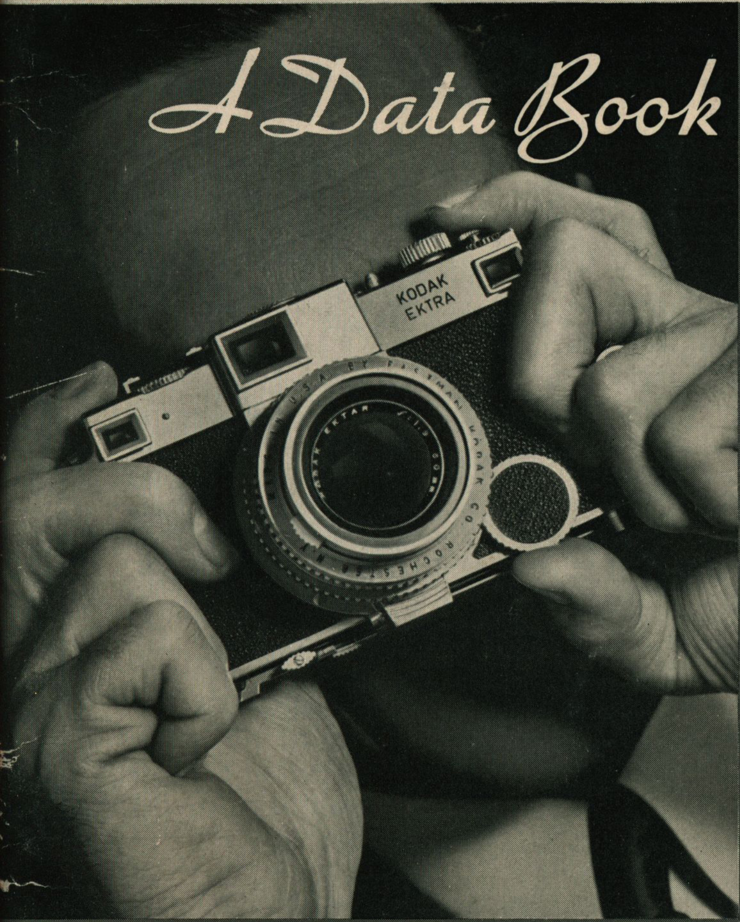
Kodak

LENS MANUAL

A Data Book ON THE USE OF



KODAK

and

CINÉ-KODAK

LENSES

RANGE FINDERS

SHUTTERS

35¢

EASTMAN KODAK COMPANY, ROCHESTER, N. Y.

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KODAK LENS MANUAL

A Data Book on the use of
Kodak and Ciné-Kodak Lenses, Range Finders, and Shutters

MODERN photography finds ever wider application in specialized and technical fields on the part of both the professional photographer and the serious hobbyist. This has led to greater emphasis on the correct and accurate use of the most important part of the camera—the lens. Higher standards in picture quality, the extended practice of color photography, the greater interest in picture taking at all times regardless of adverse light conditions, and increased activity in photographing small objects—all this demands more attention to such matters as lens correction, lens definition, exact focus, effective lens aperture, depth of field, proper use of supplementary lenses, etc. The excellence of a lens or shutter alone will not necessarily assure precise results; their properties must be fully understood and correctly applied.

This data book presents information on the best and most versatile use of lenses, supplementary lenses, range finders, and shutters. Its purpose is to aid the photographic worker to utilize these vital parts of his equipment to the fullest extent of their capabilities. Pertinent data for each Kodak lens, such as depth of field and field size tables, are presented in the specification section. Optical formulas are included for the convenience of those faced with special problems.

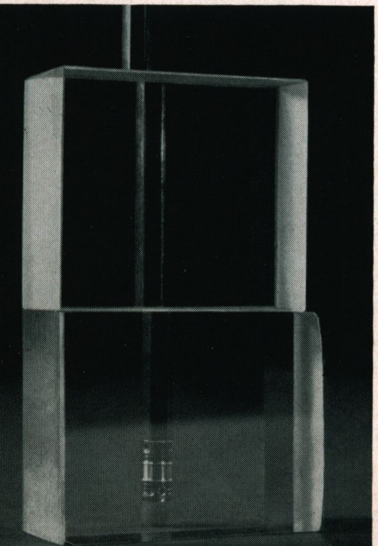
The real value of lenses, range finders, and shutters can be best judged by their performance. On this basis, Kodak products hold an unexcelled position in the particular field for which they are designed. The outstanding position of the Eastman Kodak Company among the world's manufacturers of lenses and shutters is due to the long experience and great skill of its experts and to efficient and accurate production methods.

A Century of Lens Making and Kodak's Contributions

MODERN photography represents more than 100 years of progress, to which optical design and manufacturing have made notable contributions. The earliest photographs were made with single and doublet lenses having an aperture of about $f/14$. Faster lenses, that is, those having larger apertures, were an early aim, and in 1840, a lens with the remarkable speed of $f/3.5$ was designed. Excessive astigmatism, lack of a sufficiently wide angle of view, and lack of flatness of field made this type of lens suitable only for portraits. In 1866 the search for a landscape lens with a wider angle of view produced an $f/8$ rapid rectilinear type of lens, in which speed was sacrificed for other desirable qualities. The discovery of barium crown glass—1886—gave the lens designers new means for improvements, especially in respect to increased flatness of field and reduced astigmatism. Lenses corrected along these lines were generally called "Anastigmats." During the early part of this century, the quality of anastigmats was improved by concentrating on the better designs and by a slow but steady progress in the degree of corrections attained.

KODAK AS A LENS MANUFACTURER

IN 1912, the Eastman Kodak Company started to make lenses of the simple type. Soon thereafter, with the "Kodak Anastigmat," it joined the efforts of the optical industry to supply the growing demand for lenses. Through production in quantities, Kodak has been able to bring better and faster lenses within the reach of every camera enthusiast. Today, in its modern factories staffed by experts, this company makes a wide range of photographic objectives: lenses for box cameras, lenses for Kodaks and Ciné-Kodaks, and lenses for the professional photographer. Many types of projection and enlarging lenses are also made. In addition, Kodak makes lenses for specialized purposes, of which aerial lenses for the U. S. Army and Navy are one example.



● The upper block is "crown glass," the type heretofore most satisfactorily combining high refractive index with low dispersion. The lower block is Kodak's new glass. The position of the pencil's image shows the greater ability of the new glass to refract light.

KODAK INTRODUCES SURFACE-TREATED LENSES

1940 saw the application of a new method to improve lens performance under certain conditions: inner air-glass surface treating. Air-glass surfaces normally reflect a small part of the light entering them. This reflected light does not disappear; some of it is reflected again when striking an opposite lens surface, and part of it eventually reaches the film. The more surfaces, the greater the total reflection, hence treatment is generally applied only to certain lens types with numerous air-glass surfaces. An extremely thin coat of a substance containing a fluoride reduces these reflections materially and produces black-and-white negatives of superior clarity of detail, especially in the shadow areas, and color transparencies of greater color purity. The possibility of flare and ghost images in pictures taken against light is greatly reduced. Under certain conditions, lens treating adds to the effective speed of the lens.

KODAK PRODUCES A BASICALLY NEW OPTICAL GLASS

KODAK'S new rare-element type of optical glass, made from compounds of tantalum, tungsten, and lanthanum, contains no silica, heretofore the basic component of optical glass. It has a high refractive index (the power to bend a beam of light), combined with low dispersion (spreading of the individual colors), which has not previously been available in optical glass. It gives to Kodak's lens designers a new medium with which to produce better lenses. While this unique optical glass has found its first extensive use in the making of aerial lenses, it is expected that eventually it will help to make even finer Kodak lenses for the most exacting work.

● Addition to Kodak's lens factory, the Hawk-Eye Works, in Rochester, N. Y.

Properties, Performance, Use of Lenses

Focal Length: A fundamental characteristic of any lens is the focal length. This controls the image distance and size, and ordinarily determines the usable negative size. The focal length is approximately the distance from the lens to the image of a distant object. Methods of finding focal length and the relation between it and subject and image distances are given on pages 62 and 63.

Photographic Perspective: Human eyes see in three dimensions, but a lens reproduces a view in two dimensions only. The missing dimension, depth, is suggested mainly by the relative size and position of the various objects in the picture. The relation of these objects, or perspective, and therefore the naturalness of the picture, is influenced by the position of the camera. A camera position too close to the subject results in an exaggeration of the parts nearest the lens.

Correct perspective in the final picture depends largely upon the distance at which it is viewed. Contact prints should be viewed at a distance equal to the focal length of the lens with which they were made. Enlargements require a viewing distance equal to the camera lens-focal length times the number of diameters of enlargement. This usually results in a viewing distance more convenient to the eye than the one most desirable for contact prints, which is rarely practical, with the result that enlargements seem to convey an improvement in naturalness. For pictures projected on a screen, the correct viewing distance is equal to projector-screen distance multiplied by the ratio of the focal length of the taking lens to that of the projection lens. It is natural, however, to view any picture at a distance convenient to the eye when looking at it as a whole. Only if this results in a departure by more than a factor of 2 from the correct viewing distances, is the rendering of perspective affected.

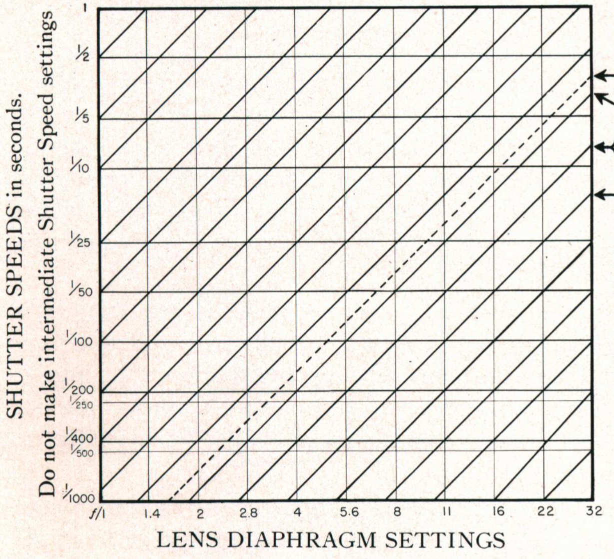
The best balance between normal perspective in the picture and compact still camera design calls for a focal length slightly greater than the picture diagonal. Lenses with a focal length shorter than this are known as wide angle, while long focus lenses, such as the telephoto type, exceed the diagonal considerably in focal length.

Lens Diaphragm and Its Markings: While slower lenses have a fixed opening or a series of apertures in a movable slide or disk, faster lenses have an adjustable opening to vary the amount of light passed. The size of this opening is indicated by a diaphragm scale, generally marked in *f*-numbers. Each *f*-number is the focal length divided by the effective diameter of the diaphragm. These numbers are related to light intensity at the image plane and permit common exposure recommendations for lenses of all focal lengths. The f-numbers 1.4, 2, 2.8, 4, 5.6, 8, 11, 16, 22, 32 indicate a decrease in exposure from one to the next by two times. The relation between these diaphragm numbers and the normally encountered shutter speeds can be determined from the chart shown below. For an average lens at $f/8$, the illumination of the image in foot-candles is about 1/700 of the subject brightness in foot-lamberts.

The Effective *f*-Number for Extreme Close-ups: In making such pictures, the image distance no longer approaches the focal length; hence the *effective* f-number will be higher than indicated. This is especially important in color photography and in copying. The formula for computing the effective f-number is given on page 63, or the exposure modification can be determined with the "Effective Lens Aperture Kodaguide" (*see page* 17) on sale at Kodak dealers.

CHART SHOWING RELATION OF DIAPHRAGM SETTINGS TO SHUTTER SPEEDS

How to use: *If, for example, conditions call for* 1/25 *sec. at f/*8 *and for stopping motion* 1/400 *sec. is desired, follow diagonal line from intersection of respective horizontal shutter speed line and vertical f/ line to where it crosses* 1/400 *sec. line and read f/ value. Answer: f/*2. *If exposure of f/*4 *at* 1/100 *sec. is correct and to gain depth of field about f/*16 *is desired, follow proper diagonal until it about intersects desired f/ number line. Answer:* 1/5 *sec., since no intermediate shutter speed setting can be made, with diaphragm halfway between f/*16 *and f/*22.



Intermediate settings can be made with iris diaphragms

APPROXIMATE DIAPHRAGM SETTING for Average Subjects in Direct Sunlight with

- Kodachrome Film
- Panatomic-X Film
- Plus-X and Verichrome Film
- Super-XX Film

can be read off at any intersection of respective film-type diagonal with shutter speed lines. If necessary, use an intermediate diaphragm setting.

CORRECTIONS IN PHOTOGRAPHIC LENSES

A SINGLE convergent lens can be used to form an image, which will, however, be found to suffer from serious defects due to lens aberrations, especially when used at full aperture. Kodak lens designers and lens makers use every means known to optical science to eliminate these aberrations entirely, or reduce them to a degree consistent with good performance. Some of the inherent shortcomings of lenses which are corrected in Kodak objectives to make them meet the exacting demands of modern photography, are briefly listed. Those interested in further details should consult a good textbook on optics.

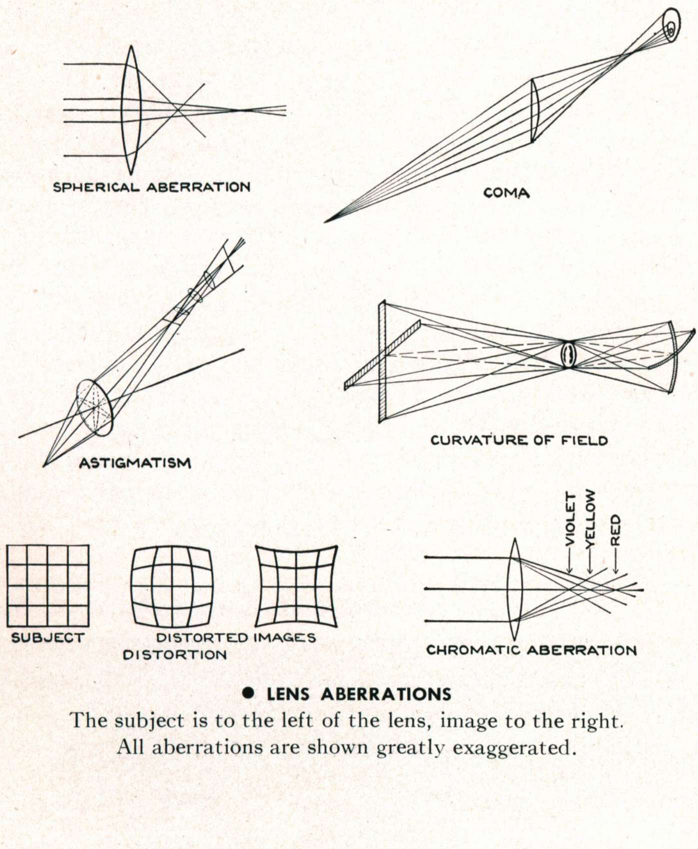
Spherical Aberration: In the case of a simple lens with spherical surfaces, the rays coming through the central portion of the lens and the rays coming through an outer zone do not converge at the same distance from the lens. As a result, a point is imaged as a blur. The aberration is due to the fact that spherical surfaces are used on the lens, and is, therefore, called "spherical aberration." The effect of a small amount of this aberration on the image of an extended subject is to cover it with a haze of light. If present in large amounts, spherical aberration will spoil the contrast and crispness of definition almost uniformly over the whole field. As the magnitude of this aberration usually rises rapidly with increased lens aperture, it becomes progressively more troublesome and harder to eliminate as the speed of the lens is increased.

Coma: Coma is a kind of lateral spherical aberration. In spherical aberration itself, the various zones of a lens suffer from a longitudinal difference of focus for rays parallel to the lens axis. Coma affects the rays not parallel to the axis. When coma is present, these oblique rays passing through the various zones converge at different distances from the center of the image, so that a single point in the subject is imaged as an arrowhead or other shape usually pointing toward the center of the field.

Astigmatism: In this aberration, a single point in the subject is imaged not as a point but as two short, mutually perpendicular lines at different distances from the lens. The distance between the lines is a measure of the astigmatism present in the lens. Neither coma nor astigmatism exists at the center of the picture, or in other words, on the axis of the lens.

Curvature of Field: The field of a lens is the imaginary surface where the image of the subject is brought to focus. The field of a simple lens is not flat, but concave or saucer-shaped. As a result, a flat subject at right angles to the lens axis is brought to focus not in a plane as would be desirable for recording the image on a flat film, but on a concave spherical surface. Curvature of field is present in single lens cameras, and, in order to provide a satisfactorily sharp image over the entire picture area, the film is placed at the distance for best average focus, and a small relative aperture is used to increase definition and depth of focus. In some simple-lens cameras, the film is held in a curved position, approximating the concavity of the lens field.

Distortion: In the case of distortion, the magnification varies from the center of the picture outward. This results in a distortion of the image and causes a square object to be imaged as either a barrel-shaped or a pincushion-shaped figure. When distortion is present, a straight line running across the center of the picture remains straight, but straight lines lying in the outer parts of the image field are bowed.



● **LENS ABERRATIONS**

The subject is to the left of the lens, image to the right.
All aberrations are shown greatly exaggerated.

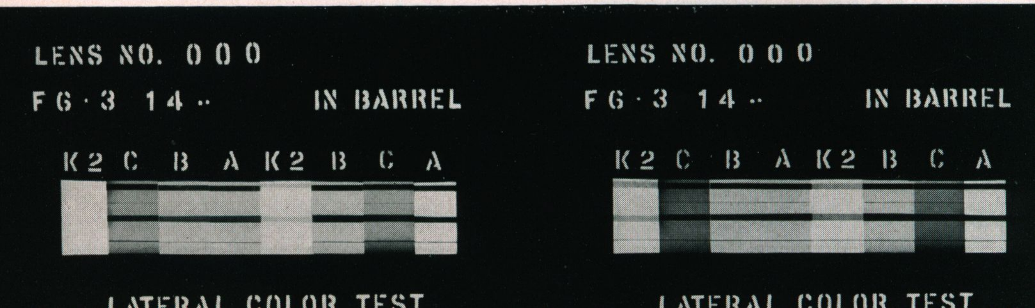
Chromatic Aberration: Because the degree of refraction or bending of a ray of light upon entering or leaving a glass surface varies with the color of the light, every property of a lens depends on color. Thus the axial position of the image itself changes slightly with the color or wave length of light; this effect is known as axial or longitudinal chromatic aberration. Fortunately, it is possible to reduce this defect greatly by using the proper combination of two or more different kinds of glass in a lens.

Lateral Color: The varying degrees of refraction of different colors can result in another aberration known as "lateral color" or chromatic differences of magnification. This can occur in a compound lens even though the lens may be corrected for the chromatic aberration as described above. In the case of lateral color, while all the color images may be focused in the same plane, the equivalent focal length of the lens varies slightly from one color to another; this results in differences in magnification of the respective color images. If present, this aberration results in colored fringes surrounding the images in the outer parts of the field. In black-and-white photography, these colored fringes appear as a slight blur or fuzziness, but in color work, especially if the lens is used in an enlarger, colored fringes may show up very badly. This aberration, like distortion, is not reduced by stopping down the lens.

Methods of Correction: In Kodak lenses corrections are accomplished by the careful selection of optical glasses, by the proper choice of lens thicknesses, curvature of the various surfaces, and spacing between lens elements. Considering that the aberrations must be eliminated or reduced simultaneously, that the types of optical glass are limited, and that physical considerations limit the number of lens elements, the task of lens designing becomes more and more apparent.

To carry out correction to a practical working degree, a certain number of lens elements are needed—generally three or four, as in the case of medium aperture Kodak Anastigmats. Lenses with higher aperture or wider angle of view generally call for a greater number of elements in order to obtain the corrections.

● Test exposures made with Eastman Ektar *f*/6.3 lenses. The test to the left was made with a lens deliberately thrown out of adjustment to illustrate the effect.



Definition at Various Apertures

THE term "definition" refers to the ability of a lens to form a clear image of fine detail. Not even a theoretically perfect lens would be capable of imaging a point source of light as a geometrical point. All practical lenses image such a point as a small blur which changes in character with the change of lens aperture. In addition to reducing speed and increasing the depth of field, decreasing the lens aperture improves definition, as it removes the small amount of haze caused by residual aberrations. This also results in a slight increase in image contrast. As a general rule, the best compromise between maximum definition and speed is made by closing down the diaphragm from wide open about two stops for moderately fast lenses, such as *f*/4.5's, and about three stops for ultra fast lenses.

The wave nature of light sets a limit to the increase in definition as the aperture is closed down. A beam of light passing through an aperture does not continue unchanged, but spreads slightly at the aperture edge in a manner similar to the spreading of water waves after passing through a small opening in a breakwater. The smaller the opening, the greater the spreading. This diffraction may begin to influence definition unfavorably as the minimum aperture is approached. If maximum definition, regardless of lens speed, is desired, it may be advisable to use a diaphragm setting one to two stops away from the minimum.

Enlarger lenses used at their smaller lens apertures may limit print definition in extreme enlargements due to the diffraction effect mentioned. This limit is seldom reached in ordinary work.

Good lenses will perform satisfactorily at all stops provided. However, for extremely critical work, especially with ultra fast lenses and those of short focal length, it is well to take the above two factors influencing definition into consideration.

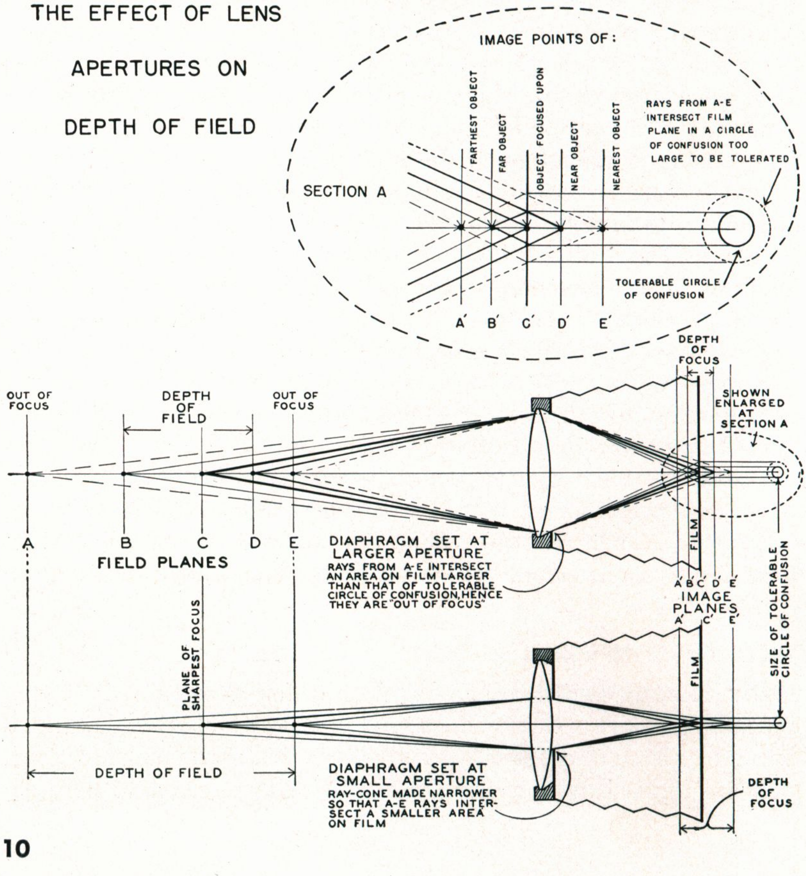
It must be stated that in general photographic work, these small changes in performance with varying lens apertures are of little consequence. Their effects on definition are generally smaller than those due to slight errors in focusing and slight camera movement.

CIRCLE OF CONFUSION AND DEPTH OF FIELD

THEORETICALLY, when a lens is focused for a certain distance, objects at that distance only are sharp. Objects at all other distances are more or less out of focus, and points outside of the plane focused upon are imaged as blurred circles which are referred to here as "circles of confusion." The farther the points are from the plane focused on, the larger the circles of confusion and the greater the out-of-focus effect. The size of the circle of confusion which appears to the eye as a point and therefore is accepted as tolerable is not a mark of lens quality, but is purely a mathematical value chosen for the purposes of computation.

For critical definition or sharpness, the circle of confusion *in the print* should not be larger than about 1/100 inch, if the print is to be viewed at the normal viewing distance of 10 inches, or, on an angular basis, the circle of confusion should not subtend more than two minutes of arc at the eye when the print is viewed for correct perspective (i.e., viewing distance equal to the focal length of the camera lens times the amount of enlargement, if any). When the circles of confusion exceed these limits, they appear to the eye as small blurs rather than points, and details within the image no longer appear sharp.

THE EFFECT OF LENS APERTURES ON DEPTH OF FIELD

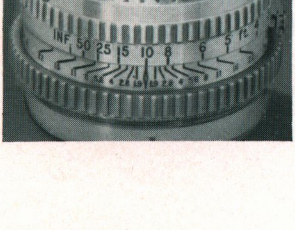


"Depth of field" of a lens refers here to the range of distances on the near and far sides of the plane focused upon, within which details are imaged with acceptable sharpness in the final print when observed from a normal viewing distance. Depth of field increases with increasing subject distance, decreases with increasing relative aperture, and increases with decreasing focal length, other things being equal.

In addition to the factors mentioned above, the depth of field for any lens is dependent upon the size of the circle of confusion which is considered as acceptable. In computing the depth of field for Kodak lenses, a circle of confusion of 1/200 inch is used for folding Kodaks, 1/500 inch for miniature Kodaks, and 1/1000 inch for 16-mm. Ciné-Kodaks, and 1/2000 inch for 8-mm. Ciné-Kodaks. For the Kodak lenses intended for commercial, press, portraiture, and studio work, a circle of confusion of 2 minutes of arc which is equal to approximately 1/1720 of the focal length is used in computing the depth of field. This is a smaller circle than is usually used in computing depth of field tables for such lenses and is for critical definition when the print is viewed for normal perspective. At the limits of the range of sharpness, the circles of confusion are of the above dimensions, and between the limits, the circles of confusion are smaller. In the plane focused upon, these circles are a minimum.

Depth of field tables for a number of lenses are given in the Lens Specification Section. Formulas for computing depth of field are on page 65.

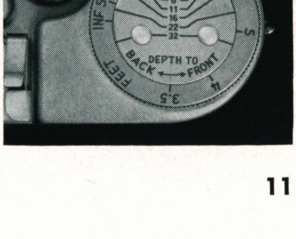
Depth of Field Indicators: Some cameras have depth of field indicators which show the approximate depth of field at various distances and lens apertures. The illustration on the left shows a depth of field indicator as part of the focusing scale. At the setting shown it indicates, for example, that at $f/8$, subjects from about 7 feet to 19 feet from the camera will be acceptably sharp. The right hand illustration shows an auxiliary type of depth of field indicator. The distance focused upon is brought opposite the index mark and the depth of field can be read off for the various lens openings. Controlled depth



DEPTH OF FIELD INDICATORS:

← As part of the Focusing Scale.

Auxiliary → Type of Indicator.



of field will not only help to emphasize or subdue fore- and background: it will help to avoid "wasting" depth of field. The following example will illustrate this: The subject is 50 feet away; exposure conditions call for $f/11$. If, instead of focusing at 50 feet, the indicator dial is turned until "infinity" comes to the $f/11$ line, the index mark is at 22 feet, and the gain in foreground sharpness is an additional 6 feet. The camera is, therefore, focused for 22, not 50 feet. For practical purposes, the sharpness of the subject is still acceptable.

Lens Performance in Color Photography: The ever-increasing interest in color photography has brought more emphasis on the color corrections of photographic lenses.

Kodak lenses of recent and present manufacture, according to their intended purposes, are adequately color corrected. The critical user can, however, test any lens for sufficient lateral color correction* in the following manner: A test object of white threads should be arranged against a black velvet drop. These threads should be well illuminated, placed to fill the picture area, and critically focused on the camera ground glass. An image of a thread, close to one edge of the ground glass and parallel to that edge, should be examined carefully. If color fringing is apparent, the lens is not satisfactory for exacting color work. Kodachromes made only for ordinary viewing require less exacting lens performance.

If a lens is to be used for extremely critical work, a more rigorous test can be made photographically with the same subject, as follows: Three exposures should be made on panchromatic plates, such as Eastman Tri-X Panchromatic Plates, Type B, with Wratten tricolor gelatin filters (cemented or glass filters should not be used for this test). These plates should be developed to low contrast, fixed, washed, and dried, as usual, and a contact positive on glass from one of them made on another plate; the positive also should be developed to a low contrast. This contact positive should be placed emulsion-to-emulsion with each of the other two negatives over an illuminator to see if the thread images coincide exactly. One of the test plates can be used to check the performance of the enlarger lens, if enlarged separation negatives are to be made, by focusing the enlarged image critically on the easel, then examining it for color fringing. If there is only a slight departure from register, definition may nevertheless be satisfactory for many types of work, and the lens can be tried on a typical subject.

*Insufficient correction causes color fringing in Kodachrome transparencies, or lack of register in color-separation negatives.

DEFINITION AND CAMERA TECHNIQUE

Poor definition and lack of sharpness in negatives are more often due to faults in camera handling, in particular focusing errors and camera motion, than to lens quality.

Focusing for Visible Light: As the subject-to-lens distance is reduced the lens-to-image distance has to be increased. With lenses of comparatively short focal length and small aperture as used on Brownies and inexpensive Kodaks, the depth of field is sufficiently great to cover the range of distance normally used for picture taking. With faster lenses the depth of field is more limited and focusing is necessary. With cameras provided with ground glass or coupled range finder focusing, this operation is simple and exact. Cameras provided with scale-focusing require an ability to estimate distances rather closely. For all close-up work and when working at maximum lens apertures with fast lenses, the distance cannot, as a rule, be estimated with sufficient accuracy, and should therefore be measured by a ruler or with the help of a range finder such as the Kodak Service Range Finder.

Focusing for Infrared Light: Focusing a lens by ground glass, range finder, or distance scale setting, produces sharp pictures only with visible light. Infrared light rays, due to their longer wave length, focus in a different plane from visible light rays. Some focusing scales provide a special focusing mark to be used when taking infrared pictures. For certain Kodak lenses, the correction is given in the specification sheet. These corrections are workable averages. As a general rule, better infrared pictures are obtained if the lens is extended by about ¼% of its focal length after it has been focused for visible light. To attain additional sharpness, the diaphragm should be closed down as much as possible.

Camera Motion During Exposure: Small cameras are not held sufficiently steady by the average person for longer than 1/50 to 1/100 second, nor large hand cameras for longer than 1/25 second. At slower shutter speeds the use of a good tripod eliminates camera motion. A shutter speed of 1/50 second is recommended for large hand-held cameras, and 1/50 or preferably 1/100 second for small cameras, if light conditions permit. To release a shutter properly, a s-l-o-w, "trigger squeeze" finger movement should be used without moving the rest of the hand. Holding the breath at the instant of exposure often helps to avoid camera motion.

KODAK SUPPLEMENTARY LENSES

Two series of Kodak supplementary lenses are available. They are the Kodak Portra Lenses, 1+, 2+, and 3+* and the Kodak Telek Lenses, 1−, 2−, 3−, and 4−. These lenses are supplied as units of the Kodak Combination Lens Attachments, a series of combinable accessories which also includes filters, Pola-Screens, and lens hoods. All supplementary lenses are shaped for best lens correction and are made and finished in the same manner as anastigmat lenses.

Kodak Portra Lenses are positive meniscus lenses and have three general uses.

1. When used with cameras which otherwise cannot focus for subjects closer than 3½ or 4 feet, the focusing range is brought to about 10 inches (with the 3+ lens) and the field size thereby reduced to about 5 x 7 inches. See Figure 1. With Ciné-Kodak lenses of normal focal length, focused at 2 feet and supplemented by a 3+ Portra Lens, the subject distance is 8¼ inches, and the field size about 2¼ x 3¼ inches. This permits copying, titling, and small-object photography. Such photography otherwise demands a considerably extended lens-to-film distance.

When the camera is focused, it must be fixed on a steady support. Unless the camera is equipped with a ground glass, focusing *must* be done by careful measurement, and the field covered, as given in the table, can be found roughly by disregarding the finder and sighting along the side of the camera. An alternative method of determining the field is to open the camera back *before loading*, place a ground glass or tissue paper across it, open the shutter, and observe the image. Lens-subject distances, field sizes, etc., are given on page 16.

2. The use of Portra Lenses with cameras having double-extension bellows makes possible larger images of small objects. See Figure 2. The image in some cases may be considerably greater in size than the object. The use of the 3+ Portra provides the greatest magnification.

3. Portra Lenses can be used on most cameras of the film-pack type to secure wide-angle effects, since the focal length of the combined camera and Portra Lenses is shorter than that of the camera lens alone. See Figure 3. The camera must be focused by means of the ground glass; the camera lens will be back of its usual infinity position. The stronger the supplementary lens, the wider is the angle.

* These figures are the power of the lens in diopters. A diopter is by definition $\frac{1}{\text{Focal length in meters}}$. Thus, a lens with a focal length of 1 meter (39.4 inches) has a dioptric power of 1. The + sign indicates a positive, the − sign a negative lens.

Kodak Portrait Attachments are low-power (¾+) meniscus lenses, especially suitable for close-up pictures of people. They are available for most Kodaks and for Ciné-Kodaks with fixed focus lenses.

Kodak Telek Lenses are negative meniscus lenses. They can be used only with cameras having double extension bellows or other means of extending the lens-to-film distance considerably, such as extension backs, extension tubes, etc., and focusing must be done on a ground glass. They make possible low-power telephoto effects and are useful in making informal pictures of children, pets, birds, and other subjects when it is impossible or undesirable to take the camera close to the subject. See Figure 4. The 4− lens gives the greatest effect.

Setting the Camera Focusing Scale for Portra Lenses does not depend on camera lens focal length, but primarily on the subject distance and power of the supplementary lens. The focusing scale settings are given in the table on page 16. They can also be found by the formula on page 64.

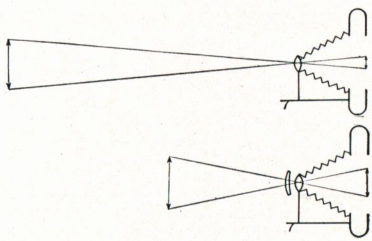


Figure 1. Portra Lens: Supplementary Positive Lens for close-ups at normal lens-to-film distance.

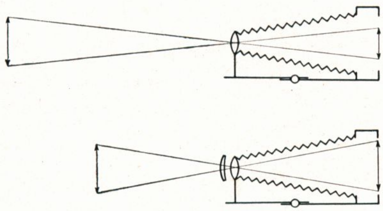


Figure 2. Portra Lens: Supplementary Positive Lens for larger pictures of small objects at extended lens-to-film distance.

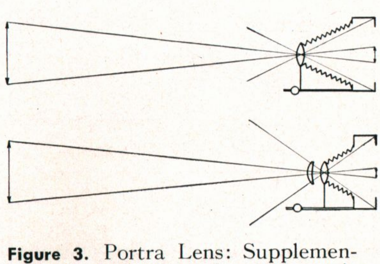


Figure 3. Portra Lens: Supplementary Positive Lens for wide-angle work at shorter than normal lens-to-film distance.

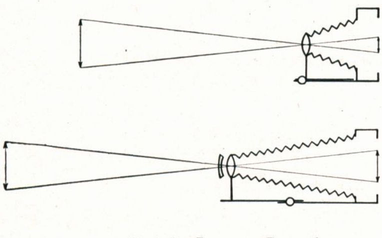


Figure 4. Telek Lens: Supplementary Negative Lens for larger images of distant subjects at extended lens-to-film distance.

Subject Distances with Portra Lenses

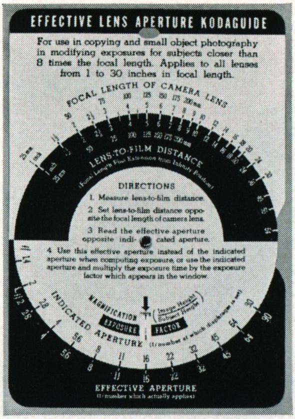
Distance from Supplementary Lens to Subject in Inches for Kodaks and Ciné-Kodaks

Focusing Scale Set At Feet	Kodak Portrait Attachment	1 + Kodak Portra Lens	2 + Kodak Portra Lens	3 + Kodak Portra Lens
Inf.	$52\frac{1}{2}$	$38\frac{3}{4}$	$19\frac{1}{2}$	13
50	$48\frac{3}{8}$	37	$19\frac{1}{8}$	$12\frac{7}{8}$
25	$44\frac{3}{4}$	$34\frac{3}{4}$	$18\frac{1}{2}$	$12\frac{1}{2}$
15	$40\frac{5}{8}$	$32\frac{3}{8}$	$17\frac{3}{4}$	$12\frac{1}{4}$
10	$36\frac{1}{2}$	$29\frac{5}{8}$	$16\frac{7}{8}$	$11\frac{7}{8}$
8	34	$27\frac{7}{8}$	$16\frac{3}{8}$	$11\frac{1}{2}$
6	$30\frac{3}{8}$	$25\frac{1}{2}$	$15\frac{1}{2}$	$11\frac{1}{8}$
5	28	$23\frac{3}{4}$	$14\frac{7}{8}$	$10\frac{3}{4}$
4	$25\frac{1}{8}$	$21\frac{5}{8}$	14	$10\frac{3}{8}$
$3\frac{1}{2}$	$23\frac{3}{8}$	$20\frac{3}{8}$	$13\frac{3}{8}$	10
3	—	$18\frac{1}{2}$	$12\frac{5}{8}$	$9\frac{1}{2}$
2	—	$14\frac{3}{8}$	$10\frac{1}{2}$	$8\frac{1}{4}$

Optical Data for Kodak Portra Lenses

	Kodak Portra Lenses		
	1 +	2 +	3 +
24 x 36-mm. Camera with 50-mm. Lens			
DEPTH OF FIELD AT $f/8$			
Distance Scale set at $3\frac{1}{2}'$	$18\frac{3}{4}'' - 22\frac{1}{4}''$	$12\frac{5}{8}'' - 14\frac{1}{4}''$	$9\frac{5}{8}'' - 10\frac{1}{2}''$
Distance Scale set at Inf.	$32\frac{1}{4}'' - 46\frac{1}{2}''$	$17\frac{7}{8}'' - 21\frac{3}{8}''$	$12\frac{1}{4}'' - 13\frac{7}{8}''$
APPROX. FIELD SIZE			
Distance Scale set at $3\frac{1}{2}'$	$9\frac{1}{4}''$ x $14''$	$6\frac{1}{8}''$ x $9\frac{1}{4}''$	$4\frac{1}{2}''$ x $6\frac{7}{8}''$
Distance Scale set at Inf.	$18\frac{5}{8}''$ x $28''$	$9\frac{3}{8}''$ x $14''$	$6\frac{1}{4}''$ x $9\frac{3}{8}''$
2¼ x 3¼-inch Camera with 100-mm. Lens			
DEPTH OF FIELD AT $f/8$			
Distance Scale set at $3\frac{1}{2}'$	$19\frac{3}{8}'' - 21\frac{3}{8}''$	$12\frac{7}{8}'' - 13\frac{7}{8}''$	$9\frac{3}{4}'' - 10\frac{1}{4}''$
Distance Scale set at Inf.	$34\frac{7}{8}'' - 43\frac{1}{2}''$	$18\frac{3}{8}'' - 20\frac{3}{4}''$	$12\frac{1}{2}'' - 13\frac{5}{8}''$
APPROX. FIELD SIZE			
Distance Scale set at $3\frac{1}{2}'$	$10\frac{1}{2}''$ x $15\frac{1}{4}''$	$6\frac{7}{8}''$ x $10''$	$5\frac{1}{4}''$ x $7\frac{1}{2}''$
Distance Scale set at Inf.	$22\frac{1}{8}''$ x $32''$	$11\frac{1}{8}''$ x $16\frac{1}{8}''$	$7\frac{1}{2}''$ x $10\frac{3}{4}''$
16-mm. Ciné-Kodak with 25-mm. Lens			
DEPTH OF FIELD AT $f/8$			
Distance Scale set at $2'$	$12\frac{3}{4}'' - 16\frac{3}{8}''$	$9\frac{5}{8}'' - 11\frac{5}{8}''$	$7\frac{3}{4}'' - 9''$
Distance Scale set at Inf.	*	$16\frac{7}{8}'' - 23\frac{1}{2}''$	$11\frac{3}{4}'' - 14\frac{3}{4}''$
APPROX. FIELD SIZE			
Distance Scale set at $2'$	$4\frac{1}{8}''$ x $5\frac{1}{2}''$	$3''$ x $4''$	$2\frac{3}{8}''$ x $3\frac{1}{4}''$
Distance Scale set at Inf.	*	$5\frac{5}{8}''$ x $7\frac{1}{2}''$	$3\frac{3}{4}''$ x $5''$
8-mm. Ciné-Kodak with 13-mm. Lens			
DEPTH OF FIELD AT $f/8$			
Distance Scale set at $2'$	$11\frac{3}{8}'' - 19''$	$8\frac{3}{4}'' - 12\frac{7}{8}''$	$7\frac{1}{4}'' - 9\frac{3}{4}''$
Distance Scale set at Inf.	*	$14\frac{7}{8}'' - 28\frac{3}{8}''$	$10\frac{3}{4}'' - 16\frac{5}{8}''$
APPROX. FIELD SIZE			
Distance Scale set at $2'$	$3\frac{7}{8}''$ x $5\frac{1}{8}''$	$2\frac{3}{4}''$ x $3\frac{3}{4}''$	$2\frac{1}{4}''$ x $3''$
Distance Scale set at Inf.	*	$5''$ x $6\frac{3}{4}''$	$3\frac{3}{8}''$ x $4\frac{1}{2}''$

*There is no advantage in using a Portra Lens 1 + on any of the Ciné-Kodak Lenses when the lens is focused at a distance greater than 4 feet, because the same field size can be obtained by using the regular lens without the Portra Lens 1 +.



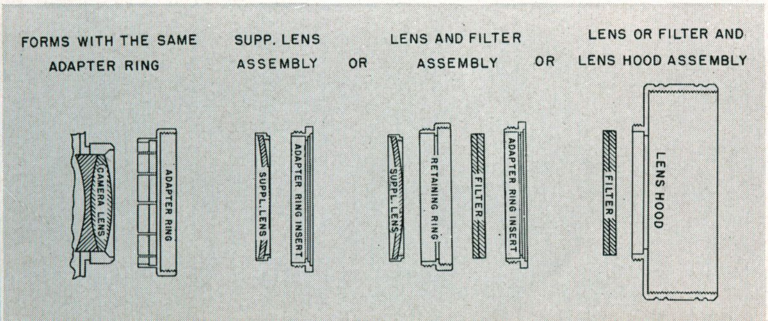
Effective *f*-Number: The Portra Lens reduces the effective focal length of the camera lens. As long as the lens combination is used at the usual lens-to-film distances, the indicated *f*-number applies for all general work. When the Portra Lens is used for wide-angle effects, there is a considerable increase in effective lens aperture. However, when the Portra Lens is used for extreme close-ups with extension bellows or backs or when Telek Lenses are employed, there is a considerable decrease in effective lens aperture. In both cases this must be taken into consideration. This can be done conveniently with the "Effective Lens Aperture Kodaguide" or by the formula given on page 64.

Size of Field is primarily dependent on subject distance and camera angle of view. It is also affected slightly by the separation between camera and supplementary lens; the values given in the tables are, therefore, approximations. Exact field size should always be found by ground glass focusing methods.

Depth of Field when using supplementary lenses is very shallow, a matter of fractions of an inch in many cases. It is, therefore, necessary to measure lens-to-subject distance accurately, and to set the focusing scale correctly. The depth of field at *f*/8 for minimum and maximum distance settings with Portra Lenses 1+ to 3+ on lenses of 4 different focal lengths is shown on page 16.

Supplementary Lenses and Definition: A supplementary lens introduces slight aberrations which increase with aperture and focal length of the camera lens and with the power of the supplementary lens. For practical purposes, definition is restored by using small apertures. A supplementary lens should be shielded from side light by a lens hood.

• Various Uses of Kodak Combination Lens Attachments:




EKTAR f:6.3
14 In
IN U.S.A. BY EASTMAN KODAK CO.

How a Kodak Lens Is Made

LENS DESIGN

MODERN lens design is a long, tedious, and complicated process, requiring months, sometimes years of calculation. Experience in making lenses is invaluable, for improved designs incorporate good points of previous lenses of proven performance. New developments in the field of optical mathematics, optical glass making and treating are taken into consideration. The first formula worked out is tested trigonometrically, modified, and rechecked. This process is repeated until eventually a formula is reached which is satisfactory in all respects. Kodak's lens designers enjoy a unique advantage, for as members of an organization manufacturing all types of film, cameras, shutters, etc., they are in a position to know and to consider future developments affecting lenses, as, for example, color film.

LENS DESIGN TESTING

FROM the final design, a number of model lenses are made and tested optically as well as photographically for all aberrations. Other properties, such as light transmission, uniformity of illumination over the entire field, accuracy of focusing, etc., are also examined. Only after it has been found that the lens serves fully the purpose for which it was designed, is it released for production.

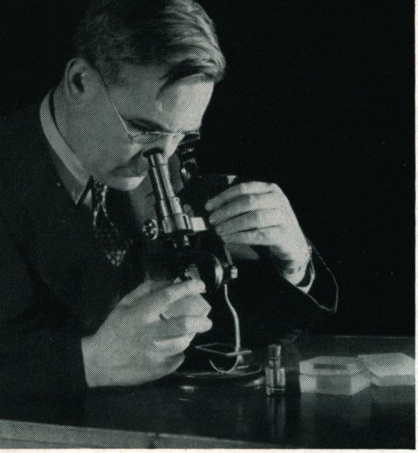
MANUFACTURING METHODS

THE optical industry has always led and still leads in precision manufacturing. Tolerances of 1/100,000 of an inch in the accuracy of lens surfaces are continually maintained. Precision machines and instruments as well as carefully controlled working conditions are prerequisites for modern lens manufacturing on a large scale. Prime factors are, however, the wholehearted co-operation between scientists, engineers, and skilled craftsmen.

Only an understanding of what goes into the making of a good lens will lead to full recognition of its value. Tracing a lens through the various stages of production and inspection should help to promote such appreciation.

- **EASTMAN EKTAR *f*/6.3**

available in a variety of focal lengths from 8½ to 14 inches.
The lens for the progressive photographer.



• Inspection and classification of each piece of optical glass before being cut for molding.

INSPECTION OF RAW MATERIALS

OPTICAL glass, which often cannot be distinguished on sight from ordinary glass yet may cost 300 times as much, is checked for its refractive and dispersive properties and examined for flaws affecting lens performance.

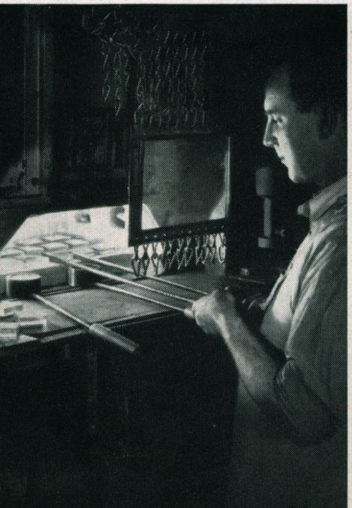
THE MAKING OF LENS BLANKS

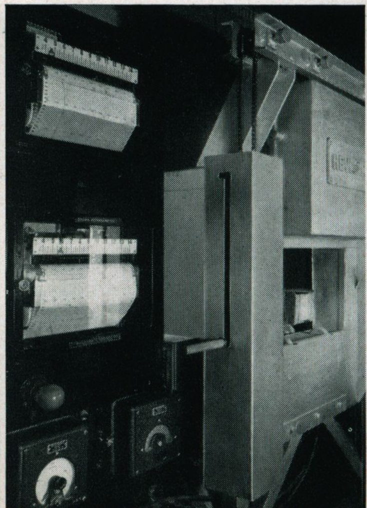
AFTER cutting or sawing optical glass in squares of the proper dimensions, the slabs are heated in special furnaces until soft. The soft slab is then pressed to the approximate shape of the finished lens to reduce the time required for grinding. To remove any internal strains set up in the molding operation, the disks, or "blanks," are permitted to cool very slowly in electric annealing ovens equipped with exact temperature reducing controls. A week is required for the blank to cool to room temperature. The blanks are carefully inspected, and only those free from fire cracks, deep pits, striations, and other defects, are sent to the grinding rooms.

LENS GRINDING

THE blank is ground by skillful hand operation with coarse emery until each surface has approximately the correct curvature and proper thickness. For further grinding and polishing, a number of ground blanks are cemented on special holding tools with pitch in

• Small slabs are softened at 1600° F. and then pressed to form lens blanks.
• Strains in molded blanks are removed by slow cooling in annealing ovens
• Molded and annealed lens blanks are inspected.





such a way that the faces to be worked lie in a single spherical surface. This block of lenses is placed on a revolving spindle. The surfaces are painted with emery and water, and a "lap" having the spherical surface desired for the finished lens is moved back and forth over them. Successively finer grades of emery are used as the surface becomes smooth and takes on the required curvature. The lenses are carefully checked and inspected as grinding continues.

LENS POLISHING

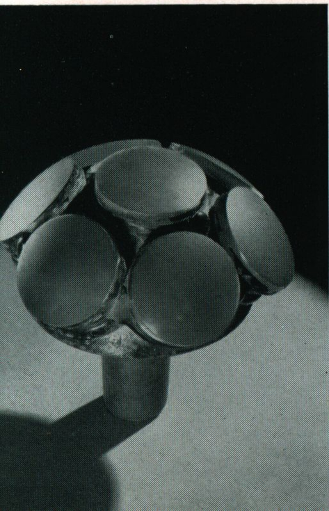
WHEN every lens on the block has been smoothly ground, the emery is washed away, and the lenses are polished with rouge and water on a pitch-lined polishing shell. Polishing a single surface takes from 1 to 10 hours, depending on the size of the lenses and other factors. The accuracy of the radius of curvature and the sphericity of the surfaces are tested by means of a glass test plate of opposite curvature. Any differences between the two surfaces show up as "Newton's Rings," which allow measurements of closeness of "fit" between lens and test plate to within a few millionths of an inch.

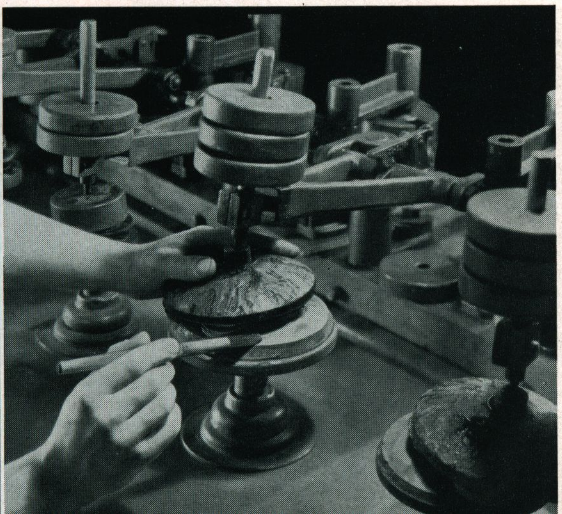
After one face of the lens is finished, the surface is protected with shellac and removed from the "blocking body." The lens is remounted so that the second lens surface can be ground and polished.

When both sides have been polished to exact specifications, the lenses are cleaned by successive bathing in alcohol, xylol, ammonium hydroxide, and soapsuds. This removes every trace of shellac, pitch, etc. The lenses are then inspected again for scratches, thickness, and sphericity.

• A "blocking body" holding lens blanks for grinding and polishing.

• "Laps" charged with emery move over the rotating blocks to grind the blanks. For polishing, pitch-lined shells are used with rouge.





CENTERING AND EDGING

At this production stage, the optical and geometrical centers of the lens may not coincide, and the total diameter of it will be larger than the mount. To correct this, each lens is cemented to a lathe chuck and is adjusted to make its optical axis coincide accurately with the rotational axis. This is assured when a test object reflected by the lens surfaces no longer appears to rotate as the lens is revolved.

The excess edge is then ground off with diamond dust to make the lens perfectly symmetrical and of the proper diameter. If the edge is to be beveled, this is also done at the same time.

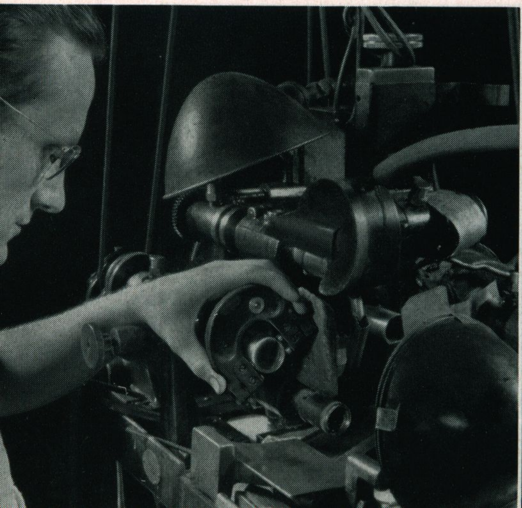
CEMENTING

Most lens designs call for two or more of the lens elements to be cemented together to form a single unit. This is done under scrupulously controlled conditions to assure freedom from dust. Specially refined Canada balsam is used. The elements to be cemented are heated to a predetermined, automatically controlled temperature. The Canada balsam is applied, and the two surfaces placed in contact. After being cemented, every unit is inspected to make sure that all elements have one common optical axis.

THE MAKING OF LENS MOUNTS

The precision observed in the manufacture of different lens elements would be of little value unless the mount which holds them was also made with extreme care. A lens mount, whether in shutter or barrel, must not only center the various elements on a common axis, but must also maintain the exact separation specified by the designer. A good focusing lens mount must be free from play so that the lens

- Each lens element is centered accurately and its edge ground to fit the mount.
- Precise lens mounts are essential for good lenses.



will be accurately focused for the distance indicated on the scale.

To assure the maintenance of accuracy of mounts, extensive use is made of special gauges and inspection methods, and particular care is taken in the selection of the proper material, from which Kodak lens mounts are made. Finished mounts are carefully checked, and only those coming up to standard are used.

MOUNTING OF THE LENS ELEMENTS

When lens elements and mounts have passed final tests, they are assembled, either by spinning the lens into the mount or by means of retaining rings. These methods make for positive and permanent positioning and keep the lens in perfect alignment in the mount.

FINAL INSPECTION

After the lens has been mounted, it is sent to the Final Inspection Department. All previous inspections described have been of a departmental scope with the primary purpose of checking on accuracy and quality of the work being done by that particular department. In addition, final inspection is carried out entirely independently of previous ones. The sole purpose of this inspection department is to examine each lens as a whole to make sure that it meets the rigid requirements and specifications to which Kodak lenses are held. These final tests, made on each individual lens, cover optical aspects, such as corrections for all aberrations, as well as mechanical features, for example the proper working of the diaphragm.

Quality in lenses may not be obvious upon first examination. The purchaser must rely to a certain extent upon the integrity and reputation of the manufacturer as a guarantee of quality. The Eastman Kodak Company confidently accepts that responsibility.

• To determine the quality of the image produced by a lens, the image of an artificial star is examined at a magnification of 200 times.

● **KODAK EKTARS—for the exacting miniature camera worker.**

Left to right and up: $f/3.3$, 35 mm.; $f/3.5$, 50 mm.; $f/1.9$, 50 mm.; $f/3.5$, 90 mm.; $f/3.8$, 135 mm.; and $f/4.5$, 153 mm.

Kodak Lenses

KODAK makes a complete line of lenses for still and amateur motion-picture cameras as well as for enlargers, projectors, and other photographic equipment. In this data book only still camera and Ciné-Kodak lenses will be described in detail. Data for each lens are given in the Specifications section, pages 39 to 59. A summary of available lenses for enlarging, home movies, and slide projection is shown on pages 60 and 61.

KODAK EKTARS

OF the millions of photographers, an increasing number carry out photographic work of a specialized nature. Industry and science are making ever greater use of photography. All this has created a demand for lenses that meet the most exacting requirements. In line with its policy to serve all photographic needs, the Eastman Kodak Company introduced in 1936 the first "Ektar" lens—the beginning of a series of highest quality lenses. Since then, other Ektar lenses have been added so that today there is available a balanced line of Ektar lenses serving practically all needs of the most exacting photographic worker. Kodak Ektars are not intended to replace, but rather to supplement the long established line of Kodak Anastigmat Lenses, which are made to precise standards and give excellent results both in black-and-white and color.

In the Ektars, designers and lens makers have co-operated in making the best lenses that skill, care, and optical research can produce. For example, astigmatism, which is normally present in small amounts in all lenses, has been reduced in the Ektars to a new minimum. Inner air-glass surface treating to reduce flare, to improve the clarity and brilliance of the image in black-and-white negatives and color purity in Kodachrome transparencies is applied to many of the Ektar lenses. Color correction has been carried out to such a degree that color pictures made with Ektars not only satisfy the most exacting demands of the advanced color worker, but meet the far stricter requirements encountered when making photomechanical color reproductions.

Kodak Ektars for Kodak Ektra and Bantam Cameras: Miniature photography with its specialized technique, its severe demands on the degree of enlargement of negatives, finds in the Kodak Ektar a lens which satisfies these requirements. All the corrections, notably those which make for greater definition, are carried out to an especially high degree. The numerous lens surfaces necessary for well-corrected high-aperture objectives permit the effective use of lens coating. Ektar lenses for Kodak Ektra and Bantam Special have treated inner air-glass lens surfaces.

With interchangeable lenses, the change-over from one lens to another must not only be quick but, above all, precise and positive. To assure exact focus and positive coupling with the range finder, Kodak Ektars for the Ektra are held in precise position against a fixed lens seat by means of a threaded collar with a locking device. The 35- and 50-mm. focal length lenses have a unique two-phase focusing scale which permits the minimum focusing limit to be extended from the customary 3½ feet to 1 foot.

Kodak Ektars for 2¼ x 3¼ and 3¼ x 4¼″ Cameras: The *f*/3.7, 105-mm., *f*/4.5, 101-mm., and *f*/4.7, 127-mm. Ektars are available in Supermatic Shutters for cameras such as the Speed Graphic. The Kodak Medalist has an *f*/3.5, 100-mm. Ektar. These lenses are of particular interest to the photographer using Kodachrome Professional Film, yet they are equally suitable for black-and-white photography, especially under adverse light conditions or when short exposures are necessary. In resolving power, definition, color correction, and other desirable lens qualities, they attain the very high standard established for all Ektar lenses. In this group, at the time of writing, only the *f*/3.5 has the inner air-glass lens surfaces coated.

Eastman Ektars for 5 x 7 and 8 x 10″ Cameras: These *f*/6.3 lenses, available in 14-inch, 12-inch, 10-inch, and 8½-inch focal lengths, and supplied in shutter or barrel, are especially designed for view and studio cameras, such as the Eastman Commercial View Camera Model B (All-Metal 8 x 10), and Eastman View Cameras 2D and 33A. They are corrected to a very high degree, especially for transverse chromatic aberrations or lateral color, and are, therefore, ideally suited to Kodachrome and black-and-white photography.

• **KODAK ANASTIGMATS** *f*/4.5, available in a variety of focal lengths from 5½ to 12 inches for commercial, portrait, and press cameras.

The treatment of the inner air-glass surfaces improves the tone separation in the shadows and the color saturation with Kodachrome transparencies. Each lens is tested for exact register of the images of the three primary colors. In the test object reproduced on page 8, the rectangles are made of colored gelatin, each passing a narrow band of the spectrum. If the lens meets the standards, the narrow black lines through the rectangles on the test object will be continuous in the test exposure. A test negative is made with each lens and kept on file.

KODAK ANASTIGMATS

Kodak Anastigmat *f*/4.5 Lenses for commercial, portrait, and press work are available in a variety of focal lengths from 5½ to 12 inches. They are supplied in barrels or shutters for use on appropriate cameras, such as the Speed Graphic and Graflex. They are highly corrected anastigmats, and their excellence is attested by the popularity they have long enjoyed among leading photographers.

Kodak Anastigmat Specials are made in a variety of focal lengths and in relative apertures of *f*/3.5 and *f*/4.5 and are supplied on various Kodaks. They are highly corrected and made according to the most reliable optical formulas and to very exact specifications, taking full advantage of recent progress in the optical field.

Kodak Anastigmats are well corrected anastigmats manufactured in a variety of focal lengths, and in relative apertures from *f*/3.5 to *f*/8.8. These lenses and the Kodak Anastigmat Specials permit the taking of pictures under unfavorable light conditions or at faster shutter speeds. Kodak Anastigmats, like other lenses having high relative apertures, require focusing.

KODAK LENSES FOR SIMPLE CAMERAS

For beginners in photography or for those who wish extreme simplicity in operation, there are cameras equipped with lenses of comparatively small aperture and a single shutter speed. Lenses in this group are the Kodak Single Meniscus and Doublet Lenses. Another group of simple lenses, which includes the Kodak Diway, Twindar, and Bimat Lenses, has a simple but efficient method of focusing for subjects as close as five feet from the lens.

These lenses within their limitations will produce excellent pictures. Cameras so equipped have the advantage of lightness of weight, simplicity of operation, and are inexpensive.

CINÉ-KODAK LENSES

THE superb quality and precision of Kodak lenses are particularly evident when Ciné-Kodak and Kodascope lenses are considered. Due to the relatively small film-image size and the subsequent projection to a screen picture many hundred times enlarged, especially high demands are made on these lenses.

A noticeable difference between a Kodak and a Ciné-Kodak lens is the relatively longer focal length considered as normal for the latter. It is about double the diagonal of the exposed part of the picture frame: for 16-mm. film, 1 inch (25 mm.), and for 8-mm. film, ½ inch (13 mm.). This longer focal length of the lens narrows the angle of view down to about one-half that of a normal-focal-length lens of a still camera. For viewing home movies on a screen, this narrower angle approaches more closely normal vision for moving objects. Human vision has less tendency to scan when viewing moving objects and consequently has a smaller angle of view than when viewing a still picture.

The narrower angle of view of Ciné-Kodak lenses not only permits the making of faster lenses at a lower cost, but also with fewer lens elements.

The depth of field for Ciné-Kodak lenses is calculated on the basis of a circle of confusion of 1/1000 inch for 16-mm. and 1/2000 inch for 8-mm. lenses. The fact that 8-mm. film is normally projected to a higher magnification than 16-mm. accounts for the difference.

Wide-angle and long-focus Ciné-Kodak lenses accomplish the same effects as such lenses on still cameras. The former lenses will be found useful in close quarters when it is desired to include a considerable portion of the subject, and the latter when a relatively large screen image of a distant object is wanted.

All Ciné-Kodak lenses are "Kodak Anastigmats," each one designed, corrected, and made to serve fully the task for which it is intended. All of them are color corrected and give excellent results with Kodachrome as well as black-and-white film.

● **CINÉ-KODAK LENSES**—for versatile home movie makers.

Front row: *f*/1.9, 25-mm. lens; lens adapter for Magazine Ciné-Kodak; and *f*/2.7, 15-mm. lens.

Back row: *f*/4.5, 76-mm.; *f*/1.6, 50-mm.; *f*/4.5, 114-mm.; *f*/2.7, 63-mm.; *f*/4.5, 152-mm.; and *f*/2.7, 102-mm. lenses.

All newer interchangeable lenses can be mounted quickly and securely by means of adapters. This permits the use of these lenses on various Ciné-Kodaks, and on new Ciné-Kodaks of the future. For normal close-ups with fixed-focus lenses, a Kodak Portrait Attachment is available. For titling, and small-object photography with lenses of normal focal length in focusing mount, Kodak Portra Lenses can be used. See pages 14 to 17.

Lenses of 38-mm. and longer focal length have unique two-phase focusing. This feature permits scale focusing for normal distances, and after lifting a plunger or removing a screw, the lens can be extended further for extreme close-ups. Using lens extension tubes gives an image on the film up to 8 times the subject size with 16-mm. and 14 times with 8-mm. Ciné-Kodaks. Making such extreme close-ups requires a camera with a reflex or an accessory focusing finder.

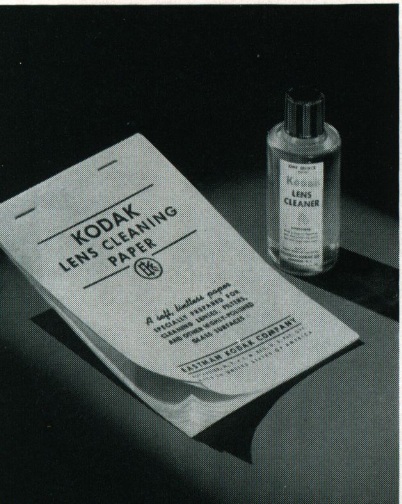
As originators of 16- and 8-mm. home movies, Kodak has had longer experience in making lenses for these two film sizes than any other lens manufacturer—a fact that has contributed greatly to maintaining a leading position in this specialized field.

Details about the various Ciné-Kodak lenses, attachment sizes, depth of field, and sizes of field covered, are shown on pages 52 to 59.

Care of Lenses, Filters, Range Finders, and Optical Parts

All optical glass surfaces should be protected as much as possible from dust, dirt, and finger marks by using a carrying case, lens cover, etc., and in the case of a folding camera, by keeping it closed when not in use.

An occasional cleaning of all outer optical surfaces is not only recommended, but is necessary for best photographic results. Do not use harsh, linty cloth on a hard stick, acids, alcohol, or other solvents. For quick dusting, a fine camel's-hair brush or Kodak Lens Cleaning Paper is recommended; and for thorough cleaning, Kodak Lens Cleaner.



Lenses, filters, and range finders should be protected from jars and jolts, and from extreme and sudden temperature changes; they should not be stored in hot or moist places.

Important: No attempt should be made to take a lens apart. If the lens or mounting requires attention, it should be returned to the manufacturer.

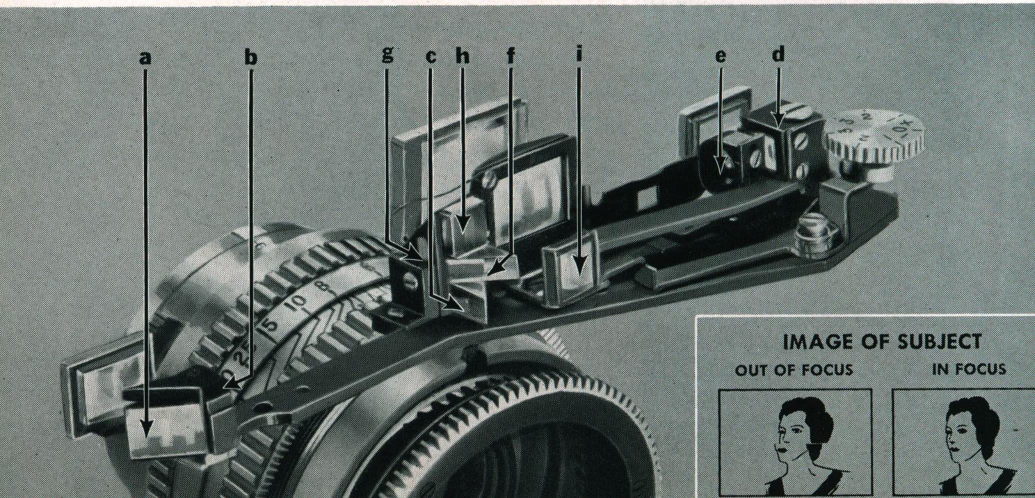
Kodak Photographic Range Finders

As an aid to accurate focusing, certain Kodaks, such as the Kodak Ektra, the Kodak Medalist, etc., have range finders coupled to the camera lens. For cameras not so equipped, the Kodak Service Range Finder is available. Basically, range finders measure the angle of convergence between two beams of light coming from the same subject point and separated at the camera by the distance between the two apertures of the range finder. The range finder operates by changing the direction of one beam to bring the two beams into alignment in the eyepiece. In coupled range finders, the movable prism or other means for deflecting the one beam of light is mechanically linked to focus the lens for the point of convergence of the two beams. The Kodak Service Range Finder contains a scale which translates angle of convergence to linear distance directly. With subject distance thus determined, the camera can be set according to its focusing scale.

The longer the base of the range finder, the greater is its accuracy. Naval range finders may have a base as long as 40 feet and permit accurate distance measurement of many miles. On cameras for which a long physical base is impractical, the effective base is, in some cases,

• SPLIT FIELD, MILITARY TYPE OF RANGE FINDER OF THE KODAK EKTRA

The image of the subject to be focused upon is reflected by fixed prism (a) through lens (b) lower coincidence prism (c) on to the latter's front part where it forms stationary half of the image. The second image of the same subject is reflected through movable prism (d), lens (e), upper coincidence prism (f) on to the latter's front part where it forms movable upper half of the image. The prism (g) erects the inverted image of both halves for normal viewing through collecting lens (h) and eye lens (i). The focusing mount of the camera lens is coupled with the movable prism (d). When both image halves are in alignment, the camera lens is focused on the subject seen aligned in the range finder.



lengthened optically. With lenses of moderate focal length, the depth of field is infinite beyond one hundred feet, and a range finder with a relatively short base is sufficient.

Ease and speed of aligning the two image halves in the range finder depend upon their size and clarity. For this reason, split-field range finders with two clear, brilliant fields showing magnified images of the subject focused on are used extensively by the navy and army. All Kodak range finders are of the split-field military type.

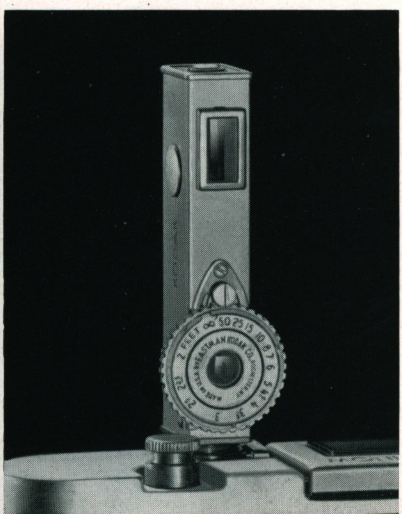
Range finders are an aid to more accurate focusing, and consequently to sharper and crisper pictures. They are, however, especially useful when distances must be determined accurately, for example, in close-up work and when high-speed lenses are used at wide apertures.

In addition, photographic range finders are useful for measuring other distances when exactness contributes toward better pictures. For example, a range finder can be used in some cases to measure the lamp-to-subject distance in picture taking with artificial light. It can also be used to determine whether near and far objects in the picture are within the depth of field given by indicator or table for a given lens setting.

Good range finders are precision instruments and should be treated as such. All outside glass surfaces should be kept clean. A range finder should never be tampered with, and if it is in need of adjustment, only a competent repairman or the factory should be allowed to do this work.

• Close Range and View Finder for Kodak Ektra.

• Kodak Service Range Finder.



COUPLED, SPLIT-FIELD, MILITARY-TYPE KODAK RANGE FINDERS

On the Kodak Ektra: The base of the range finder is 4⅛″, the magnification 2.2×, making it the longest effective range finder base on any 24 x 36 mm. camera. This base assures adequate focusing with telephoto lenses for this camera. Coupling of range finder to all the various lenses is automatic, accurate, and positive. An adjustable eyepiece permits accommodation for differences in eyesight.

On the Kodak Bantam Special: The base is $1\frac{13}{16}$″ and the magnification 3.1×, ample for the *f*/2, 45-mm. lens of this camera. The ocular can be adjusted for individual eyesight.

On the Kodak Medalist: The base is 2½″—the magnification 1.5×. When sheet film or film packs are used, range finder and focusing scale are automatically adjusted to the different film plane.

On the Kodak 35: The base of this range finder is $2\frac{5}{16}$″, unit magnification, sufficiently long for the *f*/3.5, 50-mm. lens.

AUXILIARY, SPLIT-FIELD, MILITARY-TYPE KODAK RANGE FINDERS

Kodak Service Range Finder: Inexpensive, small, and sturdy. It measures distance from "Inf." to 2 feet and can be attached to cameras having a suitable clip. Its base is $1\frac{21}{32}$″ without magnification.

Close Range and View Finder for the Kodak Ektra with *f*/1.9 lens: This range finder is especially designed for measuring distances from 3½ feet to 10½ inches. Its base of 1½″ is, without magnification, sufficient for accurate measurements at this close range.

• Accuracy and dependability of Kodak shutters are due in part to the careful assembly of rigidly inspected parts.

Kodak Photographic Shutters

INCREASES in lens and emulsion speeds, the use of full-color Kodachrome Film, and the greater exactness exercised by photographers have placed emphasis on faster and more accurate shutters.

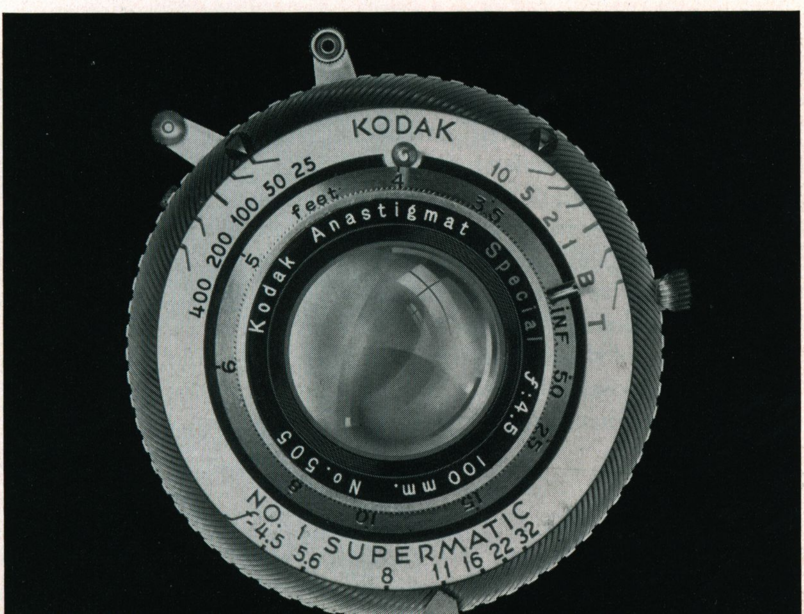
The scope of a shutter is not determined by the number and range of speeds alone. It is of equal importance that the exposure be sufficiently accurate and consistent at every speed indicated.

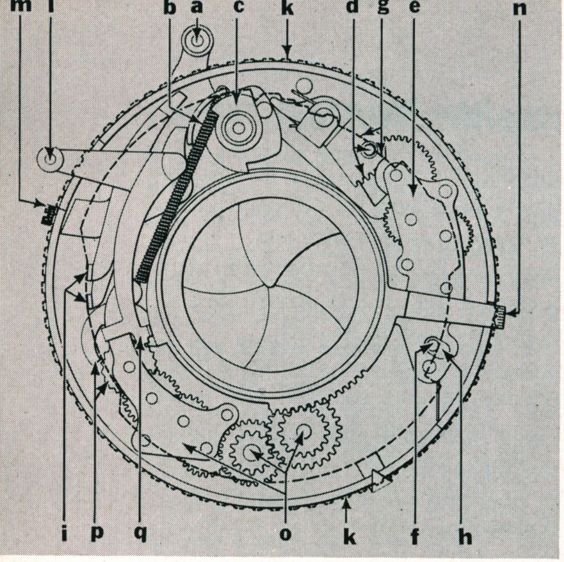
To achieve this in Kodak shutters, physicists and engineers have worked out designs, chemists have tested and selected the most suitable raw materials. For example, shutter and diaphragm blades have a wear-resisting matte black surface coat which reduces danger of lens flare even after years of use. Craftsmen, many of whom were leading watchmakers, have created a timing piece of great accuracy, sturdiness, and efficiency. As in fine watches, base plates are milled and drilled to close tolerances, and gears are cut and scratch-brushed.

Wholehearted co-operation between designer and craftsman, modern precision manufacturing methods, and more than fifty years' experience in making shutters have created a line of Kodak shutters, each one of which compares favorably with any shutter of similar type and price on the market.

While various means, such as rotating disks, dropping slides, etc., can be used as shutters for still cameras, the most commonly encountered today are between-the-lens and focal-plane shutters.

● Kodak Supermatic Shutter with nine speeds ranging from 1 to 1/400 of a second, and built-in delayed-action release—a timing instrument of watch-like precision.





KODAK SUPERMATIC SHUTTER

Presetting the shutter by moving lever (a) to the right sets up tension in spring (b); at 1/400 sec. an additional spring located under eccentric member (c) is brought into action. Shutter speeds are varied by engaged length of gear sector (d) of one member of the gear train retard mechanism (e) and the position of a small oscillating pallet relative to a ratchet wheel (f). Both of these variables are controlled by step-shaped cam shown as a dashed line (g and h). "T" and "B" are determined by position of levers (i), also controlled by a cam. All cams are part of speed-selecting ring (k). Release lever is marked (l) and socket for cable release (m). Moving self-timer lever (n) downward winds up a spring-actuated escapement mechanism (o) which, by means of an oscillating pallet and ratchet wheel (p), delays automatic tripping of shutter through extension of release lever (q) by 10 to 12 seconds.

Between-the-Lens or Central Shutters open from the center and close toward the center. Exposure time depends upon the speed of opening and closing and the time the shutter remains open. There are two types—the self-setting or automatic, and the presetting shutter. In the former, pressing the release lever first sets up the spring tension and then trips the shutter. Such a design is generally employed on shutters with fewer and slower shutter speeds. In the presetting type of shutter, the necessary spring tension is produced by the separate action of setting or cocking before an exposure can be made. This construction permits not only a greater number, but also faster and more accurate shutter speeds. On most cameras the cocking of the presetting shutter has to be done manually; however, on some cameras, such as Kodak 35, Medalist, etc., advancing the film sets the shutter.
Focal-Plane Shutters are curtain types of shutters that operate near, and parallel to, the emulsion surface. The exposure time is regulated by varying the width of the slit, the time lag between the movement of two curtains, or in some cases, by varying the tension that pulls the curtain. For uniform exposure, it is important that the velocity of the curtains be uniform or that acceleration be compensated for by increasing the width of the slit as it moves across the focal plane.

Either type of shutter has advantages and shortcomings. The central shutter exposes the total film area at one time, whereas the focal-plane shutter, when using a slit, exposes one portion of the film after another. The latter results, in photographs of rapidly moving objects, in a slightly drawn out, contracted, or diagonally distorted image, depending upon the direction of the subject's movement. Central shutters permit synchronization at fast shutter speeds with high-peak, high-intensity photoflash bulbs; whereas focal-plane shutters call for special flash bulbs with a plateau type of light output curve.

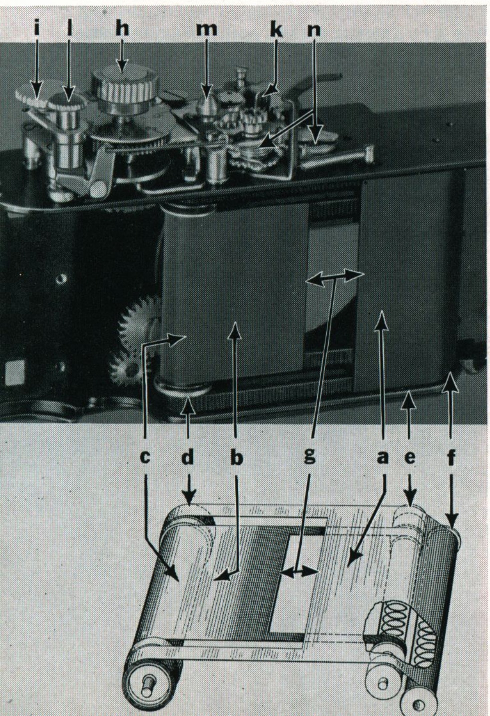
Focal-plane shutters permit speeds several times faster than obtained with the fastest between-the-lens shutters. The efficiency of the former shutter at high speeds is also greater provided it is of sound design and carefully made. The Kodak Ektra shutter is an outstanding example of a well-made, fast, and efficient focal-plane shutter.

Built-in, Delayed-Action Release: Some shutters, central as well as focal-plane, are equipped with a device that delays the actual tripping of the shutter by about 10 to 12 seconds to allow the person actuating it to get into the picture. Kodak built-in, delayed-action release works at *all* instantaneous shutter speeds.

Blade-Arrester: This feature on Kodak Supermatic Shutters used for press- and view-type cameras permits the opening of the shutter blades for focusing purposes at any speed selected, without moving the speed selecting dial to "T" or "B."

FOCAL-PLANE SHUTTER OF KODAK EKTRA

Operating the lever on the back of camera first brings edge of curtain (a) over edge of curtain (b), and then winds them together across film aperture onto rollers (c and d) setting up spring tension in rollers (e and f). Shutter speeds of 1/50 to 1/1000 sec. are determined by width of the curtain opening (g), regulated by knob (h) which turns roller (c) in relation to roller (d). Acceleration is compensated for by widening of slit as it travels across film plane due to difference in diameter of rollers (c and d). Speeds 1 to 1/25 sec. are selected with dial (i) and controlled by an escapement mechanism (k) which varies the delay of curtain (b) after curtain (a) has completed its run. At "B" setting curtain (a) moves across when the shutter release button (l) is pressed down and curtain (b) follows when button is released. Moving self-timer lever (m) in clockwise direction winds up a spring-actuated escapement mechanism (n) which delays automatic tripping of the shutter by 10 to 12 seconds.



Shutter Efficiency: With between-the-lens or central shutters, efficiency is expressed as a ratio between the actual amount of light permitted to pass and light that would pass if the shutter blades could open and close instantly. An efficiency of 100% is impossible to achieve, since moving blades have to overcome inertia and friction. Kodak shutters of the presetting type open to the maximum diaphragm setting within about two to three milliseconds from the time the blades permit the first ray of light to pass. They close in approximately the same time. Kodak shutters of the self-setting type are somewhat slower and require about six to nine milliseconds. These figures vary somewhat from shutter type to shutter type. They also depend upon the care the shutter has received.

The smaller the diaphragm, the shorter the time used by the shutter blades to clear the lens opening with the result that shutter efficiency increases markedly with smaller lens apertures. Shutter efficiency is also greater with longer exposures, since in such cases the time for opening and closing the shutter represents a smaller percentage of the total shutter operating time.

Shutter efficiency with focal-plane shutters depends upon the distance between shutter curtain and film plane and the lens stop used.

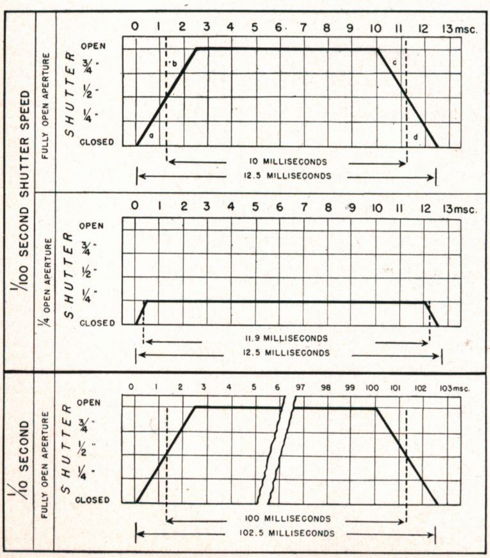
Kodak shutters supplied today have been brought to such a degree of mechanical perfection that the unavoidable lowering of efficiency at highest speeds and maximum lens aperture is so small that it will not affect correct exposures even of film with short exposure latitude.

●EFFICIENCY OF A BETWEEN-THE-LENS SHUTTER AT VARIOUS SPEEDS AND LENS OPENINGS

The top figure shows that out of 12.5 milliseconds, about 2.5 are used for the blades to open fully. About the same time is needed for the blades to close. The shutter permits light to pass the moment the blades begin to open. Light begins to be cut off the moment the blades start to close. Taking a half-open position as a basis for measuring shutter efficiency compensates for this action, since area (a) is equal to area (b) and area (c) to (d). On this basis the efficiency of the hypothetical shutter illustrated is about 78%.

The middle figure demonstrates that shutter efficiency increases with smaller diaphragm openings. Shutter blades clear a small lens stop in less time than a fully opened one. The shutter efficiency in the case illustrated is about 93%.

The lower illustration shows that shutter efficiency is greater with slower shutter speeds since the time required to open and to close the blades to the half-open position is a smaller percentage of the total time than with faster shutter speeds. At 1/10 of a second and with fully open aperture the efficiency is about 97%.



Shutter Testing: All Kodak shutters are carefully tested on special machines of the highest precision and must work within strictly held tolerances before they are permitted to leave the factory. While it may be possible to use uncalibrated testers such as rotating disks, etc., to check approximately the speeds on central shutters, such tests do not always give dependable results, especially at the higher speeds, since they do not take into consideration shutter efficiency.

Synchronization of Shutters with Flash Bulbs: To assure good synchronization, the time lag of the flash bulb as well as the lag of the shutter has to be considered. In flash bulbs, this lag represents the time between the instant the current is supplied, and the instant the peak or plateau of light intensity is approached. In central shutters, it is the time between the tripping of the shutter and the instant the shutter blades clear a given lens aperture. In Kodak central shutters of the presetting type, this average time lag is about 4 to 6 milliseconds, and in those of the self-setting type, 8 to 15 milliseconds. These figures include the time interval between pressing the shutter release to the instant the blades start to open, plus the blade opening time. In focal-plane shutters, the time lag important for correct synchronization represents the interval between tripping the shutter and the instant the curtain slit reaches the film area. In the focal-plane shutter of the Kodak Ektra, this average time lag is 15 to 20 milliseconds.

The Use of Kodak Shutters: In Kodak central shutters, the speed is selected by moving a lever or by turning a collar on the periphery of the shutter housing. The speeds are varied by means of a step-shaped cam. This type of cam permits the repeating of the same exposure with greater certainty, since the exposure over the whole width of the step is the same. A continuous cam would vary the exposure at the slightest deviation from the exact setting. A step-shaped cam further permits a more accurate calibration of shutter speeds. It does not, however, allow intermediate speeds by setting the index between marked speeds.

● The accuracy and efficiency of each shutter is checked carefully on special testing apparatus.

Care of Shutters: Shutters of the presetting and the focal-plane type should not be put aside or stored for any length of time in a set or cocked position, as this may weaken the spring tension. Avoid jarring or other rough handling, as shutters are fine timing instruments and should be treated as such. Like a watch, shutters may have to be checked and cleaned once in a while. This work should be done by a competent repair man or the factory.

Kodak Shutter Specifications

Focal-Plane Shutter of the Kodak Ektra:

Speeds: B, 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/250, 1/500, 1/1000, and delayed-action release.

Between-the-Lens or Central Shutters:

Presetting Type:

Supermatic: T*, B, 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400. Nos. 1 and 2 have built-in, delayed-action release, No. 0 does not. Supermatic shutters for press, view and similar cameras are equipped with a blade-arrester.

Kodamatic: T*, B, 1/10, 1/25, 1/50, 1/100, 1/200, and delayed-action release.

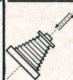
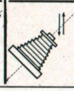
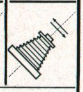
Diomatic: T, B, 1/25, 1/50, 1/100.

Self-Setting Type:

Dakon: T, B, 1/25, 1/50, 1/100—some models without 1/100.

Dak: T (time), B (bulb), I (instantaneous).

Note: The number preceding or following the shutter name indicates the size of the shutter.
*On shutters used on cameras with a double exposure prevention device, "T" is omitted.

TABLE OF SHUTTER SPEEDS TO RECORD SUBJECTS IN MOTION			Motion toward or Away from Camera	Motion at About 45° Angle to Camera	Motion at Right Angles to Camera
Approximate Speed of Subject in miles per hour	Characteristic Subjects	Distance of Subject from Camera			
			Proper Shutter Speeds		
5–10	Pedestrians, Slow-moving Animals, Construction Work, Street Activity, Children Playing, Boating	25 ft. 50 ft. 100 ft.	1/100 1/50 1/25	1/200 1/100 1/50	1/400 1/200 1/100
20–30	Athletics, Baseball, Yacht Races, Horse Racing, Motorboats, Surf Diving, Views from Trains	25 ft. 50 ft. 100 ft.	1/200 1/100 1/50	1/400 1/200 1/100	1/1000 1/400 1/200
60 and up	Auto Races, Motorcycles, Airplanes, Fast Trains	25 ft. 50 ft. 100 ft.	1/400 1/200 1/100	1/1000 1/400 1/200	... 1/1000 1/400

Kodak Lens Specifications

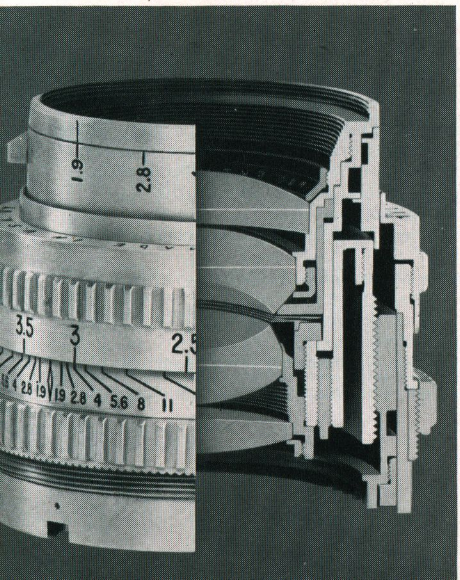
THE following pages contain data intended for use in working with Kodak lenses. Specifications for lenses are given for individual lenses or for groups of lenses of the same basic design.

Lens Diagrams: These drawings give a schematic presentation of a given lens design and show the number and approximate arrangement of the various lens elements. Cemented lens elements are shown as joined lens elements. The arrow indicates the direction in which the light normally passes through the lens on its way to the sensitized film. The two vertical lines indicate the approximate location of the lens diaphragm.

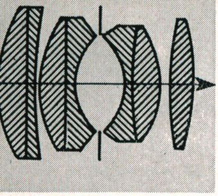
Depth of Field Tables: Where lack of space does not permit the listing of the depth of field for all aperture stops, the depth of field for the missing *f*-numbers can be approximately ascertained by interpolation.

Back Focus: For lenses supplied separately for use in studio, view, press, and reflex cameras, information about the back focus, that is, the distance between the rear-glass surface of the lens and the focal plane when focused at "infinity," is given.

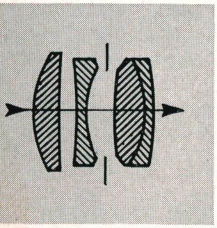
Attachment Size: This indicates the size of the Adapter Ring of the Kodak Combination Lens Attachments fitting the lens mount. Adapter Rings listed by *inches* are of the slip-on type, those listed by *number* are of the screw-in type. "Ser. Attachments" indicates the Series number of the attachments fitting this ring.



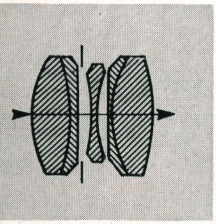
• Kodak Ektar *f*/1.9, 50 mm., with section of lens mount cut away to show number and arrangements of lens elements.



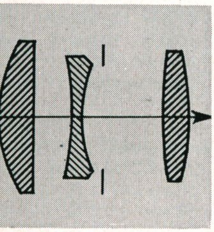
Ektar *f*/1.9, 50 mm.



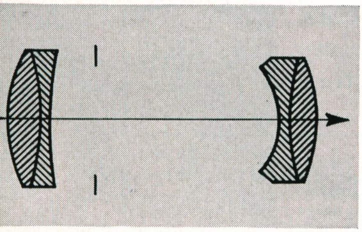
Ektar *f*/3.5, 50 mm.



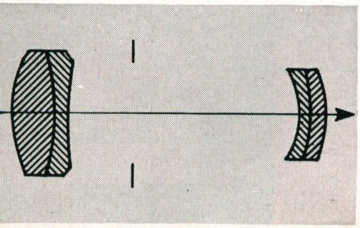
Ektar *f*/3.3, 35 mm.



Ektar *f*/3.5, 90 mm.



Telephoto Ektar *f*/3.8, 135 mm.



Telephoto Ektar *f*/4.5, 153 mm.

Specifications:

KODAK EKTARS *f*/1.9, 50 mm.; *f*/3.5, 50 mm.; *f*/3.3, 35 mm.; *f*/3.5, 90 mm.; *f*/3.8, 135 mm.; *f*/4.5, 153 mm. (as used on the Kodak Ektra)

These lenses are entirely new in design. All corrections have been carried out to the high degree so essential for fine photography and especially important for precision miniature work. Particular attention has been given to lateral and longitudinal color corrections. Inner air-glass surfaces are coated to reduce reflections, thereby improving shadow details and brilliancy in black-and-white negatives and color purity in Kodachrome transparencies. Newly designed precision mounts assure permanent accuracy as well as ease in manipulation. Each lens has an integral depth of field indicator and a focusing mark for infrared film. All lenses are readily interchangeable on the Kodak Ektra, have accurate positioning with respect to the focal plane and to automatic co-ordination with the range finder and parallax correction in the view finder.

Kodak Ektar *f*/1.9, 50 mm. Its high speed and normal focal length meet the requirements of a great range of photography. This lens is especially useful under extremely unfavorable light conditions or when working at maximum shutter speeds. *F*/1.9 is 3½ times faster than *f*/3.5.
Angle of View: When focused for infinity, 27° x 40°.
Focusing Range: Two-phase scale—Infinity to 3½ ft., and 3 ft. to 1½ ft.
Attachment Size: No. 24 Adapter Ring and Ser. VI Attachments.

Kodak Ektar *f*/3.5, 50 mm., is also of normal focal length. The speed is ample to cope with everyday picture opportunities including those with unfavorable light conditions.
Angle of View: When focused for infinity, 27° x 40°.
Focusing Range: Two-phase scale—Infinity to 3½ ft., and 3 ft. to 1½ ft.
Attachment Size: No. 25 Adapter Ring and Ser. VI Attachments.

Kodak Ektar *f*/3.3, 35 mm. This wide-angle lens serves outstandingly when it is desired to include a large portion of the subject in the picture; it is especially advantageous when working in close quarters. Due to its shorter focal length this lens has a greater depth of field than the others.
Angle of View: When focused for infinity, 38° x 55°.
Focusing Range: Two-phase scale—Infinity to 3½ ft., and 3 ft. to 1 ft.
Attachment Size: No. 26 Adapter Ring and Ser. VI Attachments.

Kodak Ektar *f*/3.5, 90 mm. With its moderately long focus, this lens gives large, sharply detailed images of semi-distant subjects and is especially adapted to informal portraiture.
Angle of View: When focused for infinity, 15° x 23°.
Focusing Range: Infinity to 3½ ft.
Attachment Size: Ser. V Adapter Ring Insert and Ser. V Attachments or Ser. V-VI Step-up Ring and Ser. VI Attachments.

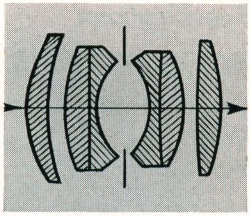
Kodak Telephoto Ektar *f*/3.8, 135 mm., is 60% faster than *f*/4.5 and especially suitable for work under unfavorable light conditions or at high shutter speeds.
Angle of View: When focused for infinity, 10° x 15°.
Focusing Range: Infinity to 4 feet.
Attachment Size: Ser. VI Adapter Ring Insert and Ser. VI Attachments.

Kodak Telephoto Ektar *f*/4.5, 153 mm., yields a 15% larger image size than the 135-mm. lens.
Angle of View: When focused for infinity, 9° x 13°.
Focusing Range: Infinity to 5 ft.
Attachment Size: Ser. VI Adapter Ring Insert and Ser. VI Attachments.

Specifications:

KODAK EKTAR *f*/2.0, 45 mm.

(as used on the Kodak Bantam Special)



This Ektar, the fastest lens in a Kodak Bantam camera, is unexcelled in design and performance. It is made and mounted with great precision, factors of special importance with good miniature camera lenses, and highly corrected for all aberrations. Special attention, however, has been given to careful color correction. The inner air-glass surfaces are treated to reduce internal reflections. This increases shadow detail and brilliance in black-and-white negatives and color purity in Kodachrome transparencies. This lens has a relatively wide angle of view for a lens of this aperture, and due to its short focal length, a great depth of field. An auxiliary focusing mark for infrared film is provided.

Lens Speed: *f*/2.0, marked apertures—*f*/2.0, *f*/2.8, *f*/4, *f*/5.6, *f*/8, *f*/11, and *f*/16.

Focal Length: 45 mm.

Focusing Range: Infinity to 3 feet, coupled with range finder. Marked distances—infinity, 50, 25, 15, 10, 8, 6, 5, 4, 3½, and 3 feet.

Shutter Speeds: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400 sec., T, and B.

Negative Size: 28 x 40 mm.

Angle of View: When focused for infinity, 35° x 48°.

Attachment Size: 1¼ in., 31.5 mm., Ser. VI Attachments except Lens Hood—use Lens Hood Ser. VIA.

Working Distance and Field Size with Kodak Portra Lenses

Camera Focus Scale at	Portra Lens 1+		Portra Lens 2+		Portra Lens 3+	
	Distance Subject to Lens	Approximate Field Size	Distance Subject to Lens	Approximate Field Size	Distance Subject to Lens	Approximate Field Size
INF.	38¾ in.	24⅛ x 34½ in.	19½ in.	12⅛ x 17⅜ in.	13 in.	8⅛ x 11½ in.
50 feet	37 in.	23 x 32¾ in.	19⅛ in.	11¾ x 16⅞ in.	12⅞ in.	8 x 11⅜ in.
25 feet	34¾ in.	21⅝ x 30¾ in.	18½ in.	11½ x 16⅜ in.	12½ in.	7¾ x 11 in.
15 feet	32⅜ in.	20 x 28⅝ in.	17¾ in.	11 x 15⅝ in.	12¼ in.	7½ x 10¾ in.
10 feet	29⅝ in.	18⅛ x 26 in.	16⅞ in.	10⅜ x 14¾ in.	11⅞ in.	7¼ x 10⅜ in.
8 feet	27⅞ in.	17⅛ x 24⅜ in.	16⅜ in.	10 x 14¼ in.	11½ in.	7 x 10 in.
6 feet	25½ in.	15½ x 22⅛ in.	15½ in.	9½ x 13½ in.	11⅛ in.	6⅝ x 9½ in.
5 feet	23¾ in.	14⅜ x 20¼ in.	14⅞ in.	9 x 12⅞ in.	10¾ in.	6½ x 9¼ in.
4 feet	21⅝ in.	13 x 18½ in.	14 in.	8⅜ x 12 in.	10⅜ in.	6¼ x 8⅞ in.
3½ feet	20⅜ in.	12⅛ x 17⅜ in.	13⅜ in.	8 x 11⅜ in.	10 in.	6 x 8½ in.
3 feet	18¾ in.	11⅛ x 15⅞ in.	12¾ in.	7½ x 10¾ in.	9⅝ in.	5¾ x 8⅛ in.

Depth of Field: **Kodak Ektar *f*/2.0, 45 mm.**

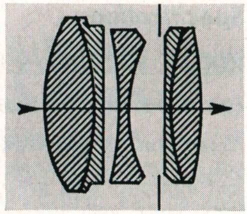
Distance Focused On	Approximate Field Size	DEPTH OF FIELD—IN FEET. Circle of Confusion, 1/500 inch.				
		f/2.0	*f*/4	*f*/8	*f*/11	*f*/16
INF.	35° x 48°	65 to inf.	32 to inf.	16 to inf.	12 to inf.	8 to inf.
50 feet	30⅓′ x 42½′	28 to inf.	19 to inf.	12½ to inf.	9⅔ to inf.	7 to inf.
25 feet	15½′ x 22′	18 to 40	14 to 106	10 to inf.	8 to inf.	6 to inf.
15 feet	9⅓′ x 13⅓′	12 to 19	10⅓ to 27	8 to inf.	6⅔ to inf.	5⅓ to inf.
10 feet	6⅙′ x 8¾′	8⅔ to 12	7⅔ to 14½	6¼ to 25	5½ to 62	4½ to inf.
8 feet	4⅚′ x 6⅚′	7⅙ to 9	6½ to 10⅔	5⅓ to 15⅔	4¾ to 24	4 to inf.
6 feet	3⅔′ x 5⅓′	5½ to 6⅔	5 to 7½	4¼ to 9⅔	4 to 12½	3½ to 24
5 feet	3′ x 4⅓′	4⅔ to 5⅙	4⅓ to 6	3⅚ to 7⅓	3½ to 8⅚	3⅙ to 13½
4 feet	2⅓′ x 3⅓′	3⅔ to 4¼	3½ to 4½	3¼ to 5⅓	3 to 6⅙	2⅔ to 8⅙
3½ feet	2⅙′ x 3′	3⅓ to 3⅔	3⅙ to 4	2⅚ to 4½	2¾ to 5	2½ to 6⅓
3 feet	1¾′ x 2½′	2⅚ to 3⅙	2¾ to 3⅓	2⅔ to 3¾	2½ to 4	2¼ to 5

The depth is not given for *f*/2.8 or *f*/5.6. For these two openings depth can be estimated.

Specifications:

KODAK EKTAR *f*/3.5, 100 mm.

(as used on the Kodak Medalist)



This lens is a new addition to Kodak's line of highest-grade precision lenses, which under the name of "Ektar" have won the acclaim of the really exacting and discriminating photographer. With its fast maximum aperture of *f*/3.5, this lens brings to photographic workers preferring larger negative sizes many of the picture-taking possibilities up to now restricted to miniature cameras. A carefully worked out formula, superior quality of the carefully chosen optical glass from which each one of the 5 elements is made, precision grinding, polishing, and mounting, all contribute to make it a really outstanding lens. Aberrations, especially those in any way affecting excellent color reproduction, are virtually non-existent. Greater clarity and brilliance of black-and-white negatives and also color purity in case of full-color pictures are assured by coating the inner air-glass surfaces of the lens. A coupled range finder and an automatic depth of field indicator aid in exact focusing. An auxiliary infrared focusing mark is provided.

Lens Speed: *f*/3.5, marked apertures—*f*/3.5, *f*/4, *f*/5.6, *f*/8, *f*/11, *f*/16, *f*/22, and *f*/32.

Focal Length: 100 mm.

Focusing Range: Infinity to 3½ feet, with coupled range finder. Marked distances: Infinity, 50, 25, 15, 10, 8, 6, 5, 4, 3½ feet.

Shutter Speeds: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400 sec., B, and delayed-action release.

Negative Size: 2¼ x 3¼ in. and 6.5 x 9 cm.

Angle of View: When focused for infinity, 32° x 45° for 2¼ x 3¼ in., 36° x 49° for 6½ x 9 cm.

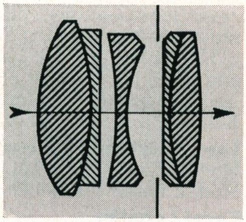
Attachment Size: Threaded lens mount accepts Ser. VI Attachments.

Depth of Field: **Kodak Ektar *f*/3.5, 100 mm.**

Distance Focused On	Approximate Field Size with 2¼ x 3¼″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 1/200 in.			
		f/3.5	*f*/4	*f*/5.6	*f*/8
INF.	32° x 45°	74 to inf.	65 to inf.	46 to inf.	32 to inf.
50 feet	28′ x 41′	30 to 155	28¼ to inf.	24 to inf.	19½ to inf.
25 feet	14′ x 20′	19 to 38	18 to 40	16 to 55	14 to 110
15 feet	8⅓′ x 12¼′	12½ to 19	12¼ to 19½	11 to 22	10 to 28
10 feet	5½′ x 8′	8¾ to 11½	8⅔ to 11¾	8⅙ to 12¾	7⅔ to 14½
8 feet	4⅓′ x 6⅓′	7⅙ to 9	7⅙ to 9⅓	6¾ to 9⅔	6⅓ to 10½
6 feet	3¼′ x 4⅔′	5½ to 6½	5½ to 6¾	5⅓ to 7	5 to 7½
5 feet	2⅔′ x 3⅚′	4⅔ to 5⅓	4⅔ to 5½	4½ to 5⅔	4⅓ to 6
4 feet	2′ x 3′	3⅚ to 4¼	3¾ to 4⅓	3⅔ to 4½	3½ to 4⅔
3½ feet	1⅚′ x 2⅔′	3⅓ to 3⅔	3⅓ to 3¾	3¼ to 3⅚	3⅙ to 4
	Approximate Field Size with 6½ x 9 cm. Neg.	*f*/11	*f*/16	*f*/22	*f*/32
INF.	36° x 49°	23 to inf.	16 to inf.	11¾ to inf.	8 to inf.
50 feet	32′ x 45′	16 to inf.	12 to inf.	9½ to inf.	7 to inf.
25 feet	16′ x 22′	12 to inf.	10 to inf.	8 to inf.	6 to inf.
15 feet	9½′ x 13¼′	9 to 42	7¾ to inf.	6½ to inf.	5¼ to inf.
10 feet	6½′ x 9′	7 to 17	6⅙ to 26	5⅓ to 69	4½ to inf.
8 feet	5′ x 7′	6 to 12	5⅓ to 16	4¾ to 25	4 to inf.
6 feet	3⅔′ x 5′	4¾ to 8⅙	4½ to 10	4 to 13	3½ to 23
5 feet	3′ x 4⅙′	4⅙ to 6½	3⅚ to 7½	3½ to 9⅙	3 to 13⅙
4 feet	2⅓′ x 3⅓′	3½ to 4⅚	3¼ to 5½	3 to 6⅓	2⅔ to 8
3½ feet	2′ x 2⅚′	3⅙ to 4⅙	3 to 4⅔	2¾ to 5¼	2½ to 6⅓

Specifications:

KODAK EKTAR *f*/3.7, 105 mm.



This lens has been designed for use on press and similar cameras or the Kodak Precision Enlarger when used as a camera, where excellence of performance and high speed are desired. It has been corrected for all the usual lens aberrations and works equally well at all distance settings from infinity to about ⅓ subject size at full lens aperture. It is especially suited for use with Kodachrome film. The performance of this lens, like other Ektars, is unsurpassed by any lens of similar type. This lens is only supplied in Kodak No. 2 Supermatic Shutter.

Lens Speed: *f*/3.7, marked apertures—*f*/3.7, *f*/4.5, *f*/5.6, *f*/8, *f*/11, *f*/16, *f*/22, and *f*/32.

Focal Length: 105 mm. (4⅛ in.), Back Focus 87.5 mm. ($3\frac{7}{16}$ in.).

Infrared Focusing: Extend lens .004 in. (.1 mm.) from visual focus.

Shutter Speeds: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400 sec., T, B, delayed-action release, and blade-arrester.

Negative Size: 2¼ x 3¼ in.

Angle of View: When focused for infinity, 31° x 43°.

Attachment Size: 1½ in., 38 mm., Ser. VI Attachments.

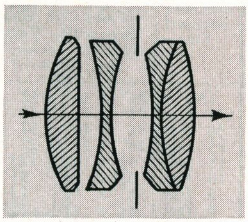
Depth of Field: For Critical Definition **Kodak Ektar *f*/3.7, 105 mm.**

Distance Focused On	Approximate Field Size with 2¼ x 3¼″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc. This equals approximately *f*/1720, and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
		f/3.7	*f*/5.6	*f*/8	*f*/11	*f*/16	*f*/32
INF.	31° x 43°	160 to inf.	105 to inf.	74 to inf.	54 to inf.	37 to inf.	18½ to inf.
100 feet	54′ x 78′	62 to 266	51 to inf.	43 to inf.	35 to inf.	27 to inf.	15⅔ to inf.
50 feet	27′ x 39′	38 to 73	34 to 96	30 to 154	26 to inf.	21 to inf.	13½ to inf.
25 feet	13⅓′ x 19⅓′	22 to 30	20 to 33	18⅔ to 38	17 to 46	15 to 77	10½ to inf.
15 feet	8′ x 11½′	13⅔ to 16½	13 to 17½	12⅛ to 18⅚	11⅔ to 21	10⅔ to 25	8⅓ to 79
10 feet	5¼′ x 7⅔′	9½ to 10⅔	9⅙ to 11	8⅚ to 11½	8½ to 12⅓	7⅚ to 13⅔	6½ to 22
8 feet	4⅙′ x 6′	7⅔ to 8⅓	7½ to 8½	7¼ to 9	7 to 9⅓	6¾ to 10⅙	5⅔ to 14
6 feet	3¼′ x 4¾′	5⅚ to 6¼	5⅔ to 6⅓	5½ to 6½	5⅓ to 6¾	5 to 7	4⅔ to 8⅔
5 feet	2½′ x 3⅔′	4⅚ to 5⅙	4¾ to 5¼	4⅔ to 5⅓	4½ to 5½	4⅓ to 5¾	4 to 6⅔
4 feet	2′ x 2⅚′	4 to 4	3⅚ to 4⅙	3⅚ to 4¼	3¾ to 4⅓	3⅔ to 4½	3⅓ to 5
3½ feet	1¾′ x 2′	3½ to 3½	3⅓ to 3⅔	3⅓ to 3⅔	3¼ to 3¾	3¼ to 3⅚	3 to 4¼

The depth is not given for *f*/4.5 or *f*/22. For these openings it can be estimated by comparison.

Specifications:

KODAK EKTAR *f*/4.5, 101 mm. and *f*/4.7, 127 mm.



These two lenses make available to the users of small and medium sized press and similar cameras the optical pre-eminence represented by Kodak Ektar Lenses. Their ability to meet most exacting requirements in black-and-white and color photography is well known.

They produce definition of exceptional quality at all apertures and all working distances from infinity to about four focal lengths from the lens.

At this distance the image produced is one-third of the size of the subject. When a closer lens-to-subject distance is used, it is advisable to stop the lens below maximum aperture particularly for work demanding critical definition.

Kodak Ektar $f/4.5$, 101 mm. is recommended for negatives up to $2\frac{1}{4}$ x $3\frac{1}{4}$ inches and $f/4.5$, 127 mm. for $3\frac{1}{4}$ x $4\frac{1}{4}$-inch negatives. Both lenses are available in Kodak No. 2 Supermatic Shutters. They are also supplied with metal lens board for Kodak Precision Enlarger.

Lens Speed and Marked Apertures:
Kodak Ektar $f/4.5$, 101 mm.—$f/4.5$, $f/5.6$, $f/8$, $f/11$, $f/16$, $f/22$, and $f/32$.
Kodak Ektar $f/4.7$, 127 mm.—$f/4.7$, $f/5.6$, $f/8$, $f/11$, $f/16$, $f/22$, and $f/32$.

Focal Length:
Kodak Ektar $f/4.5$, 101 mm. (4 in.) Back Focus 90 mm.
Kodak Ektar $f/4.7$, 127 mm. (5 in.) Back Focus 113 mm.

Infrared Focusing: Extend lens .004 in. (.1 mm.) from visual focus for both lenses.

Shutter Speeds: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400 sec., T, B, delayed-action release, and blade-arrester.

Negative Sizes and Angle of View, when focused for infinity:
Kodak Ektar $f/4.5$, 101 mm.—$2\frac{1}{4}$ x $3\frac{1}{4}$ in. 32° x 45°.
Kodak Ektar $f/4.7$, 127 mm.—$3\frac{1}{4}$ x $4\frac{1}{4}$ in. 36° x 46°.

Diameter of Lens Board Mounting Hole:
Kodak Ektar $f/4.5$, 101 mm.—$1\frac{3}{8}$ in., 35 mm.
Kodak Ektar $f/4.7$, 127 mm.—$1\frac{1}{2}$ in., 38 mm.

Attachment Sizes:
Kodak Ektar $f/4.5$, 101 mm.—$1\frac{1}{4}$ in., 31.5 mm., Ser. VI Attachments.
Kodak Ektar $f/4.7$, 127 mm.—$1\frac{1}{2}$ in., 38 mm., Ser. VI Attachments.

Depth of Field: For Critical Definition **Kodak Ektar f/4.5, 101 mm.**

Distance Focused On	Approximate Field Size with $2\frac{1}{4}$ x $3\frac{1}{4}''$ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc. This equals approximately $f/1720$, and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
		$f/4.5$	$f/5.6$	$f/8$	$f/11$	$f/16$	$f/32$
INF.	32° x 45°	127 to inf.	102 to inf.	72 to inf.	52 to inf.	36 to inf.	18 to inf.
100 feet	62′ x 100′	56 to inf.	51 to inf.	42 to inf.	34 to inf.	26 to inf.	15 to inf.
50 feet	28′ x 41′	36 to 82	34 to 98	29 to 165	25 to inf.	21 to inf.	$13\frac{1}{4}$ to inf.
25 feet	14′ x 20′	21 to 31	20 to 33	$18\frac{1}{2}$ to 38	17 to 48	15 to 83	$10\frac{1}{2}$ to inf.
15 feet	$8\frac{1}{3}'$ x $12\frac{1}{4}'$	$13\frac{1}{2}$ to 17	13 to $17\frac{1}{2}$	$12\frac{1}{2}$ to 19	$11\frac{3}{4}$ to 21	$10\frac{1}{2}$ to 26	$8\frac{1}{6}$ to 92
10 feet	$5\frac{1}{2}'$ x 8′	$9\frac{1}{4}$ to $11\frac{1}{3}$	$9\frac{1}{6}$ to 11	$8\frac{3}{4}$ to $11\frac{1}{2}$	$8\frac{1}{3}$ to $12\frac{1}{2}$	$7\frac{3}{4}$ to 14	$6\frac{1}{2}$ to 23
8 feet	$4\frac{1}{3}'$ x $6\frac{1}{3}'$	$7\frac{1}{2}$ to $8\frac{1}{2}$	$7\frac{1}{3}$ to $8\frac{2}{3}$	$7\frac{1}{6}$ to 9	7 to $9\frac{1}{2}$	$6\frac{1}{2}$ to $10\frac{1}{4}$	$5\frac{1}{2}$ to $14\frac{1}{2}$
6 feet	$3\frac{1}{4}'$ x $4\frac{2}{3}'$	$5\frac{3}{4}$ to $6\frac{1}{3}$	$5\frac{2}{3}$ to $6\frac{1}{3}$	$5\frac{1}{2}$ to $6\frac{1}{2}$	$5\frac{1}{3}$ to $6\frac{3}{4}$	$5\frac{1}{6}$ to $6\frac{5}{6}$	$4\frac{1}{2}$ to $8\frac{3}{4}$
5 feet	$2\frac{2}{3}'$ x $3\frac{5}{6}'$	$4\frac{3}{4}$ to $5\frac{1}{4}$	$4\frac{5}{6}$ to $5\frac{1}{4}$	$4\frac{2}{3}$ to $5\frac{1}{3}$	$4\frac{2}{3}$ to $5\frac{1}{2}$	$4\frac{1}{2}$ to $5\frac{3}{4}$	4 to $6\frac{3}{4}$
4 feet	2′ x 3′	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{4}$	$3\frac{3}{4}$ to $4\frac{1}{3}$	$3\frac{2}{3}$ to $4\frac{1}{2}$	$3\frac{1}{3}$ to 5
$3\frac{1}{2}$ feet	$1\frac{5}{6}'$ x $2\frac{2}{3}'$	$3\frac{1}{3}$ to $3\frac{2}{3}$	$3\frac{1}{3}$ to $3\frac{2}{3}$	$3\frac{1}{3}$ to $3\frac{2}{3}$	$3\frac{1}{4}$ to $3\frac{3}{4}$	$3\frac{1}{6}$ to $3\frac{5}{6}$	3 to $4\frac{1}{4}$

The depth is not given for $f/22$. For this opening it can be estimated by comparison.

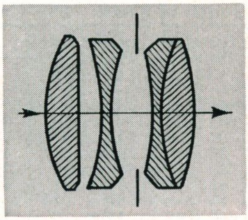
Depth of Field: For Critical Definition **Kodak Ektar f/4.7, 127 mm.**

Distance Focused On	Approximate Field Size with $3\frac{1}{4}$ x $4\frac{1}{4}''$ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc. This equals approximately $f/1720$, and is for critical definition, and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.					
		$f/4.7$	$f/5.6$	$f/8$	$f/11$	$f/16$	$f/32$
INF.	36° x 46°	152 to inf.	128 to inf.	90 to inf.	65 to inf.	45 to inf.	22 to inf.
100 feet	65′ x 85′	60 to 292	56 to inf.	47 to inf.	39 to inf.	31 to inf.	18 to inf.
50 feet	32′ x 42′	37 to 74	36 to 82	32 to 113	28 to inf.	24 to inf.	$15\frac{1}{2}$ to inf.
25 feet	16′ x 21′	22 to 30	21 to 31	$19\frac{1}{2}$ to 35	18 to 41	16 to 57	$11\frac{3}{4}$ to inf.
15 feet	$9\frac{1}{2}'$ x $12\frac{1}{3}'$	$13\frac{2}{3}$ to $16\frac{1}{2}$	$13\frac{1}{3}$ to 17	$12\frac{3}{4}$ to 18	$12\frac{1}{4}$ to $19\frac{1}{2}$	$11\frac{1}{4}$ to 23	9 to 45
10 feet	$6\frac{1}{4}'$ x $8\frac{1}{4}'$	$9\frac{1}{2}$ to $10\frac{3}{4}$	$9\frac{1}{4}$ to $10\frac{5}{6}$	9 to $11\frac{1}{6}$	$8\frac{2}{3}$ to $11\frac{3}{4}$	$8\frac{1}{4}$ to 13	7 to 18
8 feet	5′ x $6\frac{1}{2}'$	$7\frac{2}{3}$ to $8\frac{1}{3}$	$7\frac{1}{2}$ to $8\frac{1}{2}$	$7\frac{1}{3}$ to $8\frac{3}{4}$	$7\frac{1}{6}$ to $9\frac{1}{6}$	$6\frac{5}{6}$ to $9\frac{3}{4}$	6 to $12\frac{1}{4}$
6 feet	$3\frac{2}{3}'$ x $4\frac{3}{4}'$	$5\frac{3}{4}$ to $6\frac{1}{4}$	$5\frac{3}{4}$ to $6\frac{1}{4}$	$5\frac{2}{3}$ to $6\frac{1}{2}$	$5\frac{1}{2}$ to $6\frac{2}{3}$	$5\frac{1}{3}$ to $6\frac{5}{6}$	$4\frac{5}{6}$ to 8
5 feet	3′ x $3\frac{5}{6}'$	$4\frac{5}{6}$ to $5\frac{1}{6}$	$4\frac{5}{6}$ to $5\frac{1}{6}$	$4\frac{3}{4}$ to $5\frac{1}{4}$	$4\frac{2}{3}$ to $5\frac{1}{3}$	$4\frac{1}{2}$ to $5\frac{1}{2}$	$4\frac{1}{6}$ to $6\frac{1}{3}$
4 feet	$2\frac{1}{3}'$ x 3′	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{3}{4}$ to $4\frac{1}{4}$	$3\frac{2}{3}$ to $4\frac{1}{3}$	$3\frac{1}{2}$ to $4\frac{3}{4}$
$3\frac{1}{2}$ feet	2′ x $2\frac{2}{3}$	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{3}$ to $3\frac{2}{3}$	$3\frac{1}{3}$ to $3\frac{2}{3}$	$3\frac{1}{4}$ to $3\frac{3}{4}$	3 to 4

The depth is not given for $f/22$. For this opening it can be estimated by comparison.

Specifications:

EASTMAN EKTARS f/6.3, 8½ in.; f/6.3, 10 in.; f/6.3, 12 in.; f/6.3, 14 in.



These lenses are intended primarily for making color transparencies with Kodachrome Professional Film or color separation negatives. Although designed especially for color work, their use is by no means limited. They are suitable for all types of photography. When used at maximum aperture, the image size on the ground glass should not be larger than about one-third the subject size. At small apertures these lenses perform satisfactorily for almost all types of work, at lens-to-subject distances giving about 1 to 1 image size.

These lenses are exceedingly well corrected for all lens aberrations such as coma, astigmatism, curvature of field, and spherical and chromatic aberration both lateral and longitudinal. (See lens test on page 8.) The inner air-glass surfaces are treated by a special process which reduces reflections. This increases shadow detail and brilliance in black-and-white, and color purity in Kodachrome pictures. Under certain conditions, lens treating adds to the effective speed of a lens.

The Eastman Ektars *f*/6.3 cover at full aperture an angle of 53° and at small stops an angle of 64°. For example, the *f*/6.3, 14-inch lens covers adequately the recommended negative size (8 x 10 inches) at maximum aperture with allowance for full use of the rising and falling front and swing back. At apertures below *f*/16 its 64° covering power permits its use on an 11 x 14-inch camera but without allowance for swing back or rising and falling front.

These four Ektar lenses are available in shutter or in barrel. The use of these lenses for enlarging or projection printing is not recommended.

Lens Speed: *f*/6.3, marked apertures—*f*/6.3, *f*/8, *f*/11, *f*/16, *f*/22, *f*/32, and *f*/45. In barrel, the diaphragm setting ring has "click" stops. As each marked *f*-number passes the index mark, a distinct click is heard and felt.

Focal Length, Recommended Negative Size, and Angle of View:

Focal Length		*Recommended Negative Size*	*Angle of View When Focused for Infinity*
8½ inches	216 mm.	5 x 7 inches	33° x 45°
10 inches	254 mm.	6½ x 8½ inches	36° x 46°
12 inches	304 mm.	8 x 10 inches	37° x 45°
14 inches	356 mm.	8 x 10 inches	32° x 40°

Infrared Focusing: Extend lens after focusing critically for visible light by:
0.008 inch (0.2 mm.) for Eastman Ektar *f*/6.3, 8½ in.
0.012 inch (0.3 mm.) for Eastman Ektar *f*/6.3, 10 in.
0.016 inch (0.4 mm.) for Eastman Ektar *f*/6.3, 12 in.
0.031 inch (0.8 mm.) for Eastman Ektar *f*/6.3, 14 in.

Shutter Speeds:
Ektar *f*/6.3, 8½ in.: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/150 sec., T, B.
Ektar *f*/6.3, 10 and 12 in.: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100 sec., T, B.
Ektar *f*/6.3, 14 in.: 1, 1/2, 1/5, 1/10, 1/25, 1/50 sec., T, B.

Diameter of Lens Board Mounting Hole:

		in.	*mm.*
Ektar *f*/6.3, 8½ in.	in shutter or barrel	2 3/16	55
Ektar *f*/6.3, 10 in.	in shutter or barrel	2 5/8	67
Ektar *f*/6.3, 12 in.	in shutter or barrel	2 7/8	73
Ektar *f*/6.3, 14 in.	in shutter	3 3/8	86
Ektar *f*/6.3, 14 in.	in barrel	3 3/16	81

Attachment Size:
Ektar *f*/6.3, 8½ in.: 1¾ in., 44.5 mm., Ser. VII Attachments.
Ektar *f*/6.3, 10 in.: 2⅛ in., 54 mm., Ser. VIII Attachments.
Ektar *f*/6.3, 12 in.: 2½ in., 63.5 mm., Ser. VIII Attachments.
Ektar *f*/6.3, 14 in.: 2 15/16 in., 75 mm. Use Eastman 4-inch Adjustable Filter Holder.

Depth of Field: For Critical Definition **Ektar *f*/6.3, 8½ in.**

Distance Focused On	Approximate Field Size with 5 x 7″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.*				
		f/6.3	*f*/11	*f*/16	*f*/22	*f*/45
INF.	33° x 45°	193 to inf.	111 to inf.	76 to inf.	55 to inf.	27 to inf.
200 feet	117′ x 163′	98 to inf.	71 to inf.	55 to inf.	43 to inf.	24 to inf.
100 feet	58′ x 82′	66 to 208	53 to inf.	43 to inf.	36 to inf.	21 to inf.
50 feet	29′ x 41′	40 to 68	34 to 91	30 to 146	26 to inf.	18 to inf.
25 feet	14′ x 20′	22 to 29	20 to 32	19 to 37	17 to 46	13 to inf.
15 feet	8⅓′ x 12′	14 to 16¼	13 to 17½	12½ to 19	12 to 21	9½ to 34
10 feet	5½′ x 7⅔′	9½ to 10⅔	9 to 11	8⅚ to 11½	8½ to 12	7⅓ to 16
8 feet	4⅓′ x 6′	7⅔ to 8⅓	7½ to 8⅔	7¼ to 8⅚	7 to 9⅓	6 to 11
6 feet	3⅙′ x 4⅓′	5⅚ to 6¼	5⅔ to 6⅓	5½ to 6½	5⅓ to 6¾	5 to 7½
5 feet	2½′ x 3½′	4⅚ to 5⅙	4¾ to 5¼	4¾ to 5⅓	4⅔ to 5½	4⅙ to 6⅓
4 feet	2′ x 2⅔′	3⅚ to 4⅙	3⅚ to 4¼	3⅚ to 4¼	3⅔ to 4⅓	3½ to 4¾
3½ feet	1⅔′ x 2⅓′	3½ to 3½	3½ to 3½	3⅓ to 3⅔	3⅓ to 3⅔	3 to 4

Depth of Field: For Critical Definition **Ektar *f*/6.3, 10 in.**

Distance Focused On	Approximate Field Size with 6½ x 8½″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.*				
		f/6.3	*f*/11	*f*/16	*f*/22	*f*/45
INF.	36° x 46°	227 to inf.	130 to inf.	90 to inf.	65 to inf.	32 to inf.
400 feet	259′ x 339′	146 to inf.	98 to inf.	73 to inf.	56 to inf.	29 to inf.
200 feet	129′ x 169′	107 to inf.	79 to inf.	62 to inf.	49 to inf.	27 to inf.
100 feet	65′ x 85′	70 to 178	57 to inf.	47 to inf.	39 to inf.	24 to inf.
50 feet	32′ x 42′	41 to 64	36 to 81	32 to 113	28 to 214	19 to inf.
25 feet	16′ x 21′	22½ to 28	21 to 31	20 to 35	18 to 40	14 to 117
15 feet	9′ x 12′	14 to 16⅙	13½ to 17	13 to 18	12 to 20	10 to 28
10 feet	6′ x 8′	9⅔ to 10½	9⅓ to 11	9 to 11⅓	8⅔ to 12	7½ to 14
8 feet	4⅔′ x 6′	7¾ to 8⅓	7⅔ to 8½	7⅓ to 8¾	7¼ to 9⅙	6⅓ to 10¾
6 feet	3⅓′ x 4⅓′	5⅚ to 6⅙	5¾ to 6⅓	5⅔ to 6½	5½ to 6¾	5⅙ to 7⅓
5 feet	2⅔′ x 3½′	4⅚ to 5⅙	4¾ to 5¼	4⅔ to 5⅓	4½ to 5½	4⅓ to 5¾
4 feet	2′ x 2¾′	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3⅔ to 4½
3½ feet	1¾′ x 2¼′	3½ to 3½	3½ to 3½	3⅓ to 3⅔	3⅓ to 3¾	3¼ to 4

Depth of Field: For Critical Definition **Ektar *f*/6.3, 12 in.**

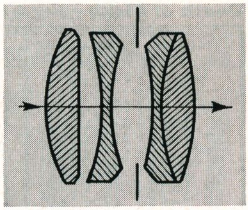
Distance Focused On	Approximate Field Size with 8 x 10″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.*				
		f/6.3	*f*/11	*f*/16	*f*/22	*f*/45
INF.	37° x 45°	273 to inf.	156 to inf.	107 to inf.	78 to inf.	38 to inf.
400 feet	266′ x 332′	162 to inf.	112 to inf.	85 to inf.	65 to inf.	35 to inf.
200 feet	133′ x 166′	115 to inf.	88 to inf.	70 to inf.	56 to inf.	32 to inf.
100 feet	66′ x 83′	73 to 158	61 to 278	52 to inf.	45 to 310	28 to inf.
50 feet	33′ x 41′	42 to 61	38 to 74	34 to 94	31 to 139	22 to inf.
25 feet	16′ x 20′	23 to 27	21 to 30	20 to 33	19 to 37	15 to 73
15 feet	9⅓′ x 12′	14¼ to 16	13½ to 17	13 to 17½	12½ to 19	11 to 25
10 feet	6′ x 7½′	9⅔ to 10½	9¼ to 10⅚	9⅙ to 11⅙	8⅚ to 12	8 to 14
8 feet	4⅔′ x 5¾′	7¾ to 8¼	7⅔ to 8½	7½ to 8⅔	7⅓ to 8⅚	6⅔ to 10⅙
6 feet	3⅓′ x 4⅙′	5⅚ to 6¼	5¾ to 6⅓	5¾ to 6⅓	5⅔ to 6⅔	5¼ to 7
5 feet	2⅔′ x 3⅓′	4⅚ to 5⅙	4⅚ to 5⅙	4⅚ to 5⅙	4¾ to 5⅓	4⅓ to 5¾
4 feet	2′ x 2½′	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3⅔ to 4½
3½ feet	1⅔′ x 2⅙′	3½ to 3½	3½ to 3½	3½ to 3½	3⅓ to 3⅔	3¼ to 3⅚

Depth of Field: For Critical Definition **Ektar *f*/6.3, 14 in.**

Distance Focused On	Approximate Field Size with 8 x 10″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.*				
		f/6.3	*f*/11	*f*/16	*f*/22	*f*/45
INF.	32° x 40°	318 to inf.	182 to inf.	125 to inf.	92 to inf.	45 to inf.
400 feet	228′ x 285′	177 to inf.	125 to inf.	95 to inf.	74 to inf.	41 to inf.
200 feet	113′ x 142′	123 to 540	96 to inf.	78 to inf.	63 to inf.	36 to inf.
100 feet	56′ x 71′	76 to 146	65 to 220	56 to inf.	48 to inf.	31 to inf.
50 feet	28′ x 35′	44 to 59	39 to 69	36 to 84	32 to 110	24 to 574
25 feet	14′ x 17′	23 to 27	22 to 29	21 to 31	19 to 34	16 to 61
15 feet	8′ x 10′	14½ to 16	14 to 16½	13½ to 17	13 to 18	11¼ to 23
10 feet	5′ x 6¼′	9⅔ to 10⅓	9½ to 10¾	9¼ to 11	9 to 11½	8⅓ to 13
8 feet	3⅚′ x 4⅚′	7¾ to 8¼	7¾ to 8⅓	7⅔ to 8½	7½ to 8¾	6¾ to 9¾
6 feet	2¾′ x 3½′	5⅚ to 6⅙	5¾ to 6⅓	5¾ to 6⅓	5⅔ to 6½	5⅓ to 6⅚
5 feet	2¼′ x 2¾′	4⅚ to 5⅙	4⅚ to 5⅙	4⅚ to 5¼	4¾ to 5⅓	4½ to 5¾
4 feet	1⅔′ x 2′	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4¼	3⅔ to 4½
3½ feet	1⅓′ x 1⅔′	3½ to 3½	3½ to 3½	3½ to 3½	3½ to 3½	3⅓ to 3¾

The depth is not given for *f*/8 or *f*/32. For these openings depth can be estimated by comparison.
*This equals approximately *f*/1720, and is for very critical definition and when extreme enlargements are to be made from the negatives. For normal work, the depth of field is greater.

Specifications:



KODAK ANASTIGMATS *f*/4.5, 5½ in.; *f*/4.5, 6⅜ in.; *f*/4.5, 7½ in.; *f*/4.5, 8½ in.; *f*/4.5, 10 in.; *f*/4.5, 12 in.

These lenses, primarily intended for press, commercial, and studio cameras, are remarkably fine lenses, covering fully the recommended film or plate sizes at their *f*/4.5 maximum aperture. Every one of them gives very good definition and satisfactory flatness of field. These lenses are recommended for any type of work which requires the fine definition of an anastigmat and are especially suitable for home or studio portraiture, architectural, landscape, and sports photography. Lens corrections are maintained from infinity to about ⅓ subject size at *f*/4.5. At small stops these lenses perform satisfactorily for most work at even closer range. These lenses are available in barrels, and lenses Nos. 32 to 36 in shutters.

Focal Length, Negative Size, Angle of View, and Attachment Size:

Lens	*Focal Length in inches*	*Recommended Negative Size inches*	*Angle of View When Focused for Infinity*	*Attachment Size in.*	*mm.*	
No. 31	5½	3¼ x 4¼	33° x 42°	1 9/16	39.5	Ser. VI
No. 32	6⅜	4 x 5	35° x 43°	1¾	44.5	Ser. VII
No. 33	7½	5 x 7	37° x 53°	2	50.5	Ser. VII
No. 34	8½	5 x 8	33° x 50°	2⅜	60	Ser. VIII
No. 35	10	6½ x 8½	36° x 46°	2⅝	67	Ser. VIII
No. 36	12	8 x 10	37° x 45°	3⅜	85.5	*

*Use Eastman 4-inch Adjustable Filter Holder.

Infrared Focusing: Extend lens from visual focus by:

.012 inch (.3 mm.) for 5½-inch (No. 31) lens
.023 inch (.6 mm.) for 6⅜-inch (No. 32) lens
.027 inch (.7 mm.) for 7½-inch (No. 33) lens
.031 inch (.8 mm.) for 8½- and 10-inch (No. 34 and No. 35) lens
.047 inch (1.2 mm.) for 12-inch (No. 36) lens

Shutter Speeds:

No. 32 lens : 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/150 sec., T, B.
No. 33 and No. 34 lens: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100 sec., T, B.
No. 35 and No. 36 lens: 1, 1/2, 1/5, 1/10, 1/25, 1/50 sec., T, B.

Depth of Field: For Critical Definition **No. 31 K. A. *f*/4.5, 5½ in.**

Distance Focused On	Approximate Field Size with 3¼ x 4¼″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.* *f*/4.5	*f*/8	*f*/11	*f*/22	*f*/45
INF.	33° x 42°	175 to inf.	99 to inf.	72 to inf.	36 to inf.	17 to inf.
100 feet	59′ x 77′	63 to 234	50 to inf.	42 to inf.	27 to inf.	15 to inf.
50 feet	28′ x 38′	39 to 70	33 to 101	30 to 166	21 to inf.	13 to inf.
25 feet	14′ x 19′	22 to 29	20 to 33	18 to 38	15 to 83	10 to inf.
15 feet	8½′ x 11′	14 to 16	13 to 18	12 to 19	10½ to 26	8 to 105
10 feet	5½′ x 7½′	9½ to 10¾	9 to 11¼	8⅚ to 11¾	7¾ to 14	6½ to 23
8 feet	4½′ x 5⅚′	7¾ to 8⅓	7½ to 8¾	7¼ to 9	6½ to 10¼	5⅓ to 15
6 feet	3¼′ x 4¼′	5¾ to 6¼	5⅔ to 6½	5½ to 6⅔	5¼ to 7⅙	4½ to 8¾
5 feet	2⅔′ x 3½′	4⅚ to 5⅙	4¾ to 5⅓	4⅔ to 5½	4⅓ to 5¾	3⅚ to 6¾
4 feet	2′ x 2¾′	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3⅔ to 4½	3⅓ to 5⅓
3½ feet	1¾′ x 2⅓′	3½ to 3½	3⅓ to 3⅔	3⅓ to 3⅔	3¼ to 3⅚	2⅚ to 4⅓

The depth of field is not given for *f*/5.6, *f*/16, or *f*/32. The depth for these openings can be estimated.

*This equals approximately *f*/1720, and is for very critical definition and when extreme enlargements are to be made from the negatives. For normal work, the depth of field is greater.

Depth of Field: For Critical Definition **No. 32 K. A. *f*/4.5, 6⅜ in.**

Distance Focused On	Approximate Field Size with 4 x 5″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.*				
		f/4.5	*f*/8	*f*/11	*f*/22	*f*/45
INF.	35° x 42°	203 to inf.	114 to inf.	83 to inf.	42 to inf.	20 to inf.
100 feet	62′ x 78′	67 to 200	53 to inf.	45 to inf.	29 to inf.	17 to inf.
50 feet	31′ x 39′	40 to 67	35 to 89	31 to 126	23 to inf.	15 to inf.
25 feet	15′ x 18′	22 to 29	20 to 32	19 to 36	16 to 63	11 to inf.
15 feet	9′ x 11′	14 to $16\frac{1}{4}$	13 to 17	$12\frac{1}{2}$ to 18	11 to 24	$8\frac{1}{2}$ to 58
10 feet	6′ x $7\frac{1}{2}$′	$9\frac{1}{2}$ to $10\frac{2}{3}$	$9\frac{1}{4}$ to 11	9 to $11\frac{2}{3}$	$8\frac{1}{4}$ to 13	$6\frac{2}{3}$ to 20
8 feet	$4\frac{3}{4}$′ x $5\frac{5}{6}$′	$7\frac{3}{4}$ to $8\frac{1}{3}$	$7\frac{1}{2}$ to $8\frac{2}{3}$	$7\frac{1}{3}$ to $8\frac{3}{4}$	$6\frac{3}{4}$ to 10	$5\frac{2}{3}$ to 13
6 feet	$3\frac{1}{2}$′ x $4\frac{1}{3}$′	$5\frac{3}{4}$ to $6\frac{1}{4}$	$5\frac{3}{4}$ to $6\frac{1}{2}$	$5\frac{2}{3}$ to $6\frac{1}{2}$	$5\frac{1}{3}$ to 7	$4\frac{3}{4}$ to $8\frac{3}{4}$
5 feet	$2\frac{3}{4}$′ x $3\frac{1}{2}$′	$4\frac{5}{6}$ to $5\frac{1}{6}$	$4\frac{3}{4}$ to $5\frac{1}{4}$	$4\frac{3}{4}$ to $5\frac{1}{3}$	$4\frac{1}{2}$ to $5\frac{3}{4}$	4 to $6\frac{1}{2}$
4 feet	$2\frac{1}{6}$′ x $2\frac{3}{4}$′	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{3}{4}$ to $4\frac{1}{4}$	$3\frac{3}{4}$ to $4\frac{1}{2}$	$3\frac{1}{2}$ to 5
$3\frac{1}{2}$ feet	$1\frac{5}{6}$′ x $2\frac{1}{3}$′	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{3}$ to $3\frac{2}{3}$	$3\frac{1}{4}$ to $3\frac{3}{4}$	3 to $4\frac{1}{6}$

Depth of Field: For Critical Definition **No. 33 K. A. *f*/4.5, 7½ in.**

Distance Focused On	Approximate Field Size with 5 x 7″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.*				
		f/4.5	*f*/8	*f*/11	*f*/22	*f*/45
INF.	37° x 53°	239 to inf.	134 to inf.	98 to inf.	49 to inf.	24 to inf.
200 feet	113′ x 186′	109 to inf.	80 to inf.	66 to inf.	39 to inf.	21 to inf.
100 feet	66′ x 93′	70 to 172	58 to inf.	50 to inf.	33 to inf.	19 to inf.
50 feet	33′ x 46′	42 to 63	36 to 80	33 to 103	25 to inf.	16 to inf.
25 feet	16′ x 23′	23 to 28	21 to 31	20 to 34	17 to 51	12 to inf.
15 feet	10′ x 13′	14 to 16	$13\frac{1}{2}$ to 17	13 to 18	11 to 22	9 to 40
10 feet	$6\frac{1}{4}$′ x $8\frac{3}{4}$′	$9\frac{1}{2}$ to $10\frac{1}{2}$	$9\frac{1}{3}$ to 11	$9\frac{1}{6}$ to $11\frac{1}{3}$	$8\frac{1}{3}$ to $12\frac{1}{2}$	7 to 17
8 feet	$4\frac{5}{6}$′ x $6\frac{5}{6}$′	$7\frac{3}{4}$ to $8\frac{1}{4}$	$7\frac{2}{3}$ to $8\frac{1}{2}$	$7\frac{1}{2}$ to $8\frac{3}{4}$	$6\frac{5}{6}$ to $9\frac{2}{3}$	6 to 12
6 feet	$3\frac{2}{3}$′ x 5′	$5\frac{3}{4}$ to $6\frac{1}{4}$	$5\frac{3}{4}$ to $6\frac{1}{3}$	$5\frac{2}{3}$ to $6\frac{1}{2}$	$5\frac{1}{2}$ to $6\frac{3}{4}$	$4\frac{3}{4}$ to 8
5 feet	$3\frac{1}{4}$′ x $4\frac{2}{3}$′	$4\frac{5}{6}$ to $5\frac{1}{6}$	$4\frac{3}{4}$ to $5\frac{1}{4}$	$4\frac{3}{4}$ to $5\frac{1}{3}$	$4\frac{1}{2}$ to $5\frac{2}{3}$	$4\frac{1}{6}$ to $6\frac{1}{3}$
4 feet	$2\frac{1}{4}$′ x $3\frac{1}{6}$′	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{2}{3}$ to $4\frac{1}{3}$	$3\frac{1}{2}$ to $4\frac{3}{4}$
$3\frac{1}{2}$ feet	$1\frac{5}{6}$′ x $2\frac{2}{3}$′	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{2}$ to $3\frac{2}{3}$	$3\frac{1}{2}$ to $3\frac{2}{3}$	$3\frac{1}{3}$ to $3\frac{3}{4}$	3 to 4

Depth of Field: For Critical Definition **No. 34 K. A. *f*/4.5, 8½ in.**

Distance Focused On	Approximate Field Size with 5 x 8″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.*				
		f/4.5	*f*/8	*f*/11	*f*/22	*f*/45
INF.	33° x 50°	271 to inf.	152 to inf.	111 to inf.	55 to inf.	27 to inf.
200 feet	117′ x 187′	115 to inf.	86 to inf.	71 to inf.	43 to inf.	24 to inf.
100 feet	58′ x 93′	73 to 158	60 to 292	53 to inf.	36 to inf.	21 to inf.
50 feet	29′ x 52′	42 to 61	37 to 75	34 to 91	26 to inf.	18 to inf.
25 feet	14′ x 23′	24 to 27	$21\frac{3}{4}$ to 30	20 to 32	17 to 46	13 to inf.
15 feet	$8\frac{1}{3}$′ x $13\frac{1}{4}$′	$14\frac{1}{4}$ to $16\frac{1}{2}$	$13\frac{1}{2}$ to 17	13 to $17\frac{1}{2}$	12 to 21	$9\frac{1}{2}$ to 34
10 feet	$5\frac{1}{2}$′ x $8\frac{3}{4}$′	$9\frac{2}{3}$ to $10\frac{1}{2}$	$9\frac{1}{3}$ to $10\frac{3}{4}$	9 to 11	$8\frac{1}{2}$ to 12	$7\frac{1}{3}$ to 16
8 feet	$4\frac{1}{3}$′ x $6\frac{5}{6}$′	$7\frac{3}{4}$ to $8\frac{1}{4}$	$7\frac{2}{3}$ to $8\frac{1}{2}$	$7\frac{1}{2}$ to $8\frac{2}{3}$	7 to $9\frac{1}{3}$	6 to 11
6 feet	$3\frac{1}{6}$′ x 5′	$5\frac{5}{6}$ to $6\frac{1}{6}$	$5\frac{3}{4}$ to $6\frac{1}{3}$	$5\frac{2}{3}$ to $6\frac{1}{3}$	$5\frac{1}{3}$ to $6\frac{3}{4}$	5 to $7\frac{1}{2}$
5 feet	$2\frac{1}{2}$′ x 4′	$4\frac{5}{6}$ to $5\frac{1}{6}$	$4\frac{3}{4}$ to $5\frac{1}{4}$	$4\frac{3}{4}$ to $5\frac{1}{4}$	$4\frac{2}{3}$ to $5\frac{1}{2}$	$4\frac{1}{6}$ to $6\frac{1}{3}$
4 feet	2′ x $3\frac{1}{6}$′	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{4}$	$3\frac{2}{3}$ to $4\frac{1}{3}$	$3\frac{1}{2}$ to $4\frac{3}{4}$
$3\frac{1}{2}$ feet	$1\frac{2}{3}$′ x $2\frac{2}{3}$′	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{3}$ to $3\frac{2}{3}$	3 to 4

Depth of Field: For Critical Definition **No. 35 K. A. *f*/4.5, 10 in.**

Distance Focused On	Approximate Field Size with $6\frac{1}{2}$ x $8\frac{1}{2}$″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.*				
		f/4.5	*f*/8	*f*/11	*f*/22	*f*/45
INF.	36° x 46°	318 to inf.	179 to inf.	130 to inf.	65 to inf.	32 to inf.
400 feet	259′ x 339′	175 to inf.	124 to inf.	98 to inf.	56 to inf.	29 to inf.
200 feet	129′ x 169′	128 to 550	95 to inf.	79 to inf.	49 to inf.	27 to inf.
100 feet	65′ x 85′	78 to 144	64 to 226	57 to inf.	39 to inf.	24 to inf.
50 feet	32′ x 42′	43 to 59	39 to 69	36 to 81	28 to 214	19 to inf.
25 feet	16′ x 21′	23 to 27	22 to 29	21 to 31	18 to 40	14 to 117
15 feet	9′ x 12′	$14\frac{1}{2}$ to 16	$13\frac{2}{3}$ to $16\frac{2}{3}$	$13\frac{1}{2}$ to 17	12 to 20	10 to 28
10 feet	6′ x 8′	$9\frac{1}{2}$ to $10\frac{1}{2}$	$9\frac{2}{3}$ to $10\frac{2}{3}$	$9\frac{1}{3}$ to 11	$8\frac{2}{3}$ to 12	$7\frac{1}{2}$ to 14
8 feet	$4\frac{2}{3}$′ x 6′	$7\frac{3}{4}$ to $8\frac{1}{4}$	$7\frac{3}{4}$ to $8\frac{1}{3}$	$7\frac{2}{3}$ to $8\frac{1}{2}$	$7\frac{1}{4}$ to $9\frac{1}{6}$	$6\frac{1}{3}$ to $10\frac{3}{4}$
6 feet	$3\frac{1}{3}$′ x $4\frac{1}{3}$′	$5\frac{5}{6}$ to $6\frac{1}{6}$	$5\frac{3}{4}$ to $6\frac{1}{3}$	$5\frac{3}{4}$ to $6\frac{1}{3}$	$5\frac{1}{2}$ to $6\frac{3}{4}$	$5\frac{1}{6}$ to $7\frac{1}{3}$
5 feet	$2\frac{2}{3}$′ x $3\frac{1}{2}$′	$4\frac{5}{6}$ to $5\frac{1}{6}$	$4\frac{5}{6}$ to $5\frac{1}{6}$	$4\frac{3}{4}$ to $5\frac{1}{4}$	$4\frac{1}{2}$ to $5\frac{1}{2}$	$4\frac{1}{3}$ to $5\frac{3}{4}$
4 feet	2′ x $2\frac{3}{4}$′	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{5}{6}$ to $4\frac{1}{6}$	$3\frac{3}{4}$ to $4\frac{1}{4}$	$3\frac{2}{3}$ to $4\frac{1}{2}$
$3\frac{1}{2}$ feet	$1\frac{3}{4}$′ x $2\frac{1}{4}$′	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{2}$ to $3\frac{1}{2}$	$3\frac{1}{3}$ to $3\frac{3}{4}$	$3\frac{1}{4}$ to 4

The depth of field is not given for *f*/5.6, *f*/16, or *f*/32. The depth for these openings can be estimated.
*This equals approximately *f*/1720, and is for very critical definition, and when extreme enlargements are to be made from the negatives. For normal work, the depth of field is greater.

Depth of Field: For Critical Definition **No. 36 K. A. *f*/4.5, 12 in.**

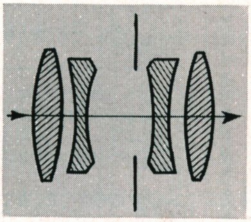
Distance Focused On	Approximate Field Size with 8 x 10″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.*				
		f/4.5	*f*/8	*f*/11	*f*/22	*f*/45
INF.	37° x 45°	382 to inf.	215 to inf.	156 to inf.	78 to inf.	38 to inf.
400 feet	266′ x 332′	185 to inf.	140 to inf.	112 to inf.	65 to inf.	35 to inf.
200 feet	133′ x 166′	135 to 425	110 to inf.	88 to inf.	56 to inf.	32 to inf.
100 feet	66′ x 83′	81 to 135	68 to 187	61 to 278	45 to 310	28 to inf.
50 feet	33′ x 41′	45 to 57	41 to 65	38 to 74	31 to 139	22 to inf.
25 feet	16′ x 20′	24 to 26	22 to 28	21 to 30	19 to 37	15 to 73
15 feet	9⅓′ x 12′	14½ to 15½	14 to 16½	13½ to 17	12½ to 19	11 to 25
10 feet	6′ x 7½′	9¾ to 10¼	9½ to 10⅔	9¼ to 10⅚	8⅚ to 12	8 to 14
8 feet	4⅔′ x 5¾′	7¾ to 8¼	7¾ to 8⅓	7⅔ to 8½	7⅓ to 8⅚	6⅔ to 10⅙
6 feet	3⅓′ x 4⅙′	5⅚ to 6⅙	5¾ to 6¼	5¾ to 6⅓	5⅔ to 6⅔	5¼ to 7
5 feet	2⅔′ x 3⅓′	4⅚ to 5⅙	4⅚ to 5⅙	4⅚ to 5⅙	4¾ to 5⅓	4⅓ to 5¾
4 feet	2′ x 2½′	3⅚ to 4⅙	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3⅔ to 4½
3½ feet	1⅔′ x 2⅙′	3½ to 3½	3½ to 3½	3½ to 3½	3⅓ to 3⅔	3¼ to 3⅚

The depth is not given for *f*/5.6, *f*/16, or *f*/32. For these openings depth can be estimated by comparison.

*This equals approximately *f*/1720 and is for very critical definition and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.

Specifications:

No. 70 KODAK ANASTIGMAT *f*/7.7, 8 in.



This lens, primarily intended for the Eastman 2D View and other 5 x 7 cameras, is of the symmetrical, air-spaced type which retains its corrections to a high degree when used for extreme close-ups. It gives extremely sharp definition over the whole field for all subject distances at maximum lens aperture. This lens is supplied in a Kodak No. 2 Supermatic Shutter.

Lens Speed: *f*/7.7, marked apertures—*f*/7.7, *f*/11, *f*/16, *f*/22, *f*/32, and *f*/45.

Focal Length: 8 inches, 203 mm., Back Focus 7½ inches, 190 mm.

Infrared Focusing: Extend lens .016 inch (.4 mm.) from visual focus.

Negative Size: 5 x 7 inches.

Angle of View: When focused for infinity, 35° x 47°.

Shutter Speeds: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400 sec., T, B, delayed-action release, and blade-arrester.

Diameter of Lens Board Mounting Hole: 1½ inches (38 mm.).

Attachment Size: 1 5/16 in., 33 mm., Ser. VI Attachments.

Depth of Field: For Critical Definition **No. 70 K. A. *f*/7.7, 8 in.**

Distance Focused On	Approximate Field Size with 5 x 7″ Neg.	DEPTH OF FIELD—IN FEET. Circle of Confusion, 2′ arc.*				
		f/7.7	*f*/11	*f*/16	*f*/22	*f*/45
INF.	35° x 47°	149 to inf.	104 to inf.	72 to inf.	52 to inf.	26 to inf.
200 feet	124′ x 174′	86 to inf.	68 to inf.	53 to inf.	41 to inf.	23 to inf.
100 feet	62′ x 87′	60 to 304	51 to inf.	42 to inf.	34 to inf.	21 to inf.
50 feet	31′ x 43′	37 to 75	34 to 96	30 to 165	26 to inf.	17 to inf.
25 feet	15′ x 21′	21 to 30	20 to 33	18 to 38	17 to 48	13 to inf.
15 feet	8⅚′ x 12½′	14 to 17	13 to 18	12½ to 19	11¾ to 21	9⅓ to 36
10 feet	5¾′ x 8¼′	9⅓ to 10¾	9⅙ to 11¼	8¾ to 11¾	8½ to 12⅓	7¼ to 16¼
8 feet	4⅔′ x 6½′	7⅔ to 8½	7½ to 8⅔	7¼ to 9	6⅚ to 9⅓	6⅙ to 11⅔
6 feet	3⅓′ x 4⅔′	5¾ to 6¼	5¾ to 6½	5⅔ to 6⅔	5½ to 6¾	4⅚ to 8
5 feet	2¾′ x 3¾′	4¾ to 5¼	4¾ to 5¼	4¾ to 5⅓	4⅔ to 5½	4¼ to 6⅓
4 feet	2′ x 2⅚′	3⅚ to 4⅙	3⅚ to 4⅙	3¾ to 4¼	3¾ to 4⅓	3½ to 4¾
3½ feet	1¾′ x 2½′	3½ to 3½	3½ to 3½	3½ to 3⅔	3⅓ to 3¾	3⅙ to 4

The depth is not given for *f*/32. For this opening depth can be estimated by comparison.

*This equals approximately *f*/1720 and is for very critical definition and when extreme enlargements are to be made from the negatives. For normal work the depth of field is greater.

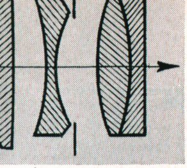
Kodak Lenses Supplied Separately in Shutters or Barrels for Use on Commercial, Portrait, Press, View, and Reflex Cameras with Interchangeable Lens Boards

LENS	Available in	Focal Length		Back Focus	Recommended Maximum Negative Size	Angle of View when focused for "inf." with recommended Negative Size	Kodak Adapter Ring Size		Kodak Lens Attach. Ser.	Diameter of Lens Board Mounting Hole		Over-All Length of Lens Mount
		in.	mm.	in.	inches		in.	mm.		in.	mm.	inches
Kodak Ektar f/4.5, 101 mm.	No. 1 Supermatic Shutter	4	101	3 1/2	2 1/4 x 3 1/4	32° x 45°	1 1/4	31.5	VI	1 3/8	35	1
Kodak Ektar f/3.7, 105 mm.	No. 2 Supermatic Shutter	4 1/8	105	3 7/16	2 1/4 x 3 1/4	31° x 42°	1 1/2	38	VI	1 3/8	35	1 11/32
Kodak Ektar f/4.7, 127 mm.	No. 2 Supermatic Shutter	5	127	4 7/16	3 1/4 x 4 1/4	36° x 46°	1 1/2	38	VI	1 1/2	38	1 5/32
No. 31 Kodak Anastigmat f/4.5, 5 1/2 in.	Barrel only	5 1/2	140	5	3 1/4 x 4 1/4	33° x 42°	1 9/16	39.5	VI	1 7/8	47.5	1 5/16
No. 32 Kodak Anastigmat f/4.5, 6 3/8 in.	No. 3 Ilex Univ. Shutter	6 3/8	161	5 3/4	4 x 5	35° x 43°	1 3/4	44.5	VII	2	50.5	1 3/8
	Barrel	6 3/8	161	5 3/4	4 x 5	35° x 43°	1 3/4	44.5	VII	2 3/32	53	1 7/16
No. 33 Kodak Anastigmat f/4.5, 7 1/2 in.	No. 4 Ilex Univ. Shutter	7 1/2	190	6 3/4	5 x 7	37° x 53°	2	50.5	VII	2 5/8	67	1 9/16
	Barrel	7 1/2	190	6 3/4	5 x 7	37° x 53°	2	50.5	VII	2 3/8	60	1 5/8
No. 70 Kodak Anastigmat f/7.7, 8 in.	No. 2 Supermatic Shutter	8	203	7 1/2	5 x 7	35° x 47°	1 5/16	33	VI	1 1/2	38	1 1/4
Eastman Ektar f/6.3, 8 1/2 in.	No. 3 Ilex Univ. Shutter	8 1/2	216	7 3/4	5 x 7	33° x 45°	1 3/4	44.5	VII	2 3/16	55	1 3/4
	Barrel	8 1/2	216	7 3/4	5 x 7	33° x 45°	1 3/4	44.5	VII	2 3/16	55	1 3/4
No. 34 Kodak Anastigmat f/4.5, 8 1/2 in.	No. 4 Ilex Univ. Shutter	8 1/2	216	7 3/4	5 x 8	33° x 50°	2 3/8	60	VIII	2 5/8	67	1 3/4
	Barrel	8 1/2	216	7 3/4	5 x 8	33° x 50°	2 3/8	60	VIII	2 5/8	67	1 13/16
Eastman Ektar f/6.3, 10 in.	No. 4 Ilex Univ. Shutter	10	254	9 1/8	6 1/2 x 8 1/2	36° x 46°	2 1/8	54	VIII	2 5/8	67	2 1/16
	Barrel	10	254	9 1/8	6 1/2 x 8 1/2	36° x 46°	2 1/8	54	VIII	2 5/8	67	2 1/16
No. 35 Kodak Anastigmat f/4.5, 10 in.	No. 5 Ilex Univ. Shutter	10	254	9	6 1/2 x 8 1/2	36° x 46°	2 5/8	67	VIII	3 3/8	86	2 1/8
	Barrel	10	254	9	6 1/2 x 8 1/2	36° x 46°	2 5/8	67	VIII	2 7/8	73	2 3/16
Eastman Ektar f/6.3, 12 in.	No. 4 Ilex Univ. Shutter	12	304	11	8 x 10	37° x 45°	2 1/2	63.5	VIII	2 7/8	73	2 1/2
	Barrel	12	304	11	8 x 10	37° x 45°	2 1/2	63.5	VIII	2 7/8	73	2 1/2
No. 36 Kodak Anastigmat f/4.5, 12 in.	No. 5 Ilex Univ. Shutter	12	304	10 7/8	8 x 10	37° x 45°	3 3/8	85.5	—*	3 3/8	86	2 9/16
	Barrel	12	304	10 7/8	8 x 10	37° x 45°	3 3/8	85.5	—*	3 5/8	92	2 9/16
Eastman Ektar f/6.3, 14 in.	No. 5 Ilex Univ. Shutter	14	356	12 3/4	8 x 10	32° x 40°	2 15/16	75	—*	3 3/8	86	2 15/16
	Barrel	14	356	12 3/4	8 x 10	32° x 40°	2 15/16	75	—*	3 3/16	81	2 15/16

Kodak No. 1, and No. 2 Supermatic (pre-setting): 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/200, 1/400, T, B, with Blade Arrester and built-in delayed-action release—
Ilex Universal (self-setting) No. 3: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, 1/150, T and B; No. 4: 1, 1/2, 1/5, 1/10, 1/25, 1/50, 1/100, T and B;
No. 5: 1, 1/2, 1/5, 1/10, 1/25, 1/50, T and B—

*Use Eastman 4 in. Adjustable Filter Holder.

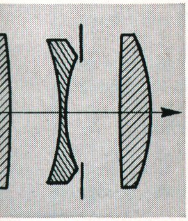
LENSES ON KODAKS



A. S. *f*/3.5, 50 mm.

KODAK ANASTIGMAT SPECIAL *f*/3.5, 50 mm. (as used on Kodak 35)

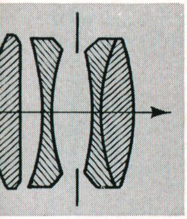
Aperture Range: *f*/3.5 to *f*/16. Negative Size: 24 x 36 mm.
Infrared Focusing: Turn focusing scale counterclockwise by 0.25 in.*
Shutter Speeds: 1/10 to 1/200 sec., T, B, and delayed-action release.
Attachment Size: 1¼ in., 31.5 mm., Ser. VI Attachments.



. *f*/4.5, 51 mm., and *f*/5.6, 50 mm.

KODAK ANASTIGMAT *f*/4.5, 51 mm., and *f*/5.6, 50 mm. (as used on Kodak 35)

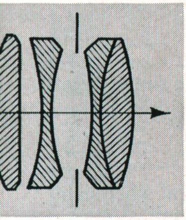
Aperture Range: *f*/4.5 or *f*/5.6, respectively, to *f*/16.
Infrared Focusing: Turn focusing scale counterclockwise by 0.17 in.*
Shutter Speeds: *f*/4.5 model: 1/25 to 1/150 sec., T, B, and delayed-action release. *F*/5.6 model: 1/25 to 1/100 sec., T, and B.
Negative Size: 24 x 36 mm.
Attachment Size: *f*/4.5–1¼ in., 31.5 mm., Ser. VI Attachments.
f/5.6–1$\frac{5}{16}$ in., 33 mm., Ser. VI Attachments.



A. S. *f*/4.5, 47 mm.

KODAK ANASTIGMAT SPECIAL *f*/4.5, 47 mm. (as used on Kodak Bantam)

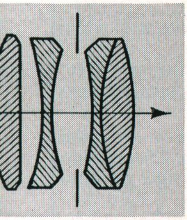
Aperture Range: *f*/4.5 to *f*/16. Negative Size: 28 x 40 mm.
Infrared Focusing: Turn focusing scale counterclockwise by 0.15 in.*
Shutter Speeds: 1/25 to 1/200 sec., T, and B.
Attachment Size: $\frac{15}{16}$ in., 23.5 mm., Ser. V Attachments.



A. S. *f*/4.5, 100, 101, and 127 mm.

KODAK ANASTIGMAT SPECIAL *f*/4.5, 100 mm., 101 mm., and 127 mm. (as used on Kodak Monitors and Kodak Vigilants)

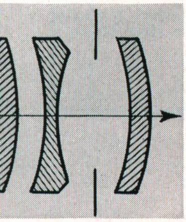
Aperture Range: *f*/4.5 to *f*/32.
Infrared Focusing: Turn focusing scale counterclockwise by 0.16 in.*
Shutter Speeds: 1 to 1/400 sec., T†, B, and delayed-action release.
Negative Size: 100 mm. and 101 mm.—2¼ x 3¼ inches. 127 mm.—2½ x 4¼ inches.
Attachment Size: 100 mm.–1¼ in., 31.5 mm., Ser. VI Attachments.
101 mm.–1$\frac{5}{16}$ in., 33 mm., Ser. VI Attachments.
127 mm.–1½ in., 38 mm., Ser. VI Attachments.



. *f*/4.5, 103 & 126 mm.

KODAK ANASTIGMAT *f*/4.5, 103 mm. and 126 mm. (as used on Kodak Monitors and Kodak Vigilants)

Aperture Range: *f*/4.5 to *f*/32.
Infrared Focusing: Turn focusing scale counterclockwise by 0.14 in.*
Shutter Speeds: 1/10 to 1/200 sec., T†, B, and delayed-action release.
Negative Size: 103 mm.—2¼ x 3¼ inches. 126 mm.—2½ x 4¼ inches.
Attachment Size: 103 mm.–1¼ in., 31.5 mm., Ser. VI Attachments.
126 mm.–1½ in., 38 mm., Ser. VI Attachments.



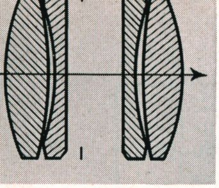
. *f*/6.3, 105 & 130 mm.

KODAK ANASTIGMAT *f*/6.3, 105 mm. and 130 mm. (as used on Kodak Vigilants)

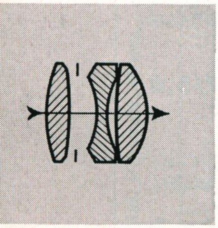
Aperture Range: *f*/6.3 to *f*/32.
Infrared Focusing: Turn focusing scale counterclockwise by 0.19 in.*
Shutter Speeds: 1/25 to 1/100 sec., T, and B.
Negative Size: 105 mm.—2¼ x 3¼ inches. 130 mm.—2¼ x 4¼ inches.
Attachment Size: 105 mm.–1¼ in., 31.5 mm., Ser. VI Attachments.
130 mm.–1¼ in., 31.5 mm., Ser. VI Attachments.

*This correction from the visual focus represents a working average for distance settings from 8 feet to Infinity.

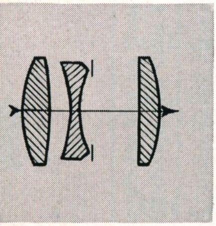
†"T" is omitted on Kodak Monitors.



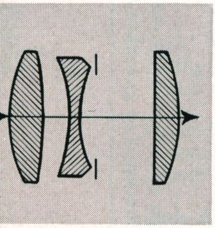
K. A. *f*/1.9, 25 mm.



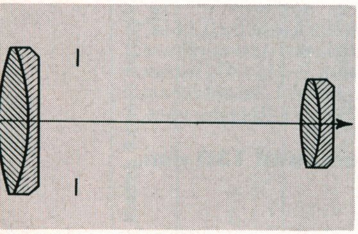
K. A. *f*/2.7, 15 mm.



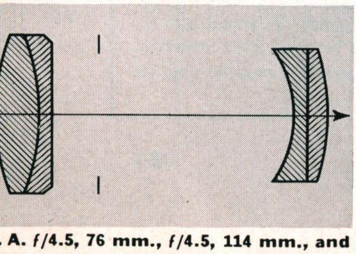
K. A. *f*/3.5, 20 mm.



K. A. *f*/3.5, 50 mm.



. A. *f*/1.6, 50 mm., *f*/2.7, 63 mm., and *f*/2.7, 102 mm.



. A. *f*/4.5, 76 mm., *f*/4.5, 114 mm., and *f*/4.5, 152 mm.

LENSES FOR CINÉ-KODAK—16 MM.

KODAK ANASTIGMAT:

***f*/1.9, 25 mm.** This high speed lens of normal focal length is the ideal all-purpose lens, able to cope with extremely poor light conditions.
Angle of View: 21.5° x 16.2°. Focusing Range: Inf. to 2 ft.
Attachment Size: W Mount or 1 1/16 in., 27 mm., Ser. V Attachments.

***f*/2.7, 15 mm.** This wide-angle lens includes a greater picture area from a given position than any other Ciné-Kodak lens. This is especially useful for photography in close quarters.
Angle of View: 34.0° x 25.7°. Focusing Range: Inf. to 6 inches.
Attachment Size: 1 9/16 in., 39.5 mm., Ser. VI Attachments.

***f*/3.5, 20 mm.** A moderate speed lens for home movie cameras designed for simplicity in operation.
Angle of View: 26.5° x 20.0°. Focusing Range: Fixed Focus.
Attachment Size: Z Mount.

***f*/3.5, 50 mm.** This lens gives twice the image size as compared with the normal focal length. Its speed is ample for general photography.
Angle of View: 10.9° x 8.1°. Focusing Range: Inf. to 2 1/4 ft.*
Attachment Size: 1 1/16 in., 27 mm., Ser. V Attachments.

***f*/1.6, 50 mm.** This long-focus lens gives twice the image size of the 25-mm. lens and, because of its unusual speed, is especially useful for sport and similar pictures under extremely poor light conditions.
Angle of View: 10.8° x 8.1°. Focusing Range: Inf. to 2 ft.*†
Attachment Size: Ser. VI Retaining Ring, Ser. VI Attachments.

***f*/2.7, 63 mm.** This long-focus lens will serve best when medium telephoto effects under unfavorable light conditions are desired.
Angle of View: 8.7° x 6.5°. Focusing Range: Inf. to 1 1/2 ft.*
Attachment Size: 1 5/16 in., 33 mm., Ser. VI Attachments.

***f*/4.5, 76 mm.** A telephoto lens giving an image size three times larger than the one obtained with a 25-mm. lens.
Angle of View: 7.2° x 5.4°. Focusing Range: Inf. to 3 3/4 ft.*
Attachment Size: 1 1/16 in., 27 mm., Ser. V Attachments.

***f*/2.7, 102 mm.** This fast long-focus lens is especially useful when light conditions or fast shutter speeds call for a large lens aperture.
Angle of View: 5.4° x 4.1°. Focusing Range: Inf. to 4 1/2 ft.*
Attachment Size: 1 13/16 in., 46 mm., Ser. VII Attachments.

***f*/4.5, 114 mm.** This telephoto lens will serve well where lens speed is not a prime consideration.
Angle of View: 4.8° x 3.6°. Focusing Range: Inf. to 4 1/4 ft.*
Attachment Size: 1 5/16 in., 33 mm., Ser. VI Attachments.

***f*/4.5, 152 mm.** This telephoto lens gives a six times larger image size than that obtained with a 25-mm. lens and is especially useful when large image size at great distances is essential.
Angle of View: 3.6° x 2.7°. Focusing Range: Inf. to 10 ft.*
Attachment Size: 1 9/16 in., 39.5 mm., Ser. VI Attachments.

*With cameras having a Reflex Focusing or an Accessory Focusing Finder, it is possible to focus this lens much closer after lifting a plunger or removing a screw.

†This lens has a depth of field indicator.

Table of Field Sizes for 16 mm. Ciné-Kodak Lenses

Name	Kodak Anastigmat f/3.5, 20 mm. (13/16 in.)		Kodak Anastigmat f/2.7, 15 mm. (⅝ in.)		Kodak Anastigmat f/1.9, 25 mm. (1 in.)		Kodak Anastigmat f/1.6, 50 mm. (2 in.)		Kodak Anastigmat f/3.5, 50 mm. (2 in.)	
	Fixed Focus		**Focusing Mount**							
Angular Field at Inf.	26.5° x 20.0°		34.0° x 25.7°		21.5° x 16.2°		10.8° x 8.1°		10.9° x 8.1°	
	Field Size									
Distance* to subject	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.
400 feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
200 feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
100 feet	— —	— —	— —	— —	— —	— —	19 —	14 2	19 —	14 2
50 feet	23 6	17 7	— —	— —	19 —	14 2	9 5½	7 1	9 5½	7 1
25 feet	11 9	8 9½	— —	— —	9 5½	7 1	4 8½	3 6½	4 8½	3 6½
15 feet	7 ½	5 3½	9 2	6 10	5 8	4 3	2 10	2 1½	2 9¾	2 1¼
12 feet	— —	— —	— —	— —	— —	— —	— —	— —	2 3	1 8
10 feet	4 8½	3 6	— —	— —	3 9	2 9¾	1 10½	1 5	1 10¼	1 4¾
8 feet	3 9	2 9¾	4 10½	3 7½	3 —	2 3	1 6	1 1½	1 5¾	1 1¼
6 feet	2 9¾	2 1¼	3 8	2 8½	2 3	1 8	1 1½	— 10⅛	1 1¼	— 9⅞
5 feet	— —	— —	3 ½	2 3¼	— —	— —	— 11¼	— 8⅜	— 10⅞	— 8⅛
4½ feet	— —	— —	— —	— —	— —	— —	— 10⅛	— 7½	— 9¾	— 7¼
4¼ feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
4 feet	1 10½	1 4¾	2 5¼	1 9¾	1 5¾	1 1¼	— 9	— 6¾	— 8⅝	— 6½
3¾ feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
3½ feet	— —	— —	— —	— —	— —	— —	— 7⅞	— 5⅞	— 7½	— 5⅝
3 feet	1 5	1 ¾	1 9¾	1 4¼	1 1¼	— 9⅞	— 6¾	— 5	— 6⅜	— 4¾
2½ feet	— —	— —	1 6	1 1½	— —	— —	— 5⅝	— 4⅛	— 5¼	— 3⅞
2¼ feet	— —	— —	— —	— —	— —	— —	— —	— —	— 4⅝	— 3½
2 feet	— —	— —	1 2½	— 10¾	— 8¾	— 6½	— 4⅜	— 3⅜	— —	— —
1½ feet	— —	— —	— 10¾	— 8	— —	— —	— —	— —	— —	— —
1¼ feet	— —	— —	— 9	— 6½	— —	— —	— —	— —	— —	— —
1 foot	— —	— —	— 7⅛	— 5⅜	— —	— —	— —	— —	— —	— —

Name	Kodak Anastigmat f/2.7, 63 mm. (2½ in.)		Kodak Telephoto Anast. f/4.5, 76 mm. (3 in.)		Kodak Anastigmat f/2.7, 102 mm. (4 in.)		Kodak Telephoto Anast. f/4.5, 114 mm. (4½ in.)		Kodak Telephoto Anast. f/4.5, 152 mm. (6 in.)	
	Focusing Mount									
Angular Field at Inf.	8.7° x 6.5°		7.2° x 5.4°		5.4° x 4.1°		4.8° x 3.6°		3.6° x 2.7°	
	Field Size									
Distance* to subject	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.
400 feet	— —	— —	— —	— —	— —	— —	— —	— —	25 3	18 10
200 feet	— —	— —	— —	— —	19 —	14 2	16 10	12 7	12 7	9 5
100 feet	— —	— —	12 7	9 5	9 5½	7 1	8 4½	6 3	6 3	4 8
50 feet	7 7	5 8	6 3½	4 8	4 8½	3 6	4 2	3 1	3 1	2 3¾
25 feet	3 9	2 10	3 1	2 3¾	2 4	1 9	2 ½	1 6¼	1 6	1 1½
15 feet	2 3	1 8¼	1 10	1 4½	1 4½	1 ½	1 2½	— 10¾	— 10½	— 7⅞
12 feet	— —	— —	1 5½	1 1	1 1¼	— 9⅞	— 11¼	— 8½	— 8¼	— 6⅛
10 feet	1 5¾	1 1¼	1 2¼	— 10¾	— 10⅞	— 8⅛	— 9¼	— 6⅞	— 6¾	— 5
8 feet	1 2¼	— 10⅝	— 11⅜	— 8½	— 8⅝	— 6½	— 7¼	— 5⅜	— —	— —
6 feet	— 10½	— 7⅞	— 8¼	— 6¼	— 6⅜	— 4¾	— 5¼	— 3⅞	— —	— —
5 feet	— 8¾	— 6½	— 6¾	— 5	— 5⅛	— 3⅞	— 4⅛	— 3⅛	— —	— —
4½ feet	— —	— —	— 6	— 4½	— 4⅝	— 3½	— —	— —	— —	— —
4¼ feet	— —	— —	— —	— —	— —	— —	— 3⅜	— 2½	— —	— —
4 feet	— 6⅞	— 5⅛	— 5¼	— 3⅞	— —	— —	— —	— —	— —	— —
3¾ feet	— —	— —	— 4⅞	— 3⅝						
3½ feet	— —	— —	— —	— —						
3 feet	— 5	— 3¾	— —	— —						
2½ feet	— 4⅛	— 3	— —	— —						
2¼ feet	— —	— —	— —	— —						
2 feet	— 3⅛	— 2⅜	— —	— —						
1½ feet	— 2¼	— 1⅝	— —	— —						
1¼ feet	— —	— —	— —	— —						
1 foot	— —	— —	— —	— —						

Field Size—distance settings less than 1 ft.
Kodak Anastigmat f/2.7, 15 mm. (⅝ in.)

Distance* to subject	Width ft.	Width in.	Height ft.	Height in.
10 inches	—	5¾	—	4¼
9 inches	—	5¼	—	3¾
8 inches	—	4½	—	3¼
7 inches	—	4	—	3
6 inches	—	3⅝	—	2⅝

*Distances measured from front of camera for all lenses except f/1.6, 50 mm. lens, for which they are measured from the engraved focusing line on the lens barrel.

DEPTH OF FIELD TABLES FOR 16 MM. CINÉ-KODAK LENSES

The distances given in the following tables are measured from the front of the camera except for the Kodak Anastigmat *f*/1.6, 50 mm., for which they are measured from the engraved focusing line on lens barrel.

The depth of field for *f*-numbers not given or for intermediate diaphragm settings can be estimated by comparison.

"inf." is the abbreviation for "infinity."

Depth of Field: Kodak Anastigmat *f*/1.9, 25 mm. (1 in.)

Distance Focused On	On 16-mm. Ciné-Kodak. Circle of Confusion, 1/1000 inch											
	f/1.9		*f*/2.8		*f*/4		*f*/5.6		*f*/8		*f*/16	
	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.
INF.	44 —	inf.	30 —	inf.	21 —	inf.	15 —	inf.	10 6	inf.	5 3	inf.
50 feet	23 —	inf.	18 8	inf.	15 —	inf.	11 6	inf.	8 7	inf.	4 9	inf.
25 feet	16 —	58 —	13 7	155 —	11 4	inf.	9 4	inf.	7 5	inf.	4 4	inf.
15 feet	11 2	23 —	10 —	30 —	8 9	54 —	7 6	inf.	6 2	inf.	3 11	inf.
10 feet	8 2	13 —	7 6	15 —	6 9	19 —	6 —	30 —	5 1	240	3 5	inf.
8 feet	6 9	9 9	6 4	11 —	5 9	13 —	5 2	17 3	4 6	34 —	3 2	inf.
6 feet	5 3	7 —	5 —	7 6	4 8	8 5	4 3	10 —	3 10	14 —	2 9	inf.
4 feet	3 8	4 5	3 6	4 7	3 4	5 —	3 2	5 6	2 11	6 6	2 3	17 —
3 feet	2 10	3 3	2 9	3 4	2 7	3 6	2 6	3 9	2 4	4 2	1 11	7 —
2 feet	1 11	2 1	1 10	2 2	1 10	2 2	1 9	2 4	1 8	2 6	1 5	3 3

Depth of Field: Kodak Anastigmat *f*/2.7, 15 mm. (⅝ in.)

Distance Focused On	On 16-mm. Ciné-Kodak. Circle of Confusion, 1/1000 inch											
	f/2.7		*f*/4		*f*/5.6		*f*/8		*f*/11		*f*/16	
	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.
INF.	12 —	inf.	8 —	inf.	5 9	inf.	4 —	inf.	3 —	inf.	2 —	inf.
15 feet	6 8	inf.	5 3	inf.	4 2	inf.	3 2	inf.	2 5	inf.	1 9	inf.
8 feet	4 10	24 —	4 —	inf.	3 4	inf.	2 8	inf.	2 2	inf.	1 7	inf.
6 feet	4 —	12 —	3 5	23 —	3 —	inf.	2 5	inf.	2 —	inf.	1 6	inf.
5 feet	3 7	8 7	3 1	13 —	2 8	38 —	2 3	inf.	1 10	inf.	1 5	inf.
4 feet	3 —	6 —	2 8	8 —	2 4	13 —	2 —	inf.	1 8	inf.	1 4	inf.
3 feet	2 5	4 —	2 2	4 9	2 —	6 3	1 9	12 —	1 6	inf.	1 2½	inf.
2½ feet	2 1	3 2	1 11	3 7	1 9	4 5	1 6	6 7	1 4	17 —	1 1½	inf.
2 feet	1 9	2 5	1 7	2 8	1 6	3 —	1 4	4 —	1 2	6 4	1 —	inf.
1½ feet	1 4	1 8	1 3	1 10	1 2	2 —	1 1	2 5	1 —	3 1	— 10½	6 —
1¼ feet	1 1½	1 5	1 1	1 6	1 —	1 7	— 11½	1 9	— 10½	2 2	— 9¼	3 1
1 foot	— 11	1 1	— 10¾	1 1½	— 10¼	1 2	— 9¾	1 4	— 9	1 6	— 8¼	1 11
10 in.	— 9½	— 10¾	— 9	— 11	— 8¾	— 11¾	— 8¼	1 —	— 8	1 2	— 7	1 5
9 in.	— 8½	— 9½	— 8¼	— 9¾	— 8	— 10¼	— 7¾	— 11	— 7¼	1 —	— 6¾	1 2
8 in.	— 7½	— 8½	— 7½	— 8½	— 7¼	— 9	— 7	— 9½	— 6¾	— 10	— 6	1 —
7 in.	— 6¾	— 7¼	— 6½	— 7½	— 6½	— 7¾	— 6¼	— 8	— 6	— 8½	— 5½	— 10
6 in.	— 5¾	— 6¼	— 5¾	— 6¼	— 5½	— 6½	— 5½	— 6½	— 5¼	— 7	— 5	— 7¾

Depth of Field: Kodak Anastigmat *f*/3.5, 20 mm. ($\frac{13}{16}$ in.)

Distance Focused On	On 16-mm. Ciné-Kodak. Circle of Confusion, 1/1000 inch											
	f/3.5		*f*/4		*f*/5.6		*f*/8		*f*/11		*f*/16	
	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.
Fixed Focus	7 8	inf.	7 2	inf.	5 11	inf.	4 8	inf.	3 9	inf.	2 9	inf.

Depth of Field: Kodak Anastigmat *f*/1.6, 50 mm. (2 in.) and *f*/3.5, 50 mm. (2 in.)

Distance Focused On	On 16-mm. Ciné-Kodak. Circle of Confusion, 1/1000 inch											
	f/1.6		*f*/2		*f*/3.5		*f*/5.6		*f*/11		*f*/22	
	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.	ft. in. to	ft. in.
INF.	210 —	inf.	168 —	inf.	95 —	inf.	60 —	inf.	30 —	inf.	15 —	inf.
100 feet	68 —	190 —	63 —	250 —	48 —	inf.	38 —	inf.	23 —	inf.	14 —	inf.
50 feet	40 —	66 —	38 —	71 —	33 —	105 —	27 —	310 —	19 —	inf.	11 6	inf.
25 feet	22 —	28 —	22 —	29 —	20 —	34 —	17 6	43 —	14 —	150 —	9 6	inf.
15 feet	14 —	16 —	13 9	16 6	13 —	18 —	12 —	20 —	10 —	30 —	7 6	inf.
10 feet	9 6	10 6	9 6	10 8	9 1	11 2	8 6	12 —	7 6	15 —	6 —	30 —
8 feet	7 8	8 4	7 7	8 4	7 5	8 8	7 —	9 3	6 4	11 —	5 3	17 —
6 feet	5 10	6 2	5 9	6 3	5 8	6 4	5 6	6 8	5 —	7 6	4 4	10 —
5 feet	4 10½	5 1½	4 10	5 2	4 10	5 3	4 8	5 5	4 3	6 —	3 9	7 5
4½ feet	4 5	4 7	4 4	4 8	4 4	4 9	4 2	4 10	3 11	5 3	3 6	6 4
4 feet	3 11	4 1	3 10½	4 ¼	3 10	4 2	3 9	4 3	3 6	4 7	3 2	5 5
3½ feet	3 5½	3 6¾	3 5	3 7	3 4	3 8	3 3	3 9	3 2	3 11	2 11	4 6
3 feet	2 11½	3 ½	2 11	3 ½	2 10¾	3 1	2 10½	3 2	2 9	3 4	2 6	3 9
2½ feet	2 5¾	2 6¼	2 5½	2 6½	2 5	2 7	2 4½	2 7½	2 4	2 9	2 2	3 —
2 feet	1 11¾	2 ¼	1 11¾	2 ¼	1 11½	2 ½	1 11	2 1	1 10½	2 1½	1 9	2 3

Depth of Field: Kodak Anastigmat f/2.7, 63 mm. (2½ in.)

On 16-mm. Ciné-Kodak. Circle of Confusion, 1/1000 inch

Distance Focused On	f/2.7		f/4		f/5.6		f/8		f/11		f/22	
	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.
INF.	193 —	inf.	130 —	inf.	93 —	inf.	65 —	inf.	47 —	inf.	24 —	inf.
50 feet	40 —	67 —	36 —	81 —	32 —	108 —	28 —	216 —	24 —	inf.	16 —	inf.
25 feet	22 —	29 —	21 —	31 —	20 —	34 —	18 —	40 —	16 —	52 —	12 —	inf.
15 feet	14 —	16 2	13 5	16 11	12 11	17 11	12 2	19 5	11 5	22 —	9 3	41 —
10 feet	9 6	10 6	9 4	10 10	9 —	11 3	8 8	11 10	8 4	12 8	7 —	17 4
8 feet	7 8	8 4	7 6	8 6	7 5	8 8	7 1	9 1	6 11	9 7	6 —	12 —
6 feet	5 9	6 3	5 9	6 4	5 7	6 5	5 6	6 7	5 4	6 10	4 10	8 —
5 feet	4 11	5 1	4 10	5 2	4 9	5 3	4 8	5 5	4 7	5 6	4 2	6 4
4 feet	3 11	4 1	3 11	4 1	3 10	4 2	3 10	4 3	3 8	4 4	3 6	4 10
3 feet	2 11½	3 ½	2 11¼	3 ¾	2 11	3 1¼	2 10½	3 1½	2 10	3 2¼	2 8½	3 5
2½ feet	2 5½	2 6½	2 5½	2 6½	2 5¼	2 6¾	2 5	2 7	2 4½	2 7½	2 3¼	2 9¼
2 feet	1 11¾	2 ¼	1 11¾	2 ¼	1 11½	2 ½	1 11½	2 ¾	1 11¼	2 1	1 10¼	2 2
1½ feet	1 5⅞	1 6⅛	1 5⅞	1 6⅛	1 5¾	1 6¼	1 5⅝	1 6⅜	1 5½	1 6½	1 5	1 7

Kodak Anastigmat f/2.7, 102 mm. (4 in.)

Distance Focused On	f/2.7		f/4		f/5.6		f/8		f/11		f/22	
INF.	494 —	inf.	332 —	inf.	238 —	inf.	167 —	inf.	121 —	inf.	61 —	inf.
200 feet	142 —	336	125 —	500 —	109 —	1250 —	91 —	inf.	75 —	inf.	47 —	inf.
100 feet	83 —	125 —	77 —	143 —	70 —	172 —	62 —	250 —	55 —	576 —	38 —	inf.
50 feet	46 —	56 —	44 —	59 —	41 —	63 —	38 —	71 —	35 —	85 —	27 —	286 —
25 feet	23 10	26 3	23 4	27 —	22 8	28 —	21 10	29 6	20 10	31 7	17 8	42 —
15 feet	14 6	15 6	14 4	15 8	14 1	16 —	13 10	16 6	13 5	17 1	12 —	20 —
12 feet	11 8	12 4	11 7	12 5	11 5	12 7	11 2	12 11	10 11	13 4	10 —	15 —
10 feet	9 10	10 2	9 9	10 3	9 7	10 5	9 5	10 7	9 3	10 11	8 7	12 —
8 feet	7 11	8 1	7 10	8 2	7 9	8 3	7 7	8 4	7 6	8 6	7 1	9 2
6 feet	5 11	6 1	5 11	6 1	5 10	6 1½	5 9½	6 2½	5 8¾	6 3½	5 6	6 7
5 feet	4 11½	5 ½	4 11⅛	5 ¾	4 10¾	5 1¼	4 10	5 1½	4 9¾	5 2½	4 8	5 5
4½ feet	4 5½	4 6½	4 5½	4 6½	4 5	4 7	4 4½	4 7¼	4 4	4 8	4 2½	4 10

Depth of Field: Kodak Anastigmat f/4.5, 76 mm. (3 in.)

On 16-mm. Ciné-Kodak. Circle of Confusion, 1/1000 inch

Distance Focused On	f/4.5		f/5.6		f/8		f/11		f/16		f/22	
	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.
INF.	167 —	inf.	134 —	inf.	94 —	inf.	68 —	inf.	47 —	inf.	34 —	inf.
100 feet	62 —	250 —	58 —	390 —	49 —	inf.	41 —	inf.	32 —	inf.	26 —	inf.
50 feet	39 —	70 —	37 —	80 —	33 —	105 —	29 —	185 —	24 —	inf.	21 —	inf.
25 feet	22 —	29 —	21 —	31 —	20 —	34 —	19 —	39 —	16 6	52 —	14 8	85 —
15 feet	13 10	16 4	13 6	16 10	13 —	17 9	12 5	19 —	11 5	21 8	10 7	26 —
12 feet	11 3	12 10	11 —	13 2	10 8	13 8	10 4	14 5	9 8	15 10	9 —	18 —
10 feet	9 6	10 7	9 4	10 9	9 1	11 —	8 10	11 6	8 4	12 6	7 11	13 8
8 feet	7 8	8 4	7 7	8 5	7 5	8 8	7 3	9 —	7 —	9 6	6 8	10 2
6 feet	5 10	6 2	5 9	6 3	5 8	6 4	5 7	6 6	5 5	6 9	5 3	7 1
5 feet	4 10	5 2	4 10	5 2	4 9	5 3	4 8	5 4	4 7	5 6	4 6	5 9
4½ feet	4 5	4 7	4 5	4 7	4 4	4 8	4 3	4 9	4 2	4 11	4 1	5 1
4 feet	3 11	4 1	3 11	4 1	3 10	4 2	3 10	4 2	3 9	4 3	3 8	4 5
3¾ feet	3 8	3 10	3 8	3 10	3 8	3 10	3 7	3 11	3 6	4 —	3 5	4 1

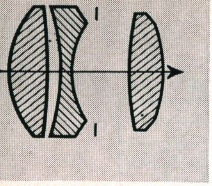
Kodak Anastigmat f/4.5, 114 mm. (4½ in.)

Distance Focused On	f/4.5		f/5.6		f/8		f/11		f/16		f/22	
INF.	375 —	inf.	300 —	inf.	210 —	inf.	155 —	inf.	105 —	inf.	77 —	inf.
200 feet	130 —	430 —	120 —	590 —	105 —	inf.	87 —	inf.	69 —	inf.	56 —	inf.
100 feet	79 —	135 —	75 —	148 —	68 —	190 —	61 —	285 —	52 —	inf.	44 —	inf.
50 feet	45 —	57 —	44 —	60 —	41 —	65 —	38 —	73 —	34 —	96 —	31 —	140 —
25 feet	23 6	26 8	23 —	27 —	22 —	28 —	22 —	29 —	20 —	32 —	19 —	36 —
15 feet	14 6	15 7	14 4	15 9	14 1	16 1	13 9	16 6	13 3	17 3	12 8	18 4
12 feet	11 8	12 5	11 7	12 6	11 5	12 8	11 2	13 —	10 10	13 5	10 6	14 —
10 feet	9 9	10 3	9 8	10 4	9 7	10 5	9 5	10 7	9 2	11 —	9 —	11 4
8 feet	7 10	8 2	7 10	8 3	7 9	8 4	7 8	8 5	7 6	8 7	7 4	8 10
6 feet	5 11	6 1	5 11	6 2	5 11	6 2	5 10	6 3	5 9	6 4	5 7	6 5
5 feet	4 11	5 1	4 11	5 1	4 11	5 1	4 10	5 2	4 10	5 2	4 9	5 3
4¼ feet	4 2	4 4	4 2	4 4	4 2	4 4	4 2	4 4	4 2	4 4	4 1	4 5

Depth of Field: Kodak Anastigmat f/4.5, 152 mm. (6 in.)

On 16-mm. Ciné-Kodak. Circle of Confusion, 1/1000 inch

Distance Focused On	f/4.5		f/5.6		f/8		f/11		f/16		f/22	
	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.
INF.	670 —	inf.	540 —	inf.	375 —	inf.	275 —	inf.	190 —	inf.	137 —	inf.
400 feet	250 —	1000 —	230 —	1580 —	195 —	inf.	163 —	inf.	128 —	inf.	102 —	inf.
200 feet	154 —	285 —	146 —	320 —	130 —	425 —	116 —	750 —	97 —	inf.	82 —	inf.
100 feet	87 —	117 —	84 —	123 —	79 —	135 —	73 —	157 —	65 —	212 —	58 —	370 —
50 feet	47 —	54 —	46 —	55 —	44 —	57 —	42 —	61 —	40 —	67 —	37 —	78 —
25 feet	24 3	25 11	24 —	26 2	23 6	26 8	23 —	27 4	22 3	28 8	21 4	30 —
15 feet	14 8	15 4	14 7	15 5	14 5	15 7	14 3	15 9	14 —	16 2	13 7	16 8
12 feet	11 9	12 3	11 9	12 3	11 8	12 4	11 6	12 6	11 4	12 8	11 —	13 —
10 feet	9 10	10 2	9 10	10 2	9 9	10 3	9 8	10 4	9 6	10 6	9 5	10 7

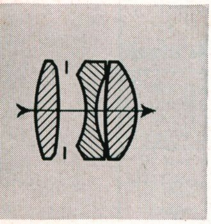


A. *f*/3.5, 13 mm., and *f*/2.7, 13 mm.

LENSES FOR CINÉ-KODAK EIGHT

KODAK ANASTIGMAT:

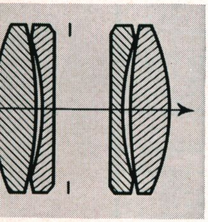
f/3.5, 13 mm. This lens of normal focal length combines sufficient speed for all outdoor and some indoor work with simplicity in use.
Angle of View: 19.7° x 14.9°. Focusing Range: Fixed Focus.
Attachment Size: Z Mount.



K. A. *f*/2.7, 9 mm.

f/2.7, 13 mm. This lens, also of normal focal length and fixed focus design, is about 70% faster than *f*/3.5, permitting picture taking under less favorable light conditions.
Angle of View: 18.7° x 14.1°. Focusing Range: Fixed Focus.
Attachment Size: Z Mount.

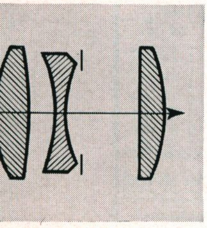
f/2.7, 9 mm. A wide-angle lens designed to include a large field—a feature especially useful for photography in close quarters.
Angle of View: 26.1° x 19.8°. Focusing Range: Fixed Focus.
Attachment Size: 15/16 in., 23.5 mm., Ser. V Attachments.



A. *f*/1.9, 13 mm., and *f*/1.9, 25 mm.

f/1.9, 13 mm. This ultra fast standard focal length lens—twice as fast as *f*/2.7 and 3.5 times as fast as *f*/3.5—is the ideal lens for all-round outdoor and indoor filming, even under adverse light conditions.
Angle of View: 19.4° x 14.6°. Focusing Range: Inf. to 2 ft.
Attachment Size: Magazine Model, 15/16 in., 23.5 mm. Ser. V Attachments.
8-60 Model, 13/16 in., 20.5 mm. Ser. V Attachments.

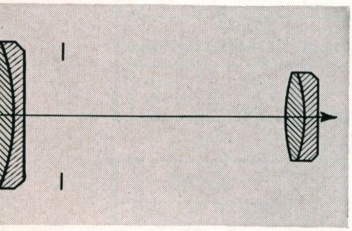
f/1.9, 25 mm. This lens gives twice the image size of the 13-mm. lens and is useful for pictures when a near-by camera position is not accessible.
Angle of View: 9.9° x 7.4°. Focusing Range: Inf. to 2 ft.
Attachment Size: W Mount or 1 1/16 in., 27 mm., Ser. V Attachments.



K. A. *f*/3.5, 50 mm.

f/2.5, 38 mm. A long-focus lens—with three times the film image size given by a normal focal length lens.
Angle of View: 6.6° x 5.0°. Focusing Range: Inf. to 2 ft.*†
Attachment Size: Ser. V Retaining Ring, Ser. V Attachments.

f/1.6, 50 mm. This long-focus lens combines considerable image magnification (about 4 times) with ultra-fast speed, making it the ideal lens for telephoto effects under adverse light conditions.
Angle of View: 4.9° x 3.7°. Focusing Range: Inf. to 2 ft.*
Attachment Size: Ser. VI Retaining Ring, Ser. VI Attachments.



A. *f*/2.5, 38 mm., *f*/1.6, 50 mm., and *f*/2.7, 63 mm.

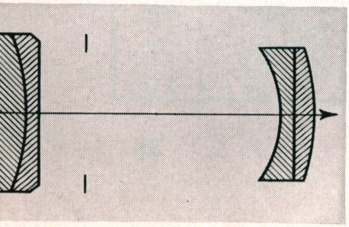
f/3.5, 50 mm. While this lens gives the same image size as the one above, its speed is less, yet ample for all general outdoor and some indoor long distance filming.
Angle of View: 5° x 3.7°. Focusing Range: Inf. to 2 1/4 ft.*
Attachment Size: 1 1/16 in., 27 mm., Ser. V Attachments.

f/2.7, 63 mm. This lens gives a five times telephoto effect as compared to a view obtained with a 13-mm. focal length lens.
Angle of View: 4° x 3°. Focusing Range: Inf. to 1 1/2 ft.*
Attachment Size: 1 5/16 in., 33 mm., Ser. VI Attachments.

f/4.5, 76 mm. This telephoto lens gives an image six times larger than the one made with the 13-mm. lens.
Angle of View: 3.3° x 2.5°. Focusing Range: Inf. to 3 3/4 ft.*
Attachment Size: 1 1/16 in., 27 mm., Ser. V Attachments.

*With a Kodak Focusing Finder, it is possible to focus this lens much closer after lifting a plunger or removing a screw.

†This lens has a depth of field indicator.



K. A. *f*/4.5, 76 mm.

Table of Field Sizes for Ciné-Kodak Eight Lenses

Name	Kodak Anastigmat *f*/2.7, 9 mm. (⅜ in.)		Kodak Anastigmat *f*/2.7, 13 mm. (½ in.)		Kodak Anastigmat *f*/3.5, 13 mm. (½ in.)		Kodak Anastigmat *f*/1.9, 13 mm. (½ in.)		Kodak Anastigmat *f*/1.9, 25 mm. (1 in.)	
	Fixed Focus						**Focusing Mount**			
Angular Field at Inf.	26.1° x 19.8°		18.7° x 14.1°		19.7° x 14.9°		19.4° x 14.6°		9.9° x 7.4°	
	Field Size									
Distance* to subject	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.
100 feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
50 feet	— —	— —	16 5	12 4	17 5	13 1	17 1	12 10	8 7	6 5½
25 feet	11 7	8 8½	8 2¾	6 2	8 8½	6 6½	8 6¾	6 5	4 3¾	3 2¾
15 feet	6 11½	5 2¾	4 11¼	3 8½	5 3	3 11¼	5 1¾	3 10½	2 6¾	1 11
12 feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
10 feet	4 7¾	3 6	3 3½	2 5¾	3 6	2 7½	3 5¼	2 7	1 8½	1 3¼
8 feet	3 8¾	2 9½	2 7¾	1 11¾	2 9½	2 1¼	2 9	2 ¾	1 4¼	1 ¼
6 feet	2 9½	2 1¼	1 11¾	1 5⅞	2 1¼	1 6⅝	2 ¾	1 6½	1 ¼	— 9⅛
5 feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
4½ feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
4 feet	1 10½	1 5	1 3⅞	— 11⅞	1 4¾	1 ⅝	1 4½	1 ½	— 8⅛	— 6⅛
3¾ feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
3½ feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
3 feet	1 5	1 ¾	— 11⅞	— 8⅞	1 ⅝	— 9½	1 ½	— 9¼	— 6	— 4½
2½ feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
2¼ feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —
2 feet	— 11⅜	— 8⅝	— 8	— 6	— 8½	— 6⅜	— 8¼	— 6⅛	— 4	— 3
1½ feet	— —	— —	— —	— —	— —	— —	— —	— —	— —	— —

Name	Kodak Anastigmat *f*/2.5, 38 mm. (1½ in.)		Kodak Anastigmat *f*/1.6, 50 mm. (2 in.)		Kodak Anastigmat *f*/3.5, 50 mm. (2 in.)		Kodak Anastigmat *f*/2.7, 63 mm. (2½ in.)		Kodak Telephoto Anast. *f*/4.5, 76 mm. (3 in.)	
	Focusing Mount									
Angular Field at Inf.	6.6° x 5.0°		4.9° x 3.7°		5.0° x 3.7°		4.0° x 3.0°		3.3° x 2.5°	
	Field Size									
Distance* to subject	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.	Width ft. in.	Height ft. in.
100 feet	— —	— —	8 8	6 6	8 8	6 6	— —	— —	5 9	4 3¾
50 feet	5 9¼	4 4	4 3¾	3 3	4 3¾	3 3	3 5½	2 7	2 10¼	2 1¾
25 feet	2 10½	2 2	2 1¾	1 7½	2 1¾	1 7½	1 8½	1 3½	1 5	1 ¾
15 feet	1 8¾	1 3½	1 3½	— 11⅝	1 3½	— 11½	1 ¼	— 9¼	— 10	— 7½
12 feet	— —	— —	— —	— —	1 ¼	— 9¼	— —	— —	— 7⅞	— 6
10 feet	1 1¾	— 10⅜	— 10⅜	— 7¾	— 10⅛	— 7⅝	— 8⅛	— 6⅛	— 6½	— 4⅞
8 feet	— 11	— 8¼	— 8¼	— 6¼	— 8⅛	— 6⅛	— 6½	— 4⅞	— 5⅛	— 3⅞
6 feet	— 8¼	— 6⅛	— 6⅛	— 4⅝	— 6	— 4½	— 4¾	— 3⅝	— 3¾	— 2⅞
5 feet	— 6⅞	— 5⅛	— 5⅛	— 3⅞	— 5	— 3¾	— 4	— 3	— 3⅛	— 2¼
4½ feet	— —	— —	— 4⅝	— 3½	— 4½	— 3⅜	— —	— —	— 2¾	— 2
4 feet	— 5½	— 4⅛	— 4⅛	— 3⅛	— 3⅞	— 3	— 3⅛	— 2⅜	— 2⅜	— 1¾
3¾ feet	— —	— —	— —	— —	— —	— —	— —	— —	— 2¼	— 1⅝
3½ feet	— 4¾	— 3⅝	— 3⅝	— 2¾	— 3⅜	— 2½	— —	— —	— —	— —
3 feet	— 4	— 3	— 3	— 2¼	— 2⅞	— 2⅛	— 2¼	— 1¾	— —	— —
2½ feet	— 3⅜	— 2½	— 2½	— 1⅞	— 2⅜	— 1¾	— 1⅞	— 1⅜	— —	— —
2¼ feet	— —	— —	— —	— —	— 2⅛	— 1⅝	— —	— —	— —	— —
2 feet	— 2⅝	— 2	— 2	— 1½	— —	— —	— 1½	— 1⅛	— —	— —
1½ feet	— —	— —	— —	— —	— —	— —	— 1	— ¾	— —	— —

*Distances measured from front of camera for all lenses except *f*/2.5, 38 mm. and *f*/1.6, 50 mm. lenses for which they are measured from the engraved focusing line on the lens barrel.

DEPTH OF FIELD TABLES FOR CINÉ-KODAK EIGHT LENSES

The distances given in the following tables are measured from the front of the camera except for Kodak Anastigmat *f*/2.5, 38 mm., and *f*/1.6, 50 mm., for which they are measured from the engraved focusing line on the lens barrel.

The depth of field for *f*-numbers not given or for intermediate diaphragm settings can be estimated by comparison.

"inf." is the abbreviation for "infinity."

Depth of Field: Kodak Anastigmat f/3.5, and f/2.7, 13 mm., and f/2.7, 9 mm.

Fixed Focus	On Ciné-Kodak Eight. Circle of Confusion, 1/2000 inch											
	f/2.7		*f*/3.5		*f*/5.6		*f*/8		*f*/11		*f*/16	
	ft. in.	to ft.	ft. in.	to ft.	ft. in.	to ft.	ft. in.	to ft.	ft. in.	to ft.	ft. in.	to ft.
f/3.5, 13 mm. (½ inch)	—	—	5 10	inf.	4 6	inf.	3 7	inf.	2 10	inf.	2 1	inf.
f/2.7, 13 mm. (½ inch)	8 6	inf.	6 10	inf.*	5 6	inf.	4 3	inf.	3 4	inf.	2 5	inf.
f/2.7, 9 mm. (⅜ inch)	4 3	inf.	3 5	inf.*	2 9	inf.	2 2	inf.	1 8	inf.	1 3	inf.

*These distances are for *f*/4.

Depth of Field: Kodak Anastigmat f/1.9, 13 mm. (½ in.)

Distance Focused On	On Ciné-Kodak Eight. Circle of Confusion, 1/2000 inch											
	f/1.9		*f*/2.8		*f*/4		*f*/5.6		*f*/11		*f*/22	
	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.
INF.	22 6	inf.	15 3	inf.	10 7	inf.	7 7	inf.	3 10	inf.	1 11	inf.
50 feet	15 6	inf.	11 8	inf.	8 9	inf.	6 7	inf.	3 7	inf.	1 10	inf.
25 feet	11 10	inf.	9 6	inf.	7 6	inf.	5 10	inf.	3 4	inf.	1 9	inf.
15 feet	9 —	45 —	7 7	75 —	6 3	inf.	5 1	inf.	3 1	inf.	1 8	inf.
10 feet	6 11	18 —	6 1	29 —	5 2	156 —	4 4	inf.	2 10	inf.	1 7	inf.
8 feet	5 11	12 5	5 3	16 10	4 7	32 —	3 11	inf.	2 7	inf.	1 6	inf.
6 feet	4 9	8 2	4 4	9 11	3 10	13 8	3 4	28 —	2 4	inf.	1 5	inf.
4 feet	3 5	4 10	3 2	5 5	2 11	6 5	2 7	8 5	1 11	inf.	1 4	inf.
3 feet	2 8	3 6	2 6	3 9	2 4	4 2	2 2	4 11	1 8	13 2	1 2	inf.
2 feet	1 10	2 2	1 9	2 4	1 8	2 6	1 7	2 9	1 4	4 2	1 —	inf.

Depth of Field: Kodak Anastigmat f/1.9, 25 mm. (1 in.)

Distance Focused On	On Ciné-Kodak Eight. Circle of Confusion, 1/2000 inch											
	f/1.9		*f*/2.8		*f*/4		*f*/5.6		*f*/8		*f*/16	
	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.
INF.	88 —	inf.	60 —	inf.	42 —	inf.	30 —	inf.	21 —	inf.	10 5	inf.
50 feet	33 —	115 —	27 —	310 —	23 —	inf.	18 8	inf.	14 9	inf.	8 8	inf.
25 feet	19 6	35 —	17 8	43 —	15 8	62 —	13 7	154 —	11 5	inf.	7 5	inf.
15 feet	12 10	18 —	12 —	20 —	11 1	23 —	10 —	30 —	8 9	53 —	6 2	inf.
10 feet	9 —	11 3	8 7	12 —	8 1	13 1	7 6	15 —	6 9	19 2	5 1	210 —
8 feet	7 4	8 10	7 1	9 3	6 9	9 11	6 4	11 —	5 10	13 —	4 7	33 —
6 feet	5 8	6 5	5 6	6 8	5 3	7 —	5 —	7 6	4 8	8 5	3 10	14 —
4 feet	3 10	4 2½	3 9	4 3½	3 8	4 5	3 6½	4 7½	3 4½	4 11	2 11	6 5
3 feet	2 11	3 1¼	2 10¼	3 1¾	2 9½	3 2¾	2 8¾	3 4	2 7½	3 6	2 4	4 2
2 feet	1 11½	2 ½	1 11¼	2 ¾	1 11	2 1¼	1 10½	2 1¾	1 10	2 2½	1 8¼	2 5½

Depth of Field: Kodak Anastigmat f/2.5, 38 mm. (1½ in.)

Distance Focused On	On Ciné-Kodak Eight. Circle of Confusion, 1/2000 inch											
	f/2.5		*f*/4		*f*/5.6		*f*/8		*f*/11		*f*/22	
	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.
INF.	150 —	inf.	94 —	inf.	67 —	inf.	47 —	inf.	34 —	inf.	17 —	inf.
50 feet	38 —	75 —	33 —	107 —	29 —	197 —	24 —	inf.	20 —	inf.	12 8	inf.
25 feet	21 —	30 —	20 —	34 —	18 2	40 —	16 3	54 —	14 5	94 —	10 1	inf.
15 feet	13 7	16 9	12 11	17 10	12 3	19 4	11 4	22 —	10 5	26 9	8 —	122 —
10 feet	9 4	10 9	9 —	11 2	8 8	11 9	8 3	12 9	7 9	14 2	6 3	24 —
8 feet	7 7	8 5	7 4	8 9	7 2	9 1	6 10	9 7	6 6	10 5	5 5	15 —
6 feet	5 9	6 3	5 8	6 5	5 6	6 7	5 4	6 11	5 1	7 3	4 5	9 3
5 feet	4 10	5 2	4 9	5 3	4 8	5 5	4 6	5 7	4 4	5 10	3 10	7 1
4 feet	3 10¾	4 1¼	3 10	4 2	3 9¼	4 3	3 8	4 4½	3 7	4 6½	3 2¾	5 3
3½ feet	3 5	3 7	3 4½	3 7½	3 3¾	3 8¼	3 3	3 9½	3 2	3 10¾	2 10¾	4 5
3 feet	2 11¼	3 ¾	2 11	3 1¼	2 10½	3 1¾	2 9¾	3 2½	2 9	3 3½	2 6½	3 7¾
2½ feet	2 5½	2 6½	2 5¼	2 7	2 5	2 7¼	2 4½	2 7¾	2 4	2 8½	2 2	2 11¼
2 feet	1 11¾	2 ¼	1 11½	2 ½	1 11¼	2 ¾	1 11	2 1	1 10¾	2 1½	1 9½	2 3¼

Depth of Field: Kodak Anastigmat f/1.6, 50 mm. (2 in.)

Distance Focused On	On Ciné-Kodak Eight. Circle of Confusion, 1/2000 inch											
	f/1.6		f/2		f/2.8		f/5.6		f/11		f/22	
	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in
INF.	420 —	inf.	335 —	inf.	240 —	inf.	120 —	inf.	60 —	inf.	30 —	inf.
100 feet	81 —	130 —	77 —	140 —	70 —	170 —	55 —	600 —	38 —	inf.	23 —	inf.
50 feet	45 —	57 —	43 6	59 —	41 6	63 —	35 6	86 —	27 6	275 —	19 —	inf.
25 feet	23 7	26 7	23 3	27 —	22 7	28 —	20 8	31 6	17 9	42 —	13 8	135 —
15 feet	14 6	15 6	14 5	15 8	14 2	16 —	13 4	17 2	12 —	20 —	10 —	29 6
10 feet	9 9	10 3	9 8	10 4	9 7	10 5	9 3	10 11	8 7	12 —	7 6	15 —
8 feet	7 10	8 2	7 10	8 2	7 9	8 3	7 6	8 7	7 1	9 3	6 4	10 10
6 feet	5 11	6 1	5 11	6 1	5 10	6 2	5 8	6 4	5 6	6 8	5 —	7 6
5 feet	4 11	5 1	4 11	5 1	4 11	5 1	4 10	5 3	4 8	5 5	4 4	6 —
4½ feet	4 5⅜	4 6⅝	4 5¼	4 6¾	4 5	4 7	4 4	4 8	4 2¼	4 10½	3 11	5 3½
4 feet	3 11½	4 ½	3 11½	4 ½	3 11¼	4 ¾	3 10½	4 1¾	3 9	4 3½	3 6½	4 7½
3½ feet	3 5⅝	3 6⅜	3 5⅝	3 6½	3 5⅜	3 6⅝	3 4¾	3 7¼	3 3¾	3 8¾	3 1½	3 11½
3 feet	2 11¾	3 ¼	2 11¾	3 ¼	2 11½	3 ½	2 11⅛	3 1	2 10¼	3 1¾	2 8¾	3 4
2½ feet	2 5⅞	2 6⅛	2 5⅞	2 6⅛	2 5¾	2 6¼	2 5¼	2 6¾	2 4¾	2 7¼	2 3½	2 8¾
2 feet	1 11⅞	2 ⅛	1 11⅞	2 ⅛	1 11¾	2 ¼	1 11⅝	2 ½	1 11¼	2 ⅞	1 10½	2 1¾

Depth of Field: Kodak Anastigmat f/3.5, 50 mm. (2 in.)

Distance Focused On	On Ciné-Kodak Eight. Circle of Confusion, 1/2000 inch											
	f/3.5		f/5.6		f/8		f/11		f/16		f/22	
	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.
INF.	190 —	inf.	120 —	inf.	85 —	inf.	60 —	inf.	42 —	inf.	30 —	inf.
100 feet	66 —	210 —	54 —	635 —	45 —	inf.	38 —	inf.	30 —	inf.	23 —	inf.
50 feet	40 —	68 —	35 —	86 —	31 —	125 —	28 —	285 —	23 —	inf.	19 —	inf.
25 feet	22 —	29 —	21 —	31 —	19 3	35 —	17 9	42 —	15 8	62 —	13 9	140 —
15 feet	13 11	16 3	13 4	17 2	12 9	18 3	12 1	19 11	11 1	23 —	10 1	29 —
12 feet	11 4	12 9	10 11	13 4	10 6	14 —	10 1	14 11	9 4	16 9	8 8	19 9
10 feet	9 6	10 7	9 3	10 11	9 —	11 4	8 7	11 11	8 1	13 1	7 7	14 10
8 feet	7 8	8 4	7 6	8 7	7 4	8 10	7 1	9 2	6 9	9 10	6 5	10 9
6 feet	5 10	6 2	5 9	6 4	5 7	6 5	5 6	6 8	5 3	7 —	5 1	7 5
5 feet	4 11	5 1	4 10	5 2	4 9	5 4	4 8	5 5	4 6	5 8	4 4	5 11
4½ feet	4 4¾	4 7¼	4 4¼	4 8	4 3¼	4 9	4 2½	4 10	4 1	5 —	3 11¼	5 2¾
4 feet	3 11	4 1	3 10½	4 1½	3 10	4 2¼	3 9¼	4 3¼	3 8	4 4¾	3 6¾	4 6¾
3½ feet	3 5¼	3 6¾	3 4⅞	3 7¼	3 4⅜	3 7¾	3 3⅞	3 8¼	3 3	3 9½	3 2	3 11
3 feet	2 11½	3 ½	2 11¼	3 ¾	2 10¾	3 1¼	2 10⅜	3 1¾	2 9¾	3 2½	2 9	3 3⅝
2½ feet	2 5⅝	2 6⅜	2 5½	2 6½	2 5¼	2 6¾	2 5	2 7⅛	2 4½	2 7¾	2 4	2 8⅜
2¼ feet	2 2¾	2 3¼	2 2½	2 3½	2 2⅜	2 3⅝	2 2⅛	2 3⅞	2 1¾	2 4⅜	2 1⅜	2 4⅞

Depth of Field: Kodak Anastigmat f/2.7, 63 mm. (2½ in.)

Distance Focused On	On Ciné-Kodak Eight. Circle of Confusion, 1/2000 inch											
	f/2.7		f/4		f/5.6		f/8		f/11		f/22	
	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.
INF.	385 —	inf.	260 —	inf.	185 —	inf.	130 —	inf.	95 —	inf.	47 —	inf.
50 feet	44 —	57 —	42 —	62 —	40 —	68 —	36 —	81 —	33 —	105 —	24 6	inf.
25 feet	23 6	26 9	23 —	27 9	22 —	28 9	21 —	31 —	19 9	34 —	16 5	53 —
15 feet	14 5	15 7	14 2	15 11	13 11	16 4	13 6	16 11	13 —	17 9	11 5	21 9
10 feet	9 9	10 3	9 8	10 5	9 6	10 6	9 4	10 10	9 1	11 2	8 4	12 7
8 feet	7 10	8 2	7 9	8 3	7 8	8 4	7 7	8 6	7 5	8 8	6 10	9 7
6 feet	5 11	6 1	5 10½	6 1½	5 10	6 2½	5 9	6 3	5 8	6 5	5 4	6 10
5 feet	4 11¼	5 ¾	4 11	5 1½	4 10½	5 2	4 10	5 2½	4 9	5 3½	4 7	5 7
4 feet	3 11½	4 ½	3 11¼	4 ¾	3 11	4 1	3 10¾	4 1½	3 10¼	4 2	3 8½	4 4¼
3 feet	2 11¾	3 ¼	2 11⅝	3 ⅜	2 11½	3 ½	2 11¼	3 ¾	2 11	3 1	2 10	3 2¼
2½ feet	2 5¾	2 6¼	2 5¾	2 6¼	2 5⅝	2 6⅜	2 5½	2 6½	2 5¼	2 6¾	2 4½	2 7½
2 feet	1 11⅞	2 ⅛	1 11⅞	2 ⅛	1 11¾	2 ¼	1 11¾	2 ¼	1 11½	2 ½	1 11⅛	2 ⅞
1½ feet	1 5⅞	1 6⅛	1 5⅞	1 6⅛	1 5⅞	1 6⅛	1 5⅞	1 6¼	1 5¾	1 6¼	1 5⅝	1 6½

Depth of Field: Kodak Anastigmat f/4.5, 76 mm. (3 in.)

Distance Focused On	On Ciné-Kodak Eight. Circle of Confusion, 1/2000 inch											
	f/4.5		f/5.6		f/8		f/11		f/16		f/22	
	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.	ft. in.	to ft. in.
INF.	335 —	inf.	270 —	inf.	190 —	inf.	135 —	inf.	95 —	inf.	70 —	inf.
100 feet	77 —	140 —	73 —	160 —	65 —	210 —	58 —	370 —	49 —	inf.	41 —	inf.
50 feet	44 —	59 —	42 —	61 —	40 —	68 —	37 —	78 —	33 —	105 —	29 —	180 —
25 feet	23 3	27 —	23 —	27 6	22 —	29 —	21 3	30 —	20 —	34 —	18 6	39 —
15 feet	14 5	15 8	14 3	15 10	14 —	16 3	13 7	16 9	13 —	17 8	12 5	19 —
12 feet	11 7	12 5	11 6	12 6	11 4	12 9	11 1	13 1	10 9	13 7	10 4	14 4
10 feet	9 9	10 3	9 8	10 4	9 6	10 6	9 4	10 8	9 1	11 1	8 10	11 6
8 feet	7 10	8 2	7 9	8 3	7 8	8 4	7 7	8 5	7 5	8 8	7 3	8 11
6 feet	5 11	6 1	5 10½	6 1½	5 10	6 2	5 9	6 3	5 8	6 4	5 7	6 6
5 feet	4 11	5 ½	4 10¾	5 1	4 10½	5 1¼	4 10	5 2	4 9½	5 2½	4 8½	5 4
4½ feet	4 5¼	4 6½	4 5	4 6¾	4 4¾	4 7	4 4½	4 7¼	4 3¾	4 8	4 3	4 9
4 feet	3 11½	4 ¼	3 11¼	4 ½	3 11	4 ¾	3 10¾	4 1	3 10¼	4 1½	3 9½	4 2
3¾ feet	3 8½	3 9¼	3 8¼	3 9⅜	3 8	3 9½	3 7¾	3 9¾	3 7½	3 10¼	3 7	3 10¾

Kodak Lenses for Kodascopes and Kodaslide Projectors

Lenses ordinarily used on Kodascopes and Kodaslide Projectors have twice the focal length of the usual taking lenses, and consequently a narrower angle of view. For 16-mm. Kodascopes, a 2-inch (50 mm.), for 8-mm. Kodascopes, a 1-inch (25 mm.), and for Kodaslide Projectors a 4- or 5-inch lens is recommended for normal use. With these lenses, a picture of proper perspective is presented to a spectator seated about half way between projector and screen. For use in small rooms where the throw is limited, 1- and 1½-inch lenses are available for 16-mm. Kodascopes. Projection lenses with longer focal length are useful for larger rooms where long throws with large screen sizes are needed. All lenses listed below are made with great care and precision, are highly corrected, and assure clean-cut, undistorted pictures with the projectors for which they are designed.

LENS	Aperture	Nominal Focal Length in.	Nominal Focal Length mm.	Projection throw for different screen picture sizes: 16½″ x 22″	22″ x 30″	30″ x 40″	39″ x 52″	54″ x 72″	63″ x 84″	Designed for
For 16-mm. Kodascopes										
Kodak Projection Lens	$f/2.5$	1	25	5 ft.	6¾ ft.	9 ft.	11½ ft.	16 ft.	19 ft.	Kodascope Model G, E, EE, Sixteen-10, Sixteen-20, and Sound Kodascope Model F Series
Kodak Projection Lens	$f/2.5$	1½	38	7½ ft.	10 ft.	13½ ft.	17 ft.	24 ft.	28 ft.	
Kodak Projection Lens	$f/2.5$	2	50	10 ft.	13½ ft.	18 ft.	23 ft.	32 ft.	37 ft.	
Kodak Projection Lens	$f/1.6$	2	50	10 ft.	13½ ft.	18 ft.	23 ft.	32 ft.	37 ft.	
Kodak Projection Lens	$f/2.0$	3	76	—	—	26½ ft.	34½ ft.	48 ft.	56 ft.	
Kodak Projection Lens	$f/2.5$	4	102	—	—	36 ft.	46 ft.	64 ft.	74 ft.	
Kodak Projection Lens	$f/1.6$	2	50	10 ft.	13½ ft.	18 ft.	23 ft.	32 ft.	37 ft.	Sound Kodascope Special
Kodak Projection Lens	$f/1.4$	3	76	—	—	26½ ft.	34½ ft.	48 ft.	56 ft.	
Kodak Projection Lens	$f/1.6$	4	102	—	—	36 ft.	46 ft.	64 ft.	74 ft.	
For 8-mm. Kodascopes										
Kodak Projection Lens	$f/2.0$	1	25	11 ft.	14½ ft.	19½ ft.	25 ft.	—	—	Kodascope Eight-33
Kodak Projection Lens	$f/1.6$	1	25	11 ft.	14½ ft.	19½ ft.	25 ft.	—	—	Kodascope Eight-70 and 70A
				Projection throw for different screen picture sizes. If vertical as well as horizontal Kodaslides are projected, a square screen is needed.						
For Kodaslide Projectors				15″ x 22″	21″ x 30″	28″ x 40″	36″ x 52″	50″ x 72″	58″ x 84″	
Kodak Projection Lens	$f/3.5$	4	102	a: 6 ft. b: 5 ft.	8 ft. 7 ft.	10½ ft. 9 ft.	13½ ft. 12 ft.	— —	— —	Kodaslide Projector Model 1
Kodak Projection Lens	$f/3.5$	5	127	a: 7½ ft. b: 6½ ft.	10 ft. 8½ ft.	13 ft. 11 ft.	16½ ft. 14½ ft.	23 ft. 20 ft.	26½ ft. 24 ft.	Kodaslide Projector Model 2 and 2A
Kodak Projection Lens	$f/4.5$	7½	190	a: 11 ft. b: 9½ ft.	15 ft. 13 ft.	20 ft. 17 ft.	25½ ft. 22 ft.	35 ft. 31 ft.	41 ft. 36 ft.	

Note: Screen-picture sizes are based on the following projected film areas:
16 mm.: .380 x .284 in.; 8 mm.: .172 x .129 in.; Kodaslide Projector a: 29/32 x 1 5/16 in. for 35-mm., b: 1 1/32 x 1½ in. for Bantam.

Kodak Projection Lenses for Enlarging

Among the many lenses manufactured by the Eastman Kodak Company, there is a group designed particularly for enlarging. A good camera lens is not necessarily the best enlarger lens. Enlarger lenses must work between the flat surface of the paper and the flat negative at relatively short subject-image distances. Kodak enlarging lenses have a flat field, good covering power, and precise corrections of aberrations at short working distances. The Projection Ektars are specially designed for color work and corrected for lateral chromatic aberrations to an exceptionally high degree.

LENS	Aperture Range	Focal Length		For Negatives Up To	Adapter Ring Size		Lens Attachment Series	Supplied in	Used for
		in.	mm.		in.	mm.			
Eastman Projection Anastigmat f/ 4.5, 10 in.	f/ 4.5–f/32	10	254	8 x 10 in.	2⅝	67	VIII	—	Eastman Projection Printer 8 x 10
Eastman Projection Anastigmat f/ 8, 10 in.	f/ 8 –f/45	10	254	8 x 10 in.	1¾	44.5	VII	—	Line Process work with above Printer
*Eastman Projection Anastigmat f/ 4.5, 7½ in.	f/ 4.5–f/32	7½	190	5 x 7 in.	2	50.5	VII	—	Eastman Auto-Focus Enlarger 5 x 7
Kodak Projection Anastigmat f/ 4.5, 6⅜ in.	f/ 4.5–f/22	6⅜	161	4 x 5 in.	2	50.5	VII	2⅝″ x 2⅝″ lens boards	Kodak Precision Enlarger with "B" Assembly and Kodak Advance Enlarger
Kodak Projection Anastigmat f/ 4.5, 5⅜ in.	f/ 4.5–f/22	5⅜	135	3¼ x 4¼ in.	1¾	44.5	VII		
Kodak Projection Anastigmat f/ 6.3, 5 in.	f/ 6.3–f/16	5	128	2½ x 4¼ in.	1 9/16	39.5	VI		
*Kodak Projection Ektar f/ 4.5, 4 in.	f/ 4.5–f/22	4	100	2¼ x 3¼ in.	1 9/16	39.5	VI		As above but with small negatives and Kodak Precision Enlarger with "A" Assembly
Kodak Projection Anastigmat f/ 4.5, 4 in.	f/ 4.5–f/22	4	105	2¼ x 3¼ in.	1 9/16	39.5	VI		
*Kodak Projection Ektar f/ 4.5, 3 in.	f/ 4.5–f/22	3	75	2¼ x 2¼ in.	1 3/16	30	V		
Kodak Projection Anastigmat f/ 4.5, 3 in.	f/ 4.5–f/22	3	75	2¼ x 2¼ in.	1 3/16	30	V		
*Kodak Projection Ektar f/ 4.5, 2 in.	f/ 4.5–f/22	2	50	1 3/16 x 1 9/16 in.	15/16	23.5	V		Kodak Precision Enlarger with "A" Assembly and Kodak Advance Enlarger
Kodak Projection Anastigmat f/ 4.5, 2 in.	f/ 4.5–f/22	2	50	1 3/16 x 1 9/16 in.	15/16	23.5	V		
Kodak Projection Anastigmat f/ 6.3, 2 in.	f/ 6.3 fixed	2	50	1 3/16 x 1 9/16 in.	13/16	20.5	V		
Kodak Projection Anastigmat f/11.0, 98 mm.	f/11.0 fixed	4	98	3¼ x 4¼ in.	1	25.5	V		
*Kodak Projection Ektar f/ 4.5, 2 in.	f/ 4.5–f/22	2	50	28 x 40 mm.	15/16	23.5	V	focusing tube	Kodak Portable Miniature Enlarger for 24 x 36 and 28 x 40 mm. negatives
Kodak Projection Anastigmat f/ 4.5, 2 in.	f/ 4.5–f/22	2	50	28 x 40 mm.	15/16	23.5	V		
Kodak Projection Anastigmat f/ 6.3, 2 in.	f/ 6.3 fixed	2	51	28 x 40 mm.	13/16	20.5	V		
Kodak Anastigmat f/ 7.7, 130 mm.	f/11.0 fixed	5	130	4 x 5 in.	1	25.5	V	—	Kodak Auto-Focus Enlarger Mod. C
*Eastman Projection Anastigmat "K" f/ 4.5, 105 mm.	f/ 4.5–f/22	4	105	28 x 40 mm.	1¼	31.5	VI	—	Process color work from 24 x 36 and 28 x 40 mm. originals

*Specially corrected for lateral chromatic aberration.

Useful Optical Formulas

IN THE photography of small objects, in special work with supplementary lenses, and with various projection arrangements, it often happens that the photographer wishes to compute the subject and image positions or sizes, field size, depth of field, etc. A few basic optical formulas are given here to assist in making such calculations.

The usual diagram of the formation of an image by a lens shows rays proceeding in straight lines from points in the subject to corresponding points in the image, as though they passed through a pinhole at the center of the lens. In an actual lens this group of rays may not proceed in straight lines through the center of the lens. Usually, these rays from the subject converge toward one point or apparent pinhole, but after passing through the lens, they diverge apparently from another pinhole or point at a different position on the lens axis. For theoretical accuracy, the subject distance and image distance should be measured from these two points, known as the first and second nodal points. With normal photographic lenses, however, these points are not unduly separated, and the following formulas will apply with practical accuracy if distances are measured to the center of the lens. This approximation does not apply to telephoto lenses in which the principal planes or nodal points may be a considerable distance in front of the lens.

To Find the Focal Length of a Lens: The focal length is roughly equal to the distance from the center of the lens to the image plane when the lens is focused for a very distant object. The focal length can be found more accurately by focusing on a small subject, such as a ruler, so that the image is exactly one half the size of the subject. The focal length is then approximately one third of the distance from the subject to the center of the lens.

To Find the Back Focus of a Lens: Focus for a very distant object (infinity) and measure the distance between the rear lens surface and the image plane.

Formulas for approximate position of subject and image:

f = focal length u = subject distance h = height of subject
m = magnification v = image distance h' = height of image
x' = distance of image from focal point, or distance lens is moved from infinity setting

The fundamental relation between focal length and image and object distance is:

$$\frac{1}{f} = \frac{1}{u} + \frac{1}{v} = \frac{u+v}{uv}$$

More directly useful relations are:

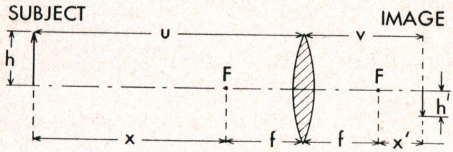
Lens to Image: $v = \frac{fu}{u - f} = mu = (m + 1)f$

Lens to Subject: $u = \frac{fv}{v - f} = \frac{v}{m} = \left\{\frac{1}{m} + 1\right\}f$

Subject to Image: $u + v = \frac{(m + 1)^2}{m}f$

Magnification: $m = \frac{h'}{h} = \frac{v}{u} = \frac{v - f}{f} = \frac{f}{u - f}$

Lens movement from infinity position: $x' = \frac{f^2}{u - f}$



Lens-Subject-Image Positions

These relations hold strictly if the measurements are made from the first and second nodal points. With a normal photographic objective, not a telephoto lens, practical accuracy results if u and v are measured from the lens center.

Effective Aperture for Close-ups differs from the indicated aperture because of the increased image distance. This is especially important in work with Kodachrome and in copying.

Effective *f*-number (for any subject distance) $= \frac{v \times f}{\mathrm{f}}$

where v = lens-to-film distance, or focal length plus lens extension from infinity focus
and *f* = indicated *f*-number of aperture
and f = focal length

For close-ups, allow this aperture correction, or increase exposure time by v^2/f^2.

Both aperture and time corrections are given directly by the Effective Lens Aperture Kodaguide for all lenses 1 to 30 inches in focal length.

Approximate Formulas for Supplementary Lenses, when the separation between supplementary lens and camera lens is small in comparison with the focal length of the latter. For a negative supplementary lens, f_s must be treated as a negative value.

f = focal length of camera lens.
f_s = focal length of supplementary lens.
f_c = focal length of the combination.

$$\frac{1}{f_c} = \frac{1}{f} + \frac{1}{f_s}$$

u = distance from supplementary lens to subject.
v = distance from center of camera lens to film.
m = magnification on film (image size/subject size).
S = distance for which camera lens is focused.

Lens to Subject: $u = \dfrac{f_c v}{v - f_c}$

Lens to Image: $v = \dfrac{f_c u}{u - f_c}$

Magnification: $m = \dfrac{v}{u} = \dfrac{f_c}{u - f_c}$

Setting of camera focusing scale: $S = \dfrac{u f_s}{f_s - u}$

Effective *f*-number = Indicated *f*-number x $\dfrac{v}{f}$.

When camera lens is set at infinity mark,
$v = f$; $u = f_s$; effective *f*-number = indicated *f*-number.
For very distant objects,
$v = f_c$; effective *f*-number = indicated *f*-number x $\dfrac{f_c}{f}$.

Angle of View: The angle of view or angular field may mean (1) the diagonal of the picture size, (2) the long, or (3) the short sides of the picture. When a single value is given it usually refers to the angle subtended at the lens by the diagonal of the picture.

Angle of view when focused for infinity: $\dfrac{\frac{1}{2}d}{f} = \tan \Theta$

Angle of view for close-ups: $\dfrac{\frac{1}{2}d}{v} = \tan \Theta$

Where:

d = negative dimension (diagonal, or long or short side).
Θ = ½ the angle of view.

To find Θ, consult a table of trigonometric functions.

Depth of Field Computations * can be made on the basis of a fixed circle of confusion or on a circle of confusion equal to a fraction of the focal length. When the latter method is used, all lenses of equal effective diameter (not relative aperture) have the same depth of field when the image is viewed at the distance for normal perspective. See the discussion of depth of field, page 9.

Method A, fixed circle of confusion:

f = focal length of lens

f = f-number of relative aperture

H = hyperfocal distance

u = distance for which camera is focused

d = diameter of circle of confusion

$$H = \frac{f \times f}{f \times d}$$

N

Near limit of depth of field (measured from camera lens) $= \dfrac{H \times u}{H + (u - f)}$

F

Far limit of depth of field (measured from camera lens) $= \dfrac{H \times u}{H - (u - f)}$

Method B, circle of confusion a fraction of the focal length of the Lens:

u = distance focused upon

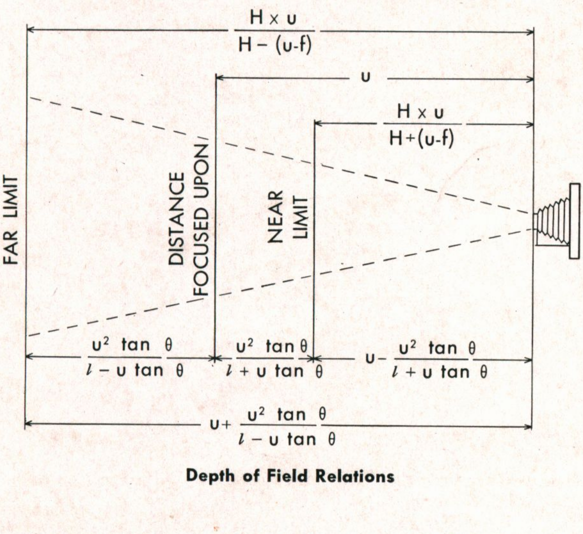
Θ = angular size of circle of confusion (in cases where critical definition is required, a common value for Θ is 2 minutes of arc [$\tan 2' = .00058$], or approximately f/1720)

l = *effective diameter of lens* $= \dfrac{f}{f}$

Near limit of depth of field (measured from plane focused upon) $= \dfrac{u^2 \tan \Theta}{l + u \tan \Theta}$

Far limit of depth of field (measured from plane focused upon) $= \dfrac{u^2 \tan \Theta}{l - u \tan \Theta}$

All distances must be expressed in the same units, such as feet, inches, etc.



Depth of Field Relations

* BASICALLY ; FOCUS FOR TWICE THE DISTANCE OF THE NEAREST "DESIRED" OBJECT

$$u = \frac{2NF}{N+F}$$

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