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Photo Equipment Buying Guide

Lenses

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What to Look for in a [Wide Angle or Wide Zoom Lens](#)

First let's define "wide angle". As a rule, wide angle lenses are classified and chosen based on their angle of view. The field of view of normal human vision is approximately 53 degrees. Allowing for some variation, we generally say that any lens with an angle of view wider than 40 degrees is considered wide angle. In extreme cases, a [fisheye lens](#) may have a 180 degree angle of view.

There are two types of wide angle lenses:

1. Rectilinear, in which straight lines appear straight.
2. Non-rectilinear, in which straight lines may appear curved. This curved line effect, when the lines bow outward away from the center, is called barrel distortion. When they bow inward toward the center it is called pincushion distortion. Pincushion distortion is a defect and very rare among wide angle lenses. Both kinds of distortion are more pronounced with lines that do not pass through the center of the image frame.

Because rectilinear and non-rectilinear lenses render images so differently, it is very important that you determine what kind of picture you want to take with the lens. For example, architectural photography, including photographing room interiors, is a great use for a wide angle lens but generally demands that you use only a rectilinear lens.

Conversely, some people may specifically want to take advantage of the "fun house mirror" effect of a wide angle lens with noticeable barrel distortion such as a [fisheye](#).

Note that wide angle lenses typically have what is known as [flower petal type lens hoods](#). These are shaped the way they are to prevent the hood from cutting off the corners of the image. The size and shape of the hood must be matched to the lens and the hood must be attached properly for it to work right.

On some extreme wide angle lenses, the front glass element actually bulges out beyond the end of the lens housing. This makes it physically impossible to mount filters on such a lens. If you use (or sometimes plan to use) filters, take care to check for this.

Most people don't really need a constant aperture zoom but, if you feel you do, make note that very few wide angle zooms have a constant aperture. The few that do are typically at the very high end of the price range.

What to Look for in a Telephoto or Tele-Zoom Lens

Many people have different ideas about what constitutes telephoto so let's define it. The field of view of normal human vision is approximately 53 degrees. Allowing for some variation, we generally say that any lens with an angle of view narrower than about 65 degrees is considered telephoto. However, when most people think telephoto they think in somewhat more vague terms of how far away they can be from a subject and still make it prominent in the frame. Most often they use focal length as a proxy unit of measure.

Before we get to features, be aware of two types of defects found on some (especially less expensive) telephoto lenses:

- **Linear distortion**, in which straight lines may appear curved. (This curved line effect, when the lines bow outward away from the center, is called barrel distortion. When they bow inward toward the center it is called pincushion distortion.) Both kinds of distortion are more pronounced with lines that do not pass through the center of the image frame. Although barrel distortion may actually be a feature on a wide angle lens, in telephotos both kinds are considered defects.
- **Chromatic aberration**, sometimes called "purple fringing". This is when the edges around high contrast subjects may show a slight purple or green outline. It is caused by low quality glass or poor/damaged coating on the lens elements.

Telephoto lenses cover such a huge range that it's a little hard to generalize. In keeping with industry tradition, let's break them into subcategories of medium telephoto, telephoto and super telephoto. Variation in sensor sizes on digital cameras takes away the universality of measure that was once common with 35mm film so we have to be a little arbitrary in what focal length ranges we assign to each subcategory.

Medium Telephoto (70mm-150mm) lenses typically will not have tripod collars. For obvious reasons, they tend to be the smallest and lightest of all telephoto lenses. For systems with in-lens image stabilization, most will not offer IS on prime medium telephotos, though they may on zooms that extend into the standard telephoto range. Lenses in this range, especially primes, tend to have the fastest maximum aperture. The fastest among these will have apertures in the f1.8 to f2 range. Most zooms will have a variable aperture, with a smaller f-number at the wider end of the range. Lenses in this range are best for portraiture from a distance and small field sports. These lenses may be useful in zoos and wild animal parks but not so much with animals in the wild. Working distance typically ranges from one to three car lengths.

Telephoto (150mm-290mm) Standard telephotos mark the upper end of affordability for most people. These zooms will have plenty of reach for everyday shooting. About half will have rotating tripod collars to move the center of balance of the camera-lens combination under the lens and provide better handling. Systems which use in-lens IS will offer at least

one stabilized lens in this range, though they may also offer a non-stabilized version as well. These lenses are excellent for sports which cover a large field (equestrian events, auto and motorcycle racing, etc.) and for animals in the wild. Birds and very small animals at a distance may be pushing the bounds of these lens' capabilities. Typical working distance for lenses in this group ranges from 3-4 car lengths to 2-3 city blocks.

Super Telephoto (300mm and up) Lenses in this subcategory are typically beyond both the means and the everyday needs of most people. Many lenses in this grouping cost as much as an inexpensive car. (For affordability, consider renting. See our guide to renting photo equipment.) Expect marginal quality from the more affordable lenses in this group. Nearly all will have rotating tripod collars. Use of a tripod or other solid support with these lenses is recommended. Super telephoto lenses usually come with their own carrying cases and frequently include accessories such as filters. Lenses in this category are all but unusable at distances closer than about 3 car lengths and they really excel at much longer distances.

What to Look for in a Macro Lens

First, know that not all "macro" lenses are created equal. A true macro is always a prime (single focal length) lens, never a zoom. There are many zoom lenses which claim to have macro capability. What this means is that they have some close focusing ability. It may be useful to start by defining the terms.

Close-up photography is the hardest to define. As noted above, some zooms claim to be macro zooms but the key thing here is that the subject is recorded smaller than life-size. This is easiest to understand if you think of film photography. Let's say you take a picture of a bug. After developing the film, you lay it on the table and that very same bug you just photographed crawls across the film. If the image of the bug on the negative is smaller than the actual bug crawling across the film, then the image is properly called a "close-up".

Macro technically refers to close-up photos where the subject is captured at a magnification of 1:1 or greater. Using the film example above, if the image on film is equal to or larger than the size of the actual bug, it is a true macro. Most people who are not too hung up on the technical definition of the terms, and especially most marketers who just want to sell you something, tend to use close-up and macro more or less interchangeably.

Micro photography is a highly technical subcategory in which the subject is photographed through a microscope. As a rule, the subject will be at least four times life size on the film.

(Special note: [Nikon](#) tends to call its macro lenses “[micro lenses](#)”. This is a naming distinction only. They still fall into the macro category.)

All of the above standards apply equally to digital but are harder to measure because you can't see the actual image chip inside the camera. Digital images can only be seen through an interpreter such as computer software or the software driving your camera's LCD screen. You can never be sure whether or not the interpreter has magnified or shrunk the image from its actual, native size.

Now that we know the three basic classes of so-called macro lenses, the battle is all but won. [Macro lenses](#) are always marketed on the basis of their **magnification ratio**. So a 1:2 lens will be able to reproduce a subject at up to one half life size. A 1:1 lens will reproduce a subject at life size. Some so-called macro zooms only go to 1:4 or even 1:5.

Dedicated macro lenses are almost always sharper than comparable regular lenses. They also almost always have **slower maximum apertures**. For example, it's relatively common to find a 50mm f1.4 or f1.8 regular lens. A 50mm macro lens will generally have f2.8 or even f3.5 as its maximum aperture.

Macro lenses may come with [extension tubes](#). Extension tubes do not contain glass, so there is no loss of image quality. Their sole purpose is to move the lens farther from the

camera body, thus increasing image magnification. There are a couple of variations to these:

- [fixed extension tubes](#)
- [adjustable bellows](#)

Fixed extension tubes will generally maintain all electrical and/or mechanical connections between body and lens. Bellows often will not.

A good rule of thumb when shopping for any lens is the **thread size** on the front of the lens. Having all your lenses with the same barrel diameter means you can use one set of filters and lens caps to share across all your lenses. If the barrel size is smaller, you can buy an inexpensive [step-up ring](#) to adapt the filters and caps. If the lens is larger, it may not be possible to [step down](#), thus necessitating buying new filters for the new lens.

Autofocus actually isn't as big a deal with macro as it is with other kinds of subjects. When dealing with close-up subjects, it's often best to focus by physically moving yourself back and forth. Fractions of an inch are often all that's needed. There are some high quality manual focus lenses still around from old film systems. These lenses may be had for less than newer current-production lenses and can often be adapted to work on modern digital cameras. (Just be sure to read the section on what to look for when buying a used lens first.)

What to Look for in a Prime Lens

A prime lens is one that does not zoom. As a rule, prime lenses are:

- lightweight
- fast (in terms of aperture)
- inexpensive
- high quality

Assuming you are buying a new lens (otherwise you should review the section on buying used lenses), the two biggest things to look at are **focal length** and **maximum aperture**.

Prime lenses can come in any fixed focal length from 8mm fisheye to beyond 400mm super telephoto. Most popular are the so-called "nifty fifty" 50mm lenses that were once all but universal with 35mm film cameras.

If you already have a zoom lens that covers the range you are thinking of for a prime, that will make the focal length decision much easier. Pick a focal length you think you might be interested in, set your zoom to that length and do not change it. Spend some time taking the kind of shots you normally would to see if this is really the right length for you.

If you already have a large number of photos, there is a free program called [Exposure Plot](#) you can download and install which will evaluate the pictures you've already taken and

compile some aggregate statistics on them for you. Among those is focal length used. (Note that this program only works to analyze photos saved in JPG format with EXIF data intact.)

If you are looking to fill a gap in your current zoom range, it pays to consider what you want from a new lens. As a rule there are generally only **two reasons to favor a prime** lens over a zoom, especially when the focal length of the prime does not overlap with the zoom range already available:

- **length**, as in super telephoto for sports or wildlife.
- **speed**, as in fast aperture low-light shooting.

It's tempting to want to simply go for the fastest maximum aperture you can afford. In truth, **optical performance** has a great deal to do with lens design. When multiple variations of the same focal length are available, there may be cases where one of those variations is widely known to be optically inferior. Photographers love to talk about their equipment and many users in brand-specific discussion boards (i.e. Olympus, Nikon, Canon, Pentax, etc.) on [Flickr](#) or DPReview will be happy to chime in with their opinions or past experience with a given lens. These can be great places to find out if that 50mm f1.4 is really better than the 50mm f1.8 you are looking at. In the example just given, realize that there is less than 0.5EV difference between the two lenses. You would be hard-pressed to find a scenario in which a difference that small made the difference between being able to get a shot or not get it.

When selecting a prime super telephoto, it pays to really consider how much you will use it and whether you really need it. For occasional use, you would probably be better off [renting a lens](#). (Check out our guide on renting equipment first!) If buying, the most important thing is a **rotating tripod collar**. At the super telephoto range, even prime lenses are large and heavy. They completely change the center of balance on a camera-lens combination. Having a tripod collar on the lens moves the tripod closer to the new center of balance. The ability to rotate the collar keeps the camera and lens positioned directly over the tripod mount for greatest stability.

Specialized Lenses

There are a couple of categories of specialized lenses you might be considering.

- [Creative Effects lenses](#), such as Lensbaby
- [Tilt-Shift or Perspective Control](#) lenses

Both are highly specialized lens types. Lensbabies are somewhat popular in a kitschy way, though their effect can get tiresome quickly.

Perspective control lenses are often rather expensive for their focal length. They are used mostly in architectural photography to maintain straight lines and avoid camera tilt.

What to Look for in a Used Lens

A camera lens may seem like more or less “a unit”. We all know there’s stuff inside the lens but many are surprised when confronted with how many things there are to evaluate when purchasing a used, and potentially abused, lens. To wit:

1. No scratches on front/rear glass elements.
2. Multi-coating, especially on front lens element, is clear and essentially invisible. Cloudiness, scratches, chipping, flaking or a rainbow pattern are all signs of the lens having been cleaned too aggressively or with a solvent that has compromised the coatings.
3. No fungus inside lens.
4. Aperture blades:
 - work smoothly
 - clean
 - oil-free
5. Focuses smoothly
6. Zooms smoothly
7. Zoom does not “creep” when pointed up or down
8. Mounts smoothly to camera
9. AF works without undue noise

10. Filter threads:
 - are clean
 - not stripped or cross-threaded
11. Both caps are included
12. Tripod mount (if so configured):
 - rotates smoothly over the full extent of its range
 - locks firmly
 - tripod mount threads are not stripped or cross-threaded
13. Lens hood (if included):
 - locks on securely
 - is not dented
 - is not scratched on the inside (can cause reflections)
 - does not darken image corners (it's the right hood for the lens)
14. Electrical contacts:
 - not oily
 - not dirty
 - not dented or damaged

15. Mechanical contacts:

- not dented or damaged
- not missing
- move smoothly
- return smoothly

16. Switches:

- operate as expected
- perform the function expected of them

17. Mounting flange:

- not dented, cracked or damaged
- is the proper one for your camera or adapter
- is not dirty or oily

Test the lens! With the lens mounted, take the following photos of any high contrast full color subject with lots of fine detail (a bookshelf full of books or toys works well):

- maximum aperture, widest zoom, lens hood mounted
- maximum aperture, widest zoom, lens hood not mounted
- maximum aperture, longest zoom
- minimum aperture, widest zoom, lens hood mounted
- minimum aperture, widest zoom, lens hood not mounted
- minimum aperture, longest zoom
- f8, widest zoom, lens hood mounted
- f8, widest zoom, lens hood not mounted
- f8, longest zoom
- pointing directly at very bright light
- positioned so that very bright light is shining on the side of the lens, where it mounts
- turned around so the light is shining on the opposite side of the mount

Look at all the photos (zoom in if using your camera's LCD) to look for:

- ✓ misfocus
- ✓ dark corners/vignetting
- ✓ softness
- ✓ chromatic aberration
- ✓ flaring
- ✓ light leaks

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