



ITSIG specification for the preparation and exchange of graphics

1 Formal requirements

1.1 Size, orientation and boundaries

All graphics intended for exchange shall comply with the following requirements.

- a) The images shall be in the original publication size (i.e. 100 %).
- b) The image orientation shall be upright.
- c) The image boundaries shall not exceed 170 mm × 250 mm or 250 mm × 170 mm (depending on the object orientation). Sufficient space shall be provided as necessary within this area to accommodate the textual elements mentioned in 1.2.3 to 1.2.5.

All dimensional information in this document refers to drawings conceived for publication on A4 format (ISO 217).

1.2 Text, item references and footnotes

1.2.1 The textual elements in figures carry semantic meaning and are language sensitive. They often need to be edited and translated.

To allow a single graphics file to be used in different language versions of a document, mechanical engineering drawings shall not contain any text other than dimensions, units, formula symbols and reference numbers. Textual descriptions shall be replaced by numerical item references (ISO 6433:1981, Figure 1) or figure footnote references (ISO/IEC Directives, Part 2, 2001, 6.6.5.5 and 6.6.5.10) depending on their content, with an explanation of their meaning placed within the textual part of the document and not within the graphics file.

- a) Item references shall be used for component parts/physical elements. A distinct numbering sequence shall be adopted.

EXAMPLE A “left to right, top to bottom” sequence.

Identical parts/elements shown in the same assembly in the same figure shall have the same item reference number. Item references to identical parts/elements need only be indicated once, provided that there is no risk of ambiguity. Each figure shall be considered to be a discrete entity with its own accompanying key.

- b) Figure footnotes shall be used for information concerning the component part/physical element. In cases where this is impractical, such information may be given after a colon following the name of the component part/physical element. Terms such as “milled” or “chromium plated” shall be treated as a figure footnote.

Item references and figure footnotes shall be numbered per figure. In the case of subdivided figures an independent numbering sequence shall be used for each subfigure (see the ISO/IEC Directives, Part 2, 2001, 6.6.5.11.2).

1.2.2 Wherever possible, graph axes shall show only the scale, the symbols representing the variables and their units. Variables whose interdependence is shown on the graph shall wherever possible be denoted by a single

symbol in an upright position. Accordingly, the presentation shown in Figure 1 shall be altered to that shown in Figure 2. The meaning of the symbols representing the variables shall be defined in a key unless they are defined elsewhere in the text (for example in a "Symbols and abbreviated terms" clause — see the ISO/IEC Directives, Part 2, 2001, 6.3.2). The meaning of the symbol shall be the first element in the key, preceding any item reference descriptions and footnotes (see Figure 2). The meaning of the symbol shall not be designated by a footnote reference to the symbol as shown in Figure 3.

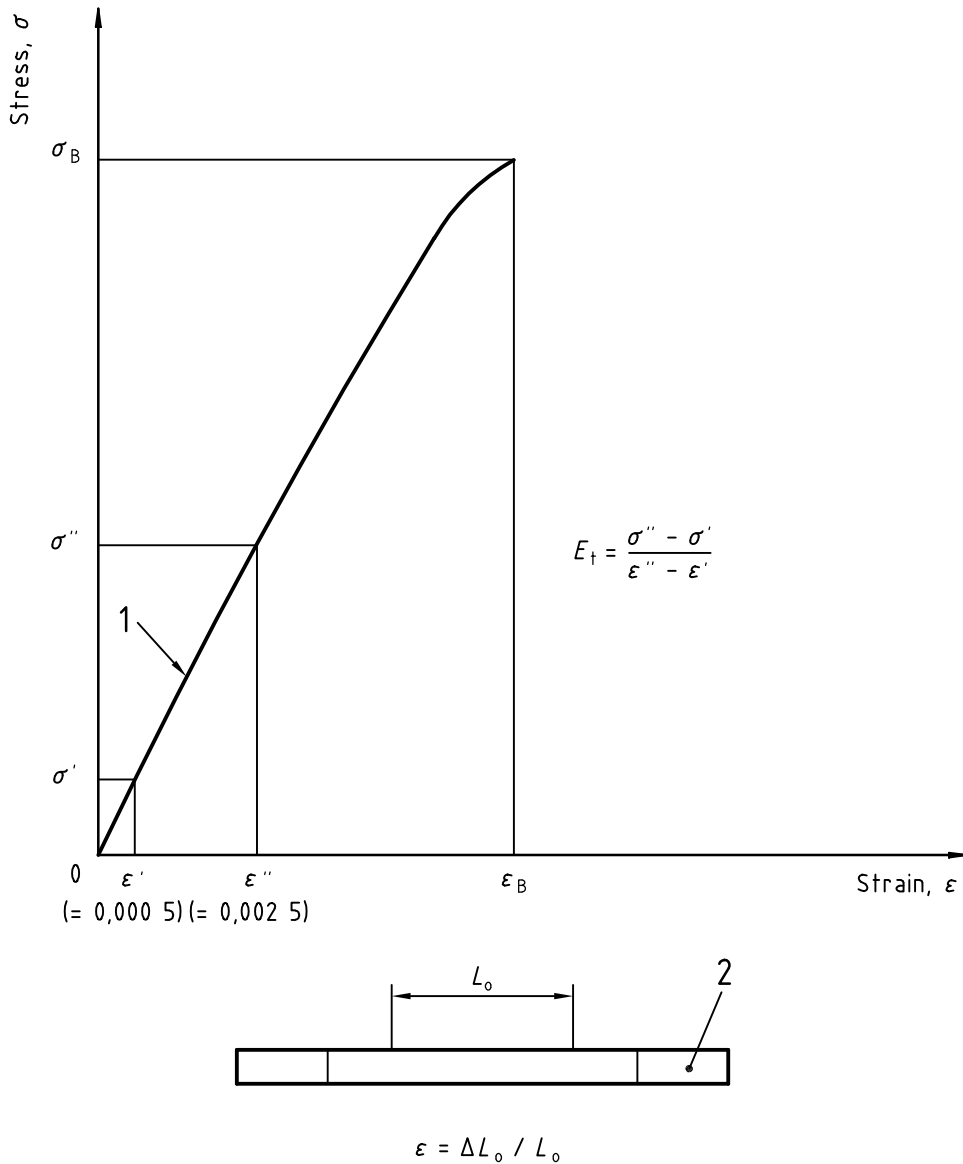
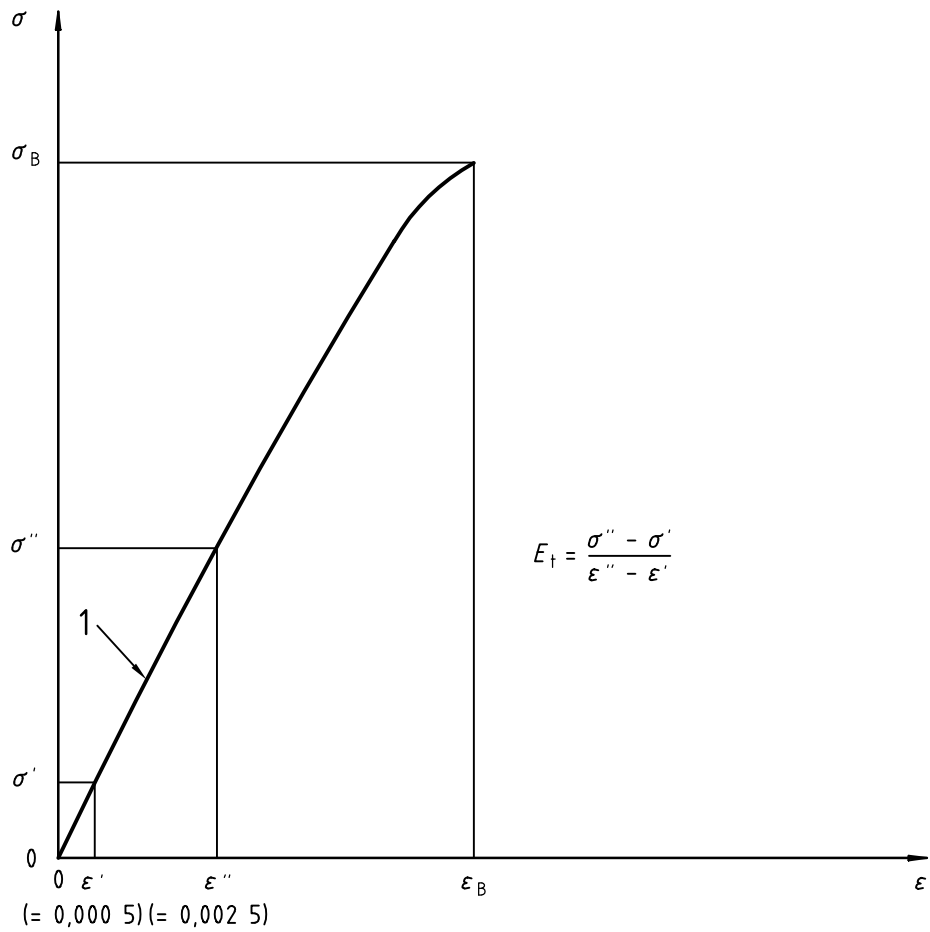


Figure 1 — Do not represent variables by language-specific text (in the graphic shown "Stress" and "Strain")



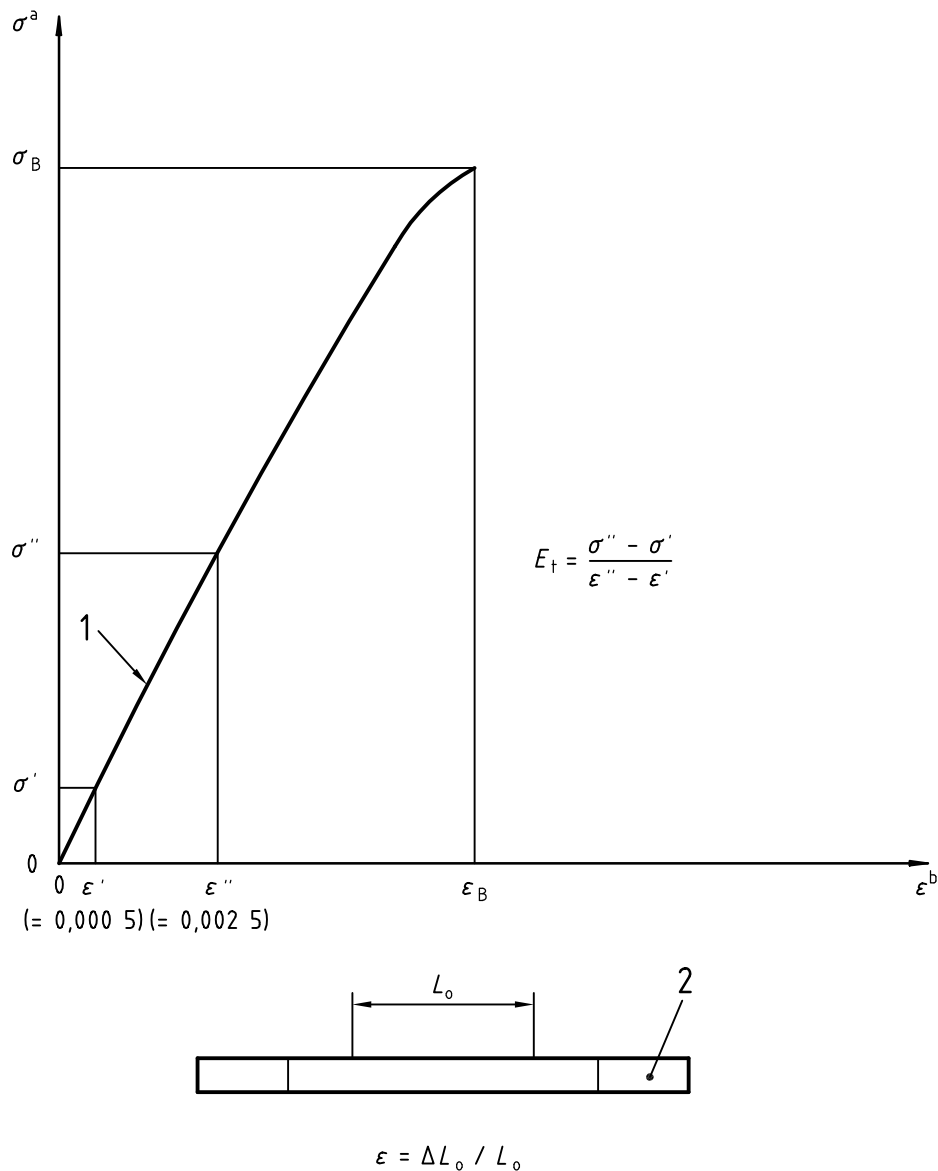
Key

σ stress
 ϵ strain

1 slope E_t
 2 test specimen

L_0 gauge length

Figure 2 — Represent variables by symbols, the meaning of which is explained in the key if necessary

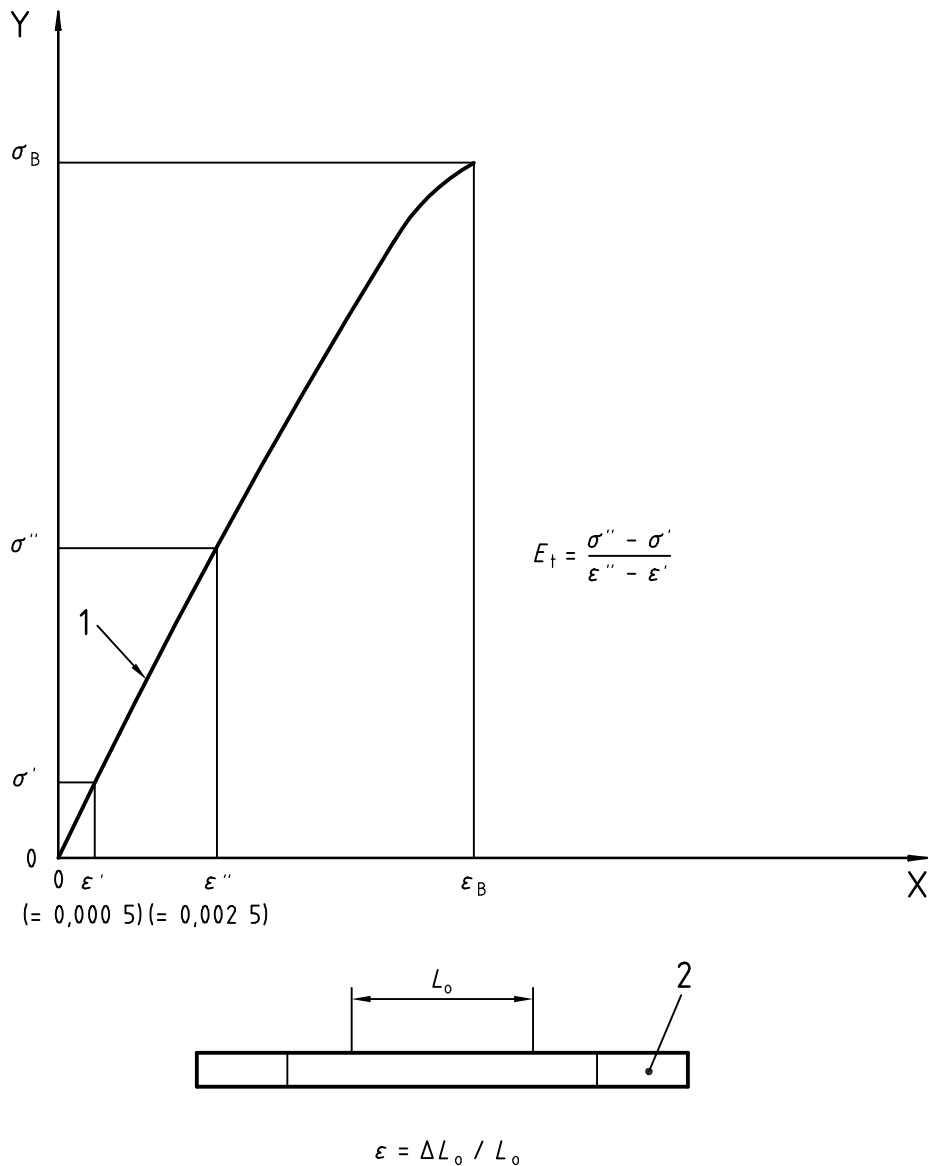


- a Meaning of symbol.
- b Meaning of symbol.

Figure 3 — Do not designate the meaning of symbols by a footnote reference to the symbol

Where the use of a symbol is not possible, the graph axes shall be denoted by the capital upright letters X, Y and Z and the respective descriptive text shall be put in a key (as the first element, preceding any item reference descriptions and footnotes — see, for example, Figure 4). The labelling on the axes shall not be replaced by item references to avoid any possible confusion between the number representing an item reference and a number representing a value on the axis.

Labelling to curves, lines, etc. shall be replaced by item references, however many curves, lines etc. there are. See Figure 4.



Key

X variable or quantity represented
 Y variable or quantity represented

1 item reference description
 2 item reference description

a Footnote text.
 b Footnote text.
 c Footnote text.

Figure 4 — Where the use of a symbol is not possible, denote the graph axes by the capital upright letters X, Y and Z; put the respective descriptive text in a key

The use of separate language versions of a graph is only permitted in cases where interpretation by the user would otherwise be made difficult. Justified cases include flow charts, forms and similar types of diagram.

1.2.3 The information on units (e.g. “Dimensions in ...”, “Surface roughness in ...”), general indications (e.g. “Remove sharp edges ...”) and the figure title (e.g. “Figure 1”) shall not be part of the graphic. Mechanical engineering drawing symbols shall be located in the upper right-hand corner of the mechanical engineering drawing file (see the following examples: ISO 128-30:2001, symbol in Figure A.2; ISO 1302:2002, symbol in Figure A.1; ISO 13715:2000, symbol in Figure 7).

1.2.4 However, text in drawings such as charts, forms, etc., may be part of the graphic.

1.2.5 The elements that may appear below a drawing shall be in the following order:

- a) key;
- b) paragraph(s) (containing requirements) and notes to the figure;
- c) footnotes to the figure;
- d) figure title.

1.2.6 Reference lines shall be finished with an arrow (to edges or surfaces — see ISO 6433:1981, Figure 1) or a dot (to fills — see ISO 6433:1981, Figure 4). Item reference numbers shall not be circled (as shown in ISO 6433:1981, Figure 3).

1.3 Lettering, sizes and symbols

1.3.1 For mechanical engineering drawings ISO 3098 fonts and glyphs for Latin (ISO 3098-2) and Greek (ISO 3098-3) character sets, respectively, shall be used. If an ISO font is not available, an appropriate grotesque or Greek font may be used as an alternative.

1.3.2 For other types of drawing such as charts, forms, etc. a grotesque font (e.g. Helvetica or Arial) should be used.

1.3.3 Characters shall be in one of the following three sizes:

- large (3,5 mm or 13,2 points) for item reference numbers, etc.;
- normal (2,5 mm or 9,4 points) for dimensions, units, tolerances, etc.;
- small (1,8 mm or 6,8 points) for figure footnote references (ISO/IEC Directives, Part 2, 2001, 6.6.5.10), indices, etc.; this is the minimum character size permissible.

1.3.4 Dimensions in the form of fractions shall be presented whenever possible in single-line form using a solidus, e.g. $f/2$. If, however, there is insufficient horizontal space for a single-line presentation, the two-line (built-up) form of presentation may be used, e.g. $\frac{f}{2}$.

1.3.5 The texts “minimum”, “maximum” and “approximately”, together with their abbreviations, are language dependent and shall be replaced by the symbols “ \geq ”, “ \leq ” and “ \approx ” respectively. The symbol shall precede the dimension.

1.4 Use of spaces between symbols (signs), values and units

All units except those for degree, minute and second for plane angle shall be preceded by a space in conformity with ISO 31-0:1992, 3.4.

EXAMPLE 1

30°
45°15'5"

30 °C
3 mm

Where a symbol precedes a value, e.g. the symbols diameter \varnothing , thread M, radius R, plus or minus \pm , there shall be no space between the symbol and the value.

EXAMPLE 2

± 3 mm
 ≥ 3
 ≤ 3
 ≈ 3
 $\varnothing 50$, $\square 20$
M20
R5, SR50, S $\varnothing 50$
30H7

+0,2
-0,5

The spacing used for mathematical signs and symbols shall be in accordance with ISO 31-11:1992.

EXAMPLE 3

M20 \times 2,5
 $a + b < c$
30 \times 45°

1.5 Line types and weights

1.5.1 For mechanical engineering drawings, the following line weights shall be used (see the table in ISO 128-24:1992):

- thin lines (0,25 mm) for line types 01.1, 02.1, 04.1 and 05.1;
- thick lines (0,5 mm) for line types 01.2, 02.2 and 04.2.

1.5.2 When draughting mechanical engineering drawings it should be borne in mind that the standard once published may be printed on low resolution printers, photocopied or reproduced in reduced sizes. All such types of reuse will lead to a reduction in the quality of the drawings. Therefore, to ensure that such reductions in quality will not render the reproductions ambiguous or unclear, small angles ($< 2^\circ$) and small lengths (< 1 mm) shall be dimensioned using one of the following alternatives.

- a) The critical part to be dimensioned shall be given as an enlarged detail view within the same figure or, if necessary, within an additional figure.
- b) The line weights shall be decreased by one step in the layer scheme, i.e. the line weight for thin lines shall be 0,18 mm and that for thick lines 0,35 mm.

For diagrams, etc., or in mechanical engineering drawings with extremely detailed parts, further line weights from the predefined set specified in clause 3 may be used (see 3.1.1).

1.5.3 Projections shall be in the first-angle representation (ISO 128-30:2001, Annex A). Projections in the third-angle representation may be used only if the content cannot be represented in the first-angle representation.

1.5.4 Interrupted views shall be in accordance with ISO 128-34:2001, Figures 14 and 15.

1.5.5 Arrows shall have a closed and filled head, with a head length of 2,5 mm and an included angle of 15° [ISO 129:1985, Figure 11a)]. Oblique strokes may be used in cases where it is not possible to insert an arrow-head [ISO 129:1985, Figures 11b) and 24].

1.5.6 Continuous dimension lines shall be in accordance with ISO 129:1985, 4.4.1, Method 1. The minimum space permitted between object edges and dimensioning is 7 mm. A space of 10 mm is recommended. The prolongation of extension lines shall be 1,5 mm. The minimum space permitted between two dimension lines is 1,5 mm.

2 Technical requirements

2.1 Encoding conventions

2.1.1 A separate file shall be supplied for each image which has a title or subtitle.

EXAMPLE

Single figure — one file

Single figure, combining multiple components or views — one file

Figure divided into subfigures — one file per subfigure

In addition, if the figures contain textual descriptions, a separate file shall be supplied for every image of each language version to be published.

2.1.2 All files should be named following a unique scheme, so that drawings can be assigned to and included in the documents automatically.

2.1.3 All drawings shall be on A4 (ISO 217) pages.

2.1.4 The coordinate system used shall have the position 0/0 at the bottom left corner of the page.

For exchange via standardized CAD exchange formats, every line type and every line weight shall be assigned to a separate layer (see clause 3).

2.1.5 Proprietary information such as a border or a stamp containing production information shall not be transported with the export files. If they are used and captured in the drawing offices, they shall be assigned to invisible layers, or filtered when the export file is created.

2.1.6 Dimensions shall be “associative”.

2.2 Data formats

Depending on the source and target environments, the following guidelines should be applied to select an appropriate exchange format.

- a) Both partners are using the same CAD system of the same or compatible versions: use the proprietary file format (e.g. AutoCAD 2000).
- b) Partners are using different CAD systems: use DXF, with layers for the different line weights and types according to the specification in 3.1.1.
- c) If no CAD-based data are available, use character-encoded EPS (Encapsulated Postscript), version 2, with the BoundingBox set, with non-standard Adobe Type 1 fonts (except Base 13 fonts) included and the preview raster file generated at 90 dpi TIFF.

Currently it is difficult to transport not only geometrical, but also functional information using standardized file formats. Normally most information is stored in the proprietary creation formats. Whenever possible, the creation format should be supplied. If the recipient uses a different software system or an incompatible version of the same software system, a standardized file format should be used for exchange.

For the exchange within the drafting and committee balloting stages it is sufficient to supply a display format (i.e. EPS).

3 Format settings

3.1 Semantics for Computer Aided Design (CAD) files

3.1.1 Layer usage

Independently from the format used, the following semantics for layers and colours shall be applied to the export and import filters of the conversion software.

Layer	Line type	Line weight	Colour	Description of entities in this layer
0	—	—	—	Reserved
1	Symbols	—	—	—
2	Dimensions	—	—	—
3	Hatching	—	—	—
4	Text	—	—	—
5	—	—	—	Reserved
6	—	—	—	Reserved
7	—	—	—	Reserved
8	Frames	—	—	—
9	References	—	—	—
10	Continuous	—	—	Reserved
11		0,13 mm	red	—
12		0,18 mm	yellow	—
13		0,25 mm	green	ISO 128-24:1999, line type 01.1
14		0,35 mm	cyan	—
15		0,50 mm	white	ISO 128-24:1999, line type 01.2
16		0,70 mm	magenta	—
17		1,00 mm	blue	—
18		—	—	Reserved
19		—	—	Reserved
20	chain thin ^a	—	—	Reserved
21		0,13 mm	red	—
22		0,18 mm	yellow	—
23		0,25 mm	green	ISO 128-24:1999, line type 04.1
24		0,35 mm	cyan	—
25		0,50 mm	white	ISO 128-24:1999, line type 04.2
26		0,70 mm	magenta	—
27		1,00 mm	blue	—
28		—	—	Reserved
29		—	—	Reserved

Layer	Line type	Line weight	Colour	Description of entities in this layer
30	Dashed ^a	—	—	Reserved
31		0,13 mm	red	—
32		0,18 mm	yellow	—
33		0,25 mm	green	ISO 128-24:1999, line type 02.1
34		0,35 mm	cyan	—
35		0,50 mm	white	ISO 128-24:1999, line type 02.2
36		0,70 mm	magenta	—
37		1,00 mm	blue	—
38		—	—	Reserved
39		—	—	Reserved
40	Chain thin double-dashed ^a	—	—	Reserved
41		0,13 mm	red	—
42		0,18 mm	yellow	—
43		0,25 mm	green	ISO 128-24:1999, line type 05.1
44		0,35 mm	cyan	—
45		0,50 mm	white	—
46		0,70 mm	magenta	—
47		1,00 mm	blue	—
48		—	—	Reserved
49		—	—	Reserved
a Possible reduction ratios are 0,25, 0,5 and 0,75.				

Layer 0 is reserved for the view of all layers. Layers 10, 20, 30, 40, 50, etc. are reserved for partial views of the respective line types.

Layer decades 1x, 2x, 3x and 4x are used for the line styles 01, 04, 02, 05 and “continuous freehand line” respectively as given in ISO 128-24:1999, Tables 1 and 2. The layer decade 5x is unused but reserved. The following layers are unused and reserved for further line widths: 18–19, 28–29, 38–39, 48–49, 58–59, etc.

Layers 1, 2, 3, 4, 8 and 9 are used for specific information concerning symbols, dimensions, hatching, text and proprietary information (i.e. frames and references) respectively. The unused layers 5, 6 and 7 are reserved and shall not be used for proprietary information.

The colours proposed are optimized for a dark (black) background. If these colours are used in conjunction with a light (white) background, layers of colour white should be replaced by layers of colour black.

NOTE If drawings with non-preferred line weights are received, the drawing may be normalized by setting the values for the import filter to the preferred line weights, i.e. layers ending with the digits 1–4 may be assigned to the value for thin line weight and layers ending with the digits 5–9 may be assigned to the value for thick line weight.

3.1.2 Font assignment

3.1.2.1 In the exchange file, the following symbolic font names shall be used:

- a) ISO3098-1 for Latin characters used in mechanical engineering drawings;
- b) ISO3098-2 for Greek characters used in mechanical engineering drawings;
- c) HELVETICA or ARIAL for Latin characters used in graphics other than mechanical engineering drawings.

3.1.2.2 The symbolic font names have to be mapped to an appropriate font name available in the local CAD software.

EXAMPLE In the AutoCAD configurations available from <http://www.iso.org/sdis/templates> appropriate fonts are ISOCP.SHX for the Latin font and GREEK.SHX for the Greek font.

3.2 Settings for Encapsulated PostScript (EPS) files

3.2.1 Character-encoded EPS up to version 2.0 shall be used (EPSF 2.0 ASCII; see the example in 3.2.4).

3.2.2 The image size shall be defined (BoundingBox set; see the example in 3.2.4, line 2).

3.2.3 Text should be converted to curves. Alternatively, non-standard base 13 Adobe Type 1 fonts shall be included (download fonts; see the example in 3.2.4, line 7).

3.2.4 Character-encoded raster preview shall be generated (90 dpi TIFF; see the example in 3.2.4, line 11).

EXAMPLE

```
1  %!PS-Adobe-2.0 EPSF-2.0
2  %%BoundingBox: 85 62 511 757
3  %%Creator: Professional Page V4.1 (C) Copyright 1993, Gold Disk Inc.
4  %%Title: Test drawing
5  %%CreationDate: 28/07/1995 22:21:39
6  %%Pages: (atend)
7  %%DocumentFonts:
8  %%+ Helvetica
9  %%+ Times-Roman
10 %%EndComments
11 %%BeginPreview: 208 150 1 150
12 %00000000000000000000000000000000000000000000000000000000000000
13 %00FFFFFFFFF00FFFFFFFFF0000FFFFFFF0000FFFFFFFFF00
14 %000000FF000000FF0000000000FF00000000000000FF000000
15 %000000FF000000FF0000000000FF00000000000000FF000000
16 %000000FF000000FFFFFFFFF00000FFFFFFFFF00000000FF000000
17 %000000FF000000FF0000000000000000000FF000000FF000000
18 %000000FF000000FF00000000000000000000FF000000FF000000
19 %000000FF000000FFFFFFFFF0000FFFFFFFFF00000000FF000000
20 %000000000000000000000000000000000000000000000000000000000000
21 %%EndPreview
22 ...
```

4 Settings for the Tagged Image File Format (TIFF)

4.1 TIFF up to revision 5.0 may be used.

4.2 Either monochrome (1 bit), 256 color (8 bit), grey scale (8 bit) or RGB true color (24 bit) encoding may be used.

4.3 Where the supplier has the possibility of providing monochrome images as Facsimile Group 4 (CCITT G4) compressed, this compression shall be used. Only if there is no possibility to use this type of compression may Level Zimp Huffman (LZW) compression be used.

4.4 The output size shall be defined as the image size.

4.5 The resolution shall be 600 dpi.

4.6 The information (tags) “resolution = 600” and “units = dpi” shall be contained in the image header.