

IEEE Standards Graphic Preparation and Requirements

Figures appropriate for use in IEEE standards may be black and white graphs, charts, schematic drawings, or photographs. Most working groups prepare figures in electronic form by using a drawing program or scanner to capture printed material. It is important to keep in mind when preparing figures that coordination with the IEEE-SA at the earliest stage can help ensure the most accurate and timely publication of a standard after approval. An IEEE Standards project editor should be contacted while figures are still in development.

Acceptable File Formats and Descriptions

EPS (Encapsulated PostScript)

- EPS is a generally a high-resolution image, stored in the Postscript page description language.
- Enables users to transfer high-resolution graphics between various applications.
- EPS files are usually created and edited in programs such as Adobe Illustrator.
- The files are generally vector based.
 - This means that they are mathematically drawn, using a series of points connected by lines.
- EPS files are generally infinite resolution.
- No matter how large the file is increased, the graphic will always show great detail and smooth edges.
- The images remain editable as long as they remain in a vector format.
- Advantage: Well suited for creating fonts, logos, technical illustrations.
- Disadvantage: Large files.

TIFF (Tagged Image File)

- Like EPS, TIFF graphics are ideal for high resolution printing.
 - TIFF offers great flexibility for use in page layout programs, due to multiple color modes, multiple compression types and cross-platform compatibility.
- Unlike EPS, TIFFs are bitmap, or raster graphics.
 - This means that the graphic is basically a grid with many little squares.
- The squares are colored in, to create an image.
- The quality of a TIFF, is determined by:
 - Size: The graphic dimensions
 - Resolution: The number of dots per inch.
- Well suited for photographic images.
- Advantage: Universal and can be used with almost any image and word processing software.
- Disadvantage: Not well suited for graphics that you may want to greatly enlarge or edit.

Windows Metafile Format (WMF)

- Windows Metafile is a 16-bit metafile format that can contain vector and/or bitmap information.
- Optimized for the Windows operating system.
- Specific to Microsoft Windows, but there are many non-Windows-based applications that support this format as a method for interchanging data with Windows applications.
- Advantage: WMF is a scalable Windows standard format that incorporates well into Office.
- Disadvantage: There is a lack of support with other operating systems, outside of Windows. Not well suited for photographic images.

Non-Acceptable Graphic Formats

- Any file formats not listed above, such as GIF, JPEG and BMP.
- Hand-drawn artwork in any format

Graphic Creation

Figures should be created in a graphics program. Figures created in programs that do not support vector illustrations may result in bitmapped graphics or graphics that do not translate well into other applications. The graphics may not scale appropriately or retain their quality.

If the document is a FrameMaker file, the FrameMaker graphics editor can be used for simple line drawings and TIFF versions do not need to be submitted. If the working group is unsure of how a graphic file was created, a TIFF version of the file should be submitted. Figure files that do not comply with the requirements stated in this clause may be converted to TIFF, which will result in a bitmapped version of the figure. If the working group cannot provide graphics in these formats or would like to inquire about other possible formats that may be used, please contact an IEEE Standards project editor.

Resolution

- Black and White: 300 DPI
- Grayscale: 150 DPI
- Line Art: 600 DPI
- Black and White Photograph: 300 DPI

Size

- Maximum width: 7.5"
- Maximum length: 10

Color

- We do not accept color graphics as we only print in black and white

Line Drawings

- Save line art as black and white.

Line Drawings with Shaded Areas

- Save these as grayscale.

Line Weight

- Lines should be of an adequate thickness, at least 0.5 to 1.0 point thickness. Hairline rules may appear broken up in printed document, or not show up at all.

Photographs

- Save photographs as grayscale

Fonts in Graphics

- All fonts shall be embedded into the figure.
- Please provide fonts with your project.

Fonts to Use

- Times New Roman
- Arial

Point Size

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Please use 8-point type size. In no case should captions smaller than 6 points, or type can become illegible. All capital letters or mixed uppercase and lowercase letters may be used, depending on the amount of text, as long as the presentation is consistent throughout the document. Letter symbols not normally capitalized should always be lowercase.

Captions in Graphics

6 point is the smallest acceptable font size, but shorter captions should be in 8-point size. A figure should be labeled by the word Figure followed by a number, an em dash, and a title (e.g., Figure 4-Typographical specifications for figure captions). Please see the IEEE Standards Style Guide for more information on figure numbering and capitalization.

Notes and Footnotes to Figures

Please see the IEEE Standards Style Guide for more information on notes and footnotes to figures.

Figures in Draft versus Figures in Proposed Standards

Although IEEE requires figures be embedded in the draft for the purposes of the ballot, separate files can be submitted for publication purposes.

Original Art

Whenever possible, original source files (from the graphics programs used) should be submitted to IEEE. The original art files should be grouped separately from those saved in the formats listed previously. All original art files will be archived for the working group but will not be used during the publication process.

Cropping

There should be no borders around the graphic. Please remove any excess white space around the image edges.

Permissions

Working groups shall obtain permission to use any figure taken from another source, including from a manufacturer, prior to using it in a draft standard.

If applicable, written permission for any copyrighted material (text, figures, or tables obtained from an outside source) used within a project shall be submitted to the IEEE-SA Standards Board as well. For further information, please refer to the IEEE Standards Style Guide.

Naming Graphic Files

A figure should be labeled by the word figure followed by a number (example: FIG1.tif). Multiple figures under a single figure number (e.g., Figure 2a and Figure 2b) should be saved as separate files with corresponding names (e.g., FIG2A.tif, FIG2B.tif). Although separate files, they should be submitted to IEEE on a single disk or CD-ROM.

Saving and Submitting Graphics

A separate electronic file should be created for each figure in a document. Please see 4.3 of the IEEE Standards Style Guide for complete guidance on electronic submittal.

Media - Accepted Formats

- CD-ROMs
- DVDs
- Zip Disks
- FTP
- e-mail (when prearranged)

Recommended Graphic Programs

The following information is given for the convenience of users of this document and does not constitute an endorsement by IEEE of these products. Equivalent products may be used if they can be shown to lead to the same results.

- Adobe® Illustrator® - <http://www.adobe.com/products/illustrator/>; *Note: Save as EPS only*
- Visio® - <http://office.microsoft.com/en-us/visio/default.aspx>; *Note: Save as WMF only*
- CorelDraw® - <http://www.corel.com/servlet/Satellite/us/en/Product/1150981051301>; *Note: Save as EPS only*
- AutoCAD® - <http://usa.autodesk.com/adsk/servlet/index?siteID=123112&id=2704278>; *Note: Save as EPS or WMF*

Graphic Terminology

- Aliasing and Anti-Aliasing - When visible jagged edges can be viewed on a graphic image; often referred to as "jaggies" or "stair-stepping." Aliasing can occur when over-enlarging a bitmapped image

Anti-aliasing is the process of removing these visibly jagged edges. This can be done by a blending of surrounding color. This tricks the eye into seeing smoother edges.

- Bitmap (Raster) - A bitmapped (raster) image consists of a grid made up by pixels. The color information of each pixel (bit) is individually defined. These images have a set resolution, so they lose quality, when resized. Bitmap images are often larger file sized than vector images. When transforming a vector graphic to a bitmap, the image is rasterized.

Bitmap file formats include the following: GIF, TIFF, PNG, PICT, and BMP.

- CMYK - The abbreviation for Cyan, Magenta, Yellow and Black. This is the process where all colors are created, by the mixture of CMYK. Also used to describe the printing process.
- Cropping - The process of discarding any unwanted areas of an image.
- DPI - The abbreviation for dots per inch. It is the printer resolution measurement of how many dots of ink are placed per inch on a page when an image is printed. The basic DPI rule of thumb is, the higher the DPI, then the higher the printed resolution.

Sometimes DPI is confused with PPI. The difference is while DPI refers to the printing device resolution; PPI refers to the pixel density of an image.

- Graphic - Illustration, photograph or any non-text image.
- Grayscale - A graphic image that is made up of 265 levels of grey.
- Halftone - Using dots in a printed picture to simulate light and dark tones.
- Importing - Process of bring external images or text into a graphics program.
- Metafile - File format that contains other files. It can also describe the contents of other files. These files can hold vector and/or bitmap images.
- Pixel - Term created by combing the words "picture" and "element." A pixel denotes a single point in a graphic image.

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- Pixel Depth - Pixel Depth describes the amount of data in each colored dot (pixel) on a computer screen. Examples:
 - Monochrome - 1 bit
 - Greyscale - 8 bits
 - RGB - 24 bits
 - CMYK - 32 bits
- PostScript - An object-oriented language that treats vector-based images and fonts by computer code. When scaling, these graphics and fonts keep their proportions
- Resize - Resize describes the process of changing the size of an image. Images can be resized down or up. Care needs to be taken when sizing up especially past 20%, as it can result in jagged edges.
- Resolution - An image's output quality, sharpness and clarity. It is usually measured in dots per inch. Images are often referred to as high resolution or low resolution.
 - Vector images are resolution-independent, and can be scaled to any size and not lose their quality. Their quality is determined by the output device used. Their clarity is retained when scaled at any size
 - Raster images are resolution-dependent, meaning that they represent a fixed number of pixels. These images can lose detail if they are scaled to high, or appear to have jagged edges.
- Typography - The art and use of typefaces.
- TrueType - A scalable type technology. It is built into both Windows and Macintosh.
- Vector - Composed of independent objects (such as lines and curves). All of the elements within a vector graphic are defined by mathematical statements. These images are resolution-independent, and can be scaled to any size and not lose their quality. Vector graphics are created in drawing programs. They usually have smaller file sizes than bitmap images.

Graphic Submission Checklist

- Good quality.
- Resolution is correct.
- Image size requirement is correct.
- Fonts are True Type Arial or Times NewRoman.
- Fonts are correct point size.
- Fonts are embedded into graphic.
- Fonts are supplied.
- Source file is provided
- Figure is properly named.
- Saved in proper file format (TIFF, EPS, WMF or PDF).
- Permissions were obtained, if needed.

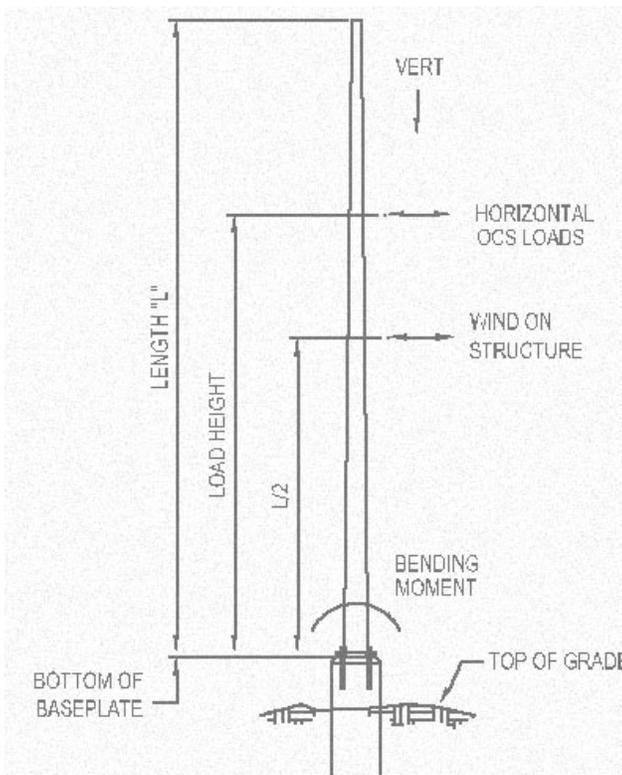
Helpful Hints

Bad image quality will result in poor print quality. With this in mind, please do not supply low-resolution graphics, such as web-ready graphics. Saving to a higher resolution will not improve an image of poor quality.

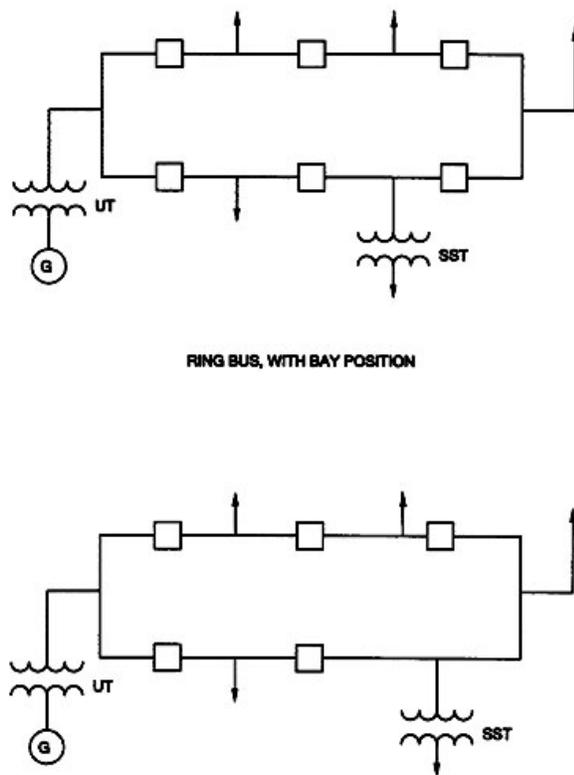
The graphic requirements in this guide were put together to help assure a quality publication. If you have any questions, please contact an IEEE Standards project editor (stds-style@ieee.org).

Graphic Examples

Bad Line Art



Good Line Art



Bad Photo Image



Good Photo Image

