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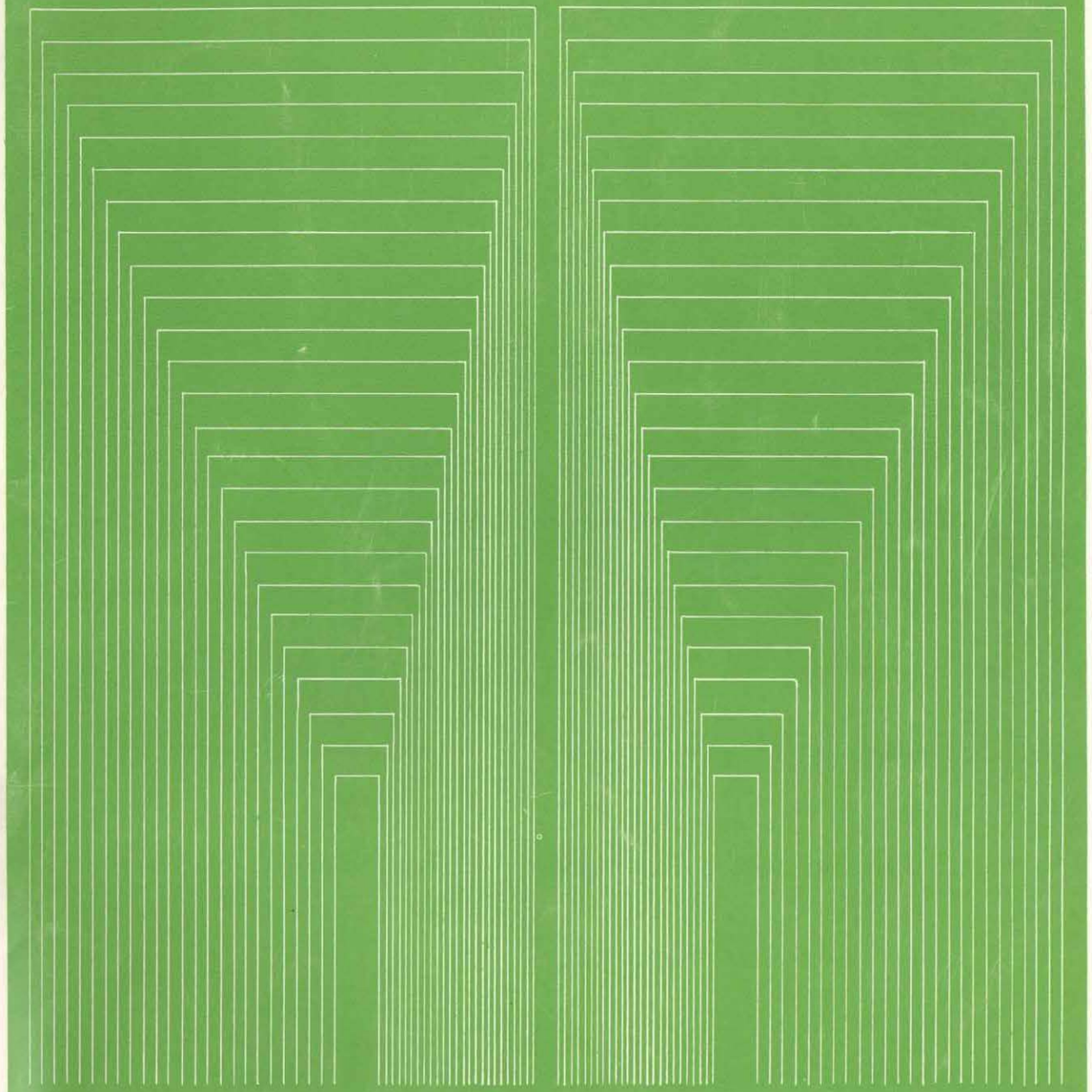
OLYMPUS SYSTEM MICROSCOPES

BHA-LS, BHA-HL
BHB-LS & BHB-HL

INSTRUCTION MANUAL



OLYMPUS

This instruction manual has been written for the use of the Olympus System Microscopes Models BHA-LS, BHA-HL, BHB-LS & BHB-HL. It is recommended that you read the manual carefully in order to familiarize yourself fully with the use of the microscopes, so that you can obtain the best performance.

IMPORTANT

Observe the following points carefully.

■ Operation

1. Always handle the microscope with the care it deserves, and **avoid abrupt motions.** (If the microscope is used in an ambient temperature higher than 40°C (104°F), it may cause a trouble to the microscope.)

2. Avoid exposure of the microscope to **direct sunlight, dust and vibration.**

3. **Only use the tension adjustment ring for altering the tension of the coarse adjustment.** Do not twist the two coarse adjustment knobs in the opposite directions simultaneously, which will cause damage.

4. Ascertain that the **line voltage selector switch** on the base plate is set to conform with the local mains voltage.
   ★ **If the microscope is used on the mains voltage higher than the rated voltage over 10%, it may cause a trouble.**

5. **Disconnect the line cord from the AC power outlet for fuse replacement.**

■ Maintenance

1. Lenses must always be kept clean. Fine dust on lens surfaces should be blown or wiped off by means of an air blower or a clean brush. Carefully wipe off oil or fingerprints deposited on the lens surfaces with gauze moistened with a **small** amount of xylene, alcohol or ether.

2. Do not use organic solutions to wipe the surfaces of various components. Plastic parts, especially, should be cleaned with a neutral detergent.

3. **Never Disassemble** the microscope for repair.

4. The microscope should be stored in its container immediately after use. If this is not possible, it should be covered with the vinyl dust cover provided. It is best to keep objectives and eyepieces in a desiccator, containing desiccants such as silica gel.

CONTENTS

I. STANDARD EQUIPMENT

A. Model BHA

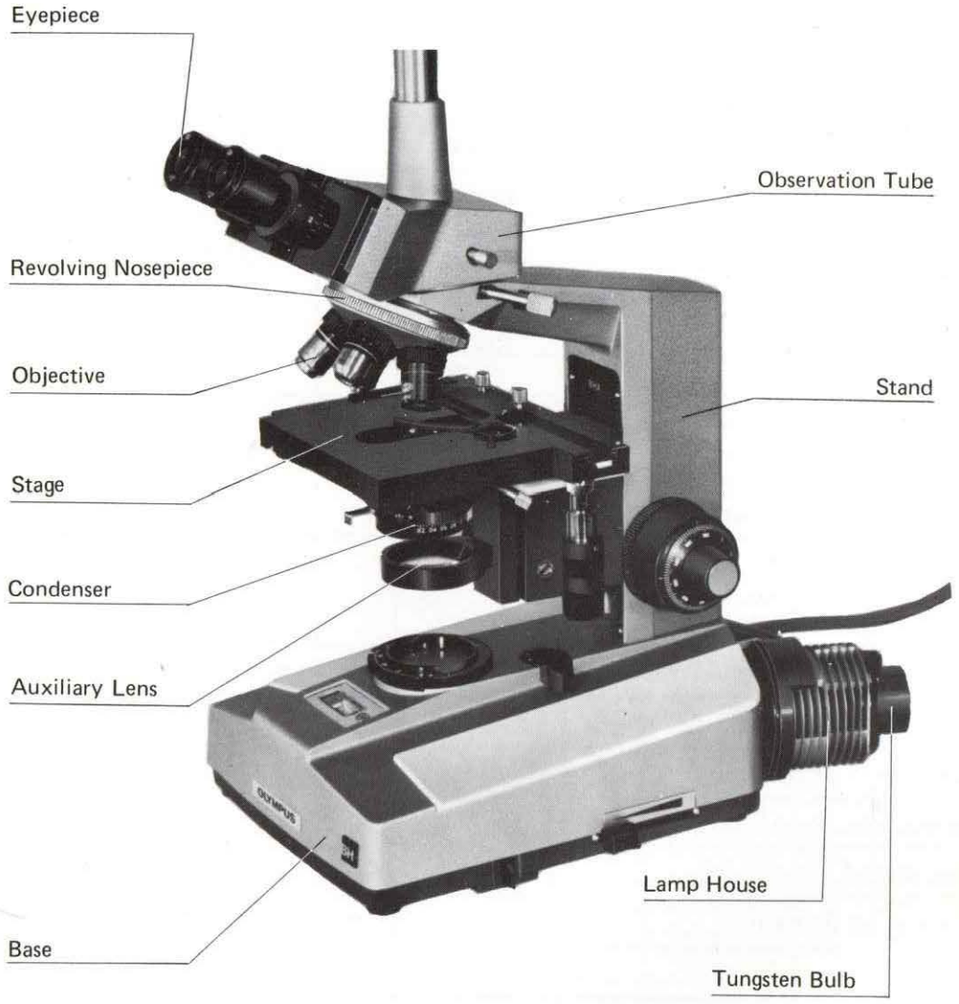
Model			BHA-					
			211LS	213LS	411LS	413LS	213HL	413HL
Microscope stand with in-base transformer, rheostat and auxiliary lens		BHA-F	○	○	○	○	○	○
Revolving nosepiece		BH-RE	○	○	○	○	○	○
Observation tubes	Binocular tube, inclined 45°,	BH-B145	○	○			○	
	Trinocular tube, inclined 45°, with vertical phototube	BH-TR45			○	○		○
Square mechanical stage with low drive coaxial controls		BH-SV	○	○	○	○	○	○
Condensers	Abbe condenser	BH-CD	○		○			
	Achromatic/aplanatic condenser	BH-AAC		○		○	○	○
Tungsten lamp house		BH-LH	○	○	○	○		
30W tungsten bulbs (3 pcs.)		LS30	○	○	○	○		
Halogen lamp house (with frosted glass)		BH-LSH					○	○
Halogen bulbs (2 pcs.)		12V100W HAL					○	○
Objectives	Ach. 4x. Ach. 10x, S-Ach. 40x, S-Ach. 100x (oil) (set of four)		○		○			
	Plan 4x, Plan 10x, Plan 20x, Plan 40x, Plan 100x (oil) (set of five)			○		○	○	○
Eyepieces high eyepoint, BiWF10x, paired			○	○	○	○	○	○
Photo eyepiece FK3.3x					○	○		○
Spare fuses (2 pcs.)			○	○	○	○	○	○
Eyepiece caps (2 pcs.)			○	○	○	○	○	○
Filter, 45KB-1			○	○	○	○	○	○
Immersion oil (bottled)			○	○	○	○	○	○
Vinyl dust cover			○	○	○	○	○	○

B. Model BHB

Model			BHB-					
			211LS	213LS	411LS	413LS	213HL	413HL
Microscope stand with revolving nosepiece, transformer rheostat and auxiliary lens		BHB-F	○	○	○	○	○	○
Observation tubes	Binocular tube, inclined 45°,	BH-B145	○	○			○	
	Trinocular tube, inclined 45°, with vertical phototube	BH-TR45			○	○		○
Square mechanical stage with low drive coaxial controls		BH-SV	○	○	○	○	○	○
Abbe condenser		BH-CD	○	○	○	○	○	○
Tungsten lamp house		BH-LH	○	○	○	○		
30W tungsten bulbs (3 pcs.)		LS30	○	○	○	○		
Halogen lamp house (with frosted glass)		BH-LSH					○	○
Halogen bulbs (2 pcs.)		12V100W HAL					○	○
Objectives	Ach. 4x. Ach. 10x, S-Ach. 40x, S-Ach. 100x (oil) (set of four)		○		○			
	Plan 4x, Plan 10x, Plan 40x, Plan 100x (oil) (set of four)			○		○	○	○
Eyepieces high eyepoint, BiWF10x, paired			○	○	○	○	○	○
Photo eyepiece FK3.3x					○	○		○
Spare fuses (2 pcs.)			○	○	○	○	○	○
Eyepiece caps (2 pcs.)			○	○	○	○	○	○
Filter, 45KB-1			○	○	○	○	○	○
Immersion oil (bottled)			○	○	○	○	○	○
Vinyl dust cover			○	○	○	○	○	○

II. VARIOUS COMPONENTS OF THE SYSTEM MICROSCOPE SERIES BH

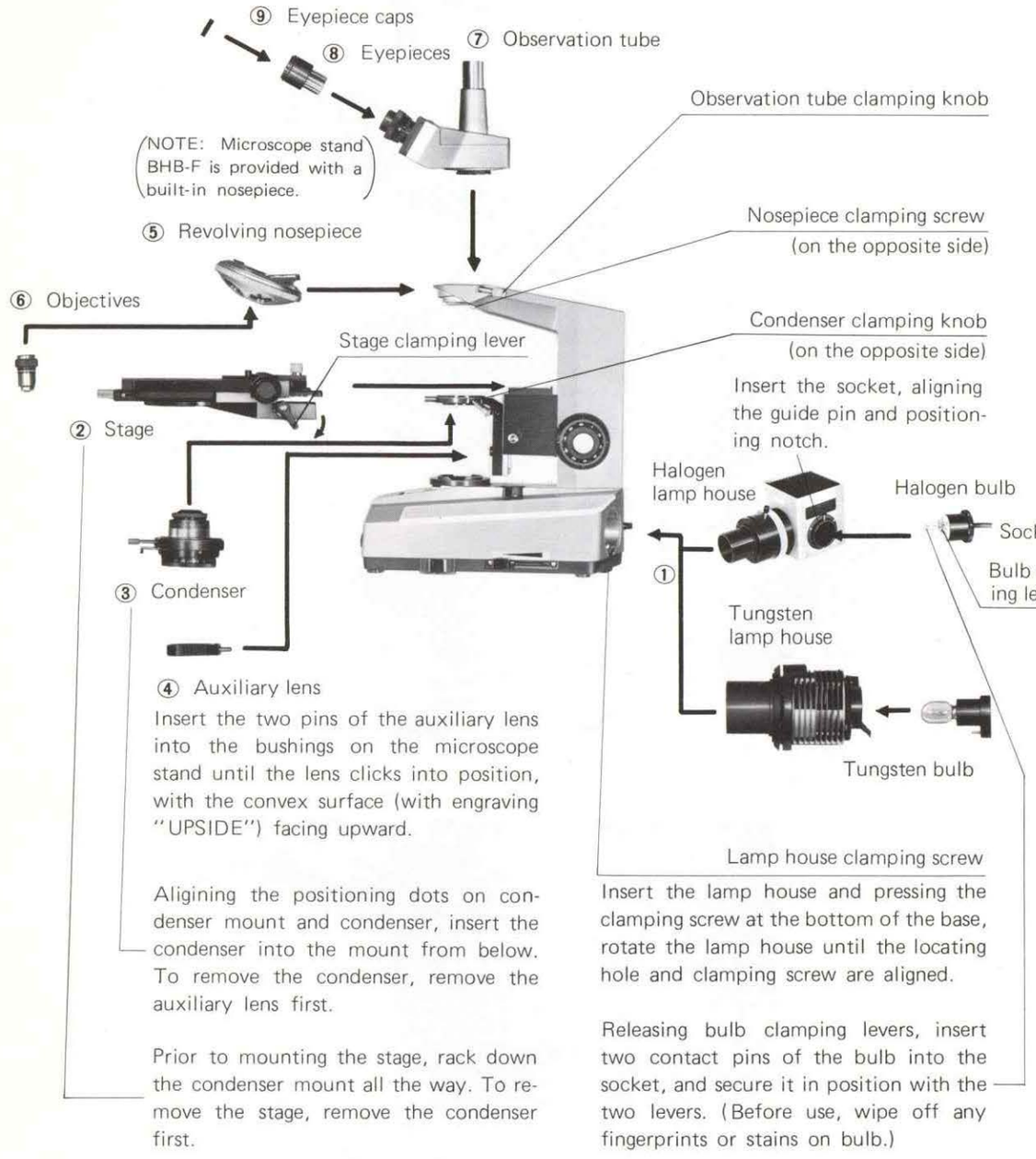
The Olympus System Microscope Series BH is composed of a modular, building-block system of various components and interchangeable accessories as shown below.
A broad variety of combinations, standardized or optional, is available according to your requirements.



BHA-413LS

III. ASSEMBLY

The picture below illustrates the sequential procedure of assembly. The numbers indicate the assembly order of various components. Remove dust caps before mounting components. Take care to keep all glass surfaces clean, and avoid scratching the surfaces.



④ Auxiliary lens
Insert the two pins of the auxiliary lens into the bushings on the microscope stand until the lens clicks into position, with the convex surface (with engraving "UPSIDE") facing upward.

Aligining the positioning dots on condenser mount and condenser, insert the condenser into the mount from below. To remove the condenser, remove the auxiliary lens first.

Prior to mounting the stage, rack down the condenser mount all the way. To remove the stage, remove the condenser first.

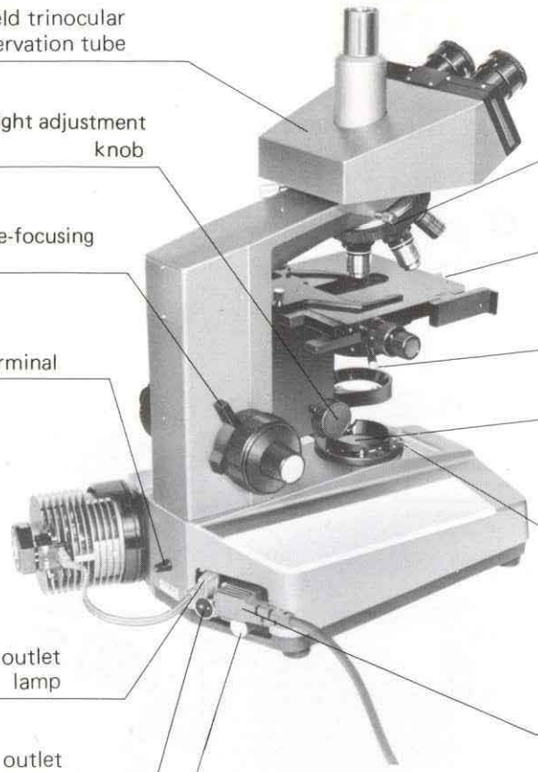
Insert the lamp house and pressing the clamping screw at the bottom of the base, rotate the lamp house until the locating hole and clamping screw are aligned.

Releasing bulb clamping levers, insert two contact pins of the bulb into the socket, and secure it in position with the two levers. (Before use, wipe off any fingerprints or stains on bulb.)

1) Connect the low voltage plug of the lamp house to the outlet at the back of microscope stand.
2) Connect the line cord to the receptacle at the back of microscope base and insert the other end of the cord into the AC power outlet.
3) Set the light source selector knob to position "T" (for tungsten lamp) or "H" (for halogen lamp) according to the light source in use.

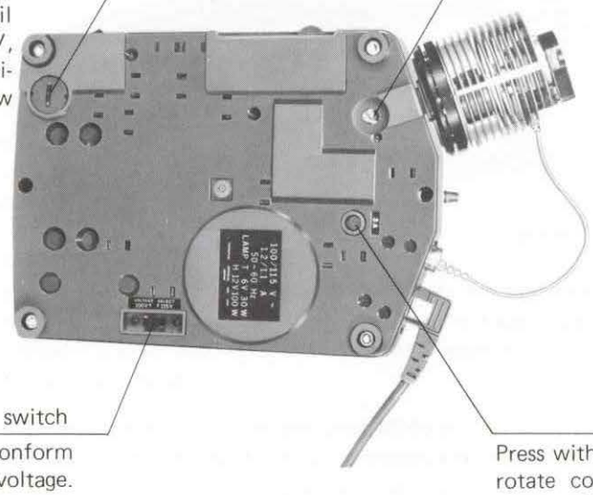
IV. IDENTIFICATION AND FUNCTION OF VARIOUS COMPONENTS

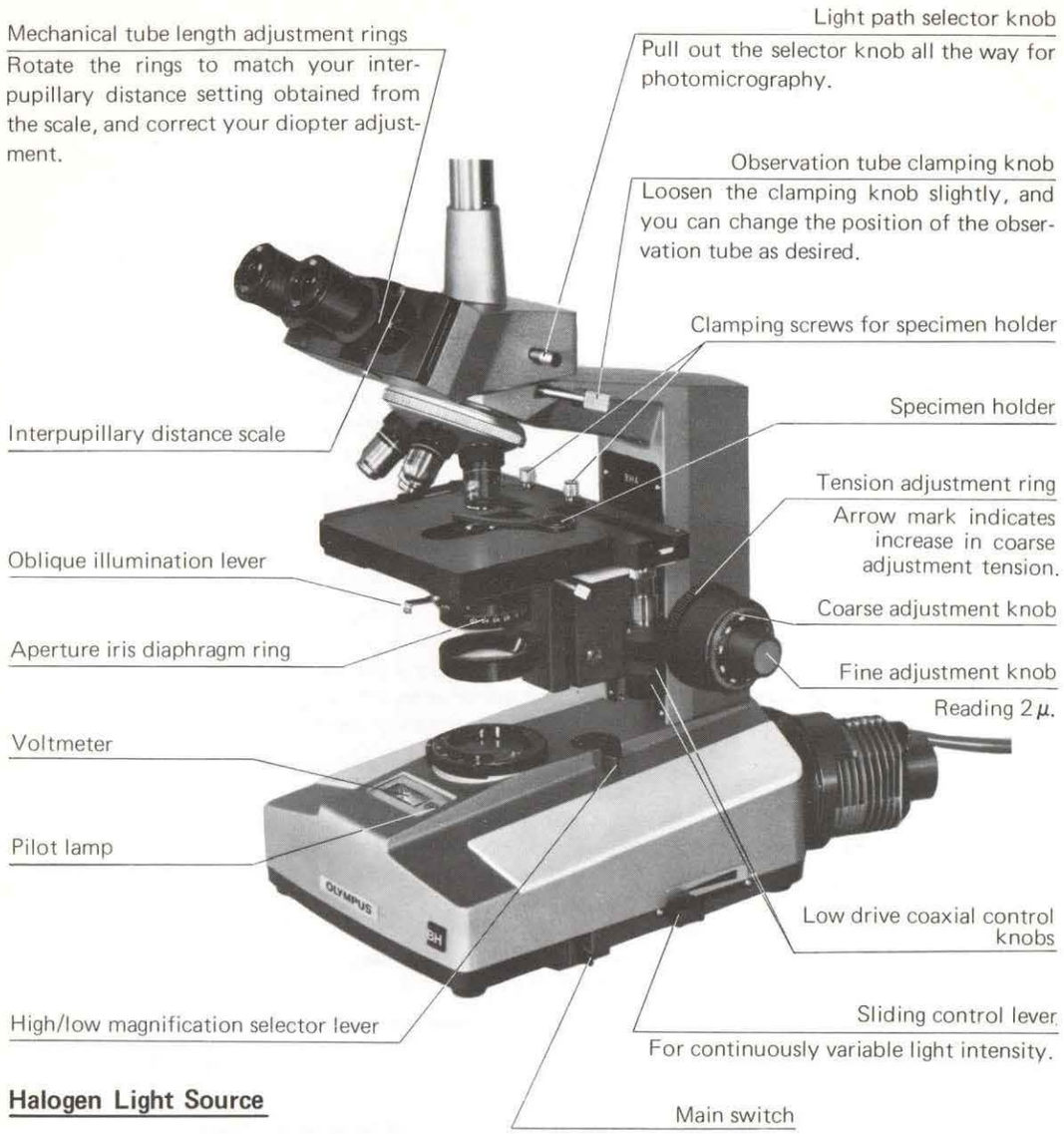
(The illustrations below include the standard and optional components.)



Rheostat trimmer screw

Rotate the trimmer screw gradually with a coin until the voltmeter indicates 1V, with the sliding lever positioned closest to you (low voltage).





Halogen Light Source

V. OPTICAL SYSTEM

The optical system of the Series BH is divided into five sections: Objectives, observation tubes, eyepieces, illumination and photomicrographic equipment. The following is the briefing of the objectives, eyepieces and illumination equipment.

1. Objectives

A. Types

- Achromat:
  Literally color-free. The achromat passes white light without separating it into its different color components. An image formed by an achromat will not be surrounded by color fringes. Recommended for general use.
- Fluorite (Fl) (or semi-apochromat):
  The name "fluorite" is derived from the mineral used in lens manufacture. It makes possible the attainment of a high order of correction for two colors chromatically and two colors spherically, and possesses excellent resolution, suited for photomicrography, as well as for bacteria and blood tests, chromosome examination, etc.
- Apochromat (Apo):
  An objective corrected chromatically for three colors and spherically for two colors. These corrections are superior to those of the achromatic series of lenses. Field curvature is still present. For research use.
- Plan Achromat (Plan):
  Chromatic aberration is corrected for two colors, hence the other colors of the secondary spectrum are not brought to the same focus. This objective is capable of producing a flat image to the edge of the field. It is therefore invaluable for the visual observation and photomicrography of flat objects such as stained smears and sections.
- Plan Apochromat (Plan Apo):
  Capable of producing a flat image to the edge of the field, excellent resolution. Free of field curvature. Chromatic aberration is corrected for three colors, and spherical aberration corrected for two colors. Highest class suitable for research use.

B. How to Use

- Immersion Objective (engraved "HI" for homogeneous immersion)
  To utilize the full numerical aperture of an immersion objective, the objective, specimen and condenser are immersed in an immersion liquid.

  (1) Focus on the specimen with a low power objective.

  (2) Put a drop of immersion oil on both the specimen and the objective front lens.

  (3) Turn the revolving nosepiece to bring the immersion objective into the light path, and focus with the fine adjustment knob.
  NOTE: Care should be taken to prevent oil bubbles from forming in the oil film between condenser, specimen slide and objective.

  (4) After use, carefully wipe off the immersion oil deposited on the lens surfaces with gauze moistened with xylene.
  Never leave oil on the lens surfaces after use as oil remnants will seriously impair the performance of the lens systems.

- Cover Glass
  The cover glass is placed over the object. Olympus objectives with an engraving "0.17" are corrected for use of cover glasses of 0.17mm thickness (No. 1½). It is essential to use only No. 1½ cover glasses with dry objectives of N.A. 0.7 and higher which are not equipped with a correction collar.

○ **Specimen Slide**
It is recommended to use specimen slides of 0.8mm to 1.5mm thickness.
However, for use with the immersion darkfield condenser BH-DCW and differential interference contrast condenser BH-NC (both are optionally available), a specimen slide between 0.8mm–1.2mm thickness is preferable.

○ **Special Objectives**

• **Objectives with Iris Diaphragm**
A small iris diaphragm is built into the objective. It is used in darkfield observations and serves to match the objective N.A. with the N.A. of the darkfield condenser.

• **Objectives with Correction Collar**
An adjustable collar is provided to move the back elements of the objective farther away or closer to the front lens or lenses to spherically correct for a thinner or thicker cover glass. The graduations on the collar read directly in hundredths of a millimeter so that adjustments can be made for variations in thickness of cover glasses.

How to Use:
Set the collar at 0.17mm and then turn it in either direction while looking through the microscope and fine focusing on the specimen. The image will either get sharper or become less distinct, depending upon whether the change is being made in the right direction or not.

• **No Cover Objectives**
Designed for observation of smears without a cover glass.

2. Eyepieces

The eyepieces available in the Series BH are computed to correct slight residual errors left uncorrected in the objectives and designed to further magnify the primary image from the objective, limiting the field as viewed by the eye.

A. Types

○ Widefield Eyepiece (WF):
Color corrected and flat, wide field; high eyepoint, convenient for observers wearing eyeglasses.

○ Compensating Eyepiece (K):
Corrected for chromatic aberration and astigmatism. For use with high power objectives.

○ Super Widefield Eyepiece (SW):
For super widefield viewing, providing a field of view twice as large as a standard eyepiece. Used together with a super widefield observation tube and super widefield objectives.

○ Photo Eyepiece (FK):
For photomicrographic use. Fully corrected for field flatness in combination with all Olympus objectives.

★ The eyepieces mentioned above can be used with drop-in eyepiece micrometer discs.

◎ **Use of Eyepiece Cap (for standard eyepiece)**
The eyepiece cap is recommended for those who wear eyeglasses. It prevents damage to the eyeglasses.

◎ **Use of Eyepiece with Eye Shield**
The eyepiece WF10x incorporates a sliding eye shield. This eye shield can be pulled out to prevent glare and loss of contrast caused by ambient light hitting the eye lens.

■ Optical Data (for standard field of view)

Objective \ Eyepiece	Type	Achromat							Fluorite		Plan Achromat						
	Magni.	4x	10x	20x	S40x	60x	S100x **	I100x **	SFL 40x	SFL 100x**	Plan 1.3x	Plan 2x	Plan 4x***	Plan 10x***	Plan 20x***	Plan 40x***	Plan 100x**
	N.A.	0.10	0.25	0.40	0.65	0.80	1.30	1.30	0.75	1.30	0.03	0.05	0.10	0.25	0.40	0.65	1.25
	W.D.(mm)	19.87	5.40	1.58	0.39	0.26	0.11	0.11	0.49	0.10	19.92	18.29	5.50	7.18	0.78	0.22	0.14
	Focal Length (mm)	29.20	15.98	8.13	4.31	2.85	1.81	1.81	4.29	1.80	31.93	37.91	31.31	17.48	8.11	4.38	1.65
	Resolving Power* (μ)	3.4	1.3	0.84	0.55	0.42	0.26	0.26	0.45	0.26	11.2	6.7	3.4	1.3	0.84	0.52	0.27
	Remarks				Spring-loaded		Spring-loaded	Diaph-ragm	Spring-loaded	Spring-loaded					Spring-loaded	Spring-loaded	Spring-loaded
BiK5x (Field Number 21)	Total Magni.	20x	50x	100x	200x	300x	500x	500x	200x	500x	6.5x	10x	20x	50x	100x	200x	500x
	Focal Depth (μ)	300.0	48.0	15.56	4.99	2.83	1.05	1.05	4.19	1.05	3115	1200	300	48.0	15.56	4.99	1.10
	Field of View (mm)	5.25	2.1	1.05	0.53	0.35	0.21	0.21	0.53	0.21	16.15	10.5	5.25	2.1	1.05	0.53	0.21
BiWF10x (18)	Total Magni.	40x	100x	200x	400x	600x	1000x	1000x	400x	1000x	13x	20x	40x	100x	200x	400x	1000x
	Focal Depth (μ)	172.5	27.60	9.19	3.03	1.77	0.66	0.66	2.49	0.66	1808	690	172.5	27.60	9.19	3.03	0.7
	Field of View (mm)	4.5	1.8	0.9	0.45	0.3	0.18	0.18	0.45	0.18	13.85	9.0	4.5	1.8	0.9	0.45	0.18
BiWF15x (12)	Total Magni.	60x	150x	300x	600x	900x	1500x	1500x	600x	1500x	19.5x	30x	60x	150x	300x	600x	1500x
	Focal Depth (μ)	130.0	20.80	7.06	2.37	1.41	0.53	0.53	1.93	0.53	1372	520	130	20.80	7.06	2.37	0.56
	Field of View (mm)	3.0	1.2	0.6	0.3	0.2	0.12	0.12	0.3	0.12	9.23	6.0	3.0	1.2	0.6	0.3	0.12
BiK20x (7.5)	Total Magni.	80x	200x	400x	800x	1200x	2000x	2000x	800x	2000x	26x	40x	80x	200x	400x	800x	2000x
	Focal Depth (μ)	108.75	17.40	6.0	2.05	1.23	0.46	0.46	1.64	0.46	1154	435	108.7	17.40	6.0	2.05	0.49
	Field of View (mm)	1.88	0.75	0.38	0.19	0.13	0.08	0.08	0.19	0.08	5.77	3.75	1.88	0.75	0.38	0.19	0.08

*The resolving power is obtained when the objective is used at the full aperture diaphragm.
**Immersion objectives.
***These objectives are capable of super widefield observation as well as standard observation.

Objective / Eyepiece	Type	Apochromat		Plan Apochromat			No Cover	
	Magni.	Apo 40x	Apo 40x **	Plan Apo 4x***	Plan Apo 10x***	Plan Apo 20x***	No Cover 40x	No Cover FL 40x
	N.A.	0.85	1.0	0.16	0.32	0.65	0.65	0.75
	W.D.(mm)	0.23	0.19	4.35	0.16	0.14	0.71	0.53
	Focal Length (mm)	4.33	4.38	27.80	14.18	7.56	4.18	4.42
	Resolving Power*(μ)	0.39	0.34	2.1	1.05	0.52	0.52	0.45
	Remarks	Correction collar; Spring-loaded; Diaphragm			Spring-loaded	Spring-loaded		
BiK5x (Field Number 21)	Total Magni.	200x	200x	20x	50x	100x	200x	200x
	Focal Depth(μ)	3.62	3.00	176.95	36.27	8.91	3.33	2.79
	Field of View(mm)	0.53	0.53	5.25	2.1	1.05	0.53	0.53
BiWF10x (18)	Total Magni.	400x	400x	40x	100x	200x	400x	400x
	Focal Depth(μ)	2.12	1.73	97.27	20.33	4.99	2.02	1.66
	Field of View(mm)	0.45	0.45	4.5	1.8	0.9	0.45	0.45
BiWF15x (12)	Total Magni.	600x	600x	60x	150x	300x	600x	600x
	Focal Depth(μ)	1.62	1.30	70.70	15.02	3.68	1.58	1.29
	Field of View(mm)	0.3	0.3	3.0	1.2	0.6	0.3	0.3
BiK20x (7.5)	Total Magni.	800x	800x	80x	200x	400x	800x	800x
	Focal Depth(μ)	1.37	1.09	57.42	12.36	3.03	1.36	1.09
	Field of View(mm)	0.19	0.19	1.88	0.75	0.38	0.19	0.19

* The resolving power is obtained when the objective is used at the full aperture diaphragm.
** Immersion objectives.
*** These objectives are capable of super widefield observation as well as standard observation.

■ Optical Data (for super widefield observation)

Objective / Eyepiece	Type	Plan Achromat					Plan Apochromat		
	Magni.	Plan 4x	Plan 10x	Plan 20x	Plan 40x	Plan 100x **	Plan Apo 4x	Plan Apo 10x	Plan Apo 20x
	N.A.	0.10	0.25	0.40	0.65	1.25	0.16	0.32	0.65
	W.D.(mm)	5.50	7.18	0.78	0.22	0.08	4.35	0.16	0.14
	Focal Length (mm)	31.31	17.45	8.11	4.38	1.59	27.80	14.18	7.56
	Resolving Power*	3.4	1.3	0.84	0.52	0.29	2.1	1.05	0.52
	Remarks			Spring-loaded	Spring-loaded	Spring-loaded		Spring-loaded	Spring-loaded
BiSW7x (Field Number 29)	Total Magni.	28x	70x	140x	280x	700x	28x	70x	140x
	Focal Depth(μ)	227.14	36.34	11.92	3.87	0.87	131.42	27.16	6.67
	Field of View(mm)	7.25	2.9	1.45	0.73	0.29	7.25	2.9	1.45
BiSW10x (26.5)	Total Magni.	40x	100x	200x	400x	1000x	40x	100x	200x
	Focal Depth(μ)	172.5	27.6	9.19	3.03	0.7	97.27	20.33	4.99
	Field of View(mm)	6.63	2.65	1.33	0.66	0.27	6.63	2.65	1.33

* The resolving power is obtained when the objective is used at the open aperture diaphragm. ** Immersion objective.

■ Nomenclature of Optical Components.

- Working Distance: The distance from the specimen or cover glass to the nearest point of the objective. A longer working distance is convenient to avoid damage to the objective front lens, specimen or substage condenser or when using a thicker slide, e.g. a blood counting chamber.
- Numerical Aperture: Generally abbreviated N.A. A mathematical relationship that directly connects the resolving power and the light-gathering power of an objective with its aperture. Numerical aperture is the product of the sine of half the angular aperture of a lens, and the refractive index of the medium through which the light passes. It is a very important constant for high power lenses. The N.A. values can be used for directly comparing the resolving power of all types of objectives, dry, water or oil immersion.
- Resolving Power: The ability of a lens to register small details. Resolving power is of vital importance in critical microscopy. The resolving power of a lens is measured by its ability to separate two points (line structure in the object may be considered as a row of points). The resolving power of a microscope is now placed at $R=K\frac{\text{Wavelength }\lambda}{\text{N.A.}}$ K=constant

  The visible wavelength λ of the light employed is 400mμ to 700mμ. Decreasing the wavelength of the light employed increases the resolving power. The higher the resolving power of an objective, the closer the image will be to the true structure of the object.
- Focal Depth: The distance between the upper and lower limits of sharpness in the image formed by an optical system is termed "focal depth." Structures outside these limits are more or less blurred and with low power objectives are apt to interfere with the image in focus. Lack of focal depth is most apparent in photomicrography, particularly with low power objectives, as the image is projected on the film in one place. (In micron.)
- Field Number: A number that represents the diameter in mm of the image of the field diaphragm that is formed by the lens in front of it.
- Field-of-View Diameter: The actual size of the field of view in mm. This is derived from $\frac{\text{Field number of eyepiece}}{\text{Power of objective}}$.

3. Condensers

The condensers available with the Series BH are designed to slip into the ring mount and are locked with a clamping screw. They permit rapid interchange for different modes of microscopy, e.g. brightfield, darkfield, immersion or dry, super widefield, phase contrast, with low to high power objectives.

A. Types

- Abbe Condenser BH-CD:
  N.A. 1.25, for objectives from 4x to 100x, with aperture diaphragm, scale graduated in mm. For general use.

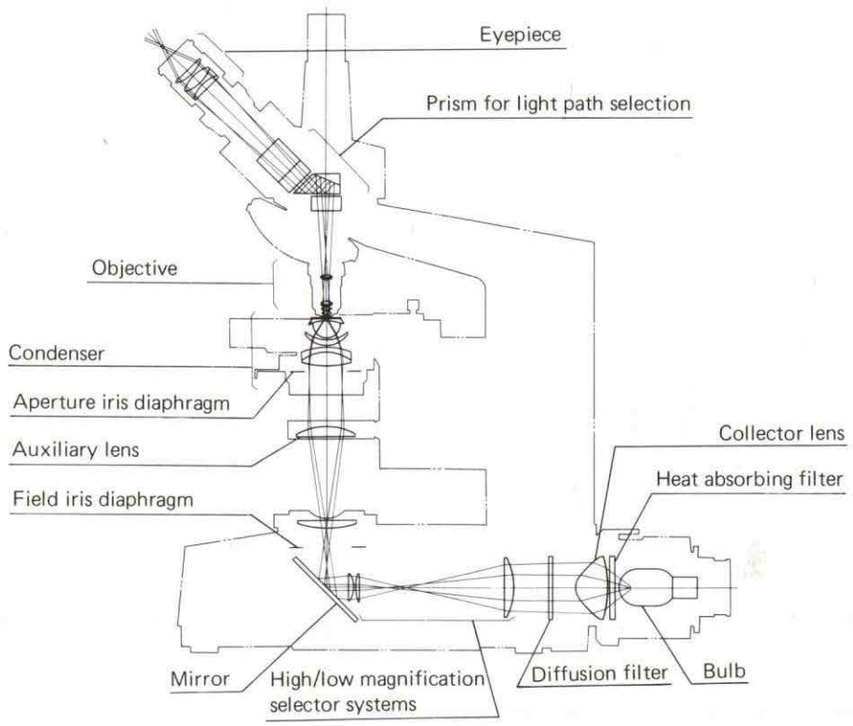
- Achromatic/aplanatic Condenser BH-AAC:
  N.A. 1.40. This condenser is corrected for chromatic aberration, spherical aberration and field curvature, and is provided with a graduated, aperture iris diaphragm, decenterable for oblique illumination. It is recommended for work with high quality apochromats and plan apochromats.

- Super Widefield Condenser BH-SWC:
  N.A. 0.95, for super widefield observation with objectives from 4x to 100x. The condenser should not be immersed for use with 100x objective. If it is desired to fully utilize the N.A. of the 100x objective, it is recommended to use the achromatic/aplanatic condenser.

- Low Power Condenser BH-ULC:
  N.A. 0.1, for objectives Plan 1.3x and Plan 2x, 4x objectives can also be used.

- Darkfield Condensers BH-DC:
  The darkfield condensers include the immersion darkfield condenser N.A. 1.2–1.4, BH-DCW and the dry darkfield condenser N.A. 0.8–0.92, BH-DCD. The Model BH-DCW is recommended for work with objectives 40x to 100x, while the Model BH-DCD works best with objectives 4x to 40x.

4. Illumination with Transmitted Light

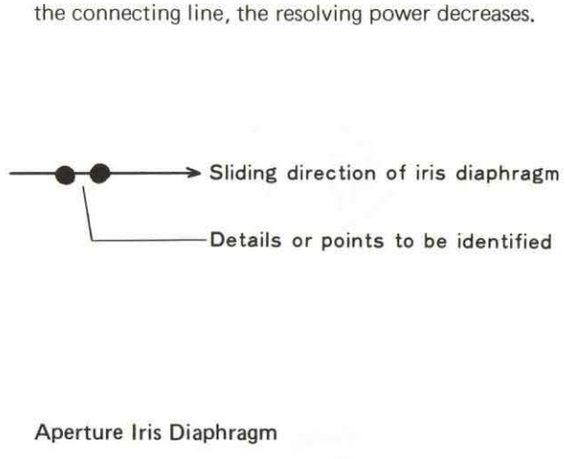


For best results, the specimen must be correctly illuminated. The illumination system adopted in the Series BH is based on the Koehler principle to obtain maximum light intensity of the light source at full numerical aperture of all the objectives, in conjunction with a high/low magnification selector system.

As shown in the drawing above, the filament of the bulb forms, through the collector lens, an image at the aperture iris diaphragm. This image, located at about the same place as the front focal point of the condenser, is projected by the objective to the rear focal point of the objective, that is, in the exit pupil of the objective. Since this image is then projected into the observer's pupil, it is completely invisible to the observer, hence, illumination free from "irregularities" is obtained.

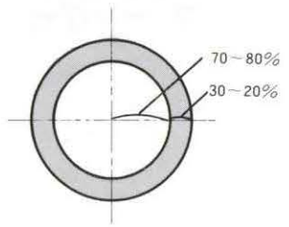
A. Oblique Illumination

The achromatic/aplanatic condenser N.A. 1.40 has extremely high resolving power and provision for oblique illumination.
With oblique illumination, the resolving power can be doubled. If it is desired to identify two points very close to each other, the aperture diaphragm is moved parallel to the straight line connecting the two points. On the contrary, if the diaphragm is moved at right angles to the connecting line, the resolving power decreases.



B. Aperture Iris Diaphragm

An aperture diaphragm opened too wide impairs image contrast due to internal reflections and related factors. On the other hand, if the diaphragm is stopped down excessively, resolution is unduly reduced. It is therefore suggested that you match the opening of the aperture iris diaphragm to the numerical aperture of the objective in use, in order to achieve optimum objective performance. However, since microscopic specimens generally are low in contrast, their image lacks contrast if the objective is used with its full numerical aperture. Therefore, it is often preferable to stop down the aperture diaphragm slightly more than indicated by the objective N.A. This will result in increased image contrast, larger depth of focus and a flatter field. On the other hand, stopping down too much impairs resolution. An aperture setting of 0.7x the N.A. of the objective is recommended. If the numerical aperture of the objective is 1, for instance, you may want to set the scale to 0.7.



★This procedure must be repeated each time the objectives are changed.

C. Field Iris Diaphragm

The field iris diaphragm controls the diameter of the ray bundle impinging on the specimen surface and thus increases image definition.

For centration of the field diaphragm: (Fig. 1)

Fig. 1

(1) Turn the high/low magnification lever ① to position "L".

(2) Place a specimen on the mechanical stage and use the objective 10x to bring the specimen in focus.

(3) Stop down the field iris diaphragm with knurled ring ② . A slightly blurred image of the field diaphragm can now be seen in the eyepiece.

(4) Move the condenser up and down to focus on the image of the field diaphragm.

(5) While widening the diameter of the field progressively, use the condenser centering knobs ③ to bring the diaphragm image into the center of the field of view. If the polygonal image of the iris diaphragm becomes inscribed in the field it means that the field diaphragm is centered. Slightly increase diameter of the field iris diaphragm until it is just outside the field of view. (Fig. 2)

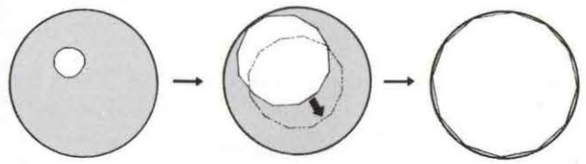


Fig. 2

VI. ELECTRICAL EQUIPMENT

1. Adjustment of Light Intensity

The minimum voltage required for the light source can be adjusted with the rheostat trimmer screw at the bottom of the microscope base in accordance with the line voltage and frequency. A silicon controlled rectifier (SCR) is provided for output voltage control. The SCR has the following advantages over conventional rheostat controls:

① Extremely fine adjustment of light intensity can be easily achieved.

② Flickering of the bulb filament is eliminated and light intensity is stabilized.

③ Increased life expectancy of the bulb.

◎ Adjustment of Minimum Line Voltage

(1) Ascertain that the line voltage selector switch is set to conform with the local mains voltage. (This switch can be set to the following voltages: 100V–115V or 220V–240V.)

(2) Ascertain that the sliding control lever is positioned closest to you (low voltage), and then activate the main switch. The pilot lamp lights up.

(3) If the bulb is dimly lit, and the voltmeter indicates about 1V, the secondary voltage is correct, and you have only to push the sliding control lever forward in order to obtain optimum light intensity.

(4) If the bulb does not light or lights up brightly immediately after switching on, rotate the rheostat trimmer screw gradually with a coin, until the voltmeter indicates about 1V.

2. Tungsten Light Source

The standard light source incorporates a 30W pre-centered tungsten filament bulb, provided with a socket for positive contact, eliminating the problems of defective contact and over-heating.

When used at the rated voltage 6V, the average life of the tungsten bulb LS30 is longer than 200 hours. This is, however, greatly reduced, if the bulb is used at higher voltage; for instance the bulb life is reduced to 1/50 at 8V. Therefore, it is advisable to avoid prolonged use at readings over 6V.

If the tungsten light source should be used at high voltage constantly, it is recommended to use a high intensity halogen bulb.

★ Do not switch the tungsten bulb on with the sliding control lever at high intensity position (away from the user). It reduces bulb life.

3. Halogen Light Source

Before the use of the halogen lamp (12V 100W HAL), make it a point to center the lamp correctly; otherwise the optimum performance can not be obtained.

A. Bulb Centration

(1) Align the dot of the light source selector knob (at the back of the microscope base) to position "H" (for halogen lamp).

(2) Swing the objective 10x in position.

(3) Set the high/low magnification selector lever to position "L".

(4) Fully open the field iris diaphragm and aperture iris diaphragm.

(5) Turn on the main switch of the microscope base and adjust light intensity.

(6) Coarse focus with the coarse adjustment knobs.

(7) Center the condenser.

(8) Remove the eyepiece from the observation tube, and look into the tube.

(9) Looking at the image of the bulb filament at the back focal plane of the objective, center it by loosening the socket clamping knob ① , sliding the socket back and forth, or rotating it clockwise or counter-clockwise. (Fig. 3)

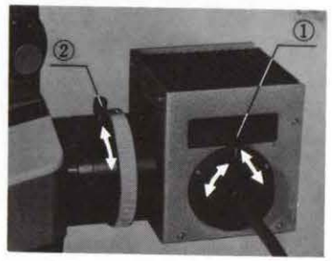


Fig. 3

(10) After completing the centration, re-insert the eyepiece into the observation tube.

(11) Turn the collector lens focusing knob ② to the right or to the left until illumination irregularities are minimized, if any. (Fig. 3)

(12) Insert the frosted glass into the filter insertion slot. (See page 6)

B. Darkfield and Fluorescence Observation

For darkfield and fluorescence observation with the interference filter Model FITC, remove the frosted glass.

C. Bulb Replacement

(1) Turn off the main switch and disconnect the line cord from the AC outlet.

(2) Loosen the socket clamping screw and remove the socket.

(3) Loosen the bulb clamping levers, and replace the defective bulb with a replacement bulb.

NOTE: Wipe off thoroughly any fingerprints or stains on the bulb before use.

D. Bulb Life

When used at 12V continuously, the average life of the halogen bulb lasts 50 hours. This durability is, however, greatly reduced, if the bulb is used at higher voltages or when a stained bulb is used. On the contrary, at the voltage lower than 12V, for instance at 10V, the bulb life is prolonged by about 10 times, and at 8V, about 70 times. Therefore, it is recommended to use the bulb at lower voltages as well as possible.

VII. STAGES

1. Removal of Specimen Holder

The standard mechanical stage is provided with a spring-loaded specimen holder, which is capable of holding a specimen up to 55mm x 85mm in size. This specimen holder is removable to obtain a large unobstructed stage surface.

2. Rotation of Mechanical Stage with Horizontal Coaxial Controls BH-SH

The mechanical stage BH-SH is rotatable when mounted on the microscope stand in the standard position. If it is necessary, however, to increase the rotation angle, it is recommended to mount the stage in the manner shown in Fig. 4.

Fig. 4

3. Stage Spacer

In order to prevent interference between objectives and specimen holder it is recommended to use the stage spacer provided and mount it in the manner shown in Fig. 5, prior to placing the specimen on the stage. This procedure is particularly important in case the stage with horizontal coaxial controls is used.

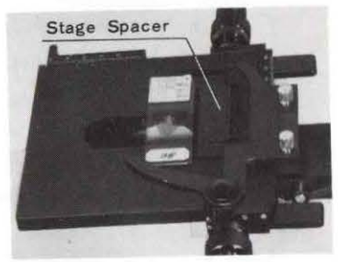


Fig. 5

VIII. OBSERVATION TUBES

1. Interpupillary Distance and Diopter Adjustments

A. Observation Tubes BH-BI45 and BH-TR45

(1) Hold the knurled dovetail slides ① of the right and left eyepiece tubes with both hands and push the tubes together, or pull them apart laterally, whichever is required, while looking through the eyepieces with both eyes, until perfect binocular vision is obtained. (Fig. 6)

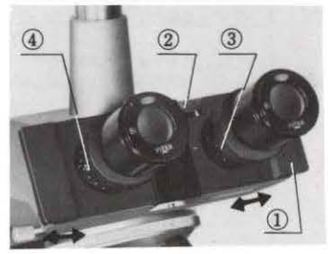


Fig. 6

(2) Memorize your interpupillary distance setting. Scale ② is provided for this purpose.

(3) Rotate the tube length adjustment ring ③ on the right eyepiece tube to match your interpupillary distance setting which you obtained from the scale.

(4) Look at the image through the right eyepiece with your right eye and focus on the specimen with the fine adjustment knobs.

(5) Next, look at the image through the left eyepiece with your left eye and rotate the tube length adjustment ring ④ to focus on the specimen without using the coarse and fine adjustment knobs.

★The mechanical tube length of the Olympus biological microscope is standardized at 160mm.

B. Super Widefield Observation Tube BH-SWTR

(1) Looking through the eyepieces with both eyes, adjust the interpupillary distance, sliding the knurled dovetail slides ① of the right and left eyepiece tubes, until perfect binocular vision is obtained. Then, looking through the right eyepiece with your right eye, focus on the edge of the field of view with the knurled ring ② of the right eyepiece. (Fig. 7)

★If you know your dioptral constant, match the scale on the eyepiece tube to it.

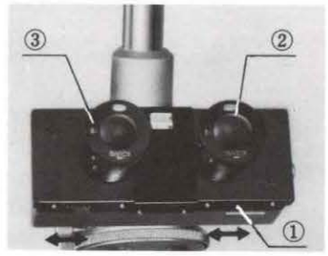


Fig. 7

(2) Look at the image through the right eyepiece with your right eye and focus on the specimen with the fine adjustment knobs.

(3) Next, look at the image through the left eyepiece with your left eye and rotate the knurled ring ③ of the left eyepiece to focus on the specimen without using the coarse and fine adjustment knobs.

2. Light Path Selection

The trinocular observation tubes are provided with a light path selector lever to direct the light to the observation tube or to the photo tube.

Lever position	Amount of light	Application
Pushed in all the way	100% into binocular tube	(1) Observation (2) Dark specimens
Pulled out all the way	20% into binocular tube 80% into photo tube	(1) Photomicrography (2) Observation of excessively bright specimens

IX. FOCUSING ADJUSTMENT

1. Tension Adjustment of Coarse Adjustment Knobs (Fig. 8)

A tension adjustment ring ① is provided next to the right hand coarse adjustment knob. With this device the tension of the coarse adjustment is freely adjustable for either heavy or light movement depending on operator preference.
However, do not loosen the tension adjustment ring too much, because the stage drops or the fine adjustment knobs slip easily.

★Be careful not to rotate the right and left coarse adjustment knobs in the opposite directions simultaneously.

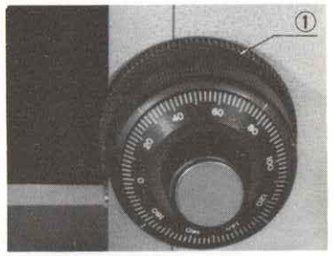


Fig. 8

2. Automatic Pre-focusing Lever (Fig. 9)

This lever ① is provided to prevent possible contact between specimen and objective as well as to simplify coarse focusing. The lever is locked after coarse focus has been accomplished. This prevents further upward travel of the stage by means of the coarse adjustment knobs, and automatically provides a limiting stop if the stage is lowered and then raised again. The automatic pre-focusing lever does not restrict fine focusing.

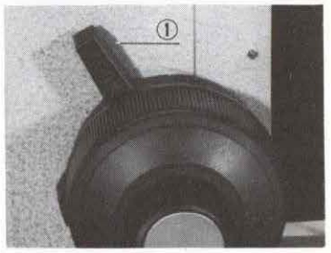


Fig. 9

X. TROUBLESHOOTING

Troubles		Causes	Remedies
1.	Optical System		
(a)	With the illuminator switched on, the field of view cannot be seen.	The high/low magnification selector lever is not correctly positioned.	Place the lever in correct positon.
		The field iris diaphragm is not opened sufficiently.	Open the field diaphragm fully.
		The condenser is lowered excessively.	Raise the condenser to the upper limit.
		With the achromatic/aplanatic condenser, the slide for oblique illumination is pulled out.	Re-position the slide correctly.
		The light source selector knob is not correctly positoned for the light source.	Re-positon correctly.
(b)	The field of view is cut off or illuminated irregularly.	The light path selector lever is stopped midway.	Push the lever all the way.
		The high/low magnification selector lever is not correctly positioned.	Place the lever all the way.
		The auxiliary lens is not correctly attached.	Correct the lens position.
		The nosepiece is not click stopped.	Slightly rotate the nosepiece until it clicks into position.
		(With BHA) the nosepiece is not correctly attached to the stand.	Insert the sliding dovetail mount into the stand all the way, until it stops, then lock.
		An incorrect condenser is used.	In case of SW observation, use the SW condenser.
		The condenser is not correctly mounted on the ring mount.	Re-insert the condenser all the way, until it stops.
		(With the achromatic/aplanatic condenser) slide for oblique illumination is pulled out.	Re-position the slide correctly.
		The field iris diaphragm is stopped down excessively.	Open the diaphragm fully.
		The lamp is not correctly attached.	Re-insert the lamp correctly.
(c)	Dust or dirt is visible in the field of view.	Dust or dirt on the glass surface at the light exit on the base.	Clean off the dust or dirt.
		Dust on objective front lens.	
		Dirty specimens.	
		Dust on eyepiece.	
(d)	Excessive image contrast.	The condenser is lowered excessively.	Raise the condenser.
		The aperture iris diaphragm is stopped down excessively.	Open the diaphragm.
		The auxiliary lens is not mounted.	Mount the auxiliary lens.
		The high/low magnification selector lever is not correctly positioned.	Place the lever in correct position.

Troubles	Causes	Remedies
(e) Resolution problems: • Image is not sharp. • Insufficient contrast. • Image details lack definition.	(With BHA) the nosepiece is not correctly attached.	Insert the sliding dovetail mount all the way, until it stops, then lock.
	The objective is not correctly positioned in the light path.	Slightly rotate the nosepiece until it clicks into position.
	The correction collar of the objective is not correctly adjusted.	Re-adjust it.
	Dirt on objective front lens.	Clean the objective.
	The immersion objective is used without immersion oil.	Apply immersion oil.
	Bubbles in the immersion oil.	Remove bubbles.
	The Olympus designated oil is not used.	Use the designated oil.
	Dirty specimen.	Clean.
	Dirt on condenser lens.	
	The specimen is not properly illuminated.	Adjust the illumination.
(f) The field of view is partially out of focus.	(With BHA) the nosepiece is not correctly attached.	Insert the sliding dovetail mount into the stand all the way, then lock.
	The objective is not correctly positioned in the light path.	Slightly rotate the nosepiece until it clicks into position.
	The specimen is not correctly positioned on the stage.	Place the specimen on the stage and secure it with the specimen holder.
(g) The image goes out of focus eccentrically.	(With BHA) the nosepiece is not correctly attached.	Insert the sliding dovetail mount all the way, until it stops, then lock.
	The objective is not correctly positioned in the light path.	Slightly rotate the nosepiece until it clicks into position.
	The condenser is out of center.	Center the condenser.
	With the achromatic/aplanatic condenser, the slide for oblique illumination is pulled out.	Re-position the slide correctly.
	The auxiliary lens is not correctly mounted.	Mount the lens correctly.
	The high/low magnification selector lever is stopped midway.	Place the lever in correct position.
(h) When objectives are changed, they are not parfocal.	The mechanical tube length is not correctly adjusted.	Adjust with the tube length adjustment rings on the observation tube.
(i) Light intensity does not increase although the voltage is raised.	The condenser is not correctly centered.	Center the condenser.
	The condenser is lowered excessively.	Raise the condenser.

Troubles	Causes	Remedies
2. Electric System		
(a) The illuminator is too bright (or too dark).	The rheostat trimmer screw is not matched to the mains voltage.	Adjust the trimmer screw to match the mains voltage.
	The mains voltage is too high (or too low).	Adjust the mains voltage with a variable voltage transformer.
	The rheostat trimmer screw is not correctly adjusted.	Adjust the trimmer screw until the voltmeter indicates 1V.
(b) Output voltage for the illuminator cannot be regulated.	The voltage selector switch is not matched to the mains voltage.	Match the voltage selector switch to the mains voltage.
	The mains voltage is too low or too high.	Adjust the mains voltage with a variable voltage transformer.
(c) The light flickers and the intensity is unstable.	The mains voltage is unstable.	Use a variable voltage transformer.
	The filament of the bulb is likely to burn out.	Replace the bulb.
	Loose electrical connection.	Secure the connection.
(d) Fuse burns out too often.	The fuse is not a standard fuse.	Use a standard fuse.
	The voltage selector switch is not matched to the mains voltage.	Match the switch to the mains voltage.
(e) The pilot lamp lights but the bulb does not.	The bulb is burned out.	Replace the bulb.
	Loose electrical connection.	Secure the connection.
(f) Reduced bulb life.	The voltage selector switch is not matched to the mains voltage.	Match the selector switch to the mains voltage.
	The bulb is not a standard bulb.	Use a standard bulb.
	Mains voltage is too high.	Use the tungsten bulb under 6V as well as possible, or use a high intensity bulb, such as a halogen bulb.
3. Focusing		
(a) Coarse adjustment is too tight.	Tension adjustment ring is tightened too much.	Loosen the tension adjustment ring properly.
	The user is trying to raise the stage passing over the upper focusing limit imposed by the engaged pre-focusing lever.	Unlock the pre-focusing lever.
(b) The stage drops and the specimen goes out of focus.	The tension adjustment ring is too loose.	Tighten the ring properly.
(c) The stage cannot be raised to the upper limit.	Automatic pre-focusing lever is engaged in lower than focusing position.	Unlock the pre-focusing lever.
(d) The stage cannot be lowered to the lower limit of the working range.	The condenser mount is lowered too much.	Raise the condenser mount.
(e) The objective front lens hits against the specimen.	The specimen is mounted on the stage upside down.	Reverse the specimen.

Troubles	Causes	Remedies
4. Observation Tube		
(a) Incomplete binocular vision.	Interpupillary distance is not correctly adjusted.	Correct the interpupillary distance.
	Diopter adjustment is incomplete.	Complete the diopter adjustment.
	Right and left eyepieces are not matched.	Use a pair of matched eyepieces.
	The user is unaccustomed with a binocular vision.	Prior to looking at the image of the specimen, try to look the entire field of view, or look at a far away object before resuming microscopic observation.
5. Stage		
(a) The image easily goes out of focus when you touch the stage.	The stage is not correctly clamped.	Clamp the stage securely.
(b) The specimen stops midway on the east-west traverse.	The specimen is not correctly positioned on the stage.	Adjust the specimen position.

MEMO