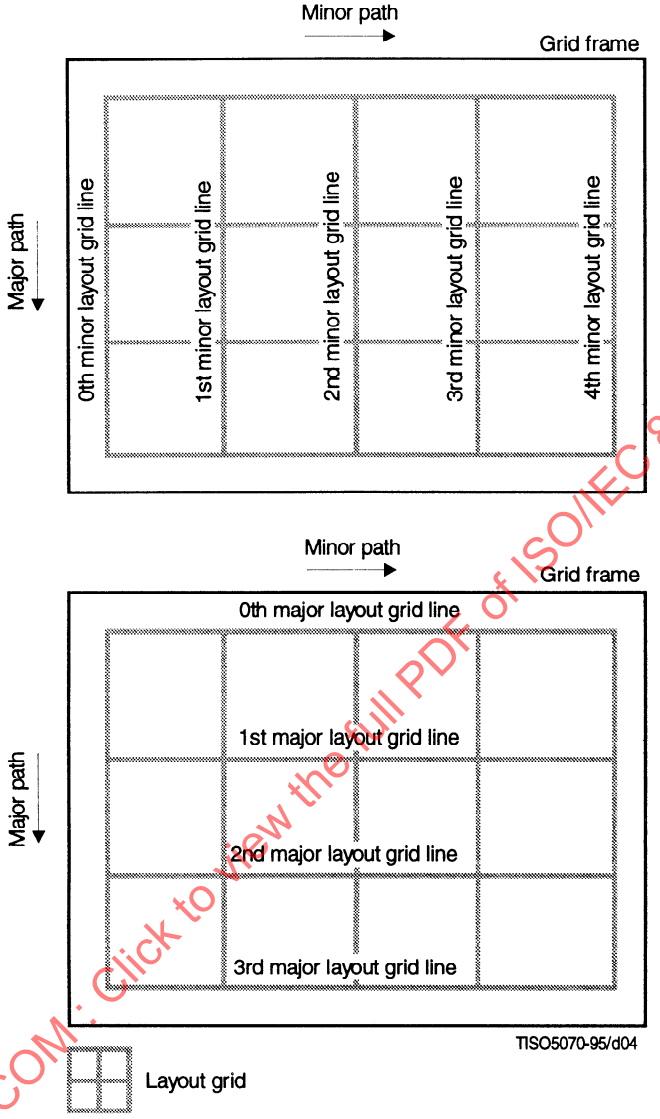


Figure 4 – Layout grid lines

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This allocation of numbers shall satisfy the following:

a) the smallest number assigned to the major / minor layout grid lines is 0;

b) the major / minor layout grid line with number $n + 1$ is either at the same position as the major / minor layout grid line with number n, or is adjacent to it in the direction of the major / minor path.

NOTE – When two or more grid lines occupy the same position, the order in which ordinal numbers are allocated to those lines is arbitrary.

9.1.4 Grid line segments

A *grid line segment* is a segment of a layout grid line delimited by two consecutively numbered layout grid lines intersecting the layout grid line concerned at right angles.

The *j*-th grid line segment of the *i*-th major / minor layout grid line is the segment of the *i*-th major / minor layout grid line, delimited by the (*j* – 1)-th and *j*-th minor / major layout grid lines.

Grid line segments are the smallest unit to which a *line segment characteristic* applies (see 11.10). A single line segment characteristic specifies a single set of *imaging factors* (i.e. line width, line type and line colour).

- Each individual grid line segment is imaged with a single line width, a single line type and a single line colour.
- Distinct grid line segments may be imaged with different line widths, different line types or different line colours, even if they are forming part of the common layout grid line.

The attribute "grid lines" applied to the grid frame specifies a set of line segment characteristics, each of which is applicable to each individual grid line segment involved in the relevant layout grid (see 12.1.5).

9.1.5 Major and minor sizes of a layout grid

The largest ordinal number assigned to a major / minor grid line within a layout grid is called the *major / minor size* of the layout grid.

In contrast to the case of a logical grid, where the major and minor sizes of the logical grid are explicitly specified by the attribute "grid description" (see 12.2.2), those of a layout grid are only implicitly specified by the attribute "grid interval dimensions" that the object description for the grid frame specifies (see 12.1.4).

The attribute "grid interval dimensions" consists of two parameters "major interval dimensions" and "minor interval dimensions". The value of each parameter is a *grid interval expression* of the grid sequence construction type (see 11.1) composed of *interval indicators* (see 11.4), namely a sequence of a finite number of interval indicators, when the attribute is specified for an object description. The number of interval indicators involved in the value of the parameter "major / minor interval dimensions" indicates the major / minor size of the layout grid.

9.1.6 Major and minor dimensions of a layout grid

If an edge of a layout grid is in the direction of the minor / major path specified for the grid frame including the layout grid, its length in scaled measurement units is called the *major / minor dimension* of the layout grid.

The attribute "grid dimensions" applied to the grid frame specifies the major and minor dimensions of the layout grid within the grid frame (see 12.1.2).

9.1.7 Grid intervals, layout grid locations and layout grid rectangles

A *grid interval* is a rectangular area within a layout grid, delimited by two consecutively numbered layout grid lines in the same direction (see Figure 5).

If the grid lines delimiting the grid interval are in the direction of the major / minor path, then the grid interval is called a *major / minor grid interval*. Furthermore, the *i*-th major / minor grid interval is the major / minor grid interval delimited by the (*i* – 1)-th and *i*-th major / minor layout grid lines.

A *layout grid rectangle* is an area within a layout grid edged with two major layout grid lines and two minor layout grid lines. Any grid interval, whether it is major or minor, is a kind of layout grid rectangle.

In particular, a layout grid rectangle is called a *layout grid location* if it is edged with consecutively numbered major layout grid lines and consecutively numbered minor layout grid lines.

In degenerate cases, where the positions of the edging layout grid lines coincide, the grid interval, layout grid rectangle or layout grid location may be a single line segment or a single point in shape.

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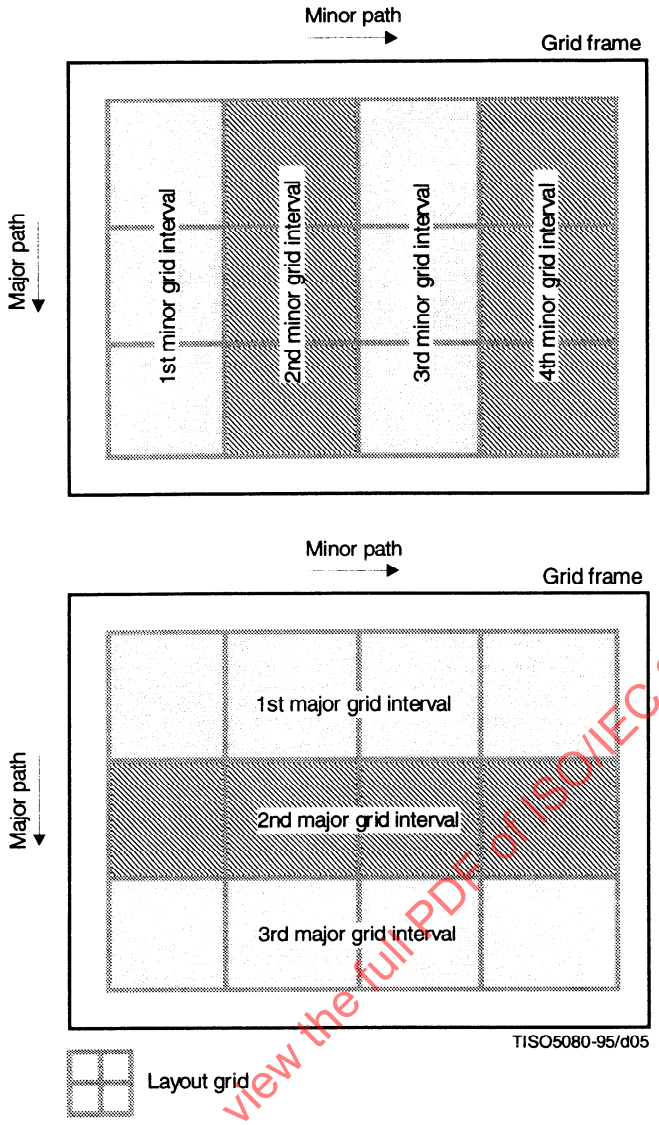


Figure 5 – Grid intervals

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9.1.8 Dimensions of grid intervals

The term *grid interval dimension* denotes the distance between two consecutively numbered layout grid lines in the same direction.

If the layout grid lines are in the direction of the minor / major path, the grid interval dimension is called a *major / minor grid interval dimension*. In particular, the distance between the $(i - 1)$-th and i-th major / minor layout grid lines is called the i-th major / minor grid interval dimension (see Figure 6).

The attribute "grid interval dimensions" applied to a grid frame specifies the dimensions of the grid intervals involved in the grid frame. Evaluation of the values of this attribute produces a set of interval indicators, each of which is to be applied to each individual grid interval.

If this attribute is specified in the class description for the grid frame, the interval indicator applied to each grid interval specifies a rule to determine the dimension of the grid interval. The layout process evaluates this interval indicator, and then determines the dimension of the grid interval.

In particular, the dimension of a grid interval may be determined to be 0, only if no content is laid out within this grid interval, and the interval indicator to be applied specifies one of the following (see 11.4):

- the parameter "fixed dimension" associated with the value 0;
- the parameter "rule B" with the minimum dimension 0;
- the parameter "proportional" with the default dimension 0.

If and only if the grid interval dimension is 0, then the two layout grid lines delimiting the grid interval are located at the same position.

If the attribute "grid interval dimensions" is specified in the object description for the grid frame, the interval indicator applied to each grid interval specifies the parameter "fixed dimension" associated with the dimension of the grid interval in scaled measurement units (see 12.1.4).

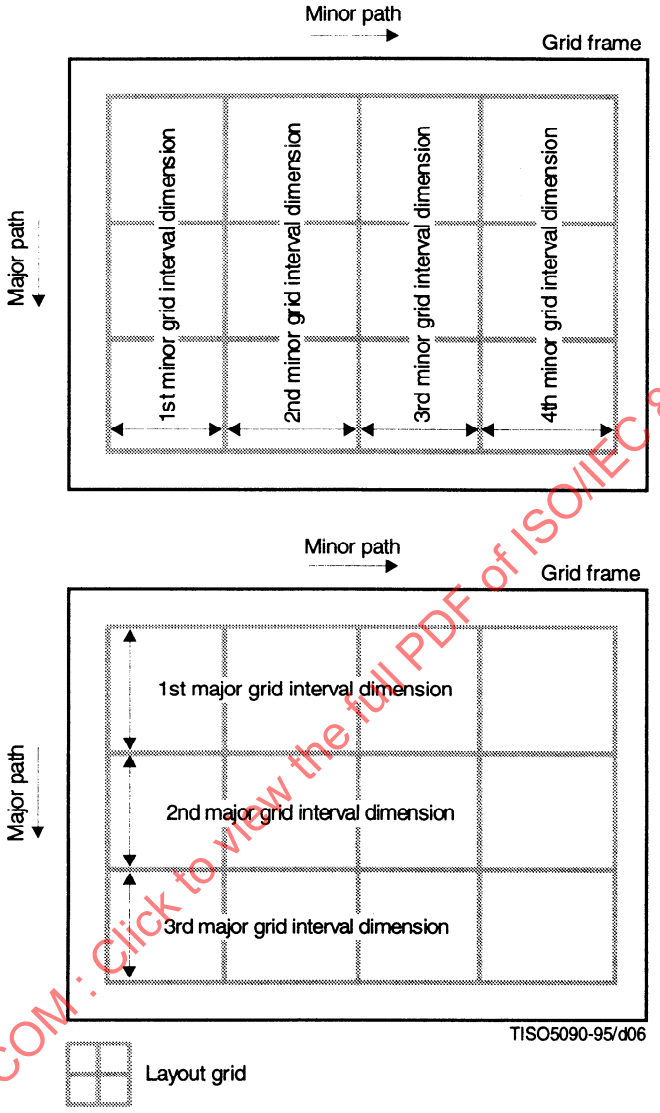


Figure 6 – Grid interval dimensions

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9.1.9 Naming of edges of a layout grid rectangle

The *leading*, *trailing*, *left-hand* and *right-hand* edges of a layout grid rectangle are defined relative to the layout path of the grid frame (see Figure 7):

- The leading and trailing edges are defined as the two opposite edges of the rectangle that are orthogonal to the direction of the layout path, such that the direction from the trailing edge to the leading edge is in the same direction as the layout path.
- The left-hand and right-hand edges are defined as the two opposite edges of the rectangle that are parallel to the direction of the layout path, such that the direction from the right-hand edge to the left-hand edge is at an angle of 90° anti-clockwise relative to the direction of the layout path.

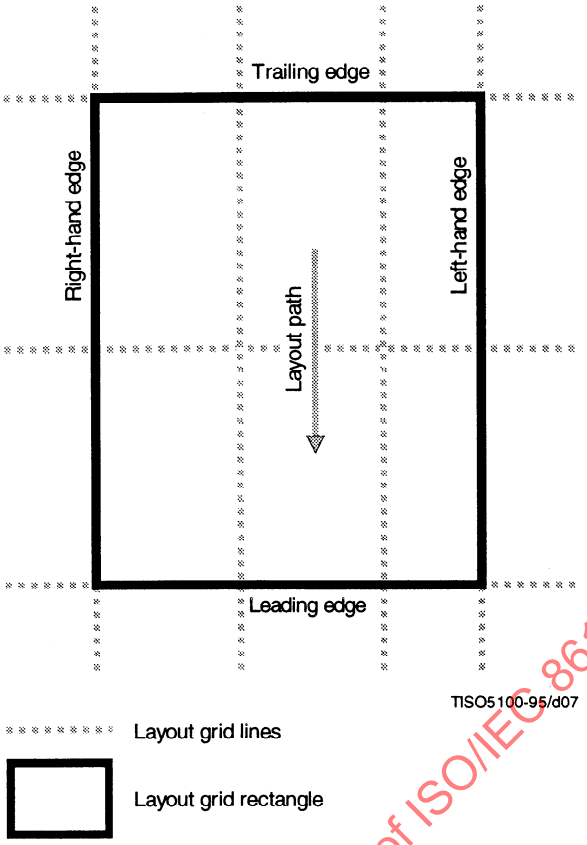


Figure 7 – Edges of grid rectangles

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9.1.10 Grid gutter spaces

A *grid gutter space* around a layout grid line is a rectangular area within a layout grid, delimited by two lines running parallel to the layout grid line concerned, such that the layout grid line runs equidistant from these two edging lines. The *width of the grid gutter space* is defined as the distance between these two edging lines.

If a variably positioned frame is constrained to be laid out inside some layout grid rectangle within its immediately superior grid frame (see 9.3), the frame shall be excluded from the grid gutter spaces reserved around the four edges of the layout grid rectangle.

The attribute "grid gutters" applied to the grid frame specifies the widths of the grid gutter spaces around the layout grid lines within the grid frame (see 12.1.3).

9.1.11 Position of a layout grid

If the grid frame contains a layout grid, the layout grid is positioned within this grid frame so that it shall never fall within the border free space of the grid frame. The attribute "border" applied to the grid frame specifies the border free space to be taken into account in positioning the layout grid (see 9.4.1.3 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

The position of a layout grid within a grid frame is represented in one of the following ways:

- The distances in the direction of the major and minor paths, from the *grid reference point* of the grid frame, to the *grid origin* of the layout grid (see Figure 8) are specified; the grid reference point is one of the corners of the grid frame, while the grid origin is one of the corners of the layout grid; both the grid reference point and the grid origin are defined relative to the major and minor paths of the grid frame (see Table 2).
- The alignment of the layout grid in the directions of the major and minor paths is specified.

The attribute "grid position" applied to the grid frame specifies the position of the layout grid within the grid frame, in one of the above ways (see 12.1.6).

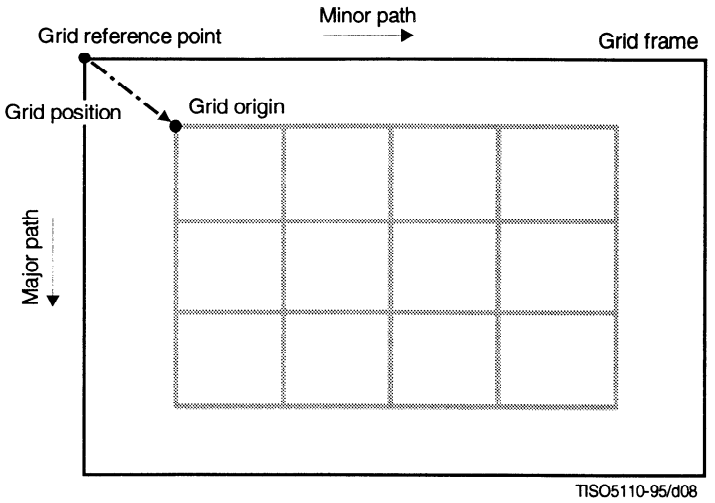


Figure 8 – Grid origin and grid reference point

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9.1.12 Minimal layout of a layout grid

Determination of the grid interval dimensions involved in a layout grid provides a *minimal layout* of the layout grid, if and only if, for an arbitrary subset of the grid intervals of the layout grid, their determined dimensions cannot be reduced without increasing the determined dimensions for other grid intervals or violating the following constraints:

- constraints on the major and minor dimensions of the layout grid, imposed by the attribute "grid dimensions" (see 12.1.2);
- constraints on the major and minor interval dimensions of the layout grid, imposed by the attribute "grid interval dimensions" (see 12.1.4).

In general, there may be more than one instance of minimal layout for a single layout grid. The layout process shall generate one of those instances of the minimal layout for the layout grid.

9.2 Association of grid frames with grid logical objects

The attribute "grid frame classes" specifies a construction expression whose evaluation may produce a sequence of grid frame classes. If this attribute is applied to a grid logical object, a sequence of one or more grid frames shall be identified in the specific layout structure concerned (see 12.2.3).

A sequence of grid frames to be identified shall satisfy the following conditions:

- the order of grid frames given by the sequence coincides with their sequential layout order;
- the sequence of frame classes obtained by replacing every grid frame in the sequence with its frame class is one of the values that can be derived from evaluation of the construction expression specified for the attribute.

The content associated with the grid logical object shall be laid out entirely within the grid frames of this set. No other part of the document shall be laid out within any grid frame in this set (see 12.2.3).

If a grid frame is identified in accordance with the attribute "grid frame classes" applied to a grid logical object, the grid frame is called a *grid frame referred to* by the grid logical object.

9.3 Binding of entry frames to layout grid rectangles

Every grid frame referred to by a grid logical object contains a layout grid.

This layout grid includes the same number of major / minor grid lines as the logical grid associated with the grid logical object does. By means of ordinal numbers assigned to grid lines within the layout grid and the logical grid, the following correspondences between grid lines and between grid rectangles are defined.

9.3.1 Correspondence between layout grid lines and logical grid lines

The correspondence between the major / minor layout grid lines within the layout grid and the major / minor logical grid lines within the logical grid is such that:

- the *i*-th major / minor layout grid line corresponds to the *i*-th major / minor logical grid line, and vice versa.

9.3.2 Correspondence between layout grid rectangles and logical grid rectangles

The correspondence between the layout grid rectangles within the layout grid and the logical grid rectangles within the logical grid is such that:

- a layout grid rectangle corresponds to the logical grid rectangle whose four edging logical grid lines respectively correspond to the four layout grid lines edging the layout grid rectangle, and vice versa.

If a layout grid rectangle corresponds to a logical grid rectangle, the former rectangle is called the *layout counterpart* of the latter rectangle.

9.3.3 Layout of content associated with entry objects

The content associated with an entry object, which occupies a logical grid rectangle within the logical grid associated with its superior grid logical object, shall be laid out within frames immediately subordinate to those grid frames referred to by this grid logical object. Moreover, each of those frames shall be located inside the layout counterpart of the logical grid rectangle which the entry object occupies, no matter whether it is variably positioned, or has its position strictly fixed, within its immediately superior grid frames.

A frame to be variably positioned within the immediately superior grid frame is called an *entry frame*. If the content of an entry object is laid out within an entry frame, and therefore the entry frame is constrained to be laid out inside the layout counterpart of the logical grid rectangle which the entry frame occupies, the entry frame is said to be *bound to* that layout grid rectangle.

10 Duplication of content

If the attribute "obligatory same layout objects" is applied to a logical object, zero or more target objects shall be identified within the specific logical structure concerned (see 12.2.4). Target objects may be basic or composite. Further, in accordance with this attribute, the layout process may duplicate the content associated with the target objects, and thereafter may lay out the generated reproduction of the content.

10.1 Reproductions of content

Whenever the duplication of the content of a target object occurs, a reproduction of the entire content associated with this target object, which is complete except for the identification attributes, shall be generated.

10.1.1 Reproductions of the content of a basic logical object

A reproduction of the content associated with a single basic logical object is such that:

- the reproduction shall be a single content portion;
- this generated content portion shall be a reproduction of the unique content portion, called the *source content portion* or the *source* in short, which was originally associated with the basic logical object before the layout process; this reproduction is complete except that it includes neither of the content portion attributes "content identifier – logical" and "content identifier – layout";
- this reproduction shall include the other content portion attributes "type of coding", "content information", "alternative representation", as well as the coding attributes proper to the content architecture;
- the same value is assigned to each of these attributes as the value assigned to its counterpart attribute in the source content portion.

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10.1.2 Reproductions of the content of a target object

When the target object is a basic logical object, one content portion shall be generated at each occurrence of the duplication of the content of the target object. This generated content portion shall be coincident with the reproduction of the content associated with the target object as defined in 10.1.1.

When the target object is a composite logical object, one content portion shall be generated for each basic logical object subordinate to the target object, at each occurrence of the duplication of the content of the target object. This content portion shall be a reproduction of the content associated with the basic logical object concerned. Hence, when the target object is superior to more than one basic logical object, the same number of content portions shall be generated. This set of content portions is collectively called a *reproduction of the content associated with the target object.*

10.1.3 Reproduction bundles

The duplication of content occurs only in accordance with the attribute "obligatory same layout objects" applied to some logical objects (see 12.2.4).

If the attribute "obligatory same layout objects" is applied to a logical object, a set of zero or more target objects shall be identified. If the duplication of content occurs in accordance with this instance of the attribute, one reproduction shall be generated for the content associated with each of those target objects, at each occurrence of the duplication.

The set of those reproductions, which are generated at a single occurrence of the duplication invoked by a single instance of the attribute "obligatory same layout objects", is called a *reproduction bundle* generated in accordance with this instance of the attribute.

A single reproduction bundle satisfies that:

- for each basic logical object subordinate to each target object, the reproduction bundle contains one content portion that is a reproduction of the content associated with this basic logical object;
- the reproduction bundle is composed of only these content portions.

The duplication of content may occur whenever it is necessary. It may occur irrespective of the processing order of basic logical objects (see 12.2.5 and 13.5): the layout process may generate a reproduction of the content associated with a basic logical object, even if it has laid out the content associated with basic logical objects that follow it in the processing order.

NOTE – The processing order of basic logical objects is the order in which the layout process lays out basic logical objects. This order is the same as the sequential logical order, unless the attribute "presentation precedence" exists within the logical structure concerned. In that case, the attribute may affect this order (see 12.2.5 and 13.5).

The duplication of content may occur as many times as is necessary, even if it is in accordance with a single instance of the attribute "obligatory same layout object".

10.2 Layout of content within reproductions

10.2.1 Order of layout

Whenever it becomes necessary for the layout process to duplicate content, the layout process suspends the layout of the relevant object until it completes the layout of the reproduction bundle generated at this occurrence of the duplication. The following steps are carried out:

- the layout process generates a bundle of reproductions, each of which is for the content associated with a single target object;
- the layout process lays out those content portions within the reproduction bundle one by one;
- the order in which the layout process lays out these content portions is the same as the processing order of the basic logical objects with which their source content portions are associated;
- the layout process starts again the layout of the relevant object.

10.2.2 Splits of content portions

The content portion in a reproduction of the content of a basic logical object may split into more than one content portions during the layout process, if the content portion are required to be laid out within more than one block (see also 6.5.2.5 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

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10.2.3 Effects of layout directive attributes on layout

A reproduction may be laid out taking account of the layout directive attributes that have affected the layout of the source of the reproduction. This subclause provides descriptions of the way in which the layout directive attributes defined in ITU-T Rec. T.412 | ISO/IEC 8613-2 affect the layout of the content of reproductions. For the layout directive attributes introduced in this Specification, their effects on the layout of reproductions is described in clause 12.

The layout directive attributes defined in ITU-T Rec. T.412 | ISO/IEC 8613-2 are classified into two types:

a) A layout directive attribute of the first type never refers to content other than that associated with the logical object to which it applies, and the effect of the attribute on the layout is confined to this content.

   The attributes that belong to this type are the attributes "block alignment", "fill order", "offset", "separation", "layout category", "logical stream category", "layout stream sub-category", "indivisibility", "layout object class", and "new layout object".

b) A layout directive attribute of the second type refers to content other than that associated with the logical object to which it applies. Such an attribute specifies that the content associated with that logical object shall be laid out related to the layout of the referenced content.

   The attributes of this type are the attributes "concatenation", "floatability range", "same layout object", and "synchronization".

Principally, a layout directive attribute affects the layout of the content of a reproduction bundle as follows.

a) When the layout directive attribute is of the first type, within the reproduction bundle, the content whose source content portions are associated with the logical object to which the attribute applies shall be laid out in accordance with this attribute. Moreover, the attribute shall independently affect the layout of each individual reproduction bundle.

b) When the layout directive attribute is of the second type, the attribute affects the layout of the reproduction bundle if and only if the *affected content*, whose layout is to be affected by the attribute, and the *referenced content*, to which the layout of the affected content is to be related, are both included in the same reproduction. Otherwise, the attribute shall not affect the layout of the reproduction.

   If the reproduction bundle includes both the affected content and the referenced content at the same time, the affected content shall be laid out related to the referenced content in accordance with the attribute. Moreover, in this case also, the attributes shall independently affect the layout of each individual reproduction of the content.

The following 10.2.3.1 to 10.2.3.10 provides descriptions of the effect of each attribute on the layout of the content of a reproduction of the content of a basic logical object, or a reproduction bundles.

10.2.3.1 "block alignment", "fill order", "offset", "separation"

If any one of the attributes "block alignment", "fill order", "offset", and "separation" applies to a basic logical object, and the reproduction is for the content associated with this basic logical object, then blocks that contain the content of this reproduction shall be laid out within their immediately superior frames as specified by the attribute (see also 9.7.2, 9.7.4, 9.7.12 and 9.7.14 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

10.2.3.2 "layout category"

If the attribute "layout category" applies to a basic logical object, and the reproduction is for the content associated with this basic logical objet, then the content of this reproduction shall be constrained to be placed within lowest level frames such that their "permitted categories" include the layout category specified by the attribute (see 9.7.7 and 9.4.2.6 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

10.2.3.3 "logical stream category", "logical stream sub-category"

If the attributes "logical stream category" and "logical stream sub-category" define a stream category that applies to a basic logical object, and the reproduction is for the content associated with this basic logical object, then the content of this reproduction is constrained to be placed within layout objects to which a stream category applies that is the same as that which applies to the basic logical object (see also 9.7.1.2, 9.7.9 and 9.7.10 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

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10.2.3.4 "indivisibility"

If the attribute "indivisibility" applies to a logical object, then, within the reproduction bundle, the affected content is such that its source content portions are associated with this logical object.

The attribute specifies that the affected content shall be laid out within a single layout object that the attribute specifies. However, the attribute never constrains this layout object to contain any other particular content,

- even if it is associated with the logical object concerned;
- even if it belongs to another reproduction bundle whose source content portion is associated with the logical object concerned.

(See also 9.7.6 of ITU-T Rec. T.412 | ISO/IEC 8613-2.)

10.2.3.5 "layout object class"

If the attribute "layout object class" applies to a logical object, then, within the reproduction bundle, the affected content is such that its source content portions are associated with this logical object.

The attribute specifies that the affected content shall be laid out within a single layout object that the attribute specifies. Furthermore, no other content shall be laid out within this layout object,

- even if it is associated with the logical object concerned; or
- even if it belongs to another reproduction whose source content portions were associated with the logical object concerned.

(See also 9.7.8 of ITU-T Rec. T.412 | ISO/IEC 8613-2.)

10.2.3.6 "new layout object"

If the attribute "new layout object" applies to a logical object, and the reproduction is for the content associated with the first basic logical object subordinate to this logical object, then the content of this reproduction shall be laid out starting within the next layout object specified by the attribute which does not contain any prior content (see also 9.7.11 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

NOTE – In 10.2.3.8 and 10.2.3.9, the first "basic logical object" and the "last basic logical objects" are the first and last basic logical objects subordinate to the logical objects in the processing order of basic logical objects (see 12.2.5 and 13.5).

10.2.3.7 "concatenation"

If the attribute "concatenation" applies to a basic logical object with the value 'concatenated', then, within the reproduction bundle:

a) the affected content is such that its source content portion is associated with the basic logical object to which the attribute applies;

b) the referenced content is such that their source content portion is associated with the nearest preceding basic logical object which has the same content architecture class, layout category, stream category, and fill order.

The attribute specifies that this affected content and this referenced content shall be concatenated (see also 9.7.3 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

NOTE – In the above, "a preceding basic logical object" is one preceding the basic logical object in the processing order of basic logical objects (see 12.2.5 and 13.5). If the attribute "presentation precedence" exists within the specific logical structure concerned, this order may be different from the sequential logical order.

10.2.3.8 "floatability range"

If the attribute "floatability range" applies to a logical object, then, within the reproduction bundle:

a) the affected content is such that its source content portions are associated with the logical object to which the attribute applies;

b) one referenced content is such that their source content portions are associated with the logical objects that the sub-parameters "logical object" identifies of the parameter "forward limit";

c) the other referenced content is such that their source content portions are associated with the logical objects that the sub-parameters "logical object" identifies of the parameter "backward limit";

The attribute specifies that this affected content shall be laid out between the former referenced content and the latter referenced content in the layout sequential order (see also 9.7.5 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

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10.2.3.9 "same layout object"

If the attribute "same layout object" applies to a logical object, then within the reproduction bundle,

a) the affected content is such that its source content portion is associated with the first basic logical object subordinate to the logical object to which the attribute applies;

b) the referenced content is such that its source content portion is associated with the last basic logical object subordinate to the logical object that the parameter "logical object" of the attribute specifies.

The attribute specifies that the start of this affected content and the end of this referenced content shall be laid out within a single layout object which is of the layout object class or object type specified by the parameter "layout object" of the attribute (see also 9.7.13 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

10.2.3.10 "synchronization"

If the attribute "synchronization" applies to a logical object, then, within the reproduction bundle,

a) the affected content is such that its source content portion is associated with the first basic logical object subordinate to the logical object to which the attribute applies;

b) the referenced content is such that its source content portion is associated with the first basic logical object that the attribute specifies.

The attribute specifies that this affected content and this referenced content shall be laid out aligned along a line orthogonal to the direction of the layout path (see also 9.7.15 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

10.3 Content identifiers for reproductions

When the content portion of a reproduction of the content associated with a basic logical object is laid out within a block, the attribute "content identifier – layout" shall be assigned to the content portion. In contrast, the attribute "content identifier – logical" shall never be assigned throughout the layout process.

When the content portion is split into more than one content portion, and therefore it is laid out within more than one block, the attribute "content identifier – layout" shall be assigned to each split content portion. In this case also, the "content identifier – logical" shall never be assigned to any split content portion.

Hence, any content portion which stems from a content portion within a reproduction never includes the attribute "content identifier – logical". In other words, such a content portion shall never be associated with any basic logical object (see 5.1).

This Specification abuses the term *reproduction* or the term *reproduction bundle*: even if content portions within a reproduction (bundle) are split into smaller content portions, the set consisting of these content portions may be also referred to as a reproduction (bundle).

11 Expressions

11.1 Grid construction expressions

Evaluation of a grid construction expression may produce either an empty sequence or a sequence of one or more *atoms*. Different types of grid construction expression deliver different types of atom.

A grid construction expression shall satisfy the following *deterministic condition*:

– if two sequences of atoms are derived from evaluation of a single grid construction expression, and they are of the same length, these sequences are coincident with each other.

NOTE – The length of a sequence of atoms is defined as the number of atoms composing the sequence. If the sequence is empty, its length is defined as 0.

There are four types of grid construction expressions, each of which delivers a different type of atom (see Table 1):

– grid interval expressions;

– grid gutter expressions;

– grid line expressions;

– line characteristic expressions.

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A grid construction expression is either a grid construction term or a grid construction type. A grid construction type is one of the following:

- a grid sequence construction, which consists of one or more grid construction terms, which are to be evaluated in the order specified;
- a grid aggregate construction, which consists of one or more grid construction terms, which are to be evaluated in an arbitrary order;
- a grid choice construction, which consists of one or more grid construction terms, one of which is to be evaluated.

A grid construction term is one of the following:

- a grid required construction factor;
- a grid optional construction factor;
- a grid repetitive construction factor;
- a grid optional repetitive construction factor.

Each grid construction factor is either an atom or a grid construction type. In the former case, the value of the grid construction factor is the atom. In the latter case, the value of the grid construction factor is derived by evaluation of the grid construction type. Evaluation of the grid construction type may produce either an empty sequence or a sequence of one or more atoms:

- A grid required construction factor is to be evaluated once when the containing grid construction term is evaluated.
- A grid optional construction factor may be evaluated once or may not be evaluated, when the containing grid construction term is evaluated.
- A grid repetitive construction factor is to be evaluated one or more times in succession, when the containing grid construction term is evaluated.
- A grid optional repetitive construction factor may be evaluated one or more times in succession, or may not be evaluated, when the containing grid construction term is evaluated.

Table 1 – Types of grid construction expression

Type of expression	Attribute	Type of atom
Grid interval expression	"grid interval dimensions"	Interval indicator
Grid gutter expression	"grid gutters"	Gutter indicator
Grid line expression	"grid lines"	Line characteristic
Line characteristic expression	–	Line segment characteristic

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11.2 Attributes with grid construction expressions as values

This Specification defines three attributes with parameters whose permissible value is a grid construction expression:

a) grid interval dimensions (see 12.1.4);

b) grid gutters (see 12.1.3);

c) grid lines (see 12.1.5).

Each attributes is associated with a different type of grid construction expression (see Table 1):

a) The permissible value for a parameter of the attribute "grid interval dimensions" is a grid interval expression (see 11.3). The layout process evaluates this attribute specified for a grid frame class description, and determines the grid interval dimensions of the layout grid within the grid frame to which this attribute applies. The determined grid intervals are expressed as a grid interval expression, and then the expression is specified for the grid frame description as a value for the same attribute.

   The imaging process evaluates the attribute "grid interval dimensions" specified for a grid frame description, and gets the positions where it shall image the layout grid lines involved in its layout grid.

b) The permissible value for a parameter of the attribute "grid gutters" is a grid gutter expression (see 11.5). The layout process evaluates this attribute, and calculates available areas for frames immediately subordinate to the grid frame to which the attribute applies.

c) The permissible value for a parameter of the attribute "grid lines" is a grid line expression (see 11.7). The layout process evaluates this attribute specified for a grid frame class description, and determines the way in which the imaging process shall image the layout grid lines within the grid frame to which this attribute applies. This way of presenting the layout grid lines is expressed as a grid line expression, and then the expression is specified for the grid frame description as a value of the same attribute.

The imaging process evaluates the attribute "grid lines", and images layout grid lines of the layout grid within the grid frame.

11.3 Grid interval expressions

The value of a *grid interval expression* is an *interval indicator* (see 11.4). A grid interval expression may be a value of a parameter of the attribute "grid interval dimensions".

The attribute "grid interval dimensions" specifies the distances or a rule to the determine distances between consecutively numbered major / minor layout grid lines (called the *major / minor grid interval dimension*). This attribute consists of two parameters "major interval dimensions" and "minor interval dimensions", which respectively specify the dimensions of the major and minor grid intervals of the layout grid within the grid frame to which the attribute is applied.

Evaluation of a grid interval expression specified for the parameter "major / minor interval dimensions" may produce either an empty sequence or a sequence of interval indicators. The length of the derived sequence shall be the same as the major / minor grid size of the layout grid, namely the number of the major / minor grid intervals within the layout grid. Each interval indicator in the sequence specifies the dimension of an individual grid interval: the i-th interval indicator in the sequence specifies the i-th major / minor grid interval dimension of the layout grid, namely the distance between $(i - 1)$-th and i-th major / minor layout grid lines.

NOTE – The deterministic condition of the grid construction expression provides for the unique sequence of interval indicators for the given major / minor size of the layout grid.

Whenever the layout process reaches a grid logical object, the process evaluates the attribute "grid frame classes", if it exists, applied to the grid logical object, and generates one or more grid frames in accordance with the construction expression specified for the attribute. At the same time, the process shall generate a layout grid within each generated grid frame so that this layout grid shall include as many major / minor grid intervals as the logical grid associated with the grid logical object does (see 9.2). Thus, the major and minor sizes of the layout grid are derived from those of the associated logical grid.

11.4 Interval indicators

Constituents:

Terminal factors for grid interval expressions.

Structure:

One of the parameters "fixed dimension", "rule B" or "proportional".

The parameter "rule B" is structured into two optional sub-parameters, "minimum dimension" and "maximum dimension".

The parameter "proportional" is structured into three optional sub-parameters, "group", "imaginary dimension" and "default dimension".

Permissible values:

For the parameter "fixed dimension": a non-negative integer.

For the sub-parameters of the parameter "rule B":

- "minimum dimension": a non-negative integer;
- "maximum dimension": either a non-negative integer or 'infinitely large'.

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For the sub-parameters of the parameter "proportional":

- "group": a non-negative integer;
- "imaginary dimension": a non-negative integer;
- "default dimension": either a non-negative integer or 'null'.

Default values:

For the sub-parameters of the parameter "rule B":

- "minimum dimension": 0;
- "maximum dimension": 'infinitely large'.

For the sub-parameters of the parameter "proportional":

- "group": 0;
- "imaginary dimension": 1;
- "default dimension": 'null'.

Definition:

An interval indicator is one of the following:

a) *The parameter "fixed dimension"*

The parameter "fixed dimension" specifies that the dimension of the relevant grid interval to which this interval indicator applies shall be the value specified for this parameter, measured in scaled measurement units (SMU).

b) *The parameter "rule B"*

The parameter "rule B" specifies that the dimension of the relevant grid interval shall be determined so that:

- the interval dimension shall be within the range between the value specified for the sub-parameters "minimum dimension" and "maximum dimension";
- the interval dimension shall be large enough for the immediately subordinate entry frames which intersect the grid interval.

The detailed definitions for the sub-parameters "minimum dimension" and "maximum dimension" are as follows:

- The sub-parameter "minimum dimension" specifies the lower limit for the relevant grid interval dimension. The grid interval dimension shall not be smaller than this lower limit.
- The sub-parameter "maximum dimension" specifies an upper limit for the relevant grid interval dimension. The grid interval dimension shall not exceed this upper limit.

  If the parameter maximum dimension specifies the value 'infinitely large', then there shall be no upper limit for the grid interval dimension.

In addition to these constraints, the interval dimension is subject to constraints on the grid dimensions of the relevant layout grid. Such constraints are specified by the attribute "grid dimensions" applied to the grid frame (see 12.1.2):

1) If the parameter "major / minor dimension" of this attribute specifies a non-negative integer, the major / minor dimension of this layout grid shall be the specified value.

2) If the parameter "major / minor dimension" of this attribute specifies the value 'expansive', the major / minor dimension of this layout grid shall be the same as the dimension of the area available for the placement of the layout grid in the direction of the major / minor path.

   In both cases, where the attribute "grid dimensions" specifies some fixed value for the grid dimension in the same direction as that of the relevant grid interval, the dimension of this grid interval may take an arbitrary value, provided that:

   - the total amount of all the grid interval dimensions in the relevant direction is constrained to be this fixed value;
   - each grid interval dimension in the relevant direction satisfies the constraints imposed by the interval indicator applied to it.

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3) If the parameter "major / minor dimension" of this attribute specifies the value 'rule B', there exists no constraint on the major / minor grid dimension except for those imposed by the area available for the relevant layout grid.

In this case, the interval dimension shall be a *minimal dimension*. Minimal dimensions for the grid intervals entirely provide an instance of minimal layout of the layout grid. For the details of the minimal layout, refer to 9.1.12.

c) *The parameter "proportional"*

The parameter "proportional" specifies that the relevant grid interval dimension to which this interval indicator applies shall be determined so that:

- the interval dimension shall be in specified proportions to other particular grid interval dimensions;
- the interval dimension shall be large enough for the immediately subordinate entry frame intersecting the grid interval concerned.

The definition of the sub-parameters are as follows:

- The sub-parameter "group" specifies the group of grid intervals whose dimensions are to be determined in proportion to the relevant grid interval dimension.

  Within the layout grid, this group consists of those grid intervals such that:

  - they are all in the same direction;
  - all the interval indicators that apply to them commonly specify the parameter "proportional";
  - these interval indicators specify the same value for the sub-parameter "group" as the relevant interval indicator does.

- The sub-parameter "imaginary dimension" specifies the dimension of the grid interval measured in a particular imaginary measurement unit. This imaginary measurement unit is shared by all the grid intervals that belong to the same group.

  The layout process shall independently determine the actual dimension for the imaginary measurement unit proper to each individual group of grid intervals. This actual dimension shall be measured in scaled measurement units. Thereafter, the layout process shall determine the dimension of each grid interval that belongs to the group concerned so that:

  - the dimension shall be the product of the determined dimension of the relevant imaginary measurement unit and the value specified for the sub-parameter "imaginary dimension" of the interval indicator applied to this grid interval.

- The sub-parameter "default dimension" specifies the default dimension which the grid interval shall take when no entry frame intersects it.

  If this parameter specifies a value of a non-negative integer, the grid interval dimension shall be this specified value, measured in scaled measurement units, irrespective of the dimensions of the other grid intervals in the same group.

  If this parameter specifies the value 'null', the dimension of the grid interval shall be always determined so as to keep the specified proportions to the dimensions of the other grid intervals in the same group, no matter whether any entry frames intersect it.

In addition to these constraints, the actual dimension of the imaginary measurement unit shall be subject to the constraints imposed by the attribute "grid dimensions", in the same way as stated in the case of the value "rule B".

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11.5 Grid gutter expressions

The value of a *grid gutter expression* is a *gutter indicators*. A grid gutter expression may be a value of a parameter of the attribute "grid gutters".

The attribute "grid gutters" specifies the gutter space width around major and minor grid lines within the grid frame to which the attribute is applied. The attribute consists of two parameters "around major grid lines" and "around minor grid lines" which respectively specify the gutter space width around major and minor layout grid lines.

Evaluation of a grid gutter expression specified for the parameter "around major / minor grid lines" may produce either an empty sequence or a sequence of gutter indicators. The length of the derived sequence is the same as the number of the major / minor layout grid lines within the layout grid concerned.

Each gutter indicator in the sequence specifies the gutter space width around an individual layout grid line: the *i*-th gutter indicator in the sequence specifies the gutter space width around the *i*-th major / minor grid line.

11.6 Gutter indicators

Constituents:

Terminal factors for grid gutter expressions.

Structure:

Consists of two optional parameters: "width", "precedence".

Permissible values:

- "width": a non-negative integer (SMU);
- "precedence": a non-negative integer.

Default values:

- "width": 0;
- "precedence": 0.

Definition:

A gutter indicator consists of two optional parameters:

- The parameter "width" specifies the gutter space width around the layout grid line to which the gutter indicator is applied. The width is measured in scaled measurement units.
- If two or more layout grid lines occupy the same position within the grid frame, the same number of gutter indicators are applicable in determining the gutter space width around the line into which those layout grid lines merge. In such degenerate cases, the layout process takes account of the parameter "precedence" associated with those gutter indicators:
  a) among those gutter indicators applicable, the one having the highest "precedence" shall be applied;
  b) if two or more gutter indicators are associated with the highest "precedence", the last in the sequential order shall be applied.

11.7 Grid line expressions

A *grid line expressions* is a *line characteristics*.

A grid line expression may be a value of the parameters "major grid lines" and "minor grid lines" of the attribute "grid lines". The parameter "major / minor grid lines" specifies a set of sequences of line segment characteristics each of which describes the way in which each individual major / minor grid line is to be imaged.

A line segment characteristic is a triplet of a line width, line type and line colour, and is applied to an individual grid line segment (see 9.1.4) forming part of a layout grid line. Thus, when a layout grid line is imaged, it may be a sequence of line segments each of which may be imaged in a different way.

Direct evaluation of a grid line expression specified for the parameter "major / minor grid lines" may produce a sequence of one or more line characteristics. The length of the derived sequence is the same as the number of the major / minor layout grid lines within the layout grid. Each line characteristic in the sequence is applied to an individual layout grid line: the i-th line characteristic in the sequence is applied to the i-th major / minor layout grid line.

11.8 Line characteristics

Constituents:

Terminal factors for grid line expressions.

Structure:

Consists of two optional parameters: "expression" and "precedence".

Permissible values:

- "expression": a line characteristic expression;
- "precedence": a non-negative integer.

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Default value:

- "expression": the grid optional repetitive construction factor which is the default line segment characteristic (see 11.10);
- "precedence": 0.

Definition:

A line characteristic consists of two optional parameters:

- The parameter "expression" takes as its value a line characteristic expression, and the effect is as described in 11.9.
- If two or more layout grid lines merge into a single line, that same number of line characteristics are applicable to the single line into which those layout grid lines merge. In such degenerate cases, the layout process takes the parameter "precedence" associated with those line characteristics into account:
  a) among the line characteristics applicable, the one having the highest "precedence" shall be applied;
  b) if two or more line characteristics are associated with the highest "precedence", the last in the sequential order shall be applied.

11.9 Line characteristic expressions

A *line characteristic expressions* is a *line segment characteristics.*

Evaluation of a grid line expression may produce either an empty sequence or a sequence of line characteristics each of which includes one line characteristic expression. Each line characteristic expression in the sequence is applied to an individual major / minor layout grid line in order to determine the way in which it is to be imaged.

Evaluation of a line characteristic expression produces a sequence of one or more line segment characteristics. The length of the derived sequence is the same as the number of the *grid line segments* composing the layout grid line.

Consecutively numbered minor / major layout grid lines may merge into a single line, and therefore the line segment delimited by these grid lines may degenerate into a point. In such cases, the point shall be counted as a line segment. Hence, the number of the line segment composing a layout grid line is the same as the number of the minor / major sizes of the layout grid concerned.

Each line segment characteristic in the sequence specifies the line width, line type and line colour of an individual grid line segment of the layout grid line to which the line characteristic expression is applied: the j-th line segment characteristic in the sequence specifies the line width, line type and line colour of the j-th line segment of the major / minor layout grid line, where the j-th line segment of the layout grid line is between the $(j - 1)$-th and j-th minor / major layout grid lines.

11.10 Line segment characteristics

Constituents:

Terminal factors for line characteristic expressions.

Structure:

Consists of three optional parameters: "line width", "line type", "line colour".

The parameter "line colour", if specified, is a choice between two sub-parameters: "implementation defined" and "colour expression". The sub-parameter "implementation defined" is not substructured. The sub-parameter "colour expression" is structured as defined for the colour expressions in 9.1.4.1 of ITU-T Rec. T.412 | ISO/IEC 8613-2.

Permissible values:

- "line width": a non-negative integer (SMU);
- "line type": one of 'solid', 'dashed', 'dash-dot', 'dash-dot-dot', 'double' and 'invisible';
- "line colour":
  - "implementation defined": 'implementation-defined';
  - "colour expression": a colour expression as defined in 9.1.4.1 of ITU-T Rec. T.412 | ISO/IEC 8613-2.

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Default value:

Each of the parameters is independently defaultable.

For the parameters "line width" and "line type":

- "line width": 0;
- "line type": 'solid'.

For the parameter "line colour", the default value is the sub-parameter "colour expression" with the sub-sub-parameters:

- "colour access mode": 'direct';
- "colour space id": 0;
- "colour specification": 1, 1, 1;
- "colour tolerance":
  - "unspecified tolerance": 'infinite'.

NOTE – The default value for a colour expression is a white colour in RGB space without limit on tolerance.

Definition:

A line segment characteristic is applied to either a grid line segment of a layout grid line or a supplementary line, and determines its line width, line type and line colour.

The parameter "line colour" specifies the line colour. It either has the value 'implementation-defined' (a value that is distinguishable from the colour visible in the layout object) or is given in terms of a colour expression as defined in 9.1.4.1 of ITU-T Rec. T.412 | ISO/IEC 8613-2. In the case of an indexed colour expression the relevant colour table is specified in the attribute "object colour table" applied to the grid frame that includes the grid line segment or the supplementary line.

12 Attribute definitions

12.1 Layout attributes

12.1.1 Frame alignment point

Constituents:

Frame component descriptions.

Classification:

Non-mandatory for object class descriptions.

Defaultable for object descriptions.

Structure:

One of the parameters: "subordinate dependent", "fixed position", "variable position".

The parameter "fixed position" is structured into two optional sub-parameters: "vertical position", "horizontal position".

The parameter "variable position" is structured into two optional sub-parameters: "vertical alignment", "horizontal alignment".

Permissible values:

For the parameter "subordinate dependent": 'first', 'last'.

For the parameter "fixed position":

- "vertical position": any integer;
- "horizontal position": any integer.

For the parameter "variable position":

- "vertical alignment": 'top', 'centre', 'bottom';
- "horizontal alignment": 'left', 'centre', 'right'.

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Default value:

If no value is specified, the default value is the parameter "subordinate dependent" with the value 'first'.

Definition:

12.1.1.1 The layout process shall take this attribute into account only when applied to a frame subordinate to some grid frame.

This attribute specifies the position of the alignment point associated with the relevant frame to which the attribute applies.

12.1.1.2 The parameter "subordinate dependent" specifies that the alignment point of the relevant frame shall be located on the alignment point associated with one of the immediately subordinate layout objects, no matter whether it is a frame or a block:

- if the parameter specifies the value 'first', then the alignment point of the relevant frame shall occupy the same position as the alignment point of the first immediately subordinate layout object in the sequential layout order;

- if the parameter specifies the value 'last', then the alignment point of the relevant frame shall occupy the same position as the alignment point of the last immediately subordinate layout object in the sequential layout order.

12.1.1.3 When the attribute specifies the parameter "fixed position", the sub-parameter "vertical / horizontal position" specifies the vertical / horizontal distance of the alignment point from the reference point of the relevant frame, measured in scaled measurement units.

The vertical position is measured in the top-to-bottom direction:

- If the sub-parameter "vertical position" specifies a positive / negative integer, the alignment point shall be located beneath / above the reference point.

The horizontal position is measured in the left-to-right direction:

- If the sub-parameter "horizontal position" specifies a positive / negative integer, the alignment point shall be located on the right / left of the reference point.

An alignment point specified by the parameter "fixed position" may fall outside the relevant frame.

If this parameter does not specify a value for any of its sub-parameters, then the value zero is assumed for each sub-parameter for which a value is not specified.

12.1.1.4 If the attribute specifies the parameter "variable position", the sub-parameter "vertical / horizontal alignment" specifies the vertical / horizontal position of the alignment point:

- If the sub-parameter "vertical alignment" specifies the value 'top' / 'bottom', then the alignment point shall be located on the top / bottom edge of the relevant frame.

  If the sub-parameter specifies the value 'centre', then the alignment point shall be located equidistant from the top and bottom edges of the relevant frame.

- If the sub-parameter "horizontal alignment" specifies 'left' / 'right', then the alignment point shall be located on the left / right edge of the relevant frame.

  If the sub-parameter specifies the value 'centre', then the alignment point shall be located equidistant from the right and left edges of the relevant frame.

NOTE – The left / right edge of the frame may be different from the left-hand / right-hand edge. The former is defined absolutely, while the latter is defined relative to the layout path (see 7.3.3 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

An alignment point specified by the parameter "variable position" is always located within the relevant frame.

If this parameter does not specify a value for any of the sub-parameters, then the value 'centre' is assumed for each sub-parameter for which a value is not specified.

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12.1.2 Grid dimensions

Constituents:

Grid frame component descriptions.

Classification:

Non-mandatory for object class descriptions.

Defaultable for object descriptions.

Structure:

Consists of two optional parameters: "major dimension" and "minor dimension".

Permissible values:

For each parameter: one of a non-negative integer (SMU), 'rule B', 'expansive'.

Default value:

Each of the parameters is independently defaultable.

For each parameter: 'rule B'.

Definition:

12.1.2.1 The layout process shall take this attribute into account only when the relevant grid frame to which this attribute applies is referred to by an instance of the attribute "grid frame classes" which applies to some grid logical object (see 12.2.3).

This attribute specifies the dimensions of the edges of the layout grid within the relevant grid frame.

The parameter "major / minor dimension" specifies the dimension of the edges parallel to the major / minor path of the grid frame. This dimension is equal to the distance between the 0-th and last major / minor layout grid lines.

12.1.2.2 If the parameter "major / minor dimension" specifies a non-negative integer, the dimension of the edges shall be the value specified by this parameter.

12.1.2.3 If the parameter "major / minor dimension" specifies the value 'rule B', the dimension of the edges shall be determined in accordance with the attribute "grid interval dimensions" applied to the same grid frame. The attribute "grid interval dimensions" specifies the major / minor grid interval dimensions, namely the distances between consecutively numbered major / minor layout grid lines within the grid frame. Therefore, the dimension of the edges parallel to the major / minor path shall be coincident with the total of all the major / minor grid interval dimensions.

12.1.2.4 If the parameter "major / minor dimension" specifies the value 'expansive', the layout grid shall expand to the available area within the relevant grid frame, in the direction of the major / minor path.

12.1.2.5 No matter which value is specified for this attribute, the grid shall be placed within the relevant grid frame. In addition, if the relevant grid frame has a border free space, the grid shall not fall within the border free space.

12.1.3 Grid gutters

Constituents:

Grid frame component descriptions.

Classification:

Non-mandatory for object class descriptions.

Defaultable for object descriptions.

Structure:

Consists of two optional parameters: "around major grid lines" and "around minor grid lines".

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Permissible values:

For each parameter: a grid gutter expression.

Default value:

Each of the parameters is independently defaultable.

For each parameter: the grid optional repetitive construction factor which is the default gutter indicator.

For the parameters of the default gutter indicator:

- "width": 0;
- "precedence": 0.

Definition:

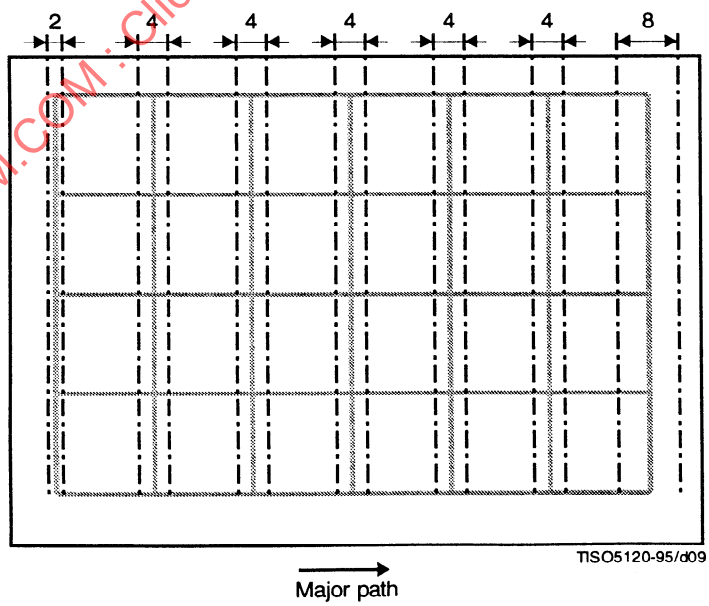
12.1.3.1 The layout process shall take this attribute into account only when the relevant grid frame to which this attribute applies is referred to by an instance of the attribute "grid frame classes" which applies to some grid logical object (see 12.2.3).

This attribute consists of two parameters: "around major grid lines" and "around minor grid lines". The parameter "around major / minor grid lines" specifies the gutter space width around the major / minor grid lines within the relevant grid frame to which this attribute is applied.

A gutter space around a layout grid line is a rectangular area within the layout grid, delimited by two lines running parallel to the layout grid line concerned, such that the layout grid line is equidistant from those two edging lines. The width of the gutter space is defined as the distance between those two edging lines (see Figure 9).

The layout process shall take gutter spaces into account in determining the area available for placement of an entry frame: if an entry frame is bound to a layout grid rectangle, the entry frame shall be excluded from the gutter spaces reserved around the four edges of the grid rectangle.

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Grid gutters around major grid lines = SEQ({2,0}, REP({4,0}), {8,0})

Figure 9 – Gutter spaces

12.1.3.2 The parameter "around major / minor grid lines" specifies the grid gutter space width around the major / minor layout grid lines.

Evaluation of the grid gutter expression specified for the parameter "around major / minor grid lines" shall produce a sequence of one or more gutter indicators. The number of gutter indicators in this derived sequence shall be the same as the number of the major / minor layout grid lines within the grid frame (see 11.5): the *i*-th gutter indicator in the sequence specifies the gutter space width around the *i*-th major / minor layout grid line.

Each gutter indicator consists of two optional parameters: "width" and "precedence". For the definition of these parameters, refer to 11.6.

12.1.4 Grid interval dimensions

Constituents:

Grid frame component descriptions.

Classification:

Non-mandatory.

Structure:

Consists of two parameters: "major interval dimensions" and "minor interval dimensions".

Permissible values:

For each parameter: a grid interval expression.

Definition:

NOTE – In this definition, the scope of the symbol / is the entire text (see 5.2).

12.1.4.1 The layout process shall take this attribute into account only when the relevant grid frame to which this attribute applies is referred to by an instance of the attribute "grid frame classes" which applies to some grid logical object (see 12.2.3).

This attribute consists of two parameters: "major interval dimensions" and "minor interval dimensions". The parameter "major / minor interval dimensions" specifies the dimensions of major / minor grid intervals. The dimension of a major / minor grid interval, called also a *major / minor grid interval dimension*, is the distance between two consecutively numbered major / minor layout grid lines.

12.1.4.2 If an object class description specifies this attribute, arbitrary grid interval expressions may be specified for the parameters.

In contrast, if an object description specifies this attribute, the grid interval expression specified for the parameter "major / minor grid interval" shall be of the grid sequence construction type composed of interval indicators. Furthermore:

- each interval indicator involved in this grid interval expression shall specify the parameter "fixed dimension" (see 11.4);
- the number of the interval indicators involved in this grid interval expression shall be the same as the major / minor grid size of the relevant layout grid.

By evaluating this attribute specified for the object description, the imaging process shall determine the absolute dimensions of the grid intervals as well as the grid sizes of the layout grid (see 9.1.5). If the attribute is omitted from the object description, the imaging process shall regard the grid frame as an ordinary frame which does not include any layout grid.

12.1.4.3 Evaluation of the grid interval expression specified for the parameter "major / minor interval dimensions" shall produce a sequence of one or more interval indicators (see 11.3). The number of interval indicators involved in the derived sequence shall be the same as the major / minor size of the layout grid within the relevant grid frame.

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The *i*-th interval indicator in the derived sequence specifies the dimension of the *i*-th major / minor grid interval (see 9.1.8).

Each interval indicator is one of the following:

a) the parameter "fixed dimension";

b) the parameter "rule B" with two optional sub-parameters: "minimum dimension" and "maximum dimension";

c) the parameter "proportional" with three optional sub-parameters: "group", "imaginary dimension" and "default dimension".

For the definition of these parameters and sub-parameters, refer to 11.4.

12.1.4.4 If an object description specifies this attribute, evaluation of the grid interval expression specified for the parameter "major / minor interval dimensions" shall produce the unique sequence of interval indicators such that:

- the number of the interval indicators involved in the sequence is the same as the major / minor grid size of the relevant layout grid;
- each interval indicator specifies the parameter "fixed dimension".

The *i*-th interval indicator in the sequence determines the *i*-th major / minor grid interval dimension, measured in scaled measurement units.

12.1.5 Grid lines

Constituents:

Grid frame component descriptions.

Classification:

Non-mandatory for object class descriptions.

Defaultable for object descriptions.

Structure:

Consists of the two optional parameters: "major grid lines" and "minor grid lines".

Permissible values:

For each parameter: a grid line expression.

Default value:

Each of the parameters is independently defaultable.

For each parameter: the grid optional repetitive construction factor which is the default line characteristic.

For the parameters of the default line characteristic:

- "expression": the grid optional repetitive construction factor which is the default line segment characteristic;
- "precedence": 0.

For the parameters "line width" and "line type" of the default line segment characteristic:

- "line width": 0;
- "line type": 'solid'.

For the parameter "line colour" of the default line segment characteristic, the default value is the sub-parameter "colour expression" with the sub-sub-parameters:

- "colour access mode": 'direct';
- "colour space id": 0;
- "colour specification": 1, 1, 1;

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- "colour tolerance":
  - "unspecified tolerance": 'infinite'.

NOTE 1 – The default value for a colour expression is a white colour in RGB space without limit on tolerance.

Definition:

NOTE 2 – In this definition, the scope of the symbol / is the entire text (see 5.2).

12.1.5.1 The layout process shall take this attribute into account only when the grid frame to which this attribute applies is referred to by an instance of the attribute "grid frame classes" which applies to some grid logical object (see 12.2.3).

The imaging process shall take this attribute into account only when the relevant object description specifies the attribute "grid interval dimensions" (see 12.1.4).

NOTE – If the object description specifies the attribute "grid interval dimensions", the grid interval expression specified for each parameter of this attribute shall be of the grid sequence construction type consisting of interval indicators. In particular, the number of the interval indicators involved in the grid interval expression specified for the parameter "major / minor interval dimensions" shall be the same as the major / minor size of the layout grid concerned.

This attribute consists of two parameters: "major grid lines" and "minor grid lines". The parameter "major / minor grid lines" specifies the way in which major / minor layout grid lines are to be imaged. More precisely, this parameter specifies the line width, line type and line colour applicable for each individual grid line segment of the major / minor layout grid lines.

12.1.5.2 For the parameter "major / minor grid lines", a grid line expression is specified.

Evaluation of the grid line expression specified for this parameter shall finally produce a set of sequences each of which consists of one or more line segment characteristics (see 11.10). Principally, each line segment characteristic is applied to each individual *grid line segment* of the major / minor layout grid lines, and determines its line width, line type and line colour, provided that a grid line segment is a segment of a major / minor layout grid line delimited by two consecutively numbered minor / major layout grid lines (see 9.1.4).

Direct evaluation of the grid line expression specified for this parameter shall produce a sequence of line characteristic expressions each of which is associated with a non-negative integer, called a *precedence* (see 11.8). The number of line characteristic expressions in the sequence shall be the same as the number of the major / minor layout grid lines within the grid frame (see 11.8), and the *i*-th line characteristic expression in the sequence shall be applied to the *i*-th major / minor layout grid line in order to determine its appearance.

If two or more major / minor layout grid line occupy the same position within the grid frame, the same number of line characteristic expressions are applicable to the single line into which those layout grid lines merge. In such degenerate cases, the precedence associated with each characteristic expression shall be taken into account:

a) among all the line characteristic expressions applicable, the one associated with the highest precedence shall be actually applied;

b) if there still exist more than one line characteristic expression associated with the highest precedence, the last one in their sequential order shall be applied.

12.1.5.3 Evaluation of the line characteristic expression applied to the *i*-th major / minor grid line shall produce a sequence of line segment characteristics. The number of line segment characteristics in the sequence shall be the same as the number of the minor / major grid intervals of the layout grid concerned (see 11.9).

The *j*-th line segment characteristic in the sequence specifies the line width, line type and line colour applicable to the *j*-th grid line segment of the *i*-th major / minor layout grid line, where the *j*-th grid line segment is defined as the segment of the *i*-th major / minor layout grid line between the (*j* – 1)-th and *j*-th minor / major layout grid lines.

Each line segment characteristic consists of three optional parameters "line width", "line type" and "line colour". For the definition of these parameters, refer to 11.10.

12.1.5.4 After the layout process evaluates the grid line expression specified for the parameter "major / minor grid lines", it may modify the derived sequences of line segment characteristics:

- if a grid line segment of a layout grid line is included in the interior of the layout grid rectangle to which some entry frame is bound, the layout process shall replace the line segment characteristic for the segment with one with the value 'invisible' specified for the parameter "line type".

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Thereafter, the layout process shall modify the grid line expression specified for the parameter so that evaluation of the modified expression shall uniquely produce these modified sequences of line segment characteristics. The modified expression shall be the value of the parameter "major / minor grid lines" of the attribute "grid lines" specified for the object description.

12.1.6 Grid position

Constituents:

Grid frame component descriptions.

Classification:

Non-mandatory for object class descriptions.

Defaultable for object descriptions.

Structure:

Either the parameter "fixed position" or the parameter "variable position".

The parameter "fixed position" consists of two mandatory sub-parameters: "major position" and "minor position".

The parameter "variable position" consists of two optional sub-parameters: "major alignment" and "minor alignment".

Permissible values:

For the parameter "fixed position":

- "major position": a non-negative integer (SMU);
- "minor position": a non-negative integer (SMU).

For the parameter "variable position":

- "major alignment": 'left-hand aligned', 'centred', 'right-hand aligned';
- "minor alignment": 'left-hand aligned', 'centred', 'right-hand aligned'.

Default value:

If no value is specified, the default value is the parameter "variable position" with the sub-parameters:

- "major alignment": 'centred';
- "minor alignment": 'centred'.

Definition:

12.1.6.1 The layout process shall take this attribute into account only when the relevant grid frame to which this attribute applies is referred to by an instance of the attribute "grid frame classes" which applies to some grid logical object (see 12.2.3).

The imaging process shall take this attribute into account only when the relevant object description specifies the attribute "grid interval dimensions" (see 12.1.4).

This attribute specifies the position of the associated layout grid within the relevant grid frame.

12.1.6.2 The *grid reference point* is one of the corners of the relevant grid frame. The *grid origin* is one of the corners of the layout grid. They are defined relative to the directions of the major and the minor paths within the grid frame.

Table 2 provides the definition of the grid reference point and the grid origin.

For example, when the attributes "major path" and "minor path" specify 270° and 90°, the grid origin and the grid reference point are the top-left corners of the layout grid and the grid frame respectively (see Figure 10).

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Table 2 – Positions of grid origins and grid reference points

Major path	Minor path	Position
0°	90°	Bottom-left corner
0°	270°	Top-left corner
90°	90°	Bottom-right corner
90°	270°	Bottom-left corner
180°	90°	Top-right corner
180°	270°	Bottom-right corner
270°	90°	Top-left corner
270°	270°	Top-right corner

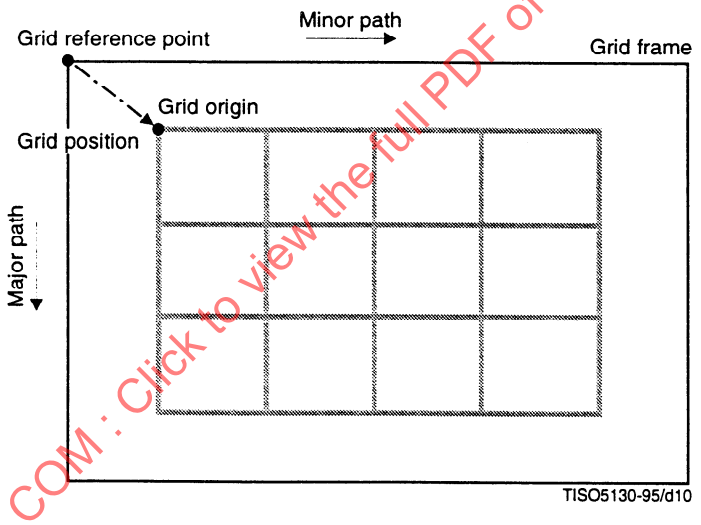


Figure 10 – Grid origin and grid reference point

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12.1.6.3 If the attribute specifies the parameter "fixed position", the sub-parameter "major / minor position" specifies the distance of the grid origin from the grid reference point, measured in the directions of the major / minor path. The direction of the major / minor path is specified by the attribute "major / minor path" applied to the relevant grid frame.

The sub-parameter "major / minor position" shall specify a value so that the layout grid shall be placed within the relevant grid frame. If the grid frame has a border free space, this value shall be further constrained so that the layout grid shall not fall within the border free space.

12.1.6.4 If the attribute specifies the parameter "variable position", the sub-parameter "major / minor alignment" specifies the alignment of the layout grid within the grid frame.

The alignment specified by the sub-parameter "major / minor alignment" determines the position in the direction orthogonal to the major / minor path:

- if the sub-parameter "major / minor alignment" specifies the value 'left-hand aligned', the layout grid shall be positioned as far as possible in the direction which traverses the major / minor path at right angles in an anticlockwise direction, without violating the border allowance of the grid frame;
- if the sub-parameter "major / minor alignment" specifies the value 'right-hand aligned', the layout grid shall be positioned as far as possible in the direction which traverses the major / minor path at right angles in an clockwise direction, without violating the border allowance of the grid frame;
- if the sub-parameter "major / minor alignment" specifies the value 'centred', the layout grid shall be centered in the direction of the minor / major path.

For example, when the attribute "major path" specifies 0°, the alignment specified by the sub-parameter "major alignment" is as follows (see also Figure 11):

- if the sub-parameter specifies the value 'left-hand aligned', the layout grid shall be located at the uppermost position as long as it does not fall within the border free space of the grid frame;
- if the sub-parameter specifies the value 'right-hand aligned', the layout grid shall be located at the bottom position as long as it does not fall within the border free space of the grid frame;
- if the sub-parameter specifies the value 'centred', the grid shall be so located that the distance between the top edge of the grid and that of the grid frame shall be the same as the distance between the bottom edge of the grid and that of the grid frame.

If this parameter does not specify a value for any of the sub-parameters, the value 'centred' is assumed for each sub-parameter for which a value is not specified.

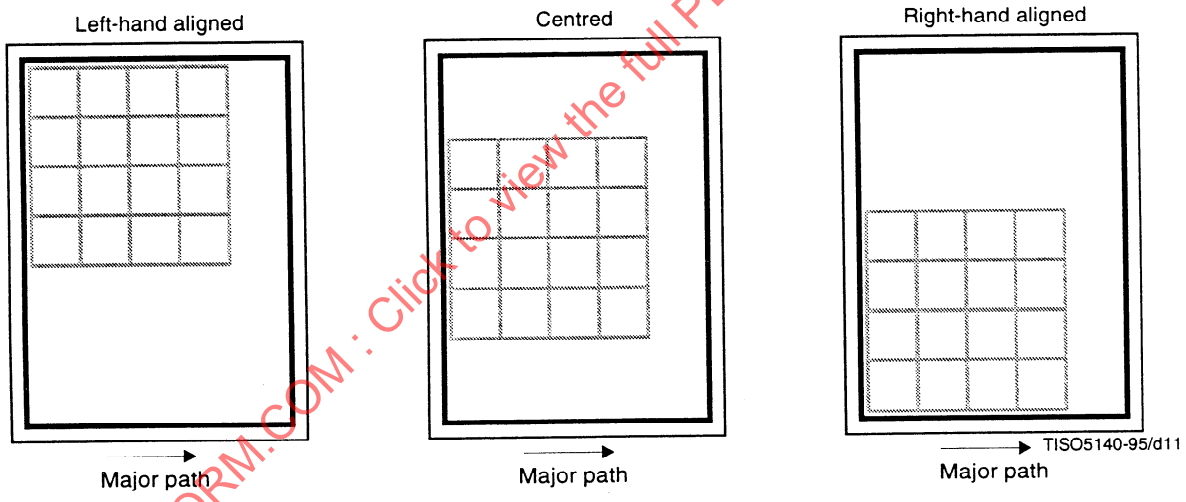


Figure 11 – Major alignment of grids

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12.1.7 Indent – major; Indent – minor

Constituents:

Frame class descriptions.

Classification:

Non-mandatory.

Permissible values:

Any integer.

Definition:

NOTE – In this definition, the scope of the symbol / is the entire text (see 5.2).

12.1.7.1 The layout process shall take the attribute "indent – major / minor" into account only when applied to entry frames immediately subordinate to grid frames. Otherwise, the layout process shall ignore this attribute completely.

If the attribute "reference line alignment – major / minor" specifies that the entry frame to which this attribute applies shall be aligned with other entry frames along some reference line, the distance of the alignment point of the entry frame from the reference line shall be the value specified by the attribute "indent – major / minor".

This distance is measured in scaled measurement units in the direction which traverses the major / minor path of the immediately superior grid frame at right angles in an anticlockwise direction.

NOTE – Even if an entry frame is aligned with other entry frames along a reference line, the attribute "reference line alignment – major / minor" may not be applied to the entry frame (see 12.1.11).

Hence, for example, if the attribute "major path" specifies 270°, and if the attribute "minor path" specifies 90°, then:

- a positive value of the attribute "indent – major" specifies that the alignment point of the entry frame shall be located to the right of the reference line;
- a negative value of the attribute "indent – major" specifies that the alignment point of the entry frame shall be located to the left of the reference line;
- a positive value of the attribute "indent – minor" specifies that the alignment point of the entry frame shall be located above the reference line;
- a negative value of the attribute "indent – minor" specifies that the alignment point of the entry frame shall be located below the reference line;
- the value 0 of the attribute "indent – major / minor" specifies that the alignment point of the entry frame shall be located on the reference line (see Figure 12).

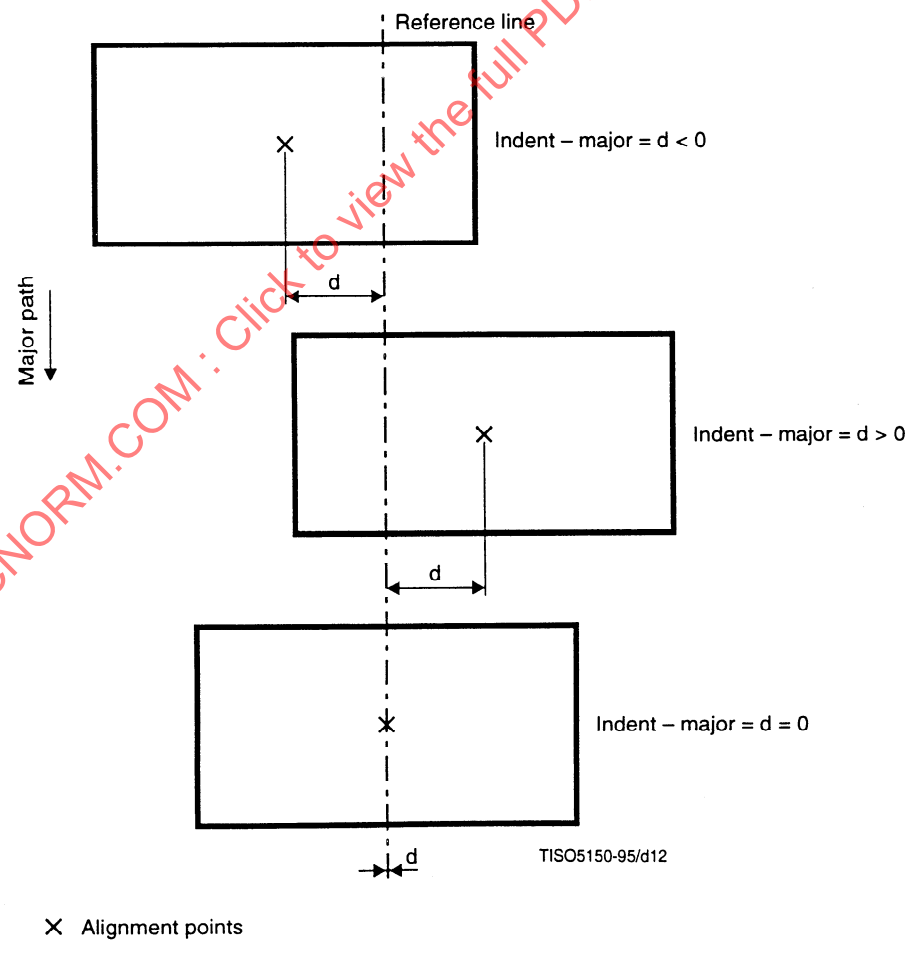


Figure 12 – Indent – major

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12.1.8 Major path

Constituents:

Grid frame component descriptions.

Classification:

Non-mandatory for object class descriptions.

Defaultable for object descriptions.

Permissible values:

A set of data elements defined for the attribute: '0°', '90°', '180°', '270°'.

Representation:

In the interchange format, '0°', '90°', '180°', '270°' are represented by the character strings d0, d90, d180, d270.

Default value:

'270°'.

Definition:

The layout process shall take this attribute into account only when the relevant grid frame to which this attribute applies is referred to by an instance of the attribute "grid frame classes" which applies to some grid logical object (see 12.2.3).

The imaging process shall take this attribute into account only when the relevant object description specifies the attribute "grid interval dimensions" (see 12.1.4).

This attribute specifies the direction of progression of the allocation of the major grid lines within the relevant grid frame. The specified direction is relative to the horizontal direction.

12.1.9 Minor path

Constituents:

Grid frame component descriptions.

Classification:

Non-mandatory for object class descriptions.

Defaultable for object descriptions.

Permissible values:

A set of data elements defined for the attribute: '90°', '270°'.

Representation:

In the interchange format, '90°', '270°' are represented by the character strings d90, d270.

Default value:

'90°'.

Definition:

The layout process shall take this attribute into account only when the relevant grid frame to which this attribute applies is referred to by an instance of the attribute "grid frame classes" which applies to some grid logical object (see 12.2.3).

The imaging process shall take this attribute into account only when the relevant object description specifies the attribute "grid interval dimensions" (see 12.1.4).

This attribute specifies the direction of progression of the allocation of the minor grid lines within the relevant grid frame. The specified direction is measured anticlockwise from the direction specified by the attribute "major path".

12.1.10 Position

Constituents:

Frame and block component descriptions.

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Classification:

Non-mandatory for object class descriptions.

Defaultable for object descriptions.

Structure:

Either, the parameter "fixed position", which has two sub-parameters: "horizontal position" and "vertical position", or the parameter "variable position", which has four optional sub-parameters: "offset", "separation", "alignment" and "fill order".

The sub-parameter "offset" is structured into four optional sub-sub-parameters: "leading offset", "trailing offset", "left-hand offset", "right-hand offset".

The sub-parameter "separation" is structured into three optional sub-sub-parameters: "leading edge", "trailing edge", "centre separation".

Permissible values:

For the parameter "fixed position":

- "horizontal position": a non-negative integer;
- "vertical position": a non-negative integer.

For the parameter "variable position":

- for the sub-parameter "offset", zero or more of "leading offset", "trailing offset", "left-hand offset", "right-hand offset" may be specified in any instance of this sub-parameter. For each the permissible value is a non-negative integer;
- for the sub-parameter "separation", zero or more of "leading edge", "trailing edge", "centre separation" may be specified in any instance of this sub-parameter. For each the permissible value is a non-negative integer;
  - for the sub-parameter "alignment", the permissible values are 'right-hand aligned', 'centred', 'left-hand aligned';
- for the sub-parameter "fill order", the permissible values are 'normal order', 'centre order', 'reverse order'.

Default value:

If no value is specified, the default value is the parameter "fixed position" with the sub-parameters:

- "horizontal position": 0;
- "vertical position": 0.

Definition:

12.1.10.1 This attribute specifies the position of the layout object relative to the layout object at the next higher level in the hierarchical structure (i.e. the immediately superior page or frame).

Two cases are to be considered, that of fixed position and that of variable position.

12.1.10.2 In the case of fixed position, the definition is given in 9.4.1.1 of ITU-T Rec. T.412 | ISO/IEC 8613-2.

12.1.10.3 The case of variable position may only be specified for frame class descriptions referred to in construction expressions from other frame class descriptions (see 9.3.2.1 of ITU-T Rec. T.412 | ISO/IEC 8613-2). Consequently, block component descriptions, frame descriptions and frame class descriptions referred to in construction expressions specified for page class descriptions may only specify fixed position.

Three cases are further to be considered, according to which of the following applies to a frame whose position within the immediate superior frame shall be determined in accordance with this parameter:

- the immediately superior frame is not a grid frame (case 1);
- the frame is bound to a layout grid rectangle within the immediately superior grid frame (case 2);
- the frame is not bound to any layout grid rectangle within the immediately superior grid frame (case 3).

12.1.10.4 Case 1

In this case, the sub-parameter "fill order" shall not specify 'centre order'. For the definition of the sub-parameters "offset", "separation", "alignment" and "fill order" in this case, refer to 9.4.1.1 of ITU-T Rec. T.412 | ISO/IEC 8613-2.

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12.1.10.5 Case 2

In this case, the relevant layout object to which this attribute applies is to be variably positioned within the particular layout grid rectangle to which the layout object is bound.

Zero or more of the sub-parameters "offset", "separation", "alignment" and "fill order" are specified as follows:

a) *offset*

This sub-parameter constrains the area available for placement of the relevant entry frame within the layout grid rectangle to which the entry frame is bound.

This sub-parameter specifies minimum amounts of offset between the boundary of the frame and the boundary of the layout grid rectangle.

The sub-parameter is structured into four sub-sub-parameters: "leading offset", "trailing offset", "left-hand offset", "right-hand offset". These specify the minimum distance between the corresponding edge of the entry frame and the leading, trailing, left-hand and right-hand edge respectively of the layout grid rectangle to which the entry frame is bound.

For each edge, the sub-sub-parameter specifies the amount of offset for that edge in scaled measurement units (for the names of the edges, refer to 9.1.9 of this Specification and 7.3.3 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

If the parameter "variable position" does not specify a value for this sub-parameter, or for any of its sub-sub-parameters, then the value zero is assumed for each sub-sub-parameter for which a value is not specified.

b) *separation*

This sub-parameter specifies minimum amounts of separation between this entry frame and the nearest adjacent entry frame which is bound to the same layout grid rectangle within the same immediate superior grid frame. The sub-parameter is structured into three sub-sub-parameters: "leading edge", "trailing edge", "centre separation".

The sub-sub-parameter "leading edge" specifies the minimum separation from the leading edge of the entry frame and the trailing edge of the next entry frame laid out with the same value for the sub-parameter "fill order" within the same layout grid rectangle.

The sub-sub-parameter "trailing edge" specifies the minimum separation from the trailing edge of the entry frame and the leading edge of the immediately preceding entry frame laid out with the same value for the sub-parameter "fill order" within the same layout grid rectangle.

Thus, a constraint on the separation of two adjacent frames which both have the same fill order, and are bound to the same layout grid rectangle, is that the separation shall be equal to, or greater than, the greater of the value of "leading edge" for the first of the entry frames in the direction of layout path and the value of "trailing edge" for the second of the entry frames.

The sub-sub-parameter "centre separation" specifies the minimum separation between two frames which are laid out with different values for the sub-parameter "fill order" within the same layout grid rectangle.

Thus, a constraint on the separation of two adjacent frames which have different fill orders, but are both bound to the same layout grid rectangle, is that the separation shall be equal to, or greater than, the greater of the values of "centre separation" specified for the two frames.

For each edge, the sub-sub-parameter specifies the amount of separation for that edge in scaled measurement units (for the names of edges, refer to 9.1.9 of this Specification and 7.3.3 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

If the parameter "variable position" does not specify a value for this sub-parameter, or for any of its sub-sub-parameters, then the value zero is assumed for each sub-sub-parameter for which a value is not specified.

c) *alignment*

This sub-parameter specifies the alignment of the entry frame within the area available for positioning the entry frame inside the layout grid rectangle to which the entry frame is bound. The alignment is in the direction orthogonal to that specified by the attribute "layout path" of the immediately superior grid frame.

This sub-parameter takes one of three values: 'right-hand aligned', 'centred', 'left-hand aligned'.

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Subject to satisfying constraints on placement specified by:

- the sub-parameter "offset" applied to this entry frame;
- the attributes "reference line alignment – major" and "indent – major" applied to this entry frame and other sibling entry frames, if the layout path is parallel to, or opposite to, the major path;
- the attributes "reference line alignment – minor" and "indent – minor" applied to this entry frame and other sibling entry frames, if the layout path is parallel to, or opposite to, the minor path;
- the attribute "grid gutters" applied to the grid frame immediately superior to the entry frame.

The values of alignment are defined as follows:

1) if the value is 'right-hand aligned', then this entry frame is to be positioned as close as possible to the right-hand edge of the layout grid rectangle to which the entry frame is bound;

2) if the value is 'left-hand aligned', then this entry frame is to be positioned as close as possible to the left-hand edge of the layout grid rectangle to which the entry frame is bound;

3) if the value is 'centred', then this entry frame is to be positioned equidistant from the two positions at which the entry frame would be placed if the value were 'right-hand aligned' and 'left-hand aligned'.

NOTE – If an entry frame is involved in reference line alignment, placement of the entry frame within the available area, which is specified by the sub-parameters "offset" and "separation" applied to it and the attribute "grid gutters" applied to the immediately superior grid frame (see 13.7.1), may be further restricted by the available area for other entry frames which are to be aligned with the relevant entry frame.

If the parameter "variable position" does not specify a value for this sub-parameter, then the value 'right-hand-aligned' is assumed.

d) *fill order*

The sub-parameter "fill order" specifies how the entry frame is to be positioned within the layout grid rectangle to which the entry frame is bound, relative to the direction of the layout path of the immediately superior grid frame.

The sub-parameter takes one of three values: 'normal order', 'reverse order', 'centre order'.

Subject to satisfying constraints on placement specified by:

- the sub-parameters "offset", "separation" applied to the entry frame;
- the attributes "reference line alignment – major" and "indent – major" applied to this entry frame and other sibling entry frames, if the layout path is orthogonal to the major path;
- the attributes "reference line alignment – minor" and "indent – minor" applied to this entry frame and other sibling entry frames, if the layout path is orthogonal to the minor path;
- the attribute "grid gutters" applied to the grid frame immediately superior to the entry frame.

The values of fill order are defined as follows:

1) If the value is 'normal order', then this entry frame is grouped together with any other sibling entry frames bound to the same layout grid rectangle and specifying this value.

These entry frames are positioned after each other in the direction of the layout path of their common immediately superior grid frame. The order in which they are positioned in the direction of the layout path is the same as their sequential layout order.

Additionally, each frame in the group is positioned as far as possible in the direction opposite to the layout path so that the first entry frame in the group shall be located closest to the trailing edge of the layout grid rectangle, of all the entry frames bound to this layout grid rectangle.

2) If the value is 'reverse order', then this entry frame is grouped together with any other sibling entry frames bound to the same layout grid rectangle and specifying this value.

These entry frames are positioned after each other in the direction of the layout path of their common immediately superior grid frame. The order in which they are positioned in the direction of the layout path is the same as their sequential layout order.

Additionally, each frame in the group is positioned as far as possible in the direction of the layout path so that the last entry frame in the group shall be located closest to the leading edge of the layout grid rectangle, of all the entry frames bound to this layout grid rectangle.

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3) If the value is 'centre order', then this entry frame is grouped together with any other sibling entry frames bound to the same layout grid rectangle and specifying this value.

These entry frames are positioned after each other in the direction of the layout path of their common immediately superior grid frame. The order in which they are positioned in the direction of the layout path is the same as their sequential layout order.

Additionally, the entry frames in the group are positioned as close as possible to each other, and are centered, as a group, within the area available for placement of the group. This available area is calculated within the area between the leading edge of the last entry frame with normal order and the trailing edge of the first entry frame with reverse order, which are both bound to the same layout grid rectangle if present.

In the two typical cases, this value of the sub-parameter specifies placement of the entry frames in the group as follows:

i) If the group is such that:

- no entry frame in the group is involved in any of those instances of reference line alignment such that the associated reference line is orthogonal to the layout path;
- the values of the sub-sub-parameter "trailing offset" specified for the entry frames in the group do not affect their placement except for the first entry frame;
- the values of the sub-sub-parameter "leading offset" specified for the entry frames in the group do not affect their placement except for the last entry frame,

then those entry frames shall be positioned so that:

- for any two adjacent entry frames in the group, their distance apart shall be equal to the greater of the values of the sub-sub-parameter "centre separation" specified for the two entry frames;
- their position shall be equidistant from the two positions at which they would be located if they were positioned as far as possible in the direction of, and in the direction opposite to, the layout path (see Figure 13).

ii) If the group is composed of one entry frame such that:

- the entry frame is involved in an instance of reference line alignment such that the associated reference line is orthogonal to the layout path;
- any entry frame in the alignment group associated with this instance of reference line alignment is the only entry frame to be positioned in centre order within the layout grid rectangle to which it is bound,

then the position of the entry frame shall be equidistant from the two positions at which it would be located if it was positioned as far as possible in the direction of, and in the direction opposite to, the layout path, particularly subject to the constraint by the reference line alignment (see Figure 14).

For more complicated cases, refer to 13.7.

If the parameter "variable position" does not specify a value for this sub-parameter, then the value 'normal order' is assumed.

12.1.10.6 Case 3

In this case, the value 'centre order' of the sub-parameter "fill order" shall be treated as equivalent to the value 'normal order'. Hence, an entry frame with centre order and another entry frame with normal order are regarded as having the same fill order.

Zero or more of the sub-parameters "offset", "separation", "alignment" and "fill order" are specified as follow:

a) *offset*

The definition for this sub-parameter is the same as that described in 9.4.1.1 of ITU-T Rec. T.412 | ISO/IEC 8613-2.

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b) *separation*

This sub-parameter specifies minimum amounts of separation between this entry frame and the nearest adjacent entry frame bound to no layout grid rectangle within the same immediately superior grid frame. The sub-parameter is structured into three sub-sub-parameters: "leading edge", "trailing edge", "centre separation".

The sub-sub-parameter "leading edge" specifies the minimum separation from the leading edge of the entry frame and the trailing edge of the next entry frame bound to no layout grid rectangle and having the same fill order.

The sub-sub-parameter "trailing edge" specifies the minimum separation from the trailing edge of the entry frame and the leading edge of the immediately preceding entry frame bound to no layout grid rectangle and having the same fill order.

Thus, a constraint on the separation of two adjacent entry frames which both have the same fill order, and are bound to no layout grid rectangle, is that the separation shall be equal to, or greater than, the greater of the value of "leading edge" for the first of the frames in the direction of layout path and the value of "trailing edge" for the second of the frames.

The sub-sub-parameter "centre separation" specifies the minimum separation between two entry frames with different fill orders, and which are both bound to no layout grid rectangle.

Thus, a constraint on the separation of two adjacent frames which have different fill orders, and are bound to no layout grid rectangle, is that the separation shall be equal to, or greater than, the greater of the values of "centre separation" specified for the two entry frames.

For each edge, the sub-sub-parameter specifies the amount of separation for that edge in scaled measurement units (for the names of edges, refer to 9.1.9 of this Specification and 7.3.3 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

If the parameter "variable position" does not specify a value for this sub-parameter, or for any of its sub-sub-parameters, then the value zero is assumed for each sub-sub-parameter for which a value is not specified.

c) *alignment*

The definition for this sub-parameter is the same as that described in 9.4.1.1 of ITU-T Rec. T.412 | ISO/IEC 8613-2.

d) *fill order*

Although this sub-parameter takes one of three values, 'normal order', 'centre order', 'reverse order', the values 'normal order' and 'centre order' are treated as equivalent.

Subject to satisfying constraints on placement specified by:

- the sub-parameters "offset", "separation" applied to an entry frame;
- the attribute "border" applied to the grid frame immediately superior to the entry frame,

the values of fill order are defined as follows:

1) If the value is one of 'normal order' or 'centre order' then this entry frame is grouped together with any other sibling entry frames bound to no layout grid rectangle and specifying one of these values.

   These entry frames are positioned after each other in the direction of the layout path of their common immediately superior grid frame. The entry frames in the group are positioned in their sequential layout order, starting at the distance specified by the trailing offset of the first of these entry frames from the trailing edge of the immediately superior grid frame.

2) If the value is 'reverse order' then this entry frame is grouped together with any other sibling entry frames bound to no layout grid rectangle and specifying this value.

   These entry frames are positioned after each other in the direction of the layout path of their common immediately superior grid frame. The entry frames in the group are positioned in their sequential layout order, ending at the distance specified by the leading offset of the last of these frames from the leading edge of the immediately superior grid frame.

If the parameter "variable position" does not specify a value for this sub-parameter, then the value 'normal order' is assumed.

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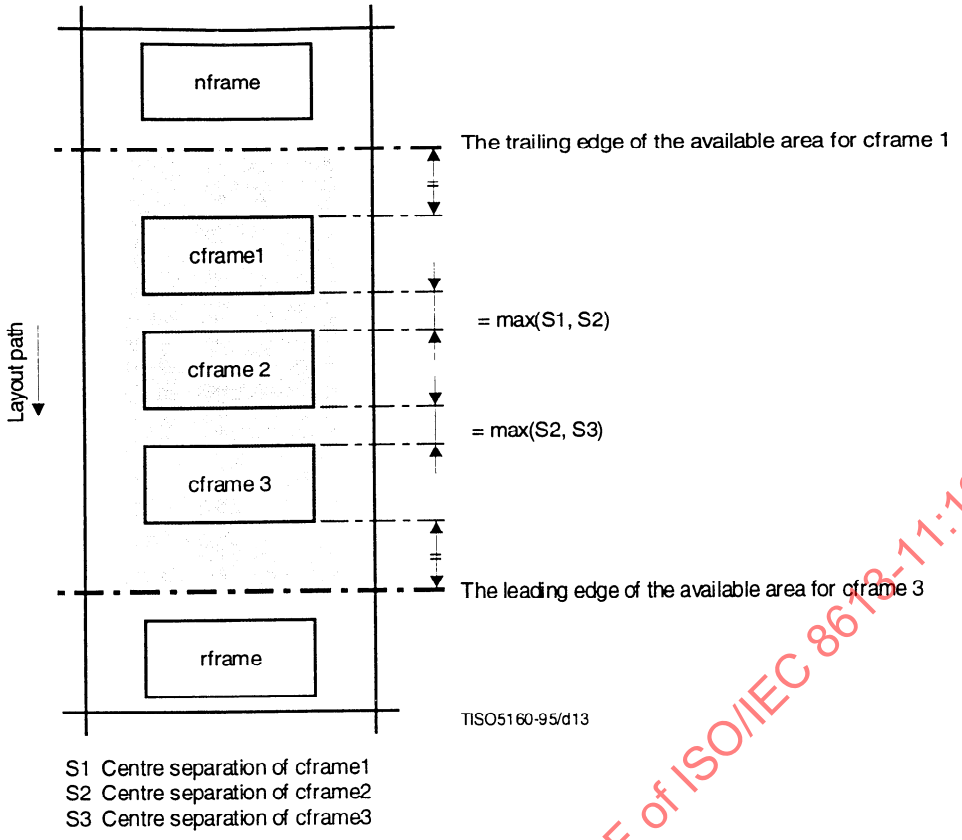


Figure 13 – Example of first typical case of placement of entry frames with centre order

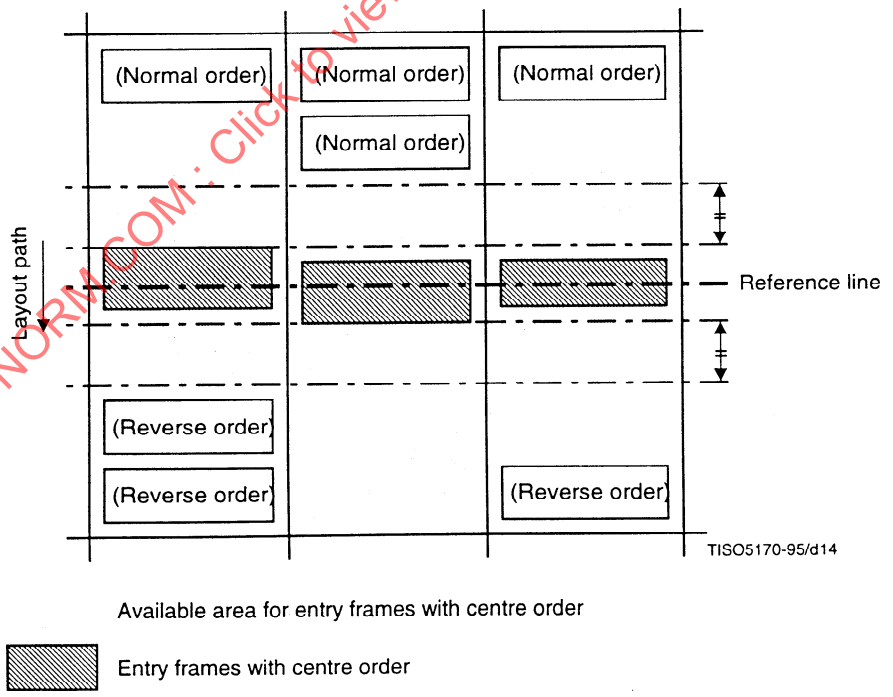


Figure 14 – Example of second typical case of placement of entry frames with centre order

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12.1.11 Reference line alignment – major; Reference line alignment – minor

Constituents:

Frame class descriptions.

Classification:

Non-mandatory.

Structure:

Consists of the two optional parameters: "aligned with" and "reference line".

Permissible values:

- "aligned with": either an empty sequence or a sequence of one or more layout object class identifiers;
- "reference line": a line segment characteristic.

Definition:

NOTE – In this definition, the scope of the symbol / is the entire text (see 5.2).

12.1.11.1 The layout process shall take the attribute "reference line alignment – major / minor" into account only when specified in an object class description such that:

- the object class description is referred to in construction expressions from other object class descriptions of the grid frame type;
- the object class description specifies the attribute "position" with the parameter "variable position".

Otherwise, the layout process shall ignore any specification for this attribute.

This attribute specifies one or more groups of entry frames, each of which is called an *alignment group*, and specifies also that all the entry frames belonging to each alignment group shall be aligned along the reference line associated with the alignment group.

In addition to the reference line, the following are associated with each alignment group:

- a pair of minor / major layout grid lines;
- one of 'right-hand aligned', 'centred' or 'left-hand aligned', if the layout path of the immediately superior grid frame is parallel to, or opposite to, its major / minor path; this set of values is the same as the set of values that are permissible for the sub-parameter "alignment" of the parameter "variable position" of the attribute "position";
- one of 'normal order', 'centre order' or 'reverse order', if the layout path of the immediately superior grid frame orthogonally traverses its major / minor path; this set of values is the same as the set of values that are permissible for the sub-parameter "fill order" of the parameter "variable position" of the attribute "position".

12.1.11.2 Determination of quasi alignment groups

The parameter "aligned with" specifies one or more *quasi alignment groups*, and then alignment groups.

A quasi alignment group is also associated with the three items listed in 12.1.11.1: a reference line, a pair of minor / major layout grid lines and one of 'right-hand aligned', 'centred', 'left-hand aligned', 'normal order', 'centre order' or 'reverse order'. A quasi alignment group is specified in accordance with the following three constraints (see Figure 15):

a) All entry frames in a quasi alignment group shall satisfy the following necessary conditions:
   - they are immediately subordinate to the common grid frame;
   - they are bound to layout grid rectangles commonly edged with a pair of minor / major layout grid lines; this pair of layout grid lines is the pair of layout grid lines associated with this quasi alignment group;
   - if the layout path of the immediately superior grid frame is parallel to, or opposite to, its major / minor path, they specify the same value for the sub-parameter "alignment"; this value is the value associated with the quasi alignment group;
   - if the layout path of the immediately superior grid frame orthogonally traverses its major / minor path, they specify the same value for the sub-parameter "fill order"; this value is the value associated with this quasi alignment group.

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b) If two entry frames satisfy one of the following conditions in addition to these necessary conditions, then both of them belong to the common quasi alignment group concerned:

- the class description for one of those entry frames specifies this attribute, and the parameter "aligned with" in the value of this attribute specifies the frame class of the other entry frame;
- they are both of the same frame class, and the class description specifies this attribute.

c) A quasi alignment group is as small as possible: no proper subset of entry frames can be removed from it without violating one of the constraints a) and b).

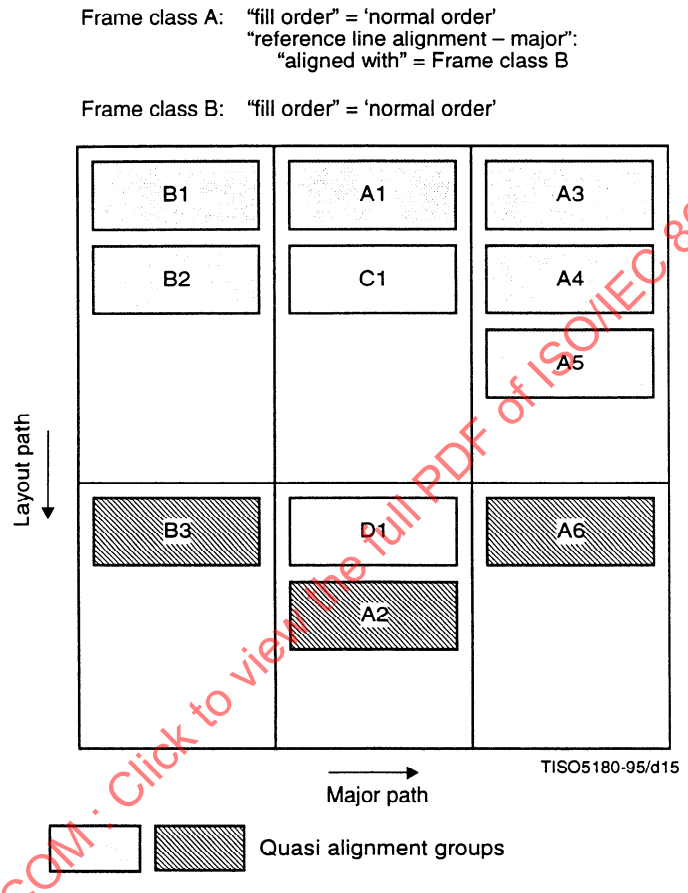


Figure 15 – Quasi alignment groups

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12.1.11.3 Determination of alignment groups

If the major / minor path is in the direction of the layout path within the immediately superior grid frame, an arbitrary quasi alignment group determined according to 12.1.11.2 is an alignment group.

If the major / minor path is in the direction orthogonal to the layout path, a quasi alignment group is subdivided into one or more alignment groups as follows (see Figure 16):

a) entry frames in the quasi alignment group are indexed; the order is the same as the sequential layout order of those entry frames such that they are all in this quasi alignment group, and are bound to the same layout grid rectangle;

b) among all entry frames in this quasi alignment group, the entry frames provided with the same index are collected, and compose a single alignment group.

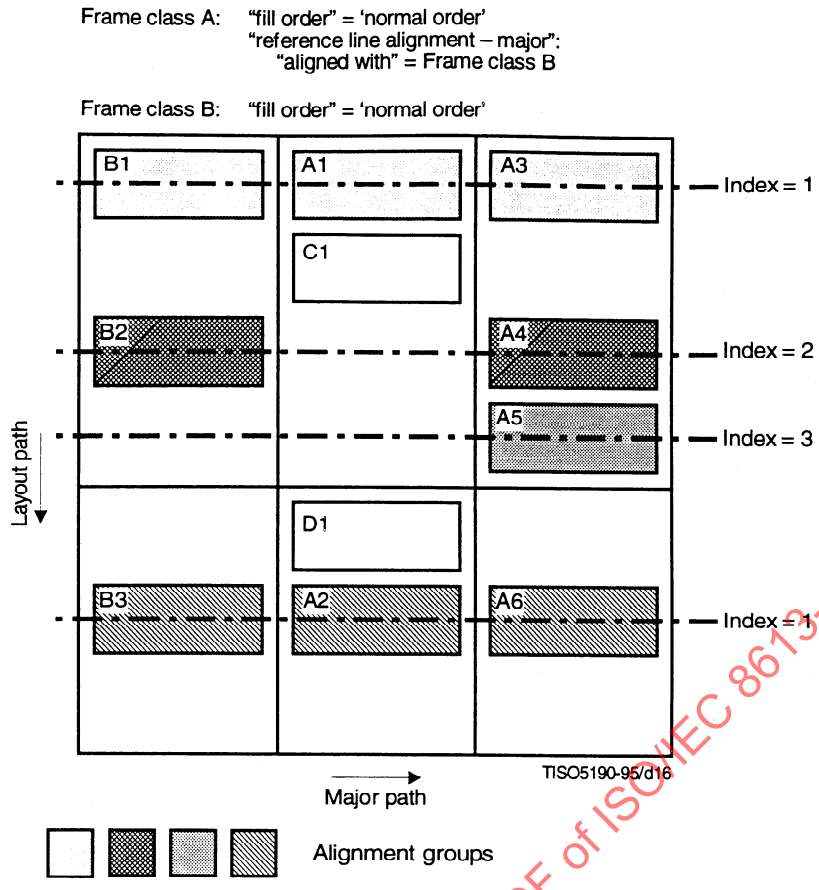


Figure 16 – Alignment groups

Hence, if two or more entry frames in a quasi alignment group are bound to a single layout grid rectangle, then, for each of such layout grid rectangles:

- the first of those entry frames in the sequential layout order is provided with the index 1;
- the second of those entry frames in the sequential layout order is provided with the index 2, and so on.

Then:

- the entry frames in this quasi alignment group with the index 1 compose the first alignment group;
- the entry frames in this quasi alignment group with the index 2 compose the second alignment group, and so on.

12.1.11.4 Placement of an entry frame relative to the reference line

All entry frames in a single alignment group share the same reference line. The reference line runs parallel to the direction of the major / minor path of the immediately superior grid frame.

Every entry frame has an alignment point associated with it. This attribute, together with the attribute "indent – major / minor" if present, specifies the distance of the alignment point of each entry frame in the alignment group, from the reference line associated with the alignment group.

The distance of the alignment point from the reference line is determined as follows:

- the entry frame is positioned so that the distance of its alignment point from the reference line is the value specified by the attribute "indent – major / minor" applied to the entry frame (see 12.1.7);
- if the attribute "indent – major / minor" does not apply to the entry frame, then the entry frame is positioned so that its alignment point shall be located on the reference line.

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12.1.11.5 Placement of the reference line

The position of the reference line is determined so that each entry frame in the alignment group shall be located within the grid rectangle to which it is bound, without violating constraints imposed by:

- the attribute "grid gutters" applied to the immediately superior grid frame (see 12.1.3);
- the sub-parameters "offset", "separation", "alignment" and "fill order" applied to the entry frame (see 12.1.10).

NOTE – By definition, an entry frame is to be variably positioned within the immediately superior grid frame. Therefore, the value of the attribute "position" in the frame class description for the entry frame specifies zero or more of the four sub-parameters "offset", "separation", "alignment" and "fill order".

If an alignment group consists of a single entry frame, the placement of the entry frame according to this attribute shall coincide with the placement without taking this attribute into consideration.

12.1.11.6 Presentation of reference lines

If the optional parameter "reference line" is specified for this attribute, the reference line associated with each alignment group shall be imaged within the immediately superior grid frame as follows (see Figure 17):

- the reference line shall be imaged only within those grid rectangles to which some entry frame in the alignment group is bound;
- the reference line may be imaged even within the grid gutter space;
- the line segment characteristics specified for this parameter shall be used in imaging the reference line.

If the layout process evaluates this parameter, it shall add one or more entries to the attribute "supplementary lines" specified in the object description for the immediately superior grid frame so that the imaging process shall be able to image the reference lines as specified by this parameter (see 12.1.12).

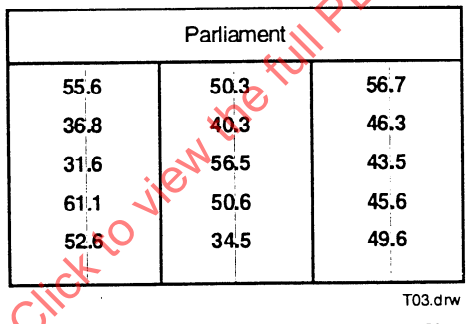


Figure 17 – Presentation of reference lines

12.1.11.7 If the attribute does not specify a value for the parameter "aligned with", then an empty sequence is assumed.

If the attribute does not specify a value for the parameter "reference line", the default line segment characteristic with the following parameters is assumed.

For the parameters "line width" and "line type":

- "line width": 0;
- "line type": 'solid'.

For the parameter "line colour":

- "colour expression":
  - "colour access mode": 'direct';
  - "colour space id": 0;
  - "colour specification": 1, 1, 1;
  - "colour tolerance":
    - "unspecified tolerance": 'infinite'.

NOTE – The default value for a colour expression is a white colour in RGB space without limit on tolerance.

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12.1.12 Supplementary lines

Constituents:

Grid frame component descriptions.

Classification:

Non-mandatory for object class descriptions.

Defaultable for object descriptions.

Structure:

A sequence of zero or more entries, each of which includes three parameters: "start", "end", "imaging factors". The parameters "start" and "end" are mandatory, while the parameter "imaging factors" is optional.

Each of the parameters "start" and "end" includes two mandatory parameters: "major coordinate" and "minor coordinate".

Permissible values:

For the parameters "start" and "end":

- "major coordinate": any integer (SMU);
- "minor coordinate": any integer (SMU).

For the parameter "imaging factors": a line segment characteristic.

Default value:

An empty sequence.

Definition:

12.1.12.1 The imaging process shall take this attribute into account only when the relevant object description specifies the attribute "grid interval dimensions" (see 12.1.4).

This attribute specifies zero or more lines to be imaged within the relevant grid frame to which the attribute is applied.

The imaging process shall image zero or more layout grid lines in accordance with the attributes "grid lines" and "grid interval dimensions" applied to the grid frame. It shall image other supplementary lines, such as reference lines, in accordance with this attribute.

12.1.12.2 Each entry specified for this attribute corresponds to a single line to be imaged within the relevant grid frame.

The parameter "start" specifies the position of one of the extremal points of the line. The parameter "end" specifies the position of the other extremal points of the line. For each, the sub-parameter "major / minor coordinate" specifies the distance of the extremal point from the grid reference point (see 9.1.11) of the grid frame in the direction of the major / minor path. The distance is measured in scaled measurement units.

The imaging process shall image the line between the start and the end extremal points using the line segment characteristic specified for the parameter "imaging factors". The line segment characteristic specifies its line width, line type and line colour (see 11.10).

If an entry of this attribute does not specify a value for the parameter "imaging factors", the default line segment characteristic with the following parameters is assumed.

For the parameters "line width" and "line type":

- "line width": 0;
- "line type": 'solid'

For the parameter "line colour":

- "colour expression":
  - "colour access mode": 'direct';
  - "colour space id": 0;

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- "colour specification": 1, 1, 1;
- "colour tolerance":
  - "unspecified tolerance": 'infinite'.

NOTES

1 The default value for a colour expression is a white colour in RGB space without limit on tolerance.

2 Although the positions of the extremal points of a supplementary line are specified by the parameters named "start" and "end", the line does not have any direction. Exchanging the values of these parameters would not affect the imaging process at all.

12.2 Layout directive attributes

12.2.1 Block alignment point

Constituents:

May be specified for layout styles.

Applicable only to basic logical component descriptions.

Classification:

Non-mandatory.

Structure:

One of the parameters: "content dependent", "fixed position", "variable position".

The parameter "fixed position" is structured into two optional sub-parameters: "vertical position", "horizontal position".

The parameter "variable position" is structured into two optional sub-parameters: "vertical alignment", "horizontal alignment".

Permissible values:

For the parameter "content dependent": 'applies'.

For the parameter "fixed position":

- "vertical position": any integer (SMU);
- "horizontal position": any integer (SMU).

For the parameter "variable position":

- "vertical alignment": 'top', 'centre', 'bottom';
- "horizontal alignment": 'left', 'centre', 'right'.

Definition:

12.2.1.1 The layout process shall take this attribute into account only when the relevant basic logical object to which this attribute applies is subordinate to some grid logical object.

This attribute specifies the position of the alignment point associated with each block which accommodates at least part of the content associated with the relevant basic object.

12.2.1.2 If the attribute specifies the parameter "content dependent", then the content layout process shall determine the positions of the alignment points. The content layout process shall calculate these positions in accordance with the presentation attribute "alignment point" (see 12.3.1.1, 12.3.2.1 and 12.3.3.1) specified for the content portions associated with the relevant basic logical object.

12.2.1.3 If the attribute specifies the parameter "fixed position", then the sub-parameter "vertical position / horizontal position" specifies the vertical / horizontal distance of each alignment point from the reference point of the block with which the alignment point is to be associated. This distance is measured in scaled measurement units.

The vertical position is measured in the top-to-bottom direction:

- if the sub-parameter "vertical position" specifies a positive / negative value, the alignment point shall be located beneath / above the reference point.

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The horizontal position is measured in the left-to-right direction:

- if the sub-parameter "horizontal position" specifies a positive / negative value, the alignment point shall be located on the right / left of the reference point.

An alignment point specified by the parameter "fixed position" may fall outside the relevant block.

If this parameter does not specify a value for any of its sub-parameters, then the value zero is assumed for each sub-parameter for which a value is not specified.

12.2.1.4 If the attribute specifies the parameter "variable position", then the sub-parameter "vertical / horizontal alignment" specifies the vertical / horizontal position of each alignment point.

- If the sub-parameter "vertical alignment" specifies the value 'top' / 'bottom', then the alignment point shall be located on the top / bottom edge of the block with which the alignment point is associated.

  If the sub-parameter specifies the value 'centre', then the alignment point shall be located equidistant from the top and bottom edges of the block.

- If the sub-parameter "horizontal alignment" specifies the value 'left' / 'right', then the alignment point shall be located on the left / right edge of the block.

  If the sub-parameter specifies the value 'centre', then the alignment point shall be located equidistant from the right and left edges of the block.

  NOTE – The left / right edge of the block may be different from its left-hand / right-hand edge. The former is defined absolutely, while the latter is defined relative to the layout path (see 7.3.3 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

An alignment point specified by the parameter "variable position" is always located within the relevant block.

If this parameter does not specify a value for any of its sub-parameters, then the value 'centre' is assumed for each sub-parameter for which a value is not specified.

12.2.1.5 The attribute "concatenation" may specify that content for more than one basic logical object shall be concatenated within a single block (see 9.7.3 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

If the attribute "block alignment point" is applied to one of those basic logical objects, and is not applied to the others, then the alignment point associated with the block concerned shall be determined in accordance with this unique instance of the attribute.

If this attribute is applied to more than one of those basic logical objects, then the alignment point shall be determined in accordance with the instance of this attribute applied to the last of such basic logical objects in the processing order.

12.2.2 Grid description

Constituents:

May be specified for layout styles.

Applicable only to grid logical component descriptions.

Classification:

Non-mandatory when specified for layout styles.

Non-mandatory when applied to object class descriptions.

Defaultable when applied to object descriptions.

Structure:

Consists of three optional parameters: "major size", "minor size", "entry-location association".

The parameter "entry-location association" is a list of entries, each of which is a pair of optional sub-parameters: "locations", "entries".

Permissible values:

For the parameters "major size" and "minor size": a positive integer.

For the parameter "entry-location association":

- "locations": two logical coordinate pairs, the second one optional; each logical coordinate in such a pair is either a non-negative integer or the special value 'last';
- "entries": one or more sequences of non-negative integers.

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Default value:

Each of the parameters is independently defaultable.

For the parameters "major size" and "minor size": 1.

Each of the sub-parameters of the parameter "entry-location association" is further independently defaultable.

For the sub-parameters:

- "locations": (0, 0), ('last', 'last');
- "entries": the same value as that of the attribute "subordinate" which is specified for the relevant grid logical object description.

Definition:

12.2.2.1 The layout process shall take this attribute into account only when the attribute "grid frame classes" applies to the relevant grid logical object to which this attribute applies.

This attribute specifies the following:

- the major and minor sizes of a logical grid;
- the association of subordinate logical objects with logical grid rectangles within the relevant logical grid.

12.2.2.2 The parameter "major / minor size" specifies the major / minor size of the logical grid associated with the relevant grid logical object to which the attribute applies.

The major / minor size of the logical grid is the largest ordinal number assigned to major / minor logical grid lines within the logical grid (see 8.1.4).

12.2.2.3 The parameter "entry-location association" specifies a list of entries. Each entry specifies the association of one or more logical objects subordinate to the relevant grid logical object, with a single grid rectangle within the logical grid associated with the grid logical object.

- The sub-parameter "locations" in the entry specifies the logical coordinate pairs for two diagonally opposite vertices of the grid rectangle to be specified.

  If the second logical coordinate pair is left out in this sub-parameter, the grid rectangle that this sub-parameter specifies shall be the single logical grid location such that the sub-parameter specifies its vertex with the smallest major and minor coordinates. Hence, if the sub-parameter specifies one coordinate pair (i, j), the specified logical grid rectangle has the vertices whose logical coordinates are (i, j), $(i + 1, j)$, $(i + 1, j + 1)$, and $(i, j + 1)$.

- The sub-parameter "entries" specifies one or more sequences.

  Each sequence is composed of one or more non-negative integers, and specifies an individual logical object subordinate to the grid logical object: the object identifier of the subordinate logical object is that of the grid logical object followed by this sequence.

  This sub-parameter specifies the same number of subordinate logical objects as the number of the sequences specified for this sub-parameter.

For each entry, one or more subordinate objects that the sub-parameter "entry" specifies are defined to be associated with the grid rectangle within the relevant logical grid that the sub-parameter "locations" specifies.

These subordinate logical objects are called *entry objects*. An entry object may or may not be immediately subordinate to the relevant logical object.

If an entry of this attribute does not specify a value for any of the sub-parameters, the following is assumed for each sub-parameter for which a value is not specified:

- "locations": (0, 0), ('last', 'last');
- "entries": the same value as that of the attribute "subordinate" which is specified for the relevant grid logical object description.

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12.2.2.4 This attribute further specifies that the content associated with every entry object, which is specified by the sub-parameter "entries" specified for the parameter "entry-location association" of the attribute "grid description" that applies to the relevant logical object, shall be laid out within frames such that:

- the frames are immediately subordinate to a grid frame referred to by the relevant grid logical object by means of the attribute "grid frame classes" (see 9.2);
- the frames are variably positioned within the available area inside the layout counterpart (see 9.3.1) of the logical grid rectangle with which the entry object is associated.

12.2.3 Grid frame classes

Constituents:

May be specified for layout styles.

Applicable only to grid logical component descriptions.

Classification:

Non-mandatory when specified for layout styles.

Non-mandatory when applied to component descriptions.

Permissible values:

Construction expressions.

Definition:

12.2.3.1 This attribute specifies a sequence of one or more grid frames within the specific layout structure concerned, and further specifies that the content associated with the relevant grid logical object to which this attribute applies is to be laid out within these grid frames.

12.2.3.2 The sequence of grid frames is such that:

- their sequential order is the same as the sequential layout order;
- if a sequence is formed consisting of the values of the attribute "object class" for all grid frames in this sequence in their sequential layout order, then this sequence shall be a result of evaluation of the construction expression specified for this attribute.

12.2.3.3 The content associated with an arbitrary basic logical object subordinate to the grid logical object and every reproduction of that content shall be laid out within the grid frames specified for this attribute. Furthermore, no other part of content of the document shall be laid out within those grid frames.

12.2.4 Obligatory same layout objects

Constituents:

May be specified for layout styles.

Applicable to all logical component descriptions except the document logical root.

Classification:

Non-mandatory.

Structure:

Consists of two parameters: "logical objects", "layout objects".

Permissible values:

For the parameter "logical objects": one or more logical class identifiers.

For the parameter "layout objects": one or more layout class identifiers.

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Definition:

12.2.4.1 The parameter "logical objects" identifies zero or more logical objects within the specific logical structure concerned. These logical objects are called *target objects*, while the logical object to which this attribute applies is called the *relevant object*. This attribute also specifies that the content associated with an arbitrary basic logical object subordinate to the relevant object and every reproduction of that content shall be laid out within those layout objects specified by the parameter "layout objects". Furthermore, each of those layout objects shall contain either:

- the entire content associated with the target objects; or
- the entire content of a single reproduction bundle in accordance with this attribute applied to the relevant object.

A reproduction bundle is a set composed of a reproduction of the content associated with every target object (see 10.1.3).

When the entire content associated with the relevant object can not be laid out within a single layout object that satisfies the constraints stated above, this attribute also specifies that the content associated with the target objects may be duplicated.

The generated reproduction bundle should be laid out within a single layout object specified by the parameter "layout objects". Then, the remaining content of the relevant object should be laid out within this same layout object.

12.2.4.2 The parameter "logical objects" specifies one or more logical object classes. From these logical object classes, the layout process shall generate a list composed of zero or more target objects.

For each logical object class specified for the parameter "logical objects", at most one target object shall be identified and added to the list. The target object to be identified is the nearest preceding object of the relevant object in the sequential logical order such that:

- the target object shall be of the current logical object class;
- the target object shall not be superior to the relevant object.

If such a target object does not exist for the current logical object class, nothing shall be added to the list.

NOTE – This is different from the case of the attribute selective same layout objects (see 12.2.6). Here, a target object is a preceding object of the relevant object instead of a following object.

If no target object is identified for any logical object class specified for the parameter "logical objects", this attribute never affects the layout.

12.2.4.3 The content associated with the relevant object shall be laid out within one or more layout objects each of which satisfies the following conditions:

a) the layout object shall be of one of the layout object classes specified for the parameter "layout objects";

b) the layout object shall contain either:

- the entire content associated with the target objects; or
- the entire content of a single reproduction bundle generated in accordance with this attribute applied to the relevant object (see 10.1.3).

If the content associated with a basic logical object subordinate to the relevant object is duplicated (see 10), the reproduction of this content shall be also laid out within one or more layout objects each of which satisfies these constraints a) and b).

The layout process may duplicate the content associated with the target objects, in order to generate layout that satisfies the constraints a) and b).

The duplication of content may occur only when the layout process is laying out the content associated with a basic logical object subordinate to the relevant object, and it has already laid out the entire content associated with the target objects. Under these conditions, the layout process may duplicate the entire content associated with the target objects in one of the following situations:

c) there is no layout object that satisfies the constraints a) and b);

d) within every layout object that satisfies the constraints a) and b), there is no area available for placement of the content associated with the basic logical object concerned.

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12.2.5 Presentation precedence

Constituents:

May be specified for layout styles.

Applicable to grid logical component descriptions.

Classification:

Non-mandatory when specified for layout styles.

Non-mandatory when applied to object class descriptions.

Defaultable when applied to object descriptions.

Permissible values:

Either 'major' or 'minor'.

Default value:

'minor'.

Definition:

12.2.5.1 The layout process shall take this attribute into account only when the attribute "grid frame classes" applies to the relevant grid logical object to which this attribute applies. Otherwise, the layout process shall ignore any specification for this attribute.

This attribute specifies the order in which the layout process shall lay out the basic logical objects subordinate to the relevant grid logical object.

12.2.5.2 For each basic logical object subordinate to the relevant grid logical object, its *major index* and *minor index* are defined in accordance with the parameter "entry-location association" of the attribute "grid description" applied to the relevant grid logical object.

- The major index of the basic logical object is the smallest major logical coordinate of a vertex of the grid rectangle *associated with* this basic logical object. The grid rectangle associated with the basic logical object is the intersection of all the grid rectangles associated with entry objects such that:

  a) they are superior to, or equal to, the basic logical object;

  b) their association with the grid rectangles is specified by the parameter "entry-location association" of the attribute "grid description" applied to the relevant logical object.

  If the basic logical object is neither an entry object nor subordinate to any entry objects satisfying the above conditions a) and b), its major index is defined as $-\infty$.

- The minor index of the basic logical object is the smallest minor logical coordinate of a vertex of the grid rectangle associated with the basic logical object.

  If the basic logical object is neither an entry object nor subordinate to any entry objects satisfying the above conditions a) and b), its minor index is defined as $-\infty$.

12.2.5.3 The attribute "presentation precedence", together with these major and minor indices, specifies the order in which the layout process shall lay out those basic logical objects subordinate to the relevant grid logical object. This order is called the *processing order of basic logical objects*.

If the attribute specifies 'major' / 'minor', the relative position in the processing order of two basic logical objects is determined as follows (see Figure 18):

a) the basic logical object associated with the smaller minor / major index is defined to be preceding the other in the processing order;

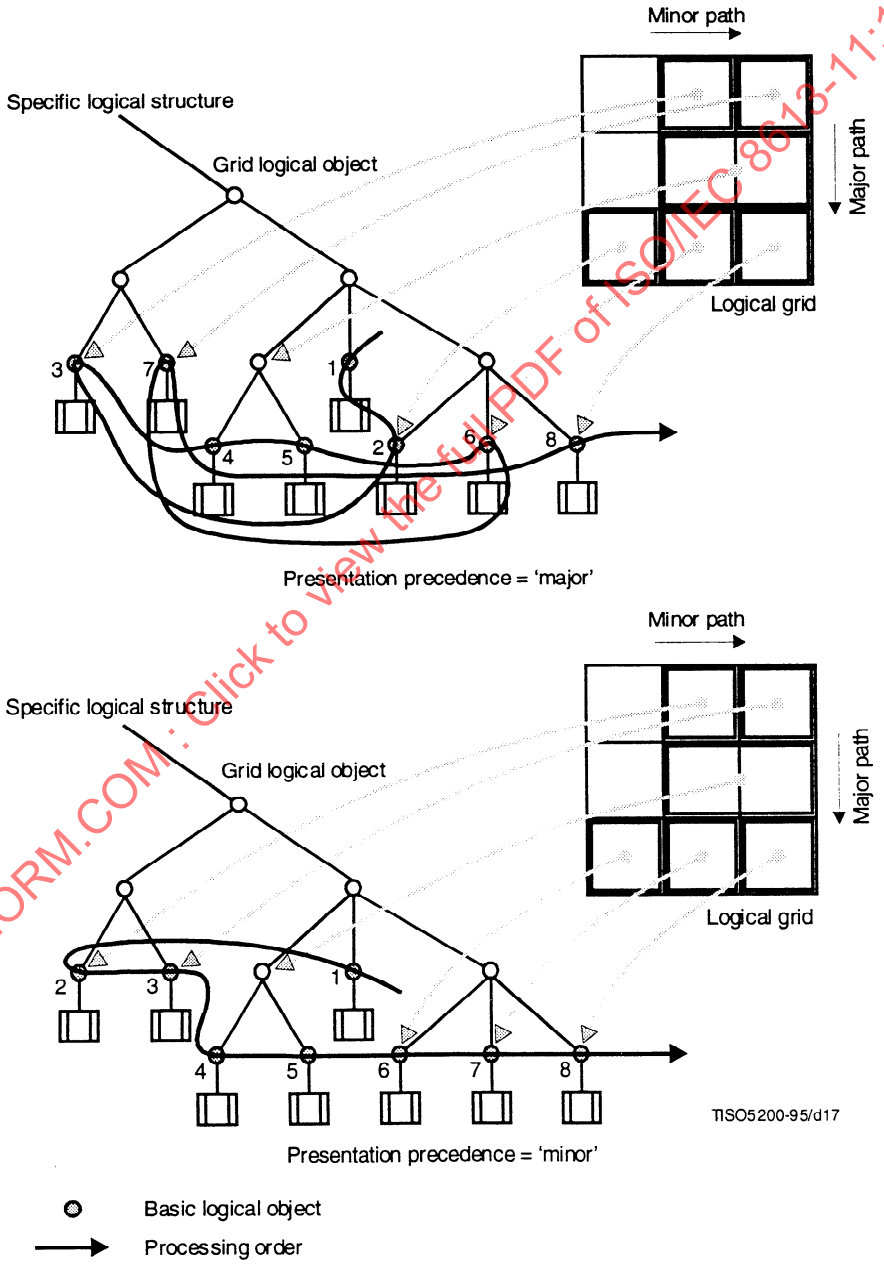
b) if both of the basic logical objects are associated with the same minor / major index, the one associated with the smaller major / minor index is defined to be preceding the other in the processing order;

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c) if both basic logical objects are associated with the same major and minor indices, the layout process takes account of the major and minor indices assigned to them in accordance with another instance of the attribute "presentation precedence" which applies to another grid logical object;

d) if the above three rules a) to c) cannot determine the processing order of the two objects, the order shall be the same as their sequential logical order.

If two or more instances of this attribute affect the processing order of common two basic logical objects, their effects on the order shall be compatible with each other (see 13.5).



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Figure 18 – Processing order of basic logical objects

12.2.6 Selective same layout objects

Constituents:

May be specified for layout styles.

Applicable to all logical component descriptions except the document logical root.

Classification:

Non-mandatory.

Structure:

Consists of two parameters: "logical objects", "layout objects".

Permissible values:

For the parameter "logical objects": one or more logical class identifiers.

For the parameter "layout objects": one or more layout class identifiers.

Definition:

12.2.6.1 First, the parameter "logical objects" identifies zero or more logical objects within the specific logical structure concerned. These logical objects are called *target objects*, while the logical object to which this attribute applies is called the *relevant object*. Thereafter, this attribute specifies that the end of the content associated with the relevant object and every reproduction of the end of this content shall be laid out within those layout objects specified by the parameter "layout objects". Furthermore, each of those layout objects shall contain at least either:

- a fragment of the content associated with some target object; or
- a reproduction of a fragment of the content associated with some target object (see 10.1).

12.2.6.2 The parameter "logical objects" specifies one or more logical object classes. From these logical object classes, the layout process shall generate a list composed of zero or more target objects.

For each logical object class specified for the parameter "logical objects", at most one target object shall be identified and added to the list. The target object to be identified is the next logical object of the relevant object in the sequential logical order such that:

- it is not subordinate to the relevant object;
- it is of the current object class.

Such a target object may not exist for the current logical object class. If not, nothing shall be added to the list.

NOTE – This is different from the case of the attribute "obligatory same layout objects" (see 12.2.4). Here, a target object is a following object of the relevant object instead of a preceding object.

If no target object is identified for any logical object class specified for the parameter "logical objects", this attribute shall never affect the layout.

12.2.6.3 The *tail object* of the relevant object denotes the basic logical object whose position is the last in the processing order (see 12.2.5) among all the basic logical objects subordinate to the relevant object.

This attribute specifies that the end of the content associated with this tail object shall be laid out within a layout object which satisfies the following conditions:

a) the layout object shall be of one of the layout object classes specified for the parameter "layout objects";

b) there shall exist at least one target object such that the layout object contains at least either:

- a fragment of the content associated with this target object; or
- a fragment of a reproduction of the content associated with a basic logical object subordinate to the target object.

If the content associated with the tail object is duplicated, this attribute also specifies that the end of the reproduction of this content shall be laid out within a layout object which satisfies these constraints a) and b).

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12.2.7 Supplementary line directive

Constituents:

May be specified for layout styles.

Applicable to grid logical component descriptions.

Classification:

Non-mandatory when specified for layout styles.

Non-mandatory when applied to component descriptions.

Structure:

A sequence of zero or more entries, each of which includes three parameters: "start", "end", "imaging factors".

The parameters "start" and "end" are mandatory, while the parameter "imaging factors" is optional.

Permissible values:

For the parameters "start" and "end": a logical coordinate pair.

For the parameter "imaging factors": a line segment characteristic.

Definition:

12.2.7.1 The layout process shall take this attribute into account only when applied to a grid logical object to which the attribute "grid frame classes" applies.

This attribute specifies zero or more lines to be imaged within every grid frame referred to by the relevant grid logical object by means of the attribute "grid frame classes" (see 12.2.3).

12.2.7.2 For each entry specified for this attribute, and for each grid frame referred to by the relevant logical object, this entry specifies a single line to be imaged within this grid frame.

The parameters included in this entry further specifies the positions of the two extremal points and the imaging factors (i.e. line width, line type and line colour) of this line.

12.2.7.3 The parameter "start" specifies the position of one of the extremal points of the line within each grid frame. The parameter "end" specifies the position of the other extremal point of the line.

The logical coordinate pair (*i*, *j*) specified for this parameter specifies that the extremal point shall be placed at the point at which the *i*-th major layout grid line and the *j*-th minor layout grid line of the layout grid intersect each other.

Taking the attribute "grid interval dimension" applied to the relevant grid frame into account, the layout process shall calculate the actual position of each extremal point, which is a pair of the distances from the grid reference point (see 9.1.11) in the directions of the major and minor paths, in scaled measurement units.

The layout process shall further generate a new entry composed of the parameters "start", "end" and "imaging factors". Values shall be assigned to these parameters as follows:

- *For the sub-parameter "major / minor coordinate" of the parameter "start"* – The calculated distance of the start extremal point from the grid reference point in the direction of the major / minor path.
- *For the sub-parameter "major / minor coordinate" of the parameter "end"* – The calculated distance of the end extremal point from the grid reference point in the direction of the major / minor path.
- *For the parameter "imaging factors"* – The same value as that assigned to the "imaging factors" specified for the relevant entry of this attribute.

  If the relevant entry does not specify a value for this parameter, the default line segment characteristic with the following parameters is assumed:

  For the parameters "line width" and "line type":

  - "line width": 0;
  - "line type": 'solid'.

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For the parameter "line colour":

- "colour expression":
  - "colour access mode": 'direct';
  - "colour space id": 0;
  - "colour specification": 1, 1, 1;
  - "colour tolerance":
    - "unspecified tolerance": 'infinite'.

NOTE – The default value for a colour expression is a white colour in RGB space without limit on tolerance.

This generated entry shall be a part of the value of the attribute "supplementary lines" specified in the object description of the relevant grid frame (see 12.1.12).

12.2.7.4 The imaging process shall image the line between the start and the end extremal points using the line segment characteristic specified for the parameter "imaging factors". The line segment characteristic specifies its line width, line type and line colour.

NOTE – Although the positions of the extremal points of a supplementary line are specified by the parameters named "start" and "end", the line does not have any direction. Exchanging the values of these parameters would not affect the imaging process at all.

12.3 Presentation attributes

This subclause defines three attributes that are used to instruct the content layout process to calculate the position of alignment points associated with blocks. Those attributes are commonly named "alignment point", and each of them is applicable to one of the content architectures: the character content architecture, the raster graphics content architecture and the geometric graphics content architecture.

12.3.1 Character content architecture

12.3.1.1 Alignment point

Category:

Shared.

Structure:

Consists of two optional parameters: "position in character path", "position in line progression".

Permissible values:

For the parameter "position in character path": graphic characters from the set of graphic elements specified by the presentation attributes "graphic character sets" and "graphic character subrepertoire", or one of the special values 'start', 'end', or 'centre'.

For the parameter "position in line progression": a positive integer, or one of the special values 'top', 'bottom', 'centre', 'top-baseline', 'bottom-baseline', 'top-middle-baseline' and 'bottom-middle-baseline'.

Default value:

For the parameter "position in character path": 'centre'.

For the parameter "position in line progression": 'centre'.

Definition:

12.3.1.1.1 This attribute specifies the position of the alignment point within a basic layout object. According to the value specified for the attribute, the content layout process shall calculate the position of the alignment point, and shall export the position to the document layout process.

12.3.1.1.2 The parameter "position in character path" specifies the position of the alignment point in the direction of the character path:

- If the parameter specifies the value 'start', the alignment point shall be on the start edge of the positioning area.

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- If the parameter specifies the value 'end', the alignment point shall be on the end edge of the positioning area.
- If the parameter specified the value 'centre', the alignment point shall be equidistant from the start and end edges.
- If the parameter specifies a group of characters, the alignment point shall be at the same position as the position point of the first character images of the first instance of this group of characters in the string positioned in the positioning area. If the specified group of characters does not appear in the string, then the position of the alignment point defaults to the centre of the positioning area.

12.3.1.1.3 The parameter "position in line progression" specifies the position of the alignment point in the direction of the line progression:

- If the parameter specifies the value 'top', the alignment point shall be on the top edge of the positioning area.
- If the parameter specifies the value 'bottom', the alignment point shall be on the bottom edge of the positioning area.
- If the parameter specified the value 'centre', the alignment point shall be equidistant from the top and bottom edges.
- If the parameter specifies the value 'top-baseline', the alignment point shall locate on the baseline nearest to the top edge of the positioning area.
- If the parameter specifies the value 'bottom-baseline', the alignment point shall locate on the baseline nearest to the bottom edge of the positioning area.
- If the parameter specifies the value 'top-middle-baseline' or 'bottom-middle-baseline', the position of the alignment point depends on the number of the baselines.

  If the block includes an odd number of baselines, the alignment point shall be located on the uniquely determined middle baseline.

  If the block includes an even number of baselines, there are two middle baselines. If the value of the parameter is 'top-middle-baseline' / 'bottom-middle-baseline', then the alignment point shall be located on the middle baseline which is closer to the top / bottom edge.
- If the parameter specifies a positive integer i, the alignment point shall locate on the i-th baseline. If i exceeds the total number of lines, the alignment point shall locate on the last baseline.

NOTE – The positions of alignment points in the character content architecture are illustrated in Figure 19.

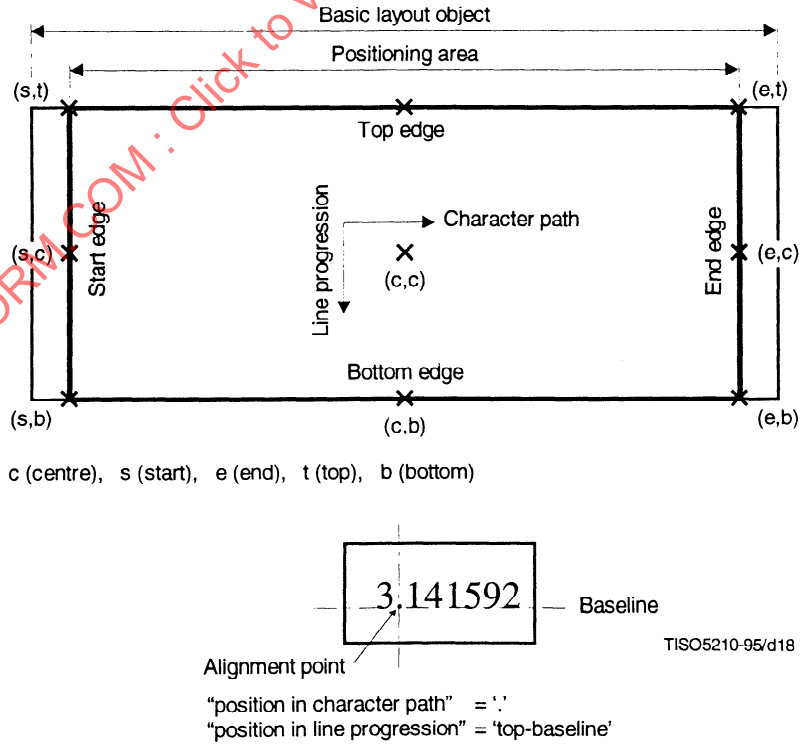


Figure 19 – Alignment points in the character content architecture

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12.3.2 Raster graphics content architecture

12.3.2.1 Alignment point

Category:

Shared.

Structure:

Two parameters: "position in pel path", "position in line progression".

Permissible values:

For the parameter "position in pel path": 'start', 'end', 'centre'.

For the parameter "position in line progression": 'top', 'bottom', 'centre'.

Default value:

For the parameter "position in pel path": 'centre'.

For the parameter "position in line progression": 'centre'.

Definition:

12.3.2.1.1 This attribute specifies the position of the alignment point within a basic layout object. According to the value specified for the attribute, the content layout process shall calculate the position of the alignment point, and shall export the position to the document layout process.

12.3.2.1.2 The parameter "position in pel path" specifies the position of the alignment point in the direction of the pel path:

- If the parameter specifies the value 'start', the alignment point shall be on the start edge of the rectangular area where the clipped pel array is positioned. The start and end edges of the area are defined such that the direction from the start edge to the end edge is in the direction of the pel path.
- If the parameter specifies the value 'end', the alignment point shall be on the end edge of the area where the clipped pel array is positioned.
- If the parameter specified the value 'centre', the alignment point shall be equidistant from the start and end edges.

12.3.2.1.3 The parameter "position in line progression" specifies the position of the alignment point in the direction of the line progression:

- If the parameter specifies the value 'top', the alignment point shall be on the top edge of the rectangular area where the clipped pel array is positioned. The top and bottom edges of the area are defined such that the direction from the top edge to the bottom edge is in the direction of the line progression.
- If the parameter specifies the value 'bottom', the alignment point shall be on the bottom edge of the area where the clipped pel array is positioned.
- If the parameter specified the value 'centre', the alignment point shall be equidistant from the top and bottom edges.

NOTE – The positions of alignment points in the raster graphics content architecture are illustrated in Figure 20.

12.3.3 Geometric graphics content architecture

12.3.3.1 Alignment point

Category:

Shared.

Structure:

Two parameters: "position in x-axis", "position in y-axis".

Permissible values:

For the parameter "position in x-axis": 'start', 'end', 'centre'.

For the parameter "position in y-axis": 'top', 'bottom', 'centre'.

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Default value:

For the parameter "position in x-axis": 'centre'.

For the parameter "position in y-axis": 'centre'.

Definition:

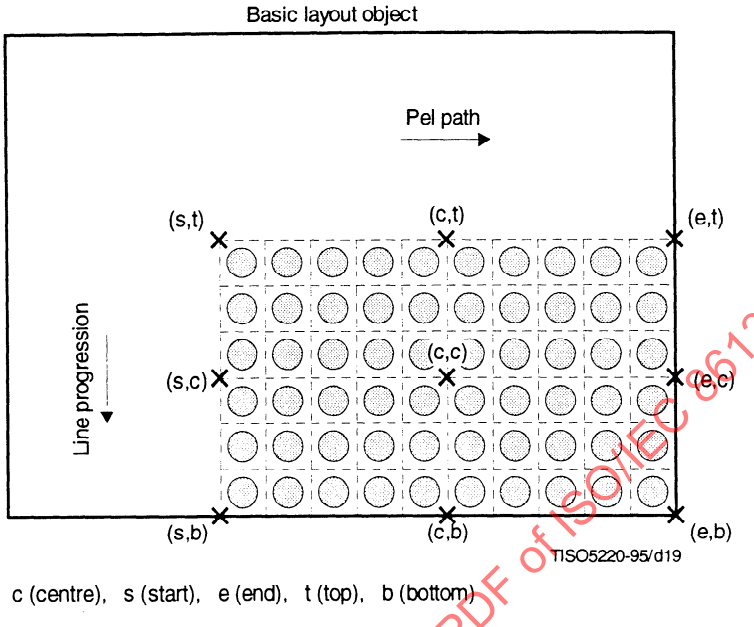


Figure 20 – Alignment points in the raster graphics content architecture

12.3.3.1.1 This attribute specifies the position of the alignment point within a basic layout object. According to the value specified for the attribute, the content layout process shall calculate the position of the alignment point, and shall export the position to the document layout process.

12.3.3.1.2 The parameter "position in x-axis" specifies the position of the alignment point in the direction of the x-axis:

- If the parameter specifies the value 'start', the alignment point shall be on the start edge of the basic layout object within which the region of interest has been laid out. The start edge is defined as the edge which has the lowest x-coordinate of the two edges orthogonal to the x-axis.
- If the parameter specifies the value 'end', the alignment point shall be on the end edge of the basic layout object. The end edge is defined as the edge which has the highest x-coordinate of the two edges orthogonal to the x-axis.
- If the parameter specifies the value 'centre', the alignment point shall be equidistant from the start and end edges.

12.3.3.1.3 The parameter "position in y-axis" specifies the position of the alignment point in the direction of the y-axis.

- If the parameter specifies the value 'top', the alignment point shall be on the top edge of the basic layout object. The top edge is defined as the edge which has the highest y-coordinate of the two edges orthogonal to the y-axis.
- If the parameter specifies the value 'bottom', the alignment point shall be on the bottom edge of the basic layout object. The bottom edge is defined as the edge which has the lowest y-coordinate of the two edges orthogonal to the y-axis.
- If the parameter specifies the value 'centre', the alignment point shall be equidistant from the top and bottom edges.

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13 Reference model of the document layout process with respect to tabular layout

This clause provides a description of the document layout process as applicable to documents which contain a specific logical structure, a complete generic layout structure and optionally layout styles, presentation styles, and/or a generic logical structure.

This Specification introduces the following additional functions to the document layout process described in ITU-T Rec. T.412 | ISO/IEC 8613-2:

- layout of reproductions of content;
- a layout reference of a grid logical object to grid frames;
- determination of the dimensions of a layout grid;
- determination of the imaging factors of table lines.

Additionally, this Specification modifies some functions of the document layout process described in ITU-T Rec. T.412 | ISO/IEC 8613-2 in the following areas:

- processing order of basic logical objects;
- placement of entry frames within a grid frame.

13.1 Layout of reproductions of content

Duplication of content shall occur only in accordance with the layout directive attribute "obligatory same layout objects" (see 12.2.4). The logical object to which this attribute applies is called a relevant object. The sub-parameter "logical objects" of this attribute specifies zero or more logical objects, called target objects.

When the layout process commences to lay out the content associated with the relevant object, its content shall be laid out as far as possible within a single layout object. This layout object shall be of one of the layout object classes specified by the parameter "layout objects" of the attribute "obligatory same layout objects" applied to the relevant object, and shall contain the entire content associated with each of the target objects.

If no such layout object exists, a reproduction of the content associated with each target object may be generated. The entire content of these generated reproductions is laid out within a single layout object of one of the layout object classes specified by the parameter "layout objects". Then, the content associated with the relevant object is laid out as far as possible within this layout object.

If the area within this layout object available for the content of the relevant object is consumed completely, the content associated with each target object may be duplicated. The entire content of these generated reproductions is laid out within a single layout object of one of the layout object classes specified by the parameter "layout objects". Then, the layout process continues to lay out the remaining content of the relevant object.

This step shall be repeated until all of the content associated with the relevant object has been laid out subject to the constraints imposed by this attribute.

The relevant object may be a target object of the attribute "obligatory same layout objects" that applies to a different logical object. In such cases, the content of the relevant object may be duplicated. The generated reproduction is also subject to the attribute "obligatory same layout objects" that applies to the relevant object with which the source content portions of the reproduction are associated. Hence, the reproduction shall be laid out in accordance with the same rules as apply to the content associated with the relevant object.

13.2 Layout reference from a grid logical object to grid frames

When the layout process reaches an active grid logical object, one or more grid frames are identified within the specific layout structure under construction. These grid frames are said to *be referenced* by the grid logical object (see 9.2).

The layout process shall identify those referenced grid frames in accordance with:

- the attribute "grid frame classes" applied to the grid logical object;
- the construction expressions specified in the generic layout structure concerned.

The layout process also generates a layout grid within each of the referenced grid frames, whose major and minor sizes are equal to those of the logical grid associated with the grid logical object.

The attribute "grid frame classes" further specifies that the content associated with the grid logical object shall be entirely laid out within these referenced grid frames, and that other parts of the document shall be excluded from any of those referenced grid frames.

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In addition, the attribute "grid description" applied to the same grid logical object constrains layout of the content associated with any of those entry objects whose association with their logical grid rectangles are specified by the parameter "entry-location association" of this attribute: the content shall be laid out within frames each of which is such that:

- it is immediately subordinate to one of the referenced grid frames;
- it is placed within the layout counterpart of the logical grid rectangle with which the entry object is associated (see 8.2).

13.3 Determination of the dimensions of layout grids

13.3.1 Constraints on the dimensions of layout grids

The dimensions of a layout grid within a grid frame are subject to the following constraints.

13.3.1.1 Dimensions and border allowance of the grid frame

The layout grid shall be entirely within the grid frame. Furthermore, the layout grid shall not fall within the border free space of the grid frame.

The dimensions and border allowance of the grid frame are specified by the attributes "dimensions" and "border" applied to the grid frame (see also 9.4.1.2 and 9.4.1.3 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

13.3.1.2 Grid dimensions

The attribute "grid dimensions" applied to the grid frame specifies either specific dimensions or a rule to determine the dimensions of the layout grid (see 12.1.2).

The attribute is structured into two parameters "major dimension" and "minor dimension" which specify the dimension of the layout grid in the direction of the major and minor path respectively.

Each parameter includes one of the sub-parameters "fixed dimension", "expansive dimension" and "rule B":

- if the parameter specifies the sub-parameter "fixed dimension", the dimension of the grid shall be the specified value;
- if the parameter specifies the sub-parameter "expansive dimension", the dimension shall be the dimension of the area available for placement of the layout grid within the grid frame;
- if the parameter specifies the sub-parameter "rule B", the parameter specifies no particular constraints.

13.3.1.3 Grid interval dimensions

The attribute "grid interval dimensions" applied to the grid frame specifies either specific dimensions or a rule to determine the dimensions of the grid intervals of the layout grid (see 12.1.4).

To each grid interval dimension, one of the sub-parameters "fixed dimension", "proportional" and "rule B" is applied:

- if the parameter specifies the sub-parameter "fixed dimension", the grid interval dimension concerned shall be the specified value;
- if the parameter specifies the sub-parameter "proportional", the ratio of the grid interval dimension to other specified grid interval dimensions shall have the specified value;
- if the parameter specifies the sub-parameter "rule B", the parameter specifies no particular constraints on the grid interval dimension.

13.3.2 Minimal layout of the layout grid

The document layout process determines all the grid interval dimensions of a layout grid so that the determination shall provide a *minimal layout* of the layout grid.

Determination of the grid interval dimensions of a layout grid provides a *minimal layout*, if and only if, for an arbitrary subset of the grid intervals of the layout grid, their determined dimensions cannot be decreased without increasing the determined dimensions for other grid intervals or violating the constraints described in 13.3.1.

In general, there may be two or more instances of minimal layout of the layout grid. The layout process is merely constrained to select an arbitrary instance of minimal layout for each layout grid.

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Based on the instance of minimal layout that the layout process selects, the layout process assigns values to the parameters of the attribute "grid interval dimensions" specified in the grid frame description corresponding to the relevant grid frame. The specified values are:

– for the parameter "major / minor interval dimensions", a grid construction expression of the grid sequence construction type composed of interval indicators such that the *i*-th interval indicator has the value of the parameter "fixed dimension" associated with the value of the dimension of the *i*-th major / minor grid interval.

13.4 Determination of the imaging factors of table lines

A *grid line segment* is a segment of a layout grid line delimited by two consecutively numbered layout grid lines intersecting that layout grid line at right angles.

The layout process determines the line segment characteristic to be applied to each grid line segment in accordance with the attribute "grid lines" specified by the grid frame class description.

Evaluation of a grid line expression specified for the parameters of the attribute may produce a set of line segment characteristics. Each line segment characteristic applies to an individual grid line segment (see 11.7). This line segment characteristic indicates the imaging factors (the line width, line type and line colour) applicable to the grid line segment (see 11.10).

If the grid line segment is within the interior of some grid rectangle to which one or more entry frames are bound, the line segment characteristic shall be modified so as to specify the invisible line type.

If at least one line segment characteristic derived from the attribute "grid lines" specified in the class description is modified, the layout process assigns values to the attribute "grid lines" specified in the object description corresponding to the relevant grid frame, so that the modification is reflected:

– For the parameter "major / minor grid lines", a grid line expression of the grid sequence construction type consisting of line characteristics is specified.

  The value of the parameter "expression" of the *i*-th line segment characteristic expression involved is of the grid sequence construction type consisting of line segment characteristics such that the *j*-th line segment characteristic indicates the imaging factors of the *j*-th line segment of the *i*-th major /minor grid line.

If no line segment characteristic derived from evaluation of the attribute "grid lines" is modified, the layout process should assign the same values to this attribute in the object description as those specified for the attribute "grid lines" in the grid frame class description.

13.5 Processing order of basic logical objects

If the relevant specific logical structure does not contain any grid logical objects to which the attribute "grid frame classes" applies, the order in which the layout process lays out the content associated with the basic logical objects of the specific logical structure is their sequential logical order (see 7.1.2 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

If the specific logical structure contains grid logical objects to which the attribute "grid frame classes" applies (called *active grid logical objects*), then the layout process shall determine the order in which it processes basic logical objects according to the values of the parameter "entry-location association" of the attribute "grid description" and the attribute "presentation precedence" which are both applied to those active grid logical objects. These values specified for each active grid logical object provide an independent constraint on the processing order of the basic logical objects subordinate to this grid logical object (see 12.2.5).

Hence, if two or more active grid logical objects are superior to a single basic logical object, the values of the parameter "entry-location association" and the attribute "presentation precedence" applied to those active grid logical objects may impose contradictory constraints on the processing order around this basic logical object. The logical structure shall be designed so that such contradictory situations shall not occur.

If all active grid logical objects satisfy the condition:

– no other active grid logical objects shall be located between an active grid logical object and any of its entry objects, whose association with the grid rectangle is defined by the parameter "entry-location association" of the attribute "grid description" applied to that active grid logical object,

their constraints on the processing order are always compatible. It is recommended that the specific logical structure be designed in this way.

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13.6 Placement of an entry frame not bound to a grid rectangle

An entry frame is, by definition, to be variably positioned. Hence, the value of the attribute "position" in the frame class description for the entry frame specifies the four sub-parameters "offset", separation", "alignment" and "fill order".

If the entry frame is not bound to any grid rectangle, the entry frame shall be laid out within its immediately superior grid frame as described in 10.5.2 of ITU-T Rec. T.412 | ISO/IEC 8613-2, provided that the layout process takes account of only those entry frames which are not bound to any grid rectangle within their common immediately superior grid frame (see 12.1.10).

The area available for placement of the entry frame is determined in accordance with:

- the attribute "border" applied to the immediately superior grid frame;
- the sub-parameter "offset" applied to the entry frame;
- the sub-parameters "separation" and "fill order" applied to those entry frames which are not bound to any grid rectangles.

The sub-sub-parameters "leading edge" and "trailing edge" of the sub-parameter "separation" constrain the distances between the leading edge and trailing edge of any two adjacent entry frames with the same fill order, neither of which is bound to any grid rectangles.

The sub-sub-parameter "center separation" of the sub-parameter "separation" constrains the distances between the leading edge and trailing edge of the adjacent entry frames with different fill orders, neither of which is bound to any grid rectangles.

The entry frame is positioned within this available area as specified by the sub-parameter "fill order".

13.7 Placement of an entry frame bound to a grid rectangle

If an entry frame accommodates content associated with some entry object, then the entry frame shall be laid out within a particular layout grid rectangle. This entry frame is said to be *bound to* that layout grid rectangle. For placement of the entry frame, the following are carried out:

a) determine the area available for placement of the entry frame (see 13.7.1);

b) position the entry frame within the determined available area (see 13.7.2);

c) for each temporarily positioned entry frame, determine the area available for its placement (see 13.7.1 and 13.7.3);

d) position this temporarily positioned entry frame within the determined available area (see 13.7.2 and 13.7.3);

e) repeat the steps c) and d) until no temporarily positioned entry frame is left;

f) rectify the position of the entry frames with centre order which are involved in the above steps (see 13.7.4).

13.7.1 Determination of the area available for placement of entry frames

The area available for placement of an entry frame is confined to the inside of the layout grid rectangle to which the entry frame is bound. Further, the following constrain the available area:

- the attribute "grid gutters" applied to the immediately superior grid frame;
- the sub-parameter "offset" applied to the entry frame;
- the sub-parameters "separation" and "fill order" applied to those entry frames which are bound to the same grid rectangle.

In addition, in calculating the available area, some entry frames may be *temporarily positioned*.

13.7.1.1 Constraints imposed by the attribute "grid gutters"

The entry frame is constrained not to fall within the gutter spaces reserved around the edges of the grid rectangle to which the entry frame is bound.

The gutter space widths are specified by the attribute "grid gutters" applied to the immediately superior grid frame (see 12.1.3).

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13.7.1.2 Constraints imposed by the sub-parameter "offset"

The entry frame shall be so positioned that the distance between the corresponding edge of the grid rectangle to which the entry frame is bound and the trailing, leading, left-hand and right-hand edges of the entry frame shall be no less than the minimum amounts specified respectively by the four sub-sub-parameters "trailing offset", "leading offset", "left-hand offset" and "right-hand offset" of the sub-parameter "offset".

13.7.1.3 Constraints imposed by the sub-parameter "separation"

The entry frame shall be so positioned that separation from the adjacent sibling entry frames which are also bound to the same grid rectangle shall be no less than the minimum amounts determined in accordance with the sub-parameter "separation" applied to the entry frame and its adjacent siblings. This sub-parameter is structured into three sub-sub-parameters: "leading edge", "trailing edge" and "centre separation".

13.7.1.3.1 The sub-sub-parameters "leading edge" and "trailing edge"

If the adjacent entry frame is placed earlier in the direction of the layout path within the same grid rectangle, and it is laid out in the same fill order, then the distance between the leading edge of this adjacent entry frame and the trailing edge of the relevant entry frame is constrained to be no less than the maximum of:

- the value of the sub-sub-parameter "leading edge" applied to the adjacent entry frame;
- the value of the sub-sub-parameter "trailing edge" applied to the entry frame concerned.

If the adjacent entry frame is placed later in the direction of the layout path within the same grid rectangle, and it is laid out in the same fill order, then the distance between the trailing edge of this adjacent entry frame and the leading edge of the relevant entry frame is constrained to be no less than the maximum of:

- the value of the sub-sub-parameter "trailing edge" applied to the adjacent entry frame;
- the value of the sub-sub-parameter "leading edge" applied to the entry frame concerned.

13.7.1.3.2 The sub-sub-parameter "centre separation"

If the adjacent entry frame is laid out in a different fill order within the same grid rectangle, the pair of edges whose distance is to be constrained is one of the following:

a) the leading edge of the adjacent entry frame and the trailing edge of the relevant entry frame;

b) the trailing edge of the adjacent entry frame and the leading edge of the relevant entry frame.

Case a) applies if any of the following applies:

- the normal order applies to the adjacent entry frame, and the centre order applies to the relevant entry frame;
- the normal order applies to the adjacent entry frame, the reverse order applies to the relevant entry frame, and no entry frame is laid out in centre order within the same grid rectangle;
- the centre order applies to the adjacent entry frame, and the reverse order applies to the relevant entry frame.

Case b) applies if any of the following applies:

- the centre order applies to the adjacent entry frame, and the normal order applies to the relevant entry frame;
- the reverse order applies to the adjacent entry frame, and the centre order applies to the relevant entry frame;
- the reverse order applies to the adjacent entry frame, the normal order applies to the relevant entry frame, and no entry frame is laid out in centre order within the same grid rectangle.

In both of cases a) and b), the distance between the edges is constrained to be no less than the maximum of:

- the value of the sub-sub-parameter "centre separation" applied to the adjacent entry frame;
- the value of the sub-sub-parameter "centre separation" applied to the entry frame concerned.

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13.7.1.4 Temporary positioning of entry frames

In calculating the area available for placement of an entry frame, the layout process *temporarily positions* entry frames already laid out within the same grid rectangle. Then, the layout process determines the dimensions of the available area in accordance with the constraints described in 13.7.1.1 – 13.7.1.3.

The layout process may re-calculate the available area for an entry frame which has already been laid out. This re-calculation occurs when the position of the entry frame is to be rectified because the entry frame is involved in some reference line alignment invoked by layout of another entry frame.

Those entry frames which are to be temporarily positioned vary depending on the fill order that applies to the relevant entry frame.

13.7.1.4.1 Available area for an entry frame with normal order

For the purpose of calculating the available area for an entry frame with normal order, all entry frames laid out in centre order are *temporarily positioned* as far as possible in the direction of the layout path, without violating the constraints described in 13.7.1.1 – 13.7.1.3.

For the purpose of re-calculating the available area for an entry frame already laid out, all entry frames laid out in normal order subsequent to the entry frame concerned are further *temporarily positioned* as far as possible in the direction of the layout path, without violating the constraints described in 13.7.1.1 – 13.7.1.3.

Then, the area available for placement is determined taking into account the constraints described in 13.7.1.1 – 13.7.1.3 (see Figure 21).

13.7.1.4.2 Available area for an entry frame with centre order

For the purpose of calculating the available area for an entry frame with centre order, all entry frames laid out in centre order prior to the entry frame concerned are *temporarily positioned* as far as possible in the direction opposite to the layout path, without violating the constraints described in 13.7.1.1 – 13.7.1.3.

For the purpose of re-calculating the available area for an entry frame already laid out, all entry frames laid out in centre order subsequent to the entry frame concerned are further *temporarily positioned* as far as possible in the direction of the layout path, without violating the constraints described in 13.7.1.1 – 13.7.1.3.

Then, the area available for placement is determined taking into account the constraints described in 13.7.1.1 – 13.7.1.3 (see Figure 22).

13.7.1.4.3 Available area for an entry frame with reverse order

For the purpose of calculating the available area for an entry frame with reverse order, all entry frames laid out in centre order and all entry frames laid out in reverse order prior to the entry frame concerned are *temporarily positioned* as far as possible in the direction opposite to the layout path, without violating the constraints described in 13.7.1.1 – 13.7.1.3.

For the purpose of re-calculating the available area for an entry frame already laid out, all entry frames laid out in centre order and all entry frames laid out in reverse order prior to the entry frame concerned are *temporarily positioned* as far as possible in the direction opposite to the layout path, without violating any of the constraints described in 13.7.1.1 – 13.7.1.3.

Then, the area available for placement is determined taking into account the constraints described in 13.7.1.1 – 13.7.1.3 (see Figure 23).

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13.7.1.5 The following notations are used in Figures 21, 22 and 23:

G_1 Gutter width around gridline1

G_2 Gutter width around gridline2

G_3 Gutter width around gridline3

G_4 Gutter width around gridline4

O_t Trailing offset of the relevant entry frame

O_l Leading offset of the relevant entry frame

O_{lh} Left-hand offset of the relevant entry frame

O_{rh} Right-hand offset of the relevant entry frame

S_t Trailing separation of the relevant entry frame

S_l Leading edge separation of the relevant entry frame

S_c Centre separation of the relevant entry frame

O_t^A Trailing offset of frame A

O_l^A Leading offset of frame A

S_t^A Trailing edge separation of frame A

S_l^A Leading edge separation of frame A

S_c^A Centre separation of frame A

H^A Height of frame A

O_t^B Trailing offset of frame B

O_l^B Leading offset of frame B

S_t^B Trailing edge separation of frame B

S_l^B Leading edge separation of frame B

S_c^B Centre separation of frame B

H^B Height of frame B

O_t^C Trailing offset of frame C

O_l^C Leading offset of frame C

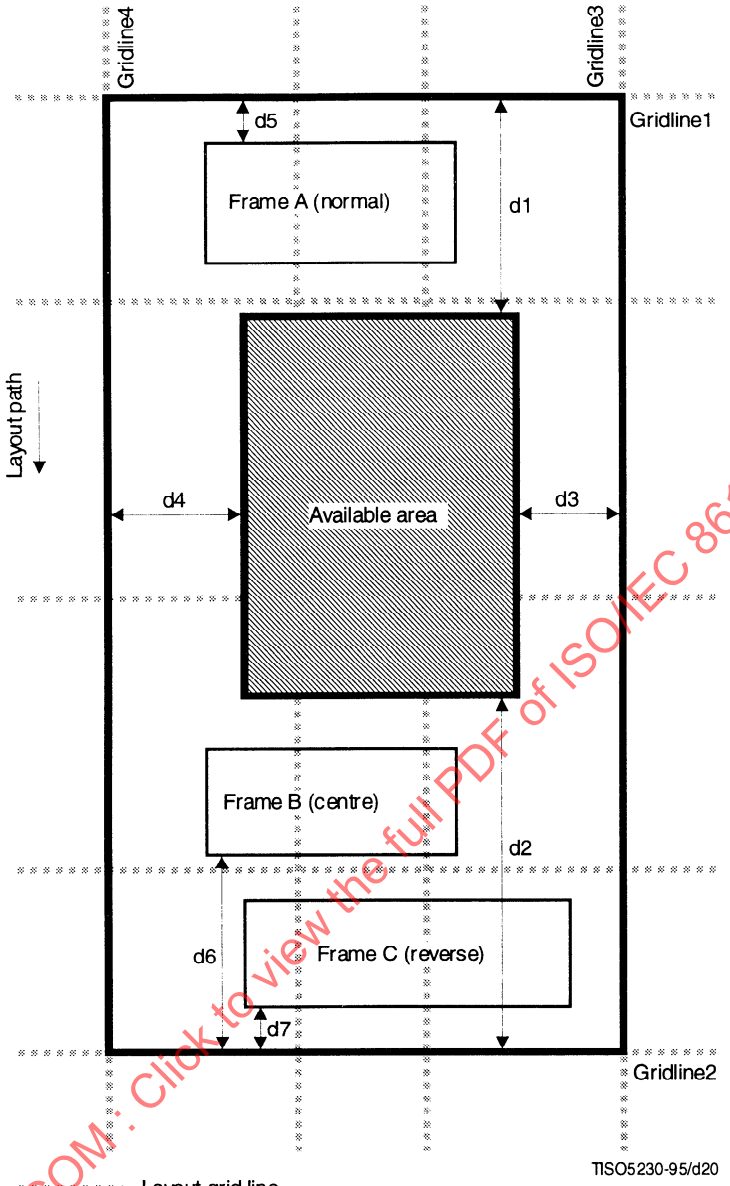
S_t^C Trailing edge separation of frame C

S_l^C Leading edge separation of frame C

S_c^C Centre separation of frame C

H^C Height of frame C

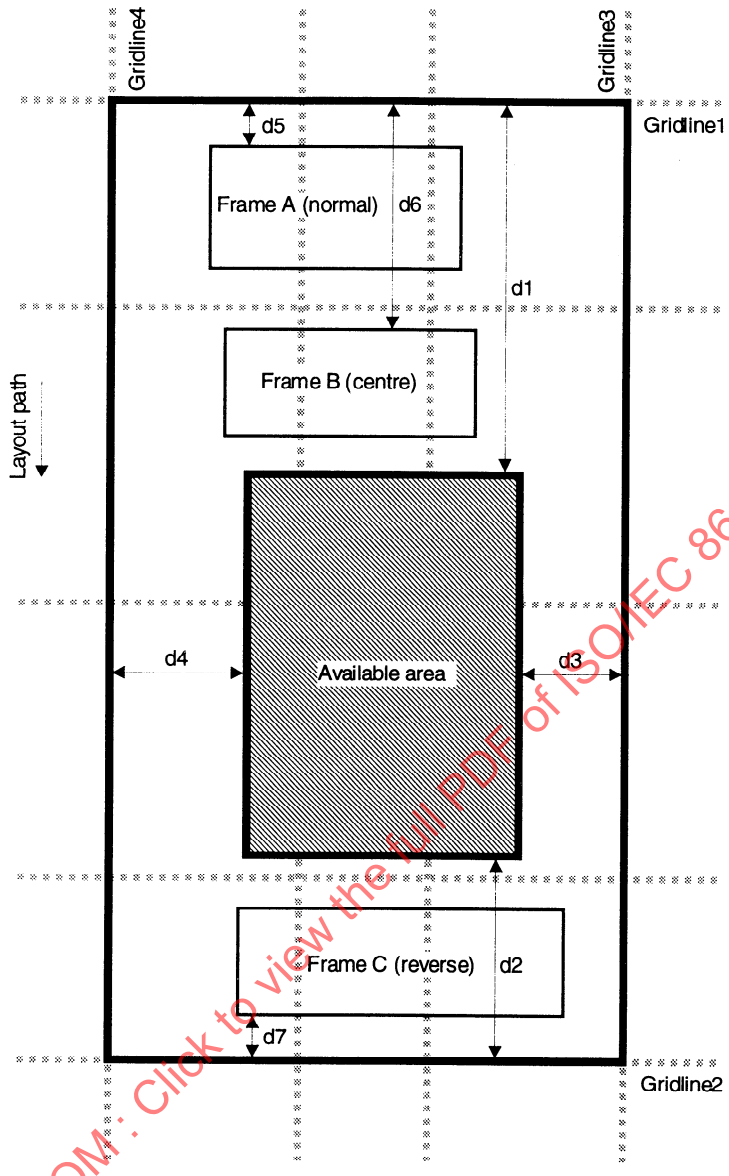
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$d_1 = \max(O_t, G_1/2, d_5 + H^A + \max(S_t, S_t^A))$
$d_2 = \max(O_l, G_2/2, d_6 + H^B + \max(S_c, S_c^B))$
$d_3 = \max(O_{lh}, G_3/2)$
$d_4 = \max(O_{rh}, G_4/2)$
$d_5 = \max(O_t^A, G_1/2)$
$d_6 = \max(O_l^B, G_2/2, d_7 + H^C + \max(S_c^B, S_c^C))$
$d_7 = \max(O_l^C, G_2/2)$

Figure 21 – Available area for an entry frame with normal order

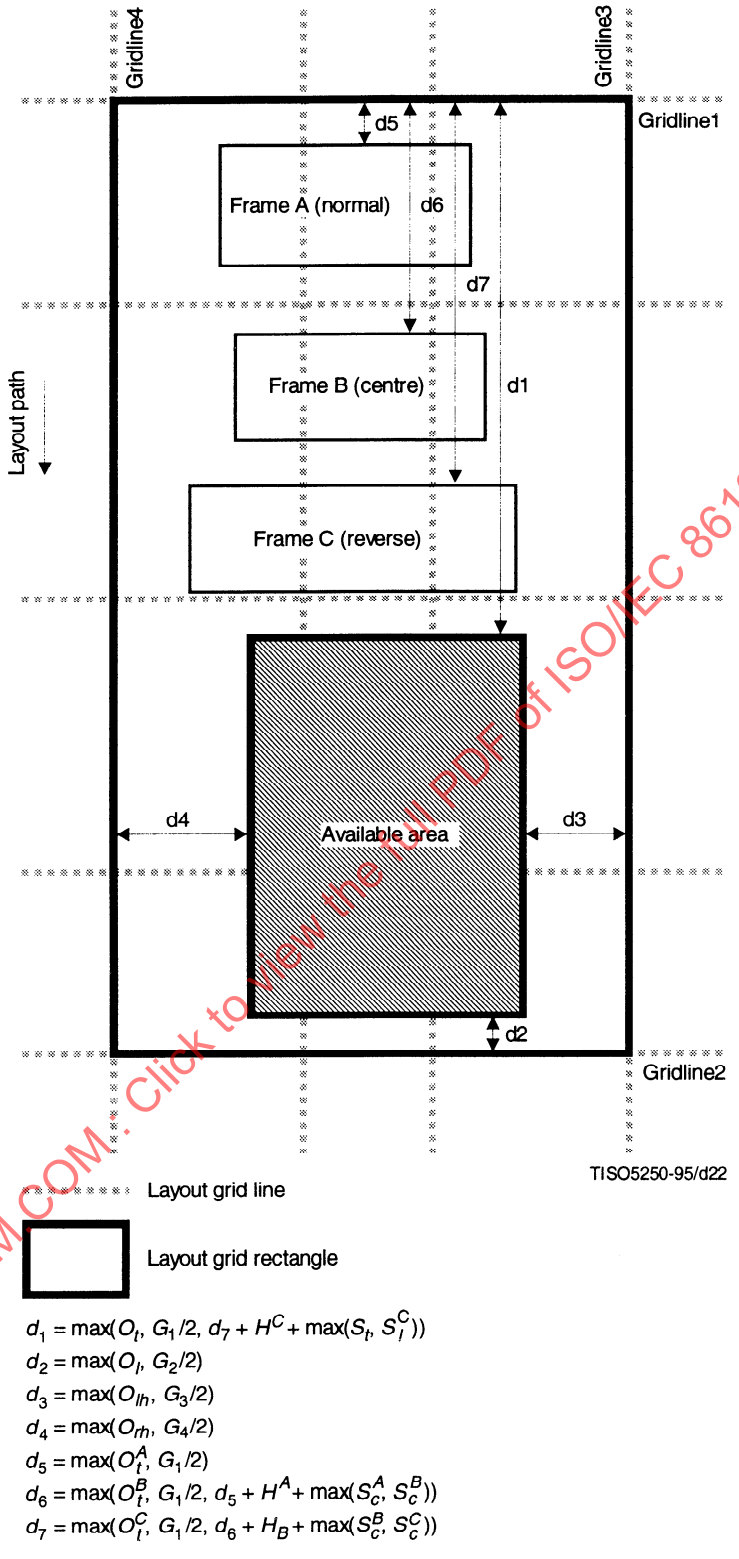
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$d_1 = \max(O_t, G_1/2, d_6 + H^B + \max(S_t, S_t^B))$
$d_2 = \max(O_l, G_2/2, d_7 + H^C + \max(S_c, S_c^C))$
$d_3 = \max(O_{lh}, G_3/2)$
$d_4 = \max(O_{rh}, G_4/2)$
$d_5 = \max(O_t^A, G_1/2)$
$d_6 = \max(O_t^B, G_1/2, d_5 + H^A + \max(S_c^A, S_c^B))$
$d_7 = \max(O_l^C, G_2/2)$

Figure 22 – Available area for an entry frame with normal order

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Figure 23 – Available area for an entry frame with reverse order

13.7.2 Placement of an entry frame within its available area

If the attribute "reference line alignment – major" or "reference line alignment – minor" is applied to some of the entry frames immediately subordinate to a grid frame, the attribute specifies zero or more groups, each of which is composed of two or more entry frames. These groups of entry frames are called *alignment groups*.

Placement of an entry frame is carried out in one of the following ways: cases a) and b):

a) if the entry frame to be positioned is included in one of the alignment groups, the layout process positions this relevant entry frame and the other entry frames in this alignment group as a group (see 13.7.2.2);

b) if the entry frame is not included in any of the alignment groups, the layout process positions this relevant entry frame independent of any other entry frames (see 13.7.2.1).

13.7.2.1 Placement of an independent entry frame

An entry frame which is not involved in any instance of reference line alignment is positioned within its available area under the following constraints.

13.7.2.1.1 Layout path and fill order

In positioning the entry frame in the direction of the layout path of the immediately superior grid frame, the layout process shall take account of the fill order of the entry frame and the layout path.

The fill order, which is specified by the sub-parameter "fill order" applied to the entry frame, has one of the values 'normal order', 'centre order' and 'reverse order':

- If the sub-parameter "fill order" specifies the value 'normal order', the entry frame is positioned within the available area as close as possible to the trailing edge of the available area.
- If the sub-parameter "fill order" specifies 'centre order', the entry frame is positioned within the available area as close as possible to the trailing edge of the available area.

  This position of the entry frame is just temporary. The position of the entry frame, together with those of other entry frames laid out in centre order, shall subsequently be rectified as described in 13.7.4.
- If the sub-parameter "fill order" specifies the value 'reverse order', the entry frame is positioned within the available area as close as possible to the leading edge of the available area.

13.7.2.1.2 Alignment

In positioning the entry frame in the direction orthogonal to the layout path of the immediately superior grid frame, the layout process shall take account of the alignment type applied to the entry frame.

The alignment type, which is specified by the sub-parameter "alignment" applied to the entry frame, has one of the values 'left-hand aligned', 'centred' and 'right-hand aligned':

- if the sub-parameter "alignment" specifies the value 'left-hand aligned', the entry frame is positioned as close as possible to the left-hand edge of the available area;
- if the sub-parameter "alignment" specifies the value 'centred', the entry frame is centred, in the direction orthogonal to the layout path, within the available area;
- if the sub-parameter "alignment" specifies the value 'right-hand aligned', the entry frame is positioned as close as possible to the right-hand edge of the available area.

13.7.2.2 Placement of entry frames in an alignment group

If the entry frame to be positioned is included in some alignment group, the layout process positions all entry frames in this alignment group as a group. More precisely, the layout process aligns those entry frames along a single reference line.

This reference line is parallel to either the major path or the minor path of the immediately superior grid frame. If the reference line alignment occurs in accordance with the attribute "reference line alignment – major / minor", then the associated reference line runs parallel to the major / minor path.

In positioning the entry frames in this alignment group, the layout process takes account of:

- the attribute "frame alignment point" applied to the entry frames in the alignment group;
- the attribute "indent – major" applied to the entry frames in the alignment group, if the reference line is parallel to the major path of the immediately superior grid frame;

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- the attribute "indent – minor" applied to the entry frames in the alignment group, if the reference line is parallel to the minor path of the immediately superior grid frame;
- the sub-parameters "fill order" and "alignment of the parameter position" applied to the relevant entry frame.

13.7.2.2.1 Determination of alignment groups

At the first step of placement of an entry frame, which is involved in reference alignment, the layout process shall identify those alignment groups including the entry frame to be positioned (see 12.1.11). The entry frame is included in one or two alignment groups. Each alignment group is composed of two or more entry frames including the relevant entry frame, and if the entry frame is included in two alignment groups, then their associated reference lines are orthogonal to each other.

Furthermore, the alignment group satisfies the following conditions (see 12.1.11):

- Every entry frame in the alignment group shall be bound to a grid rectangle within the common immediately superior grid frame. Although different entry frames in the group may be bound to different grid rectangles, those grid rectangles shall be edged with two common layout grid lines parallel to their associated reference line.
- If the reference line is parallel to the layout path of the immediately superior grid frame, the sub-parameter "alignment" applied to each entry frame in the group shall specify a common value.
- If the reference line is orthogonal to the layout path of the immediately superior grid frame, the sub-parameter "fill order" applied to each entry frame in the group shall specify a common value.

13.7.2.2.2 Determination of available areas

At the second step, the layout process calculates the area available for placement of the entry frames in the alignment group.

The available area for the relevant entry frame is calculated as described in 13.7.1.

For the available area for each of the other entry frames in the alignment group:

- if the reference line is orthogonal to the layout path of the immediately superior grid frame, the area is calculated as described in 13.7.1;
- if the reference line is parallel to the layout path of the immediately superior grid frame, only the position of the entry frame in the direction orthogonal to the reference line is calculated; hence no entry frames are temporarily positioned during the calculation of the available area (see 13.7.1.4).

13.7.2.2.3 Placement of entry frames in the direction of the reference line

The position of the relevant entry frame in the direction of the reference line shall be determined in accordance with:

- the sub-parameter "fill order" applied to this entry frame, if the reference line is parallel to the layout path, and if the entry frame is not involved in any other instance of reference line alignment (see 13.7.2.1.1);
- the sub-parameter "alignment" applied to this entry frame, if the reference line is orthogonal to the layout path, and if the entry frame is not involved in any other instance of reference line alignment (see 13.7.2.1.2);
- the rule described in 13.7.2.2.4, if the entry frame is involved in another instance of reference line alignment.

The position of each of the other entry frames in the alignment group in the direction of the reference line remains unchanged.

13.7.2.2.4 Placement of entry frames in the direction orthogonal to the reference line

The positions of the entry frames in the direction orthogonal to the reference line shall be determined by the following two steps:

- At the first step, the entry frames are positioned relative to the reference line.
- At the second step, the reference line is positioned. There are two cases:
  - the reference line is parallel to the layout path;
  - the reference line is orthogonal to the layout path.

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13.7.2.2.4.1 Placement of entry frames relative to the reference line

Entry frames which are to be aligned along a single reference line are first positioned relative to the reference line. In this step, the layout process shall take account of the alignment point and the indent applied to each entry frame.

- The attribute "frame alignment point" applied to the entry frame specifies the position of the alignment point associated with the entry frame.
- Either the attribute "indent – major" or "indent – minor" applied to the entry frame specifies the distance between the alignment point associated with the entry frame and the reference line.

  If the relevant instance of reference line alignment is in accordance with the attribute "reference line alignment – major / minor", then the value of the attribute "indent – major / minor" specifies the amount of indent (see also Figure 12). If the attribute "indent – major / minor" does not apply to the entry frame, then the value zero is assumed for this attribute.

Thus, the layout process evaluates the attributes "frame alignment point" and "indent – major / minor" applied to each entry frame involved in this instance of reference line alignment, and determines its position in the orthogonal direction viewed from the reference line concerned.

13.7.2.2.4.2 Placement of the reference line parallel to the layout path

If the reference line is parallel to the layout path of the immediately superior grid frame, the layout process positions the reference line taking account of the sub-parameter "alignment" applied to the entry frames aligned along this reference line.

NOTE – For every entry frame concerned, the sub-parameter "alignment" always specifies the same value (see 12.1.11).

The value of the sub-parameter "alignment" is one of the values 'left-hand aligned', 'centred' and 'right-hand aligned'.

Irrespective of the value of the sub-parameter, the reference line shall be positioned so that every entry frame in this alignment group shall fall entirely within the area available for placement of the entry frame.

Subject to this common constraint, the reference line is positioned as follows:

- if the sub-parameter specifies the value 'left-hand aligned', the reference line is positioned as far as possible in the direction which traverses the layout path at right angles in an anticlockwise direction;
- if the sub-parameter specifies the value 'right-hand aligned', the reference line is positioned as far as possible in the direction which traverses the layout path at right angles in a clockwise direction;
- if the sub-parameter specifies the value 'centred', the reference line is positioned equidistant from the following two imaginary positions:
  - the position at which the reference line would be placed, if the sub-parameter specified the value 'left-hand aligned';
  - the position at which the reference line would be placed, if the sub-parameter specified the value 'right-hand aligned'.

13.7.2.2.4.3 Placement of the reference line running orthogonal to the layout path

If the reference line is orthogonal to the layout path of the immediately superior grid frame, the layout process positions the reference line taking account of the sub-parameter "fill order" applied to the entry frames aligned along this reference line.

NOTE – For every entry frame concerned, the sub-parameter "fill order" specifies the same value (see 12.1.11).

The value of the sub-parameter "fill order" is one of the values 'normal order', 'centre order' and 'reverse order'.

Irrespective of the value of the sub-parameter, the reference line shall be positioned so that every entry frame in this alignment group shall fall entirely within the area available for placement of the entry frame (see Figure 24).

Subject to this common constraint, the reference line is to be positioned as follows:

- If the sub-parameter specifies the value 'normal order', the reference line is positioned as far as possible in the direction opposite to the layout path.
- If the sub-parameter specifies 'centre order', the reference line is positioned as far as possible in the direction opposite to the layout path.

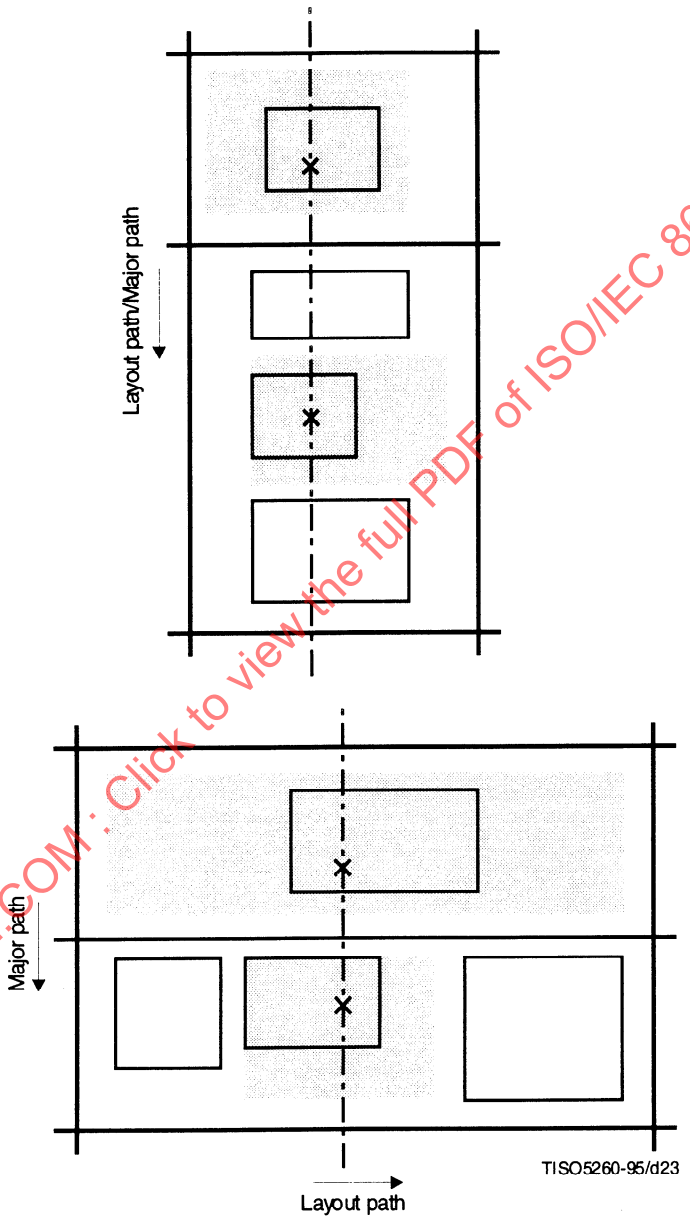
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The position of the reference line determined in this step is just temporary. The position of the reference line, together with that of other entry frames laid out in centre order, shall subsequently be rectified as described 13.7.4.

– If the sub-parameter specifies the value 'reverse order', the reference line is positioned as far as possible in the direction of the layout path.

13.7.3 Placement of temporarily positioned entry frames

When the layout process calculates the area available for placement of entry frames, it may also *temporarily position* them (see 13.7.1.4). The layout process repositions those temporarily positioned entry frames one by one, in accordance with the rules described in 13.7.



'left-hand aligned' specified for reference line alignment in major path

× Alignment points

Available areas

Figure 24 – Reference line alignment

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For each entry frame that is temporarily positioned, the layout process modifies its position in the direction of the layout path, and leaves the position in the direction orthogonal to the layout path unchanged. Hence:

a) if that entry frame is not involved in any instance of reference line alignment such that the associated reference line is orthogonal to the layout path, the rule described in 13.7.2.1.1 applies to the placement; such a frame is called *independent*;

b) if that entry frame is involved in some instance of reference line alignment such that the associated reference line is orthogonal to the layout path, the rule described in 13.7.2.2.3 and 13.7.2.2.4 applies to the placement; such a frame is called *associated*.

The fill orders of those temporarily positioned entry frames are dependent on the fill order of the initial entry frame that the layout process initially tries to lay out:

- if the initial entry frame is positioned in normal order, the fill order of an arbitrary entry frame positioned temporarily is either normal or centre order;
- if the initial entry frame is positioned in reverse order, the fill order of an arbitrary entry frame positioned temporarily is either reverse or centre order;
- if the initial entry frame is positioned in centre order, the fill order of an arbitrary entry frame positioned temporarily is always centre order.

The order in which the layout process repositions them varies depending on the values of fill order applied to them.

- The layout process repositions an entry frame with normal / reverse order, if one of the following applies:

  a) the entry frame is of the independent type, and it is the first / last in the sequential layout order among those entry frames with normal / reverse order that are temporarily positioned within the layout grid rectangle to which the entry frame concerned is bound and that have not been repositioned yet;

  b) the entry frame is of the associated type, and each entry frame in the alignment group is the first / last in the sequential layout order among those entry frames with normal / reverse order that are temporarily positioned within the layout grid rectangle to which this entry frame is bound and that have not been repositioned yet.

- If one or more entry frames with centre order are temporarily positioned, the layout process shall first reposition all entry frames positioned temporarily in normal or reverse order. Then the layout process repositions an entry frame with centre order, if one of the following applies:

  a) the entry frame is of the independent type, and it is the first in the sequential layout order among those entry frames with centre order that are temporarily positioned within the layout grid rectangle to which the entry frame concerned is bound and that have not been repositioned yet;

  b) the entry frame is of the associated type, and each entry frame in the alignment group is the first in the sequential layout order among those entry frames with centre order that are temporarily positioned within the layout grid rectangle to which this entry frame is bound and that have not been repositioned yet.

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13.7.4 Rectification of position of entry frames with centre order

If entry frames are to be positioned in centre order, and if their positions in the direction of the layout path are determined in accordance with 13.7.2.1.1 and 13.7.2.2.4.3, the positions still remain temporary. At the final step, the layout process shall rectify their positions in the direction of the layout path. The entry frames involved in this rectification are such that:

- they are to be positioned in centre order;
- their positions in the direction of the layout path are determined in accordance with 13.7.2.1.1 and 13.7.2.2.4.3.

The following two steps are carried out:

a) the layout process packs those involved entry frames with centre order;

b) the layout process moves the involved entry frames as a group in the direction of the layout path.

13.7.4.1 Packing of entry frames

The layout process classifies all the involved entry frames into two groups, which are respectively called the *movable* group and the *immovable* group. The movable and immovable groups shall satisfy the following:

- the movable and immovable groups shall contain no common entry frame;
- if two entry frames are included respectively in the movable and immovable group, and if they are positioned within the same grid rectangle, then the former entry frame shall precede the latter in the direction of the layout path;
- there shall be at least one grid rectangle within which at least one entry frame belonging to the movable group and at least one entry frame belonging to the immovable group are positioned;
- if an entry frame is of the associated type, then all entry frames in the associated alignment group shall be included in either the movable or immovable group to which that entry frame belongs.

The layout process moves all the entry frames in this movable group by the same amount in the direction of the layout path. The distance moved shall be as large as possible, subject to the constraints imposed by:

- the attribute "grid gutters" applied to the immediately superior grid frame;
- the sub-parameters "offset" and "separation" applied to all the entry frames within the grid frame.

The layout process repeats these procedures until there exists no movable group which can be moved by a positive amount.

13.7.4.2 Final placement of the entry frames

After the involved entry frames are packed, the layout process finally moves all the involved entry frames by the same amount in the direction of the layout path.

The distance moved is one half of the maximum possible, subject to the constraints imposed by:

- the attribute "grid gutters" applied to the immediately superior grid frame;
- the sub-parameters "offset" and "separation" applied to all the entry frames within the grid frame.

14 Reference model of the document imaging process with respect to tabular layout

This clause provides a description of the document imaging process as applicable to documents of the formatted document architecture class or the formatted processable document architecture class (see 6.3.13 of ITU-T Rec. T.412 | ISO/IEC 8613-2).

Such documents include constituents representing a specific layout structure and may optionally include constituents representing a generic layout structure and/or presentation styles. In the case of the formatted processable document architecture class, other constituents are present but these do not affect the imaging process.

Specifically, this clause provides a description of those functions which the document imaging process provides when processing grid frames that include a layout grid.

The functions described in this clause are all additional to the functions described in clause 11 of ITU-T Rec. T.412 | ISO/IEC 8613-2. Hence, they do not affect the definition of the reference model of the document imaging process provided by clause 11 of ITU-T Rec. T.412 | ISO/IEC 8613-2.

The functions described here are:

- generation of images of layout grid lines;
- generation of images of supplementary lines composing tabular layout.

14.1 Generation of images of layout grid lines

The imaging process identifies the direction, position, dimension and imaging factors of each grid line segment, and then images the grid line segment according to the information identified.

14.1.1 Direction of a grid line segment

If a grid line segment is a segment of a major / minor layout grid line, the grid line segment is called a *major / minor grid line segment.*

The attributes "major / minor path" applied to the grid frame concerned specify the direction of the major / minor path within the grid frame, and hence the direction of minor / major grid line segments respectively.

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14.1.2 Position and dimension of a grid line segment

A grid frame that include a layout grid is characterized by the attribute "grid interval dimensions" specified in its object description.

The value of each parameter of the attribute is a grid interval expression of a grid sequence construction type consisting of interval indicators such that every interval indicator involved has the parameter "fixed dimension" associated with a non-negative integer (see 13.3).

Each interval indicator involved in the parameter "major / minor interval dimensions" corresponds to an individual major / minor grid interval, and the non-negative integer specified for the parameter "fixed dimension" specifies the dimension of the corresponding grid interval, measured in scaled measurement units.

The position of the grid origin of the layout grid concerned is specified by the attribute "grid position" applied to the grid frame (see 12.1.6).

Hence, the position and dimension of each line segment are determined in accordance with the attributes "grid interval dimensions" and "grid position" applied to the grid frame.

14.1.3 Imaging factors for a grid line segment

The attribute "grid lines" applied to a grid frame specifies imaging factors (the line width, line type and line colour) of the line segments composing the layout grid within the grid frame.

Evaluation of a grid line segment specified for the parameter "major / minor grid lines" of the attribute provides the line segment characteristics to be applied to the major / minor grid line segments (see 13.4).

14.2 Generation of images of supplementary lines

The imaging process may image one or more lines within a grid frame in accordance with the attribute "supplementary lines" applied to the grid frame.

The attribute "supplementary lines" consists of one or more entries each of which is a triplet of the parameters "start", "end" and "imaging factors".

Each entry in the attribute specifies the direction, position, dimension and imaging factors to be used in imaging an individual line:

- The parameter "start" specifies the position of the starting point of the line to which the entry applies. The value is the horizontal and vertical distance of the starting point from the reference point of the grid frame measured in scaled measurement units.
- The parameter "end" specifies the position of the end point of the line to which the entry applies. The value is the horizontal and vertical distance of the end point from the reference point of the grid frame measured in scaled measurement units.
- The parameter "imaging factors" specifies a line segment characteristic indicating the imaging factors of the line to which the entry applies (see 11.10).

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Annex A

Formal definition of tabular structures and tabular layout

(This annex forms an integral part of this Recommendation | International Standard)

Since this Specification defines a number of attributes in addition to those defined in ITU-T Rec. T.412 | ISO/IEC 8613-2, the formal definition given in ITU-T Rec. T.415 | ISO/IEC 8613-5, ITU-T Rec. T.416 | ISO/IEC 8613-6, ITU-T Rec. T.417 | ISO/IEC 8613-7 and ITU-T Rec. T.418 | ISO/IEC 8613-8 is no longer sufficient to define:

- the format of the data stream used to interchange documents structured in accordance with the conjunction of ITU-T Rec. T.412 | ISO/IEC 8613-2 and this Specification;
- the representation of the constituents which may appear in an interchanged document including tabular materials.

This annex provides sufficient descriptions of ODIF for documents structured in accordance with the conjunction of ITU-T Rec. T.412 | ISO/IEC 8613-2 and this Specification.

Since almost all formal definition given in ITU-T Rec. T.415 | ISO/IEC 8613-5, ITU-T Rec. T.416 | ISO/IEC 8613-6, ITU-T Rec. T.417 | ISO/IEC 8613-7 and ITU-T Rec. T.418 | ISO/IEC 8613-8 remains compatible with the definition introduced by this Specification, this Specification provides only necessary amendments to them to avoid repeating the bulky descriptions that have been already given in those parts. The following components are amended:

- Layout-Descriptors { 2 8 1 5 8 };
- Logical-Descriptors { 2 8 1 5 9 };
- Style-Descriptors { 2 8 1 5 10 };
- Default-Value-Lists { 2 8 1 5 11 };
- Character-Presentation-Attributes { 2 8 1 6 2 };
- Raster-Gr-Presentation-Attributes { 2 8 1 7 2 };
- Geo-Gr-Presentation-Attributes { 2 8 1 8 2 }.

Furthermore, the additional descriptions introduced by this Specification are structured into the two components:

- Grid-Layout-Descriptors { 2 8 1 11 1 };
- Grid-Style-Descriptors { 2 8 1 11 2 }.

Those components export types to and import types from the existing components defined in ITU-T Rec. T.415 | ISO/IEC 8613-5, ITU-T Rec. T.416 | ISO/IEC 8613-6, ITU-T Rec. T.417 | ISO/IEC 8613-7 and ITU-T Rec. T.418 | ISO/IEC 8613-8.

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A.1 Layout descriptors

Layout-Descriptors { 2 8 1 5 8 }

DEFINITIONS ::= BEGIN

EXPORTS -- *Put here the descriptions for EXPORTS in 7.9*
-- *of ITU-T Rec. T.415 | ISO/IEC 8613-5.* --
;

IMPORTS -- *Put here the descriptions for IMPORTS in 7.9*
-- *of ITU-T Rec. T.415 | ISO/IEC 8613-5.* --
-- *Append the following items.* --
Frame-Alignment-Point,
Grid-Dimensions, Grid-Gutters,
Grid-Interval-Dimensions,
Grid-Lines, Grid-Position,
Indent,
Major-Path, Minor-Path,
Reference-Line-Alignment,
Supplementary-Lines
FROM Grid-Layout-Descriptors { 2 8 1 11 1 };

```
Position-Spec-Grid ::= SET {
    offset                                  [0]  IMPLICIT SET {
        leading                                      [0] IMPLICIT INTEGER OPTIONAL,
        trailing                                     [1] IMPLICIT INTEGER OPTIONAL,
        left-hand                                    [2] IMPLICIT INTEGER OPTIONAL,
        right-hand                                   [3] IMPLICIT INTEGER OPTIONAL } OPTIONAL,
    separation                              [1]  IMPLICIT SET {
        leading                                      [0] IMPLICIT INTEGER OPTIONAL,
        trailing                                     [1] IMPLICIT INTEGER OPTIONAL,
        centre                                       [2] IMPLICIT INTEGER OPTIONAL } OPTIONAL,
    alignment                               [2]  IMPLICIT INTEGER {
                                                 right-hand (0), centred (1),
                                                 left-hand (2) } OPTIONAL,
    fill-order                              [3]  IMPLICIT INTEGER {
                                                 normal (0), reverse (1), centre (2) } OPTIONAL }

-- Put here the descriptions for types from
-- Dimension-Pair
-- to
-- Layout-Object-Descriptor
-- in 7.9 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --

Layout-Object-Type ::= INTEGER { document-layout-root (0),
                                 page-set (1), page (2), frame (3), block (4), grid-frame (5)}

Layout-Object-Descriptor-Body ::= SET {
                                        -- Put here the descriptions for Layout-Object-Descriptor-Body
                                        -- in 7.9 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --
                                        -- Append the following descriptions. --
        frame-alignment-point                   [38] Frame-Alignment-Point OPTIONAL,
        grid-dimensions                         [39] IMPLICIT Grid-Dimensions OPTIONAL,
        grid-gutters                            [40] IMPLICIT Grid-Gutters OPTIONAL,
        grid-interval-dimensions                [41] IMPLICIT Grid-Interval-Dimensions OPTIONAL,
        grid-lines                              [42] IMPLICIT Grid-Lines OPTIONAL,
        grid-position                           [43] Grid-Position OPTIONAL,
        major-path                              [44] IMPLICIT Major-Path OPTIONAL,
        minor-path                              [45] IMPLICIT Minor-Path OPTIONAL,
        supplementary-lines                     [46] IMPLICIT Supplementary-Lines OPTIONAL }
-- Put here the descriptions for Layout-Class-Descriptor
-- in 7.9 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --

Layout-Class-Descriptor-Body ::= SET {
                                        -- Put here the descriptions for Layout-Class-Descriptor-Body
                                        -- in 7.9 of ITU-T Rec. T.415 | ISO/IEC 8613-5,
                                        -- except for the descriptions for position. --
                                        -- Append the following descriptions. --
    position                                CHOICE {
        fixed-position                              [3] IMPLICIT Measure-Pair,
        variable-position                           [26] IMPLICIT Position-Spec-Grid } OPTIONAL,
    frame-alignment-point                   [38] Frame-Alignment-Point OPTIONAL,
    grid-dimensions                         [39] IMPLICIT Grid-Dimensions OPTIONAL,
    grid-gutters                            [40] IMPLICIT Grid-Gutters OPTIONAL,
    grid-interval-dimensions                [41] IMPLICIT Grid-Interval-Dimensions OPTIONAL,
    grid-lines                              [42] IMPLICIT Grid-Lines OPTIONAL,
    grid-position                           [43] Grid-Position OPTIONAL,
    major-path                              [44] IMPLICIT Major-Path OPTIONAL,
    minor-path                              [45] IMPLICIT Minor-Path OPTIONAL,
    supplementary-lines                     [46] IMPLICIT Supplementary-Lines OPTIONAL,
    indent-major                            [47] IMPLICIT Indent OPTIONAL,
    indent-minor                            [48] IMPLICIT Indent OPTIONAL,
    reference-line-alignment-major          [50] IMPLICIT Reference-Line-Alignment OPTIONAL,
    reference-line-alignment-minor          [51] IMPLICIT Reference-Line-Alignment OPTIONAL }
END
```

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A.2 Logical descriptors

Logical-Descriptors { 2 8 1 5 9 }

```
DEFINITIONS ::= BEGIN
-- Put here the descriptions for
-- EXPORTS
-- IMPORTS
-- Logical-Object-Descriptor
-- in 7.10 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --

Logical-Object-Type ::= INTEGER { document-logical-root (0),
                                  composite-logical-object (1),
                                  basic-logical-object (2),
                                  grid-logical-object (3) }
-- Put here the descriptions for types from
-- Logical-Object-Descriptor-Body
-- to
-- Protection
-- in 7.10 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --
END
```

A.3 Style descriptors

Style-Descriptors { 2 8 1 5 10 }

```
DEFINITIONS ::= BEGIN

EXPORTS                         -- Put here the descriptions for EXPORTS in 7.11
                                -- of ITU-T Rec. T.415 | ISO/IEC 8613-5. --
                                ;

IMPORTS                         -- Put here the descriptions for IMPORTS in 7.11
                                -- of ITU-T Rec. T.415 | ISO/IEC 8613-5. --
                                -- Append the following descriptions. --
                                   Block-Alignment-Point,
                                   Grid-Description, Grid-Frame-Classes,
                                   Obligatory-Same-Layout-Objects,
                                   Presentation-Precedence,
                                   Selective-Same-Layout-Objects,
                                   Supplementary-Line-Directive
                                   FROM Grid-Style-Descriptors { 2 8 1 11 2 };
-- Put here the descriptions for types from
-- Presentation-Style-Descriptor
-- to
-- Layout-Style-Descriptor
-- in 7.11 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --

Layout-Directives ::= SET {
                                -- Put here the descriptions for Layout-Directives
                                -- in 7.11 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --
                                -- Append the following descriptions. --
        block-alignment-point       [25] Block-Alignment-Point OPTIONAL,
        presentation-precedence     [26] IMPLICIT Presentation-Precedence OPTIONAL,
        grid-frame-classes          [27] Grid-Frame-Classes OPTIONAL,
        obligatory-same-layout-objects [28] IMPLICIT Obligatory-Same-Layout-Objects OPTIONAL,
        selective-same-layout-objects  [29] IMPLICIT Selective-Same-Layout-Objects OPTIONAL,
        supplementary-line-directive   [30] IMPLICIT Supplementary-Line-Directive OPTIONAL,
        grid-description            [31] IMPLICIT Grid-Description OPTIONAL }
-- Put here the descriptions for types from
-- Separation
-- to
-- Block-Alignment
-- in 7.11 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --
END
```

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A.4 Default value lists

```
Default-Value-Lists { 2 8 1 5 11 }

DEFINITIONS ::= BEGIN

EXPORTS                                 -- Put here the descriptions for EXPORTS in 7.12
                                        -- of ITU-T Rec. T.415 | ISO/IEC 8613-5. --
                                        ;

IMPORTS                                 -- Put here the descriptions for IMPORTS in 7.12
                                        -- of ITU-T Rec. T.415 | ISO/IEC 8613-5. --
                                        -- Append the following descriptions. --
                                            Frame-Alignment-Point,
                                            Grid-Dimensions, Grid-Gutters,
                                            Grid-Lines, Grid-Position,
                                            Major-Path, Minor-Path,
                                            Supplementary-Lines
                                            FROM Grid-Layout-Descriptors { 2 8 1 11 1 };
-- Put here the descriptions for types from
-- Default-Value-Lists-Layout
-- to
-- Page-Attributes
-- in 7.12 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --

Frame-Attributes ::= SET {
                                        -- Put here the descriptions for Frame-Attributes
                                        -- in 7.12 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --
        frame-alignment-point           < Attribute OPTIONAL,
        grid-dimensions                 < Attribute OPTIONAL,
        grid-gutters                    < Attribute OPTIONAL,
        grid-lines                      < Attribute OPTIONAL,
        grid-position                   < Attribute OPTIONAL,
        major-path                      < Attribute OPTIONAL,
        minor-path                      < Attribute OPTIONAL,
        supplementary-lines             < Attribute OPTIONAL }
-- Put here the descriptions for types from
-- Block-Attributes
-- to
-- Basic-Logical-Attributes
-- in 7.12 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --

Attribute ::= CHOICE {
                                        -- Put here the descriptions for Attribute
                                        -- in 7.12 of ITU-T Rec. T.415 | ISO/IEC 8613-5. --
                                        -- Append the following descriptions. --
        frame-alignment-point               [21] Frame-Alignment-Point,
        grid-dimensions                     [22] IMPLICIT Grid-Dimensions,
        grid-gutters                        [23] IMPLICIT Grid-Gutters,
        grid-lines                          [24] IMPLICIT Grid-Lines,
        grid-position                       [25] Grid-Position,
        major-path                          [26] IMPLICIT Major-Path,
        minor-path                          [27] IMPLICIT Minor-Path,
        supplementary-lines                 [28] IMPLICIT Supplementary-Lines }
END
```

A.5 Character presentation attributes

```
Character-Presentation-Attributes { 2 8 1 6 2 }

DEFINITIONS ::= BEGIN

EXPORTS                                 -- Put here the descriptions for EXPORTS in 11.2
                                        -- of ITU-T Rec. T.416 | ISO/IEC 8613-6. --
                                        ;
```

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```
Character-Attributes ::= SET {
                                        -- Put here the descriptions for Character-Attributes
                                        -- in 11.2 of ITU-T Rec. T.416 | ISO/IEC 8613-6. --
                                        -- Append the following item. --
        alignment-point                     [25] Alignment-Point-Char OPTIONAL }
-- Put here the descriptions for types from
-- One-of-Four-Angles
-- to
-- Pairwise-Kerning
-- in 11.2 of ITU-T Rec. T.416 | ISO/IEC 8613-6. --
-- Append the following descriptions. --

Alignment-Point-Char ::= SET {
    position-in-character-path          CHOICE {
        alignment-string                    [0] IMPLICIT OCTET STRING,
                                                -- string of graphic characters
                                                -- from the set of graphic elements
                                                -- specified by the presentation attributes
                                                -- "graphic character sets" and
                                                -- "graphic character subrepertoire"
        start                               [1] IMPLICIT NULL,
        end                                 [2] IMPLICIT NULL,
        centre                              [3] IMPLICIT NULL } OPTIONAL,
    position-in-line-progression        CHOICE {
        baseline-number                     [4] IMPLICIT INTEGER,
        top                                 [5] IMPLICIT NULL,
        bottom                              [6] IMPLICIT NULL,
        centre                              [7] IMPLICIT NULL,
        top-baseline                        [8] IMPLICIT NULL,
        bottom-baseline                     [9] IMPLICIT NULL,
        top-middle-baseline                 [10] IMPLICIT NULL,
        bottom-middle-baseline              [11] IMPLICIT NULL } OPTIONAL }
END
```

A.6 Raster graphics presentation attributes

```
Raster-Gr-Presentation-Attributes { 2 8 1 7 2 }

DEFINITIONS ::= BEGIN

EXPORTS                                 -- Put here the descriptions for EXPORTS in 10.2
                                        -- of ITU-T Rec. T.417 | ISO/IEC 8613-7. --
                                        ;

Raster-Graphics-Attributes ::= SET {
                                        -- Put here the descriptions for Raster-Graphics-Attributes
                                        -- in 10.2 of ITU-T Rec. T.417 | ISO/IEC 8613-7. --
                                        -- Append the following item. --
        alignment-point                     [8] Alignment-Point-Raster-Gr OPTIONAL }
-- Put here the descriptions for types from
-- One-of-Four-Angles
-- to
-- Image-Dimensions
-- in 10.2 of ITU-T Rec. T.417 | ISO/IEC 8613-7. --
-- Append the following descriptions. --

Alignment-Point-Raster-Gr ::= SET {
    position-in-pel-path                [0] IMPLICIT INTEGER {
                                            start (0), end (1), centre (2) } OPTIONAL,
    position-in-line-progression        [1] IMPLICIT INTEGER {
                                            top (0), bottom (1), centre (2) } OPTIONAL }

END
```

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A.7 Geometric graphics presentation attributes

```
Geo-Gr-Presentation-Attributes { 2 8 1 8 2 }

DEFINITIONS ::= BEGIN

EXPORTS                                 -- Put here the descriptions for EXPORTS in 10.2
                                        -- of ITU-T Rec. T.418 | ISO/IEC 8613-8. --
                                        ;

Geometric-Graphics-Attributes ::= SET {
                                        -- Put here the descriptions for Geometric-Graphics-Attributes
                                        -- in 10.2 of ITU-T Rec. T.418 | ISO/IEC 8613-8. --
                                        -- Append the following item. --
    alignment-point                         [12] Alignment-Point-Geo-Gr OPTIONAL }
-- Put here the descriptions for types from
-- ASF-Type
-- to
-- Picture-Dimensions
-- in 10.2 of ITU-T Rec. T.418 | ISO/IEC 8613-8. --
-- Append the following descriptions. --

Alignment-Point-Geo-Gr ::= SET {
    position-in-x-axis                  [0] IMPLICIT INTEGER {
                                            start (0), end (1), centre (2) } OPTIONAL,
    position-in-y-axis                  [1] IMPLICIT INTEGER {
                                            top (0), bottom (1), centre (2) } OPTIONAL }

END
```

A.8 Grid layout descriptors

```
Grid-Layout-Descriptors { 2 8 1 11 1 }

DEFINITIONS ::= BEGIN

EXPORTS                                 Frame-Alignment-Point,
                                        Grid-Dimensions, Grid-Gutters,
                                        Grid-Interval-Dimensions,
                                        Grid-Lines, Grid-Position,
                                        Line-Segment-Characteristic,
                                        Major-Path, Minor-Path,
                                        Reference-Line-Alignment, Indent,
                                        Supplementary-Lines;

IMPORTS                                 Object-or-Class-Identifier
                                        FROM Identifiers-and-Expressions { 2 8 1 5 7 }
                                        One-Of-Four-Angles
                                        FROM Layout-Descriptors { 2 8 1 5 8 }
                                        Colour-Expression
                                        FROM Colour-Attributes { 2 8 1 5 14 };

Grid-Interval-Expression ::= CHOICE {
    construction-type                       Grid-Interval-Construction-Type,
    single-term-construction            [3] Grid-Interval-Construction-Term }

Grid-Interval-Construction-Type ::= CHOICE {
    sequence-construction               [0] IMPLICIT Grid-Interval-Term-Sequence,
    aggregate-construction              [1] IMPLICIT Grid-Interval-Term-Sequence,
    choice-construction                 [2] IMPLICIT Grid-Interval-Term-Sequence }

Grid-Interval-Term-Sequence ::= SEQUENCE OF Grid-Interval-Construction-Term

Grid-Interval-Construction-Term ::= CHOICE {
    required-construction-factor        [0] Grid-Interval-Construction-Factor,
    optional-construction-factor        [1] Grid-Interval-Construction-Factor,
    repetitive-construction-factor      [2] Grid-Interval-Construction-Factor,
    optional-repetitive-factor          [3] Grid-Interval-Construction-Factor }

Grid-Interval-Construction-Factor ::= CHOICE {
    interval-indicator                      Interval-Indicator,
    construction-type                       Grid-Interval-Construction-Type }
```

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```
Interval-Indicator ::= CHOICE {
    fixed-dimension                     [3]  IMPLICIT INTEGER,
    rule-b                              [4]  IMPLICIT SEQUENCE {
        minimum-dimension                    [0] IMPLICIT INTEGER OPTIONAL,
        maximum-dimension                    CHOICE {
                                             [1] IMPLICIT INTEGER,
            infinitely-large                 [2] IMPLICIT NULL } OPTIONAL },
    proportional                        [5]  IMPLICIT SEQUENCE {
        group                                [0] IMPLICIT INTEGER OPTIONAL,
        imaginary-dimension                  [1] IMPLICIT INTEGER OPTIONAL,
        default-dimension                    CHOICE {
                                             [3] IMPLICIT INTEGER,
            null                             [4] IMPLICIT NULL } OPTIONAL }
                                    }

Grid-Gutter-Expression ::= CHOICE {
    construction-type                        Grid-Gutter-Construction-Type,
    single-term-construction            [3]  Grid-Gutter-Construction-Term }

Grid-Gutter-Construction-Type ::= CHOICE {
    sequence-construction               [0]  IMPLICIT Grid-Gutter-Term-Sequence,
    aggregate-construction              [1]  IMPLICIT Grid-Gutter-Term-Sequence,
    choice-construction                 [2]  IMPLICIT Grid-Gutter-Term-Sequence }

Grid-Gutter-Term-Sequence ::= SEQUENCE OF Grid-Gutter-Construction-Term

Grid-Gutter-Construction-Term ::= CHOICE {
    required-construction-factor        [0]  Grid-Gutter-Construction-Factor,
    optional-construction-factor        [1]  Grid-Gutter-Construction-Factor,
    repetitive-construction-factor      [2]  Grid-Gutter-Construction-Factor,
    optional-repetitive-factor          [3]  Grid-Gutter-Construction-Factor }

Grid-Gutter-Construction-Factor ::= CHOICE {
    gutter-indicator                    [3]  Gutter-Indicator,
    construction-type                        Grid-Gutter-Construction-Type }

Gutter-Indicator ::= SEQUENCE {
    gutter-space-width                  [0]  IMPLICIT INTEGER OPTIONAL,
    precedence                          [1]  IMPLICIT INTEGER OPTIONAL }

Grid-Line-Expression ::= CHOICE {
    construction-type                        Grid-Line-Construction-Type,
    single-term-construction            [3]  Grid-Line-Construction-Term }

Grid-Line-Construction-Type ::= CHOICE {
    sequence-construction               [0]  IMPLICIT Grid-Line-Term-Sequence,
    aggregate-construction              [1]  IMPLICIT Grid-Line-Term-Sequence,
    choice-construction                 [2]  IMPLICIT Grid-Line-Term-Sequence }

Grid-Line-Term-Sequence ::= SEQUENCE OF Grid-Line-Construction-Term

Grid-Line-Construction-Term ::= CHOICE {
    required-construction-factor        [0]  Grid-Line-Construction-Factor,
    optional-construction-factor        [1]  Grid-Line-Construction-Factor,
    repetitive-construction-factor      [2]  Grid-Line-Construction-Factor,
    optional-repetitive-factor          [3]  Grid-Line-Construction-Factor }

Grid-Line-Construction-Factor ::= CHOICE {
    line-char-expr-with-precedence      [3]  IMPLICIT SET {
    line-char-expression                     [0] Line-Char-Expression,
        precedence                           [1] IMPLICIT INTEGER OPTIONAL },
    construction-type                        Grid-Line-Construction-Type }

Line-Char-Expression ::= CHOICE {
    construction-type                        Line-Char-Construction-Type,
    single-term-construction            [3]  Line-Char-Construction-Term }
-- NOTE – "Char" stands for "Characteristic".

Line-Char-Construction-Type ::= CHOICE {
    sequence-construction               [0]  IMPLICIT Line-Char-Term-Sequence,
    aggregate-construction              [1]  IMPLICIT Line-Char-Term-Sequence,
    choice-construction                 [2]  IMPLICIT Line-Char-Term-Sequence }

Line-Char-Term-Sequence ::= SEQUENCE OF Line-Char-Construction-Term
```

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```
Line-Char-Construction-Term ::= CHOICE {
    required-construction-factor          [0]  Line-Char-Construction-Factor,
    optional-construction-factor          [1]  Line-Char-Construction-Factor,
    repetitive-construction-factor        [2]  Line-Char-Construction-Factor,
    optional-repetitive-factor            [3]  Line-Char-Construction-Factor }

Line-Char-Construction-Factor ::= CHOICE {
    line-segment-characteristic           [3]  Line-Segment-Characteristic,
    construction-type                          Line-Char-Construction-Type }

Line-Segment-Characteristic ::= SEQUENCE {
    line-width                            [0]  IMPLICIT INTEGER OPTIONAL,
    line-type                             [1]  IMPLICIT INTEGER {
                                               invisible (0), solid (1), dashed (2),
                                                   dot (3), dash-dot (4), dash-dot-dot (5),
                                                   double (6) } OPTIONAL,
    line-colour                                Grid-Line-Colour OPTIONAL }

Grid-Line-Colour ::= CHOICE {
    implementation-defined                [3]  IMPLICIT NULL,
    colour-expression                          Colour-Expression }

Frame-Alignment-Point ::= CHOICE {
    fixed-position                        [0]  IMPLICIT SET {
        vertical-position                          [0] IMPLICIT INTEGER OPTIONAL,
        horizontal-position                        [1] IMPLICIT INTEGER OPTIONAL },
    variable-position                     [1]  IMPLICIT SET {
        vertical-alignment                         [0] IMPLICIT INTEGER {
                                                       top (0), centre (1), bottom (2)
                                                   } OPTIONAL,
        horizontal-alignment                       [1] IMPLICIT INTEGER {
                                                       left (0), centre (1), right (2)
                                                   } OPTIONAL },
    subordinate-dependent                 [2]  IMPLICIT INTEGER { first (0), last (1) }
                                               }

Major-Path ::= One-Of-Four-Angles

Minor-Path ::= One-Of-Two-Angles

One-Of-Two-Angles ::= INTEGER { d90 (0), d270 (1) }

Reference-Line-Alignment ::= SET {
    aligned-with                          [0]  IMPLICIT SET OF Object-or-Class-Identifier OPTIONAL,
    reference-line                        [1]  IMPLICIT Line-Segment-Characteristic OPTIONAL }

Indent ::= INTEGER

Grid-Position ::= CHOICE {
    fixed-position                        [0]  IMPLICIT SET {
        major-position                             [0] IMPLICIT INTEGER,
        minor-position                             [1] IMPLICIT INTEGER },
    variable-position                     [1]  IMPLICIT SET {
        major-alignment                            [0] IMPLICIT INTEGER {
                                                       right-hand-aligned (0), centred (1),
                                                       left-hand-aligned (2) } OPTIONAL,
        minor-alignment                            [1] IMPLICIT INTEGER {
                                                       right-hand-aligned (0), centred (1),
                                                       left-hand-aligned (2) } OPTIONAL }
                                               }

Grid-Dimensions ::= SET {
    major-dimension                       [0]  CHOICE {
        fixed-dimension                            [0] IMPLICIT INTEGER,
                                                   [1] IMPLICIT INTEGER {
                                                       rule-b (0), expansive (1) } } OPTIONAL,
    minor-dimension                       [1]  CHOICE {
        fixed-dimension                            [0] IMPLICIT INTEGER,
                                                   [1] IMPLICIT INTEGER {
                                                       rule-b (0), expansive (1) } } OPTIONAL
                                               }
```

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```
Grid-Lines ::= SET {
    major-grid-line                 [0]  Grid-Line-Expression OPTIONAL,
    minor-grid-line                 [1]  Grid-Line-Expression OPTIONAL }

Grid-Interval-Dimensions ::= SET {
    major-interval-dimensions       [0]  Grid-Interval-Expression OPTIONAL,
    minor-interval-dimensions       [1]  Grid-Interval-Expression OPTIONAL }

Grid-Gutters ::= SET {
    around-major-grid-lines         [0]  Grid-Gutter-Expression OPTIONAL,
    around-minor-grid-lines         [1]  Grid-Gutter-Expression OPTIONAL }

Supplementary-Lines ::= SEQUENCE OF Supplementary-Line

Supplementary-Line ::= SET {
    start                           [0]  IMPLICIT SEQUENCE {
        start-major                      [0]  IMPLICIT INTEGER,
        start-minor                      [1]  IMPLICIT INTEGER },
    end                             [1]  IMPLICIT SEQUENCE {
        end-major                        [0]  IMPLICIT INTEGER,
        end-minor                        [1]  IMPLICIT INTEGER },
    imaging-factors                 [2]  IMPLICIT Line-Segment-Characteristic OPTIONAL }
END
```

A.9 Grid style descriptors

Grid-Style-Descriptors { 2 8 1 11 2 }

```
DEFINITIONS ::= BEGIN

EXPORTS                             Block-Alignment-Point,
                                    Grid-Description, Grid-Frame-Classes,
                                    Obligatory-Same-Layout-Objects,
                                    Presentation-Precedence,
                                    Selective-Same-Layout-Objects,
                                    Supplementary-Line-Directive;

IMPORTS                             Object-or-Class-Identifier,
                                    Construction-Expression
                                    FROM Identifiers-and-Expressions { 2 8 1 5 7 }
                                    Line-Segment-Characteristic
                                    FROM Grid-Layout-Descriptors;

Block-Alignment-Point ::= CHOICE {
    content-dependent               [0]  IMPLICIT NULL,
    fixed-position                  [1]  IMPLICIT SET {
        vertical-position                    [0]  IMPLICIT INTEGER OPTIONAL,
        horizontal-position                  [1]  IMPLICIT INTEGER OPTIONAL },
    variable-position               [2]  IMPLICIT SET {
        vertical-alignment                   [0]  IMPLICIT INTEGER {
                                                  top (0), centre (1), bottom (2) } OPTIONAL,
        horizontal-alignment                 [1]  IMPLICIT INTEGER {
                                                  left (0), centre (1), right (2) } OPTIONAL }
                                    }

Grid-Description ::= SET {
    major-size                      [0]  IMPLICIT INTEGER OPTIONAL,
    minor-size                      [1]  IMPLICIT INTEGER OPTIONAL,
    entry-location-association      [2]  IMPLICIT
                                         Entry-Location-Associations OPTIONAL
                                    }

Entry-Location-Associations ::= SET OF Entry-Location-Association

Entry-Location-Association ::= SET {
    locations                       [0]  IMPLICIT SEQUENCE {
        vertex-major                     [0]  Grid-Coordinate,
        vertex-minor                     [1]  Grid-Coordinate,
        opposite-vertex-major            [2]  Grid-Coordinate OPTIONAL,
        opposite-vertex-minor            [3]  Grid-Coordinate OPTIONAL } OPTIONAL,
    entries                         [1]  IMPLICIT SET OF
                                         Object-or-Class-Identifier OPTIONAL
                                    }
```

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```
Grid-Coordinate ::= CHOICE {
                                        [0]  IMPLICIT INTEGER,
    last                                [1]  IMPLICIT NULL }

Presentation-Precedence ::= INTEGER { major (0), minor (1) }

Grid-Frame-Classes ::= Construction-Expression

Obligatory-Same-Layout-Objects ::= SET {
    logical-objects                     [0]  IMPLICIT SET OF Object-or-Class-Identifier,
    layout-objects                      [1]  IMPLICIT SET OF Object-or-Class-Identifier }

Selective-Same-Layout-Objects ::= SET {
    logical-objects                     [0]  IMPLICIT SET OF Object-or-Class-Identifier,
    layout-objects                      [1]  IMPLICIT SET OF Object-or-Class-Identifier }

Supplementary-Line-Directive ::= SEQUENCE OF Supplementary-Line-Directive-Unit

Supplementary-Line-Directive-Unit ::= SEQUENCE {
    start                               [0]  IMPLICIT SEQUENCE {
        start-major                          [0] Grid-Coordinate,
        start-minor                          [1] Grid-Coordinate },
    end                                 [1]  IMPLICIT SEQUENCE {
        end-major                            [0] Grid-Coordinate,
        end-minor                            [1] Grid-Coordinate },
    imaging-factors                     [2]  IMPLICIT
                                             Line-Segment-Characteristic OPTIONAL }
END
```

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Annex B

Examples

(This annex does not form an integral part of this Recommendation | International Standard)

B.1 Example 1

B.1.1 Generic Layout Structure

```
Object Type                          document layout root
Object Class Identifier              0
Generator for Subordinates           REP ( 0 0 )

Object Type                          page
Object Class Identifier              0 0
Generator for Subordinates           REQ ( 0 0 0 )

Object Type                          grid frame
Object Class Identifier              0 0 0 (table frame)
Generator for Subordinates           REP ( CHO ( 0 0 0 0, 0 0 0 1, 0 0 0 2, 0 0 0 3 ) )
Layout Path                          270
Dimensions
    Horizontal Dimension
        Fixed Dimension              300 (SMU)
    Vertical Dimension
        Fixed Dimension              120 (SMU)
Border
    Left Hand Edge
        Border Freespace Width       15 (SMU)
    Right Hand Edge
        Border Freespace Width       15 (SMU)
    Trailing Edge
        Border Freespace Width       15 (SMU)
    Leading Edge
        Border Freespace Width       15 (SMU)
Major Path                           270
Minor Path                           90
Grid Position
    Variable Position
        Major Alignment              left-aligned
        Minor Alignment              centred
Grid Dimensions
    Major                            rule b
    Minor                            rule b
Grid Interval Dimensions
    Major Interval Dimensions        SEQ (
                                         rule-b { minimum = 40 , },
                                         OPTREP ( proportional { group = 0, im-dim = 1, default = 0 } )
                                         )
    Minor Interval Dimensions        SEQ (
                                         fixed-dimension { 100 },
                                         OPTREP ( proportional { group = 1, im-dim = 1, default = 0 } ),
                                         proportional { group = 1, im-dim = 2, }
                                         )
Grid Lines
    Major Grid Lines                 SEQ (
                                         { OPTREP ( { 4, solid, black } ), precedence = 5 },
                                         { OPTREP ( { 2, solid, black } ), precedence = 4 },
                                         OPTREP (
                                             { SEQ ( { 1, invisible, black }, OPTREP ( { 1, solid, black } ) ),
                                             precedence = 0 }
                                             ),
                                         { OPTREP ( { 4, solid, black } ), precedence = 5 }
                                         )
```

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Minor Grid Lines	SEQ ({ OPTREP ({ 4, solid, black }), precedence = 5 }, { OPTREP ({ 2, solid, black }), precedence = 4 }, OPTREP ({ OPTREP ({ 1, dashed, black }), precedence = 0 }), { OPTREP ({ 1, solid, black }), precedence = 1 }, { OPTREP ({ 4, solid, black }), precedence = 5 })
Grid Gutters	
Around Major Grid Lines	OPTREP ({ width = 10, precedence = 0 })
Around Minor Grid Lines	OPTREP ({ width = 10, precedence = 0 })
Object Type	frame
Object Class Identifier	0 0 0 0 (entry frame for box headings)
Position	
Variable Position	
Fill Order	reverse
Offset	leading = trailing = left-hand = right-hand = 0
Alignment	centred
Object Type	frame
Object Class Identifier	0 0 0 1 (entry frame for row headings)
Position	
Variable Position	
Fill Order	normal
Offset	leading = trailing = left-hand = right-hand = 0
Alignment	right-hand aligned
Object Type	frame
Object Class Identifier	0 0 0 2 (entry frame for numeric data)
Position	
Variable Position	
Fill Order	normal
Offset	leading = trailing = left-hand = right-hand = 0
Alignment	left-hand aligned
Object Type	frame
Object Class Identifier	0 0 0 3 (entry frame for figure data)
Position	
Variable Position	
Fill Order	centre order
Offset	leading = trailing = left-hand = right-hand = 0
Alignment	centred

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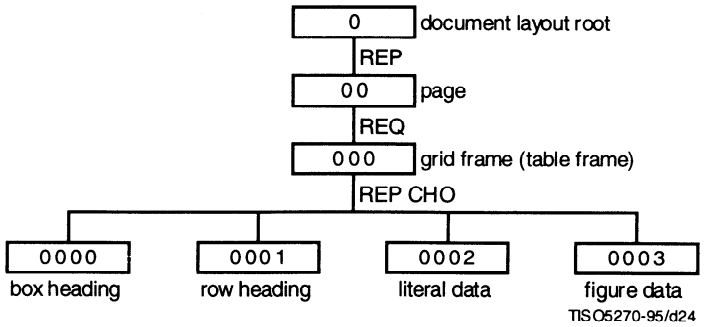


Figure B.1 – Generic Layout Structure of Example 1

B.1.2 Explanation

The layout object class whose identifier is 0 0 0 defines the generic properties of tabular layout whose example is depicted with Figure B.2. An instance of this grid frame class contains a layout grid which comprises major (horizontal) and minor (vertical) grid lines. The properties of these grid lines, namely their positions, lengths, line types, line widths and line colours, are specified in the layout object class description.

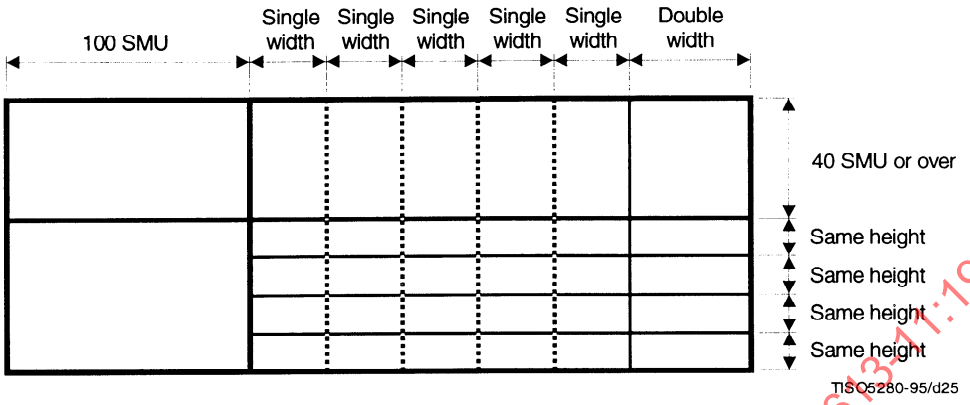


Figure B.2 – Example 1

The layout object class description 0 0 0 defines the following constraints on tabular layout:

- the table includes one or more rows and one or more columns;
- the height of the first row is not smaller than 40 SMU;
- the heights of the following rows are all the same;
- the width of the first column is 100 SMU;
- the widths of the following columns except the last one are all the same;
- the last column is twice as wide as the second column;
- the four bordering edges of the table are drawn with the wide solid line (4 SMU wide);
- the separating line of the first and second rows is imaged with the medium wide solid line (2 SMU wide);
- the other separating lines of adjacent rows are imaged with the narrow solid line (1 SMU wide) within the second and the following columns, and invisible within the first column;
- the separating line of the first and second columns is drawn with the medium wide solid line (2 SMU wide);
- the separating line of the last column and its immediately preceding column is drawn with the narrow solid line (1 SMU wide);
- the other separating lines of adjacent columns are drawn with the narrow dashed line (1 SMU wide);
- the total width of the table does not exceed 270 SMU;
- the total height of the table does not exceed 90 SMU;
- the gutter space width around each line, which specifies a free space around the line to be kept blank, is 10 SMU;
- the table as a whole is positioned vertically top aligned and horizontally centred within a table frame.

Moreover, the four layout object class descriptions for entry frames, whose identifiers are 0 0 0 0 to 0 0 0 3, define the following constraints on tabular layout:

- the box headings are bottom aligned and horizontally centred;
- the row headings are top aligned and left-hand aligned (viewed from the reader);
- the literal data are top aligned and right-hand aligned (viewed from the reader);
- the figure data are centred in both the horizontal and vertical directions.

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B.2 Example 2

B.2.1 Generic Logical Structure

Object Type	**document logical root**
Object Class Identifier	**2**
Generator for Subordinates	**REQ (2 0)**
Object Type	**grid logical**
Object Class Identifier	**2 0**
Generator for Subordinates	**SEQ (2 0 0, OPTREP (2 0 1))**
Grid Frame Classes	**REP (0 0 0)** -- *style attribute*
Object Type	**composite logical**
Object Class Identifier	**2 0 0 (box heading row)**
Generator for Subordinates	**OPTREP (2 0 0 0)**
Object Type	**basic logical**
Object Class Identifier	**2 0 0 0 (box headings)**
Layout Object Class	**0 0 0 0** -- *style attribute*
Object Type	**composite logical**
Object Class Identifier	**2 0 1 (row)**
Generator for Subordinates	**SEQ (2 0 1 0, OPTREP (CHO (2 0 1 1, 2 0 1 2)))**
Obligatory Same Layout Objects	-- *style attribute*
To-Logical-Object-Class	**2 0 0**
To-Layout-Object-Class	**0 0 0**
Object Type	**basic logical**
Object Class Identifier	**2 0 1 0 (row headings)**
Layout Object Class	**0 0 0 1** -- *style attribute*
Object Type	**basic logical**
Object Class Identifier	**2 0 1 1 (literal data)**
Layout Object Class	**0 0 0 2** -- *style attribute*
Object Type	**composite logical**
Object Class Identifier	**2 0 1 2 (figure data)**
Generator for Subordinates	**SEQ (2 0 1 2 0, 2 0 1 2 1)**
Layout Object Class	**0 0 0 3** -- *style attribute*
Object Type	**basic logical**
Object Class Identifier	**2 0 1 2 0 (figure)**
Block Alignment	**centred** -- *style attribute*
Object Type	**basic logical**
Object Class Identifier	**2 0 1 2 1 (caption)**
Block Alignment	**centred** -- *style attribute*

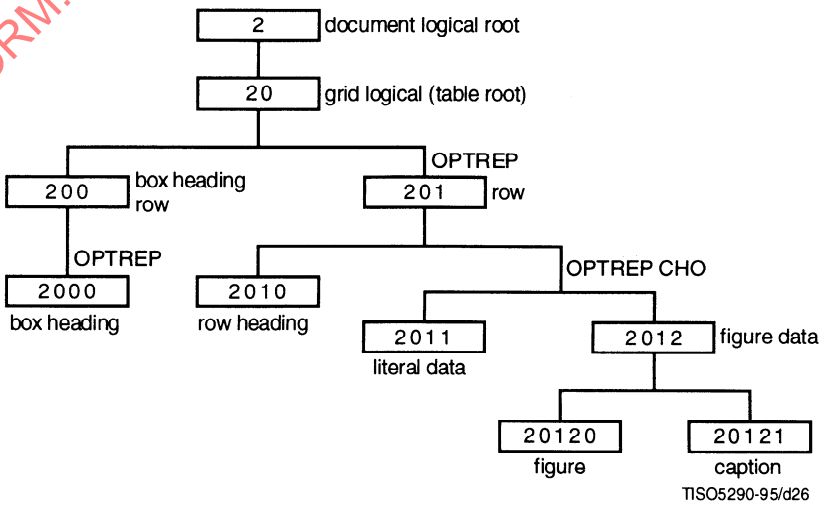


Figure B.3 – Generic Logical Structure of Example 2

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B.2.2 Specific Logical Structure

Object Type	**document logical root**
Object Identifier	**3**
Object Class	**2**
Subordinates	**0**
Object Type	**grid logical**
Object Identifier	**3 0**
Object Class	**2 0**
Subordinates	**0, 1, 2**
Grid Description	*-- style attribute*
Major Size	**6**
Minor Size	**5**
Entry Location Association	**{ locations = {(0, 1), }, entries = {0 0} },** **{ locations = {(0, 2), }, entries = {0 1} },** **{ locations = {(1, 0), }, entries = {1 0} },** **{ locations = {(2, 0), }, entries = {2 0} },** **{ locations = {(1, 1), }, entries = {1 1} },** **{ locations = {(1, 2), }, entries = {1 2} },** **{ locations = {(2, 1), }, entries = {2 1} },** **{ locations = {(2, 2), }, entries = {2 2} }**
Object Type	**composite logical**
Object Identifier	**3 0 0 (box heading row: 1st row)**
Object Class	**2 0 0**
Subordinates	**0, 1**
Object Type	**basic logical**
Object Identifier	**3 0 0 0 (box heading for 2nd column)**
Object Class	**2 0 0 0**
Content Portions	**0 ('XXX')**
Object Type	**basic logical**
Object Identifier	**3 0 0 1 (box heading for 3rd column)**
Object Class	**2 0 0 0**
Content Portions	**0 ('YYY')**
Object Type	**composite logical**
Object Identifier	**3 0 1 (2nd row)**
Object Class	**2 0 1**
Subordinates	**0, 1, 2**
Object Type	**basic logical**
Object Identifier	**3 0 1 0**
Object Class	**2 0 1 0**
Content Portions	**0 ('AAA')**
Object Type	**basic logical**
Object Identifier	**3 0 1 1**
Object Class	**2 0 1 1**
Content Portions	**0 ('111111.')**
Object Type	**basic logical**
Object Identifier	**3 0 1 2**
Object Class	**2 0 1 1**
Content Portions	**0 ('22.')**
Object Type	**composite logical**
Object Identifier	**3 0 2 (3rd row)**
Object Class	**2 0 1**
Subordinates	**0, 1, 2**
Object Type	**basic logical**
Object Identifier	**3 0 2 0**
Object Class	**2 0 1 0**
Content Portions	**0 ('BBB')**
Object Type	**basic logical**
Object Identifier	**3 0 2 1**
Object Class	**2 0 1 1**
Content Portions	**0 ('33.')**

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Object Type	**basic logical**
Object Identifier	**3 0 2 2**
Object Class	**2 0 1 1**
Content Portions	**0 ('444.')**
Content Identifier – Logical	**3 0 0 0 0**
Content Information	**"XXX"**
Content Identifier – Logical	**3 0 0 1 0**
Content Information	**"YYY"**
Content Identifier – Logical	**3 0 1 0 0**
Content Information	**"AAA"**
Content Identifier – Logical	**3 0 1 1 0**
Content Information	**"111111."**
Content Identifier – Logical	**3 0 1 2 0**
Content Information	**"22."**
Content Identifier – Logical	**3 0 2 0 0**
Content Information	**"BBB"**
Content Identifier – Logical	**3 0 2 1 0**
Content Information	**"33."**
Content Identifier – Logical	**3 0 2 2 0**
Content Information	**"444."**

B.2.3 Specific Layout Structure

This subclause provides a description of the specific layout structure which the layout process generates from B.1.1, B.2.1 and B.2.2. The specific layout structure is described in the form of the formatted document architecture.

Object Type	**document layout root**
Object Identifier	**1**
Object Class	**0**
Subordinates	**0**
Object Type	**page**
Object Identifier	**1 0**
Object Class	**0 0**
Subordinates	**0**
Object Type	**grid frame**
Object Identifier	**1 0 0**
Object Class	**0 0 0**
Subordinates	**0, 1, 2, 3, 4, 5, 6, 7**
Dimension	**HD = 300, VD = 120**
Grid Position	
Fixed Position	
Major Position	**15**
Minor Position	**30**
Grid Interval Dimensions	
Major Interval Dimensions	**SEQ (fixed-dimension { 40 }, fixed-dimension { 22 }, fixed-dimension { 22 }, fixed-dimension { 0 }, fixed-dimension { 0 }, fixed-dimension { 0 })**
Minor Interval Dimensions	**SEQ (fixed-dimension { 100 }, fixed-dimension { 35 }, fixed-dimension { 35 }, fixed-dimension { 0 }, fixed-dimension { 70 })**
Grid Lines	
Major Grid Lines	**SEQ ({ SEQ ({ 4, , }, { 4, , }, { 4, , }, { 4, , }, { 4, , }), }, { SEQ ({ 2, , }, { 2, , }, { 2, , }, { 2, , }, { 2, , }), }, { SEQ ({ 1, invisible, }, { 1, , }, { 1, , }, { 1, , }, { 1, , }), }, { SEQ ({ 4, , }, { 4, , }, { 4, , }, { 4, , }, { 4, , }), }, { SEQ ({ 4, , }, { 4, , }, { 4, , }, { 4, , }, { 4, , }), }, { SEQ ({ 4, , }, { 4, , }, { 4, , }, { 4, , }, { 4, , }), })**

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Minor Grid Lines	SEQ ({ SEQ ({ 4, , }, { 4, , }, { 4, , }, { 4, , }, { 4, , }, { 4, , }), }, { SEQ ({ 2, , }, { 2, , }, { 2, , }, { 2, , }, { 2, , }, { 2, , }), }, { SEQ ({1, dashed,},{1, dashed,},{1, dashed,}, {1, dashed,},{1, dashed,},{1, dashed,}), }, { SEQ ({ 2, , }, { 2, , }, { 2, , }, { 2, , }, { 2, , }, { 2, , }), }, { SEQ ({ 2, , }, { 2, , }, { 2, , }, { 2, , }, { 2, , }, { 2, , }), }, { SEQ ({ 4, , }, { 4, , }, { 4, , }, { 4, , }, { 4, , }, { 4, , }), })
Object Type	frame
Object Identifier	1 0 0 0
Object Class	0 0 0 0
Subordinates	0
Position	HP = 138, VP = 38
Dimension	HD = 19, VD = 12
Object Type	frame
Object Identifier	1 0 0 1
Object Class	0 0 0 0
Subordinates	0
Position	HP = 173, VP = 38
Dimension	HD = 19, VD = 12
Object Type	frame
Object Identifier	1 0 0 2
Object Class	0 0 0 1
Subordinates	0
Position	HP = 35, VP = 60
Dimension	HD = 19, VD = 12
Object Type	frame
Object Identifier	1 0 0 3
Object Class	0 0 0 2
Subordinates	0
Position	HP = 135, VP = 60
Dimension	HD = 25, VD = 12
Object Type	frame
Object Identifier	1 0 0 4
Object Class	0 0 0 2
Subordinates	0
Position	HP = 186, VP = 60
Dimension	HD = 9, VD = 12
Object Type	frame
Object Identifier	1 0 0 5
Object Class	0 0 0 1
Subordinates	0
Position	HP = 35, VP = 82
Dimension	HD = 17, VD = 12
Object Type	frame
Object Identifier	1 0 0 6
Object Class	0 0 0 2
Subordinates	0
Position	HP = 151, VP = 82
Dimension	HD = 9, VD = 12
Object Type	frame
Object Identifier	1 0 0 7
Object Class	0 0 0 2
Subordinates	0
Position	HP = 182, VP = 60
Dimension	HD = 13, VD = 12
Object Type	block
Object Identifier	1 0 0 0 0
Dimension	HD = 19, VD = 12
Content Portions	0 ('XXX')

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Object Type	block
Object Identifier	1 0 0 1 0
Dimension	HD = 19, VD = 12
Content Portions	0 ('YYY')
Object Type	block
Object Identifier	1 0 0 2 0
Dimension	HD = 19, VD = 12
Content Portions	0 ('AAA')
Object Type	block
Object Identifier	1 0 0 3 0
Dimension	HD = 25, VD = 12
Content Portions	0 ('111111.')
Object Type	block
Object Identifier	1 0 0 4 0
Dimension	HD = 9, VD = 12
Content Portions	0 ('22.')
Object Type	block
Object Identifier	1 0 0 5 0
Dimension	HD = 17, VD = 12
Content Portions	0 ('BBB')
Object Type	block
Object Identifier	1 0 0 6 0
Dimension	HD = 9, VD = 12
Content Portions	0 ('33.')
Object Type	block
Object Identifier	1 0 0 7 0
Dimension	HD = 13, VD = 12
Content Portions	0 ('444.')
Content Identifier - Logical	3 0 0 0 0
Content Identifier - Layout	1 0 0 0 0 0
Content Information	"XXX"
Content Identifier - Logical	3 0 0 1 0
Content Identifier - Layout	1 0 0 1 0 0
Content Information	"YYY"
Content Identifier - Logical	3 0 1 0 0
Content Identifier - Layout	1 0 0 2 0 0
Content Information	"AAA"
Content Identifier - Logical	3 0 1 1 0
Content Identifier - Layout	1 0 0 3 0 0
Content Information	"111111."
Content Identifier - Logical	3 0 1 2 0
Content Identifier - Layout	1 0 0 4 0 0
Content Information	"22."
Content Identifier - Logical	3 0 2 0 0
Content Identifier - Layout	1 0 0 5 0 0
Content Information	"BBB"
Content Identifier - Logical	3 0 2 1 0
Content Identifier - Layout	1 0 0 6 0 0
Content Information	"33."
Content Identifier - Logical	3 0 2 2 0
Content Identifier - Layout	1 0 0 7 0 0
Content Information	"444."

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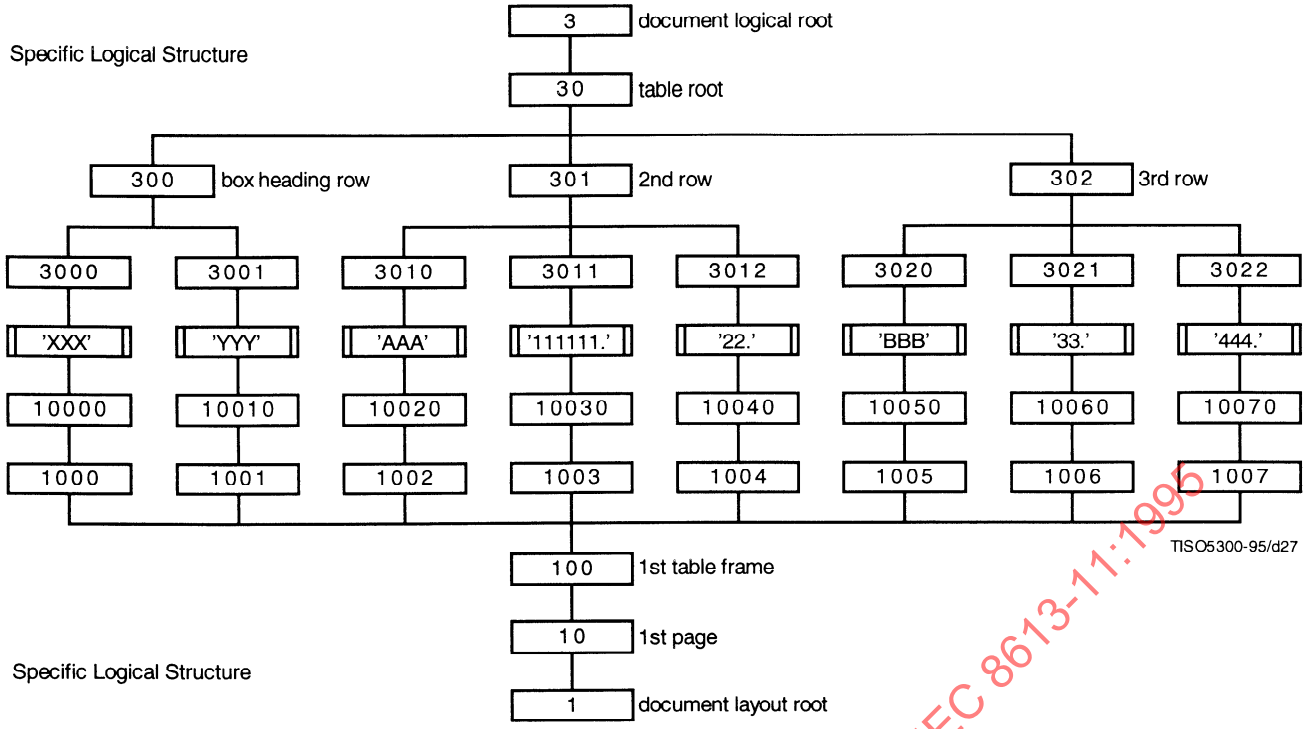


Figure B.4 – Specific Structures of Example 2

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B.2.4 Explanation

Figure B.5 depicts the image of tabular layout that the layout process generates by applying the generic layout structure (see B.1.1) to the logical structures (see B.2.1 and B.2.2).

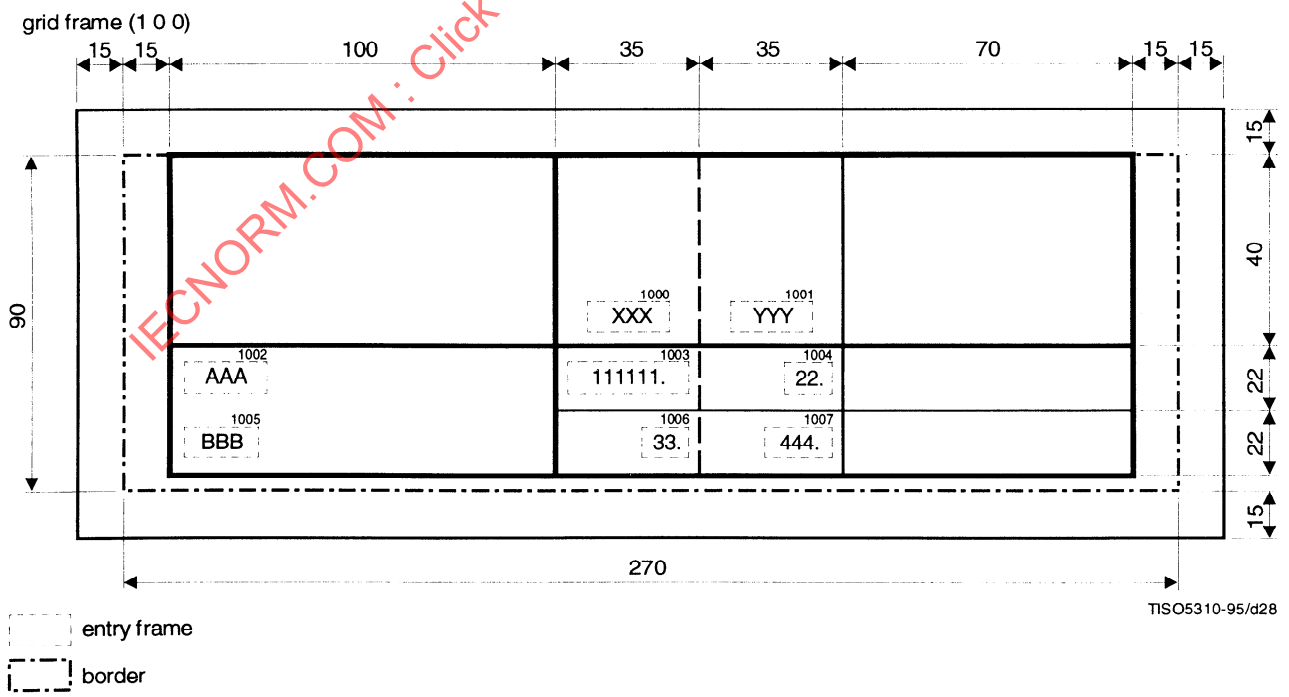


Figure B.5 – Formatted Table of Example 2

B.2.4.1 Determination of column widths

The grid frame 1 0 0 is referred to by the grid logical object 3 0 by means of the attribute "grid frame classes" specified for the grid logical object class 2 0 (see 9.2).

Therefore, the layout grid within the grid frame 1 0 0 has the same number of minor grid intervals as the minor size of the logical grid associated with the grid logical object 3 0. The value specified by the parameter "minor size" of the attribute "grid description" applied to this grid logical object is 5, and the layout grid contains 5 columns.

The parameter "minor interval dimensions" applies to the grid frame class 0 0 0 with the value:

```
SEQ (
          fixed-dimension { 100 },
OPTREP ( proportional { group = 1, im-dim = 1, default = 0 } ),
          proportional { group = 1, im-dim = 2, }
)
```

This parameter specifies the minor grid interval dimensions, namely the widths of the columns within the layout grid. Since the layout grid has 5 minor grid intervals, the grid interval expression specified for the parameter "minor interval dimensions" shall evaluate to a sequence of 5 interval indicators, each of which specifies a rule to determine the dimension of each individual minor grid interval (see 11.4). The sequence to be derived from the expression is:

```
fixed-dimension{100}
proportional {group = 1, im-dim = 1, default = 0}
proportional {group = 1, im-dim = 1, default = 0}
proportional {group = 1, im-dim = 1, default = 0}
proportional {group = 1, im-dim = 2,}
```

The *i*-th interval indicator in the sequence is used to determine the *i*-th minor grid interval dimension.

- the width of the 1st column shall be fixed to be 100 SMU;
- the 2nd to 5th column widths shall be variable and proportional to one another;
- each of the 2nd to 4th column widths shall be the default width 0, if no content is laid out within this column;
- whenever two of the 2nd to 4th column widths are positive, they shall be the same;
- the 5th column shall be always twice as wide as the positive width of any of the 2nd to 4th columns.

Actually, in Figure B.5, the 2nd and 3rd columns have the same width 35 SMU, which is determined by the horizontal dimension of the image of the text '111111.' and the gutter space widths around the 1st and 2nd minor grid lines.

Since no content is laid out within the 4th column, the default width 0 is applied to the 4th column width. Hence, the 4th column degenerates, and the table looks as if it had only 4 columns.

In contrast with the 4th column, although no content is laid out within the 5th column either, the 5th column is twice as wide as the 2nd and 3rd column: without a default width specified for a proportionally determined grid interval dimension, the grid interval dimension is always determined so as to keep the specified proportion to other grid interval dimensions.

B.2.4.2 Determination of imaging factors of vertical lines

The parameter "minor grid lines" is specified for the layout object class 0 0 0 with the value:

```
SEQ (
          { OPTREP ( { 4, solid, black } ), precedence = 5 },
          { OPTREP ( { 2, solid, black } ), precedence = 4 },
OPTREP ( { OPTREP ( { 1, dashed, black } ), precedence = 0 } ),
          { OPTREP ( { 1, solid, black } ), precedence = 1 },
          { OPTREP ( { 4, solid, black } ), precedence = 5 }
)
```

This parameter shall be used to determine the imaging factors of the minor grid lines (vertical lines) forming part of the layout grid. Since the minor size of the layout grid is 5, it contains 6 minor layout grid lines (vertical lines). Hence, the above grid line expression specified for the attribute "minor grid lines" shall evaluate to a sequence of 6 line characteristic expressions. The derived sequence is:

```
OPTREP ({4, solid, black})
OPTREP ({2, solid, black})
OPTREP ({1, dashed, black})
OPTREP ({1, dashed, black})
OPTREP ({1, solid, black})
OPTREP ({4, solid, black})
```

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These line characteristic expressions in the sequence are sequentially applied to the minor grid lines.

To the 0th minor layout grid line (the left edge of the table), for example, the line characteristic expression OPTREP ({4, solid, black}) is applied. Since the major size of the layout grid is 6, the layout grid line is divided into 6 grid line segments. Hence, this line characteristic expression evaluates to the sequence of 6 line segment characteristics:

{4, solid, black}, {4, solid, black}, {4, solid, black}, {4, solid, black}, {4, solid, black}, {4, solid, black}

The *i*-th line segment characteristic is applied to the *i*-th grid line segment of the grid line. In this case, since the line segment characteristics involved in the sequence are all the same ({4, solid, black}), the grid line is imaged with the wide solid line (4 SMU wide).

In the same way, OPTREP ({2, solid, black}), OPTREP ({1, dashed, black}), OPTREP ({1, dashed, black}), OPTREP ({1, solid, black}) and OPTREP ({4, solid, black}) are respectively applied to the 1st to 5th minor grid lines.

Since the dimension of the 4th minor grid interval is 0, the vertical lines with which the grid interval is edged, namely the 3rd and 4th minor grid line, merge into a single line. Therefore, two line characteristic expressions OPTREP ({1, dashed, black}) and OPTREP ({1, solid, black}) are applicable to this single line: the former specifies that the line shall be imaged with the narrow dashed line, while the latter does that the line shall be imaged with the narrow solid line.

The layout process takes account of the precedence associated with each line characteristic expression: the line characteristic expression associated with higher precedence shall precede the other. In this case, the expression for the dashed line is associated with precedence 0, whilst the expression for the solid line is associate with precedence 1. Consequently, the line characteristic expression OPTREP ({1, solid, black}) takes precedence over the expression OPTREP ({1, dashed, black}), and therefore the line is imaged with the solid line (see 11.8).

B.2.4.3 Determination of heights of rows

Since the major size of the logical grid is specified as 6, the layout grid contains 6 major grid intervals. The parameter "major interval dimensions" specifies the dimensions of those grid intervals, namely the heights of the rows. In the same way as in determining the minor grid interval dimensions, the layout process evaluates the grid interval expression.

```
SEQ (
        rule-b {minimum = 30, },
OPTREP ( proportional {group = 0, im-dim = 1, default = 0} )
)
```

to the sequence of 6 entries:

```
rule-b {minimum = 40, }
proportional {group = 0, im-dim = 1, default = 0}
proportional {group = 0, im-dim = 1, default = 0}
proportional {group = 0, im-dim = 1, default = 0}
proportional {group = 0, im-dim = 1, default = 0}
proportional {group = 0, im-dim = 1, default = 0}
```

The *i*-th interval indicator in the sequence is used to determine the *i*-th major grid interval dimension:

- the height of the 1st row shall be determined in accordance with the rule B under the condition that it cannot be smaller than 40 SMU;
- the 2nd to 6th row heights shall be variable and proportional to one another;
- each of those row heights shall be the default height 0, if no content is laid out within this row;
- whenever two of those row heights are positive, they shall be the same.

Actually, in Figure B.5, the 2nd and 3rd rows have the same height 22 SMU. Since the dimensions of the 4th to 6th major grid intervals are determined to 0, the corresponding rows degenerate, and the table looks as if it had only 3 rows.

B.2.4.4 Determination of imaging factors of horizontal lines

Since the layout grid includes 7 major grid lines, the value of the parameter "major grid lines" evaluates to the sequence of 7 line characteristic expressions:

```
OPTREP ({4, solid, black})
OPTREP ({2, solid, black})
SEQ ({1, invisible, black}, OPTREP ({1, solid, black}))
SEQ ({1, invisible, black}, OPTREP ({1, solid, black}))
SEQ ({1, invisible, black}, OPTREP ({1, solid, black}))
SEQ ({1, invisible, black}, OPTREP ({1, solid, black}))
OPTREP ({4, solid, black})
```

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These line characteristic expressions in the sequence are sequentially applied to the major grid lines in the layout grid.

For example, the line characteristic expression SEQ ({1, invisible, black}, OPTREP ({1, solid, black})) applies to the 2nd major layout grid line. Since the minor size of the layout grid is 5, and therefore this layout grid line is divided into 5 line segments, the line characteristic expression evaluates to the sequence of 5 line segment characteristics:

{1, invisible, black}, {1, solid, black}, {1, solid, black}, {1, solid, black}, {1, solid, black}

NOTE – Because the 3rd and 4th minor grid lines merge into a single line, the 4th line segment on the major grid line degenerates into a point. Nevertheless, this degenerating line segment is counted as well.

The line segment characteristic {1, invisible, black} applies to the 1st line segment of the 2nd major grid line, and the line segment is imaged invisible. The rest of the line segment of the grid line are all imaged with the narrow solid line, since the common line segment characteristic {1, solid, black} applies to them.

The degeneration of the 4th to 6th rows causes the merge of 3rd to 6th major grid lines into a single line (the bottom edge of the table). Hence, the two line characteristic expressions SEQ ({1, invisible, black}, OPTREP ({1, solid, black})) and OPTREP ({4, solid, black}) are applicable to this single line. Since the former expression is associated with precedence 0 whilst the latter with precedence 5, this line is imaged with the wide solid line (4 SMU wide).

B.2.4.5 Placement of entry frames within layout grid

The content of an entry object is laid out within the layout grid rectangle which is the layout counterpart of the logical grid rectangle with which the entry object is associated.

For example, the entry object 3 0 0 0 is associated with the logical grid rectangle edged with the 0th and 1st major grid lines, and the 1st and 2nd minor grid lines. This association is specified by the parameter "entry-location association" of the attribute "grid description" specified for the grid logical object 3 0: the parameter includes an entry of {locations = {(0, 1), }, entries = {0 0}}.

Principally, the sub-parameter "locations" specifies the logical coordinates of two diagonally opposite vertices of a logical grid rectangle. However, if the logical grid rectangle is a grid location, the sub-parameter may include only the coordinates of the the left-top vertex of the rectangle. Hence, locations = {(0, 1), }, for example, specifies the logical rectangle with a pair of diagonally opposite vertices (0, 1) and (1, 2).

The sub-parameter "entries" identifies those entry objects to be associated with the logical grid rectangle identified by the sub-parameter "locations". The value for the sub-parameter "entries" is a set of one or more sequences of non-negative integers. The object identifiers of the entry objects are obtained by appending each specified sequence of non-negative integers to the object identifier of the grid logical object for which the sub-parameter is specified. Hence, entries = {0 0}, for example, specifies the object identifier 3 0 0 0.

The layout counterpart of the logical grid rectangle associated with the entry object 3 0 0 0 is the layout grid rectangle edged with the 0th and 1st major (horizontal) layout grid lines, and the 1st and 2nd minor (vertical) layout grid lines. The available area for the entry frame 1 0 0 0, within which the content associated with the entry object 3 0 0 0 is to be laid out, shall be calculated within this layout grid rectangle.

The attribute "grid gutters" specified for the grid frame class 0 0 0 and the sub-parameter "offset" specified for the frame class 0 0 0 0 are taken into account when the layout process calculates this available area. The gutter space widths around the layout grid lines are specified as 10 SMU, and the offsets for the leading, trailing, left-hand and right-hand edges are all 0. Hence, the available area for the entry frame 1 0 0 0 is a rectangle within the layout grid rectangle whose distances from the bordering grid lines of the layout grid rectangle are 5 SMU (see Figure B.6).

When the layout process positions the entry frame 1 0 0 0 within this available area, it further takes account of the following attributes and parameters:

- "layout path" specified for the grid frame class 0 0 0;
- "alignment" specified for the (entry) frame class 0 0 0 0.

Since the layout path of the grid frame 1 0 0 is 270°, and further the fill order applied to the entry frame 1 0 0 0 is 'reverse' (specified for the frame class 0 0 0 0), the entry frame is positioned within the available area so that it shall be as close as possible to the 1st major layout grid line, which is the bottom edge of the rectangle (see Figure B.6).

In horizontally positioning the entry frame 1 0 0 0, the parameter alignment applied to the entry frame is taken into account. Since the specified value is 'centred', the entry frame is positioned equidistant from the 1st and 2nd minor grid lines, which are respectively the left and right edges of the rectangle (see Figure B.6).

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