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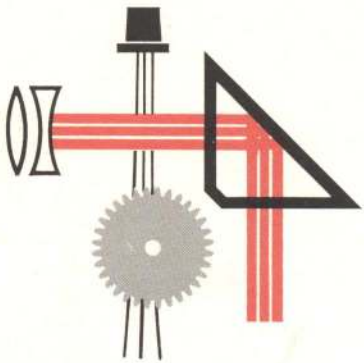

INSTRUCTIONS

Standard Teaching Microscopes

MONOCULAR ST VERTICAL IST INCLINED SERIES

BAUSCH & LOMB

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STANDARD TEACHING MICROSCOPES

MONOCULAR VERTICAL STANDARD TEACHING MODEL ST
MONOCULAR INCLINED STANDARD TEACHING MODEL IST

CAT. NO. 31-19-27

INSTRUCTIONS

SECOND EDITION
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TABLE OF CONTENTS

Page

INTRODUCTION 5

GENERAL OPERATING PROCEDURE 5
- Placing Specimen on Stage 6
- Illumination of the Specimen 6
- Focusing on the Specimen 7
  - Use of the Prefocusing Gage 7
  - Direct Focusing 8
- Use of the Revolving Nosepiece 9
- Coarse and Fine Adjustment 10
- Identification of Objectives 10
- Oil Immersion Objectives 10
  - Table of Equivalent Size of Pointer 10
  - Table of Magnifications 10
- Pointer Eyepiece 11

ILLUMINATION 11
- Substage Diaphragm Disc 12
- Condenser Integral with Stage 12
- Simplified Condenser 12
- Substage Condenser 12
  - Verti-Slide Condenser 12
  - Abbe Condensers 13
  - Focusing the Abbe Condenser 13
- Substage Iris Diaphragm 13
- Condenser with Oil Objectives 14
- Choice of Mirror 14
- Opti-lume 15

THE COVER GLASS 15

THE INCLINED MONOCULAR SERIES 17
- Reversible Eyepiece Tube 17

THE MECHANICAL STAGE 17
- Attaching Stage to Microscope 17
- Adjusting Tension of Control Knobs 18
- Vacuum Adjustment 18

CARE OF THE MICROSCOPE 18
- Care of the Stand 18
- Care of Objectives and Eyepiece 19

ACCESSORIES AND REPLACEMENTS 21

EXPLODED VIEW 22

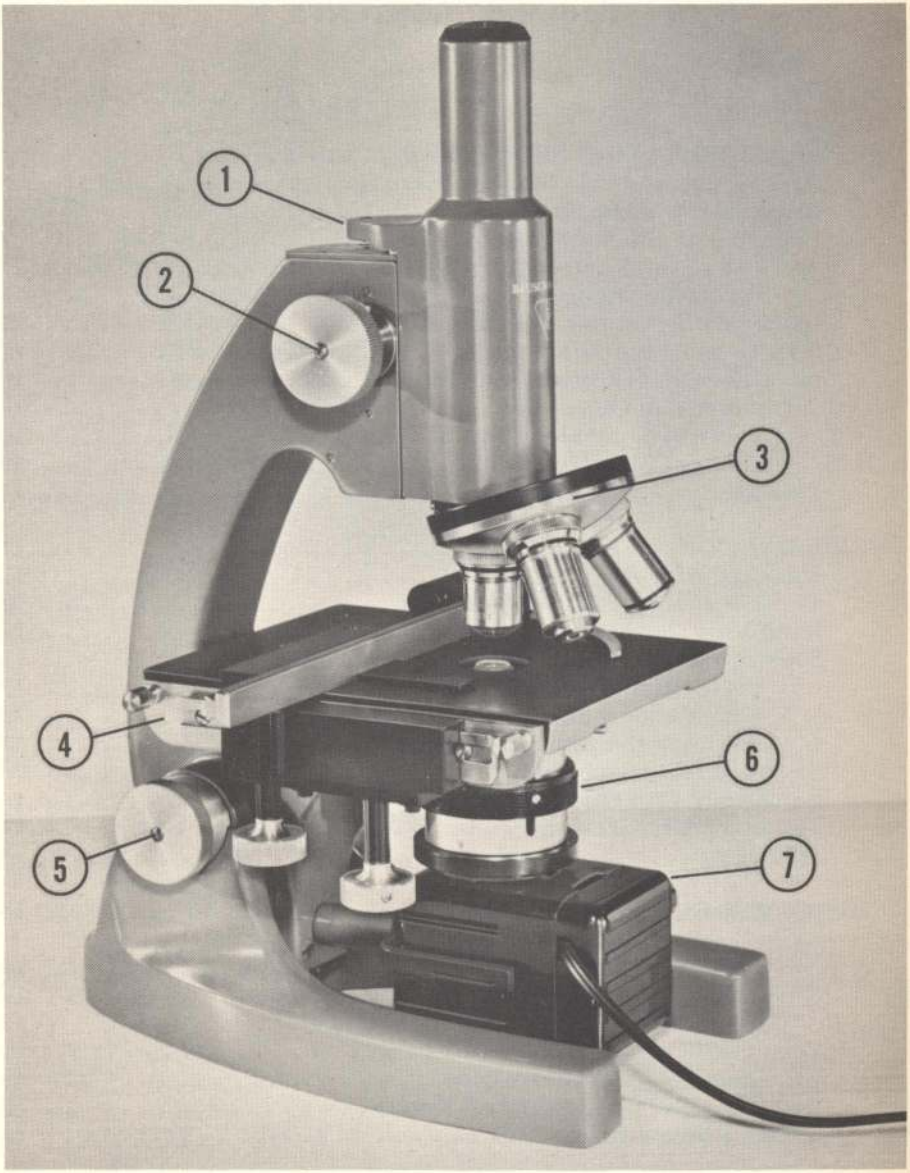


FIGURE 1

Bausch & Lomb Standard Teaching Microscope Model STAV-28 with Mechanical Stage and Opti-lume Illuminator

1—Prefocusing Gage
2—Coarse Adjustment Focusing Knob
3—Rotosphere Revolving Nosepiece
4—Mechanical Stage 31-59-66
5—Fine Adjustment Focusing Knob
6—Variable Focus Condenser
7—Opti-lume Illuminator

BAUSCH & LOMB STANDARD TEACHING MICROSCOPES

INTRODUCTION

Several series of Bausch & Lomb Standard Teaching Microscopes are available, comprising models with a variety of possible equipments and accessories. It will, therefore, be necessary for the reader to select from this manual that information which is pertinent to his particular microscope.

To permit an overall view of the available selections and their purposes a brief general description of the various series is given below.

The Bausch & Lomb Series ST Microscopes have been designed to meet the need of precision built microscopes for use in elementary and college science courses. They embody practically all of the features found on the more expensive laboratory microscopes – coarse and fine adjustments, double or triple revolving nosepiece with parfocalized objectives, standard diameter eyepieces containing a pointer, reagent resistant stage, etc.

The Bausch & Lomb Series STA Microscopes have been designed for the more advanced student who is able to utilize to full advantage the higher resolution provided by the optics with which these microscopes are equipped. The revolving nosepiece and the objectives are the same as those supplied with the more expensive Bausch & Lomb Dynoptic and DynaZoom Laboratory Microscopes.

The Bausch & Lomb Series STAA Microscopes have, in addition to the professional quality objectives and nosepiece, an attached substage condenser of the Abbe type.

The Bausch & Lomb Series IST Microscopes have, in addition to the features of the Series ST, an inclined, reversible eyepiece tube, infinity corrected objectives, and a condenser integral with the stage which permits the filling of the apertures of all of the objectives up to and including the 43x.

The Series ISTA Microscopes have all the features listed above for the Series IST but instead of the condenser integral with the stage they are equipped with a substage condenser capable of filling the aperture of the oil immersion objective.

GENERAL OPERATING PROCEDURE

It will be found that, in the course of normal use of the microscope, one follows a set pattern of operations. These operations must, of

necessity, follow one another and may be classified under five main headings:

1. Rotate the nosepiece until the lowest power objective is in viewing position.
2. Place a specimen slide on the stage, manipulating the specimen material to the approximate center of the stage aperture.
3. Illuminate the specimen.
4. Focus on the specimen.
5. Use the revolving nosepiece for examination under higher magnification.

Placing Specimen on Stage

The preparation to be studied under the microscope is usually mounted on a glass slide which measures about 1" x 3" and is about 1.3mm thick. Some means must be provided on the stage to secure this slide in position once some particular point of interest has been found and, at the same, time, the slide must be movable as desired. Keep the stage free of dust and grit, so that your slides may be easily moved without scratching them. The stage will be equipped with either spring clips or a mechanical stage.

If the microscope is equipped with spring clips, simply place the object slide under the clips, cover glass upward, and move it until the object is approximately over the center of the stage opening. If the spring clips do not appear to exert sufficient pressure on the object slide, check to see that the holding pins at the ends of the clips are fully inserted in the holes in the stage.

If the microscope is equipped with the optical mechanical stage, the object slide should be positioned as follows. Press inward on the lever which is located at the rear left hand corner of the mechanical stage. This will cause the slide finger to open, and the slide may be placed within the mechanical stage, its right and rear edges contacting the corresponding edges of the mechanical stage. The bottom of the slide should rest on the microscope stage and not on the mechanical stage. Release the finger control lever, allowing the finger to close, holding the slide within the mechanical stage. The finger pressure is controlled by a vacuum controlled spring – the pressure being sufficient to hold the slide firmly but not so great as to break the corner of the slide even if released from its full open position. Using the mechanical stage controls, move the slide until the object is approximately over the center of the stage opening. The forward mechanical stage knob moves the stage in the north-south direction; the rear knob moves it east-west.

Illumination of the Specimen

This subject will be dealt with in detail in a later section. Suffice it to say, at the present time, that the larger illuminators such as the Professional Illuminators or the Micro-Lite should be placed about 6" -8" from the microscope and adjusted so that the light is striking the substage mirror centrally. If using the Opti-lume in conjunction with the mirror, place the illuminator about 3" away from the mirror. Adjust the mirror until the object appears illuminated when viewed from the side. (When using the Opti-lume as an attached sub-

stage illuminator the above adjustments are unnecessary.) Further adjustment of the illumination will have to be done after the microscope is focused on the object.

Focusing on the Specimen

Unless one is thoroughly familiar with the object to be studied, it will be advantageous to start examining it under low magnification, proceeding to higher powers as specific points of interest are found during the lower power survey. In any event, even if it is known that one wishes to examine a certain portion of the object with, say, the 43x objective, it is extremely unlikely that the slide will be positioned on the stage, from the outset, so that the desired spot would fall within the field of view of the 43x objective when first focused. Therefore, it would be wise in every instance to use first the lowest power objective with which your microscope is equipped. The field may be examined and, when the particular point of interest is found, it should be moved to the center of the field of view. In this connection, it should be noted that a movement of the object to the right causes an apparent movement of the image to the left. This is due to the fact that the objective forms an inverted image of the object. After a little practice one mechanically moves the object in the direction opposite to that which the eye seems to indicate. Once the object has been brought to the center of the field of view, the higher power objectives may be brought into position by means of the revolving nosepiece.

To focus a microscope is to adjust the relation between the optical system and the object so that a clear image is obtained. With higher power objectives the distance between the cover glass and the front lens of the objective is so short that unless the operation of focusing is conducted with care and skill there is danger of damaging the specimen, the objective, or both. In lower power objectives the danger is less because of the greater working distance (distance from slide to objective). It is wise, therefore, for the beginner in microscopy to practice the operation of finding an object and focusing with low powers first, and then proceeding to the higher powers as his touch becomes more sure and his conception of how an image comes into and goes out of focus develops.

Use of the Prefocusing Gage

When working with transparent specimens and with slides of varying thicknesses, the microscopist often has difficulty in finding and focusing the object. The Bausch & Lomb Prefocusing Gage eliminates lengthy searches by the students and automatically gives quick and accurate focus for any thickness slide. Prefocusing is possible only on this Bausch & Lomb Student Microscope.

Simply place the slide under the gage as shown in the illustration. Using the coarse adjustment knob rack the microscope body down until the stop on the gage makes light contact with the slide. Without moving the coarse adjustment, remove the slide from the gage, and place it on the stage – you're in focus. For critical focus, a light touch of the fine adjustment may be desired.

To assure accurate prefocusing

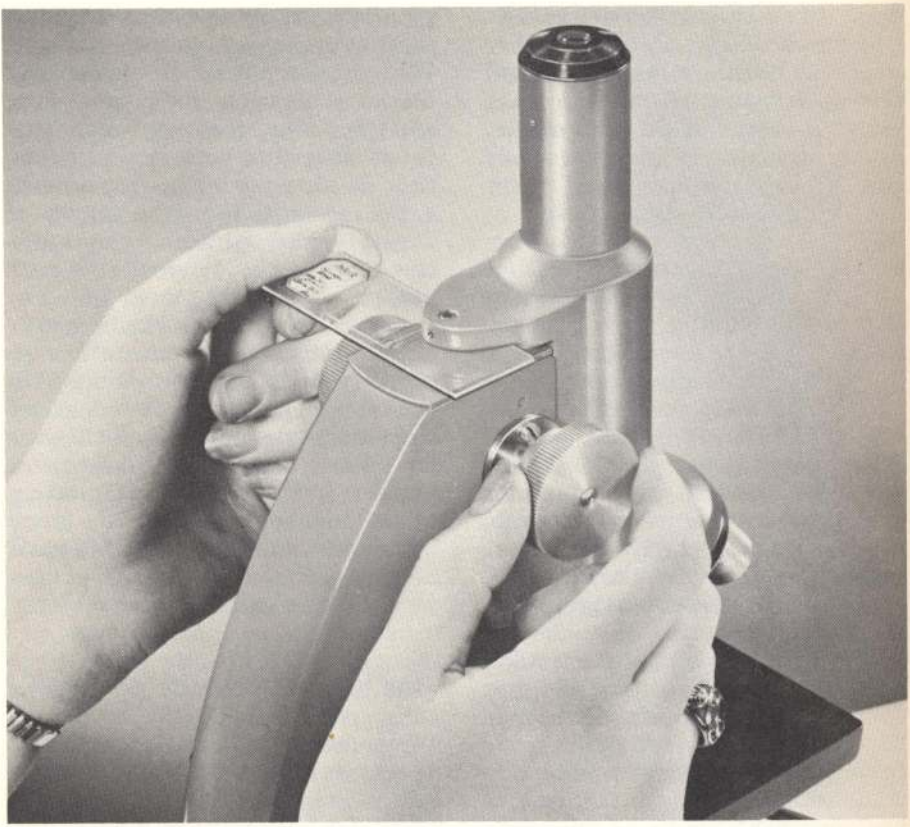


FIGURE 2

Using the Prefocusing Gage

and protection of the specimen, be certain that the stop on the gage makes contact with a free area of the slide and not on the cover glass or areas covered by labels.

Direct Focusing

Should one wish to omit the use of the prefocusing gage for special applications the following procedure should be used to focus the microscope. Place the object on the stage and bring the low power objective into position. Using the coarse adjustment, lower the microscope tube as far as it will go. Looking through the microscope and using the coarse adjustment, raise the tube until the image comes into focus. Should greater magnification be desired bring one of the higher power objectives into position. Only a slight adjustment of the fine adjustment will be necessary to bring the image into sharp focus.

A low power objective permits the observer to see a much greater area of the specimen than one can see with a high power objective. Therefore, it is useful as a "finder." The specimen may be

examined with a low power objective and some particular point of interest in the specimen located and moved to the center of the field of view. Then, if greater magnification is desired, the high power objective may be brought into use by means of the revolving nosepiece.

Use of the Revolving Nosepiece

This is provided in order to enable rapid, convenient exchange of one objective for another. To effect this change, grasp the objectives between the thumb and forefinger of the right hand and rotate until the desired object is brought into line with the axis of the body tube. It is very important that exact alignment be obtained. The correct setting is indicated by a slight click which indicates the stop for each objective.

The objectives will be so nearly parfocal that, if the microscope is focused for either of them, it will be possible to swing the other objective into place without touching the coarse adjustment and with only a slight turn of the fine adjustment required to restore perfect focus.

Coarse and Fine Adjustment

Do not keep hold of the coarse adjustment knobs while operating the fine adjustment, as the former must be free to rotate.

The purpose of the fine adjustment is to provide a much greater degree of sensitivity in focusing than can be obtained with the rack and pinion coarse adjustment. The fine adjustment mechanisms of these microscopes operate through a range of 1.5mm with a speed of 0.25mm per revolution of the fine adjustment knob. The mechanism will not be damaged should the knob be accidentally forced beyond the limit of adjustment, owing to a clutch arrangement. It would be well, before each focusing operation, to set the fine adjustment at the approximate midpoint of its range of motion – about three full revolutions from either extreme. Be sure not to hold the coarse adjustment knob while operating the fine adjustment.

Identification of Objectives

The Achromatic objectives which are supplied with these microscopes are color coded for quick

OBJECTIVES FOR USE ON ST & IST MICROSCOPES

31-10-04	4x	32mm	0.10NA	
31-10-11	4x	32mm	0.10NA	
31-10-12	10x	16mm	0.25NA	
31-10-17	10x	16mm	0.25NA	
31-10-19	10x	16mm	0.25NA	
31-10-13	43x	4mm	0.55NA	
31-10-24	43x	4mm	0.55NA	
31-10-26	43x	4mm	0.65NA	
31-10-14	97x	1.8mm	1.3 NA	oil
31-10-69	97x	1.8mm	1.3 NA	oil

TABLE OF APPROXIMATE EQUIVALENT SIZE OF POINTER IN THE PLANE OF THE SPECIMEN (in mm)

OBJECTIVE	WIDTH	LENGTH
4x	0.25	1.3
10x	0.10	0.5
43x	0.025	0.12
97x	0.01	0.05

TABLE OF MAGNIFICATIONS 10X HUYGENIAN EYEPIECE

Objective Magnification	Total Magnification	Approximate Working Distance (mm)	Real Field of View (mm)
3.5x	35x	17.0	4.3
4x	40x	22.0	3.7
10x	100x	5.0	1.5
43x	430x	0.35	0.35
97x	970x	0.14	0.15

and easy identification. The engraved markings of the objectives are colored blue for the 4x, green for the 10x, yellow for the 43x objectives, and red for the 97x. In addition some have the knurled ring on the upper part of the objective body colored as indicated above; others have a corresponding colored band around the objective body. As a result, it is a simple matter to determine at a glance which objective is in position for use.

Oil Immersion Objectives

Immersion contact between the objective and cover glass is made with an oil which is specially prepared for optical purposes. Great care should be used to keep it free from dust.

Apply a small quantity of oil to the front lens of the objective or to the cover glass, using for this purpose the rod in the oil bottle. Lower the objective very carefully with the coarse adjustment until contact is made. This can best be determined by watching the space between objective and slide with the eye well down to the level of the stage. At the instant contact is made a flash of light will illuminate the oil. When this flash is seen, the objective will be near enough to focus by means of the fine adjustment.

The presence of dust or air bubbles in the immersion oil may destroy the definition of the best objective, therefore, it is very

essential to keep the oil bottle stoppered at all times. If bubbles are trapped between objective and slide, it may be necessary to apply fresh oil and re-focus in order to get rid of them.

Special care must be observed if a low power objective is used after an oil immersion. The oil must invariably be removed from the top of the cover glass by wiping with lens paper. The front of the objective should always be cleaned in the same manner immediately after it has been used.

Pointer Eyepiece Cat. 31-05-20

The Microscopes are equipped with 10x Huygenian eyepieces containing a pointer. This will be found to be of particular value for instructional purposes, since it can be used as a reference to point out areas of interest to another observer. An additional advantage is that the dimensions of the pointer can be used to measure the approximate dimensions of specimen structure in the specimen plane, as given in Table on Page 10.

ILLUMINATION

Much of the literature concerning microscopy has been devoted to the subject of the methods and techniques of proper illumination. This is justly so, as improper illumination may easily lead to an erroneous interpretation of the microscopical image. However, there is no touch of magic involved in this matter, as one might be led to believe if he followed all of the arguments between the adherents of "critical" illumination and those who favor "Koehler" illumination. (Briefly stated, the term "critical illumination" implies that the light source is imaged, by the substage condenser, in the plane of the object; "Koehler illumination" is that form in which the light source is imaged in the front focal plane of the substage condenser and the lamp condenser is imaged in the plane of the object.)

It has been found that, as a practical matter, the best illumination is achieved if two conditions are satisfied: a). The back lens of the objective should be filled with light when the iris diaphragm is opened to a sufficient extend. b). The field of view should be evenly illuminated.

Your Bausch & Lomb Microscope is supplied with one of several possible choices of equipment in the substage – that part of the microscope which is below the stage surface upon which the slide preparation is placed. Your microscope will be provided with one of the following:

a. Substage diaphragm disc
b. Iris diaphragm without condenser
c. 0.55NA Condenser integral with the stage
d. 0.55NA Simplified Condenser
e. 0.70NA Abbe Condenser in sleeve focusing mount
f. 1.30NA Abbe Condenser in sleeve focusing mount
g. 1.25NA Verti-slide Variable Focus Condenser

In addition to the condenser or iris diaphragm, the substage will also have either a concave mirror, a plano-concave mirror, or an attached Opti-lume Illuminator.

Daylight may be used as a source of illumination, although the constancy and convenience of

an electric illuminator is to be preferred. If daylight must be used, place the microscope as near directly in front of a north window as possible. Direct sunlight is intolerably bright and if it falls on the table anywhere near the microscope, the glare is exceedingly uncomfortable and is fatal to good observation.

Substage Diaphragm Disc Integral with Stage Cat. #31-59-33

There are four apertures in the substage diaphragm disc. By rotating the disc and going from a larger to a smaller opening, the contrast and depth of focus may be increased; however, one must realize that definition is lost in so doing.

Condenser Integral with Stage 0.55 NA Substage Disc Diaphragm, Cat. #31-59-09 Condenser Integral with Stage 0.55 NA for use with Iris Diaphragm, Cat. #31-59-98

With the condenser integral with the stage the back aperture of the 43x objective can be completely and evenly illuminated when the largest aperture of the diaphragm disc is used. This theoretically enables us to use the maximum possible resolving power of the objective, since the numerical aperture of the condenser equals that of the 43x objective. This is an important feature when observing high contrast specimens having very fine detail. In the case of low contrast specimens, a smaller aperture in the diaphragm disc should be used to prevent "washing out" of specimen detail. The depth of focus is increased with decreasing aperture size in the diaphragm disc. When contrast and depth of focus are increased there will be a corresponding loss in theoretical resolving power.

Simplified Condenser 0.55NA Cat. #31-58-97

This condenser is similar to the condenser integral with stage but is designed to attach to the stage and will accept the iris diaphgram.

Substage Condenser

Critical work with objectives of numerical aperture greater than 0.25 cannot be done without the use of a substage condenser. This condenser collects the light sent forth by the light source and converges it into a cone of sufficient angle to fill the back lens of the objective with light (up to the stated numerical aperture of the condenser). The condenser should be fitted with an iris diaphragm in order that the angular aperture of the illuminating cone can be controlled.

Verti-Slide Condenser 1.25NA Cat. #31-58-87

The patented Bausch & Lomb Variable Focus Condenser is by far the most convenient type to use for routine microscopy. Proper illumination with respect to both field and aperture is achieved simply by the proper positioning of the lower element of the condenser. It is not necessary to remove

condenser lenses when using low power objectives as is necessary when using condensers of conventional construction. The Variable Focus Condenser is substantially a two-lens Abbe condenser in which the upper element is mounted in a fixed position in the microscope stage and the lower element is independently focusable.

The Verti-slide condenser has the lens elements mounted within a tubular casing. The lower element is raised and lowered by means of the black ring which is slid vertically. The iris diaphragm is fixed with relation to the upper condenser element.

Any convenient light source that provides an extended area of uniform illumination can be used. After a light source has been chosen and placed approximately four to six inches in front of the microscope mirror, the latter can be adjusted and work with the microscope proceeds in the following manner:

Move the focusable lens to its uppermost position and with the low power objective in position adjust the plano side of the substage mirror until the illuminated area on the specimen appears centered. If a low power objective is to be used in the work to follow, the lower condenser lens should be moved down toward the mirror until the field of view is fully illuminated.

It should be noticed that moving this lens down increases the illuminated field and decreases the numerical aperture, while moving it up decreases the illuminated field and increases the numerical aperture. Thus, when high power objectives are used, the movable lens should be in its top position and when low power objectives are employed, this element should be in its low position.

If it appears impossible to fill the field of a low power objective, it indicates that the light source is too far away for its area.

Abbe Condensers

Cat. #31-58-34	1.30NA
Cat. #31-58-74	1.25NA
Cat. #31-58-76	0.70NA

Abbe condensers are usually not corrected for either chromatic or spherical aberration, but for all ordinary work serve their purpose very well. Their function is to send light through the object under an angle sufficiently large to fill the aperture of the objective with light.

Focusing the Abbe Condenser

This is a matter that assumes a high degree of importance when working with high aperture objectives. The procedure is very simple. Focus the microscope on the object and then slowly focus the condenser up and down in its spiral sleeve mount until the front lens of the illuminator may be seen imaged in the field of view of the microscope. One of the reasons for carrying out this adjustment is to ensure that the back lens of the objective is filled with light. Of course, if a condenser of less numerical aperture than is possessed by the objective is used, it will be impossible to fill the back lens of the objective with light.

Substage Iris Diaphragm Cat. #31-58-28

The substage iris diaphragm is

provided to limit the angle of the cone of illumination to that value which is best suited, as determined by experiment, for the object under examination. In the examination of most microscopic preparations, the problem is to differentiate structure difficult to see, because its color or opacity differs so little from its surroundings, rather than to observe detail at the limit of resolution of the objective. The skillful use of the substage diaphragm will be found extremely helpful in examining such specimens by increasing contrast and improving definition. Often, different diaphragm openings are required for different types of detail within the same preparation. Experience and attentive study are required to learn the most effective use of the diaphragm. The last use to which it should be put is to use it to control intensity of illumination. If the light is too bright, it may be reduced by means of neutral filters introduced between the light source and condenser. The Iris Diaphragm is equipped with slotted recess to hold the daylite filter.

Condenser With Oil Objectives

It has often been stated that there is absolutely nothing gained in using an oil immersion objective unless the condenser is also oil immersed. This is not so. Experience has indicated that the most satisfactory image is the result of a compromise between resolution and contrast, and that this is obtained when the objective is used at approximately 2/3 of its maximum aperture. This condition is almost automatically established when an oil immersion objective is used with a dry condenser. It is, therefore, common practice to use oil immersion objectives without immersing the condenser. (The objective, of course, must be immersed.)

It is true, however, that the objective will be unable to deliver its maximum resolving power unless its back aperture is filled with light, and this condition cannot be satisfied for an oil immersion objective unless the condenser is also oil – contacted to the slide. To accomplish this, place a drop of oil on the top lens of the condenser, and place the slide on the stage. In the case of the Verti-slide condenser no adjustment will be required in the distance between the bottom of the slide and the top condenser lens, but the N.A. 1.30 condenser must be moved upward in its spiral sleeve until oil-contact is made between its top lens and the slide.

With all objectives having a numerical aperture less than 1.00, the condenser may, at all times, be used dry, i.e., without oil.

Choice of Mirror
Cat. #31-50-01 & 31-50-18

The choice of which mirror to use – plane or concave – depends, for the most part, on the type of illumination and the objective being employed. The condenser is designed so that parallel rays of light from the illuminating unit are brought to a focus in the plane of the specimen. The concave mirror will cause these rays to converge more rapidly and the apex of the cone of light will fall within the condenser. Therefore, when using parallel light as one does for strictly "critical" illumination, the plane mirror should be used with the condenser.

When a diffusing surface, such as a ground glass, is placed between the illuminator bulb and the microscope mirror, as is the case with the Micro-Lite and the Opti-lume, parallel light is not being used. The use of the concave mirror permits the illumination of a larger field for low power work in addition to giving a more intense illumination. It may not be possible, however, to completely fill the aperture of an oil immersion objective when using the concave mirror.

Therefore, for general use of the microscope, the use of the plane mirror is recommended, reserving the concave mirror for use with the lower power objectives.

Opti-lume
Cat. #31-33-90 & 31-33-93

The Opti-lume is an inexpensive form of illuminator which may be used attached to the microscope base, as shown in Figure 1, or placed on the work table and used in conjunction with the substage mirror. See the Accessory List at the rear of this manual to order an appropriate opti-lume. Normally it is used fastened to the base, since this gives one the advantages of a permanently aligned built-in system of illumination.

To replace a lamp in the Opti-lume Illuminator, remove the Opti-lume from the microscope base. A slot near the base permits inserting a coin to separate the base from the upper part of the Opti-lume. Pull the base of the Opti-lume off, unscrew the lamp and replace with a new one. Use Cat. #31-31-15 (15 volts, 15 watts, mfrs. #15 S11/102-115). Re-assemble the Opti-lume and re-insert in the base.

THE COVER GLASS

The cover glass, which is normally placed over the specimen, might appear to be a rather insignificant item and little consideration given to it in the preparation of the specimen slide. This, however, is far from true, as the cover glass, especially when dealing with high power dry objectives, becomes an integral part of the optical system. The microscope objectives have been designed to be used with cover glasses which are made of crown glass of refractive index nD = 1.523 and are 0.18mm thick. A variation of only a very few hundredths of a millimeter in thickness is sufficient to cause a marked deterioration of the image when using, say, the 43x (4mm) 0.55NA objective.

Cover glasses are available from any laboratory supply house and are usually sold according to thickness. The usual commercial classifications are Nos. 1, 2, and 3, the thickness range of each group being:

#1	0.13	to	0.17mm	thick
#2	0.17	to	0.25mm	thick
#3	0.25	to	0.50mm	thick

Cover glasses of thickness #1 and #2 are the ones with which one is normally concerned.

No. 1 cover glasses are principally used on specimens which are to be studied under the oil immersion objective. Since oil, of approximately the same refractive index as that of the cover glass and the

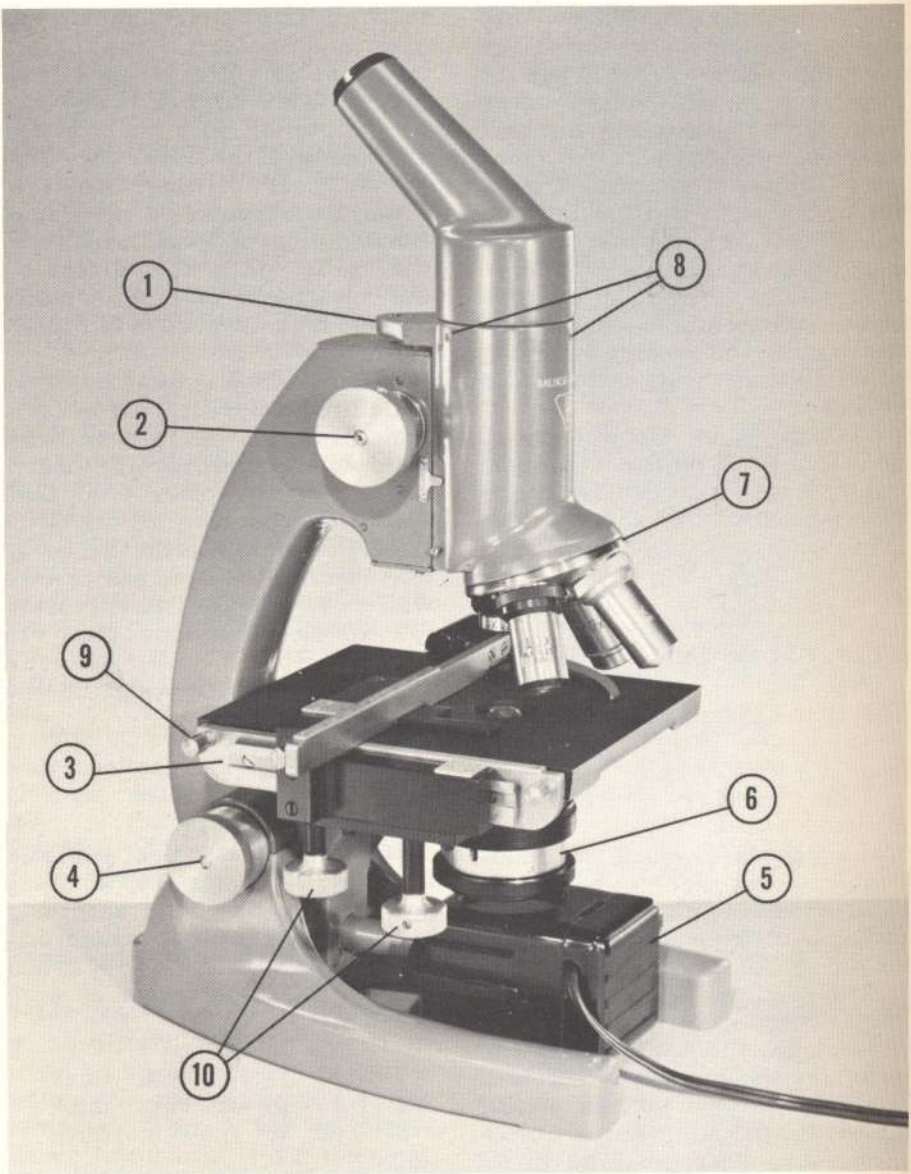


FIGURE 3

Bausch & Lomb Standard Teaching Microscope Model ISTAV-29 with Mechanical Stage and Opti-lume Illuminator

1—Prefocusing Gage
2—Coarse Adjustment Knob
3—Mechanical Stage 31-59-67
4—Fine Focusing Knob
5—Opti-lume Illuminator
6—Verti-Slide Condenser
7—Revolving Nosepiece
8—Reversible Eyepiece Tube Lock Screws
9—Mechanical Stage Mounting Screws
10—Stage Control Knobs

front lens of the objective, is to be used, the thickness of the cover glass is not significant from the optical viewpoint. However, oil immersion objectives have a very short working distance (distance from front of the objective to the specimen) and, with too thick a cover glass, it will be impossible to focus on the specimen. Therefore, the thinner cover glasses are advantageously used in these cases.

No. 2 cover glasses should be used for specimens examined under the low and high power dry objectives, the thicker glasses in this group being used for the low powers. For optimum performance with higher power dry objectives, cover glasses exactly 0.18mm thick, as measured with a micrometer caliper, should be used.

No. 1-1/2 cover glasses are also available from certain supply houses. These vary in thickness from 0.16 to 0.18mm, and are best suited for use with high power dry objectives.

In preliminary examinations of solid objects with low powers, a cover glass may be dispensed with; but where fluids are used, whether with low or high power, it should always be used. A drop or small quantity of fluid placed upon a slide assumes a spherical form and, on viewing it with a low power, it will be found to give a distorted field and cause disagreeable reflections and shadows. For high power examination the front lenses will be so close to the fluid that capillary attraction will cause an adhesion to the front surface of the objective if the front lens once touches the liquid. By merely dropping a cover glass upon it, these objections are overcome.

THE INCLINED MONOCULAR SERIES

Reversible Eyepiece Tube

In the Bausch & Lomb Inclined Series of Microscopes provision has been made to reverse the position of the eyepiece tube. Many people will prefer to use the instrument in the reverse position as this position allows easier access to the objectives, specimen slide, diaphragm disc, and fine and coarse adjustment knobs. This is accomplished by loosening the three screws in the body tube, (Figure 3) rotating the inclined eyepiece tube 180°, and re-tightening the screws. Use of the microscope in the reverse position will be most efficient when an attached Opti-lume illuminator is used.

THE MECHANICAL STAGE CAT. #31-59-66, -31-59-67

The mechanical stage is of great value in the operation of searching a specimen for points of particular interest, and permits one easily and precisely to bring any desired area of the specimen to the center of the field of view for critical examination.

The low position of the stage controls, in addition to the low position fine adjustment knob, makes for a compact operating area which requires a minimum amount of hand movement in going from the fine adjustment to the stage controls.

Attaching Stage to Microscope

A mechanical stage may be added to the advanced series microscope (equipped with a 31-59-35 or 31-59-98 stage) at any time without

the necessity of returning the microscope to the factory. The procedure is very simple. Remove the spring clips from the microscope stage. Insert the two knurled screws provided into the two holes in the mechanical stage. Place the mechanical stage on the microscope stage such that the two knurled screws (Figure 3) line up with the two drilled holes in the stage. Secure the mechanical stage by tightening the two knurled screws.

Adjusting Tension of Control Knobs

The tension of the operating knobs may be adjusted to suit the preference of the operator. The tension should be adjusted so that only a moderate amount of pressure is required to operate the stage, but not so loosely that the stage will move should the hand accidently brush the knobs. This adjustment is to be made on each knob individually, and is effected by first loosening the small screw which is located on the periphery of the knurled portion of the knob. Then tighten or loosen, as desired, the screw which extends through the bottom of the knob and secures it to the shaft. When the desired tension is obtained, tighten the small screw which was first loosened.

Vacuum Adjustment

The closing of the slide finger, upon releasing the slide finger control lever, is effected by a vacuum-controlled spring. The retarding force of the vacuum may be regulated by adjustment of the small screw, which is located on the inside of the piston assembly, with a jeweler's small screwdriver. As the screw is unscrewed, the vacuum becomes less effective and the slide finger will close faster and with greater force. The proper adjustment is such that there is an ideal compromise between speed of closing and the contacting force between the finger and the corner of the slide. If the finger closes too rapidly, there is danger of chipping or breaking the slide. The holding power of the slide finger is not affected by this adjustment, as once contact is made between finger and slide, the slide is held under a constant and uniform pressure.

CARE OF THE MICROSCOPE

Besides acquiring the ability to use an instrument properly with its accessories, it is important to know how to keep it in the best working condition. It may be said without reserve that an instrument properly made at the outset and judiciously used should hardly show any signs of wear, either in appearance or in its working parts, even after the most protracted use.

Especial care should be given to the optical parts; in fact, such care that they will remain in as good condition as when first received, after any amount of use.

Care of the Stand

Keep free from dust is one of the first rules to be observed. When not in use, place the microscope in a cabinet, or cover with

a plastic cover, bell jar or close-mesh cloth, such as cotton flannel or velvet, which should reach to the table.

When handling the stand, grasp it by the arm and base, in order to achieve a firm support.

Avoid sudden jars, such as placing upon the table with force.

If the inclination joint should become loose, preventing the arm from being set at any angle of inclination, it should be adjusted by tightening the screws which may be seen on the underside of the microscope, when placed on its side.

Care of Objectives and Eyepieces

The user should supply himself with a camel's hair brush and a well washed piece of linen. Chamois skin is desirable, but only after it has been repeatedly washed. No dust should be permitted to settle upon the lenses nor should the finger come into contact with any of the surfaces.

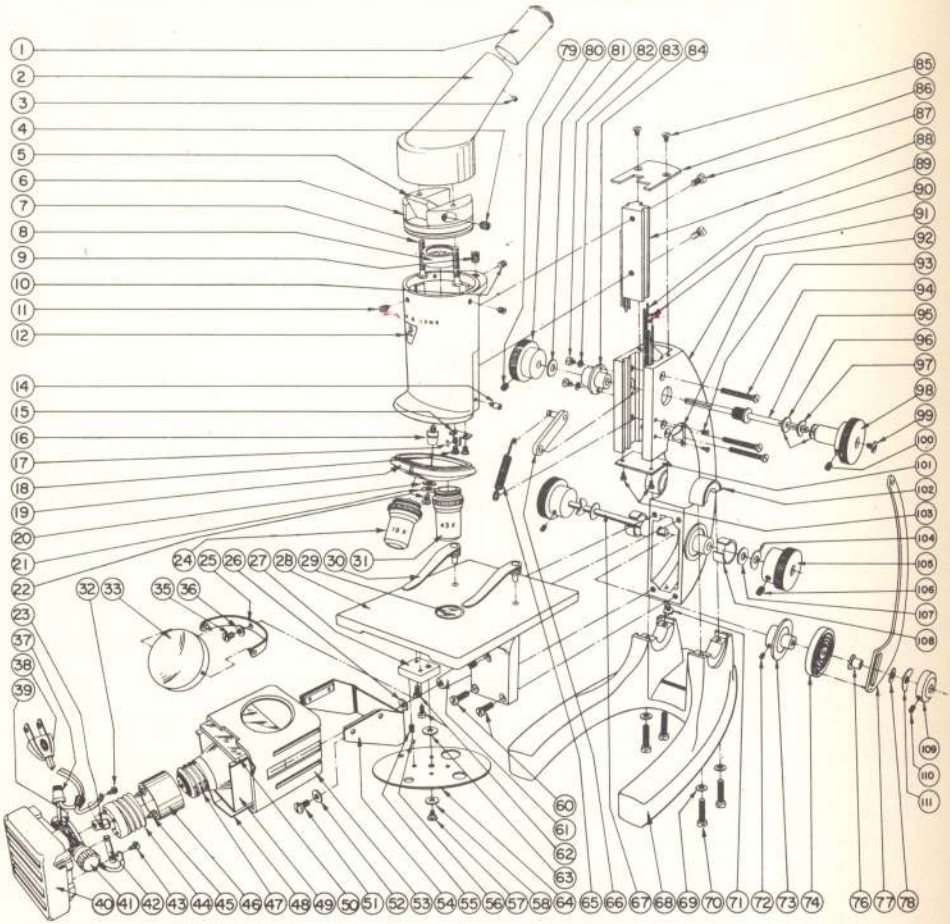
The objectives should be left attached to the microscope, and the eyepiece left in the tube, so that no dust can enter and settle upon the internal optical surfaces.

If dust has settled on the eye-lens of the eyepiece, it will appear as dark, indistinct spots upon the field of view. To remove the dust, brush it of with a camel's hair brush and then wipe with a well washed chamois skin or piece of linen. Use the camel's hair brush again to remove any lint.

Never separate the systems, even if they can be unscrewed, as they are liable to become de-centered and dust may enter.

ACCESSORIES & REPLACEMENTS

31-05-20	Huygenian Eyepiece 10x with Pointer
31-19-01	Nosepiece Single
31-19-17	Nosepiece Double Revolving
31-19-18	Nosepiece Triple Revolving
31-19-19	Nosepiece Quadruple Revolving
31-31-15	Replacement Lamp 115 Volt for Opti-lume
31-33-90	Opti-lume with Blue Glass Filter
31-33-93	Opti-lume with Blue Glass Filter, Clear Condenser and Reflector
31-34-19	Daylite Filter for Opti-lume
31-34-21	Blue Filter for Opti-lume
31-34-48	Bracket for Opti-lume (High Position)
31-34-72	Bracket for Opti-lume (Low Position) for use with Focusing Condensers
31-40-17	Metal Carrying Case for Microscope
31-50-01	Mirror Plano-Concave Second Surface
31-50-18	Mirror Concave Second Surface
31-50-14	Plastic Microscope Cover
31-50-95	Cargille's Immersion Oil
31-50-97	Grease for Glide Stage
31-58-04	Condenser Sleeve for 31-58-74 and 31-58-76 Condenser
31-58-18	Mirror Fork
31-58-28	Iris Diaphragm
31-58-28-022	Blue Filter for Iris Diaphragm
31-58-34	Sleeve Mount Abbe Condenser 1.30NA
31-58-74	Abbe Condenser 1.25NA
31-58-76	Abbe Condenser 0.70NA
31-58-87	Verti-Slide Condenser 1.25NA
31-58-97	Condenser 0.55NA
31-59-04	Condenser Ring for 31-58-87 Condenser
31-59-07	Stage Clips
31-59-09	Stage with Integral Condenser 0.55NA and Disc Diaphragm
31-59-33	Stage with Disc Diaphragm
31 59-35	Stage for Condensers and Mechanical Stage
31-59-98	Stage with Integral Condenser 0.55NA, Iris Diaphragm and Mechanical Stage



STUDENT MICROSCOPE

LEGEND	DESCRIPTION	DRAWING NO.
1	Eyepiece	31-05-20
2	Tube	312197-104
3	2-64S3N Screw	95222-1267
4	Retaining Ring Small	311955-175
5	Prism	311942-021
6	Prism Mount	312197-105
7	6-32T Screw	33132 -109
8	Lens	312197-021
8	Objective Mount	312197-113
9	10-32T Screw	312118-197ND
10	2-64S4T Screw	97222-1209
11	4-40U4S Screw	96276-0402
12	Body	312197-117

LEGEND	DESCRIPTION	DRAWING NO.
13	Body Tube (ST) not shown	311927-226
14	SC-8 Screw	90046-22
15	Stop Spring	311927 132
16	Nosepiece Bearing	311927-131
17	Roller	311927-163
18	1-72C6S Screw	96202-1106
19	Nosepiece	311927-130
20	Parchment Washer	311927-159
21	Washer	311927-162
22	SE-49 Screw	90048-85
23	Terminal "A"	313390-103
24	10x Objective	31-10-12
25	Pivot Assy.	315818-106
26	Washer	214315-384ND
27	Spacer	315909-107
28	Stage	315909-113
29	Lens	313353-023
29	Dust Cover	315909-021
29	Mount	315909-112
30	Stage Clip	31-59-07
31	43x Objective	31-10-13
32	#4 x .187 Lg. Screw	313386-108ND
33	Mirror	31-50-18
35	Screw	315091-103
36	F-129 Washer	90008-134
37	Connector LC-19	632577-361ND
38	LW-8D Cord Set	313302-110ND
39	Switch Nut	313390-122
40	Lamphouse Base	313390-101
41	Switch	313390-123
42	Terminal "B"	313390-104
43	#6 x 187 Lg. Screw	313386-109ND
44	LY-115 Lampholder	313302-107ND
45	4x .187 Lg. Screw	313386-108ND
46	Insulator	313390-105
47	15S11/102 Lamp	31-31-15
48	Filter Support Spring	313390-121
49	Filter Support	313390-111
50	Filter Mod. I	313421-021
51	SE 53 Screw	90048-89
52	F-24 Washer	90008-25
53	Lamphouse Cover	313390-102
54	Opti-lume Bracket	31-34-48
55	Diaphragm Spring	315933-107
56	RK-1 Ball	531271-316ND
57	Diaphragm Screw	315933-110
58	F-39 Washer	90008-41
60	8-32T Screw	315933-109ND
61	Mirror Post	315933-103

LEGEND	DESCRIPTION	DRAWING NO.
62	4-40F10S Screw	96206-0408
63	F-39A Washer	90008-42
64	Stage Diaphragm	315933-108
65	Clutch Spring	311927-117
66	Link and Pin Assembly	311927-129
67	Fine Adjustment Shaft	311927-211
68	Base	311927-121
69	F-262 Washer	90008-294
70	8-32T Screw	311927-181ND
71	8-32T Screw	311927-197ND
72	6-40T Screw	311927-133ND
73	Cam Driver	311927-187
74	Cam	311927-188
76	Fine Adjustment Bushing	311927-189
77	Fine Adjustment Arm Ass'y	311927-114
78	F-287 Washer	90008-345
79	SE-91 Screw	90048-129
80	Pinion Button A	311927-109
81	F-39A Washer	90008-95
82	4-40T Screw	311927-209ND
83	F-92 Washer	90008-97
84	Pinion Bearing	311927-223
85	2-56T Screw	311927-179ND
86	Dust Cover	311927-167
87	6-32T Screw	311927-183ND
88	Slide	311927-225
89	Rod	311927-173
90	Spacer	311927-206
91	Arm	311927-169
92	Mechanical Stage Stop	423139-288
93	O-80F3B Screw	91206-0008
94	4-40T Screw	311927-177ND
95	Pinion	311927-224
96	F-39A Washer	90008-42
97	F-258 Washer	90008-396
98	Pinion Button B	311927-110
99	SD-123 Screw	90047-187
100	SE-91 Screw	90048-129
101	Lower Dust Cover	311927-170
102	Bearing Cap	311927-182
103	2-56T Screw	311927-180ND
104	F-22 Washer	90008-23
105	Fine Adjustment Button	311927-212
106	SE-91 Screw	90048-129
107	F-257 Washer	90008-288
108	Axle Insert	311927-200
109	Fine Adjustment Guide	311927-104
110	6-40T Screw	311927-133ND
111	Spring Washer	311927-195ND

RESPONSIBILITY FOR SAFE DELIVERY

Especially designed and tested packaging is provided for all Bausch & Lomb products to protect them from normal transportation hazards and assure their safe delivery.

After the product leaves the factory, responsibility for its safe delivery is assumed by the transportation company handling the shipment.

If your shipment shows evidence of rough handling, request the party making delivery to note "received in bad order" on your delivery receipt. If "concealed damage" is revealed after the shipment is unpacked, contact a representative of the transportation company and request that a "Bad Order" report be made out.

In either event, the transportation company should be notified immediately of any damage to your shipment to protect your rights to recovery.

Should it become necessary to return a product for repair, please follow the procedure described in the Service section of this manual.

IMPROVEMENTS

Improvements are constantly being made in all Bausch & Lomb products to provide better performance, greater convenience of use, longer life, and improved appearance.

You may accordingly receive product which differs slightly from that shown in the accompanying illustrations.

Often, the nature of such differences will be self evident and will not require an explanation.

If the differences affect use or maintenance procedures, supplementary instructions will be included in your manual or with the instrument.

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