

# Technical Illustration in the 21<sup>st</sup> Century: A Primer for Today's Professionals

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## Overview

The field of technical illustration is vast, and now comprises a multitude of techniques and principles. Describing all of these techniques in detail would be a never-ending project. Yet, for today's illustrators searching for insightful information on topics such as illustrations versus drawings, the current situation is paradoxical: technical illustration is a huge topic, yet there are few books and publications available, as many of the 'classics' have gone out of print.

Just the same, the need for technical illustrations and technical illustrators is increasing due to various factors, including stricter European Union regulations and warranty issues demanding higher-quality documentation. Unfortunately, many educational institutions that once taught the subject no longer offer courses. In many countries, my home country (Germany) being among them, technical illustration is taught only at a handful of private institutions.

Furthermore, technical publications departments within companies are often downsized, leaving technical authors, with no drawing experience, being forced to familiarise themselves with the principles of technical illustration. The paradox: where can they get the information they need to educate themselves?

In PTC's Education Services organization, we have observed this tendency time and again; participants in our product training classes for Arbortext® IsoDraw™ ask us for general guidance on perspectives and other techniques, appreciating any help they can get.

Accordingly, in this technical white paper, I'd like to provide an overview of some basic aspects of technical illustration that I hope will be useful to illustrators seeking more information on the topic.

## Technical Illustrations versus Drawings: A Jaunt through the Jargon

### Why 'illustration' and not 'drawing'?

On first encounter, many people are confused by this terminology, and consequently they mix up these two terms. There are, however, clear differences between the two.

A technical drawing is used for designing and manufacturing a machine. It is always a scale representation of a unit or part, providing views that are needed to furnish an accurate visual description. In technical drawings, even the smallest detail must be defined precisely to ensure that the drawing is unambiguous. Reading a technical drawing can, therefore, be a very complex process because a wealth of information has to be interpreted.

Technical illustrations, on the other hand, are in many ways the exact opposite. This is because they have a completely different purpose. The intention is to depict a part in such a way that it is quickly and clearly recognisable. In a technical illustration, less is often more, in that less detail will make the picture more understandable. Here, it is not precision that is demanded but, rather, easy comprehension. The viewer should be able to identify the depicted part without requiring any special training as a draughtsperson.

With technical illustrations, all unnecessary detail is omitted. In addition, the technical illustrator has the artistic freedom to use various stylistic devices to support the purpose of an illustration. The use of perspectives, graphic devices and simplifications are all valuable tools for emphasising key details in an illustration.

### Perspective

In contrast to technical drawings, technical illustrations are created as perspective representations. As a rule, you can say that the more natural

the perspective, the more complex it will be to include it in an illustration. The reason for this lies in the perspective reduction used.

### Vanishing Point Perspective

Everyone knows from experience that an object appears smaller at a distance than it does close-up: lengths further away from the observer's eye appear to be shorter. This reduction results in what is known as a vanishing point perspective, which corresponds to the way in which the human eye or a camera sees things. Therefore, photographs always show vanishing point perspective. The natural way in which this reduction happens can also be a disadvantage, because it requires parts to be depicted differently, as their position changes relative to the observer. This means that a part in an illustration will need to be redrawn, even if it is merely shifted to another position.

### Parallel Perspective

The amount of work involved in using perspective can be reduced by selecting a different form of presentation—such as parallel perspective—which, while being slightly less natural in effect, is easier to create. In this reduction, unlike in a vanishing point perspective, two lines that are parallel in reality remain parallel in the illustration.

The direction from which the observer views the object is unimportant. The advantage is that a part drawn using parallel perspective can be moved around without being redrawn.

### Sub-Classifications

Within these two basic perspectives there are various sub-classifications. Vanishing point perspectives may use one, two or three vanishing points. Parallel perspectives may use trimetric, dimetric and isometric projections. There are also oblique projections, such as cavalier perspective, though these are seldom used.

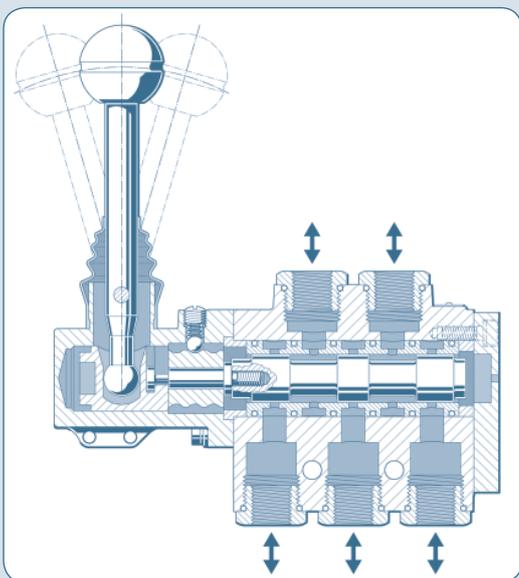


Figure 1. Using a cutaway to show internal detail

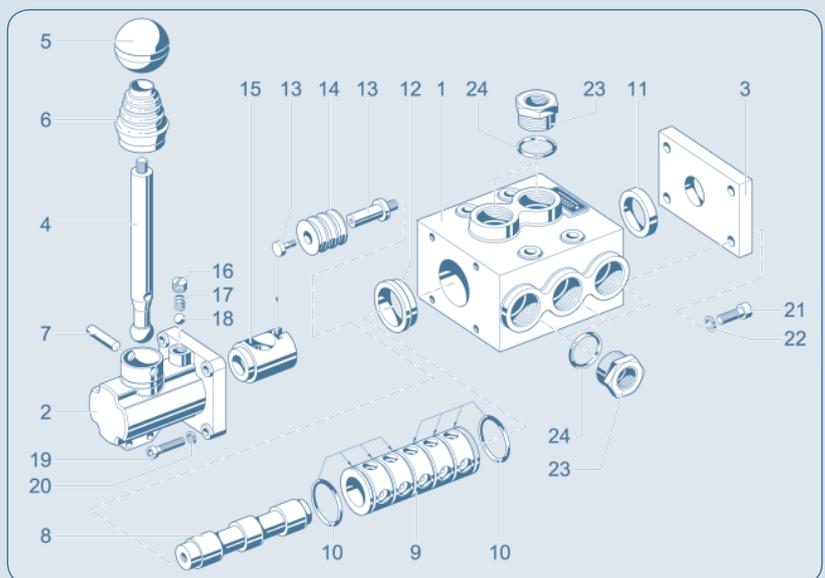


Figure 2. Using an exploded view to show parts in an assembly

As you can see, perspective is an extensive field. Until recently, there was some valuable literature available on perspectives; however, many of the titles are no longer in print, as their demand seems to be decreasing. However, if you'd like to do some reading on this topic, check the architects' bookshelves.

### Illustration Techniques

When you have chosen the most suitable perspective for your illustration, you then need to decide on the representation method and the stylistic devices to be used. Representation methods include:

- Cutaway drawings (Figure 1)
- Exploded views (Figure 2)
- Ghost representations (Figure 3)

Before choosing a particular method, you should always base your decision on the purpose of the illustration. If you need to create illustrations for a parts catalogue, for instance, you might want to depict the parts in their installation environment, so as to provide context. Here, a ghost representation would be a good solution. The installation environment is drawn in a lighter color, or in 'thin' lines; it is easily recognised, and yet merges into the background when viewed against the spare parts that are drawn in the 'standard' style.

This example demonstrates how representation method and style are closely connected. It is important to choose your stylistic devices carefully (Figure 4). In technical illustration, there is rarely a 'black or white', right or wrong choice. The technical illustrator has a variety of methods and styles to choose from, and the 'only' requirement is to use them in a way that helps convey meaning. However, you should not mix too many styles because this tends to obscure meaning. As I said, less is often more in technical illustration.

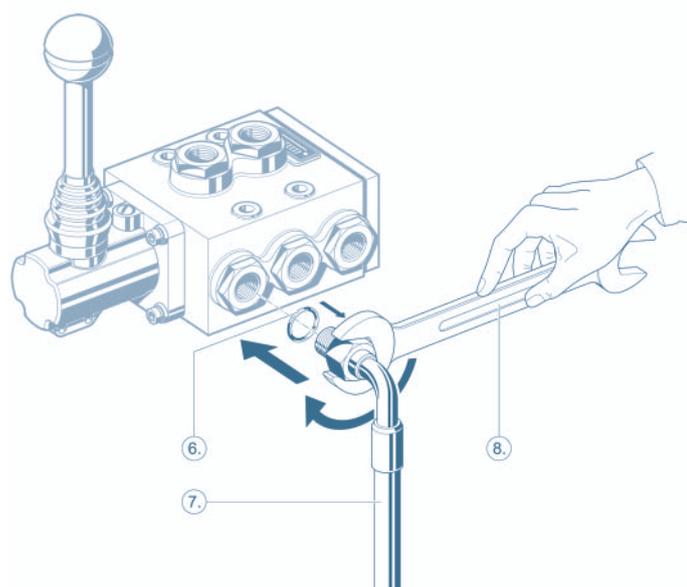


Figure 3. Using ghosting to highlight relevant detail

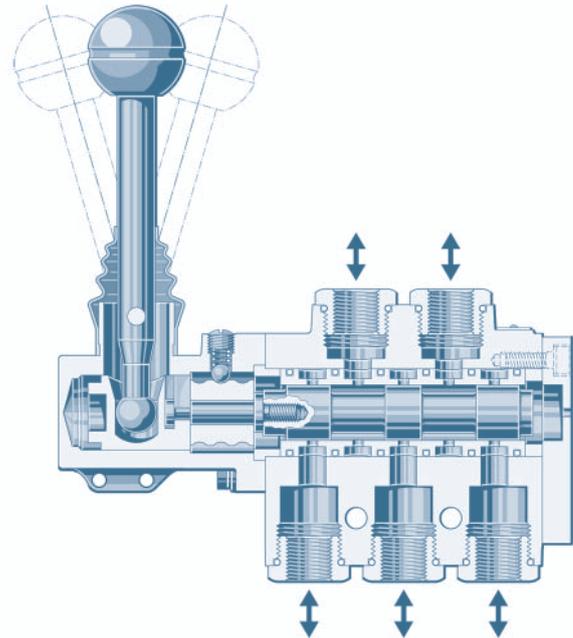


Figure 4. Using stylistic devices to enhance realism

Let's take a closer look at exploded views. These are often used for assembly instructions. The parts of a machine are drawn separately in their assembly position, with lines or arrows providing information on assembly order. The creation of a high-quality exploded view is not easy and can be very time-consuming. The first challenge is size; since many parts have to be drawn in extended positions, the illustration consumes more space. And the larger the machine, the more parts have to be drawn, thus the greater the challenge.

As a result, the illustrator needs to place parts skillfully, keeping in mind that the order has a direct influence on the clarity and comprehensibility of the illustration.

Keep in mind, the viewer should not get 'lost' when looking at the illustration. Before starting the work, the illustrator should think about what to depict and how to arrange the parts, so that the structure is clear. Furthermore, the illustrator should avoid making the graphic too ornate, as too much detail will distract the viewer and obscure the meaning. In this context, the effects and strengths of various stylistic devices start to become apparent. Thick-thin line technique is a fundamental illustration style. It enables the viewer to see the meaning of the illustration more easily, and should be seen as a prerequisite for complex illustrations, such as some exploded views.

### Examples of Stylistic Devices

- Line weights
- Line types
- Magnifier
- Callouts
- Colour
- Hatchings

## Adding Texture to Your Pictures

Here, you'll learn how lines can form patterns to convey regular and irregular textures.

Technical illustrators are often seeking information on the use of patterns to simulate regular features like grills, and irregular features like bristles. Figure 5 shows a radiator grill on a car, while Figure 6 shows holes drilled in a footplate. Both are regular features. Figure 7 shows the brush on a pressure washer, with its irregular bristles. A series of lines is used to convey an impression of the feature, whether regular or irregular, rather than attempting to precisely depict the exact number and relative positions of the elements of which it is composed.

The challenge when designing patterns that are to be used in this way is to choose appropriate weights and spacings for the lines; they must remain distinct, even when illustrations are scaled. The lines may be:

- Lighter-weight than the rest of the illustration
- Grey instead of black, giving an impression of lightness

However, if the line is too thin or if the colour is too light, the effect may appear more of background than a texture. Since you don't want to draw each line separately—imagine how long that would take!—you can create the effect by inserting a pattern into a defined area. You can then copy and connect this area to create larger areas, which is how the brush in Figure 7 would be created. Adding a few single bristles, manually, enhances the effect.

Masks, which are offered by most graphics tools, are closed paths (that is, shapes) into which you can insert patterns. The main benefit of using a mask is that the pattern is not adjusted to fit it, which means that the effect is consistent across large and small areas.

You can adjust the shape and size of the mask to reveal either more or less of the pattern behind it, without changing the appearance of the pattern itself. You can also experiment with different patterns until you find one that conveys the right overall impression for your illustration.

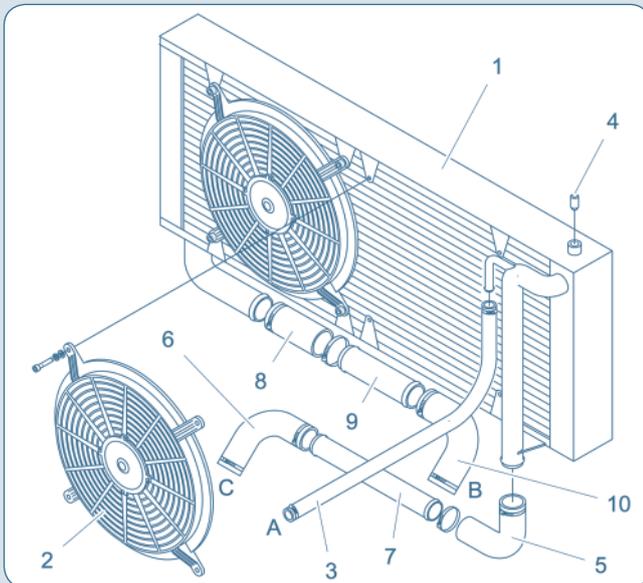


Figure 5. The regular horizontal fins in a car radiator.

Illustration: Mosler MT900S road car (excerpt) created by Harber Technical Services ([www.harbertech.co.uk](http://www.harbertech.co.uk)), © Breckland Technology

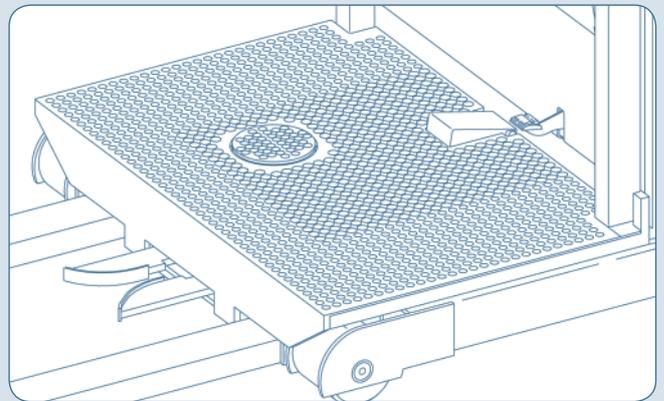


Figure 6. Holes drilled at regular intervals in a footplate.

Illustration: OPX30 Order Picker Truck (excerpt), © BT Prime-Mover Inc



Figure 7. The irregular bristles in a brush. Illustration: brush from a pressure washer created by Alfred Kärcher GmbH & Co ([www.karcher.de](http://www.karcher.de)), © Alfred Kärcher GmbH & Co

## Formatting Text in Illustrations

It's all too easy for titles and annotations to change position or appearance, often spoiling the intended effect. Here, the Arbortext IsoDraw team from PTC suggests a few basic principles to help avoid this.

Technical illustrators often need to add text to their illustrations, such as in titles and annotations. There are several things to bear in mind when doing this, which will ensure successful formatting of text in your illustrations.

### Formatting Text Elements

Badly presented or misplaced text can spoil the overall effect of even the best artwork, so consider carefully how to position text. This is especially important when an illustration will be used on other computers or in other software applications. When creating a graphic, you choose appropriate fonts and attributes, for example, a proportionally spaced font, as shown in Figure 8.

When the graphic is opened on a different computer, however, the font may be misrepresented. This can happen, for example, when the font is not installed on the other computer and is replaced by a quite different font. The space that the text occupies may change (for example, the substitute font is wider because it uses fixed spacing, as in Figure 9).

Such problems can be avoided if you format your text in such a way that it cannot run into the illustration. In our example, the situation would be improved by aligning the upper text to the right, and the lower text to the left. That would anchor the end of the text nearest the graphic and leave the other end free to move without overlapping.

Figure 8 demonstrates this method, with four red dots indicating the corners of each text box and a fifth red dot indicating the end with which the text is aligned. Another solution would be to transform the text into paths, turning it into graphic elements. However, the disadvantage of this method is that the text cannot be edited later.

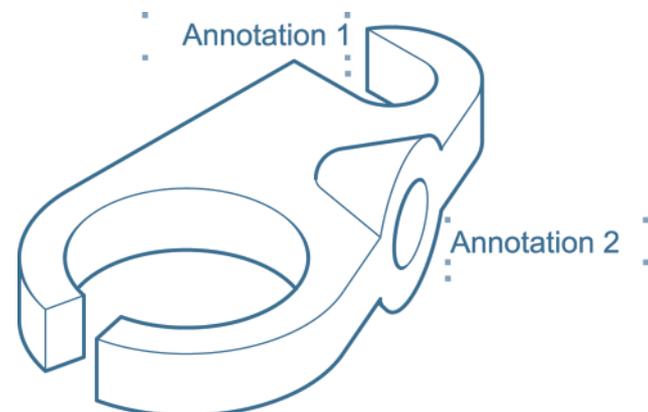


Figure 8. Well-positioned text in the chosen font

### Using Layers to Separate Text

When working with complex illustrations, it is helpful to save text elements and leader lines on separate layers from the graphic elements. You can then set any layer to be invisible, so you can see the illustration more clearly as you work.

This technique is also useful when your illustration contains elements that have backgrounds or fills; these can be easily hidden while developing the illustration.

A major benefit of using layers is that you establish security. If you later need to edit or translate the text, you can lock all the layers containing graphic elements to prevent them from being accidentally deleted, moved or changed.

Leader lines usually have a white shadow to distinguish them where they cross the edges of depicted parts. However, by default, text does not have a white background because it does not usually cover graphic elements. If you decide to position text over graphics, format the text in a way that separates it from the elements that it covers.

### Exporting Text for Translation

Ideally, your illustration tool will provide an option to export the textual information from an illustration into a text file (for example, as object lists).

This flexibility makes it possible to work on the text using any word processor, and then import the revised text into its original location in the illustration file. This method is especially useful in translation. A popular alternative for documents that require translation is to use the documentation tool to add text, rather than making the text part of the illustration itself. Many of the same considerations apply when it comes to formatting the text. Positioning can be even more problematic, given that the annotations and graphic elements can only be locked together at the highest level. If the illustration is changed, the annotations will require checking.

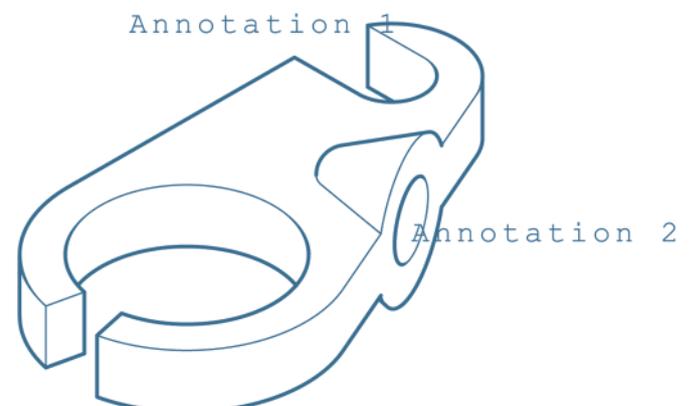


Figure 9. Poorly positioned text in a substitute font

## Detail Illustrations: Taking a Closer Look

In this section, the Arbortext IsoDraw team presents some examples to demonstrate what can be achieved by highlighting details in illustrations.

A detail illustration is a means of highlighting elements pulled from the main illustration. Its appearance depends on what the illustrator aims to achieve. In most cases, detail illustrations are used to show more information about portions of the main illustration. As this often means creating a piece of an illustration in a larger scale, the term ‘magnifier’ is sometimes used.

However, you do not necessarily have to enlarge a part to add information. For example, you may want to add emphasis rather than detail. The mere fact that a portion of the illustration is shown in a separate frame may be sufficient to attract the viewer’s attention. Most important is how you draw the highlighted portion.

The level of abstraction in a detail illustration should support its purpose. A typical use is to show a small but important item in a parts illustration (Figure 10). To make the part as recognisable as possible, you may omit unnecessary detail and show only the characteristics needed to identify it. Then you can label it with its part number.

When a detail illustration is used to show a portion of an illustration more clearly (Figure 11), an enlarged view is certainly the best choice.

You can also incorporate other stylistic devices in detail illustrations. For example, you might choose ghosting or transparency to convey more information. You might even use a different perspective. Also, detail illustrations may be enclosed in any shape, including circles, ovals and squares, and be connected to the main illustration by lines or arrows. Adding a white frame to the inner contour helps to distinguish the content from the enclosing shape. You can highlight several details in one illustration (Figure 12), as long as it does not become overcrowded. To help the reader, detail sequences are usually numbered. Creating each detail on a separate layer enables you to show and hide details, as needed.

## Who Needs X-Ray Vision?

Here, you’ll discover how technical illustrations can give us all superhuman powers.

Sometimes, it can be interesting for the viewer to see what a machine looks like on the inside. This is especially helpful when the function of an appliance needs to be visualised. In technical illustration, two methods of representation can be used in such cases: cutaways and ghosting.

### Cutaways

As the name indicates, in a cutaway drawing, a piece of the object is ‘cut away’, or removed so as to display a section (or part section) through the object.

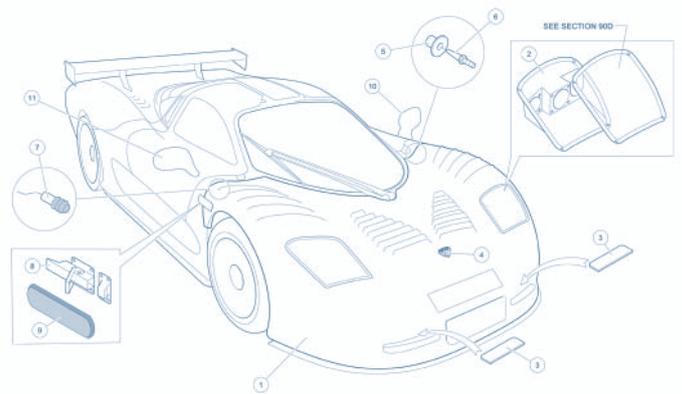


Figure 10. Illustration detailing small parts.

Illustration: Mosler MT900S road car, created by Harber Technical Services ([www.harbertech.co.uk](http://www.harbertech.co.uk)), Suffolk (UK). © Breckland Technology

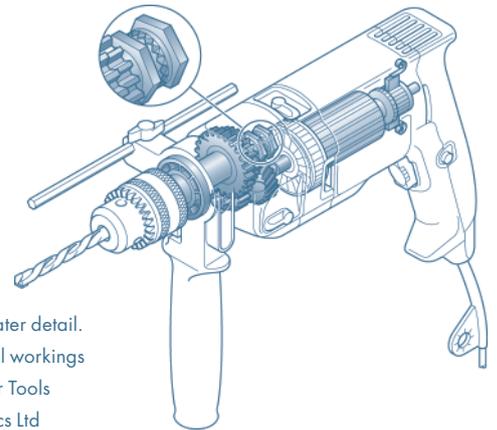


Figure 11. A part in greater detail.

Illustration: Hammer drill workings created for Bosch Power Tools GmbH by Altec Graphics Ltd ([www.altegraphics.co.uk](http://www.altegraphics.co.uk)). © Altec Graphics Ltd

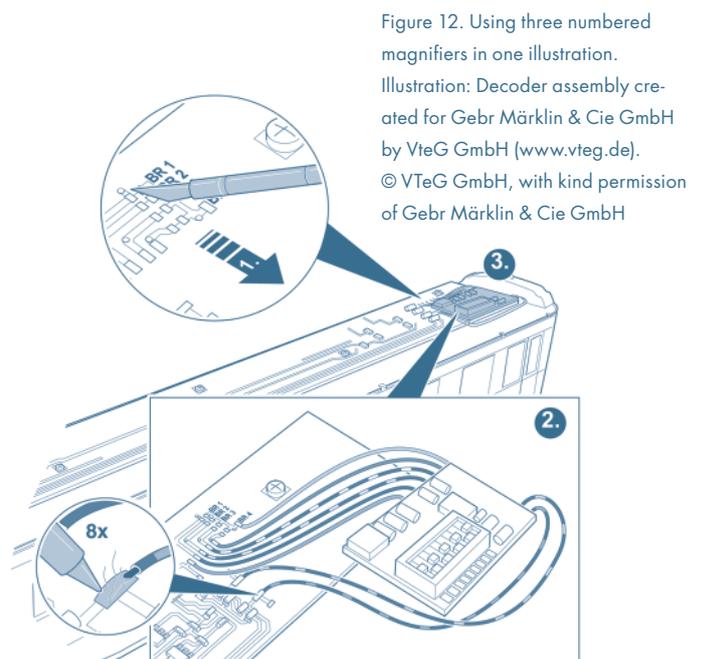


Figure 12. Using three numbered magnifiers in one illustration.

Illustration: Decoder assembly created for Gebr Märklin & Cie GmbH by VteG GmbH ([www.vteg.de](http://www.vteg.de)). © VTeG GmbH, with kind permission of Gebr Märklin & Cie GmbH

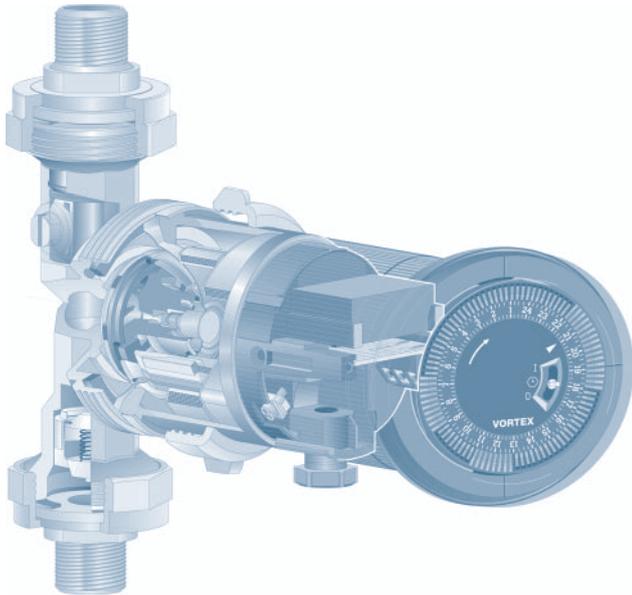


Figure 13. The cutaway (left) and ghosting (right) techniques

This technique is most suitable for cylindrical bodies, such as turbines and pumps, but it can be applied to other objects as well.

Every object having a central axis helps illustrators to maintain orientation during their work.

When starting a cutaway illustration, it is important to have a clearly defined idea of what to depict and how to depict it. The illustrator must know where to make the cut and what kind of cut is most appropriate. Also, s/he needs to choose a perspective. Although isometric perspective is one of the most common, it might not be the best choice for a specific requirement. Dimetric perspective, for example, is often used for cutaways.

### Ghosting

This technique uses transparency as the dominant method. The inner parts of an object can be seen by displaying the outer case of the product as if it were transparent. Various levels of depth can be displayed by using multiple levels of transparency; however, nothing is removed. Here, care must be taken to preserve clarity.

Too much detail—that is, too much depth—becomes confusing for the viewer. When using color, check that your graphics program is capable of doing transparency, especially if you wish to use gradients instead of full color tones. If the tool you're using does not support transparency, you might want to use layers to simulate transparency. You would place different layers in light colors over each other, just as a painter places paint on canvas. You could add light effects and shading to enhance the impression of transparency. Although this, of course, demands knowledge of graphic design, it shows, once again, the versatility of technical illustration.

### Conclusion

Both techniques—cutaways and ghosting—require the illustrator to have some experience, since creating such drawings from scratch takes time and preparation. The visual effect, however, can be stunning. As a result, cutaway drawings and ghost representations are often used for marketing purposes, for example, on the covers of manuals or in advertisements for appliances. Although you will see many examples of colored illustrations that use these techniques, the effects can also be achieved in black and white by using shades of grey.

[Figure 13. A coloured illustration of a pump that uses both techniques. Contributed by TGG, a provider of technical illustration services in Germany ([www.tgg.de](http://www.tgg.de)); created using Arbortext IsoDraw, with colour added using Adobe Illustrator. Here, the transparency of the outer case is visualised by light-coloured fine lines.]

## Technical Illustration – A Matter of Perspective

Here, we discuss two ways of approaching perspective.

When working with technical illustrations, you must consider perspective. In this topic, you'll find some useful information for working with both true and parallel perspective.

### True Perspective

Every technical illustration is done in a perspective. Usually, you will employ the perspective that best suits the information you wish to communicate within the depicted situation. Individuals who are new to technical illustration are confronted with several questions when choosing the appropriate perspective. Quite often, they try to depict a body as realistically as possible. To achieve this, they choose a vanishing point perspective, for example, true perspective.

However, as a general rule, the more natural the perspective, the more complex it is to include in the illustration. The reason for this is the perspective reduction used. Sighted people know from experience that an object appears smaller at a distance than it does close up. It is also true that lengths are reduced as they move further from the observer's eye. This reality has two effects:

- Creation of a true perspective is difficult. When creating a true perspective manually, you cannot work with real measurements. You have to project every measurement, and the effort is disproportionate to the result. In various positions, ellipses, for instance, have different diameters, values and angles.
- It is not possible to reuse existing objects. Since the size and orientation of each element—down to the last screw, will change wherever it appears, it is not possible to reuse an object that has been drawn before.

### Parallel Perspective

Parallel perspective is certainly the most efficient method of depicting an object spatially, and therefore it has become the most commonly used method of representation in technical illustration. In a parallel perspective model, you can use real measurements, which means that measurements can be also taken directly from technical drawings.

Since dimensions shown in a parallel perspective do not become smaller as distance increases, elements in both foreground and background can easily be recognised and compared. Elements can be reused when they are in the same installation position. The best known parallel perspective is isometric. This variant offers the additional advantage of allowing elements to be used in other views by rotating them through 120°.

Reusing a drawn part is an extremely important factor in the time required to create an illustration. Imagine that you need to create a complete set of manuals for a machine—such as assembly instructions, an operating manual, and a spare parts list—in which the machine and its parts need to be depicted in various situations. Using parallel perspective throughout the document means you can reuse parts in all kinds of illustrations. This not only saves you a lot of drawing time, but it also ensures that the parts are clearly recognisable for the reader.

### Conclusion

While true perspective is visually pleasing, it is more suited to technical advertising than technical illustration. A suitable application for true perspective would be a colorful cover page of a technical manual. The contents of the manual, however, are intended to convey technical details in an understandable way. Here, the parallel perspective is the most appropriate method.

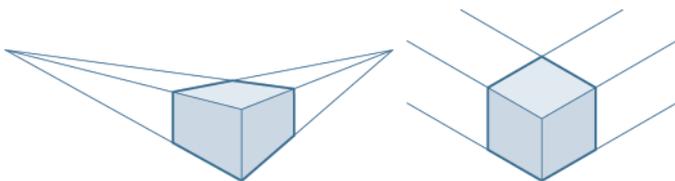


Figure 14. True (a) and parallel (b) perspective

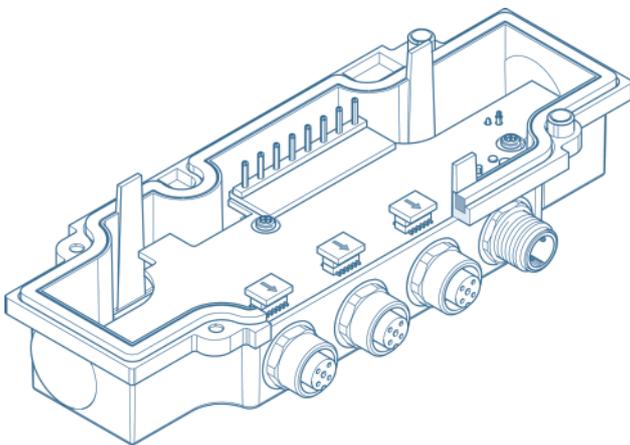


Figure 15. Drawing using parallel perspective

## Back to Basics: The Value of Lines in High-Quality Illustrations

Here, we continue our exploration of the building blocks of technical illustration by focusing on the line.

The line is the most basic element of a technical illustration. However, if you think that the term ‘basic’ means ‘simple’, then you are somewhat mistaken. The shape, thickness and significance of lines in an illustration all contribute to its artistic effect and its success in conveying form.

This section, which barely scratches the surface of this topic, concentrates on the kinds of lines created in vector graphic tools, such as Arbortext IsoDraw and Adobe Illustrator. It is intended to help inexperienced illustrators use lines more effectively.

### Types of Lines

There are various types of lines, as shown in Figure 16:

- A line is defined as a straight line between two points that has a beginning and an end point.
- A polyline is a line with several points. It not only has a start point and an end point, but it also has other points in between that may not lie in a straight line. An example is a zig-zag line.
- A Bézier curve—named after French mathematician Pierre Bézier—is defined by mathematical formulas. The two endpoints are called anchor points. The other points, which define the shape of the curve, are called either handles, tangent points or nodes. A handle can have one or two control points; moving these points modifies the shape and direction of the curve. As a result, a Bézier curve uses at least two anchor points and one handle to define a curve.

Most graphics programs offer a wide range of line drawing tools, but illustrators have to use them in an appropriate way to create an effective technical illustration. Below you’ll find recommendations on how to show lines in technical illustration and, of course, these ideas can also be applied to working with pen and ink.

### Representational Lines

The simplest form of a line-art representation is the one-line representation. This means that all lines in the illustration are of the same thickness. To convey form more effectively, however, very often two or more line thicknesses are used, as shown in Figure 17. This stylistic device is called ‘thick and thin’ technique. The actual and relative weights of the lines are determined by house style and aesthetic effect; a typical recommendation is for thick lines to be twice the weight of thin lines. Thick lines tend to be applied to the outer edges of the depicted objects, while thin lines are used for inner edges. You might imagine reaching behind a line with your hand: if you can’t see your fingertips, the line should be thick (Figure 3).

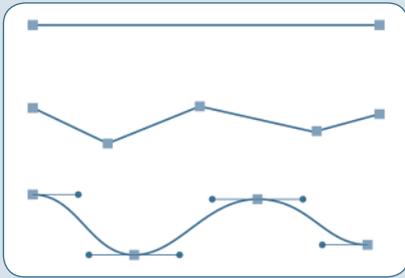


Figure 16. Types of lines

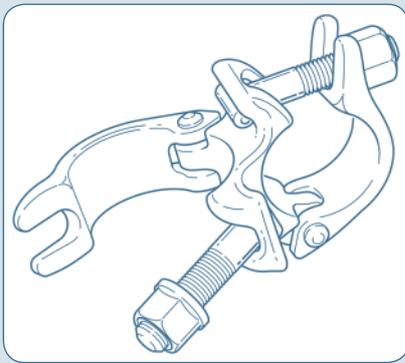


Figure 17. Use of thick and thin lines

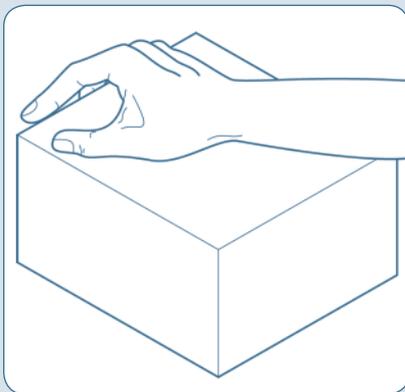


Figure 18. Determining line weight

Lines may sometimes be broken and their thickness may change after the break, suggesting, for example, a change from an outline to a contour. This is often the case with castings, as shown in Figure 18. Thicker lines are sometimes used to highlight specific objects. Color, if available, may be used in the same way or to convey more information about the depicted objects.

### Additional Lines

When you have created your illustration, you might want to apply more lines to complete it. There are several types of lines with special functions, including:

- Leader lines for annotations
- Centre lines in exploded views, which are often dashed

Adding white shadows helps to distinguish leader lines and centre lines from the representational lines within the drawing itself.

### Conclusion

Careful selection of the lines that you show and the styles that you use will enhance the overall impression created by an illustration. Removing hidden lines—as long as they are not needed to convey details of concealed parts, can tighten the focus on important aspects of the depicted object. Everything you include and, by implication, everything you omit should be chosen to help the viewer envision the object more easily.

## Line Drawings Done the Easy Way

Here, we examine a technique that anyone can master: phototracing.

Phototracing can be an effective technique for creating impressive technical illustrations. Of course, tracing an existing picture, instead of drawing it from scratch, seems easy, and is often, therefore, considered an appropriate technique for beginners in technical illustration. I'm using the word 'seems' because, as with all things, there are some rules to follow if you want to achieve good results.

To create a line drawing from a photograph, you take a picture of the subject and use it as a template. Most graphics programs, including Adobe® Illustrator, Arbortext IsoDraw, Freehand® and CorelDraw®, offer a background layer on which you can place your photograph. A lock function enables you to lock the layer to prevent the photograph from being accidentally selected, moved or deleted. You then trace the photograph on a second layer, reproducing all reference lines with the tools provided by your graphics program.

### Choosing a Photograph

Before you start tracing a photograph, check that it will make a good template:

- The file should not be too large, otherwise your graphics program may become sluggish. Two factors influence the file size: the color and resolution of the photograph. To conserve memory, use a grayscale photograph of sufficient resolution to recognise the necessary details. A resolution of between 180 and 250 dpi is usually serviceable.
- The photograph must not be too dark or have reflections in it, as these will cause problems in tracing. When taking pictures yourself, pay attention to correct lighting and use a flash, if necessary.

### Limitations of the Method

A photograph is always in vanishing point perspective...

- ...and so is any illustration traced from a photograph! Vanishing point perspective corresponds to the way in which a human eye or a camera sees. The disadvantage of this perspective, however, is the natural way in which it presents an object. This requires parts to be depicted differently, as their positions change relative to the observer, which means that a part in an illustration will need to be redrawn even if it is merely shifted to another position on the drawing area.
- ...and this means there is a special demand for accuracy! Make sure that all elements and lines you draw are in the correct position. Use auxiliary lines to check position, since any displaced line or ellipse can destroy the overall impression created by the illustration. This is especially true for complex illustrations where more than one object is depicted.

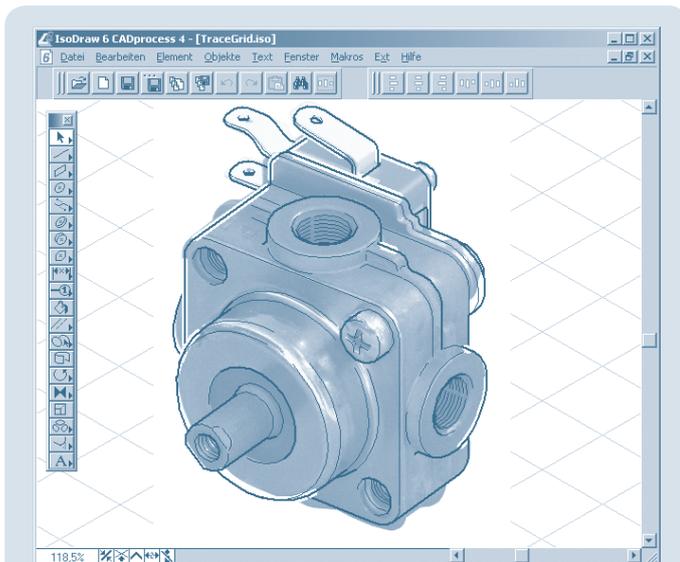


Figure 19. Tracing the photograph

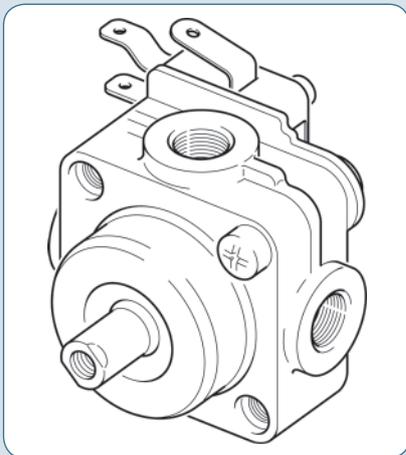


Figure 20. Resulting line drawing

### In Conclusion

For phototracing, the same general rule applies as for all technical illustrations: depict only what is needed to convey the desired meaning, and omit unnecessary details to make the illustration easy to understand. When you have finished your illustration, delete the background layer containing the photograph rather than hiding it. This keeps the file small.

### Using Annotations to Identify Parts

Clear labelling helps readers interpret complex technical illustrations quickly and easily. Here are a few ideas on organising and positioning labels.

#### What is an Annotation?

An annotation is an item on an illustration that identifies a part, using either a label or a description, and has a leader line that points to the item. In engineering, annotations are often referred to as callouts. A 'direct' annotation is a textual description (for example, 'bolt'). An 'indirect' annotation can be either a number or letter, or a combination of both.

Indirect annotations are often chosen because they are more compact and can facilitate translation, meaning that only the textual part of the document requires translation. The illustration in Figure 21, which is taken from an illustrated parts catalogue for an agricultural machine, shows the use of indirect annotations.

#### Where are Annotations Used?

Annotations are found in all types of technical manuals, but they are most common in spare parts catalogues. Depending on the catalogue, the annotation can either describe the spare part with a direct annotation, or identify it with an indirect annotation, which may be the part number itself or the position of the spare part in the parts list.

In assembly instructions, annotations can be used to show the order in which parts should be assembled. In user instructions, the first page of a manual often shows an overview drawing of the product, in which annotations are used either to identify the most important parts or to show what is included in the product package.

These examples cover only a few of the applications for annotations. However, as useful as they are, annotations can be time-consuming to include. In a spare parts list for a complex assembly, there are often many annotations, and it can be difficult to design a layout that is not confusing.

### What is the Best Approach to Using Annotations?

There are several things to consider when choosing your approach to annotations:

- Plan the whole process before you start adding annotations; it can take considerable time if you must go back and renumber them.
- Arrange the annotations clockwise or anti-clockwise around the illustration. There is no rule on the direction, but be consistent throughout the document to avoid confusion.
- Position the annotations carefully. It is particularly important to maintain a clear structure when the drawing area is full. If necessary, you can 'dogleg' leader lines to locate annotations conveniently and in logical groups.
- Use white shadows behind leader lines. When leader lines cross parts of the drawing, shadows will help to separate the lines, giving them a cleaner look and clearer connection.

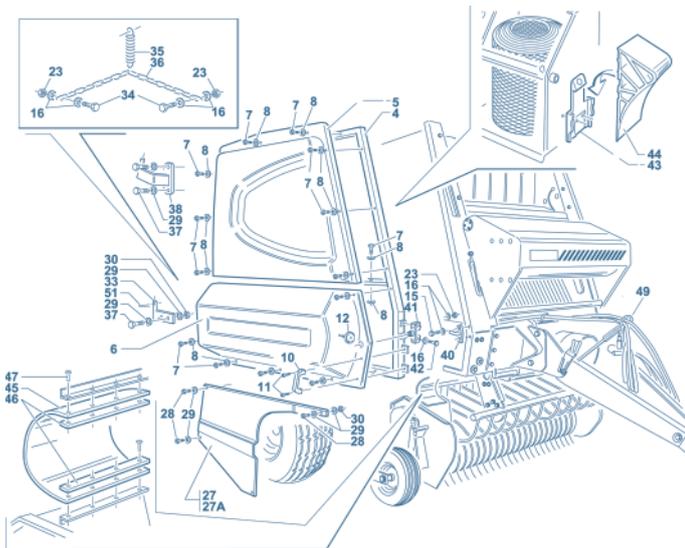


Figure 21. Illustration showing indirect annotations and magnified areas. Reproduced by kind permission of the Montanari Group, Correggio, ([www.montanarigroup.it](http://www.montanarigroup.it))

- If an assembly drawing contains many components that need annotations, consider extracting parts into separate sub-assembly drawings, perhaps on separate layers in the drawing file.
- If a component is very small, consider showing it magnified in a separate area. A small bolt might be hard to identify in a complex illustration.

Note: Extracted areas of a drawing are also sometimes described as callouts.

Because working with annotations can be time-consuming, look in your drawing tool for features such as:

- Varied styles for annotations
- Automated numbering to renumber annotations after a deletion
- Automated shadows on leader lines

### Summary: Learning More About Technical Illustrations

The field of technical illustration will continue to grow and expand as the demand increases for higher-quality graphics within manuals and documentation. Keeping up with advanced technology and the latest illustration tools will enable illustrators to produce high-quality publications in the shortest amount of time.

If you'd like further information on this topic, or you'd like to learn more about Arbortext IsoDraw, the technical illustration solution from PTC, then visit [www.ptc.com](http://www.ptc.com), or contact your nearby PTC representative.

### Author's Note:

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