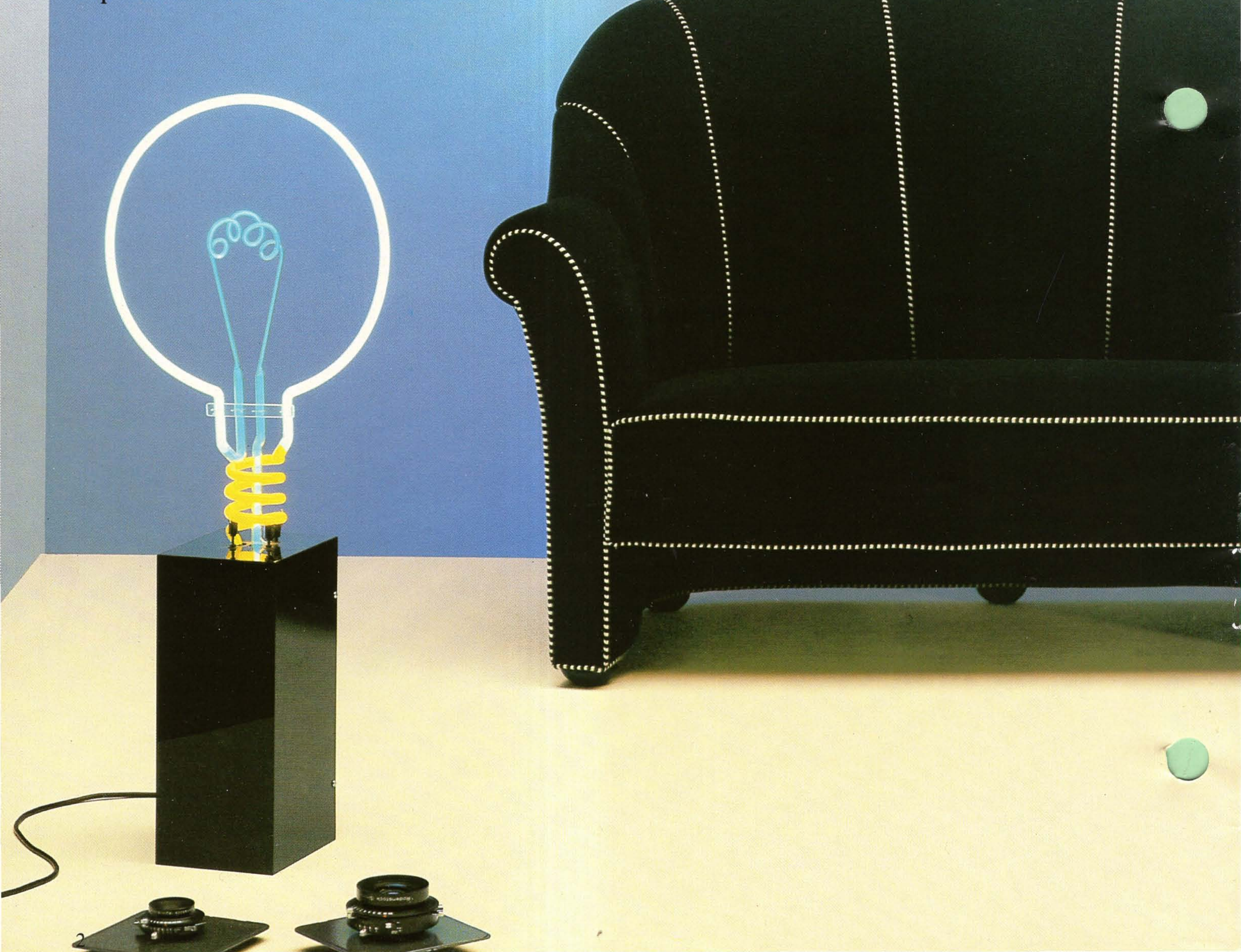
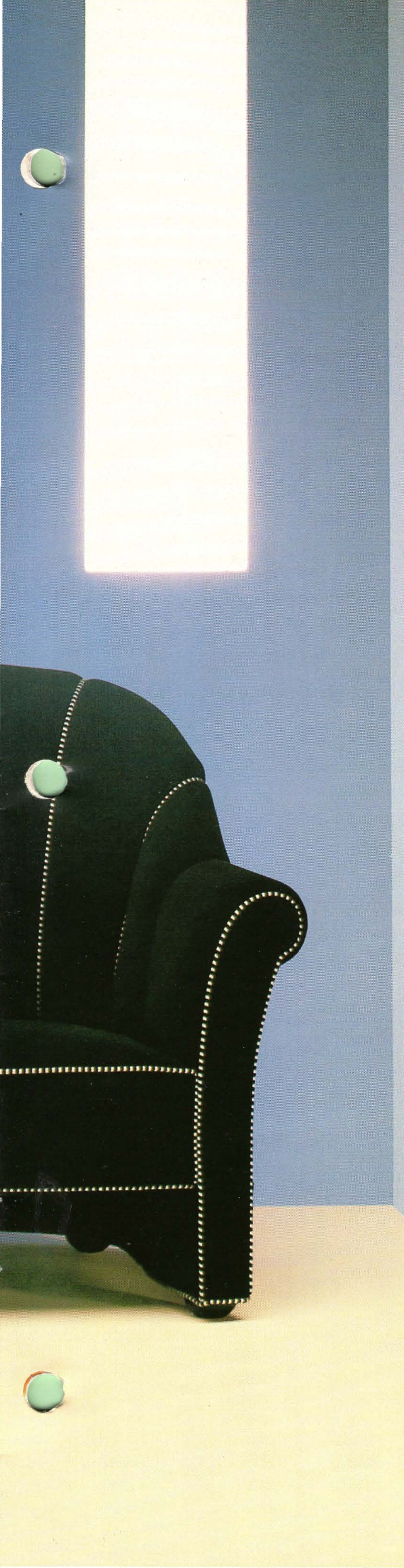
Camera Lenses

Rodenstock®

Rodenstock has a tradition of nearly 100 years in the design and production of photographic lenses. From the very beginning it has been our goal to provide photographers with a "tool" that represents the state of the art of lens making, and which meets the various requirements encountered in practical applications.
Thus, the present range of Rodenstock lenses offers an extensive opportunity for large-format photographers to master every conceivable photographic situation. These lenses are produced with the deep commitment to quality which is the basis for Rodenstock's excellent reputation.
In this brochure, the user of large-format cameras will find general information concerning the features of lenses, details of special characteristics of Rodenstock lenses (complete with MTF curves), a guide to the interpretation of this technical data and suggestions for the full utilization of Rodenstock camera lenses in various applications.

Optische Werke G. Rodenstock





Large Film Format – Large Format Photography

Advantages of large-format photography

Photography using sheet film continues to have its place in advertising, for product shots of every kind, in architectural photography and, therefore, also in photographic schools.

There are three important reasons: in presenting the finished result, a larger transparency makes a better impression. With larger formats the client can determine more easily if his intentions have been realized; original layouts can quickly be compared; sheet films are convenient for the production of color separations.

Furthermore, cameras for large-format photography permit adjustments which are normally not possible with smaller format cameras. Correction or modification of perspective, extension of depth of field – these are possibilities which are typical of large-format camera technique.

Finally, the large format yields superb image quality in black and white as well as color photography. This is because less image reduction is necessary in large format photography. For example, when photographing the same subject on 35 mm film and 4"×5" film, if a 20× reduction is necessary on the 35 mm format, only a 5× reduction would be necessary on the 4"×5" format. Thus, if 10 lines per millimeter (Lp/mm) are necessary to record the subject on the 4"×5" format, 40 Lp/mm would be necessary to record the same detail on the 35 mm format. Note that the original contrast of the scene will be reduced through light diffusion in the film emulsions.

Typical color negative films reproduce 10 Lp/mm with nearly 100% contrast, but 40 Lp/mm not even with 50%. Since the contrast transfer of taking and enlarging lenses also decreases with an increasing number of lines per millimeter, the larger format is clearly superior. Since the contrast of even very fine details is especially high, the impression of a very sharp image with high resolution can be created. In addition, sheet films require less enlargement than smaller formats for a given size print, therefore, tonal modulation in black and white films and color saturation in color negative films are largely preserved. Thus the quality advantage of the large-format technique is quite obvious. The success of large-format technique depends equally on camera and camera lens. The camera should provide the adjustability to cope with all picture situations; the lens must satisfy the optical requirements of the film format and fill an image circle large enough to allow camera adjustments.

Image circle and adjustment possibilities

In large-format technique, lens focal lengths and film formats cannot be definitely related.
The 150 mm f/5.6 SIRONAR-N is the normal lens for 4"×5" (9×12 cm). For 2¼"×3¼" (6.5×9 cm) it would be considered a longer lens, for 5"×7" (13×18 cm) a moderate wide-angle. Similarly, the 155 mm f/6.8 GRANDAGON could be used as an extreme wide-angle lens for 8"×10" (18×24 cm), normal lens for 4"×5" (9×12 cm), or even as a longer lens for 2¼"×3¼" (6.5×9 cm).
The image circle of a lens is always decisive: if it equals the diagonal of the film format, just this format will be covered. The larger the image circle, the greater the possible camera movements.
The Rodenstock camera lens program provides a normal lens and at least one wide-angle lens for each large-format size. For example, the 150 mm f/5.6 SIRONAR-N is the normal lens for 4"×5" (9×12 cm). The possible camera movements are approximately 35 mm. There are several wide-angle lenses that can be used for the 4"×5" format. The 65 mm f/4.5 GRANDAGON provides extreme wide-angle effects, but with little movements. The 75 mm and 90 mm GRANDAGON lenses offer less extreme angles but allow for greater movements. Even the 135 mm f/5.6 SIRONAR-N may be used as a moderate wide-angle lens if the image circle need not be too large.
Long focal length lenses for the 4"×5" (9×12 cm) format are the 180 mm to 480 mm SIRONAR-N and 240 mm to 1200 mm APO-RONAR lenses. With increasing focal length the allowable movements become so great that they are limited only by the capabilities of the camera.

For a given maximum aperture each particular lens type can be corrected for a specific image angle. This image angle gives an image circle on the film whose size is dependent on the lens to film distance. At infinity focus, the image circle is smallest. As closer objects are focused, the lens to film distances gets larger, and so does the image circle. (See Reproduction Ratio page 4 for more information on this phenomenon).
Within the image circle, image quality is uniform from the center to about two-thirds to three-quarters from the edge. Further towards the edge, there is a decrease in image quality. At the very edge, there will be only a soft image, if the mount has not already cut off the light rays.

The limit of the usable image angle lies somewhere between the center maximum and the area of zero performance – in the outer one-third or one-quarter of the image circle. Where the limit is placed will depend on the required image quality. With the proper choice of focal length and without camera adjustments, the image utilizes only the "best" part of the image circle. The degree of fine details to be resolved on the image at the corners of the film format will determine the amount of lens coverage necessary. If clouds fill the corners of the film, one can use a lens with a smaller image circle because there is no texture which must be exactly reproduced. However, if ornaments of a building are placed in the corners of the film format, the image circle should be greater. Under such critical conditions, the usable image angle and, therefore, the diameter of the usable image circle, are somewhat smaller because only the center 2/3 or 3/4 of the image circle may provide sufficient performance. It is standard practice to define a lens' image angle as the maximum angle that can be used without sacrificing performance. The resulting image circle diameter determines the adjustment possibilities. These include the lateral shift, vertical rise and fall, tilts and swings of the front and back standards of the camera. However, since every possible combination of these movements cannot be considered, the tables (see page 16ff) indicate only the horizontal and vertical movement possibilities. They facilitate comparisons and provide a conception of the magnitude of the adjustment possibilities.

The MTF curves of the individual lenses permit the photographer to determine which image circle diameter and which camera adjustments can be utilized under given conditions.

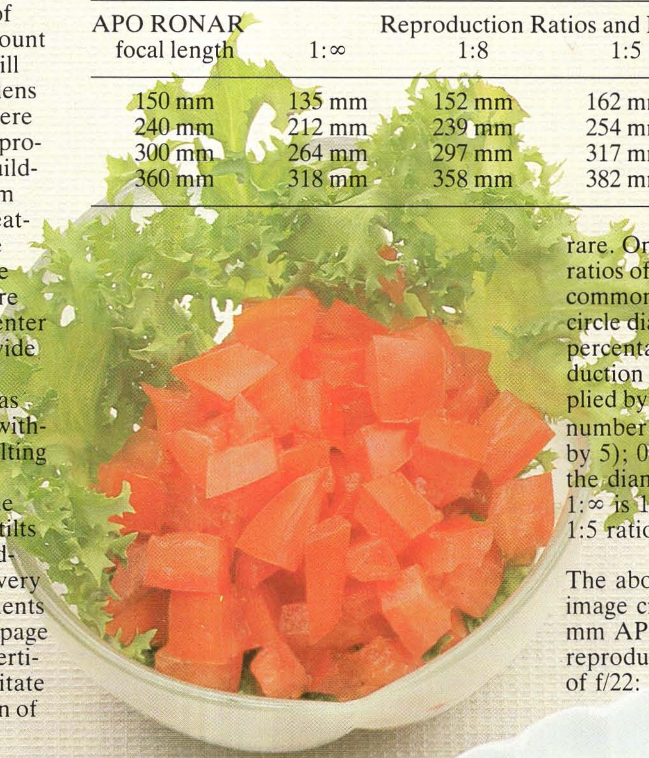
Diffraction

Image angle and image circle also depend on the lens aperture. Stopping down of the lens reduces the influence of some aberrations: the zone of equally good projection is extended, and the usable image area becomes larger. However, this does not mean that the smallest aperture is best. Rather, with increasing reduction of the aperture, diffraction, (which is controlled by physical laws) becomes increasingly noticeable. Fine detail can no longer be reproduced with the desired contrast. While the area of equal resolution is larger, the resolution itself is not optimal. Stopping down the lens to f/22 results in a favorable compromise: aberrations are largely avoided but the diffraction does not yet affect the image. Furthermore, contrast performance with an f/22 aperture is uniform over the entire format area, and the image angle, even with further stopping down, would increase only slightly. Therefore, the f/22 aperture is always recommended when the lenses are to yield optimum results.

Reproduction ratio

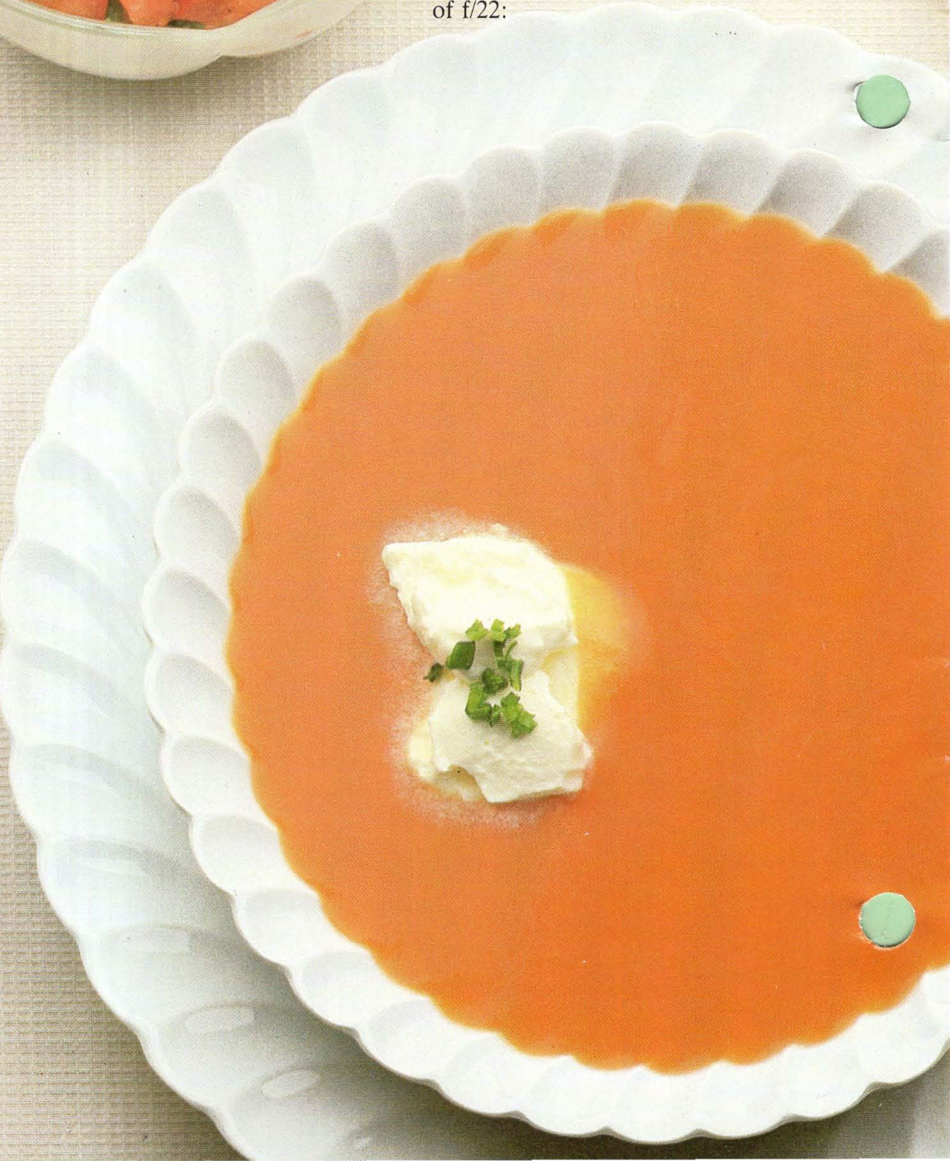
The image circle, and the corresponding camera movements possible are also dependent on the reproduction ratio. The tables refer to the maximal image angle at a reproduction ratio of 1:∞. In this case the image circle is equal to the focal length. For the reproduction of closer subjects, lens-to-film distance is increased. In this case, the image angle is unchanged but the diameter of the image circle increases. Therefore, greater movements are possible. At the 1:1 ratio the diameter of the image circle is twice as large as with 1:∞.
However, with the exception of the APO-RONAR, reproduction in full 1:1 size is

APO RONAR focal length	Reproduction Ratios and Image Circle Diameters 1:∞	1:8	1:5	1:3	1:1
150 mm	135 mm	152 mm	162 mm	180 mm	270 mm
240 mm	212 mm	239 mm	254 mm	283 mm	424 mm
300 mm	264 mm	297 mm	317 mm	352 mm	528 mm
360 mm	318 mm	358 mm	382 mm	424 mm	636 mm



rare. On the other hand, reproductions at ratios of 1:8, 1:5 and the like are quite common and, with these, the larger image circle diameter becomes apparent. The percentage increase is equal to the reproduction ratio (as a decimal number) multiplied by 100. For example, the decimal number for a 1:5 ratio is 0.2 (1 divided by 5); 0.2 × 100 = 20%. Therefore, if the diameter of the usable image circle at 1:∞ is 135 mm, it would increase at the 1:5 ratio by 20% to 162 mm.

The above table shows examples of image circle diameters for 150 mm to 360 mm APO-RONAR lenses at selected reproduction ratios and with an aperture of f/22:



Depth of field

Depth of field is determined by the permissible circle of confusion and is calculated from lens aperture, focal length and reproduction ratio. The only exception to this is the variable-softness IMAGON lens with its extraordinary correction. Since this lens yields a different, seemingly greater depth of field, it is also called a "Depth Imager".

In practice, the desired depth of field may cause problems. For example, subjects of considerable spatial depth may require lens apertures of f/45 or even f/64. However, in such cases the contrast transfer, and with it the overall resolution, is affected by diffraction to such a degree that the image quality would be reduced. Here, the photographer must arrive at a well-balanced compromise between depth of field and the adverse effects of diffraction.

Maximum aperture and mount vignetting

The maximum aperture of a lens for large-format photography should permit convenient and precise focusing. With a maximum "speed" of f/5.6 all standard requirements are met. Additionally the f/4.5 maximum aperture of several GRANDAGON models facilitates focusing of these wide-angle lenses.

While the f/9 maximum aperture of the APO-RONAR appears to be relatively small, this is outweighed by the uncompromising sharpness which distinguishes this lens type. Additionally, in the photography of still subjects – the eminent domain of the APO-RONAR – larger apertures are not required.

There remains the question of how an exposure with a given maximum aperture will work out.

Since optimal performance of the lenses occurs at an aperture of about f/22, an exposure at full aperture would consequently show reduced contrast and less resolution of detail. Nevertheless, such results may be quite adequate under certain conditions.

Furthermore, with use of the maximum aperture, some degree of mount vignetting may be expected: the lens mount cuts off the peripheral light rays. With a very oblique incidence of light rays the entrance pupil does not appear as a circle (O) but as a small form bounded by two arcs (◎). Such mount vignetting causes lower illumination in the format corners compared with the center. This can, however, be equalized by stopping down the lens.
Rodenstock lenses are designed so that mount vignetting is eliminated after stopping down by two f/stops. This stopping down simultaneously improves the imaging quality.

Recommended working apertures

While the aperture should be closed by two – or more – stops to avoid vignetting, high contrast and uniform contrast distribution over the entire image area will be obtained at f/22. Consequently, any aperture within this range will provide maximum image quality. Therefore, these f-stops are recommended as working apertures.

This aperture range comprises up to three f-stop values. For example, if highest contrast is demanded while the entire image angle is not being utilized, stopping down by merely two stops is advisable. However, if the image angle is more fully utilized, and if high contrast with uniform distribution into the corners is needed, the optimal aperture is f/22.

Contrary to the other lenses, there is only one recommendation for the APO-RONAR f/9 (or f/16 respectively): working aperture f/22 (respectively f/32).

No specific working aperture can be recommended for the IMAGON. The desired softening effect is obtained with the variable perforated diaphragm.

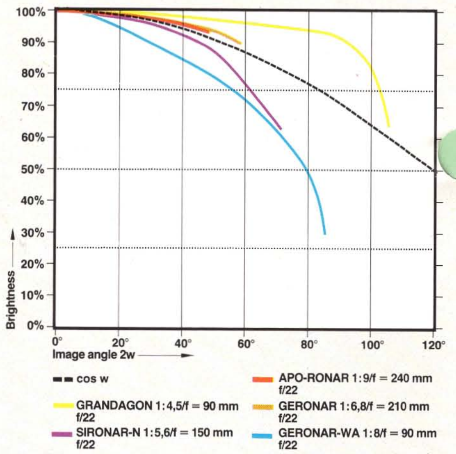
Natural light fall-off

Even after the mount vignetting has been eliminated by stopping down two stops, a light fall-off at the focal plane remains and is more noticeable with wide-angle lenses. This is partly due to the arrangement and the reflection characteristics of the subject matter to be photographed, and thus cannot be influenced by the lens designer. The "contribution" by the lens is explained by the following phenomenon: as the line of sight moves from the center axis to the side, the image of a circle progressively becomes elliptical. This is also true of the exit pupil of the lens. When the light rays pass through the lens along the optical axis, the exit pupil is circular, therefore its area and light transmission is greatest. As light rays pass through the lens at greater angles to the center axis, the exit pupil becomes more elliptical and thus has less area. This smaller area lets through less light. This decrease in light transmission varies with the cosine of the angle from the center axis and is called a cosine effect. Although it cannot be totally eliminated, it is the aim of lens design to approach this "theoretical limit" as closely as possible and not introduce any further fall-off.

The light transmission variation of the different lenses, as well as the theoretical variations based on the cosine effect, are shown in the following diagrams.

When negative films are used, slightly underexposed corner areas are of secondary importance because the light fall-off of the camera lens will be offset by the light fall-off of the enlarging lens that

Light fall-off (Brightness variations on image area)



occurs during printing. However, with positive film used in connection with very wide angles, such fall-off can become more apparent, because there is no reversal during printing. For this eventuality Rodenstock offers center filters for GRANDAGON lenses. These graduated filters, dark in the center and progressively lighter toward the edges, compensate for fall-off. A special feature of Rodenstock center filters lies in the fact that the extreme wide angle of the GRANDAGON is not restricted even at 105°.

Quality made visible with MTF-Measurements

The goal of every optical design is to produce an optical image that is as closely defined to the original as possible. MTF (Modulation Transfer Function) is today's accepted method for measuring the imaging capability of lenses, providing an objective measurement of the various performance characteristics of lenses; it is used by most lens manufacturers as the standard in lens evaluation.

What is MTF?

Many of the key parameters that determine the imaging capabilities of a lens can be determined by contrast loss. Ideally, a perfect lens would show no loss of contrast regardless of the subject imaged or the conditions under which the lens were used (i.e. various apertures, subject-to-lens distance). However, physical laws dictate that real lenses have limitations. Accurate and objective methods of determining those limitations are necessary. MTF is that method, wherein various grids of black & white lines are used to determine contrast loss as those grids are projected through the lens. Each grid is composed of a specific number of equal-width black and white lines; one black and one white line is considered a pair. Grids are differentiated by the number of these line pairs per millimeter (Lp/mm). High numbers of Lp/mm represent a grid with fine detail and conversely, smaller numbers of Lp/mm represent a grid with coarse detail. The number of Lp/mm is referred to as subject spatial frequency. The higher the spatial frequency, the greater the Lp/mm that are represented.

The change between light and dark areas of the subject imaged is called *modulation*.

If a grid were imaged through a perfect lens, the black lines would be perfectly black and the white lines would be perfectly white. A real lens will cause the black lines to be somewhat lighter, and the white lines to be somewhat darker. This loss of contrast occurs as the light rays of the subject are *transferred* through the lens. Thus, the origin of the name - Modulation Transfer Function (MTF).

If you could ignore physical laws, a perfect lens would have an MTF of 1 (where 1=100% contrast) at all subject spatial frequencies. The closer the MTF of a lens approaches "1", especially at higher spatial frequencies, the better the performance of the lens. The MTF is dependent on wavelength of illumination, aperture of the lens and reproduction ratio. As an aid to evaluating MTF, information is conventionally displayed as a curve plotting the contrast against distance (from image center of the lens) along the image diagonal. Each curve will specify the aperture used, type of illumination, reproduction ratio and spatial frequency. The MTF curve of the "perfect" lens would not be a curve at all. It would be a straight line, indicating 100% contrast transfer at all points along the image diagonal. Taking into account the limitations of physical laws, the best possible performance available is indicated on each MTF chart as diffraction limits.

For a real lens, the closer its MTF curve approaches these diffraction limits, the better the overall performance will be. The theoretical diffraction limit is dictated by aperture, wavelength and spatial frequency.

Sagittal & Tangential

During the actual testing of lenses, the previously mentioned grids are composed of two groups of lines which are perpendicular to each other. The reason being that, outside of the image center, the direction of the lines becomes important. The lines are arranged so that one set is parallel to imaginary lines drawn from the

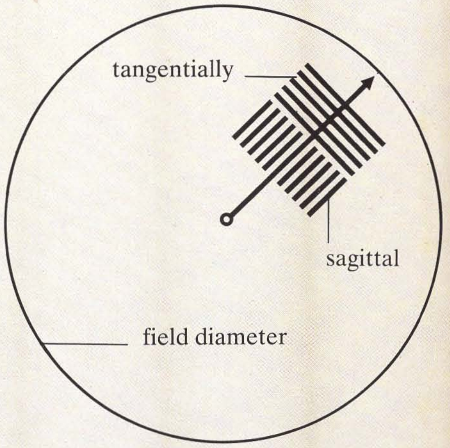


image center to the outer limits of the image circle. These are called sagittal lines. The other set of lines is perpendicular to the imaginary lines drawn from the image center and are therefore "tangent" to the image circle. As you might have guessed, these lines are called "tangential". Some lens aberrations can cause differences in the sagittal and tangential contrasts. Therefore, MTF curves are measured for both sagittal and tangential line pairs. Generally, as you move away from the optical axis, the difference between sagittal and tangential measurements becomes greater. The closer the sagittal and tangential measurements are at any specific point, the better the performance of the lens. When reading an MTF curve, you will note that there is one theoretical limit indicated at the optical axis, and two limits indicated at the outer limit of the image circle. Those at the outer limit represent the theoretical limits for tangential and sagittal measurements.

Significance of spatial frequencies

The spatial frequency used to evaluate lens performance is directly related to the resolution needed for the final image as viewed. For example, in an 8″×10″ image, at normal viewing distances, the eye can resolve, at best, 4 to 5 Lp/mm. If a 16″×20″ image is viewed at its normal viewing distance (which is greater than the viewing distance for 8″×10″) approximately 2 to 2½ Lp/mm will make the image appear as sharp as an 8″×10″ which has 4 to 5 Lp/mm. Carrying this even further, a 30″×40″ print with 1 to 1¼ Lp/mm, viewed at its normal viewing distance, would appear as sharp as the 8″×10″ with 4 to 5 Lp/mm.

Therefore, these resolutions when referred back to 4″×5″ film result in a required resolution of 8 to 10 Lp/mm to reach the limits of normal human vision under ideal conditions. Generally, 5 Lp/mm is visually adequate for most applications. Note that with the 35 mm film format, between 20 to 40 Lp/mm would be required on the film to achieve the same apparent sharpness.

It's important to also realize that most films show contrast loss at 20 Lp/mm; therefore, the difficulties of using smaller format film become even more apparent. Thus, the MTF curves at 5 to 10 Lp/mm are the most important ones as these are the frequencies that are most frequently utilized. A loss in the contrast at these spatial frequencies would result in lower image quality.

Color of illumination

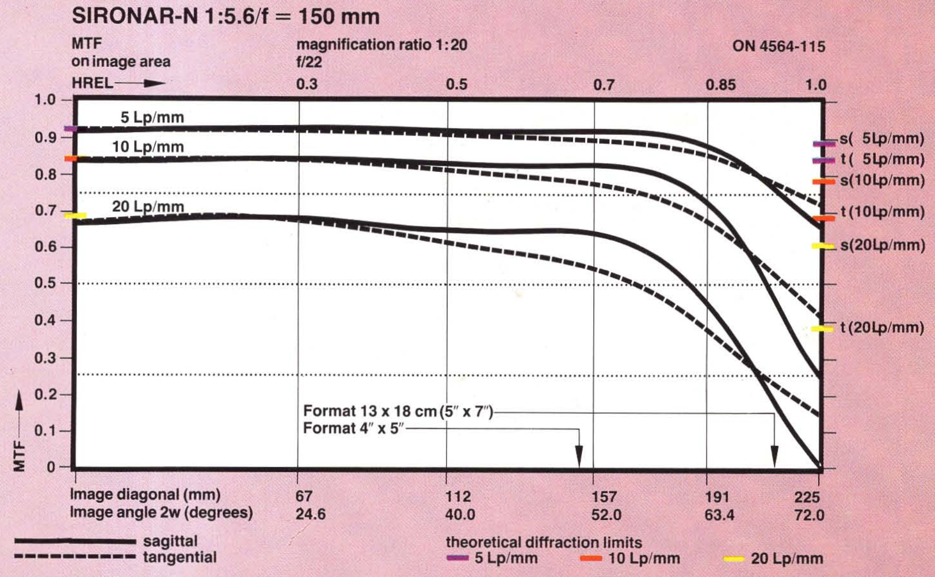
As previously mentioned MTF is dependent on the wavelength of the illumination. Practically speaking, different wavelengths appear as different colors. All other things being èqual, different wavelengths will effect contrast transfer. To permit consistent interpretation of the MTF, the colors violet, blue, green and red are rated in such a manner that they correspond to the sensitization of commercially available color films or panchromatic black & white films.

Consistency

The MTF charts shown in the brochure were calculated by computer, based on the specifications of the various lens types. One of the most important aspects in lens production is the consistency with which lenses can be produced to approach design performance levels. Optische Werke G. Rodenstock have developed a method to reduce this variance to exceptionally low levels.
This procedure has great impact on the consistent, high quality of Rodenstock lenses. Two areas are of particular importance: a lens design that minimizes the effects of production variances, and close tolerances on lens components which are verified by a scrupulous quality control program.
During the design phase of a lens at Rodenstock, "simulation programs" are fed into the computer which show the effects of various production tolerances on the final product. The design that demonstrates the least change in optical performance for a given amount of production variance can then be chosen.
The application of this simulation program, in conjunction with extensive experience in precision production assures the unusually high consistency in the imaging quality of Rodenstock lenses.

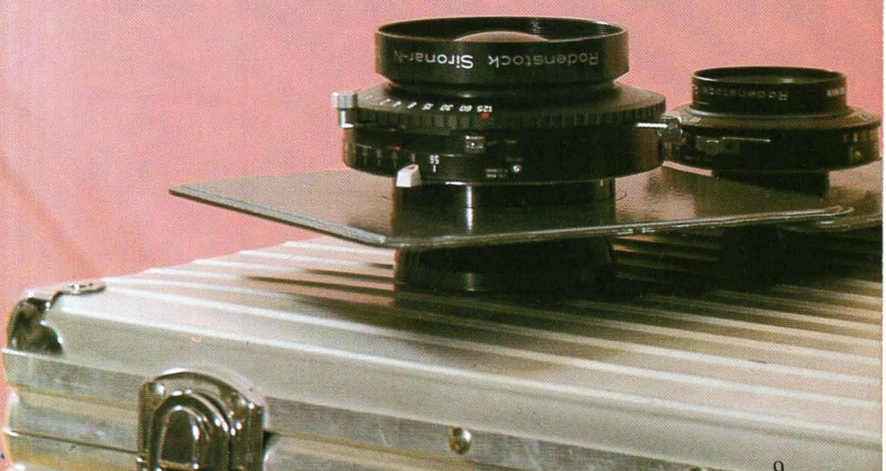
Reading an MTF chart

The interpretation of an MTF chart is given here, with the 150 mm f/5.6 SIRONAR-N as an example.
The magnification ratio is 1:20. However, the design of Rodenstock camera lenses permits extension of the data to the entire ratio range from 1:∞ to about 1:5.
The MTF curves in this booklet are based on the smallest and largest recommended working aperture for the given lens. In this example the smallest, f/22 was chosen. The maximal image angle is 72°. With a 1:20 ratio, this corresponds to an image circle of 225 mm diameter. For better orientation, the diagonals of the 4″×5″ and 13×18 cm (almost 5″×7″) formats are also indicated.
The spatial frequencies in the image plain are 5, 10 and 20 Lp/mm. The theoretical central diffraction limit values for these frequencies are indicated at the upper portion of the left vertical axis of the graph. On the right vertical axis of the graph are the respective limits for the sagittal and tangential edge values – actually the highest theoretically attainable.



Along the uppermost horizontal axis of the graph is the designation HREL. This refers to the percentage displacement of a measured point from the optical axis to the outer limits of the image circle. HREL is useful for visualizing the position of the point being measured, relative to total image circle.
At the image diagonal of 67 mm (2w = 24.6°; HREL = 0.3) the sagittal and tangential contrast levels gradually begin to separate. The sagittal is shown as a solid line, tangential as a dotted line.
Up to the image diagonal of 157 mm (2w = 52°) the curves move very evenly. The resulting performance is optimal and proves the excellent correction of the lens. The contrast losses increase gradually, only in the last quarter of the image field, due primarily to diffraction.
The excellent correction of the lateral chromatic errors, astigmatism and coma is evidenced by the consistently small difference between sagittal and tangential structures.
Now, what do these curves mean to the practical user, the photographer?
First, they prove the exceptionally high quality of the lens, such that it is diffraction limited in the primary area of the image circle. Even in areas where there is a decrease in contrast, below the theoretical maximum, the close tracking of the sagittal and tangential curves indicates a high degree of freedom from chromatic aberration, astigmatism and coma.
MTF curves represent a powerful tool as they provide objective, accurate, reliable information from which the optimum evaluation can be made on an individual basis.
Different situations will require different performance levels and only you – the photographer – can decide what those performance levels are. Remember that physical laws dictate that the greater the camera movements, the lower the theoretical performance of the lens. Individual photographers must evaluate this information in light of their specific needs and applications.

But you can be assured that using Rodenstock lenses will give you the best possible results.



SIRONAR-N normal lens

The normal focal length for each format produces a perspective similar to that seen by the human eye.

These universally usable focal lengths correspond approximately to the diagonal of the camera format: 150 mm for 4″×5″ (9×12 cm), 210 mm for 5″×7″ (13×18 cm), and 300 mm for 8″×10″ (18×24 cm). The focal length of wide-angle lenses is correspondingly shorter so that, at a short working distance, large objects can be covered. Conversely, long focal length lenses are those whose focal length exceeds the diagonal of the format.

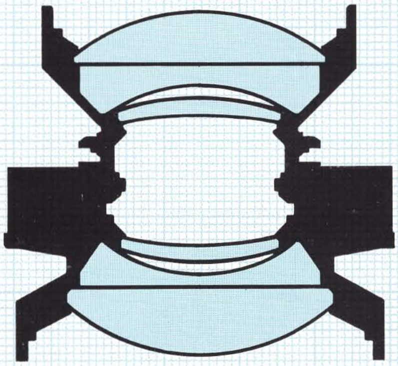
A normal lens is universally usable. If merely the film format were to be covered, an image angle of approximately 53° would be required. However, the professional photographer must be able to apply camera movements without losing image quality. The six-element SIRONAR-N meets these requirements with a 72° image angle. Thus the image circle is approximately 45% larger than the pertinent format diagonal, so that remarkable resolution at the edges is obtainable while maintaining ample camera movements. However, the SIRONAR-N normal lens is not limited to only "normal" application; it may also be used as a "slight" wide-angle lens for larger formats. Thus, the 150 mm f/5.6 SIRONAR-N will also cover the 5″×7″ (13×18 cm) format, even at 1:∞, if no camera movements are used. If the camera-to-subject distance is limited to 15 feet, the 210 mm f/5.6 SIRONAR-N is usable even for 8″×10″.

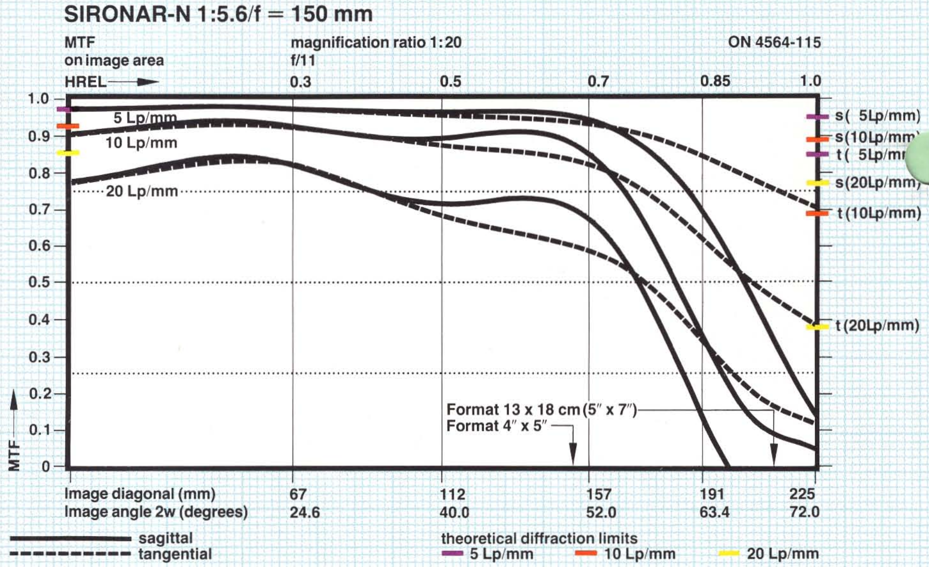
With smaller formats the larger format normal lens is the ideal "longer" focal length. View cameras provide a long extension which can be made even longer with auxiliary bellows. Therefore, "true" tele lenses – i.e. lenses whose flange focal distance is clearly shorter than their focal length – are not necessary. Using a SIRONAR-N of considerably longer than normal focal length is an excellent alternative. For example, the 210 mm and 300 mm focal lengths are ideal for product shots on 4″×5″ (9×12 cm).

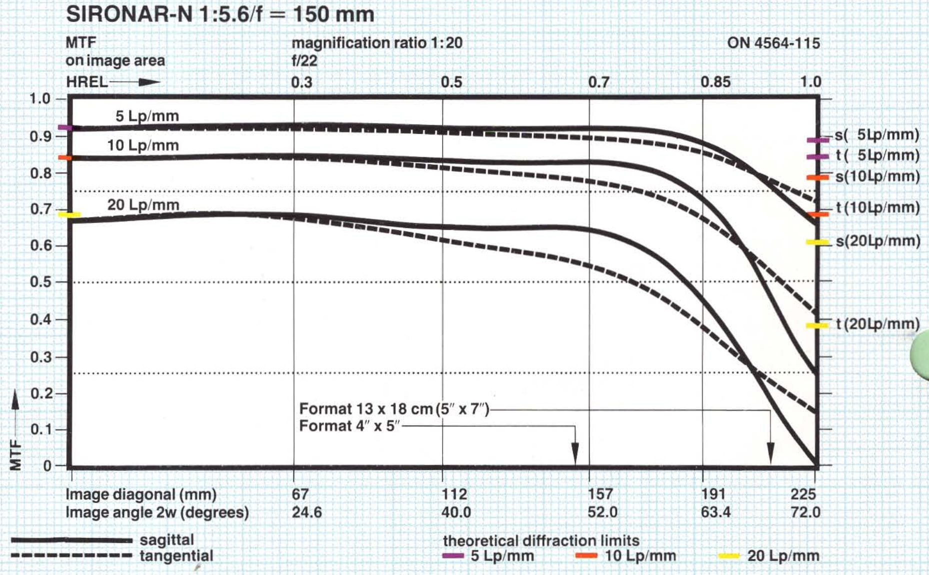
The SIRONAR-N is available in focal lengths from 100 mm to 480 mm for formats from 2¼″×3¼″ (6.5×9 cm) to 11″×14″ (30×40 cm). The maximum aperture for focal lengths to 300 mm is f/5.6. Because of the limited diameter of # 3 shutters, the maximum opening of the 360 mm SIRONAR-N had to be reduced to f/6.8, and that of the 480 mm to f/8.4.

The SIRONAR-N is the workhorse of the professional photographer. Its range of applications is especially wide: object shots of all kinds, industrial photography, landscapes, architectural and urban scenes are typical examples.

The photo shows a SIRONAR-N 1:5,6/f = 240 mm in Prontor professional 3







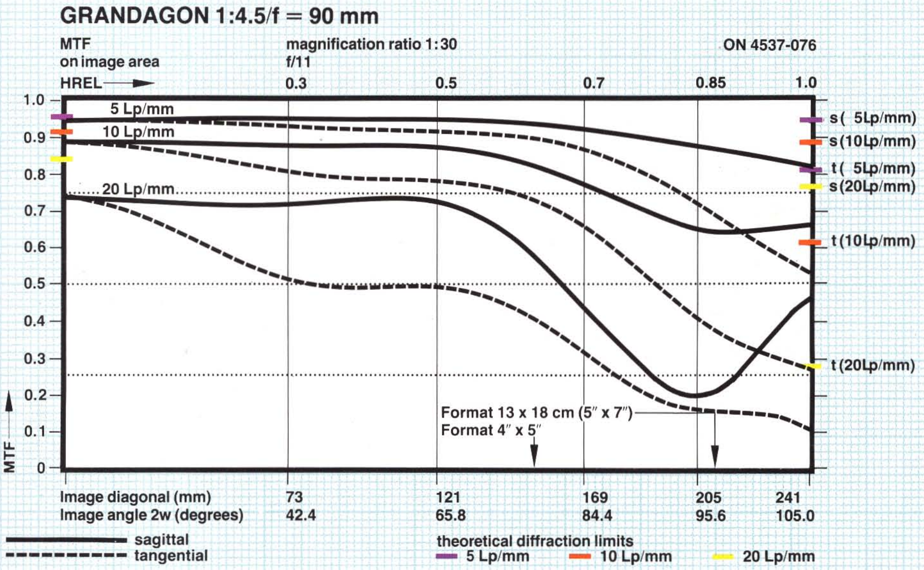
GRANDAGON wide-angle lens

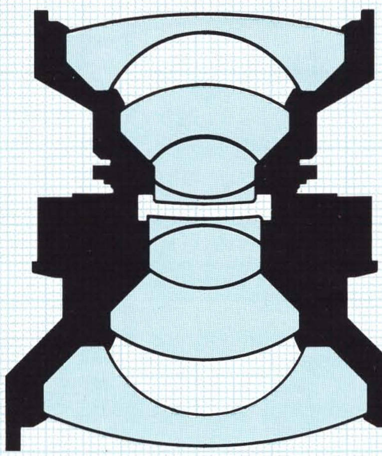
Lenses whose image angle is considerably larger than that of normal lenses make additional demands on optical design. All optical imaging systems tend to distortion, to bend straight lines in the shape of a pincushion or a barrel. This aberration is slight with a narrow image angle and can, therefore, be more easily corrected. It becomes more pronounced as the image angle becomes larger. Thus, in the design of wide-angle lenses, correction of the aberration becomes of major importance. The best resolution is of little value if straight lines at the edges of the format are no longer straight.

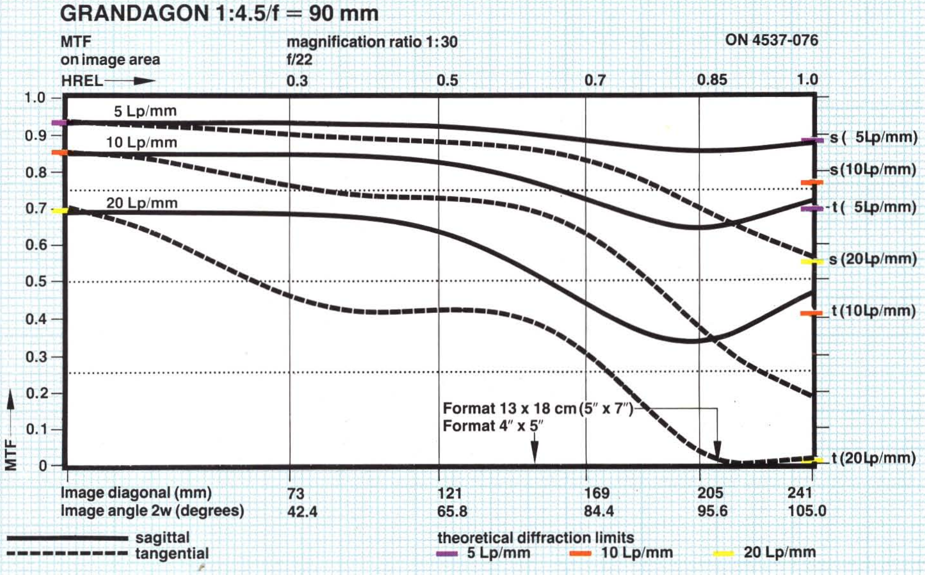
Distortion is a change in the spatial relationship of different image points on the film as compared to their original relationship in the scene being photographed. The deviation depends on the distance from the optical axis and is expressed in percentages (%). Hence, 1% distortion in 100 mm distance from the image center indicates that the image point is 1 mm removed from the theoretical position.

In the GRANDAGON all but 0.5% of the distortion has been eliminated – a value that is no longer noticeable. Thus, the architectural photographer has the assurance that straight lines appear straight even at the edges of the format, even when an image angle of more than 100° is utilized.

The GRANDAGON is available in focal lengths from 65 mm to 200 mm and is usable for all formats up to 11″×14″ (30×40 cm). The f/6.8 Grandagons are six-element lenses with focal lengths of 75 mm, 90 mm, 115 mm, 155 mm and 200 mm. The eight-element Grandagons with the large maximum opening of f/4.5 and 105° image angle at f/22, are supplied in focal lengths of 65 mm, 75 mm and 90 mm.
The eight-element f/4.5 design not only provides a brighter groundglass image, but also improved evenness of illumination and reduced distortion.
The large image angle of the GRANDAGON permits photography of interiors under cramped conditions such as factory areas as well as architectural photography. If the recommended maximum format size for a given lens is used, the resulting steep perspective permits creative composition and creates an image of spaciousness.







APO-RONAR process lens

Photographic lenses are generally optimized for greatly reduced images: for ratios of 1:20 or 1:30. However they are computed so that a change of the magnification ratio in the range from 1:∞ to approximately 1:5 has no noticeable influence on performance. It is, of course, also possible to work at a 1:1 ratio, particularly, since this utilizes only the central portion of the expanded image circle.
But if the best possible reproduction in natural size is important, process lenses – because of their optimization for 1:1 – are superior. The APO-RONAR process lens is especially suited for use with large-format cameras, and has the advantage of not being restricted to small reproduction ratios. While it is computed for 1:1, its imaging quality is largely maintained even with considerable enlargements or reductions. This is confirmed by the MTF curves of the APO-RONAR for the 1:1 and 1:20 ratios. In both cases the achieved contrast transfer is close to the theoretical limits of diffraction.
For close-up work, wide image angles are generally not necessary. This is because longer than normal focal lengths are usually used to provide greater working distance between the camera and the subject. These longer focal length lenses will have relatively large image circles even though the image angles may be smaller, especially when used in a close-up situation.
For 1:∞ with APO-RONARS, focal lengths are required which correspond to approximately twice the longer side of the format.

For only 3× reduction of the subject, definitely shorter focal lengths are adequate.

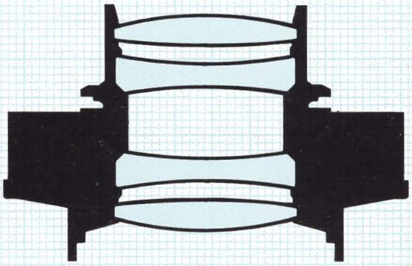
Necessary focal lengths:

Filmformat	Minimum focal length at 1:∞	Minimum focal length at 1:3
9 x 12 cm 4″ x 5″	240 mm	150 mm
13 x 18 cm 5″ x 7″	300 mm 360 mm	240 mm
18 x 24 cm 8″ x 10″	480 mm	360 mm

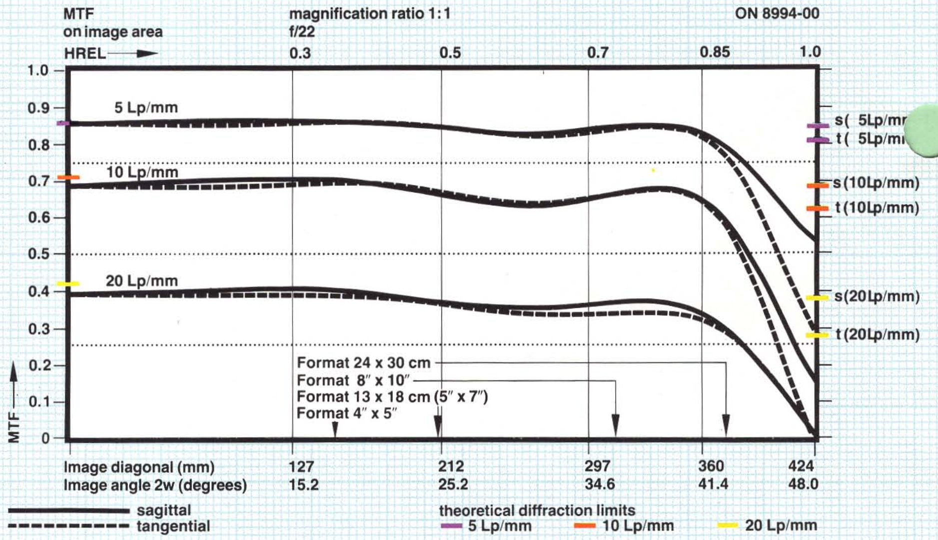
Furthermore, the APO-RONAR is a special lens that opens up the field of the extremely long focal lengths (up to 1200 mm) to the photographer.

The design of the four-element, symmetrically built APO-RONAR limits the maximum aperture to f/9 (and f/16, respectively, for the six-elements of the 1000 mm and 1200 mm focal lengths). Note that the maximum aperture is intended only for focusing. However, the APO-RONAR is very compact and, therefore cost-efficient. And, with a working aperture of f/22 (f/32, respectively) the APO-RONAR provides an image quality for close-up and macrophotography that cannot be equalled by standard lenses. The APO-RONAR is also available without a shutter in barrel mount.

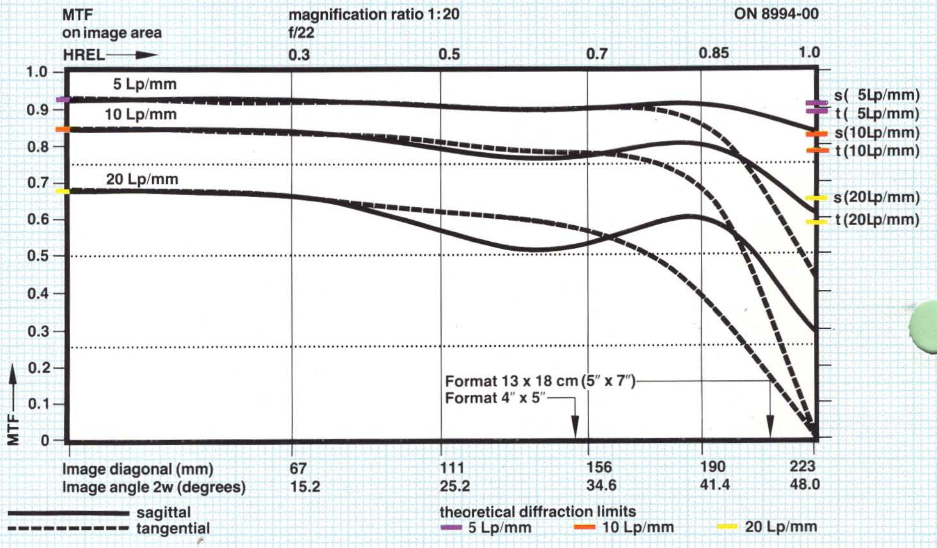
The photo shows a
APO-RONAR 1:9/f = 300 mm in Copal 1



APO-RONAR 1:9/f = 240 mm



APO-RONAR 1:9/f = 240 mm



The IMAGON variable softness lens

Performance and imaging quality of a lens usually means the sharpest and most contrasty reproduction of a subject possible. On the other hand, one Rodenstock camera lens – the IMAGON – was designed as an alternative to highly perfected sharp imaging with another kind of reproduction that dispenses with the highest resolution of detail as well as high contrast values.

This does not imply by any means that the IMAGON produces an unsharp or blurred image. It preserves a distinct image core which is superimposed with circles of diffusion. The softened image that results is quite appealing. The IMAGON provides clear representation of the subject without any harshness and gives the subject a "luminous appearance". This cannot be achieved with a front-of-the-lens attachment. The IMAGON also reduces contrast in backlit subjects. Therefore, pictures with fine detail in the light and shadow portions are possible even if the contrast is much too high for other photographic lenses.

Photography with the IMAGON requires some familiarization – only through experience and testing can the great creative potential of this tool be realized.

The IMAGON contains a cemented two element lens of the achromat type, and is greatly under-corrected. Considerable residual spherical aberration and a small residue of chromatic aberration create the softening effect. The interchangeable, variable slip-on grid disks contribute significantly to the results achieved with the IMAGON. It's as though two images are projected – one distinct basic image and a secondary softened image that is superimposed on it. With the disks, the photographer can control the intensity of the softening effect according to personal preference.

The IMAGON has an image angle of about 40° and is supplied with focal lengths of 200 mm, 250 mm and 300 mm. The 200 mm focal length covers the 4″×5″ (9×12 cm) format. If the use of camera movements is needed, the 250 mm focal length should be used for this format. The 300 mm focal length covers the 5″×7″ (13×18 cm) format, but is also suitable for 4″×5″ (9×12 cm) portraiture of format-filling heads.

To bring the advantages of the IMAGON to users of medium-format cameras, the following camera adapters are available for the 200 mm H 5.8 IMAGON lens in normal (barrel) mount:

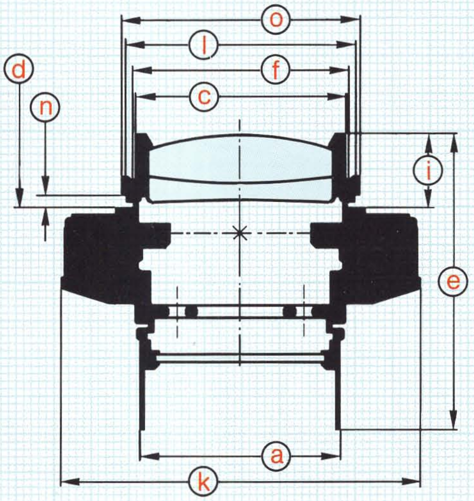
Mamiya RB 67	Rollei SL 66
Pentax 6×7	Hasselblad 2000 FC
Mamiya 645	Zenza Bronica TL
Pentacon Six	

The IMAGON in shutter may also be used with a Hasselblad 500 C/M or 500 EL/M by means of either a camera adapter or standard bellows adapter.

The maximum aperture of the IMAGON is stated in H-values. These do not correspond to the calculated relative openings, but they provide a guide for exposure meter settings.
The IMAGON is THE portrait lens which delivers any image, from a flattering rendition to a stark characterization. To become fully acquainted with the unique capabilities of this lens, please ask for our IMAGON Instruction Manual.

It would be meaningless to obtain MTF curves for this lens. The fascination of this kind of reproduction lies in the relation of the basic and super-imposed images.

The photo shows a
IMAGON H 5,8/f = 200 mm in Copal 3



Technical data

Relative aperture	Focal length	Filmformat	Slip on diameter	Diameter of rear mount	Flange focal distance at ∞	Overall length	Shutter type and size	Shutter screw thread	Distance from Shutter Seating to rear of lens	Largest shutter diameter	Aperture in lens board	Thickness of lens board	Outside diameter of mounting ring
			a	c	d	e		f	i	k	l	n	o
H 5,8	200	9×12 cm/4″×5″	55	60	216	78,0	Normal mount	M 62×0,75	15,0	–	65,3	1,5…4,0	68,0
H 5,8	200	9×12 cm/4″×5″	55	60	216	78,0	Copal 3	M 62×0,75	15,0	102,0	65,3	1,5…5,0	68,0
H 5,8	200	9×12 cm/4″×5″	55	60	216	78,0	Compur 3	M 62×0,75	15,0	95,0	65,3	1,5…5,0	68,0
H 5,8	200	9×12 cm/4″×5″	55	60	216	78,0	Prontor professional 3	M 62×0,75	15,0	99,0	65,3	1,5…4,0	68,0
H 5,8	200	9×12 cm/4″×5″	55	60	216	78,0	Compur electronic 3	M 62×0,75	15,0	95,0	65,3	1,5…5,0	68,0
H 5,8	250	9×12 cm/4″×5″	55	60	276	84,5	Normal mount	M 62×0,75	21,5	–	65,3	1,5…4,0	68,0
H 5,8	250	9×12 cm/4″×5″	55	60	276	84,5	Copal 3	M 62×0,75	21,5	102,0	65,3	1,5…5,0	68,0
H 5,8	250	9×12 cm/4″×5″	55	60	276	84,5	Compur 3	M 62×0,75	21,5	95,0	65,3	1,5…5,0	68,0
H 5,8	250	9×12 cm/4″×5″	55	60	276	84,5	Prontor professional 3	M 62×0,75	21,5	99,0	65,3	1,5…4,0	68,0
H 5,8	250	9×12 cm/4″×5″	55	60	276	84,5	Compur electronic 3	M 62×0,75	21,5	95,0	65,3	1,5…5,0	68,0
H 6,8	300	13×18 cm/5″×7″	55	60	332	91,0	Normal mount	M 62×0,75	28,0	–	65,3	1,5…4,0	68,0
H 6,8	300	13×18 cm/5″×7″	55	60	332	91,0	Copal 3	M 62×0,75	28,0	102,0	65,3	1,5…5,0	68,0
H 6,8	300	13×18 cm/5″×7″	55	60	331	91,0	Compur electronic 5FS	M 92×0,75	27,0	–	96,0	1,5…6,5	99,0

All sizes not otherwise indicated are in mm.

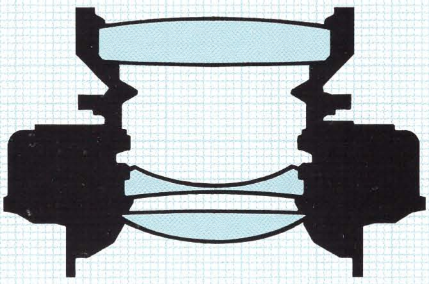
Large format technique for the budget-minded: GERONAR

Familiarity with cameras designed on the optical bench principle is basic to instruction in professional photography because the complete range of imaging techniques can be learned only through their use. When the student or beginning photographer wants to obtain his own view camera equipment, the purchase of elaborate and costly cameras is usually not feasible. But, along with budget-priced cameras, budget-priced lenses must be available and, therefore, Rodenstock has developed such a series especially for the beginner. These lenses will also appeal to the amateur photographer who wants to expand his hobby into large-format photography. Large-format photography as a contrast to automatic snapshooting – that's something which could fascinate the amateur photographer. Because of the vast range of camera adjustments available with large format cameras, your photography can be the result of your abounding creativity rather than be limited to the primitive confines of an automatic camera.

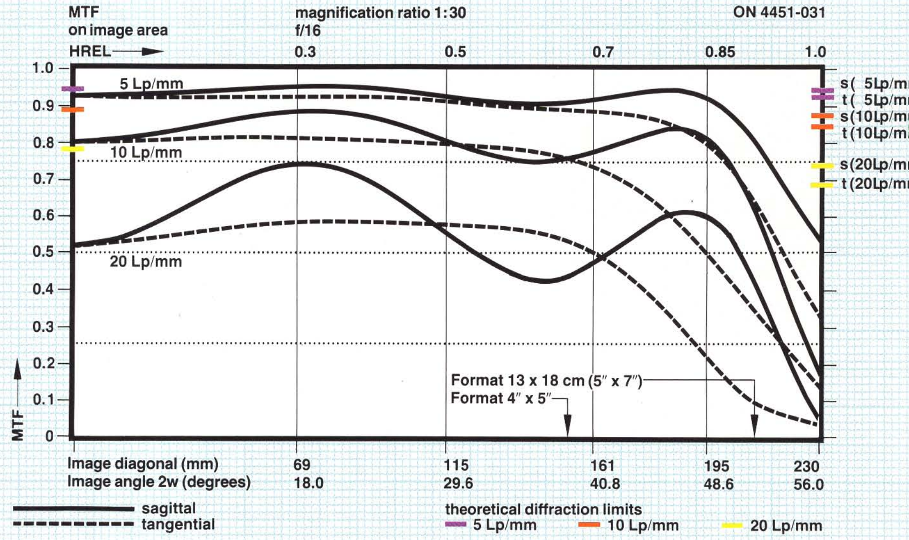
If a lens is to be budget-priced, savings have to be made somewhere. The GERONAR and GERONAR-WA achieve good image quality, but their maximum aperture is less and their image circle smaller than that of the comparable SIRONAR-N and GRANDAGON lenses. Therefore, only three or four lens elements are necessary.

The GERONAR normal lens is a triplet. This lens type cannot produce a large image angle but, if it is computed for a medium-size maximum aperture, good performance up to about a 60° angle will result. If the GERONAR is used as a normal lens, the results are good, but the range of camera movements is limited compared to the SIRONAR-N. The GERONAR is produced in the following models: 150 mm f/6.3, 210 mm f/6.8 and 300 mm f/9. f/16 and f/22 are recommended as working apertures for these lenses.

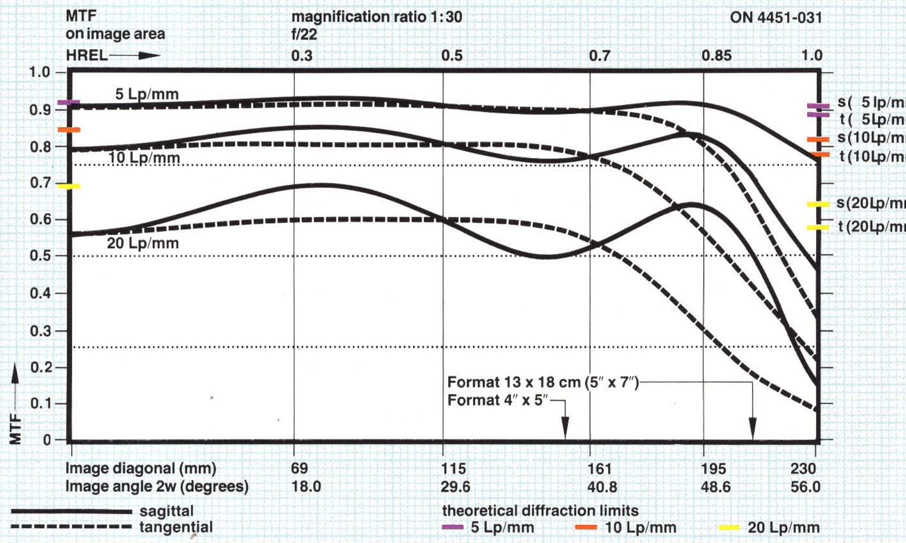
The photo shows a GERONAR 1:6,3/f = 150 mm in Copal 0



GERONAR 1:6.8/f = 210 mm



GERONAR 1:6.8/f = 210 mm

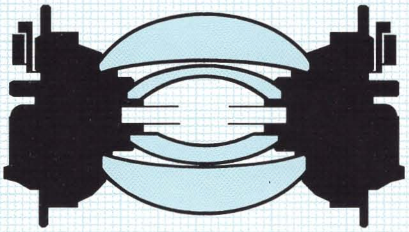


GERONAR-WA

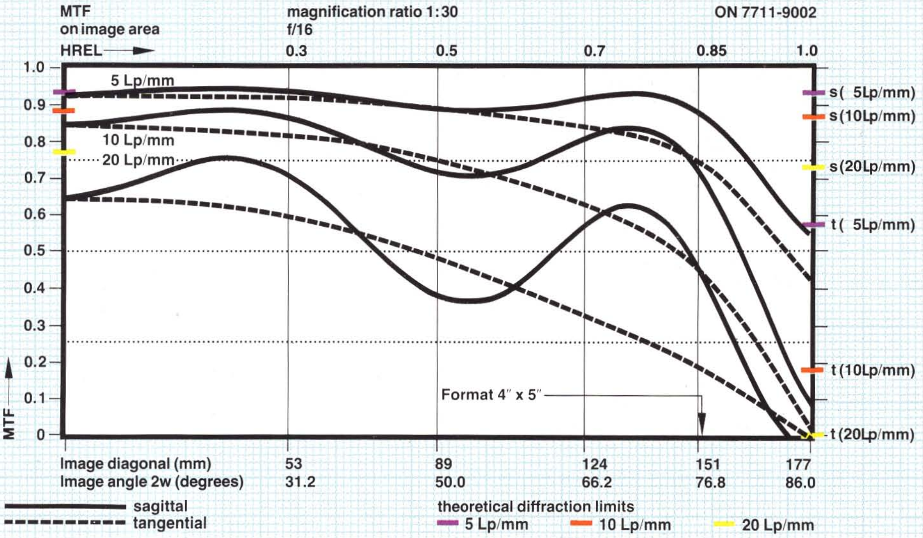
The 90 mm f/8 GERONAR-WA wide angle lens has four elements and attains an image angle of 85° at f/22. It is designed for 4″×5″ (9×12 cm); f/16 and f/22 are recommended as working apertures for these lenses. The following table shows the relation of the focal lengths to those of the 35 mm format, based on the image diagonal.

lens	for film format	corresponding focal length for 24×36 mm
Geronar 150 mm f/6.3	9×12 cm	46 mm
	4″×5″	42 mm
Geronar 210 mm f/6.8	9×12 cm	64 mm
	4″×5″	59 mm
	13×18 cm	43 mm
	5″×7″	44 mm
Geronar 300 mm f/9	9×12 cm	92 mm
	4″×5″	84 mm
	13×18 cm	62 mm
	5″×7″	62 mm
Geronar-WA 90 mm f/8	9×12 cm	28 mm
	4″×5″	25 mm

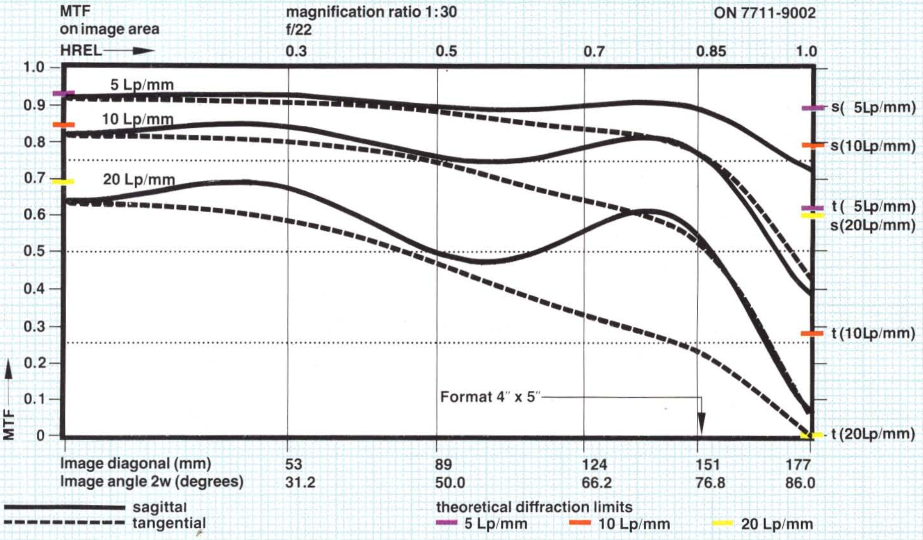
The photo shows a GERONAR-WA 1:8/f = 90 mm in Copal 1



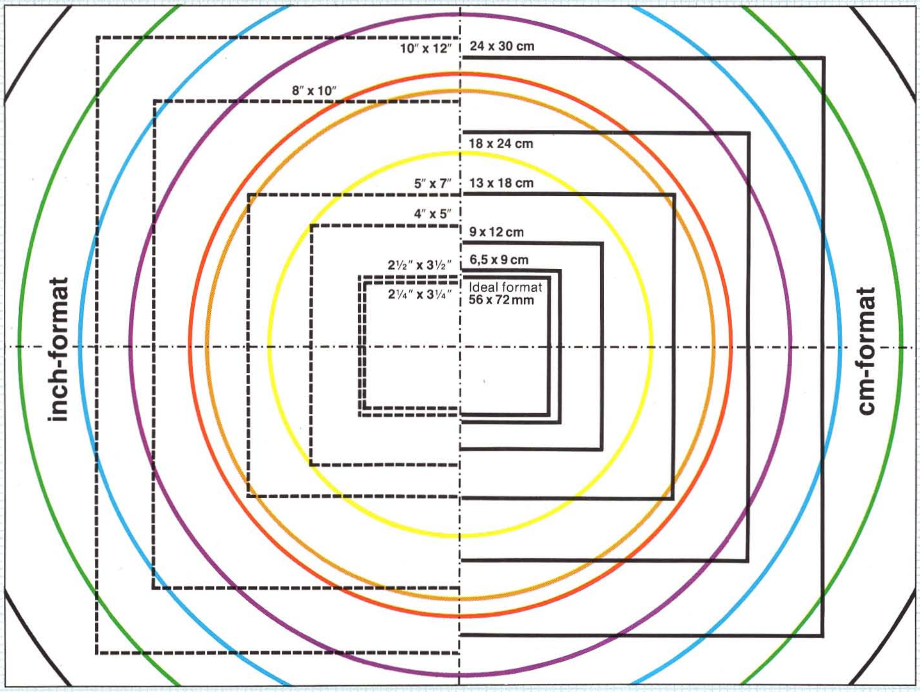
GERONAR-WA 1:8/f = 90 mm



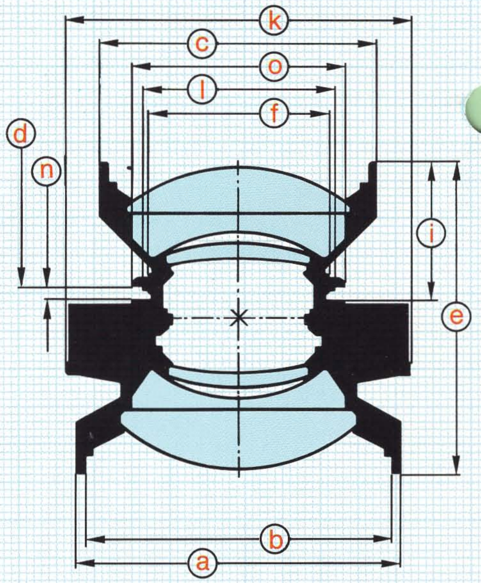
GERONAR-WA 1:8/f = 90 mm



Formats, image circle diameters at f/22 and 1:∞



SIRONAR-N



- ● 5,6/100 ∅ = 151 mm
- ● 5,6/135 ∅ = 200 mm
- ● 5,6/150 ∅ = 214 mm
- ● 5,6/180 ∅ = 262 mm
- ● 5,6/210 ∅ = 301 mm
- ● 5,6/240 ∅ = 350 mm
- ● 5,6/300 ∅ = 425 mm
- 6,8/360 ∅ = 435 mm
- 8,4/480 ∅ = 500 mm

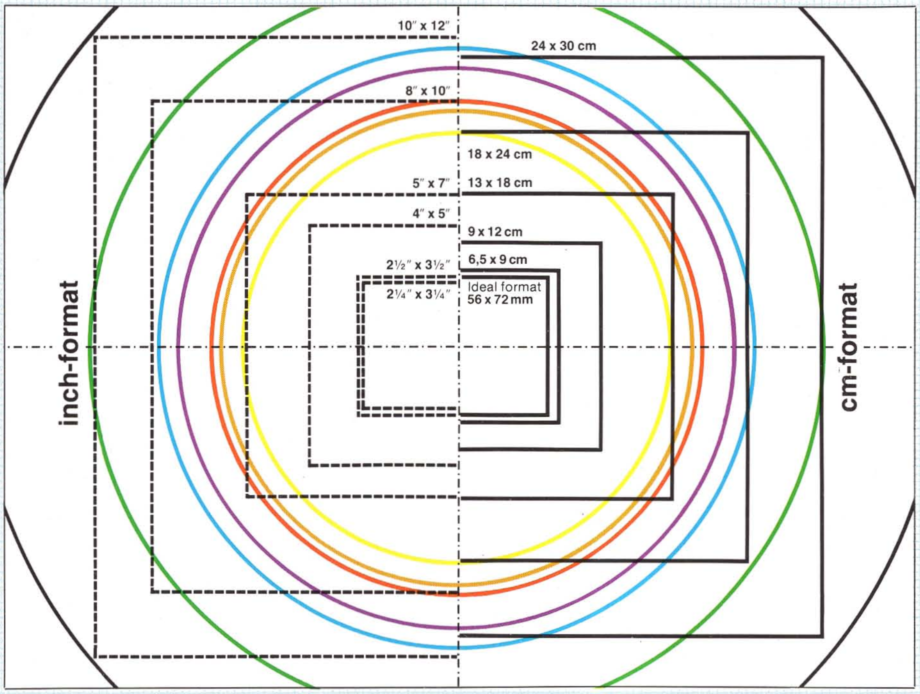
Image circle diameters and permissible camera movements for ratio 1:∞ (mm)

SIRONAR-N	5,6/100		5,6/135		5,6/150		5,6/180		5,6/210		5,6/240		5,6/300		6,8/360		8,4/480	
Aperture	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22
Image circle diameter	141	151	185	200	198	214	244	262	276	301	325	350	393	425	415	435	420	500
Image angle 2 w	68°	72°	68°	72°	68°	72°	68°	72°	68°	72°	68°	72°	68°	72°	62°	64°	48°	56°
Negative size																		
Ideal format 56 x 72 mm 2¼" x 2¾"	↑33 →29	↑38 →34	↑57 →52	↑65 →60	↑64 →59	↑73 →67	↑88 →83	↑98 →92										
6,5 x 9 cm	↑28 →22	↑34 →29	↑54 →47	↑62 →55	↑61 →54	↑70 →62	↑86 →78	↑96 →87	↑103 →94	↑116 →107	↑128 →119	↑141 →132						
9 x 12 cm		↑8 →6	↑31 →26	↑41 →34	↑39 →33	↑50 →42	↑66 →58	↑77 →67	↑84 →75	↑100 →88	↑111 →100	↑126 →113						
13 x 18 cm						↑3 →2	↑26 →20	↑38 →30	↑47 →38	↑63 →52	↑77 →65	↑92 →79	↑116 →101	↑134 →118	↑128 →113	↑139 →123		
18 x 24 cm										↑11 →8	↑29 →23	↑47 →37	↑73 →61	↑93 →79	↑87 →74	↑99 →84	↑90 →76	↑136 →119
24 x 30 cm													↑17 →14	↑40 →34	↑33 →28	↑47 →40	↑37 →31	↑89 →77
30 x 40 cm																		↑11 →9
2¼" x 3¼"	↑33 →27	↑39 →32	↑59 →50	↑67 →58	↑66 →57	↑74 →65	↑09 →81	↑100 →900										
2½" x 3½"	↑30 →25	↑36 →29	↑55 →48	↑64 →56	↑63 →55	↑71 →63	↑87 →79	↑97 →88	↑104 →95	↑117 →108	↑130 →120	↑142 →133						
4" x 5"			↑22 →19	↑32 →28	↑31 →27	↑41 →36	↑58 →52	↑68 →61	↑76 →69	↑90 →83	↑103 →95	↑116 →108						
5" x 7"						↑5 →3	↑27 →21	↑39 →31	↑48 →39	↑64 →53	↑78 →66	↑92 →79	↑117 →102	↑134 →118	↑129 →113	↑140 →124		
8" x 10"											↑10 →8	↑28 →23	↑57 →48	↑77 →67	↑70 →61	↑83 →72	↑74 →64	↑121 →108
10" x 12"													↑7 →6	↑30 →26	↑23 →20	↑37 →30	↑27 →23	↑79 →70
11" x 14"																		↑36 →29

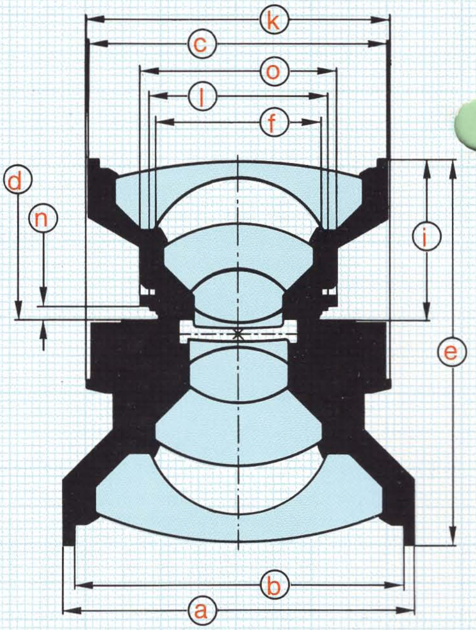
Relative aperture	Focal length	Filmformat	Smallest aparture	Slip-on dia-meter	Filter-thread	Dia-meter of rear mount	Flange focal distance at ∞	Overall length	Shutter type and size	Shutter screw thread	Distance from shut-ter seating to rear of lens	Largest shutter diameter	Aperture in lens board	Thickness of lens board	Outside diameter of mounting ring
				a	b	c	d	e		f	i	k	l	n	o
1:5,6	100	6,5×9 cm/2½″×3½″	45	42	M 40,5×0,75	31,5	100	38	Copal 0	M 32,5×0,5	14,0	61,0	34,8	1,5…3,3	40,0
1:5,6	100	6,5×9 cm/2½″×3½″	45	42	M 40,5×0,75	31,5	100	38	Compur 0	M 32,5×0,5	14,0	58,5	34,8	2,0…3,7	39,1
1:5,6	100	6,5×9 cm/2½″×3½″	45	42	M 40,5×0,75	31,5	100	38	Prontor professional 01	M 39×0,75	14,0	77,0	41,8	1,5…3,0	46,4
1:5,6	135	9×12 cm/4″×5″	64	42	M 40,5×0,5	40,5	130	43,5	Copal 0	M 32,5×0,5	18,5	61,0	34,8	1,5…3,3	40,0
1:5,6	135	9×12 cm/4″×5″	45	42	M 40,5×0,5	40,5	130	43,5	Compur 0	M 32,5×0,5	18,5	58,5	34,8	2,0…3,7	39,1
1:5,6	135	9×12 cm/4″×5″	64	42	M 40,5×0,5	40,5	130	43,5	Prontor professional 01	M 39×0,75	18,5	77,0	41,8	1,5…3,0	46,4
1:5,6	150	9×12 cm/4″×5″	64	51	M 49×0,75	42,0	142	51,0	Copal 0	M 32,5×0,5	20,3	61,0	34,8	1,5…3,3	40,0
1:5,6	150	9×12 cm/4″×5″	45	51	M 49×0,75	42,0	142	51,0	Compur 0	M 32,5×0,5	20,3	58,5	34,8	2,0…3,7	39,1
1:5,6	150	9×12 cm/4″×5″	64	51	M 49×0,75	42,0	141	51,0	Compur 1	M 39×0,75	19,3	75,0	41,8	1,3…3,0	46,4
1:5,6	150	9×12 cm/4″×5″	64	51	M 49×0,75	42,0	142	51,0	Prontor professional 01	M 39×0,75	20,3	77,0	41,8	1,5…3,0	46,4
1:5,6	150	9×12 cm/4″×5″	64	51	M 49×0,75	42,0	141	51,0	Compur electronic 1	M 39×0,75	19,3	75,0	41,8	1,3…3,0	46,4
1:5,6	180	13×18 cm/5″×7″	64	60	M 58×0,75	51,0	174	57,0	Copal 1	M 39×0,75	24,5	73,0	41,8	1,5…3,0	47,0
1:5,6	180	13×18 cm/5″×7″	45	60	M 58×0,75	51,0	174	57,0	Compur 1	M 39×0,75	24,5	75,0	41,8	1,3…3,0	46,4
1:5,6	180	13×18 cm/5″×7″	64	60	M 58×0,75	51,0	174	57,0	Prontor professional 1	M 39×0,75	24,5	77,0	41,8	1,5…3,0	46,4
1:5,6	180	13×18 cm/5″×7″	45	60	M 58×0,75	51,0	174	57,0	Compur electronic 1	M 39×0,75	24,5	75,0	41,8	1,3…3,0	46,4
1:5,6	210	13×18 cm/5″×7″	64	70	M 67×0,75	60,0	200	66,0	Copal 1	M 39×0,75	28,5	73,0	41,8	1,5…3,0	47,0
1:5,6	210	13×18 cm/5″×7″	64	70	M 67×0,75	60,0	200	66,0	Compur 1	M 39×0,75	28,5	75,0	41,8	1,3…3,0	46,4
1:5,6	210	13×18 cm/5″×7″	64	70	M 67×0,75	60,0	200	66,0	Prontor professional 1	M 39×0,75	28,5	77,0	41,8	1,5…3,0	46,4
1:5,6	210	13×18 cm/5″×7″	64	70	M 67×0,75	60,0	200	66,0	Compur electronic 1	M 39×0,75	28,5	75,0	41,8	1,3…3,0	46,4
1:5,6	210	13×18 cm/5″×7″	32	70	M 67×0,75	60,0	195	66,0	Compur electronic 5FS	M 92×0,75	23,5	–	96,0	1,5…6,5	99,3
1:5,6	240	18×24 cm/8″×10″	64	80	M 77×0,75	70,0	231	76,7	Copal 3	M 62×0,75	32,2	102,0	65,3	1,5…5,0	68,0
1:5,6	240	18×24 cm/8″×10″	64	80	M 77×0,75	70,0	231	76,7	Compur 3	M 62×0,75	32,2	95,0	65,3	1,5…5,0	68,0
1:5,6	240	18×24 cm/8″×10″	64	80	M 77×0,75	70,0	231	76,7	Prontor professional 3	M 62×0,75	32,2	99,0	65,3	1,5…4,0	68,0
1:5,6	240	18×24 cm/8″×10″	64	80	M 77×0,75	70,0	231	76,7	Compur electronic 3	M 62×0,75	32,2	95,0	65,3	1,5…5,0	68,0
1:5,6	240	18×24 cm/8″×10″	45	80	M 77×0,75	70,0	229	76,7	Compur electronic 5FS	M 92×0,75	30,5	–	96,0	1,5…6,5	99,3
1:5,6	300	24×30 cm/10″×12″	64	90	M 86×1	80,0	282	94,5	Copal 3	M 62×0,75	39,9	102,0	65,3	1,5…5,0	68,0
1:5,6	300	24×30 cm/10″×12″	64	90	M 86×1	80,0	282	94,5	Compur 3	M 62×0,75	39,9	95,0	65,3	1,5…5,0	68,0
1:5,6	300	24×30 cm/10″×12″	64	90	M 86×1	80,0	282	94,5	Prontor professional 3	M 62×0,75	39,9	99,0	65,3	1,5…4,0	68,0
1:5,6	300	24×30 cm/10″×12″	64	90	M 86×1	80,0	282	94,5	Compur electronic 3	M 62×0,75	39,9	95,0	65,3	1,5…5,0	68,0
1:5,6	300	24×30 cm/10″×12″	45	90	M 86×1	80,0	280	94,5	Compur electronic 5FS	M 92×0,75	38,2	–	96,0	1,5…6,5	99,3
1:6,8	360	24×30 cm/10″×12″	64	110	M 105×1	80,0	333	116,5	Copal 3	M 62×0,75	41,0	102,0	65,3	1,5…5,0	68,0
1:6,8	360	24×30 cm/10″×12″	64	110	M 105×1	80,0	333	116,5	Compur 3	M 62×0,75	41,0	95,0	65,3	1,5…5,0	68,0
1:6,8	360	24×30 cm/10″×12″	64	110	M 105×1	80,0	333	116,5	Prontor professional 3	M 62×0,75	41,0	99,0	65,3	1,5…4,0	68,0
1:6,8	360	24×30 cm/10″×12″	64	110	M 105×1	80,0	333	116,5	Compur electronic 3	M 62×0,75	41,0	95,0	65,3	1,5…5,0	68,0
1:6,8	360	24×30 cm/10″×12″	64	110	M 105×1	80,0	331	116,5	Compur electronic 5FS	M 92×0,75	39,3	–	96,0	1,5…6,5	99,3
1:8,4	480	24×30 cm/10″×12″	90	115	M 112×1,5	95,0	452,7	146,8	Copal 3	M 62×0,75	58,5	102,0	65,3	1,5…5,0	68,0
1:9	480	24×30 cm/10″×12″	90	115	M 112×1,5	95,0	452,7	146,8	Compur 3	M 62×0,75	58,5	95,0	65,3	1,5…5,0	68,0
1:9	480	24×30 cm/10″×12″	90	115	M 112×1,5	95,0	452,7	146,8	Prontor professional 3	M 62×0,75	58,5	99,0	65,3	1,5…4,0	68,0
1:9	480	24×30 cm/10″×12″	90	115	M 112×1,5	95,0	452,7	146,8	Compur electronic 3	M 62×0,75	58,5	95,0	65,3	1,5…5,0	68,0
1:9	480	24×30 cm/10″×12″	90	115	M 112×1,5	95,0	450,7	146,8	Compur electronic 5FS	M 92×0,75	56,5	–	96,0	1,5…6,5	99,3

All sizes not otherwise indicated are in mm.

Formats, image circle diameters at f/22



GRANDAGON



- 4,5/65 ∅ = 170 mm
- 6,8/75 ∅ = 187 mm
- 4,5/75 ∅ = 195 mm
- 6,8/90 ∅ = 221 mm
- 4,5/90 ∅ = 236 mm
- 6,8/115 ∅ = 291 mm
- 6,8/155 ∅ = 382 mm
- 6,8/200 ∅ = 495 mm

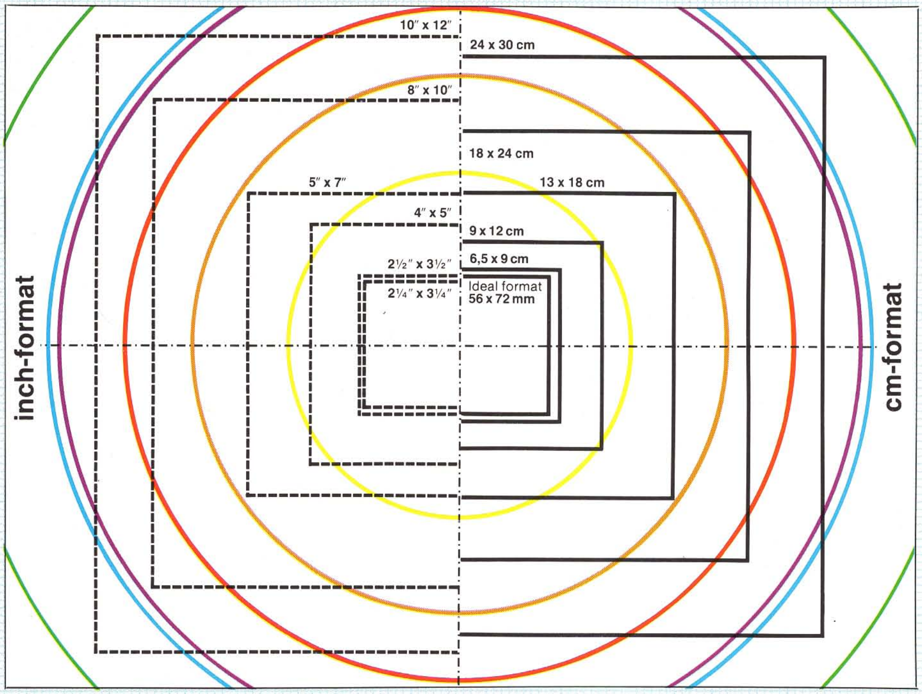
Image circle diameters and permissible camera movements for ratio 1:∞ (mm)

GRANDAGON	4,5/65		4,5/75		6,8/75		4,5/90		6,8/90		6,8/115		6,8/155		6,8/200	
Aperture	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22
Image circle diameter	167	170	192	195	181	187	232	236	213	221	281	291	369	382	475	495
Image angle 2 w	104°	105°	104°	105°	100°	102°	104°	105°	100°	102°	102°	104°	100°	102°	100°	102°
Negative size																
Ideal format 56 x 72 mm 2¼″ x 2¾″	↑47 →43	↑49 →44	↑61 →56	↑63 →57	↑55 →50	↑58 →53	↑82 →77	↑84 →79	↑72 →67	↑76 →71	↑108 →102	↑113 →107				
6,5 x 9 cm	↑44 →38	↑46 →39	↑58 →51	↑60 →53	↑52 →45	↑55 →48	↑80 →72	↑82 →74	↑70 →62	↑74 →66	↑106 →97	↑111 →102				
9 x 12 cm	↑20 →15	↑22 →17	↑36 →30	↑38 →31	↑29 →23	↑33 →28	↑60 →51	↑62 →53	↑48 →41	↑53 →45	↑87 →77	↑92 →82	↑134 →123	↑141 →129		
13 x 18 cm							↑17 →13	↑20 →16	↑3 →2	↑9 →7	↑50 →41	↑57 →47	↑102 →89	↑110 →95		
18 x 24 cm												↑3 →2	↑58 →48	↑67 →55	↑122 →106	↑133 →118
24 x 30 cm															↑73 →63	↑86 →74
30 x 40 cm																↑7 →6
2¼″ x 3¼″	↑49 →41	↑50 →43	↑62 →54	↑64 →56	↑56 →48	↑58 →51	↑84 →75	↑86 →77	↑74 →65	↑78 →69	↑110 →100	↑115 →105				
2½″ x 3½″	↑45 →39	↑47 →40	↑59 →52	↑61 →53	↑53 →46	↑56 →49	↑81 →73	↑83 →75	↑71 →63	↑75 →67	↑107 →98	↑112 →103				
4″ x 5″	↑10 →8	↑12 →10	↑27 →23	↑29 →25	↑20 →17	↑24 →20	↑51 →46	↑54 →48	↑40 →35	↑45 →40	↑79 →72	↑85 →77	↑126 →118	↑133 →125		
5″ x 7″							↑18 →14	↑21 →16	↑4 →3	↑10 →7	↑51 →42	↑58 →47	↑103 →89	↑111 →96		
8″ x 10″													↑41 →34	↑50 →42	↑106 →94	↑118 →105
10″ x 12″															↑64 →58	↑76 →68
11″ x 14″															↑17 →14	↑32 →26

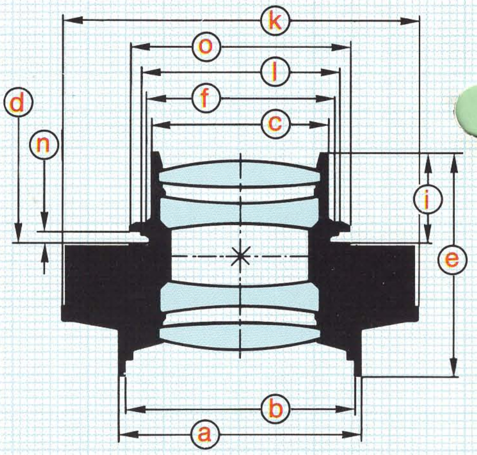
Relative aperture	Focal length	Filmformat	Smallest aparture	Slip-on dia-meter	Filter-thread	Dia-meter of rear mount	Flange focal distance at ∞	Overall length	Shutter type and size	Shutter sorew thread	Distance from shutter seating to rear of lens	Largest shutter diameter	Aperture in lens board	Thickness of lens board	Outside diameter of mounting ring
				a	b	c	d	e		f	i	k	l	n	o
1:4,5	65	9×12 cm/4″×5″	45	70	M 67×0,75	54	72	68,0	Copal 0	M 32,5×0,5	27,3	61,0	34,8	1,5…3,3	40,0
1:4,5	65	9×12 cm/4″×5″	45	70	M 67×0,75	54	72	68,0	Compur 0	M 32,5×0,5	27,3	58,5	34,8	2,0…3,7	39,1
1:4,5	65	9×12 cm/4″×5″	45	70	M 67×0,75	54	72	68,0	Prontor professional 01	M 39×0,75	27,3	77,0	41,8	1,5…3,0	46,4
1:4,5	75	9×12 cm/4″×5″	45	70	M 67×0,75	60	83	78,0	Copal 0	M 32,5×0,5	32,3	61,0	34,8	1,5…3,3	40,0
1:4,5	75	9×12 cm/4″×5″	45	70	M 67×0,75	60	83	78,0	Compur 0	M 32,5×0,5	32,3	58,5	34,8	2,0…3,7	39,1
1:4,5	75	9×12 cm/4″×5″	45	70	M 67×0,75	60	83	78,0	Prontor professional 01	M 39×0,75	32,3	77,0	41,8	1,5…3,0	46,4
1:4,5	75	9×12 cm/4″×5″	45	70	M 67×0,75	60	82	78,0	Compur electronic 1	M 39×0,75	31,3	75,0	41,8	1,3…3,0	46,4
1:6,8	75	9×12 cm/4″×5″	45	60	M 58×0,75	54	79	65,0	Copal 0	M 32,5×0,5	28,5	61,0	34,8	1,5…3,3	40,0
1:6,8	75	9×12 cm/4″×5″	45	60	M 58×0,75	54	79	65,0	Compur 0	M 32,5×0,5	28,5	58,5	34,8	2,0…3,7	39,1
1:6,8	75	9×12 cm/4″×5″	45	60	M 58×0,75	54	79	65,0	Prontor professional 01	M 39×0,75	28,5	77,0	41,8	1,5…3,0	46,4
1:6,8	75	9×12 cm/4″×5″	45	60	M 58×0,75	54	78	65,0	Compur electronic 1	M 39×0,75	27,3	75,0	41,8	1,3…3,0	46,4
1:4,5	90	13×18 cm/5″×7″	45	85	M 82×0,75	70	100	93,0	Copal 1	M 39×0,75	38,0	73,0	41,8	1,5…3,0	47,0
1:4,5	90	13×18 cm/5″×7″	45	85	M 82×0,75	70	100	93,0	Compur 1	M 39×0,75	38,0	75,0	41,8	1,3…3,0	46,4
1:4,5	90	13×18 cm/5″×7″	45	85	M 82×0,75	70	100	93,0	Prontor professional 1	M 39×0,75	38,0	77,0	41,8	1,5…3,0	46,4
1:4,5	90	13×18 cm/5″×7″	45	85	M 82×0,75	70	100	93,0	Compur electronic 1	M 39×0,75	38,0	75,0	41,8	1,3…3,0	46,4
1:6,8	90	13×18 cm/5″×7″	45	70	M 67×0,75	60	94	78,5	Copal 0	M 32,5×0,5	33,2	61,0	34,8	1,5…3,3	40,0
1:6,8	90	13×18 cm/5″×7″	45	70	M 67×0,75	60	94	78,5	Compur 0	M 32,5×0,5	33,2	58,5	34,8	2,0…3,7	39,1
1:6,8	90	13×18 cm/5″×7″	45	70	M 67×0,75	60	94	78,5	Prontor professional 01	M 39×0,75	33,2	77,0	41,8	1,5…3,0	46,4
1:6,8	90	13×18 cm/5″×7″	45	70	M 67×0,75	60	93	78,5	Compur electronic 1	M 39×0,75	32,0	75,0	41,8	1,3…3,0	46,4
1:6,8	115	13×18 cm/5″×7″	45	85	M 82×0,75	70	121	93,0	Copal 1	M 39×0,75	39,0	73,0	41,8	1,5…3,0	47,0
1:6,8	115	13×18 cm/5″×7″	45	85	M 82×0,75	70	121	93,0	Compur 1	M 39×0,75	39,0	75,0	41,8	1,3…3,0	46,4
1:6,8	115	13×18 cm/5″×7″	45	85	M 82×0,75	70	121	93,0	Prontor professional 1	M 39×0,75	39,0	77,0	41,8	1,5…3,0	46,4
1:6,8	115	13×18 cm/5″×7″	45	85	M 82×0,75	70	121	93,0	Compur electronic 1	M 39×0,75	39,0	75,0	41,8	1,3…3,0	46,4
1:6,8	155	18×24 cm/8″×10″	45	110	M 105×1	90	169	133,5	Copal 1	M 39×0,75	57,6	73,0	41,8	1,5…3,0	47,0
1:6,8	155	18×24 cm/8″×10″	45	110	M 105×1	90	169	133,5	Compur 1	M 39×0,75	57,6	75,0	41,8	1,3…3,0	46,4
1:6,8	155	18×24 cm/8″×10″	45	110	M 105×1	90	169	133,5	Prontor professional 1	M 39×0,75	57,6	77,0	41,8	1,5…3,0	46,4
1:6,8	155	18×24 cm/8″×10″	45	110	M 105×1	90	169	133,5	Compur electronic 1	M 39×0,75	57,6	75,0	41,8	1,3…3,0	46,4
1:6,8	200	24×30 cm/10″×12″	64	140	M 135×1	113,8	214,8	172,0	Copal 3	M 62×0,75	72,5	102,0	65,3	1,5…5,0	68,0
1:6,8	200	24×30 cm/10″×12″	64	140	M 135×1	113,8	214,8	172,0	Compur 3	M 62×0,75	72,5	95,0	65,3	1,5…5,0	68,0
1:6,8	200	24×30 cm/10″×12″	64	140	M 135×1	113,8	213,7	172,0	Prontor professional 3	M 62×0,75	71,4	99,0	65,3	1,5…4,0	68,0
1:6,8	200	24×30 cm/10″×12″	64	140	M 135×1	113,8	214,8	172,0	Compur electronic 3	M 62×0,75	72,5	95,0	65,3	1,5…5,0	68,0

All sizes not otherwise indicated are in mm.

Formats, image circle diameters at f/22



APO-RONAR



- 9/150 Ø = 135 mm
- 9/240 Ø = 212 mm
- 9/300 Ø = 264 mm
- 9/360 Ø = 318 mm
- 9/420 Ø = 323 mm
- 9/480 Ø = 396 mm
- 9/600 Ø = 496 mm
- 16/1000 Ø = 730 mm
- 16/1200 Ø = 870 mm

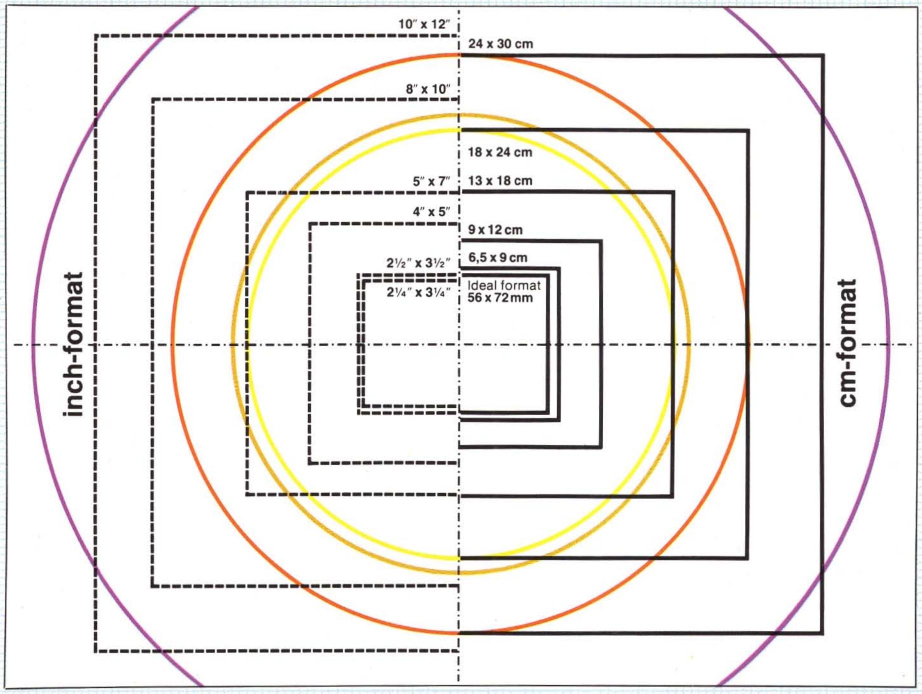
Image circle diameters and permissible camera movements for ratio 1:∞ (mm)

APO-RONAR	9/150		9/240		9/300		9/360		9/420		9/480		9/600		16/1000		16/1200	
Aperture	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22	1:11	1:22		1:22		1:22
Image circle diameter	130	135	204	212	256	264	308	318	312	323	382	396	476	496		730		870
Image angle 2 w	46°	48°	46°	48°	46°	48°	46°	48°	40°	42°	44°	46°	43°	45°		40°		40°
Negative size																		
Ideal format 56 x 72 mm 2¼" x 2¾"	↑26 →23	↑29 →25	↑67 →62	↑72 →66	↑95 →89	↑99 →93												
6,5 x 9 cm	↑22 →18	↑25 →20	↑65 →57	↑69 →61	↑92 →84	↑97 →88	↑120 →111	↑125 →116										
9 x 12 cm			↑43 →36	↑48 →41	↑73 →64	↑78 →68	↑102 →91	↑107 →96	↑104 →93	↑110 →99	↑141 →129	↑148 →137						
13 x 18 cm					↑34 →27	↑40 →32	↑67 →56	↑73 →61	↑69 →58	↑76 →64	↑110 →95	↑118 →103	↑161 →145	↑172 →155				
18 x 24 cm							↑16 →13	↑24 →19	↑19 →15	↑27 →22	↑67 →55	↑75 →63	↑123 →107	↑134 →117		↑261 →239		↑334 →311
24 x 30 cm											↑9 →7	↑20 →16	↑74 →63	↑86 →75		↑220 →201		↑295 →275
30 x 40 cm														↑8 →6		↑164 →140		↑244 →215
2¼" x 3¼"	↑27 →21	↑30 →24	↑69 →60	↑73 →64	↑97 →87	↑101 →91												
2½" x 3½"	↑23 →19	↑26 →21	↑66 →58	↑70 →62	↑94 →85	↑98 →89	↑121 →111	↑126 →117										
4" x 5"			↑34 →30	↑39 →35	↑65 →59	↑70 →63	↑94 →86	↑99 →92	↑96 →88	↑102 →94	↑133 →125	↑141 →132						
5" x 7"					↑35 →28	↑40 →32	↑68 →57	↑74 →62	↑70 →59	↑77 →65	↑111 →96	↑118 →104	↑162 →145	↑172 →156				
8" x 10"								↑4 →3		↑8 →7	↑50 →42	↑59 →50	↑107 →95	↑119 →106		↑247 →229		↑320 →302
10" x 12"												↑10 →8	↑64 →57	↑77 →68		↑211 →195		↑287 →270
11" x 14"													↑24 →20	↑38 →32		↑179 →160		↑258 →235

Relative aperture	Focal length	Filmformat	Smallest aparture	Slip-on dia-meter	Filter-thread	Dia-meter of rear mount	Flange focal distance at ∞	Overall length	Shutter type and size	Shutter sorew thread	Distance from shutter seating to rear of lens	Largest shutter diameter	Aperture in lens board	Thickness of lens board	Outside diameter of mounting ring
				a	b	c	d	e		f	i	k	l	n	o
1:9	150	6,5×9 cm/2½″×3½″	64	42	M 40,5×0,5	31,5	149	35,5	Copal 0	M 32,5×0,5	9,5	61,0	34,8	1,5…3,3	40,0
1:9	150	6,5×9 cm/2½″×3½″	45	42	M 40,5×0,5	31,5	149	35,5	Compur 0	M 32,5×0,5	9,5	58,5	34,8	2,0…3,7	39,1
1:9	150	6,5×9 cm/2½″×3½″	45	42	M 40,5×0,5	31,5	149	35,5	Prontor professional 01	M 39×0,75	9,5	77,0	41,8	1,5…3,0	46,4
1:9	240	9×12 cm/4″×5″	90	51	M 49×0,75	37,5	235	41,5	Copal 1	M 39×0,75	13,0	73,0	41,8	1,5…3,0	47,0
1:9	240	9×12 cm/4″×5″	64	51	M 49×0,75	37,5	235	41,5	Compur 1	M 39×0,75	13,0	75,0	41,8	1,3…3,0	46,4
1:9	240	9×12 cm/4″×5″	64	51	M 49×0,75	37,5	235	41,5	Prontor professional 1	M 39×0,75	13,0	77,0	41,8	1,5…3,0	46,4
1:9	240	9×12 cm/4″×5″	64	51	M 49×0,75	37,5	235	41,5	Compur electronic 1	M 39×0,75	13,0	75,0	41,8	1,3…3,0	46,4
1:9	240	9×12 cm/4″×5″	45	80	M 77×0,75	57,0	230	62,3	Compur electronic 5FS	M 92×0,75	8,0	–	96,0	1,5…6,5	99,3
1:9	300	13×18 cm/5″×7″	90	51	M 49×0,75	37,5	296	47,3	Copal 1	M 39×0,75	18,7	73,0	41,8	1,5…3,0	47,0
1:9	300	13×18 cm/5″×7″	90	51	M 49×0,75	37,5	296	47,3	Compur 1	M 39×0,75	18,7	75,0	41,8	1,3…3,0	46,4
1:9	300	13×18 cm/5″×7″	90	51	M 49×0,75	37,5	296	47,3	Prontor professional 1	M 39×0,75	18,7	77,0	41,8	1,5…3,0	46,4
1:9	300	13×18 cm/5″×7″	90	51	M 49×0,75	37,5	296	47,3	Compur electronic 1	M 39×0,75	18,7	75,0	41,8	1,3…3,0	46,4
1:9	300	13×18 cm/5″×7″	64	80	M 77×0,75	57,0	291	62,3	Compur electronic 5FS	M 92×0,75	17,0	–	96,0	1,5…6,5	99,3
1:9	360	18×24 cm/5″×7″	90	60	M 58×0,75	58,0	351	59,2	Copal 3	M 62×0,75	21,0	102,0	65,3	1,5…5,0	68,0
1:9	360	18×24 cm/5″×7″	90	60	M 58×0,75	58,0	351	59,2	Compur 3	M 62×0,75	21,0	95,0	65,3	1,5…5,0	68,0
1:9	360	18×24 cm/5″×7″	90	60	M 58×0,75	58,0	351	59,2	Prontor professional 3	M 62×0,75	21,0	99,0	65,3	1,5…4,0	68,0
1:9	360	18×24 cm/5″×7″	90	60	M 58×0,75	58,0	351	59,2	Compur electronic 3	M 62×0,75	21,0	95,0	65,3	1,5…5,0	68,0
1:9	360	18×24 cm/5″×7″	64	80	M 77×0,75	65,0	349	64,5	Compur electronic 5FS	M 92×0,75	19,3	–	96,0	1,5…6,5	99,3
1:9	420	18×24 cm/5″×7″	90	60	M 58×0,75	60,0	416	63,5	Copal 3	M 62×0,75	24,3	102,0	65,3	1,5…5,0	68,0
1:9	420	18×24 cm/5″×7″	90	60	M 58×0,75	60,0	416	63,5	Compur 3	M 62×0,75	24,3	95,0	65,3	1,5…5,0	68,0
1:9	420	18×24 cm/5″×7″	90	60	M 58×0,75	60,0	416	63,5	Prontor professional 3	M 62×0,75	24,3	99,0	65,3	1,5…4,0	68,0
1:9	420	18×24 cm/5″×7″	90	60	M 58×0,75	60,0	416	63,5	Compur electronic 3	M 62×0,75	24,3	95,0	65,3	1,5…5,0	68,0
1:9	480	24×30 cm/8″×10″	90	70	M 67×0,75	60,0	463	67,0	Copal 3	M 62×0,75	25,9	102,0	65,3	1,5…5,0	68,0
1:11	480	24×30 cm/8″×10″	90	70	M 67×0,75	60,0	463	67,0	Compur 3	M 62×0,75	25,9	95,0	65,3	1,5…5,0	68,0
1:11	480	24×30 cm/8″×10″	90	70	M 67×0,75	60,0	463	67,0	Prontor professional 3	M 62×0,75	25,9	99,0	65,3	1,5…4,0	68,0
1:11	480	24×30 cm/8″×10″	90	70	M 67×0,75	60,0	463	67,0	Compur electronic 3	M 62×0,75	25,9	95,0	65,3	1,5…5,0	68,0
1:9	480	24×30 cm/8″×10″	90	80	M 77×0,75	72,0	461	72,0	Compur electronic 5FS	M 92×0,75	24,2	–	96,0	1,5…6,5	99,3
1:9	600	24×30 cm/11″×14″	90	105	M 95×1	90,0	592	91,0	Compur electronic 5FS	M 92×0,75	34,1	–	96,0	1,5…6,5	99,3
1:16	1000	30×40 cm/11″×14″	90	110	M 127×1	110,0	1001	188,7	Compur electronic 5FS	M 92×0,75	86,6	–	96,0	1,5…6,5	99,3
1:16	1200	30×40 cm/11″×14″	90	132	M 127×1	132,0	1192	232,0	Compur electronic 5FS	M 92×0,75	105,0	–	96,0	1,5…6,5	99,3

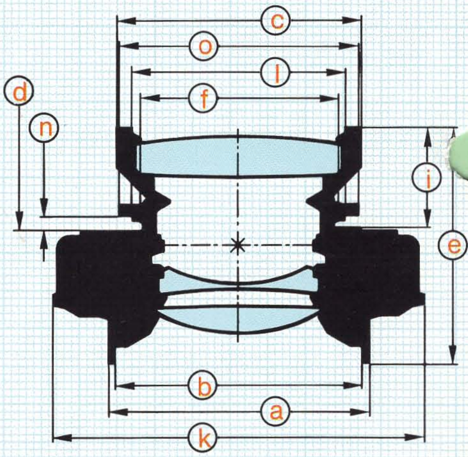
All sizes not otherwise indicated are in mm.

Formats, image circle diameters at 1/22 and 1:∞



● Geronar-WA 8/90 ∅ = 170 mm
● Geronar 6,3/150 ∅ = 180 mm
● Geronar 6,8/210 ∅ = 230 mm
● Geronar 9/300 ∅ = 340 mm

GERONAR



GERONAR-WA

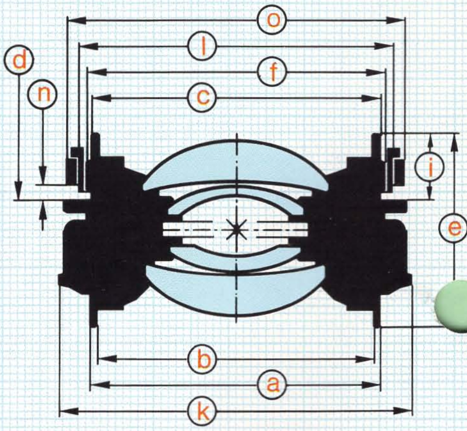


Image circle diameters and permissible camera movements for ratio 1:∞ (mm)

GERONAR-WA	8/90		GERONAR	6,3/150		6,8/210		9/300	
Aperture	1:11	1:22	Aperture	1:11	1:22	1:11	1:22	1:11	1:22
Image circle diameter	155	170	Image circle diameter	165	180	210	230	300	340
Image angle 2 w	80°	85°	Image angle 2 w	58°	62°	53°	58°	53°	59°
Negative size			Negative size						
Ideal format 56 x 72 mm 2¼″ x 2¾″	↑41 →36	↑49 →44	Ideal format 56 x 72 mm 2¼″ x 2¾″	↑46 →42	↑54 →50	↑70 →65	↑81 →76		
6,5 x 9 cm	↑37 →31	↑46 →39	6,5 x 9 cm	↑43 →37	↑51 →45	↑68 →60	↑79 →71		
9 x 12 cm	↑11 →8	↑22 →17	9 x 12 cm	↑18 →14	↑28 →23	↑47 →39	↑58 →50	↑97 →87	↑119 →108
13 x 18 cm			13 x 18 cm				↑16 →12	↑62 →52	↑86 →73
18 x 24 cm			18 x 24 cm					↑10 →8	↑39 →31
2¼″ x 3¼″	↑42 →35	↑50 →43	2¼″ x 3¼″	↑47 →40	↑56 →48	↑72 →63	↑83 →74		
2½″ x 3½″	↑38 →32	↑47 →40	2½″ x 3½″	↑44 →38	↑53 →46	↑69 →61	↑80 →72		
4″ x 5″	↑1 →1	↑12 →10	4″ x 5″	↑9 →7	↑19 →16	↑38 →33	↑50 →45	↑89 →82	↑111 →103
5″ x 7″			5″ x 7″			↑2 →1	↑17 →13	↑63 →52	↑87 →74
8″ x 10″			8″ x 10″						↑21 →17

Technical data

Relative aperture	Focal length	Filmformat	Smallest aparture	Slip-on diameter	Filter-thread	Diameter of rear mount	Flange focal distance at ∞	Overall length	Shutter type and size	Shutter sorew thread	Distance from shutter seating to rear of lens	Largest shutter diameter	Aperture in lens board	Thickness of lens board	Outside diameter of mounting ring
				a	b	c	d	e		f	i	k	l	n	o
GERONAR-WA															
1:8	90	9 x 12 cm/4″ x 5″	32	60	M 58 x 0,75	60,0	87,1	41,0	Copal 1	M 62 x 0,75	14,0	73	65,3	1,5…5,0	68
GERONAR															
1:6,3	150	9 x 12 cm/4″ x 5″	64	42	M 40,5 x 0,5	31,5	137,0	34,5	Copal 0	M 32,5 x 0,5	11,9	61	34,8	1,5…3,3	40
1:6,8	210	9 x 12 cm/5″ x 7″	64	51	M 49 x 0,75	48,0	195,3	51,6	Copal 1	M 39 x 0,75	20,1	73	41,8	1,3…3,0	47
1:9	300	18 x 24 cm/5″ x 7″	64	60	M 58 x 0,75	61,0	282,0	61,2	Copal 1	M 39 x 0,75	31,7	73	41,8	1,3…3,0	47

All sizes not otherwise indicated are in mm.

Shutters

As a complement to its wide range of high-performance lenses Rodenstock offers a complete program of different, highly precise types of shutters. The installation of the lens components is made by Rodenstock, whose many years of experience and accurate measuring instruments determine every assembly step. For instance, the distance between the front and rear lens components of the GRANDAGON is precisely adjusted to within 0.02 mm to guarantee critical performance. Only after this ultra-precise adjustment is the Rodenstock Quality Seal given to these lenses.

As each type of shutter is particularly suited for specific kinds of tasks, the required system should be selected with utmost care. To select the best system for every kind of task from this broad assortment, technical specifications as well as operating features must be considered.

Copal shutter

The Copal shutter is a very precise, attractively priced mechanical shutter. As there are no aperture click stops, any desired intermediate f-stop values can be readily set. The press-to-focus lever adds time-saving operating convenience. The concept of this shutter permits wide-ranging applications.

Compur shutter

The Compur shutter is provided with click stops which allow quick and reliable setting of the working aperture. This convenience can be supplemented, on Compur # 1 and # 3 shutters, by the installation of an aperture control accessory.

Prontor Professional shutter system

The Prontor Professional shutter also functions mechanically, but is self-cocking. Its control unit, also mechanical, permits remote setting of all lenses for groundglass focusing with fully open or pre-set working apertures.

Closing the shutter and stopping down the diaphragm to the pre-selected f/stop may be made manually through the control unit or automatically with an appropriate camera back when a film holder is inserted. Accessory aperture setting controls are available which may be attached and easily removed after opening of a safety catch. The operating convenience is enhanced by the fact that it allows operation exclusively from behind the camera. In addition to the special suitability of this shutter system for scientific and industrial photography, close-ups or sequence and trick exposures, its advantages become clear in setups which exclude any manipulation at the shutter, and for flash exposures when flash units must be repeatedly fired.

			Cocking of shutter			Shutter speed		Remote control			Shutter-opening						
Shutter type	Size	Exposure time	Mechanical shutter	Self cocking shutter	Magnetic shutter	Mechanical	Electronic	Shutter speed	Working aperture	Releasing ②	Lever	Mechanical remote control	Electronic remote control	Opened at full aperture	X-Contact	Aperture setting device	Click-stop	Necessary equippment
Copal 0	0	B, T, 1-1/500 s	○			○					○				○			
Copal 1	1	B, T, 1-1/400 s	○			○					○				○			
Copal 3	3	B, T, 1-1/125 s	○			○					○				○			
Synchro-Compur	0	B, 1-1/500 s	○			○					○				○		1/2	
Compur 1	1	T 1-1/500 s	○			○					○				○	○	1/3	
Compur 3	3	T, 1-1/200 s	○			○					○				○	○	1/3	
Prontor professional 01	0	B, 1-1/125 s		○		○				○		○		○	○	○	1/3	Central
Prontor professional 1	1	B, 1-1/125 s		○		○				○		○		○	○	○	1/3	Remote
Prontor professional 3	3	B, 1-1/125 s		○		○				○		○		○	○	○	1/3	control
Compur electronic 1	1	T, 32-1/500 s	○				○				○				○	○	1/3	
Compur electronic 3	3	T, 32-1/200 s	○				○				○				○	○	1/3	
Compur electronic 5 FS	5	T, 32-1/60 s					○	○	○	○			○	○	○	③	1/3	Remote control unit
Copal CVS-0 ④	0	T, 16-1/250 s		①	○		○	○	○	○			○	○	○	③	1/3	Copal CVS-Remote control unit
Copal CVS-1 ④	1	T, 16-1/125 s		①	○		○	○	○	○			○	○	○	③	1/3	
Copal CVS-3 ④	3	T, 16-1/60 s		①	○		○	○	○	○			○	○	○	③	1/3	
Prontor magnetic 250-0 (System autolux)	0	15 min - 1/250 s		①	○		○	○		○			○	○	○	○	1/3	Prontor autolux-Remote control unit
Prontor magnetic 125-1 (System autolux)	1	15 min - 1/125 s		①	○		○	○		○			○	○	○	○	1/3	
Prontor magnetic 60-3 (System autolux)	3	15 min - 1/60 s		①	○		○	○		○			○	○	○	○	1/3	

① Self cocking shutter
③ Pre-selection on remote control unit
② Cable release is not considered
④ In preparation

Compur Electronic shutter # 1 and # 3

The Compur Electronic shutter differs from the Compur shutter because of its ultra-precise electronic timing, and by the added long exposure time range. Therefore, this shutter is particularly suitable for applications which frequently require exposure times between 1 and 32 seconds.

Compur Electronic shutter system 5 FS

The Compur Electronic 5 FS shutter consists of a between-the-lens shutter with electronic timing and a remote control unit for preset exposure and aperture capability.
Opening of the lens for focusing, closing down of the lens for depth of field control, and shutter release are remotely controlled. Furthermore, the # 5 shutter size permits installation of lenses with extremely long focal lengths.
Operation exclusively behind the camera facilitates subject control considerably so that even fastest catalog photography can be handled with ease.

Copal CVS shutter system (in preparation)

The Copal CVS shutter exemplifies an expanded remote control system which includes additional safeguards against operating errors as for example, blocking of the shutter release in the event of inadvertent multiple exposure. The relatively small dimensions of the shutters and of the control unit allow for application to many assignments in the studio as well as outdoors.

Prontor Autolux shutter system

The Prontor Autolux system consists of Prontor magnetic shutters, a central control unit and different exposure sensors. Please ask us for the special brochure describing the seven different exposure possibilities and the unusually versatile features of this system.

Sinar rear lens shutter

This shutter requires lenses in special mounts which may be obtained from the Sinar sales organization. To the extent that dimensions permit, the entire RODENSTOCK program can be supplied in this version.

Rodenstock sets objective standards –
for camera, enlarging and process lenses.

For further information on camera lenses or our complete line of optical products, contact:

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