

What Is a Magnifier?

A magnifier is a lens that increases the apparent size of objects seen through it. It may be a single lens, thicker at the center than at its edge, or it may be a compound lens made of several lenses mounted or cemented together.

By moving closer to an object we are able to see it in more detail. But the focusing power of our eyes is limited and we are able to see clearly only down to about 10 inches. A magnifier, in effect, adds focusing power to the eye, enabling us to move closer than 10 inches to the object and to see more detail. We see the effect as an increase in the image size.

Depending on its power, a magnifier makes it possible to see an object clearly as close as one-half inch from the eye.

Why So Many Different Magnifiers?

Basically, the purpose of a magnifier is to enlarge the image of an object so that its details may be seen more clearly. This is a function of the *power* of the magnifier. However, three other factors affect the performance of a magnifier and its suitability for certain jobs: *field of view*, *depth of field* and *working distance* (focal length). The four factors are interdependent; if the power is increased, the other three become smaller, and so forth. In selecting a magnifier, you should consider all four factors.

Power of Magnification

The power of magnification refers to the capacity in the lens to increase the image size. X, the symbol used with a number in

denoting the power of a magnifier, is quite simply the multiplication sign, "times." Thus, a 2X magnifier creates an image size twice as large as that which the unaided eye sees at 10 inches.

A 3X magnifier triples the image size, and so on.

Focal Length (Working Distance)

Focal length is the distance at which a magnifier must be held away from an object to achieve clear focus and maximum magnification.

In a 2X magnifier the focal length is approximately 5 inches (the lens thickness is a factor); in a 5X magnifier it is 2 inches; and in a 20X magnifier it is 1/2 inch.

Field of View

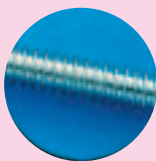
Field of view is the size of the area that can be seen at any one time. In a magnifier, a number of things influence the field of view: the diameter of the lens for instance. However, the power of magnification primarily determines the size of the field of view—the higher the power the smaller the field of view.

Depth of Field

Depth of field is the distance that you can move a magnifier toward or away from an object and still have the object in focus. It also refers to the depth of the area in front of or behind the viewed object that can be seen clearly. Like the field of view, the depth of field has an inverse relationship with the power of magnification—the higher the power the shorter the depth of field.

Field of View

The Higher the Power, the Smaller the Field of View



2X

Here is a 6-32 button-head machine screw, 1 1/2" long, as seen through a 2X magnifier. Working distance is about 5 inches.



10X

With a 10X glass only a few of the screw threads are visible. Here the lens must be held less than an inch away.



20X

Field of view with a 20X lens is very restricted. Working distance now is only about 1/2 inch.

Notice, too, that the depth of field decreases as the power increases.

Size in a Magnifier

The Stronger the Power, the Smaller the Lens

Although the refractive index (light-bending power) of the glass or plastic is a factor, it is primarily the curves of the lens that determine the power of the magnifier. And the radius of the strongest curve physically limits the width of the lens. Low-powered lenses have shallower curves with longer radii than high-powered lenses, and consequently can be larger. As is evident in the diagram, it is possible to have a much wider lens in a magnifier with a one-inch radius curve than in one with a half-inch radius curve.

