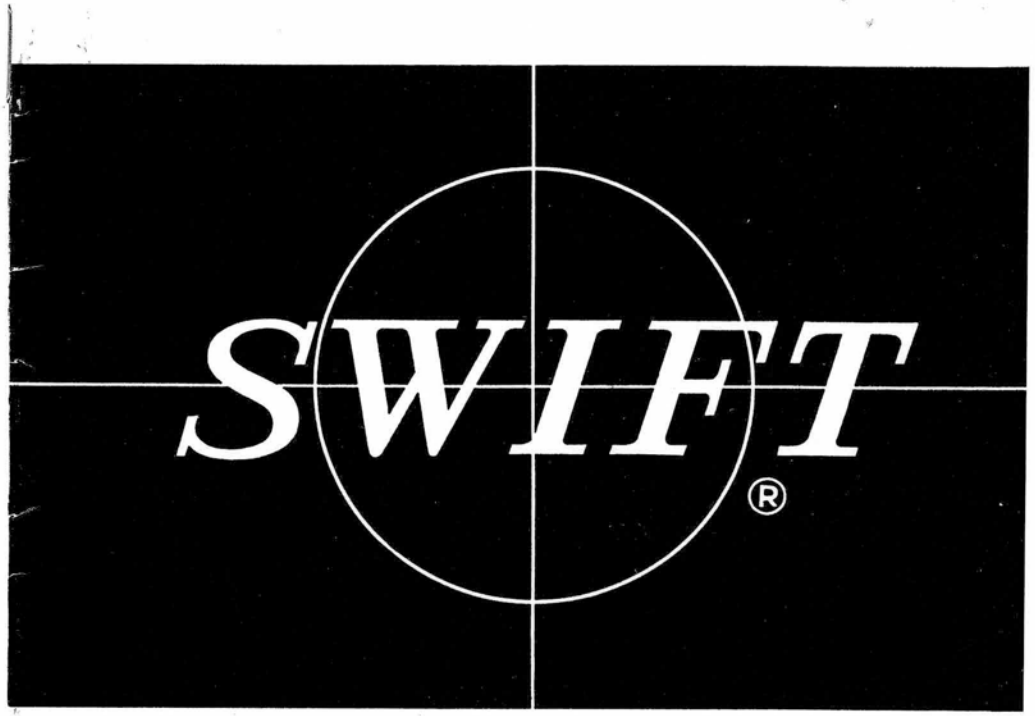
SWIFT INSTRUMENTS, INC.
www.Swiftoptical.com
877-967-9438

www.Swift-MicroscopeWorld.com
800-942-0528 Toll Free
760-438-0528 International
info@swift-microscopeworld.com

USE AND CARE OF SWIFT M-2500 SERIES

MEDICAL-BIOLOGICAL MICROSCOPE



USE AND CARE OF SWIFT M-2500 SERIES MICROSCOPE

Your SWIFT M-2500 Series microscope is an instrument of precision, both optically and mechanically and will last a lifetime with a minimum of maintenance. It is built to the highest and most rigid optical and mechanical standards and has many built-in features to insure durability and high performance in the hands of both student and professional users. It is designed to withstand the rigors of daily use with only normal care.

Unpacking: Your SWIFT M-2500 Series microscope arrived packed in either a fitted cabinet or molded styrofoam container. The objectives may be in sealed plastic vials and care should be taken not to drop them or allow your fingers to contact the lenses. Install the objectives in a clockwise direction from the lowest to the highest power.

Familiarize yourself with the components of the microscope.

Arm:	The frame that supports all components above the base.
Body:	The unit comprising the inclined eyetubes and prisms which control the path of light to the eyepiece.
Objective:	The optical system which does the initial magnifying to form the primary image.
Nosepiece:	The revolver which carries the objectives.
Eyepiece:	The upper optical components that further magnify the primary image and brings the light rays to a focus at the eyepoint.
Condenser:	The optical lens built below the center of the stage.
Stage:	The table of the microscope on which the specimen is placed.
Base:	The component which supports the entire instrument. This component includes an illuminator which directs light through the condenser to the specimen.

Important terminology common to the science of microscopy:

Compound microscope: a microscope having a primary magnifier (the objective) and a secondary (the eyepiece) to further magnify the image and bring the light rays to a focal point (the eyes).

Achromatic Objective: an optical system corrected for two colors chromatically and one color (yellow-green) spherically.

Angular Aperture: the angle (or cone) of light rays capable of entering the front lens of the objective from a point in the object. By

increasing the angular aperture of an objective more light rays from the specimen can be taken in by the lens, hence the resolving power is increased.

Numerical Aperture (N.A.): a mathematical formula devised by Ernst Abbe for the direct comparison of dry and all types of immersion objectives for resolving power. Numerical aperture (N.A.) is the sine of half the angular aperture of the objective multiplied by the refractive index of the medium between the front lens of the objective and the cover glass on the slide. Numerical apertures of all SWIFT objectives are of research quality.

Condenser: a lens or system of lenses to collect light rays and converge them to a focus. Condenser for the M-2500 Series is the N.A. 1.25 Abbe Condenser with iris diaphragm and swing out filter carrier.

Cover Glass: thin glass cut in circles, rectangles or squares, for covering the specimen, usually a thickness of 0.17 to 0.18mm. The majority of specimens should be covered by a cover glass, and this is a necessity when using the 40X and 100X lens.

Depth of focus: the ability of a lens to furnish a distinct image above and below the focal plane. Depth of focus decreases with the increase of numerical aperture or with the increase of magnification.

Eyepiece: the lens near the eye which magnifies the primary image of the objective so as to form a virtual image 10" away from the eyepoint.

Field: the area of the object that is seen when the image is observed. It may range in diameter from several millimeters to less than 0.1mm. Also the size of the diaphragm opening in the eyepiece governs the diameter of the field of view.

Focal length: parallel rays of light after refraction through a lens will be brought to a focus at the focal point. The distance from the optical center of the lens to the focal point is the focal length or focus.

Objective: the lens system near the specimen which forms the primary image.

Parfocal: a term applied to objectives and eyepieces when practically no change in focus has to be made when one power is substituted for another. The objectives on your SWIFT M-2500 Series microscope are parfocalized at the factory so that only a slight movement or no movement at all of the fine focus control is required when a change is made from high to lower powers.

Resolving Power: the ability of a lens to clearly separate fine detail. Resolving power is directly proportional to the numerical aperture of the objective. Also the shorter the wavelength of the light used, the

greater the resolving power of the optical system.

$$\text{Resolving power} = \frac{\lambda}{\text{N.A.}} \quad \text{when} \quad \frac{\lambda}{\text{N.A.}} \begin{array}{l} = \text{wave length of light being used.} \\ = \text{numerical aperture.} \end{array}$$

Widefield Eyepiece: is generally an ocular with an achromatic doublet for an eyelens and with the plano side of the lower lens nearest the objective. Such a corrected system does not have to be stopped down with a diaphragm, hence a large, flat field is assured.

Working Distance, Free: the distance between the front lens of the objective and the cover glass when the lens is focused on the specimen.

Coarse Focus: this is the large knob found on each side of the microscope and is used for rapid movement of the stage to bring the specimen near to focus.

Fine Focus: the smaller knobs within the larger coarse focus knobs. Fine focus controls are used to precisely focus the specimen to produce the sharpest image.

USING YOUR SWIFT M-2500 SERIES MICROSCOPE

Most models of M-2500 Series microscopes will be equipped with widefield 10X eyepieces, objectives 4X, 10X, 40XR, 100XR and N.A. 1.25 condenser with iris diaphragm and swing out filter holder. These models are used as follows:

1. Secure the slide to the stage with spring fingers.
2. Revolve the nosepiece to position the lowest power objective.
3. View through the eyepiece and use the coarse focus control to bring the specimen nearly into focus. The fine focus control is now used to complete the focusing of the specimen to produce the sharpest image.
4. The iris diaphragm is not intended to control the brightness of the illumination but induces contrast into the specimen by diffracting light rays. Focusing of the specimen should be done with the iris diaphragm opened to its largest aperture. If additional contrast is required to permit accurate viewing of the specimen, the diaphragm should be slowly closed until the details of the specimen are sharply defined. Care should be taken not to use an aperture too small to gain high contrast, as then fine structure of the image will be destroyed. Reducing the aperture does increase contrast and depth of focus, but it also reduces resolution and introduces diffraction. The aperture

must be selected for each objective: i.e. the aperture for the 10X (N.A. 0.25) objective will not be the same as for the 40X (N.A. 0.65), since the angle of light required is determined by the numerical aperture of the objective. Proper adjustment of the diaphragm aperture is easily determined after a little experience with the microscope.

The rule governing condenser numerical apertures is: the numerical aperture of the condenser must be equal to or greater than the numerical aperture of the highest powered objective. In this instance, the 100X oil immersion objective has an N.A. of 1.25. Thus, the Abbe condenser (N.A. 1.25) is required to utilize the full resolving power of the objective. The iris diaphragm provides a continuously variable increase or reduction of the diameter of the cone of light from the illuminator. Proper focusing of the N.A. 1.25 condenser is important and is accomplished as follows:

1. Raise the condenser to its upper limits of focus. The iris diaphragm should be fully opened.
2. Focus the specimen with the 10X objective. (The diameter of the cone of light should fill the back lens of the objective. This utilizes the full resolving power of the objective. However, most specimens react better to a cone of light approximately 3/4 the diameter of the back lens of the objective).
3. Remove the eyepiece and view the cone of light visible on the back lens of the objective.
4. Lower the condenser to achieve a cone of light approximately 3/4 the diameter of the lens.
5. Replace the eyepiece and view the specimen.
6. If additional contrast is required to permit study of the specimen, the iris diaphragm may be closed slightly.
7. It is necessary to exclude air from the space between the cover glass over the specimen and the front lens of the 100X objective. This is accomplished by placing a drop of cedarwood oil, or the more commonly used, Cargille Immersion Oil, onto the cover glass. The controls are then manipulated to immerse the front lens of the objective into the oil. This forms an air tight connection through which the specimen may be viewed without interference from the atmosphere. Care must be taken not to come into direct contact between the lens of the objective and the cover glass since this may scratch or otherwise mar the viewing area of the lens itself.

Oil immersion objectives should be cleaned immediately after each use since the oil will dry after a time and prevent satisfactory viewing thereafter.

CARE OF YOUR SWIFT M-2500 SERIES MICROSCOPES

Your SWIFT M-2500 Series microscope is a precision instrument and requires only routine maintenance. With ordinary care, the microscopes will last a lifetime. Microscopes like other precision instruments should be cleaned after each use, which prevents dust and other forms of contaminents from drying on exposed surfaces.

Eyepiece and objective lenses should never be wiped while dry. Particles of dust should be removed using a soft camels hair brush or air. Lens paper folded several times and moistened with an approved lens cleaner such as Xylol or Xylene should be used to clean glass surfaces. Lenses should never be disassembled except by qualified, authorized technicians.

The painted metal surfaces of your SWIFT M-2500 Series microscopes are finished with a formula of epoxy-ester-resin, and are resistant to staining or dulling from most reagents found in classrooms or laboratories. The finish should be wiped off periodically with a soft, moistened piece of flannel or chamois.

Periodic servicing is recommended. This should be done only by qualified technicians since general servicing includes disassembly, cleaning and relubrication. Also, at this time all parts are tightened and inspected for wear. Periods of maintenance will vary depending on the hours of use of the microscope each day. Some schools will find servicing every three years adequate, while others will require more frequent attention.

SWIFT M-2500 Series microscopes operate best when lubricated only with lubricants recommended by SWIFT. Depending on the climate, moisture will evaporate from lubricants over a period of time, usually about three years. At that time, the lubricant no longer performs its function and should be removed and replaced to ensure ease of operation in the movement of parts on their bearing surfaces.

Your SWIFT M-2500 Series microscope is covered by the most liberal warranty available, which is printed within all SWIFT brochures and is backed by a fully stocked and manned plant in Tokyo, Japan and San Jose, California, U.S.A., as well as service dealers in most states and many countries of the world.

Inquiries regarding the SWIFT M-2500 Series or other **SWIFT** products should be directed to your authorized SWIFT dealer, or:

SWIFT INSTRUMENTS, INC.
Scientific Instrument Division
SanJose, California 95106

Arm **PARTS LIST**

Part Number	Description	Part Number	Description
31A	Fine Focus Knob	3m/m SW	Washer
4S5	Screw	4C12	Screw
1.7MC–2.5SG	Screw	3C6	Screw
31B	Ring	1.7P(0)+3SBr	Screw
35B	Ring	BGL-1	Ball Guide
HN	Nut	4m/m SW	Washer
HSW	Washer	4C12	Screw
35A	Coarse Focus Knob	4C6	Screw
134A	Spindle	SH-1	Slider Holder
1.7M–1.8SG	Screw	3S4	Screw
137	Ring	103R-1	Block
136	Washer	108R-1	Set Screw
135A	Ring	105R-1	Shaft
8φ B	Steel Ball	3S6	Screw
133	Derlin Ring	106R-1	Spring
132A	Pinion	102R-1	Cap Screw
131	Coupling	123	Arm Cover
130A	Pinion Metal	2T+4SG	Screw
114R-1	Screw	3C8	Screw
1.7F+5SBr	Screw	BGS-1	Ball Guide
112R-2	Stopper	125	Slider
3P+8SG	Screw	3K13SNi	Knock Pin
1.7MC–3SG	Screw	4m/m SW	Washer
101R-1	Arm	4C12	Screw
112R-1	Screw	3C6	Screw
122R-1	Nosepiece Joint	142	Plate
TH	Tension Control Knob	2.3S-2SG	Screw
35C	Coarse Focus Knob	2.3K9SNi	Knock Pin
HSW	Washer	143	Dove Slide
HN	Nut	AS	Nut
4S8	Screw	3P+6SG	Screw
31	Fine Focus Knob	2.6F+6SG	Screw
HBW-1	Celluloid Washer	144	Rack
115	Marking Plate	1.7F+3SBr	Screw
111	Shaft	3P+6SG	Screw
4S6	Screw	141	Rack
140	Gear	140	Stage Holder
3C8	Screw	BGP	Plate
103R-2	Plate	3φ B	Steel Ball
2.3MC-2SG	Screw	1.7P(0)+3SBr	Screw
124A	Slide Holder	3S6	Screw
3S3	Screw	145B	Stopper

Arm **PARTS LIST**

Part Number	Description	Part Number	Description
145C	Stopper	3C8	Screw
145D	Cap Screw	145A	Condenser Holder
R-6	Spring	148	Screw
2P+4SG	Screw	145E	Screw
151	Pinion	149A	Condenser Sleeve
152	Washer	147	Screw
2.6MC–3.5SG	Screw	146A	Ring
154	Knob	1.7P+4SG	Screw
153	Bush		

Binocular Head **PARTS LIST**

Part Number	Description	Part Number	Description
2MC-3SG	Screw	15	Prism Housing
1	Tube, uppper	CA-23	Prism
2	Tube, middle	2.3P+5SBr	Screw
2.6P+6SP	Screw	3S3	Screw
3	Tube, lower	16	Prism Housing
13	Screw	2.3P+5SBr	Screw
SR-8	Screw	CA-22, 23	Prism
12	Link	3S3	Screw
2T+4SP	Screw	CA-21	Prism
4	Cover Plate	17	Prism Housing
6	Cover, right	2.3P+5SBr	Screw
7	Calibrated Plate	2T+4SP	Screw
9	Dove Slide, right	19	Marking Plate
11	Guide Plate	CA-44	Prism
14	Seat	3T+8SBr	Screw
KeS	Screw	20	Prism Seat
2.6P+5SBr	Screw	18	Binocular Body
2T+4SP	Screw	2.6S-5SP	Screw
5	Cover, left	21	Prism Seat
8	Dove Slide, left	3P+8SG	Screw
S-21	Screw	22	Prism Seat
10	Guide Plate	CA-45	Prism
2K8.5SNi	Knock Pin	23	Prism Ring
3S3	Screw		

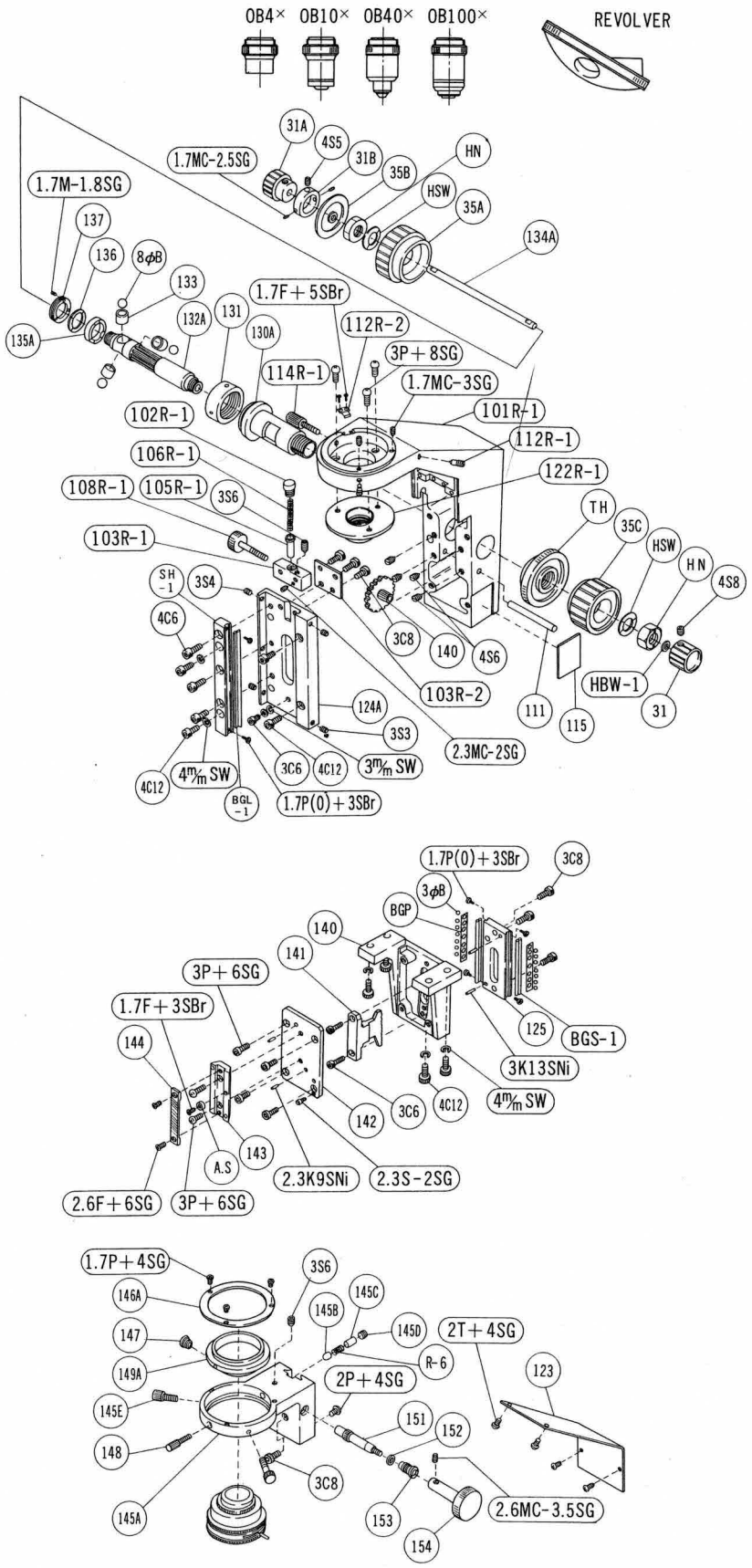
Mechanical Stage **PARTS LIST**

Part Number	Description	Part Number	Description
BG	Ball Guide	28	Holder
2.5B	Steel Ball	BGP	Plate
BGP	Plate	2.5B	Steel Ball
1.7S-2SG	Screw	BG	Ball Guide
224	Graduation Plate	29	Slider
2P(0)+6SG	Screw	3P+8SG	Screw
1.7P(0)+2SG	Screw	1.7P(0)+6SG	Screw
2.6B+10SG	Screw	30	Rack
26	Holder	3P+8SG	Screw
25	Slider Holder	1.7S-2SG	Screw
1.7S-2SG	Screw	31	Slider Holder
23	Slider	32	Plate
1.7P(0)+6SG	Screw	210A-1	Graduation Plate
24	Rack	33	Screw
7	Lever	201L-1	Stage
9	Nut	4m/mSW	Washer
1.7P(0)+2SG	Screw	4C12	Screw
235	Vernier	27	Pinion Block
22	Block	3P+18SG	Screw
21	Plate	30L-1	Pinion
2P(0)+4SG	Screw	31L	Washer
20	Finger Plate	32L-1	Pinion Metal
2P(0)+4SG	Screw	33L	Washer
BS	Spring	34L-1	Pinion
10	Shaft	2MC-2SG	Screw
6	Finger	35L-1	Knob
3P+10SG	Screw	33L	Washer
1.7P(0)+2SG	Screw	37L	Nut
210A	Vernier	31L	Washer
2.6P+15SG	Screw	38L-1	Knob
2.6P+10SG	Screw	39L	Nut

Base **PARTS LIST**

Part Number	Description	Part Number	Description
BA-25	Mirror	54	Illuminator housing
BA-26	Mirror Fork	BA-28	Bush
50	Base	MA722-A	Bulb
HR-24	Rubber Shoes	55	Bulb Holder
3B+10-2	Screw	56	In-line Switch
51	Ring	CB	Cord Band
52	Lens	48A	Three-wire cord
53	Filter		

Arm


0B4×
0B10×
0B40×
0B100×
REVOLVER
31A
4S5
31B
35B
HN
HSW
35A
134A
1.7MC-2.5SG
1.7M-1.8SG
137
136
8φB
133
132A
131
130A
135A
1.7F+5SBr
112R-2
3P+8SG
114R-1
1.7MC-3SG
102R-1
101R-1
112R-1
106R-1
122R-1
108R-1
105R-1
3S6
103R-1
TH
35C
HSW
HN
4S8
SH-1
3S4
4C6
3C8
140
4S6
HBW-1
31
103R-2
111
115
124A
3S3
2.3MC-2SG
4C12
4m/m SW
3C6
4C12
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BGL-1
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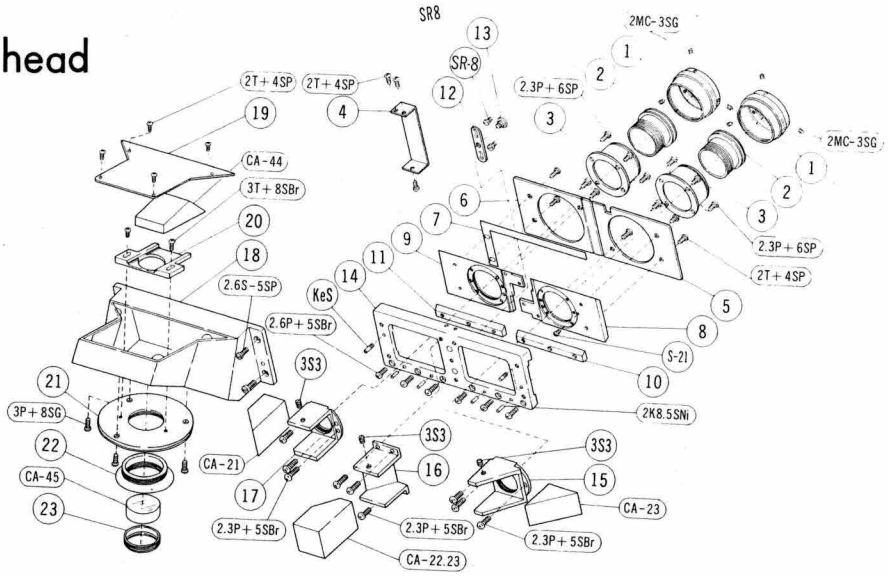
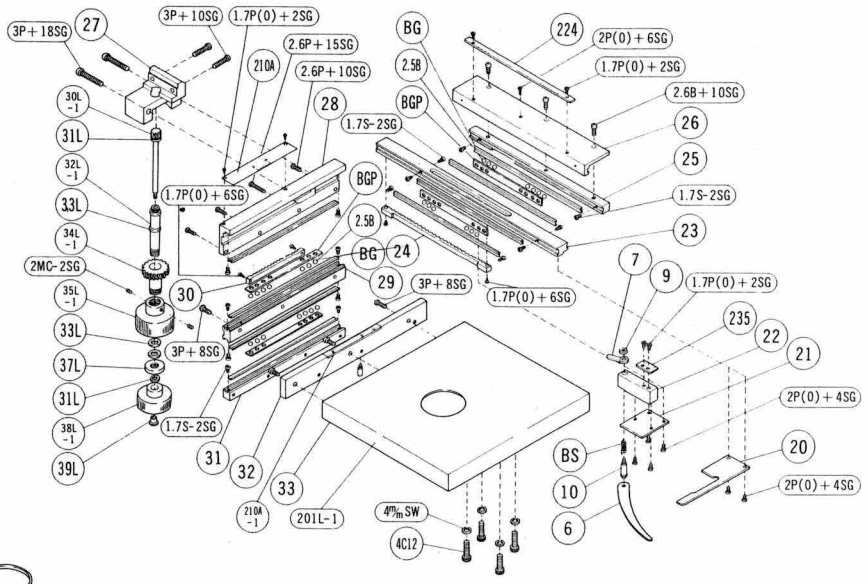
1.7P(0)+3SBr
3C8
3φB
BGP
140
141
3P+6SG
1.7F+3SBr
125
BGS-1
144
3K13SNi
4C12
4m/m SW
3C6
142
143
A.S
2.3K9SNi
2.3S-2SG
2.6F+6SG
3P+6SG
1.7P+4SG
3S6
146A
145C
145B
145D
2T+4SG
147
R-6
123
149A
2P+4SG
145E
151
152
148
3C8
2.6MC-3.5SG
153
145A
154

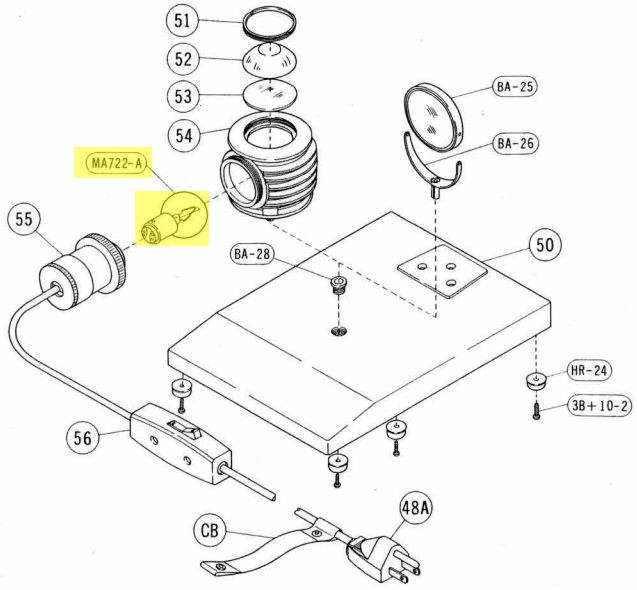
Binocular head

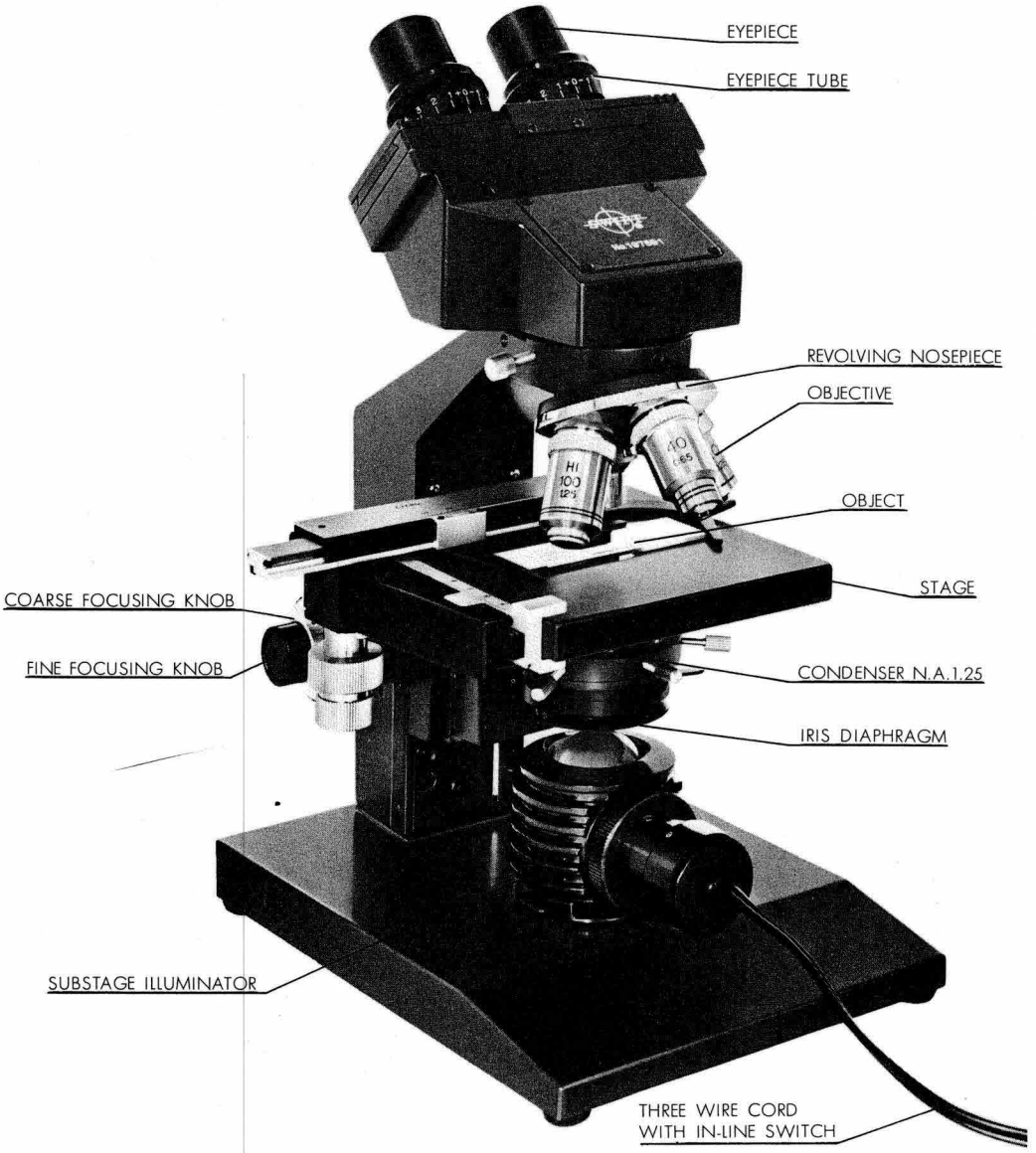


Mechanical Stage



Base




EYEPIECE
EYEPIECE TUBE
REVOLVING NOSEPIECE
OBJECTIVE
OBJECT
STAGE
COARSE FOCUSING KNOB
FINE FOCUSING KNOB
CONDENSER N.A.1.25
IRIS DIAPHRAGM
SUBSTAGE ILLUMINATOR
THREE WIRE CORD
WITH IN-LINE SWITCH