

BAUSCH & LOMB



**PHOTOGRAPHIC
LENSES**





That eyes may see better and farther

Unsurpassed precision characterizes Bausch & Lomb microscopes, photographic lenses, spectrographs, and other optical instruments serving Science, Industry, and Education. This precision is also reflected in Bausch & Lomb ophthalmic lenses, eyewear, and instruments for visual examination.

Vision is taken for granted and frequently ignored in the belief that the eyes are functioning well. However, impartial tests reveal that the perfect eye is a rarity, and that seven persons in every ten require glasses. Since 83% of mental impressions are said to be received through the eye, an impairment of vision reduces mental efficiency.

As years go by, visual imperfections vary, whether or not complicated by added defects. Hence the need for periodical re-examinations.

To provide the highest possible level of normal vision, Bausch & Lomb scientists have developed Orthogon Wide-Vision Lenses, Panoptik Bifocals, Loxit Rimless Mountings, and a wide variety of Ophthalmic Instruments to aid eyesight specialists, who each year furnish millions of patients with Bausch & Lomb eyewear.

Be sure your eyes, too, enjoy the protection and comfort afforded by Bausch & Lomb quality.



The illustrations in this catalog show Bausch & Lomb scientific instruments of current production. However, due to our constant efforts to improve and refine, this company reserves the right to supply apparatus that may differ in unimportant or minor details from those shown in the illustrations.



THE BAUSCH & LOMB OPTICAL COMPANY normally manufactures several types of photographic objectives and optical systems not shown herein due to limited demand, special application, or manufacturers' specification. Such applications range from aerial mapping and x-ray photography to sound recording. If you have a photographic problem wherein optical parts are involved, such as objectives, condensing systems or prisms, your specific requirements will receive individual consideration.

BAUSCH & LOMB OPTICAL CO.

MAIN OFFICES AND WORKS, ROCHESTER, NEW YORK. U. S. A.

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Branch offices are maintained in New York, Chicago, San Francisco, Toronto, London, and Rio de Janeiro, where sample lines of our products are carried for inspection. Our products are also supplied by dealers in the United States and Canada and by our representatives in foreign countries.

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PHOTOGRAPHIC LENSES



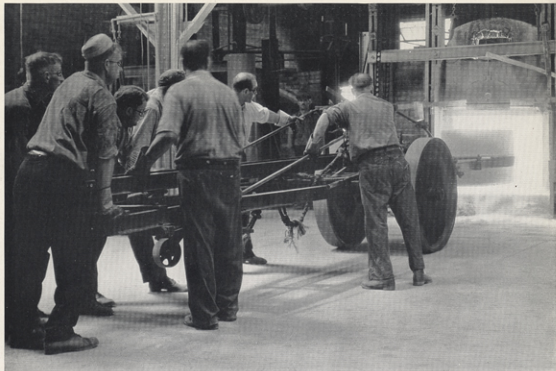
CATALOG

F-127

BAUSCH & LOMB OPTICAL COMPANY

Main Offices and Works at Rochester, New York, U. S. A.

NEW YORK • CHICAGO • SAN FRANCISCO • LONDON • RIO DE JANEIRO



TYPICAL of the complete control of every step in the design and manufacture of photographic lenses is the Bausch & Lomb Glass Plant. Shown above is the dramatic moment when the white-hot pot containing 1000 pounds of molten glass is being taken from one of the furnaces. Of this glass, not more than 150 pounds will meet the rigid requirements of Bausch & Lomb lenses.

INTRODUCTION

PHOTOGRAPHY has attained its present status by development along three main lines, chemical, mechanical, and optical. Advances in any one of these have called for parallel progress in the others.

For instance, modern emulsions, with wide range of color response and fine grain capable of rendering fine detail, demand refinements in photographic lens correction for everyday work. Today in routine lens performance an approach to perfection is required such as was formerly utilized and appreciated only in highly specialized and technical fields.

The Bausch & Lomb Optical Co. began to make photographic lenses in 1878 during the period when photography was emerging from the limitations and inconveniences of the collodion wet plate. At the start, only the single achromatic landscape lens, a form now obsolete except upon the most inexpensive cameras, was made. At the request and insistence of American camera manufacturers, the regular production of Rapid Rectilinears was begun in 1885. This type remained popular for many years and hundreds of thousands of Bausch & Lomb Rapid Rectilinears were made and used on the better grades of amateur equipment and, in the longer focal lengths, selected by professionals for their work. Wide angle lenses of the symmetrical type were also made. Bausch & Lomb Petzval Portrait lenses were used in the better studios everywhere. Prior to the introduction of the anastigmat, Bausch & Lomb was manufacturing a complete line of photographic lenses, including the Alvin G. Clarke objective in which there is evidence of considerable success in overcoming the limitations established by the inherent properties of optical glass then available.

Another early Bausch & Lomb contribution to photography was the Iris Diaphragm shutter, invented by Edward Bausch, and from which was developed the Volute shutter, regularly manufactured for many years. The Diaphragm shutter and the Triplex type, also made by Bausch & Lomb, replaced the "drop shutter" and the lens cap as an exposing mechanism at the time when emulsions sufficiently sensitive to permit rapid exposures became available commercially. From the Triplex type were developed the Unicum, Victor, and Automat shutters, all familiar to the photographer of three and four decades ago. As it became possible to buy a satisfactory shutter from outside sources and thereby release factory facilities for products of more purely optical nature, the manufacture of photographic shutters was discontinued.

When researches in optical glass made possible the modern anastigmat, Bausch & Lomb was among the first to add this type to its line, with the result that Bausch & Lomb Protars VII, VIIa, and V, and Tessars IIb and Ic at once became the favored lens equipment among more critical operators. These early anastigmats set new standards in lens performance.

Prior to the time when Bausch & Lomb produced its own optical glass, Bausch & Lomb designers were limited in manufacture by the quality of glass available from outside sources. Now, however, Bausch & Lomb has the advantage of being able not only to specify optical glass

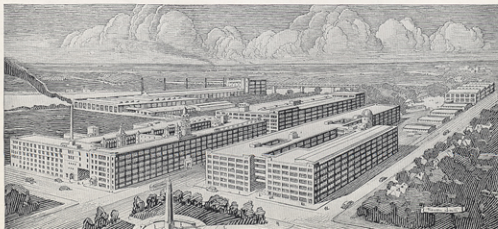
of closely predetermined refractive index and dispersion, but also to control the quality and uniformity. In addition, it has been possible to develop special types of optical glass which in turn permit more complete realization of theory in practice. In this way these basic types have been refined with resulting improvements in correction that can be utilized to advantage in the critical work which is demanded generally today.

Probably no other optical instrument requires a more complete approximation to perfection than the photographic lens. It must have high resolving power (ability to define minute detail); it must have a flat image plane; it must cover a comparatively wide field; it must be corrected for a wide spectral range; it must work at relatively large aperture; it must have even illumination over a useful area; it should have a minimum of reflecting surfaces and be free from flare and ghosts which, in the form of distributed light, degrade shadow detail. The choice of glass is limited to such as are resistant to accidental tarnish, efflorescence, change in color, and are not hygroscopic. These are a few of the factors which must be considered in the design.

Equally important are the problems which arise in the actual execution of the design, such as maintaining accuracy of curve and surface, the centering, and the separation. Failure in any one of these vitiates all the care that has gone before.

Consequently, a photographic lens in which attention to all these details has been given cannot be offered at a price closely competitive with one in which some have been ignored or one that is made to more lenient standards when examined critically for each correction. Nor is it possible to replace painstaking hand artisanship and human experience by machine methods beyond a certain point, if the utmost in individual correction is to be attained.

For these reasons, Bausch & Lomb does not manufacture and list regularly the simpler photographic lens types, such as the single landscape lens and rapid rectilinear or photographic objectives wherein the inherent limitations of performance due to design are such as do not justify the precision manufacturing methods, rigorous inspection, and testing which are a regular part of Bausch & Lomb production methods.



WHAT LENS TO CHOOSE

AS PHOTOGRAPHY became a science as well as an art more severe requirements have been placed upon the lens designer and manufacturing optician. With optical materials as now available it is impossible to compute a lens which will be completely free from all aberrations under all conditions. However, so close an approach to perfection is possible that the deviation therefrom is below the limits of perception when the lens is used under the conditions for which it was designed.

Since the finest photographic lens is essentially a compromise and can only approach perfection, the lens user is dependent upon the skill and resources of the lens manufacturer. The maker, being cognizant of the limitations, is all the more obligated to provide the best possible compromise for each specific kind of work.

Some constructions lend themselves to special requirements as speed, flat field, reserve covering power, freedom from distortion, coma, astigmatism or color aberrations, with adequate over-all correction, better than others. For this reason, Bausch & Lomb manufactures several types of photographic lenses. There is no difference in quality of workmanship or materials between them. The difference in cost is due to the greater complexity in design required to satisfy more completely some special requirement in use as speed, trichromatic correction, etc. Several factors enter into the selection of photographic objectives for special purposes. While almost any modern lens can be used with varying degrees of satisfaction for a wide range of work, it is desirable to choose lens equipment with specific applications in mind.

Aerial Photography

Speed, flatness of field, and ability to cover rated plate size sharply from corner to corner, coupled with high color correction, are essential. The Aero Tessar is recommended for both oblique and vertical shots.

For map-making, surveys, and photogrammetry, the Metrogon provides exceptional correction with exceptional coverage. In this lens the correction for distortion and flatness of field has been brought to a very high order. This lens requires special fitting and cannot be used on all cameras.

Architectural Subjects

The Protar VII and Protar VIIa used on a camera with sufficient range of extension and adjustments should be considered as basic equipment. Depending upon plate size the C, D, or F Convertible Protar Sets are



Every step in the manufacture of optical glass must be accurately and closely controlled. Temperature readings are made frequently to determine the completion of reactions and fusion.

suggested as basic equipment since the range of equivalent foci provided in each gives the photographer complete control of image size and perspective.

The owner of a Protar VIIa has the advantage of being able to extend the range of foci available by the addition of one or more Protar VII Lenses at any time.

For operation in confined situations the Series V Extreme Wide Angle Protar is provided.

Athletic Events

Great light gathering ability for high shutter speeds, plus definition to endure subsequent enlargement is provided in the Tessar Ic. Its maximum speed of $f:4.5$ enables the photographer working with modern sensitive materials to cover practically any photographable assignment. This series can be fitted, in proper focal length, to reflecting and focal plane shutter cameras.

Where space prevents the fitting of the Tessar Ic, the Tessar IIb is recommended. This lens works at $f:6.3$.

High speed emulsions have made it possible also to enjoy the advantages of convertibility as provided in the Series VIIa Protar. By choosing a lens with similar Series VII elements, a combined working speed of $f:6.3$ is secured, with availability of a second focal length working at $f:12.5$ of approximately double that of the combination.

Biological Photography

Lens recommendations are the same as those for Clinical Photography and Nature Photography.



One of the steps in the manufacture of a B&L Photographic Lens is the examination of the glass used under polarized light. This reveals strain that escapes detection in ordinary light, but which would degrade the definition of the finished lens.

Candid Photography

The photographer specializing in this interesting branch of unposed portraiture and record work will find the combination of a Tessar Ic, $f:4.5$, on one of the modern direct vision finder folding hand cameras or one of the smaller size reflecting cameras ideal, especially when subsequent enlarged prints are required. For use with synchronized flash the Tessar Ic may be mounted in a between-the-lens shutter.

Children's Photographs

The requirements of the amateur for the photography of children parallel those of candid camera work as outlined above. Some types of hand cameras as well as the smaller size view type can be fitted with the Tessar Ic. Where lack of space prevents this, the Tessar IIb can be used.

For studio photography by professionals the Tessar Ic in longer focal lengths is recommended.

Clinical Photography

For the wide range of work that comes under this heading from the photography of anatomical specimens, operative techniques, results of plastic and corrective surgery, to case records, a battery of objectives is desirable for more complete control of image size and perspective. As basic equipment for 5×7 or 8×10 plate size, the Protar VIIa D and F Sets are recommended. Depending upon the importance of the work at hand, this can be supplemented by Micro Tessars, a Tessar Ic or IIb for more rapid exposures and natural color work, and the Process Apochromat.

Color Work

No advance in photography has emphasized the need for photographic lens quality more than the extensive

use of panchromatic highly red sensitive emulsions, and natural color processes.

Many lenses that were satisfactory when used on the old "color blind" or the orthochromatic emulsions give unsatisfactory results when used in three-color separation or one-plate color processes, due to difference of image size depending upon wavelength of light, difference of image position, poor light distribution, etc.

Not only must the photographic objective be corrected superbly, but also it must have sufficient speed to compensate for the light loss inherent to some of the successful processes.

Each of the color processes has individual requirements which result in one lens type being slightly better than another for specific conditions.

For three-color separation negatives, direct from the object, either with repeating back or reflectors, and for single exposure, as Kodachrome, Dufay, and Autochrome, the Tessar Ic is unsurpassed.

For making enlarged color separation negatives from small color positives, the Micro Tessar of 72mm focal length is recommended.

In general it may be stated confidently that the Bausch & Lomb Tessar Ic or IIb, Protar VIIa or Process Apochromat, $f:10$, will be entirely adequate for any color process, and perform well within the limits established by the process itself. The slight difference in performance between them is balanced by difference in speed or availability for other work.

Commercial Photography

The demands on the commercial photographer are so varied that no one lens is sufficient to meet all of his requirements.

The Convertible Protar VIIa, as provided in the Protar F Set, permits use of equivalent focal lengths of from $10''$ to $27''$ on an 8×10 plate. These should be supplemented by a Series V Extreme Wide Angle. With suitable filter and shutter equipment which is included in the complete F Set, the operator has optical resources to cover any assignment. Since the longer focal lengths used to secure proper perspective in commercial work require some stopping down to secure satisfactory depth of field, the top speed of the Protar VIIa will be found more than adequate for work employing living models. When greater lens speed is usable or required, the Tessar Ic, with the Tessar IIb as a second choice, is recommended.

Where much copying work is done, or advertising photography of small objects as shoes, jewelry, etc., a B&L Process Apochromat, $f:10$, can be added to advantage. This objective is specially corrected for photography of near objects and gives negatives which stand the excessive enlargement sometimes required in this class of work.

Copying

Although any of the Tessars or Protars can be used for copying work, there are slight differences in per-

formance due to the fact that a lens cannot be designed to give superlative performance on both near and distant objects. For most purposes this difference will not be important.

The Tessar IIb is recommended, since its corrections are uniformly balanced and of very high order. If sufficient copying work is being done to justify expenditure for a special lens, the Process Apochromat, $f:10$, is recommended for the maximum in definition.

Crime Photography—See Police Work

Enlarging

Recommendations covering lens equipment for enlarging depend upon negative size and enlarging equipment.

For working with small negatives, the Tessar Ic in short focal lengths is recommended. This lens has a flat field and good light distribution. Its speed is such as to permit rapid exposures in either reflector or condenser enlargers. For larger negative sizes, up to 5×7 , a longer focal length Tessar Ic is suggested. Here again the uniform light distribution and large usable aperture, coupled with crisp defining power, are valuable. The Tessar IIb can be used with equal advantage with a slight lowering of speed due to its smaller aperture of $f:6.3$.

For precision commercial enlarging, as in the production of large display pieces, murals, etc., the Process Apochromat, $f:10$, with specially corrected condensing system is suggested.

Flash and Synchroflash Photography

For commercial work in larger sizes, as banquet photography, interiors, etc., there is an advantage in having available sufficient aperture to permit sure focusing and rapid exposure. Thus, either the Tessar Ic, Tessar IIb or Protar VIIa can be used. Where a large angle must be included the Protar V is recommended. With modern flash and photoflood lighting, the illumination can be built up to any point desired so that in every case depth of field need not be sacrificed for adequate exposure.

For synchronized flash, news and candid work, either the Tessar Ic or the Tessar IIb mounted in a between-the-lens shutter is suggested.

Flower Photography

Control of perspective and definition is more important than speed in this work, consequently the Protar VIIa or one of the Protar VIIa Sets is recommended as first choice. If final image size is to be controlled by subsequent enlarging, the Tessar Ic or IIb can be used. For natural color photography of flowers the recommendations given under Color Work are in order.

Focal Plane Shutter Work

Work with focal plane shutters falls within the range of speed photography where the lens must have high light gathering ability to compensate for short expo-

sure or lack of illumination in addition to correction. The recommendations covering Reflecting Camera work apply. Much work that formerly was possible only with reflecting outfits is now done with rangefinder-equipped focal plane folding cameras.

Groups

The varied requirements of group photography are best met by the Tessar Ic. It has usable high speed, edge to edge definition, flat field, and reserve covering power which makes it possible to use a shorter than normal focal length when work must be done in limited space.

The Tessar IIb and Protar VIIa can also be used for groups since highly sensitive emulsions now make top speeds of $f:6.3$ and $f:7.7$ adequate for work that formerly could be accomplished only with $f:4.5$.

Home Portraiture

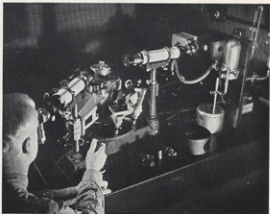
The Tessar Ic is first choice for this work, with either artificial or day light. The longer focal lengths provide pleasing perspective at speeds that insure a high percentage of satisfactory negatives. The correction of the Tessar Ic also fits it for natural color work.

The Tessar IIb and Protar VIIa are given as second choice only because of their slower speed, for which some compensation can be made by using high speed emulsions.

Interiors

In the photography of interiors, as in other architectural work, the operator finds himself in many situations where a compromise between the best possible perspective and angle of view must be made. To get the best results, and to utilize fully the negative area, he

The optical characteristics, refractive index and dispersion, of the glass from each individual pot of glass to be used in B&L Photographic Lenses are accurately determined by the examination of prism samples with a large, specially made, precision spectrometer.



should have available as complete a battery of focal lengths as possible.

For the 8 x 10 plate size all requirements are met by the Protar Series VIIa F Set. Starting with the Protar Series V Extreme Wide Angle lens which is included in this set, focal lengths of $7\frac{1}{4}$, 10, 11, 12, $12\frac{3}{4}$, $14\frac{1}{4}$, $16\frac{3}{4}$, 19, $23\frac{1}{2}$ and $27\frac{3}{4}$ inches are available, either as single or combination anastigmats.

For other plate sizes, corresponding Protar Series VIIa Sets can be built up.

As an important supplement to existing lens equipment, the Protar V Extreme Wide Angle Lens is suggested since it makes possible many pictures not obtainable otherwise.

Landscapes

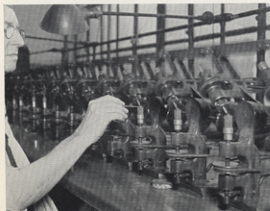
The requirements of serious landscape photography are essentially the same as those of architectural and interior photography, with the emphasis, in most cases, on the use of longer focal lengths. The first choice for a single objective, if bought primarily for landscape work, is the Protar VIIa, $f:7.7$. In this case three focal lengths are available.

For landscape work in natural color, the same recommendations as those covering color work apply.

Lantern Slide Making

For making reductions from larger negatives, the Tessar IIb is recommended because of its extremely flat field and ability to reproduce fine detail. For making positives same size or enlarged from miniature negatives, the 72mm Micro Tessar is recommended. To secure all of the advantages of objective quality, the lens should be used on stable equipment accurately aligned in every case.

Grinding and polishing of the lens elements are done on special machines. The accuracy of the final surface is proved by the interference method which requires an optical test plate for each lens surface curvature.



Micro Film

This type of photography requires the utmost in definition in a greatly reduced image. The Micro Tessar or Tessar IIb is recommended for this work, depending upon focal length required, with the reservation that some types of work may require a specially designed optical system.

Motion Picture Photography

Extremely high resolving power, or ability to record fine detail, high speed, freedom from flare, and exquisite color correction are required for this work. The Baltar, $f:2.3$, meets these requirements. It was designed in answer to the demands from leading producers for a motion picture taking lens that, regardless of cost, should represent the utmost in correction.

Nature Photography

For use on cameras with sufficient bellows draw to permit use of single combinations, the Protar VIIa is suggested. For work at higher shutter speeds the Tessar Ic meets all requirements.

Newspaper Photography

The news photographer seldom gets a second chance. Hence he must reduce to a minimum the number of variables in his photographic procedure. For all-around use, the Tessar Ic is first choice. It has usable high speed, covering and defining power. It can be mounted in modern folding focal plane or reflecting cameras.

Where work is done in the department that requires a view outfit, the news photographer's requirements are the same as those of the commercial photographer.

For enlarging from miniature negatives the Micro Tessar is suggested.

Low Power Photomicrography

The requirements in making enlarged photographs, directly from small objects, such as insects, textiles, flower parts, steel fractures, etc., where the magnification does not exceed 25 times as a rule, are essentially the same as in enlarging. The Micro Tessars are specially corrected for this purpose. For work requiring coverage of large object areas the Tessar Ic and Tessar IIb are suggested.

(Special literature on equipment for high power photomicrography, including microscopes, illuminants, etc., on request.)

Police Photography

The requirements of the police photographer are many and varied. He has the same problems as the commercial and news photographer plus those of the scientific specialist. Our experience in equipping police laboratories is freely available.

Projection

Where the work in hand justifies the expense, the Tessar Ic and Tessar IIb, because of their flat field,

coverage, and defining power, are recommended in place of projection lenses of the conventional type. Where extremely precise measurements are made on the projected image the Tessar IIb should be selected.

For low power projection of microscope slides the Micro Tessars are available.

(Special projection apparatus catalog on request.)

Photoengraving, Process Work, and Photolithography

The optical requirements of photoengraving including line, halftone, and color work for letterpress, photolithography, and planographic printing are very severe and require lenses in which the utmost in correction for all aberrations has been achieved for the conditions under which the objective is used, namely, without extreme variance between image and object distance. The Bausch & Lomb Process Apochromat, $f:10$, has been designed to meet these conditions. Matching the Process Lens in precise workmanship are Bausch & Lomb Photoengraving Prisms.

Reflecting Camera Work

For this use the Tessar Ic has no superior. Its speed of $f:4.5$ is retained in all sizes at no sacrifice of any optical quality. Brilliance, superior sharpness of definition, evenness of illumination, flatness and freedom from distortion over the entire field make the Tessar Ic first choice.

For a given focal length, the Tessar Ic possesses a larger circle of sharp definition than is found in any competing lens. Since the plane of sharp definition does not shift when the lens is stopped down, the ability to focus at large apertures is highly advantageous.

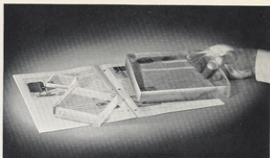
To the long bellows draw model cameras, the Convertible Protar VIIa lens with its single anastigmat combinations of longer focal length may be fitted, offering unusual possibilities where great shutter speed is not required.

Science and Research

Photographic recording has become an important factor in practically all laboratory procedures. Since each problem usually requires special consideration we request the opportunity to make specific recommendations. However, for general laboratory work with the 8 x 10 plate size the Protar VIIa F Set is suggested as basic equipment.

Speed Photography

For work within the range of speeds given by the between-the-lens shutter the Tessar Ic so mounted is first choice. Where space does not permit mounting a lens of this size, the Tessar IIb can usually be fitted. Where exposures fall within the range of the focal plane shutter, the recommendations covering reflecting camera work apply.



In addition to special requirements in uniformity, refractive index and dispersion, the optical glass used for photographic lenses must be free from inclusions and highly transparent.

Stereoscopic Photography

A pair of lenses accurately matched in focal length is required. The Tessar IIb or the Convertible Protar VIIa is usually selected. Lenses of higher relative aperture are not often used as the lens diameters are such as to require lens mounts and barrels too large for proper lens separation and to permit fitting to Stereo shutters. The necessity for great depth of field usually prevents working at large f values. However, in special cases it is possible to fit lenses of higher speed, such as the Tessar Ic, $f:4.5$, in the shorter focal lengths.

Studio Portraiture (Professional)

The larger sizes of the Tessar Ic have long been popular for portraiture because of their great speed, which makes it possible to catch fleeting expressions that are so easily lost with longer exposure required by a slower lens. Speed is also necessary thereby reducing failures due to movement by the subject. The Tessar Ic lens is equally useful for large heads, standing figures and groups.

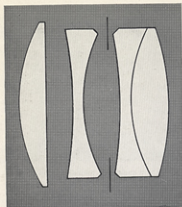
Telephotography

Your particular problem will be made the subject of special correspondence.

Wide Angle Photography

Protar V, $f:18$, meets the demand for making extreme wide angle photographs of architectural subjects, interiors, exteriors, in daylight, photoflood or flash. The correction for flatness of field and astigmatism has been carried to a greater degree than in other lenses designed for this kind of work. Due to the small separation between the front and rear combination required in order to provide uniform light distribution over wide angles, the Protar V cannot be fitted to all shutters.

Convertible Protar VIIa lenses may also be used on larger plates than those for which they are listed since they possess an unusual reserve covering power which becomes available when the lens is stopped down.



Four types of optical glass, utilized in two singlets in front of the diaphragm and a cemented pair behind it, are used in the B&L Tessar Ic.

Tessar Ic, f:4.5

Available in barrel or factory fitted shutters. See Price List for mountings.

Plate Covered with Stop f:4.5, Inches	E. F., Inches	E. F. in mm
2 1/4 x 3 1/4	3 3/8	91
2 1/2 x 3 1/2	4 3/8	113
3 1/4 x 4 1/4	5 1/2	139
4 x 5	6 3/8	164
5 x 7	7 1/2	190
5 x 8	8 1/4	210
6 1/2 x 8 1/2	10	255
8 x 10	12	305

Lens in barrel is furnished in a case, cap and flange are included.

When lens is ordered in shutter, case is not furnished; cap and flange are furnished.

Tessar Ic, 8 x 10, in Studio Barrel Mount

BAUSCH & LOMB TESSAR Ic, f:4.5

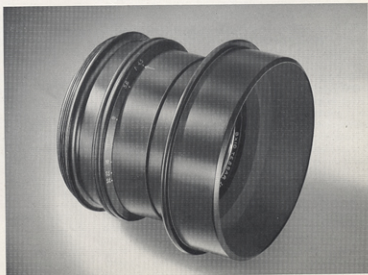
THE remarkably wide range of application in scientific and technical photography makes the Tessar Ic unequalled among anastigmats of the unsymmetrical type. The outstanding characteristic of this lens is its usable high speed, maintained in all focal lengths at no sacrifice in other important optical properties. Its flatness of field, superior sharpness of definition, brilliancy and freedom from distortion extend evenly over the entire field or area of the plate for which the lens is listed. The chromatic corrections are of such high order that the Tessar Ic can be used with satisfaction for color photography and with pan-chromatic negative materials.

For all photography where superior correction at relatively large aperture is essential the Tessar Ic should be specified. In the medium and shorter focal lengths it is widely used as an enlarging objective as well as for negative making, due to

its flat field and critical definition at large stops. In the longer focal lengths, the Tessar Ic is widely used by portrait and commercial photographers and illustrators for critical work of every variety.

Light absorption is reduced to a minimum in Tessar Ic because this lens is made of relatively thin, colorless glass elements of high transparency. Compact mounting is another feature which extends the usefulness. When supplied in barrel, the Tessar Ic can be fitted readily to reflecting cameras; mounted in shutter it can be used in compact cameras of the hand and stand types. The longer focal length lenses when furnished in barrel are provided with front lens mounting as shown below. The shorter focal lengths have mounts similar to the Tessar IIb illustrated on page 11.

Full details as to the possibility of mounting the Tessar Ic on any camera will be furnished on request.



BAUSCH & LOMB TESSAR IIb, f:6.3

THE Tessar IIb is recommended for critical work of every kind, including commercial, group, engineering, clinical and record photography, copying, enlarging and photomicrography. This series is also suitable for color work, and black and white, using panchromatic negative material.

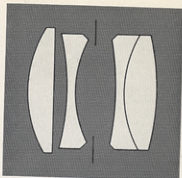
Another desirable application of the Tessar IIb is its use in precision projection, as in the enlargement of spectrograms, scales or other subjects requiring extremely close register. For this class of work, the exquisite definition and flat field enable the operator to hold to very close limits. The Tessar IIb can be furnished in rack and pinion focusing mount for this purpose. Choice of focal length will depend upon desired image size at specified projection distance.

The Tessar IIb is of the same basic design as the Tessar Ic. The main difference is that of speed. In the

Tessar IIb the largest relative aperture is f:6.3 which is held throughout the entire series. This speed, f:6.3, is about 61% faster than lenses rated at f:8 (U.S.4) and 49% faster than f:7.7. At the same diaphragm values and equal focal lengths, the Series Ic and Series IIb have the same depth of field.

Uniform precision and sharpness of definition of the image on the plate from center to margin, and unusually brilliant and evenly distributed illumination characterize Tessar IIb performance. The covering power, or area of critical sharpness, is further increased at small working diaphragm values, an important feature when extreme range of rising and falling front adjustments is used.

Because of its lesser speed, the Tessar IIb is smaller and lighter than the Tessar Ic of corresponding focal length. This makes it possible to adapt the Tessar IIb to hand and stand cameras of compact design.



The B&L Tessar IIb is of the same general design as the Ic. As in the Tessar Ic, relatively simple construction results in exceptional flatness of field and anastigmatic correction.

Tessar IIb, f:6.3

Available in barrel or factory fitted shutter. See Price List for mountings.

Covers at f:6.3, Inches	E. F., Inches	E. F. in mm
2½ x 3½	4½	117
4 x 5	6¼	158
5 x 7	7	179
5 x 8	8¾	213
6½ x 8½	10	255
8 x 10	12	305

Lens in barrel is furnished in a case; cap and flange are included.

When lens is ordered in shutter, case is not furnished; cap and flange are furnished.



Tessar IIb, 8 x 10, in Regular Barrel Mount

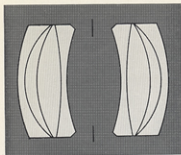


Diagram of a B&L Protar VIIa made up of two identical Protars VII. Each Protar VII is a complete anastigmat, usable alone or in combination with other Series VII Protars to form convertible doublets.

BAUSCH & LOMB

PROTARS—VII and VIIa

IN the Series VII and VIIa Protars the scientific and technical photographer is provided with lens equipment to cover a wide variety of work.

Series VII Protars are single anastigmats, composed of four thin glass elements cemented together and carefully mounted in a metal cell of standard size which fits either end of the lens barrel or shutter. The single Series VII Protar is so highly corrected for spherical, astigmatic and chromatic aberrations that it can be used alone with entire satisfaction, and is practically rectilinear over plate areas for which it is listed.

Series VIIa Protars are doublets, consisting of a pair of Series VII Protars of like or unlike foci, fitted in a barrel or shutter—one Series VII element being used on each side of the diaphragm. Thus a Series VIIa Protar can be chosen to make available two focal lengths when similar Series VII Protars are used and three focal lengths when Series VII Protars of unequal foci are chosen. The

speed of the doublet is in every case greater than that of the single combination ($f:12.5$) and will be $f:6.3$ when combinations of equal focal length are used, $f:7$ and $f:7.7$ when combinations of unequal focal length are chosen.

The Bausch & Lomb Series VIIa Protar is a truly convertible anastigmat. This means that the owner can add Series VII Protars at any time to increase the number of focal lengths. Any Series VIIa Protar, $f:7$ or $f:7.7$, by the addition of One Series VII Protar of suitable focal length, will provide the working equivalent of six separate photographic objectives, giving the photographer more complete control of perspective. He can operate under conditions requiring medium wide angle to long focus lenses.

Thus, a Series VIIa Protar is a high grade photographic objective which, complete, can be used for all critical work. At the same time the Protar VIIa provides one or two highly corrected longer focus combinations, in effect, telephoto anastigmats. These, with modern sensitive material, have

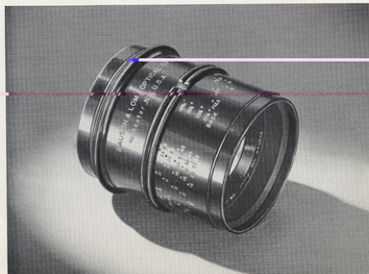
sufficient speed to cover any type of exposure required.

This feature makes the Series VIIa Protar desirable for use on modern hand, clinical, commercial and reflecting cameras with sufficient bellows extension to permit use of the single combinations. The extensive use of the Series VIIa Protar by commercial photographers is evidence of its value in filling widely varied needs with the minimum outlay for apparatus.

The Series VIIa Protar is recommended for the highest class architectural, engineering, nature, biological and anatomical photography; expeditions and geological surveys; progress of work and clinical records in black and white. Its reserve covering power and even illumination make it desirable in any work where the full range of camera movements is required.

The Series VIIa Protar, $f:6.3$, is recommended for three-color separation work.

Recommendations for combinations to fill specific needs are made gladly on request.



Convertible Protar VIIa, 8×10 , in F Set Barrel Mount

Protar VII, f:12.5

Available in Cell without Barrel or Shutter, in Barrel with Iris Diaphragm, and Factory Fitted Shutters. See Price List for Mountings

Plate Covered with Full Aperture, Inches	Equivalent Focus, Inches	Back Focus, Inches	Equivalent Focus in mm	Back Focus in mm	Speed <i>f</i>
5 × 7	9	9¾	228	248	12.5
6½ × 8½	11½	12½	290	315	12.5
8 × 10	13¾	15¼	350	385	12.5
10 × 12	16¼	17¾	415	450	12.5
11 × 14	19	20½	485	520	12.5
12 × 16	23½	25½	600	650	12.5
13 × 16	27	30	690	760	12.5

Convertible Protar VIIa, f:6.3, f:7.0 and f:7.7

Available in Barrel with Iris Diaphragm and Factory Fitted Shutters. See Price List for Mountings

Plate Covered with Full Aperture, Inches	Equivalent Focus, Inches	Equivalent Focus in mm	Speed <i>f</i>	E. F., Inches—Component Series VII Protars	
				Front Lens	Back Lens
4 × 5	5½	131	6.3	9	9
4¼ × 6½	5¾	146	7.0	11½	9
4¼ × 6½	6¼	158	7.7	13¾	9
4½ × 7¼	6½	165	6.3	11½	11½
5 × 7	7¼	182	7.0	13¾	11½
5 × 8	7¾	195	7.7	16¼	11½
5 × 8	7¾	202	6.3	13¾	13¾
6½ × 8½	8½	218	7.0	16¼	13¾
6½ × 8½	9¼	233	7.7	19	13¾
6½ × 8½	9¾	237	6.3	16¼	16¼
7 × 9	10	255	7.0	19	16¼
7 × 9	11	280	7.7	23½	16¼
7 × 9	10¾	275	6.3	19	19
8 × 10	12	305	7.0	23½	19
8 × 10	12¾	325	7.7	27	19
8 × 10	13½	340	6.3	23½	23½
10 × 12	14½	370	7.0	27	23½
10 × 12	15¾	400	6.3	27	27

Lens in barrel is furnished in a case; cap, flange and screen ring are included. When lens is ordered in shutter, case is not furnished; cap, flange and screen ring included. The diaphragm scale is graduated for each focal length of Protar VIIa.

C Set—for 4 x 5

Complete C Set consists of barrel or shutter with three Series VII Protars (9", 11½", 13½" E. F.) which singly and in combination provide 6 focal lengths and coverage shown in table below.

E. F., Inches			Speed f	Size of Plate Covered, Inches
Front	Rear	Comb.		
	9		12.5	5 x 7
	11½		12.5	6½ x 8½
	13½		12.5	8 x 10
11½	9	5½	7.0	4¼ x 6½
13½	9	6½	7.7	4¼ x 6½
13½	11½	7½	7.0	5 x 7

D Set—for 5 x 7

Four Series VII Protars (11½", 13½", 16½" and 19" E. F.) in barrel or shutter make up the complete D Set, which provides 9 focal lengths and coverage as shown in table below.

E. F., Inches			Speed f	Size of Plate Covered, Inches
Front	Rear	Comb.		
	11½		12.5	6½ x 8½
	13½		12.5	8 x 10
	16½		12.5	10 x 12
	19		12.5	11 x 14
13½	11½	7½	7.0	5 x 7
16½	11½	7½	7.7	5 x 8
16½	13½	8½	7.0	6½ x 8½
19	13½	9½	7.7	6½ x 8½
19	16½	10	7.0	7 x 9

BAUSCH & LOMB CONVERTIBLE PROTAR VIIa

SETS C, D and F

As a convenience to technical photographers Protar VIIa Sets for 4 x 5, 5 x 7 and 8 x 10 negative size are listed. For owners of cameras with sufficient bellows draw to utilize the components separately these

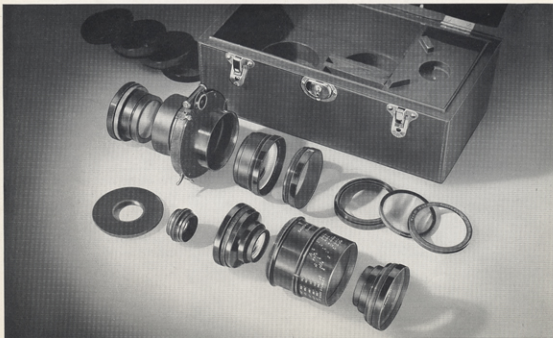
sets are very desirable. For the commercial photographer working with 8 x 10, the F Set is available. It provides in one outfit all the lens equipment needed to cover practically every assignment.

F Set—for 8 x 10

9 focal lengths and coverage as shown below are provided by four Series VII Protars (16½", 19", 23½", 27½" E. F.). Supplied in suitably marked barrel or shutter.

E. F., Inches			Speed f	Size of Plate Covered, Inches
Front	Rear	Comb.		
	16½		12.5	10 x 12
	19		12.5	11 x 14
	23½		12.5	12 x 16
	27		12.5	13 x 16
19	16½	10	7.0	7 x 9
23½	16½	11	7.7	7 x 9
23½	19	12	7.0	8 x 10
27	19	12½	7.7	8 x 10
27	23½	14½	7.0	10 x 12

Convertible Protar VIIa Complete F Set for 8 x 10 Negative Size, including F Set Protar VIIa and Series V Wide Angle, filters, barrel, shutter and case

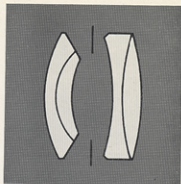
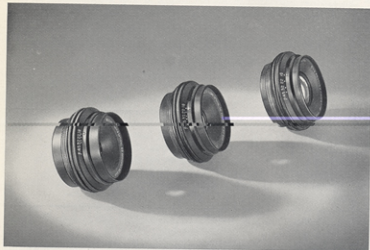


BAUSCH & LOMB PROTAR V, f:18, EXTREME WIDE ANGLE

THE Series V Protar is recommended for the most exacting wide angle photography, because the corrections for flatness of field and astigmatism have been carried to a high degree. Its effective angle

and covering capacity especially recommend the Protar V for architectural and interior photography, and work in confined conditions. Reserve covering power is available for extreme rise and fall of front.

Series V Protars for 4 x 5, 5 x 7 and 8 x 10



The B&L Protar V consists of two cemented pairs, both of which are required in providing the exceptional coverage with correction for which this objective is noted.

Protar V, f:18

Available in Barrel with Iris Diaphragm, and *Excessy Fitted Shutters*. See Price List for Mountings.

Covers at f:18, Inches	E. F., Inches	E. F. in mm
4 x 5*	3 1/4	90
5 x 7	4 1/2	113
8 x 10	7 1/4	183

*Supplied in barrel only.

Lens in barrel is furnished in a case; cap and flange are included.

When lens is ordered in shutter, case is not furnished; cap and flange are furnished.

BAUSCH & LOMB ENLARGING CONDENSERS

BAUSCH & LOMB Condensers for enlarging are well annealed, carefully ground and polished, and are made from practically colorless

glass. They are furnished in wood mounts, opening up like a book. The outer surface of the mount is protected by metal and the condensers

may be placed safely on edge, without rolling or danger of scratching.

Pair of Condensers Mounted

Recommended for Negative Size	Condenser Diameter, Inches	Condenser E. F., Inches	Lens Separation
3 1/4 x 5 1/2 or 4 x 5	6 1/2	8 1/8	3 1/8"
4 3/4 x 6 1/2	8	6 1/4	7/8"
5 x 7	9	7 3/8	9/8"
5 x 8	10	7 3/8	1 1/8"
6 1/2 x 8 1/2	12	9	1 1/8"
8 x 10	14	10 3/4	1 1/2"





The B&L Process Apochromat employs four single lenses in combination. In this design a high order of correction is provided by relatively simple but extremely precise construction.

BAUSCH & LOMB PROCESS APOCHROMAT, f:10, AND PHOTOENGRAVING PRISMS

ALTHOUGH its most important application is in photoengraving, where the utmost in definition and freedom from all aberrations is essential, the Bausch & Lomb Process Apochromat is useful in scientific and technical work where similar precision is required.

The Process Apochromat has exceptional spherical correction, and

unusual freedom from distortion and zonal aberration. This lens is corrected especially for scientific and commercial photography of near-by objects, distant from 1 to 10 times the focal length of the lens.

The Process Apochromat is highly recommended for the most exacting work at unit magnification in both color and black and white.

PHOTOENGRAVING PRISMS

USED in photoengraving to reverse the image formed by the lens from left to right. Also useful in direct photography of text materials, scales, drawings, etc. These prisms are made of selected, homogeneous glass. They are precisely worked to the highest optical standards specified for accurate prism work.

Process Apochromat, f:10, in Barrel with Iris Diaphragm, with 5 Waterhouse Stops

Covers for Same Size Reproduction, Inches	Covers for Reduction, Inches	E. F., Inches	E. F. in mm	Diameter of Lens, Inches
8 x 10	6½ x 8½	10¼*	260	1
11 x 14	8 x 10	12¾	325	1⅜
12 x 15	10 x 12	16¼	410	1¾
14 x 17	12 x 15	18	455	2
20 x 24	16 x 20	25	640	2½

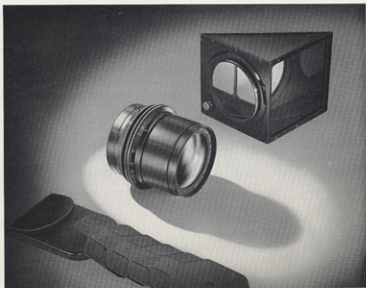
*Supplied in Barrel with Iris only—no Waterhouse Stops.

Photoengraving Prisms

Aperture of Prism, Inches	For Bausch & Lomb Process Apochromat
2	260 mm E. F.
2½	325 mm E. F.
3	410¼ mm E. F.
3½	455 mm E. F.
4	640 mm E. F.

Other sizes quoted on request.

Waterhouse Stops,
B&L Process Apochromat and
Photoengraving Prism



BAUSCH & LOMB AERO TESSAR Ic, f:4.5

DESIGNED primarily for aerial photography of the most critical nature, the Aero Tessar utilizes the inherent possibilities of the basic Tessar formula. As a result, corrections of very high order have been achieved for flatness of field, uniform magnification from center to corners and microscopic definition. These have been achieved without

sacrifice of speed essential to successful working under all flying conditions. Aero Tessar negatives are notable for their enlarging possibilities.

The Aero Tessar is available in barrel, in focusing mount, 8 feet to infinity, and in cells, and in equivalent focal lengths of 10 and 12 inches. The normal plate area covered at f:4.5 is 7 x 9 inches.

Aero Tessar Ic, f:4.5 with Iris Diaphragm

Covers at f:4.5 Aperture Inches	E. F. in Inches	E. F. in mm
7 x 9	10	255
7 x 9	12	305

BAUSCH & LOMB BALTARS For 35mm Motion Picture Cameras

THE Baltar was produced to meet the highly specialized and critical requirements of the most advanced motion picture photography. It was made in answer to a definite request for the best possible lens for both black and white and color work, without regard to expense involved.

The corrections of the Baltar establish new standards for defining power resolution, freedom from flare,

coma, astigmatism, spherical aberration and curvilinear distortion. The field is flat. The optical characteristics of modern emulsions have been considered carefully in this design. These have set up new and rigid requirements in freedom from chromatic errors which have been met.

Coupled with the superiority of the Baltar formula is the care in manufacture and the rigid tests which

each lens must undergo. The Baltar is recommended for the highest type of critical motion picture photography and is now being used for this by leading studios.

To make the advantages available for each of the different types of work encountered in modern picture production, the Baltar is made in eight equivalent focal lengths, from wide angle to telephoto.

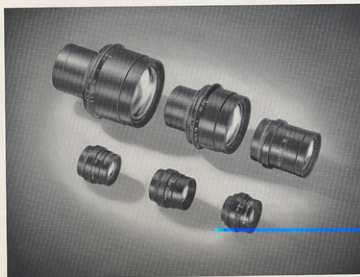
Baltar f:2.3

For 35mm Motion Picture Cameras
In Barrel with completely closing iris

Equivalent Focus	Speed
*25mm	f:2.3
*30mm	f:2.3
35mm	f:2.3
40mm	f:2.3
50mm	f:2.3
75mm	f:2.3
100mm	f:2.3
152mm	f:2.7

*Iris diaphragm not completely closing.

Bausch & Lomb
Baltars in Standard Mounts





Micro Tessars f:4.5

BAUSCH & LOMB MICRO TESSARS

MICRO TESSARS are short focus lenses of the Tessar type designed especially for low power photomicrography. For the same magnification they are to be preferred over regular microscope objective and eyepiece combinations whenever it is required to cover the largest possible area with a minimum of curvature of field. The superior flatness of field is obtained by reason of lower numerical aperture as compared to high power microscope objectives, and more complex construction as compared to ordinary low power microscope objectives. When operated at such camera extensions as to give a magnification of 10X, they work at a numerical aperture of 0.10 which is the same as the 32mm achromatic microscope objective. But because of the simpler construction of the latter, aberrations at the margin of the field cannot be reduced to the same degree as is possible in Micro Tessars.

Micro Tessars may be used for enlarging up to 50 or more diameters, depending on the available bellows draw of the camera. In using

them for very low magnifications, it is advisable to reduce the aperture somewhat to secure the best definition, since they are designed to work to best advantage at somewhat higher magnifications. In every case Micro Tessars are used without an eyepiece, and the large lens should face the longer conjugate.

The diameter of field covered by Micro Tessars depends upon conditions of illumination, focal length of the lens and magnification. Generally, at a given magnification, the field covered will result in an image greater than available plate area.

These lenses are supplied in four convenient focal lengths: 72mm, 48mm, 32mm and 16mm. The 72mm is supplied in a regular photographic lens barrel which by means of suitable adapters can be fitted directly to the lens board or shutter of the camera. The others are supplied in mounts threaded with the standard society screw thread so as to fit the regular microscope nosepiece, but suitable adapters are supplied so that they can be fitted to the lens board of the camera.

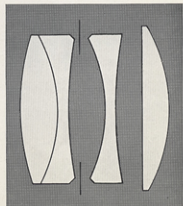
The 72mm, 48mm and 32mm lenses are equipped with iris diaphragms, providing a control of the aperture from f:4.5 to f:22.0 for the 72mm and 48mm lenses and to f:16.0 for the 32mm. The 16mm lens is made with the fixed relative aperture of f:4.5. Although the depth of focus of these Tessars is usually sufficient for most subjects, it may be increased for special cases by reducing the diaphragm aperture.

Micro Tessar, f:4.5

Available in Barrel as specified

Description
72mm (2 $\frac{3}{4}$ ") Equivalent Focus
48mm (2") Equivalent Focus
32mm (1 $\frac{1}{4}$ ") Equivalent Focus
16mm ($\frac{3}{4}$ ") Equivalent Focus
Rack and Pinion Focusing Mount, fitting front board of camera, and accommodating shutters or adapters for photographic lenses
Adapter for fitting 72mm Micro Tessars and photo lenses to front of shutter or focusing mount
Adapter for use with 72mm adapter to fit 16, 32 or 48mm Micro Tessars to shutter or focusing mount

When the Micro Tessar Lens or combined lens and shutter is used on the camera, we recommend that it be mounted on a rack and pinion focusing mount.





Bausch & Lomb

PHOTOGRAPHIC LENSES

PROTAR VII and VIIa



BAUSCH & LOMB PROTARS—VII and VIIa

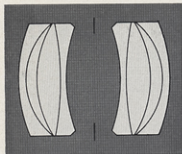


Diagram of a B&L Protar VIIa made up of two identical Protars VII. Each Protar VII is a complete anastigmat, usable alone or in combination with other Series VII Protars to form convertible doublets.

IN the Series VII and VIIa Protars the scientific and technical photographer is provided with lens equipment to cover a wide variety of work.

Series VII Protars are single anastigmats, composed of four thin glass elements cemented together and carefully mounted in a metal cell of standard size which fits either end of the lens barrel or shutter. The single Series VII Protar is so highly corrected for spherical, astigmatic and chromatic aberrations that it can be used alone with entire satisfaction, and is practically rectilinear over plate areas for which it is listed.

Series VIIa Protars are doublets, consisting of a pair of Series VII Protars of like or unlike foci, fitted in a barrel or shutter—one Series VII element being used on each side of the diaphragm. Thus a Series VIIa Protar can be chosen to make available two focal lengths when similar Series VII Protars are used and three focal lengths when Series VII Protars of unequal foci are chosen. The speed of the doublet is in every case greater than that of the single combination ($f:12.5$) and will be $f:6.3$ when combinations of equal focal

length are used, $f:7$ and $f:7.7$ when combinations of unequal focal length are chosen.

The Bausch & Lomb Series VIIa Protar is a truly convertible anastigmat. This means that the owner can add Series VII Protars at any time to increase the number of focal lengths. Any Series VIIa Protar, $f:7$ or $f:7.7$, by the addition of one Series VII Protar of suitable focal length, will provide the working equivalent of six separate photographic objectives, giving the photographer more complete control of perspective. He can operate under conditions requiring medium wide angle to long focus lenses.

Thus, a Series VIIa Protar is a high grade photographic objective which, complete, can be used for all critical work. At the same time the Protar VIIa provides one or two highly corrected longer focus combinations, in effect, telephoto anastigmats. These, with modern sensitive material, have sufficient speed to cover any type of exposure required.

This feature makes the Series VIIa Protar desirable for use on modern hand, clinical, commercial, and reflecting cameras with sufficient bellows extension to permit use of the single combinations. The extensive use of the Series VIIa Protar by commercial photographers is evidence of its value in filling widely varied needs with the minimum outlay for apparatus.

The Series VIIa Protar is recommended for the highest class architectural, engineering, nature, biological and anatomical photography; expeditions and geological surveys; progress of work and clinical records in black and white. Its reserve covering power and even illumination make it desirable in any work where the full range of camera movements is required.

The Series VIIa Protar, $f:6.3$, is recommended for three-color separation work.

Recommendations for combinations to fill specific needs are made gladly on request.



Convertible Protar VIIa,
8 x 10, in F Set Barrel Mount

BAUSCH & LOMB TESSAR IIb, f:6.3

THE Tessar IIb is recommended for critical work of every kind, including commercial, group, engineering, clinical and record photography, copying, enlarging and photomicrography. This series is also suitable for color work, and black and white, using panchromatic negative material.

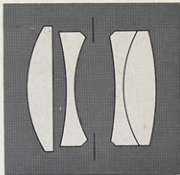
Another desirable application of the Tessar IIb is its use in precision projection, as in the enlargement of spectrograms, scales or other subjects requiring extremely close register. For this class of work, the exquisite definition and flat field enable the operator to hold to very close limits. The Tessar IIb can be furnished in rack and pinion focusing mount for this purpose. Choice of focal length will depend upon desired image size at specified projection distance.

The Tessar IIb is of the same basic design as the Tessar Ic. The main difference is that of speed. In the

Tessar IIb the largest relative aperture is f:6.3 which is held throughout the entire series. This speed, f:6.3, is about 61% faster than lenses rated at f:8 (U.S. 4) and 49% faster than f:7.7. At the same diaphragm values and equal focal lengths, the Series Ic and Series IIb have the same depth of field.

Uniform precision and sharpness of definition of the image on the plate from center to margin, and unusually brilliant and evenly distributed illumination characterize Tessar IIb performance. The covering power, or area of critical sharpness, is further increased at small working diaphragm values, an important feature when extreme range of rising and falling front adjustments is used.

Because of its lesser speed, the Tessar IIb is smaller and lighter than the Tessar Ic of corresponding focal length. This makes it possible to adapt the Tessar IIb to hand and stand cameras of compact design.



The B&L Tessar IIb is of the same general design as the Ic. As in the Tessar Ic, relatively simple construction results in exceptional flatness of field and anastigmatic correction.

Tessar IIb, f:6.3

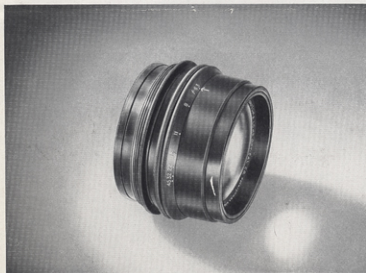
Available in barrel or factory fitted shutter.

Covers at f:6.3, Inches	E.F., Inches	E.F. in mm
2½ × 3½	4½	117
4 × 5	6¼	158
5 × 7	7	179
5 × 8	8¾	213
6½ × 8½	10	255
8 × 10	12	305

Lens in barrel is furnished in a case; cap and flange are included.

When lens is ordered in shutter, case is not furnished; cap and flange are furnished.

**Tessar IIb, 8 x 10, in
Regular Barrel Mount**



Orders with Priority Rating naturally take precedence. Delivery dates under current conditions cannot be guaranteed. Prices quoted do not exceed maximum price levels as established by the Office of Price Administration. Orders are subject to final acceptance at Rochester, New York, and are subject to taxes, excises or other Government charges applicable at time of shipment.

BAUSCH & LOMB OPTICAL COMPANY
Main Offices and Works - Rochester 2, New York, U. S. A.

Protar VII, f:12.5

Available in Cell without Barrel or Shutter, in Barrel with Iris Diaphragm, and Factory Fitted Shutters.

Plate Covered with Full Aperture, Inches	Equivalent Focus, Inches	Back Focus, Inches	Equivalent Focus in mm	Back Focus in mm	Speed <i>f</i>
5 x 7	9	9 $\frac{3}{4}$	228	248	12.5
6 $\frac{1}{2}$ x 8 $\frac{1}{2}$	11 $\frac{1}{2}$	12 $\frac{1}{2}$	290	315	12.5
8 x 10	13 $\frac{3}{4}$	15 $\frac{1}{4}$	350	385	12.5
10 x 12	16 $\frac{1}{4}$	17 $\frac{3}{4}$	415	450	12.5
11 x 14	19	20 $\frac{1}{2}$	485	520	12.5
12 x 16	23 $\frac{1}{2}$	25 $\frac{1}{2}$	600	680	12.5
13 x 16	27	30	690	760	12.5

Convertible Protar VIIa, f:6.3, f:7.0 and f:7.7

Available in Barrel with Iris Diaphragm and Factory Fitted Shutters.

Plate Covered with Full Aperture, Inches	Equivalent Focus, Inches	Equivalent Focus in mm	Speed <i>f</i>	E.F., Inches—Component Series VII Protars	
				Front Lens	Back Lens
4 x 5	5 $\frac{1}{4}$	131	6.3	9	9
4 $\frac{1}{4}$ x 6 $\frac{1}{2}$	5 $\frac{3}{4}$	146	7.0	11 $\frac{1}{2}$	9
4 $\frac{1}{4}$ x 6 $\frac{1}{2}$	6 $\frac{1}{4}$	158	7.7	13 $\frac{3}{4}$	9
4 $\frac{1}{2}$ x 7 $\frac{1}{4}$	6 $\frac{1}{2}$	165	6.3	11 $\frac{1}{2}$	11 $\frac{1}{2}$
5 x 7	7 $\frac{3}{8}$	182	7.0	13 $\frac{3}{4}$	11 $\frac{1}{2}$
5 x 8	7 $\frac{3}{4}$	195	7.7	16 $\frac{1}{4}$	11 $\frac{1}{2}$
5 x 8	7 $\frac{3}{4}$	202	6.3	13 $\frac{3}{4}$	13 $\frac{3}{4}$
6 $\frac{1}{2}$ x 8 $\frac{1}{2}$	8 $\frac{3}{4}$	218	7.0	16 $\frac{1}{4}$	13 $\frac{3}{4}$
6 $\frac{1}{2}$ x 8 $\frac{1}{2}$	9 $\frac{3}{8}$	233	7.7	19	13 $\frac{3}{4}$
6 $\frac{1}{2}$ x 8 $\frac{1}{2}$	9 $\frac{3}{8}$	237	6.3	16 $\frac{1}{4}$	16 $\frac{1}{4}$
7 x 9	10	255	7.0	19	16 $\frac{1}{4}$
7 x 9	11	280	7.7	23 $\frac{1}{2}$	16 $\frac{1}{4}$
7 x 9	10 $\frac{3}{4}$	275	6.3	19	19
8 x 10	12	305	7.0	23 $\frac{1}{2}$	19
8 x 10	12 $\frac{3}{4}$	325	7.7	27	19
8 x 10	13 $\frac{1}{2}$	340	6.3	23 $\frac{1}{2}$	23 $\frac{1}{2}$
10 x 12	14 $\frac{1}{2}$	370	7.0	27	23 $\frac{1}{2}$
10 x 12	15 $\frac{1}{4}$	400	6.3	27	27

Lens in barrel is furnished in a case; cap, flange and screen ring are included. When lens is ordered in shutter, case is not furnished; cap, flange and screen ring included. The diaphragm scale is graduated for each focal length of Protar VIIa.

C Set—for 4 x 5

Complete C Set consists of barrel or shutter with three Series VII Protars (9", 11 1/4", 13 1/4" E.F.) which singly and in combination provide 6 focal lengths and coverage shown in table below.

E.F., Inches			Speed f	Size of Plate Covered, Inches
Front	Rear	Comb.		
	9		12.5	5 x 7
	11 1/4		12.5	6 1/2 x 8 1/2
	13 1/4		12.5	8 x 10
11 1/4	9	5 3/4	7.0	4 1/4 x 6 1/2
13 1/4	9	6 1/4	7.7	4 3/4 x 6 1/2
13 1/4	11 1/4	7 1/4	7.0	5 x 7

D Set—for 5 x 7

Four Series VII Protars (11 1/4", 13 1/4", 16 1/4" and 19" E.F.) in barrel or shutter make up the complete D Set, which provides 9 focal lengths and coverage as shown in table below.

E.F., Inches			Speed f	Size of Plate Covered, Inches
Front	Rear	Comb.		
	11 1/4		12.5	6 1/2 x 8 1/2
	13 1/4		12.5	8 x 10
	16 1/4		12.5	10 x 12
	19		12.5	11 x 14
13 1/4	11 1/4	7 1/4	7.0	5 x 7
16 1/4	11 1/4	7 3/4	7.7	5 x 8
16 1/4	13 1/4	8 3/4	7.0	6 1/2 x 8 1/2
19	13 1/4	9 3/4	7.7	6 1/2 x 8 1/2
19	16 1/4	10	7.0	7 x 9

Convertible Protar VIIa Complete F Set for 8 x 10 Negative Size, including F Set Protar VIIa and Series V Wide Angle, filters, barrel, shutter and case

BAUSCH & LOMB CONVERTIBLE PROTAR VIIa

SETS C, D and F

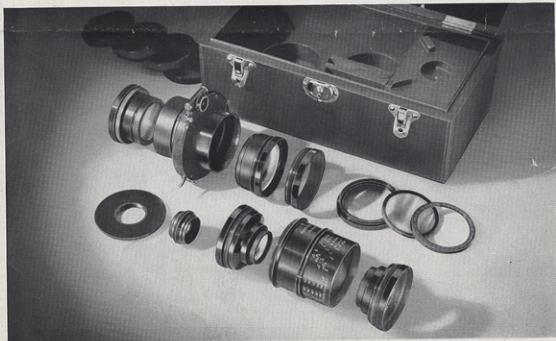
A Sa convenience to technical photographers Protar VIIa Sets for 4 x 5, 5 x 7 and 8 x 10 negative size are listed. For owners of cameras with sufficient bellows draw to utilize the components separately these

sets are very desirable. For the commercial photographer working with 8 x 10, the F Set is available. It provides in one outfit all the lens equipment needed to cover practically every assignment.

F Set—for 8 x 10

9 focal lengths and coverage as shown below are provided by four Series VII Protars (16 1/4", 19", 23 1/2", 27 1/4" E.F.). Supplied in suitably marked barrel or shutter.

E.F., Inches			Speed f	Size of Plate Covered, Inches
Front	Rear	Comb.		
	16 1/4		12.5	10 x 12
	19		12.5	11 x 14
	23 1/2		12.5	12 x 16
	27 1/4		12.5	13 x 16
19	16 1/4	10	7.0	7 x 9
23 1/2	16 1/4	11	7.7	7 x 9
23 1/2	19	12	7.0	8 x 10
27 1/4	19	12 3/4	7.7	8 x 10
27 1/4	23 1/2	14 1/4	7.0	10 x 12



Orders with Priority Rating naturally take precedence. Delivery dates under current conditions cannot be guaranteed. Prices quoted do not exceed maximum price levels as established by the Office of Price Administration. Orders are subject to final acceptance at Rochester, New York, and are subject to taxes, excises or other Government charges applicable at time of shipment.

BAUSCH & LOMB OPTICAL COMPANY
Main Offices and Works - Rochester 2, New York, U. S. A.

TABLE OF MAGNIFICATIONS

for the Micro Tessar, Tessar Ic, Tessar Iib, and Process Apochromat

This table will enable the user to determine the amount of enlargement or reduction possible with bellows draw available, when employing lenses of from 16mm to 305mm E.F. The upper figure is the Object distance. The lower figure is the Image distance. For reductions, interchange the object and image distances given in table. Distances are measured to the principal planes of the lens.

To compute approximate object and image distance for a lens of any equivalent focus use the following formula:

$$U = F \left(1 + \frac{1}{M} \right), V = F (1 + M). \quad U \text{ is object distance, } V \text{ image distance, } F \text{ focal length and } M \text{ magnification.}$$

Magnification	MICRO TESSAR				TESSAR Ic—TESSAR Iib—PROCESS APOCHROMAT															
	16mm in mm	32mm in mm	48mm in mm	72mm in mm	90mm in mm	113mm in mm	117mm in mm	139mm in mm	158mm in mm	164mm in mm	179mm in mm	190mm in mm	210mm in mm	213mm in mm	255mm in mm	305mm in mm				
1 ×	32 32	64 64	96 96	144 144	180 180	226 226	234 234	278 278	316 316	328 328	358 358	380 380	420 420	426 426	510 510	610 610				
2 ×	24 48	48 96	72 144	108 216	135 270	170 339	176 351	209 417	237 474	242 496	269 537	285 570	315 630	320 639	383 765	458 915				
3 ×	21.3 64	42.7 128	64 192	96 288	120 360	151 452	156 468	185 556	211 632	219 656	239 716	254 760	280 840	284 852	340 1020	407 1220				
4 ×	20 80	40 160	60 240	90 360	113 450	141 565	146 585	174 695	198 790	205 820	224 895	238 950	263 1050	266 1065	319 1275	381 1525				
5 ×	19.2 96	38.4 192	57.6 288	86.4 432	108 540	136 678	140 702	167 834	190 948	197 984	215 1074	228 1160	252 1260	256 1278	306 1380	366 1830				
6 ×	18.7 112	37.3 224	56 336	84 504	105 630	132 791	137 819	162 973	184 1106	191 1148	209 1253	221 1330	245 1470	249 1491	298 1785	355 2135				
7 ×	18.3 128	36.6 256	54.9 384	82.3 576	103 720	129 904	134 936	159 1112	181 1264	187 1312	205 1432	217 1520	240 1680	243 1704	291 2040	349 2440				
8 ×	18 144	36 288	54 432	81 648	101 810	127 1017	132 1053	156 1251	178 1422	185 1476	202 1611	214 1710	236 1890	240 1917	287 2295	343 2745				
9 ×	17.8 160	35.6 320	53.3 480	80 720	100 900	126 1130	130 1170	156 1390	176 1580	182 1640	199 1790	211 1900	233 2100	237 2130	283 2550	339 3050				
10 ×	17.6 176	35.2 352	52.8 528	79.2 792	99 990	124 1243	129 1287	153 1529	174 1738	180 1804	197 1969	209 2090	231 2310	234 2343	281 2805	336 3355				
15 ×	17.1 256	34.1 512	51.2 768	76.8 1152																
20 ×	16.8 336	33.6 672	50.4 1008	75.6 1512																
25 ×	16.6 416	33.3 832	49.9 1248	74.8 1872																
30 ×	16.5 496	33.08 992	49.6 1488	74.4 2232																
40 ×	16.4 656	32.8 1312	49.2 1968	73.8 2952																

DEPTH OF FIELD

Depth of field is one of the desirable characteristics of the Micro Tessars and following is the method of computing the depth of field and examples of the computation.

$$\text{Depth of field} = \frac{cU}{m\phi - c} + \frac{cU}{m\phi + c}$$

c = radius of circle of least confusion; U = distance from the object to the front principal plane $U = F \left(1 + \frac{1}{M} \right)$;

m = magnification; $\phi = \frac{1}{2}$ diameter of aperture of the entrance pupil (relative aperture = $\frac{F}{2\phi}$); F = equivalent focal length.

Example 1—48mm Micro Tessar stopped at f:4.5 (relative aperture) working at magnification of 10 ×. $C = 0.05mm$

$$\text{Depth of Field} = \frac{0.05 \times 52.8}{10 \times 5.333 - 0.05} + \frac{0.05 \times 52.8}{10 \times 5.333 + 0.05} = \frac{2.64}{53.28} + \frac{2.64}{53.38} = 0.0495 + 0.0494 = 0.099mm$$

From the above formula it will be seen that it is possible to photograph an object not more than 0.099mm in thickness or a section of no greater thickness without the circle of least confusion being larger than 0.1mm in diameter for any part.

Example 2—The effect of stopping down to secure greater depth of field is shown below. Here all the conditions are taken as being the same as above except that the Micro Tessar is stopped down to f:8.

$$\text{Depth of Field} = \frac{2.64}{10 \times 3 - 0.05} + \frac{2.64}{10 \times 3 + 0.05} = \frac{2.64}{29.95} + \frac{2.64}{30.05} = 0.088 + 0.088 = 0.176mm$$



THE BAUSCH & LOMB OPTICAL COMPANY normally manufactures several types of photographic objectives and optical systems not shown herein due to limited demand, special application, or manufacturers' specification. Such applications range from aerial mapping and x-ray photography to sound recording. If you have a photographic problem wherein optical parts are involved, such as objectives, condensing systems or prisms, your specific requirements will receive individual consideration.

BAUSCH & LOMB OPTICAL CO.

MAIN OFFICES AND WORKS, ROCHESTER, NEW YORK, U. S. A.

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Branch offices are maintained in New York, Chicago, San Francisco, Toronto, London, and Rio de Janeiro, where sample lines of our products are carried for inspection. Our products are also supplied by dealers in the United States and Canada and by our representatives in foreign countries.

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Stereo-Campimeter
Universal Slit Lamp

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Glass to meet the exacting specifications for all types of scientific instruments is made in the Bausch & Lomb Glass Plant, the only one of its kind in America.

Orthogon "wide vision" eyeglass lenses, designed by the Bausch & Lomb Scientific Bureau, afford perfect correction from center to edge. Enjoy their advantages—ask for them the next time you have your eyes examined.



Consumer Price List for Catalog F-127

PHOTOGRAPHIC LENSES, SHUTTERS, AND ACCESSORIES

Effective February 16, 1942

Prices shown herein include Excise Tax effective as of October 1, 1941

Not in force now



PRICES SUBJECT MFGR'S EXCISE TAX

BAUSCH & LOMB OPTICAL COMPANY
ROCHESTER, N. Y., U. S. A.

NEW YORK

CHICAGO

SAN FRANCISCO

TORONTO

LONDON, ENG.

RIO DE JANEIRO

TERMS

When ordering, give catalog number and name of item. Use code words in telegraphing. Orders can now be sent by telegraph between points in the United States, in the same message with remittance.

Financial Standing

To avoid delay, purchasers with whom we have no account may accompany their first order with commercial references or remittance in cash.

Shipments

All orders will be shipped transportation charges prepaid to consumer. The customer pays the shipping charges on goods sent on memorandum. C.O.D. shipments will be made if sufficient funds to cover the shipment both ways accompany the order. Goods made on special order can not be forwarded C.O.D.

The prices herein are subject to change without notice and to addition or increase for applicable taxes, excises or other charges imposed by any governmental authority with respect to the articles listed herein, or to the sale, use or consumption thereof. Orders are subject to final acceptance at Rochester, New York, and are accepted subject to prices prevailing at time of shipment.

To secure **Tax-free Price** for sales to government agencies or Tax-free Institutions order must be accompanied by Tax Exemption Certificate.

The **Equivalent Focal Length** of all current Bausch & Lomb Photographic Lenses is engraved on the lens cell, in the metric system.

We will **repair** Bausch & Lomb Photographic Lenses and Accessories. Please submit equipment, for estimates of charges, to Photographic Repair Department.

The **Supermatic Shutter**, manufactured by Eastman Kodak Co., is of the gear controlled type, giving automatically controlled speeds of from 1 second to 1/400 second inclusive, Time and Bulb. The shutter must be cocked for all settings. Settings can be made before or after cocking. The Supermatic Shutter has a built-in self timer or delayed-action device with its own cocking lever. Pressure on the regular shutter release starts the delayed action mechanism which results in making the exposure 10 to 15 seconds later. Extra flanges and releases should be ordered direct from Eastman Kodak Co., Rochester, N. Y.

The **Betax Shutter**, manufactured by the Wollensak Optical Co., is of the automatic type with gearless, pumpless retarding mechanism for all automatic exposures, Time and Bulb. Speed ranges are as follows: No. 2 Shutter: Time, Bulb, 1/100, 1/50, 1/25, 1/10, 1/5, 1/2; Nos. 3, 4, and 5 Shutters: Time, Bulb, 1/50, 1/25, 1/10, 1/5, 1/2. Extra flanges and releases should be ordered direct from Wollensak Optical Co., Rochester, N. Y.

Due to the high proportion of our production for National Defense requirements, certain items in this list may be out of stock from time to time. We shall be glad to give information as to availability.

Owing to Defense requirements, and the wide application of priorities, we cannot guarantee delivery. All orders are accepted with this understanding. Shortages may therefore develop quickly.

Damaged or Imperfect Goods

We exercise the utmost care in manufacturing and packaging. In the case of faulty goods reaching our customers, we shall feel under obligation if our attention is called to the condition. In packing, we recheck all goods, and obtain proper receipts from the transportation and insurance companies. All claims for breakage should be reported to the transportation and insurance companies at once, as they are held responsible for losses or damage to goods in transit. Please examine all packing minutely for small items.

Returning Goods

Goods being returned for any reason should be plainly tagged with the sender's name and address. We furnish identification tags on request. Whenever possible, please give the date of invoice on which the goods were originally billed.

TESSAR Ic, f:4.5
In Barrel with Iris Diaphragm

Plate Covered with Stop f:4.5, Inches	Inches	E. F. mm	Cap Number	Flange Number	Catalog Number	Code Word	Price Including Tax
2 1/4 x 3 1/4	3 1/4	91	53	13	51-21-12	Maajh	\$ 28.25
2 1/2 x 3 1/2	4 1/4	113	53	13	51-21-13	Maaml	32.00
3 1/4 x 4 1/4	5 1/2	139	55	17	51-21-14	Metil	40.50
4 x 5	6 1/4	164	57	20	51-21-15	Metom	50.10
5 x 7	7 1/2	190	60	22	51-21-25	Metun	59.70
5 x 8	8 1/4	210	64	25	51-21-16	Mebeg	73.60
6 1/2 x 8 1/2	10	255	66	27			107.70
8 x 10	12	305	80	35	51-21-18	Macij	192.00

Lens in barrel is furnished in a case; cap and flange are included. When ordering extra caps or flanges, for catalog number of cap or flange, add 51-79- ahead of cap or flange number listed above.

TESSAR Ic, f:4.5

Plate Covered with Stop f:4.5, Inches	Inches	E. F. mm	Shutter Number	Cap Number	Catalog Number	Code Word	Price Including Tax
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In Supermatic Shutter without Barrel

2 1/4 x 3 1/4	3 1/4	91	1	53	\$ 34.10
2 1/2 x 3 1/2	4 1/4	113	2	53	39.45

In Betax Shutter without Barrel

3 1/4 x 4 1/4	5 1/2	139	3	55	51-21-84	Meaff	51.20
4 x 5	6 1/4	164	3	57	51-21-85	Meagg	69.30
5 x 7	7 1/2	190	4	60	51-21-95	Meakk	80.00
5 x 8	8 1/4	210	4	64	51-21-86	Meall	96.00
6 1/2 x 8 1/2	10	255	5	66	51-21-87	Meumm	154.65
8 x 10	12	305	5	80	51-21-88	Meunn	234.65

When lens is ordered in shutter, case is not furnished; cap and flange are included. When ordering extra caps, for catalog number of cap, add 51-79- ahead of cap number listed above.

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TESSAR IIB, f:6.3
In Barrel with Iris Diaphragm

Plate Covered with Stop f:6.3, Inches	Inches	E. F. mm	Cap Number	Flange Number	Catalog Number	Code Word	Price Including Tax
2 1/2 x 3 1/2	4 1/4	117	53	13	51-23-05	.....	\$ 25.60
4 x 5	6 1/4	158	53	13	51-23-15	Hekim	32.00
5 x 7	7	179	57	20	51-23-15	Helin	44.80
5 x 8	8 1/4	213	60	22	51-23-06	Helop	57.60
6 1/2 x 8 1/2	10	255	62	25	51-23-07	Helar	96.00
8 x 10	12	305	66	27	51-23-08	Henep	182.40

Lens in barrel is furnished in a case; cap and flange are included. When ordering extra caps or flanges, for catalog number of cap or flange, add 51-79- ahead of cap or flange number listed above.

TESSAR IIB, f:6.3

Covers at f:6.3, Inches	Inches	E. F. mm	Shutter Number	Cap Number	Catalog Number	Code Word	Price Including Tax
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In Supermatic Shutter without Barrel

2 1/2 x 3 1/2	4 1/4	117	1	53	\$ 29.85
4 x 5	6 1/4	158	2	53	51-23-45	Miaic	40.50

In Betax Shutter without Barrel

5 x 7	7	179	3	57	51-23-85	Miagd	56.50
5 x 8	8 1/4	213	3	60	51-23-76	Miahf	69.30
6 1/2 x 8 1/2	10	255	4	62	51-23-77	Miajq	119.45
8 x 10	12	305	4	66	51-23-78	Miakh	203.70

When lens is ordered in shutter, case is not furnished; cap and flange are included. When ordering extra caps, for catalog number of cap, add 51-79- ahead of cap number listed above.

737.50
21.92
\$ 153.42

PROTAR VII, f:12.5
In Cell without Barrel or Shutter

Plate Covered with Stop f:12.5, Inches	E. F.		B. F.		Cap Number	Catalog Number	Code Word	Price Including Tax
	Inches	mm	Inches	mm				
5 x 7	9	228	9 $\frac{1}{4}$	248	53	.....	.....	\$ 40.80
6 $\frac{1}{2}$ x 8 $\frac{1}{2}$	11 $\frac{1}{2}$	290	12 $\frac{1}{2}$	315	55	.....	.....	51.20
8 x 10	13 $\frac{1}{4}$	350	15 $\frac{1}{4}$	385	57	.....	.....	59.70
10 x 12	16 $\frac{1}{4}$	415	17 $\frac{1}{4}$	450	60	.....	.....	60.00
11 x 14	19	485	20 $\frac{1}{2}$	520	62	.....	.....	101.30
12 x 16	23 $\frac{1}{2}$	600	25 $\frac{1}{2}$	650	66	.....	.....	145.05
13 x 16	27	690	30	760	69	.....	.....	183.45

Lens in cell is furnished with cap. When ordering extra caps, for catalog number of cap, add 51-79- ahead of cap number listed above.

PROTAR VII, f:12.5
In Barrel with Iris Diaphragm

Plate Covered with Stop f:12.5, Inches	E. F.		B. F.		Cap Number	Flange Number	Catalog Number	Code Word	Price Including Tax
	Inches	mm	Inches	mm					
5 x 7	9	228	9 $\frac{1}{4}$	248	53	13	.....	.....	\$ 53.30
6 $\frac{1}{2}$ x 8 $\frac{1}{2}$	11 $\frac{1}{2}$	290	12 $\frac{1}{2}$	315	55	17	.....	.....	64.00
8 x 10	13 $\frac{1}{4}$	350	15 $\frac{1}{4}$	385	57	20	.....	.....	72.80
10 x 12	16 $\frac{1}{4}$	415	17 $\frac{1}{4}$	450	60	22	.....	.....	90.65
11 x 14	19	485	20 $\frac{1}{2}$	520	62	25	.....	.....	112.00
12 x 16	23 $\frac{1}{2}$	600	25 $\frac{1}{2}$	650	66	27	.....	.....	155.70
13 x 16	27	690	30	760	69	30	.....	.....	202.65

Lens in barrel is furnished in a case; cap, flange and screen ring are included. When ordering extra caps or flanges, for catalog number of cap or flange, add 51-79- ahead of cap or flange number listed above.

PROTAR VII, f:12.5

Plate Covered with Stop f:12.5, Inches	E. F.		B. F.		Shutter Number	Cap Number	Catalog Number	Code Word	Price Including Tax
	Inches	mm	Inches	mm					

In Supermatic Shutter without Barrel

5 x 7	9	228	9 $\frac{1}{4}$	248	1	53	.....	.....	\$ 65.05
6 $\frac{1}{2}$ x 8 $\frac{1}{2}$	11 $\frac{1}{2}$	290	12 $\frac{1}{2}$	315	2	55	.....	.....	80.90

In Betax Shutter without Barrel

8 x 10	13 $\frac{1}{4}$	350	15 $\frac{1}{4}$	385	3	57	.....	.....	89.05
10 x 12	16 $\frac{1}{4}$	415	17 $\frac{1}{4}$	450	3	60	.....	.....	118.40
11 x 14	19	485	20 $\frac{1}{2}$	520	4	62	.....	.....	139.70
12 x 16	23 $\frac{1}{2}$	600	25 $\frac{1}{2}$	650	5	66	.....	.....	195.70
13 x 16	27	690	30	760	5	69	.....	.....	234.10

When lens is ordered in shutter, case is not furnished; cap, flange and screen ring are included. When ordering extra caps, for catalog number of cap, add 51-79- ahead of cap number listed above.

CONVERTIBLE PROTAR VIIa, f:6.3, f:7.0, f:7.7

Consisting of pairs of Series VII Protars to be used singly and in combination.

In Barrel with Iris Diaphragm

Plate Covered with Full Aperture, Inches	E. F., Inches		Combined E. F.		Speed <i>f</i>	Cap No.	Flange No.	Catalog Number	Code Word	Price Including Tax
	Front Lens	Back Lens	Inches	mm						
4 x 5	9	9	5½	131	6.3	53	13	.....	.....	\$ 93.85
4¼ x 6½	11½	9	5½	146	7.0	55	17	.....	.....	104.50
4¼ x 6½	13¼	9	6¼	158	7.7	57	20	.....	.....	113.05
4½ x 7¼	11½	11½	6½	165	6.3	55	17	.....	.....	115.20
5 x 7	13¼	11½	7½	182	7.0	57	20	.....	.....	123.70
5 x 8	16¼	11½	7½	195	7.7	60	22	.....	.....	141.85
5 x 8	13¼	13¼	7½	202	6.3	57	20	.....	.....	132.25
6¼ x 8½	16¼	13¼	8½	218	7.0	60	22	.....	.....	150.40
6¼ x 8½	19	13¼	9¼	233	7.7	62	25	.....	.....	171.70
6½ x 8½	16¼	16¼	9½	237	6.3	60	22	.....	.....	170.65
7 x 9	19	16¼	10	255	7.0	62	25	.....	.....	192.00
7 x 9	23½	16¼	11	280	7.7	66	27	.....	.....	235.70
7 x 9	19	19	10¼	275	6.3	62	25	.....	.....	213.30
8 x 10	23½	19	12	305	7.0	66	27	.....	.....	257.05
8 x 10	27	19	12¾	325	7.7	69	30	.....	.....	304.00
8 x 10	23½	23½	13½	340	6.3	66	27	.....	.....	300.80
10 x 12	27	23½	14½	370	7.0	69	30	.....	.....	347.70
10 x 12	27	27	15½	400	6.3	66	30	.....	.....	386.10

Lens in barrel is furnished in a case; cap, flange and screen ring are included.

The diaphragm scale is graduated for each focal length.

When ordering extra caps or flanges, for catalog number of cap or flange, add 51-79- ahead of cap or flange number listed above.

CONVERTIBLE PROTAR VIIa, f:6.3, f:7.0, f:7.7

Consisting of pairs of Series VII Protars to be used singly and in combination.

In Betax Shutter without Barrel

Plate Covered with Full Aperture, Inches	E. F., Inches		Combined E. F.		Speed <i>f</i>	Shutter Number	Cap Number	Catalog Number	Code Word	Price Including Tax
	Front Lens	Back Lens	Inches	mm						
4 x 5	9	9	5½	131	6.3	1	53	.....	.....	\$105.60
4¼ x 6½	11½	9	5½	146	7.0	2	55	.....	.....	121.05
4¼ x 6½	13¼	9	6¼	158	7.7	3	57	.....	.....	129.60
4½ x 7¼	11½	11½	6½	165	6.3	2	55	.....	.....	131.70
5 x 7	13¼	11½	7½	182	7.0	3	57	.....	.....	140.25
5 x 8	16¼	11½	7½	195	7.7	3	60	.....	.....	169.60
5 x 8	13¼	13¼	7½	202	6.3	3	57	.....	.....	148.80
6¼ x 8½	16¼	13¼	8½	218	7.0	3	60	.....	.....	178.10
6¼ x 8½	19	13¼	9¼	233	7.7	4	62	.....	.....	199.45
6½ x 8½	16¼	16¼	9½	237	6.3	3	60	.....	.....	198.40
7 x 9	19	16¼	10	255	7.0	4	62	.....	.....	219.70
7 x 9	23½	16¼	11	280	7.7	5	66	.....	.....	275.70
7 x 9	19	19	10¼	275	6.3	4	62	.....	.....	241.05
8 x 10	23½	19	12	305	7.0	5	66	51-48-87	Mezor	297.05
8 x 10	27	19	12¾	325	7.7	5	69	.....	.....	335.45
8 x 10	23½	23½	13½	340	6.3	5	66	.....	.....	340.80
10 x 12	27	23½	14½	370	7.0	5	69	.....	.....	379.20
10 x 12	27	27	15½	400	6.3	5	69	.....	.....	417.60

When lens is ordered in shutter, case is not furnished; cap, flange and screen ring are included.

The diaphragm scale is graduated for each focal length.

When ordering extra caps, for catalog number of cap add 51-79- ahead of cap number listed above.

EXTREME WIDE ANGLE—PROTAR SERIES V, f:18**In Barrel with Iris Diaphragm**

Plate Covered with Stop f:18, Inches	Inches	E. F. mm	Cap Number	Flange Number	Catalog Number	Code Word	Price Including Tax
4 x 5	3½	90	53	13	†51-45-01	Maing	\$37.30
5 x 7	4½	113	53	13	51-45-02	Mainb	42.65
8 x 10	7¼	183	53	13	51-45-04	Mainp	55.45

Lens in barrel is furnished in a case; cap and flange are included. When ordering extras caps or flanges, for catalog number of cap or flange, add 51-79- ahead of cap or flange number listed above.

†Supplied in barrel only.

EXTREME WIDE ANGLE—PROTAR SERIES V, f:18

Plate Covered with Stop f:18, Inches	Inches	E. F. mm	Shutter Number	Cap Number	Flange Number	Catalog Number	Code Word	Price Including Tax
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In Compur Shutter without Barrel

5 x 7	4½	113	0	51	12	51-45-02-70	Metaj	\$64.50
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In Supermatic Shutter without Barrel

8 x 10	7¼	183	1	57		51-45-44	Miadb	76.80
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When lens is ordered in shutter, case is not furnished; cap and flange are included. When ordering extra caps or flanges, for catalog number of cap or flange, add 51-79- ahead of cap or flange number listed above.

CONDENSERS FOR ENLARGING**Pair of Condensers Mounted**

Negative Size Covered, Inches	E. F. Inches	Diameter, Inches	Distance Between Lenses, Inches	Catalog Number	Code Word	Price Not Subject to Tax
3½ x 5½ or 4 x 5	5½	6½	¾	51-72-10-20	Mecow	\$ 24.00
4¼ x 6½	6¼	8	1	51-72-12-20	Medat	34.00
5 x 7	7¾	9	1¼	51-72-14-20	Medox	52.00
5 x 8	7¾	10	1½	51-72-15-20	Meecy	79.00
6½ x 8½	9	12	1¾	51-72-18-20	Meefb	99.00
8 x 10	10¾	14	2	51-72-21-20	Meehd	130.00

CONDENSERS FOR ENLARGING**One Condenser Unmounted**

Diameter, Inches	E. F., Inches	Catalog Number	Code Word	Price Not Subject to Tax
6½	10	51-71-10	Meciv	\$ 6.00
8	12	51-71-12	Mecux	11.00
9	14	51-71-14	Medev	19.00
10	15	51-71-15	Meduy	32.00
12	18	51-71-18	Meedr	42.00
14	21	51-71-21	Meegc	56.00

PROCESS APOCHROMAT, f:10
In Barrel with Iris Diaphragm
Including Five Waterhouse Stops

Covers for Same Size Reproduction, Inches	Covers for Reduction, Inches	E. F.		Diameter of Lens, Inches	Cap Number	Flange Number	Catalog Number	Code Word	Price Including Tax
		Inches	mm						
8 x 10	6½ x 8½	10¼	260	1	57	20	51-73-10	Meopn	\$ 99.20
11 x 14	8 x 10	12¾	325	1½	57	20	51-73-01	Hekon	140.00
12 x 15	10 x 12	16¼	410	1¾	62	25	.....	.....	163.60
14 x 17	12 x 15	18	455	2	64	25	.....	.....	186.65
20 x 24	16 x 20	25	640	2½	72	35	.....	.....	298.65

When ordering extra caps or flanges, for catalog number of cap or flange, add 51-79- ahead of cap or flange number listed above.
 †Supplied in barrel with iris only—no Waterhouse stops.

PHOTO-ENGRAVING PRISMS

Aperture of Prism, Inches	For Bausch & Lomb Process Apochromat		Catalog Number	Code Word	Price Fitted to B&L Lenses Not Subject to Tax
	Number	E. F., mm			
2	51-73-10	260	.....	.....	\$ 54.00
2½	51-73-01	325	.....	.....	74.00
3	51-73-02	410	.....	.....	112.00
3½	51-73-11	455	.....	.....	136.00
4	51-73-12	640	.....	.....	190.00

Other sizes quoted on request.

AERO TESSAR Ic, f:4.5

Covers at f:4.5 Aperture, Inches	E. F.		Thread Size	Catalog Number	Code Word	Price, Lens in Barrel Including Tax	Price, Lens in Focusing Mount 8 ft. to infinity Including Tax	Price, Lens in Cell Including Tax
	Inches	mm						
7 x 9	10	255	2.982 x 24T	.....	.....	\$107.70	.....	.....
7 x 9	10	255	3.625 x 20T	.....	.....	.....	\$138.65	.....
7 x 9	10	255	.....	.....	.....	.....	.....	.....
7 x 9	12	305	3.530 x 25.4T	.....	.....	192.00	.....	.....
7 x 9	12	305	4.312 x 30T	.....	.....	.....	240.00	.....
7 x 9	12	305	.....	.....	.....	.....	.....	176.00

BALTAR, f:2.3
(For 35mm Motion Picture Cameras)
In Barrel with Iris Diaphragm

Focus	Speed	Catalog Number	Code Word	Price Including Tax
25mm	f:2.3	51-17-59	Meocr	\$117.30
30mm	f:2.3	51-17-60	Meots	117.30
35mm	f:2.3	51-17-61	Meovt	122.65
40mm	f:2.3	51-17-62	Meorw	128.00
50mm	f:2.3	51-17-63	Meoxy	128.00
75mm	f:2.3	51-17-66	Meapm	144.00
100mm	f:2.3	51-17-65	Mepeg	176.00
152mm	f:2.7	51-17-67	Meplh	218.65

MICRO TESSAR, f:4.5
In Barrel with Iris Diaphragm less flange

Specifications	Thread Size	Catalog Number	Code Word	Price Including Tax
116mm (3/4") E. F.	** 797 x 36T	51-25-16-03	Magim	\$36.55
32mm (1 1/8") E. F.	** 797 x 36T	51-25-32-65	Dhehw	47.30
48mm (2") E. F.	** 797 x 36T	51-25-48-65	Dhegy	47.30
72mm (2 7/8") E. F.	1.329 x 40T	51-25-72-01	Dheft	53.75

**Society thread size, same as used on microscope objectives.
 †In barrel without iris diaphragm.

FLANGES FOR MICRO TESSAR

Thread Size	Outside Diameter, Inches	Catalog Number	Code Word	Price Including Tax
1.329 x 40T	1 11/16	51-79-13	Meigd	\$.90
.797 x 36T	1 1/4	51-79-08	Mepoj	.80

CAPS FOR BAUSCH & LOMB LENSES

Cap Diameter Inside, Inches	Catalog Number	Code Word	Price Including Tax	Cap Diameter Inside, Inches	Catalog Number	Code Word	Price Including Tax
1 1/8	51-79-53	Mejib	\$.65	3 1/4	51-79-72	Melab	\$1.10
1 1/8	51-79-55	Mejoc	.70	3 3/8	51-79-79	Melec	1.50
1 1/8	51-79-57	Mejud	.75	4 1/8	51-79-80	Melid	1.60
2	51-79-60	Mekaz	.75	4 1/8	51-79-81	Melof	1.70
2 1/8	51-79-62	Mekeb	.80	4 1/8	51-79-85	Melug	1.90
2 1/8	51-79-64	Mekic	.85	4 3/8	51-79-86	Memac	2.15
2 1/8	51-79-66	Mekod	.90	6 1/8	51-79-99	Memed	3.10
2 1/8	51-79-69	Mekuf	.95				

FLANGES FOR BAUSCH & LOMB LENSES IN BARREL

Inside Diameter, Inches	Outside Diameter, Inches	Catalog Number	Code Word	Price Including Tax
1 1/8	1 11/16	51-79-13	Meigd	\$.90
1 1/4	2 1/8	51-79-17	Meikh	1.25
2	2 1/2	51-79-20	Meijj	1.55
2 1/4	2 3/4	51-79-22	Meimk	1.65
2 1/2	3 1/8	51-79-25	Meini	1.90
2 3/4	3 3/8	51-79-27	Meipm	2.00
3	3 1/2	51-79-30	Meirn	2.15
3 1/2	4 1/8	51-79-35	Meisp	3.25
4	5 1/8	51-79-40	Meitr	4.30
4 1/2	5 3/8	51-79-45	Meivs	5.30
5	6 1/4	51-79-47	Meixv	5.90
5 1/2	6 3/8	51-79-48	Mejay	7.00