

OPERATING INSTRUCTIONS

SORVALL[®] MT-2B ULTRAMICROTOME

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Sorvall[®] Microtomes



PN 16153-2
Issued March 1984

This manual is a guide for the use of the
SORVALL® MT-2B ULTRAMICROTOME

- Data herein has been verified and validated and is believed adequate for the intended use of the instrument. If the instrument or procedures are used for purposes over and above the capabilities specified herein, confirmation of their validity and suitability should be obtained; otherwise, DuPont does not guarantee results and assumes no obligation or liability. This publication is not a license to operate under, nor a recommendation to infringe upon, any process patents.
- Publications prior to the Issue Date of this manual may contain data in apparent conflict with that provided herein. Please consider all data in this manual to be the most current.

NOTES, CAUTIONS, and WARNINGS within the text of this manual are used to emphasize important and critical instructions.

WARNING

An operating procedure which, if not correctly followed, could result in personal injury, affect the operator's health, or contaminate the environment.

CAUTION

An operating procedure which, if not strictly followed, could result in damage of equipment.

NOTE

Highlights essential information.

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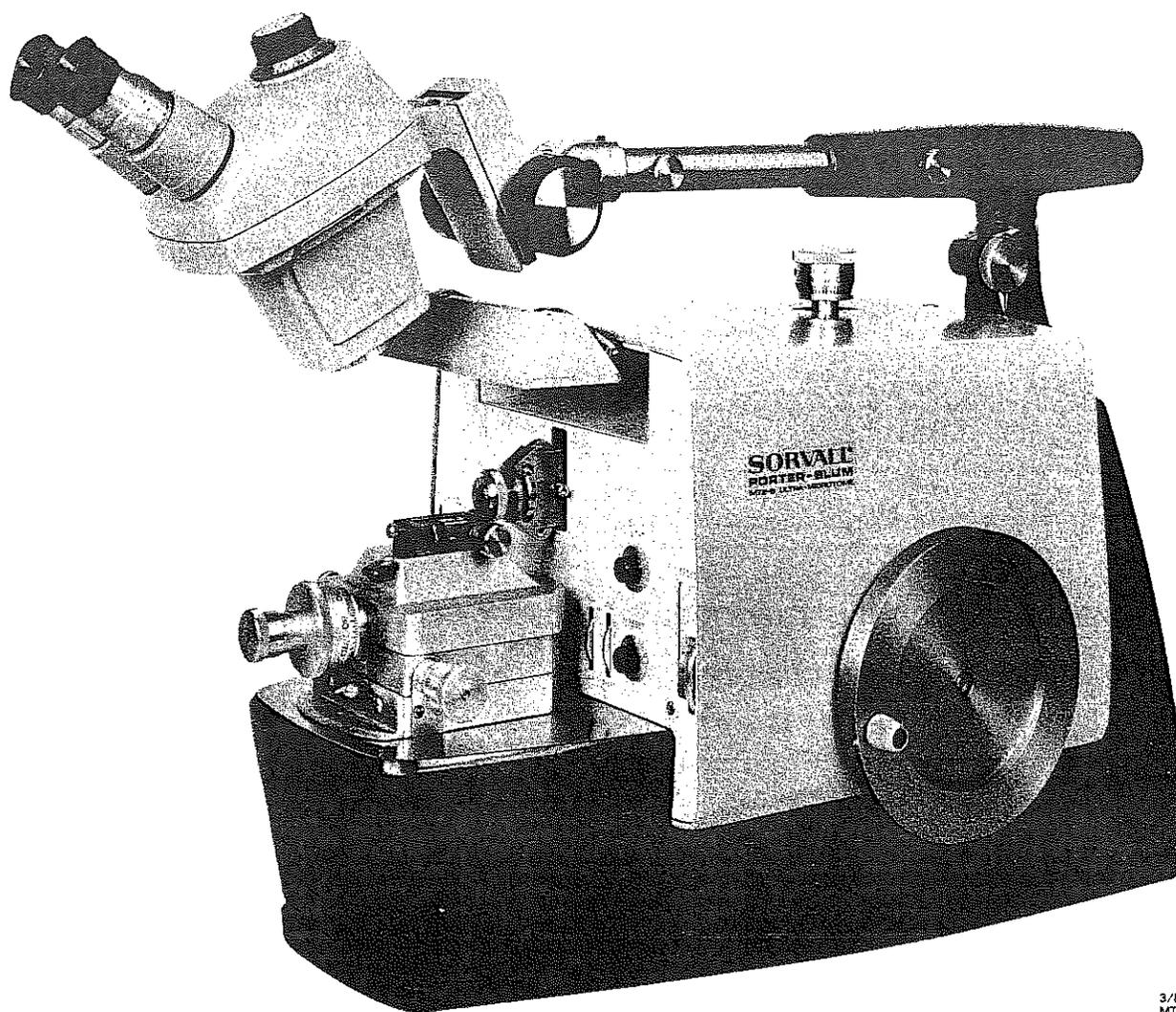
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WARRANTY

The Sorvall® MT-2B Ultramicrotome is warranted to be free from defects in materials and workmanship for a period of one year from the date of delivery. DuPont will repair or replace and return free of charge any part which is returned to its factory within said period, transportation prepaid by user, and which is found upon inspection to have been defective in materials or workmanship. This warranty does not include normal wear from use, it does not apply to any instrument or part which has been altered by anyone other than an employee of DuPont, nor to any instrument which has been damaged through accident, negligence, failure to follow operating instructions, the use of electric currents or circuits other than those specified on the plate affixed to the instrument, use beyond the specified capacity of the instrument, misuse or abuse.

DuPont reserves the right to change, alter, modify or improve any of its instruments without any obligation whatever to make corresponding changes to any instrument previously sold or shipped.

THE FOREGOING OBLIGATIONS ARE IN LIEU OF ALL OTHER OBLIGATIONS AND LIABILITIES INCLUDING NEGLIGENCE AND ALL WARRANTIES OF MERCHANTABILITY OR OTHERWISE, EXPRESSED OR IMPLIED IN FACT OR BY LAW, AND STATE OUR ENTIRE AND EXCLUSIVE LIABILITY AND BUYER'S EXCLUSIVE REMEDY FOR ANY CLAIM OR DAMAGES IN CONNECTION WITH THE SALE OR FURNISHING OF GOODS OR PARTS, THEIR DESIGN, SUITABILITY FOR USE, INSTALLATION OR OPERATION. DUPONT WILL IN NO EVENT BE LIABLE FOR ANY SPECIAL OR CONSEQUENTIAL DAMAGES WHATSOEVER, AND OUR LIABILITY UNDER NO CIRCUMSTANCES WILL EXCEED THE CONTRACT PRICE FOR THE GOODS FOR WHICH LIABILITY IS CLAIMED.



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Figure 1-1. Sorvall® MT-2B Ultramicrotome

Section 1. DESCRIPTION

1-1. SCOPE OF THE MANUAL

This manual provides you with the information you will need to install, operate and maintain your MT-2B Ultramicrotome. If you encounter any problem concerning either operation or maintenance that is not covered in this manual, please contact the nearest district office or local representative of DuPont's Clinical and Instrument Systems Division, Sorvall® Products, listed on the back of this manual.

1-2. DESCRIPTION OF THE MT-2B

The Sorvall MT-2B Ultramicrotome is used to produce ultrathin sections of specimens for light or electron microscopy. The microtome is capable of cutting sections in the range of 10 nm to 4 μ m.

Specimen and Knife Positioning

The MT-2B cantilever arm advances the specimen a maximum of 85 μ m at a 50 nm setting. Total advance can be as much as 150 μ m at the 4 μ m setting. The specimen holder that is supplied with the microtome permits specimen orientation in different planes around the knife edge by allowing 360° rotation of the specimen holder as well as a 20° arc above and below the central axis.

The microtome knife stage assembly rotates about the vertical axis that passes through the specimen/knife contact point. The knife stage assembly rotates 30° to the left and right and can be locked into any position in this 60° range. The knife stage assembly also provides coarse and fine front to back adjustment.

Specimen Viewing

The MT-2B is equipped with a variable stereozoom microscope which can be moved forward and back. A built-in fluorescent lamp provides wide angle illumination.

Cutting

The MT-2B can either be used manually or automatically by using the motor drive. The duration control determines the length of the stroke at the preset cutting speed.

1-3. SPECIFICATIONS

- Depth 56 cm (22 in)
- Width 27 cm (10-3/4 in)
- Height 47 cm (18-1/2 in) to top of stereomicroscope
- Mass (Weight) 54.5 kg (120 lbs)
- Electrical Requirements* 115V, 60 Hz

* For 220V, 50 Hz operation, Cat. No. 04264 step-down transformer is required.

Table 1-2 lists Additional Parts and Accessories available for use with the MT-2B which are not supplied with the basic instrument.

Table 1-2. Additional Parts and Accessories

Catalog Number	Description
04264*	Step-Down Transformer
16080	Collet-Type Holder, 8 mm (5/16 in)
16081	Collet-Type Holder, 6 mm (7/32 in)
16082	Collet-Type Holder, 5 mm (3/16 in)
16890	Vise-Type Holder
16892	MT-2B Knife Holder
16711	Aluminum Specimen Holder, 8 mm (5/16 in)
16813	Trimming Block
16158	Light Replacement Parts Package
16159	Wrench Replacement Parts Package
45700	Glass Knife Maker

* For 220V, 50 Hz operation only.

To obtain replacement parts or accessories, contact the nearest Sorvall® office or local representative listed on the back of this manual. Be sure to provide the catalog number, description of the item desired and serial number of the instrument.

Section 2. INSTALLATION

This section contains information necessary to unpack, assemble and install the MT-2B Ultramicrotome.

2-1. INSPECTION

The MT-2B is shipped in a carton designed to prevent shipment damage. Carefully inspect the instrument for any damage that may have occurred. It is the customer's responsibility to report shipping damage to the transportation company and file a damage claim immediately. If any parts are missing contact the nearest Sorvall® office or local representative of DuPont's Clinical and Instrument Systems Division. You will find a list of offices and representatives on the back cover of this manual.

2-2. LOCATION

Microtomes, because of their precision design, are sensitive to vibration and thermal changes. Care should be taken in the placement of the MT-2B. We recommend placing the microtome on a sturdy work table with a rigid top capable of supporting the microtome's weight. If the microtome is placed on a common laboratory bench that is connected to the floor or wall, make sure there is no other equipment running during sectioning (e.g., pumps or motors). Avoid placing the microtome in areas of heavy traffic or where heavy rotating machinery is nearby (e.g., air conditioning units, elevator shafts, etc.). Heavy drafts should also be avoided. In areas of extremely high vibrations, we recommend the use of the Micro-g^{T.M.} Air Isolation System (Cat. No. 67671).

2-3. ASSEMBLY

The MT-2B requires the assembly of some parts that were removed for shipment. The MT-2B should be assembled where it will be used to reduce the possibility of damage after assembly.

To assemble the MT-2B (see figure 3-1 for parts identification):

1. Bolt the microscope stand assembly and base plate together, using the three cap screws (Cat. No. 61055) supplied.
2. Loosen the screw from rear of the louvered cover. Remove cover and packing material from top and bottom of motor. Replace cover.
3. Place the microtome on base plate, centering foot pads in recesses.
4. Loosen all knife stage locking levers. Turn the coarse advance micrometer knob counterclockwise to disengage cantilever arm locking pin from the shipping block in the stage.

5. To release locking pin, loosen the collet holder, turning counterclockwise. To release block, loosen knife clamping thumbscrew. (Note: pin and block should be retained for future use in the event the microtome is moved.)
6. Place handwheel on shaft and tighten mounting screw.
7. Loosen each of the Phillips screws (about one-quarter turn) at lower left and right corners of front panel and on the top of the cover behind the upper thickness control knob.
8. Turn upper thickness control knob clockwise to zero, then turn counterclockwise to position 10.
9. Insert microscope arm in microscope stand assembly and tighten locking clamp screw.
10. Insert microscope holder into the microscope arm and tighten; insert the microscope into holder and lock in place with side levers.
11. Plug the power cord into power supply.

The MT-2B should be placed 8 cm to 13 cm (3 to 5 in) from the edge of the work surface.

2-4. ELECTRICAL REQUIREMENTS

The motor and cold light source require a power supply of 115 V, 60 Hz. The cord is fitted with a NEMA Type 5-15P 3-prong molded cap with ground pin and parallel blades.

For power supplies 200 V and 240 V, 50 and 60 Hz, Cat. No. 04264 Step-Down Transformer is required.

2-5. MOVING THE MT-2B ULTRAMICROTOME

The MT-2B is a delicate instrument and must be moved carefully. If there is a possibility the MT-2B will be moved to another building, it is recommended that the original shipping carton and unpacking instructions be saved for repacking.

To move the MT-2B to a new location, reverse the assembly procedure outlined in paragraph 2-3, then place the microtome in its shipping container reversing the order of the unpacking instructions.

2-6. CONTAMINATION

WARNING

Because of the nature of samples likely to be processed in the laboratory, the chance of contamination, either biological or radioactive, is possible. Always be aware of this possibility and take normal precautions. Use the appropriate decontamination procedures should exposure occur.

Should an instrument that has been used with radioactive or pathogenic material require servicing by DuPont personnel, either at the customer's laboratory or at a DuPont facility, comply with the following procedure to ensure the safety of all personnel:

- Clean the instrument to be serviced of all encrusted material and decontaminate it prior to servicing by the DuPont representative. There must be no radioactivity detectable by survey equipment.
- Complete and attach Decontamination Information Certificate (Sorvall® Instruments Form No. IPDP-59) to the instrument.

If an instrument to be serviced does not have a Decontamination Information Certificate attached and, in DuPont's opinion, presents a potential radioactive or biological hazard, the DuPont representative will not service the equipment until proper decontamination and certification is complete. If DuPont receives an instrument at its Service facilities which, in its opinion, is a radioactive or biological hazard, the sender will be contacted for instructions as to disposition of the equipment. Disposition costs will be borne by the sender.

Decontamination Information Certificates are included with these instructions. Additional certificates are available from the local Technical or Service Representative. In the event these certificates are not available, a written statement certifying that the unit has been properly decontaminated and outlining the procedures used will be acceptable.

NOTE

The Service Representative will note on a Field Service Repair Report if decontamination was required, and if so, what the contaminant was and what procedure was used. If no decontamination was required, it will be so stated.

Section 3. PARTS, CONTROLS & INDICATORS

Figures 3-1 through 3-3 in this section show the location of each operating part, control, and indicator and tables 3-1 through 3-3 describe their function.

**Table 3-1. MT-2B Parts Identification and Function
(keyed to figure 3-1)**

Item	Description	Function
1	Base Plate	Provides a solid base for the microtome and component parts to be secured.
2	Microscope Holder Stand	Supports the pivoting microscope arm.
3	Handwheel	Rotates manually to cycle the cantilever arm.
4	Pivoting Microscope Locking Screw	Turns clockwise to lock the pivoting microscope arm in place.
5	Pivoting Microscope Arm	Provides lateral movement of the stereomicroscope.
6	Telescopic Locking Screw	Turns clockwise to lock the telescopic arm in place.
7	Upper Thickness Control Knob	Determines how far the cantilever arm has advanced.
8	Telescopic Arm	Provides front to back movement for the stereomicroscope.
9	Microscope Locking Screw	Locks the microscope holder in place on the telescopic arm.
10	Microscope Holder	Holds the stereomicroscope and can be adjusted to rotate the microscope.
11	Stereomicroscope	Provides magnified viewing of the specimen and knife edge.
12	Cold Light Source	Provides an overhead cold light source to illuminate the work area without thermal distortion.
13	Cantilever Arm	Advances the specimen to the knife edge, and provides cutting and retract motions.

**Table 3-1. MT-2B Parts Identification and Function
(continued)**

Item	Description	Function
14	Specimen Holder Mount	Mounts the specimen holder to the cantilever arm.
15	Specimen Holder (collet or vice)	Holds specimen block for sectioning.
16	Knife Stage Assembly	Provides support of the knife holder allowing side to side and front to back knife movement.
17	Knife Holder	Holds glass or diamond knife.
18	Knife Clamping Thumbscrew	Clamps knife in position in the knife holder.
19	Knife Clearance Angle Scale	Provides reference points for setting knife clearance angle.

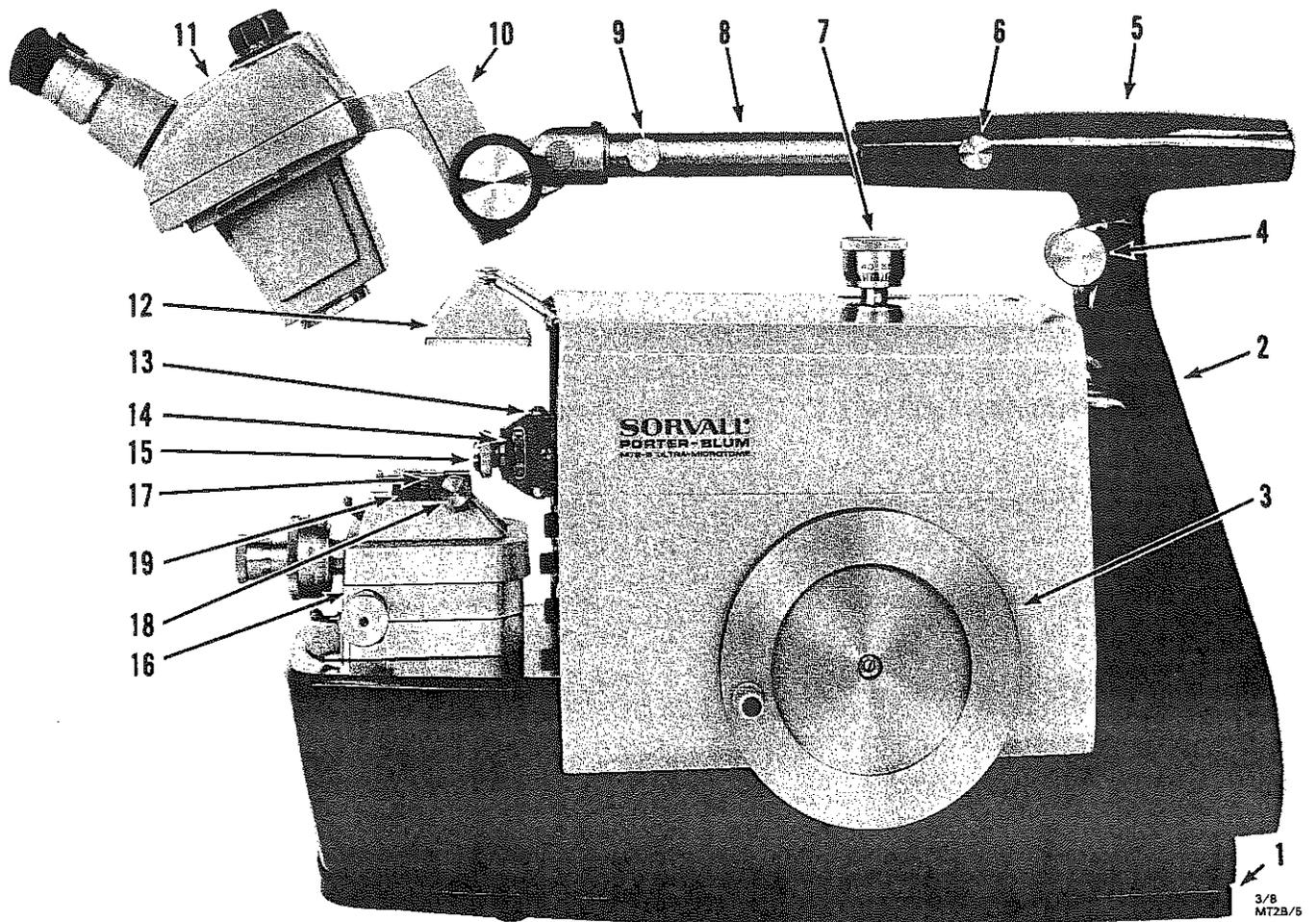


Figure 3-1. MT-2B Parts Identification

Table 3-2. Function of the Knife Stage Parts
(keyed to figure 3-2)

Item	Description	Function
1	Knife Stage	Holds a glass or diamond knife and provides knife rotation and knife clearance angle adjustment.
2	Knife Holder Locking Lever	Locks knife holder in place on the knife stage.
3	Lateral Movement Micrometer	Provides side to side knife adjustment.
4	Fine Advance Micrometer	Provides fine adjustment of advance.
5	Coarse Advance Micrometer	Provides coarse adjustment of advance.
6	Lateral Movement Lock	Secures lateral knife movement.
7	Knife Stage Rotation Scale	Indicates knife edge vertical axis angle.
8	Index Marks	Indicates rotation angle.
9	Fine Advance Engagement Thumbscrew	<ul style="list-style-type: none"> ● Unlocked - will provide coarse adjustment advance of the Coarse Advance Micrometer. ● Locked - provides fine adjustment advance of the Fine Advance Micrometer.
10	Knife Advance Lock	Locks and unlocks the knife stage assembly to the lower stage.
11	Knife Stage Rotation Lock	Locks and unlocks the stage assembly to the microtome table.
12	Microtome Table	Holds the stage assembly or the trimming block during sectioning or block trimming.

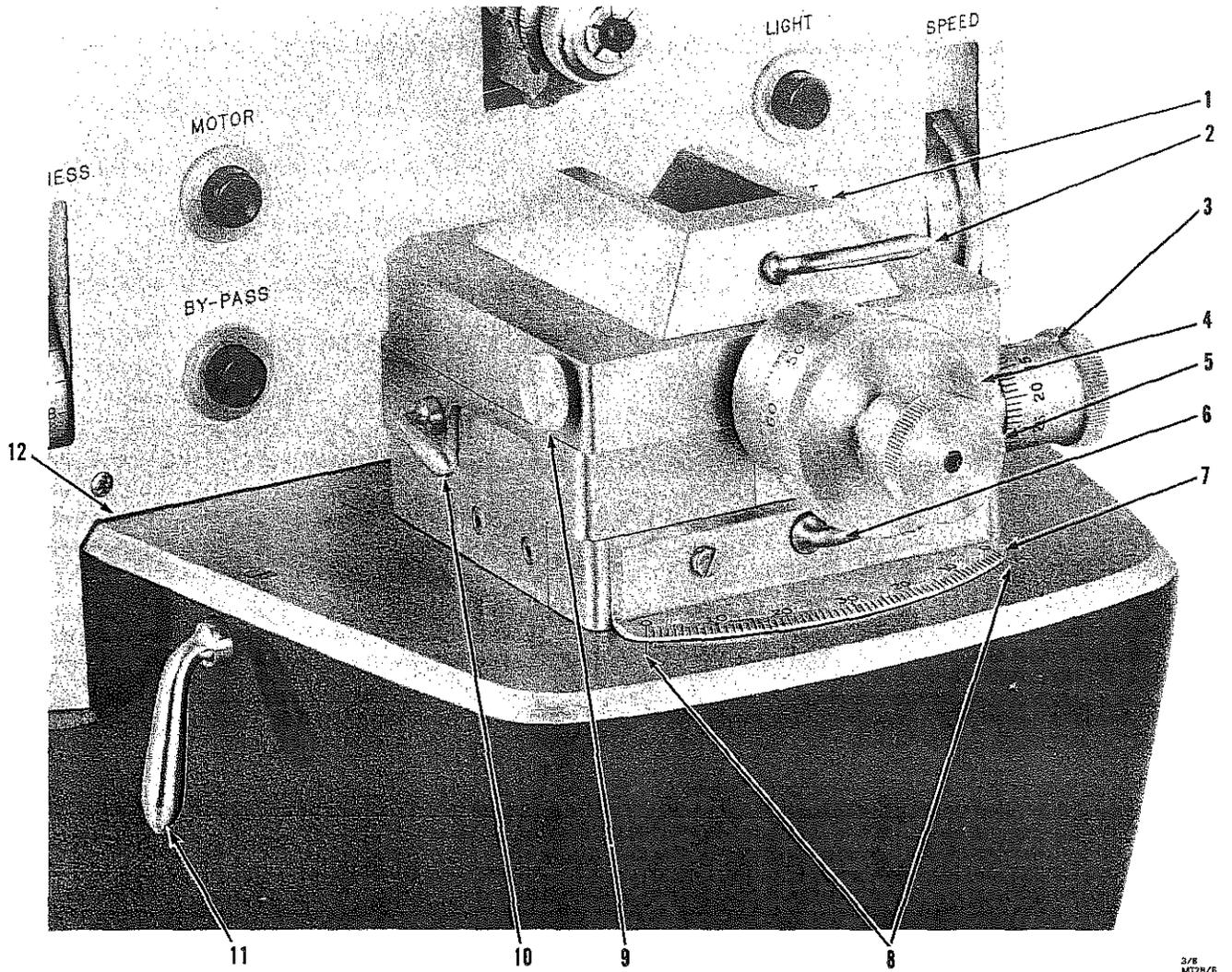
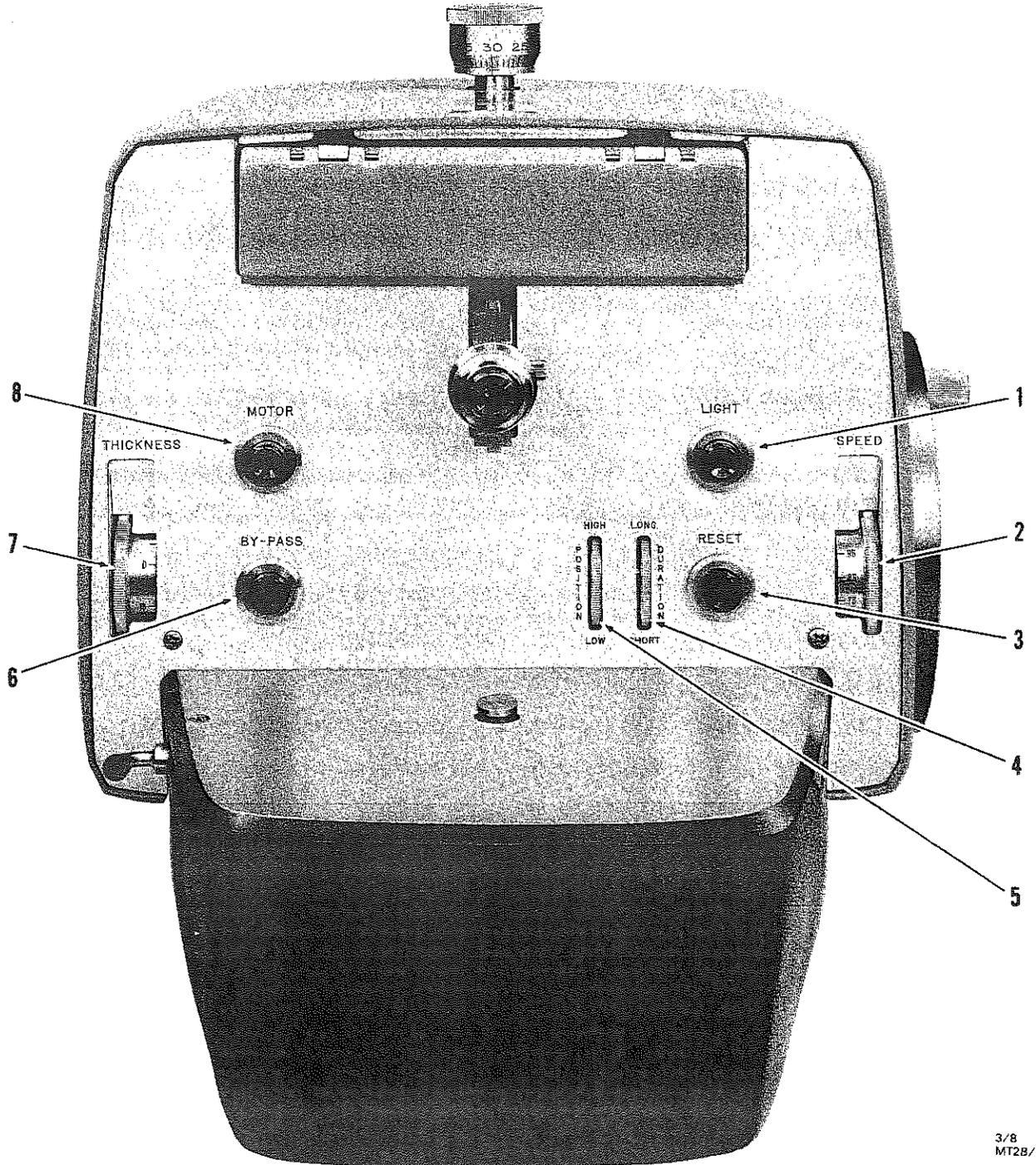


Figure 3-2. Knife Stage Parts

Table 3-3. Controls and Indicators
(keyed to figure 3-3)

Item	Description	Function
1	Light Switch	ON and OFF for the cold light source.
2	Speed Control Dial	Sets speed of the cutting stroke.
3	Reset Button	Resets the Pivot Arm/Lead Screw.
4	Duration Control Dial	Varies the length of the cutting stroke.
5	Position Control Dial	Varies the beginning position of the cutting stroke.
6	By-Pass Button	When pressed, allows by-passing of cutting strokes for thicker sections.
7	Thickness Control Dial	Controls the amount the pivot arm is moved for each cycle.
8	Motor Switch	Provides ON and OFF for the motor.



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Figure 3-3. Controls and Indicators

Section 4. OPERATION

This section provides the basic information needed to prepare a specimen for sectioning and to operate the MT-2B. Before you begin to operate the microtome you should read through Section 3 so you are familiar with all operating controls and indicators. For other electron microscopy methods, such as embedding tissue, making glass knives or preparing specimen grids, refer to any standard manual on EM techniques.

4-1. SPECIMEN PREPARATION

Specimens to be sectioned must be properly sized to fit a collet-type or vise-type holder, or to be glued or attached to a mounting which can be fitted to either holder.

The collet-type holders will accept cylindrical specimens from 5 mm to 8 mm (3/16 in to 5/16 in) in diameter and up to 16 mm (5/8 in) in length.

Embedded specimens can be prepared in standard sized gelatin capsules. Listed below are various capsule sizes and the corresponding collet holders.

Capsule Size	Specimen Holder Size	Collet Holder Catalog Number
0, 00	8 mm (5/16 in)	16080
1, 2	6 mm (7/32 in)	16081
3, 4, 5	5 mm (3/16 in)	16082

A specimen in a flat embedding, or on a flat support can be used with the vise-type holder (Cat. No. 16890). The dimensions cannot exceed 5 mm (3/16 in) thick, 10 mm (3/8 in) wide and 6 mm to 10 mm (1/4 in to 5/8 in) long.

Specimens larger than this size should be cut to a usable size, or mounted on a suitable support (i.e., metal or plastic).

4-2. SPECIMEN AND KNIFE POSITIONING

Before sectioning can begin, the specimen and knife must be positioned properly. During sectioning, the knife remains in a fixed position. Cutting occurs when the specimen moves down across the knife edge in such a position that a section of the specimen will be cut during each advance cycle of the cantilever arm.

Because the relationship between the knife edge and the specimen is so important, there are several ways to position both the knife and the specimen prior to sectioning to achieve final positioning. Towards this end, it is possible to position the cantilever arm, specimen block face, knife, knife holder and knife stage through a variety of horizontal, vertical and rotational movements.

4-3. SPECIMEN AND SPECIMEN HOLDER INSTALLATION

1. Install specimen holder (collet or vise type) on cantilever arm (with rotation locking ring), tightening with the adjusting wrench provided (see figure 4-1).
2. Insert specimen into holder, leaving 3 mm to 6 mm (1/8 in to 1/4 in) of specimen protruding from the face of a collet-type holder; about 2 mm (1/16 in) protruding from a vise-type holder.
3. Secure the specimen in specimen holder by tightening the locking ring (collet-type) or the locking screw (vise-type).

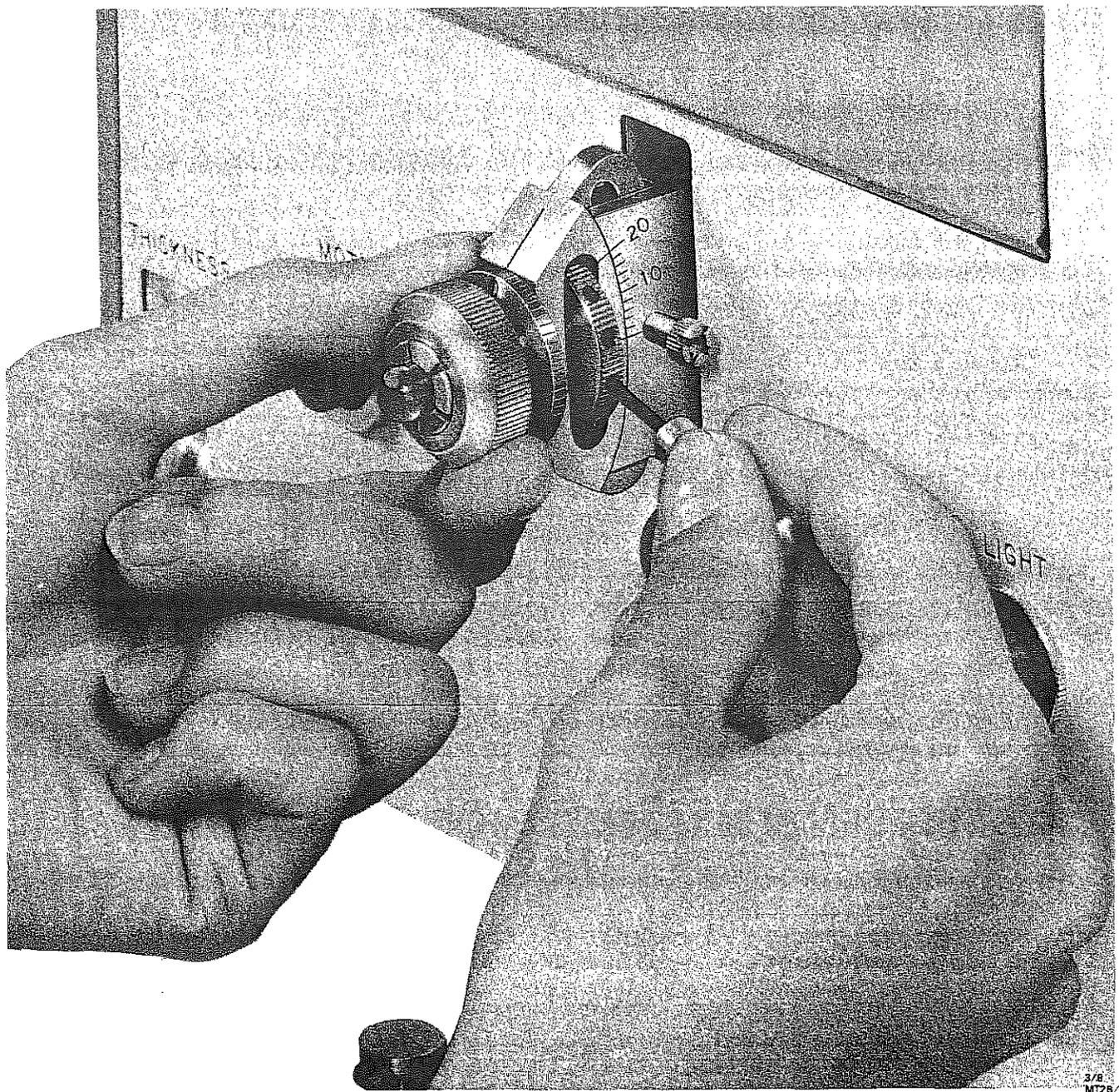


Figure 4-1. Specimen Holder Installation

4-4. KNIFE INSTALLATION AND KNIFE HOLDER ADJUSTMENT

The MT-2B accepts glass or diamond knives. There are two steps to knife positioning: adjusting the knife height and setting the knife clearance angle.

a. Glass Knife Installation

Glass knives with dimensions shown in figure 4-2 will fit the knife holder.

NOTE

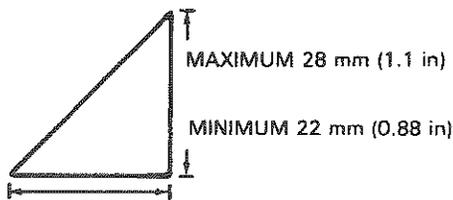
Before a glass knife is placed in the holder, a trough for fluid on which the sections will float as they are cut can be attached to the knife if desired. Refer to a text on electron microscopy for instructions on this technique.

WARNING

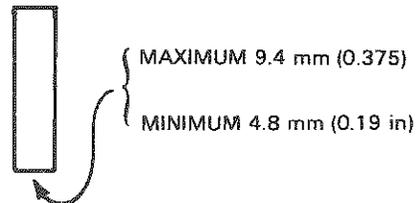
Glass knives are extremely sharp and can cause injury if not handled carefully.

1. Clean the knife holder so there is no dirt, wax, or glass chips on any of the surfaces that the knife will touch.
2. Unscrew the knife clamping thumbscrew enough to hold the knife.
3. Insert a glass knife and slide it forward against the front plate of the knife holder.
4. Raise the knife height gauge.

HEIGHT



THICKNESS



MAXIMUM 25.4 mm (1 in)

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Figure 4-2. Glass Knife Dimensions

5. Insert the height adjusting tool into the hole in the bottom of the knife holder and turn the adjusting screw until the knife edge is level with the top of the knife height gauge (see figure 4-3).
6. Tighten the knife clamping thumbscrew and lower the knife height gauge.
7. Place the knife holder into the knife stage and secure in place using the knife holder locking lever.
8. Using the graduated scale on the right side of the knife holder adjust the knife clearance angle. The suggested clearance angle for glass knives is 3° to 5° .

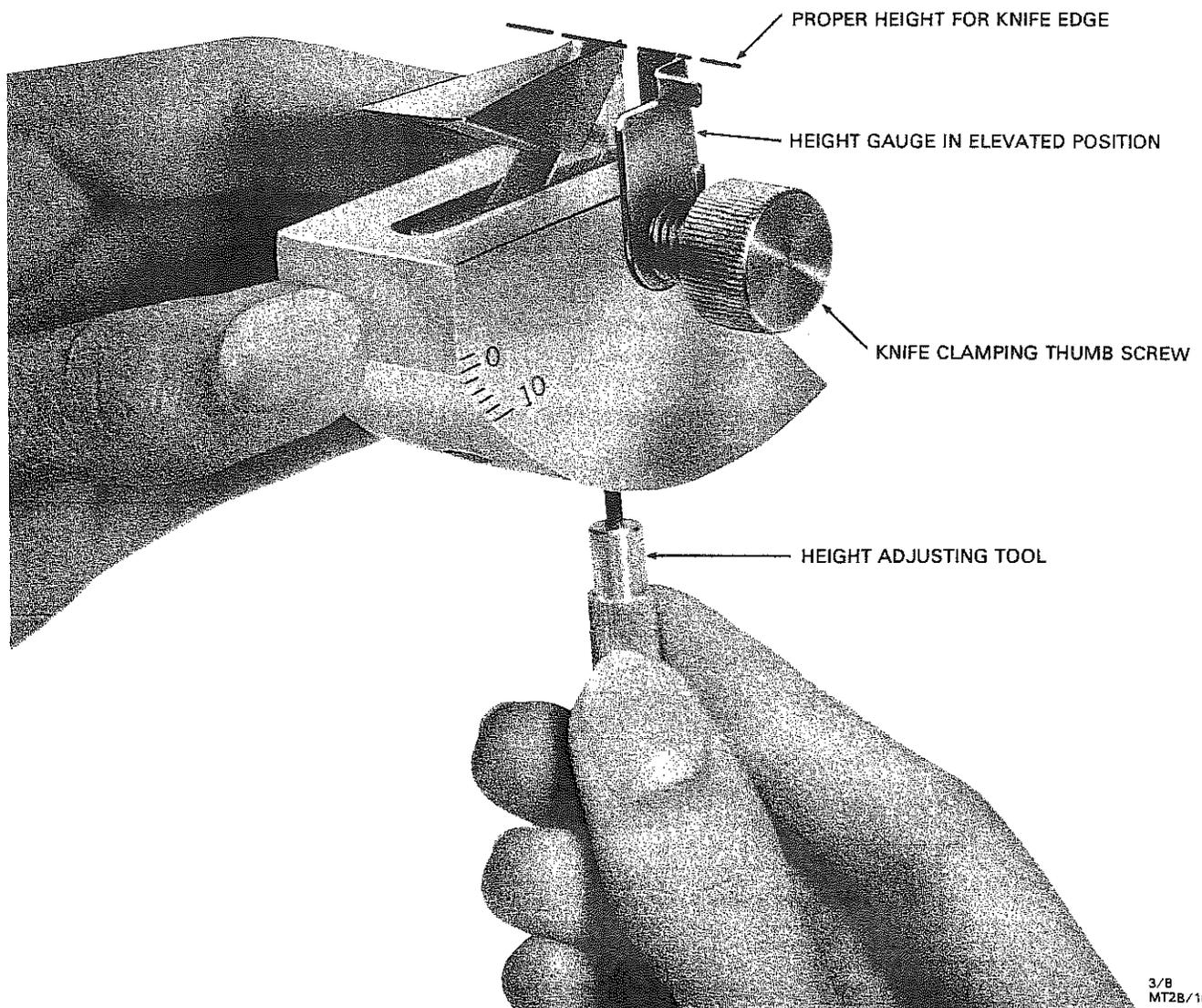


Figure 4-3. Adjusting Glass Knife Height

b. Diamond Knife Installation

Diamond knives are purchased as a unit with the trough necessary to hold fluid during sectioning. DuPont diamond knives, as well as those of other manufacturers will fit the knife holder directly; others may require Cat. No. 16891 Diamond Knife Boat Assembly.

To install a diamond knife:

1. Clean the knife holder surfaces.
2. Insert the diamond knife and slide it forward against the front plate of the knife holder, unscrewing the knife clamping thumbscrew as necessary.
3. Securely tighten the knife clamping screw.
4. Place the knife holder into the knife stage and secure in place using the knife holder locking lever.
5. The proper clearance angle may be specified by the manufacturer or it may have to be found by individual experience. The clearance angle can be adjusted by releasing the knife holder locking lever and setting the knife to the desired angle using the graduated scale on the right side of the knife holder as a guide. Tighten the knife holder locking lever.

4-5. TRIMMING

Prior to sectioning, the specimen must be trimmed to a proper shape and size. There are two stages to the trimming procedure: rough trimming and precision trimming. Trimming can be accomplished with a razor blade if the specimen is soft enough. Harder specimens may require a metal file, jeweler's saw, or motor driven abrasive wheel. A diamond abrasive disc in a dentist's drill is suggested.

a. Rough Trimming

Rough trimming can be done either with the specimen holder attached to the cantilever arm or by attaching the specimen holder to the trimming block (Cat. No. 16813).

To Rough Trim Specimen Using Trimming Block:

1. Remove the knife stage assembly by raising the knife stage rotation lock and sliding the knife stage off.
2. Slide the trimming block onto the microtome table so that the slot in the bottom of the trimming block engages with the lock on the microtome table. Leave lock loose to enable specimen block to be rotated during trimming.
3. Place a specimen holder on the trimming block.
4. Using a razor blade, shape specimen so sides are about 1 mm long and shaped to provide support for the specimen.
5. Refine sectioning face so that top and bottom edges are parallel, to assure the specimen will contact and leave the knife edge evenly and produce a straight ribbon of sections (see figure 4-4).

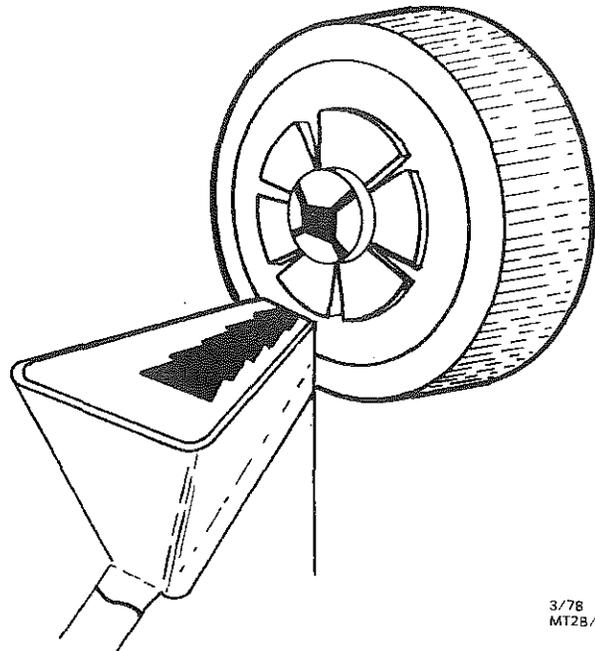


Figure 4-4. Ribbon Formation

6. Shape the sectioning face only as large as needed for the particular specimen.
7. When rough trimming is completed, loosen the knife stage rotation lock and remove the trimming block.
8. Remove the specimen holder from the trimming block. Place specimen holder on the cantilever arm using the adjusting wrench to tighten the locking ring.

b. Precision Trimming

Precision trimming can be done by hand with the specimen holder attached to the trimming block or on the cantilever arm.

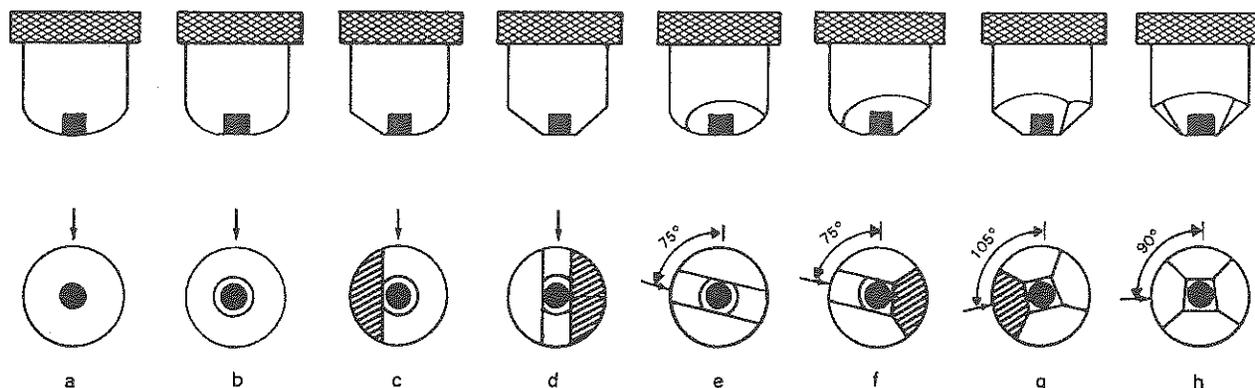
Precision Trimming by Hand:

1. Follow the procedure for rough trimming, steps 1-6 above, and on previous page.
2. Rinse a fresh razor blade in acetone and wipe dry to remove any oil from the blade surfaces.
3. Move the stereomicroscope directly overhead like a dissecting scope, if desired.
4. Beginning at the face, make one clean razor cut down each side of the specimen, making sure the proper dimensions are maintained.
5. Cut in from each side at the base to remove any chips.
6. If additional material must be removed from the face to reach the desired level of the specimen, make sure the new face is properly dimensioned and the edges are clean and straight.

Precision Trimming Using the Microtome:

Use a glass knife, without a trough (trimming is done dry) or an old diamond knife no longer suitable for thin sectioning.

With a rough-trimmed specimen installed in a holder on the cantilever arm, and the knife stage assembly with the knife to be used for trimming in position on the microtome, the steps for precision trimming should be done in the sequence illustrated in figure 4-5. The diagram shows a specimen not rough trimmed, but experience has shown rough trimming to be a time saver when large amounts of material have to be removed.



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NOTE

The block may have previously been rough-trimmed, although the diagrams show an untrimmed block. The upper row of diagrams are top views: the lower row are the corresponding front views. The shaded areas indicate the portions that are cut away in that particular step. The small arrow is a reference point to aid in following the rotation of the specimen from step to step. The angles shown are suggested, approximate angles for forming a satisfactory block face. Other angles may, of course, be used. Table 4-1 summarizes the steps shown in the diagram.

Figure 4-5. Diagram of Precision Trimming Sequence

1. Lock the specimen holder in place on the cantilever arm.

If there is a preferred position of the specimen for sectioning, the block should first be rotated until the specimen is oriented 90° from that position. This will be step a in figure 4-5.

2. Set knife stage at 0° (straight forward) on knife stage rotation scale.
3. Advance the knife using coarse advance micrometer (this can be done using the fine advance engagement thumbscrew unlocked), until the knife edge is about 2 mm from the specimen block face.
4. If lateral adjustment of the knife position is necessary, lift lateral movement lock and turn lateral movement micrometer until the proper position is reached. Lock into place.

5. Lock the fine advance engagement thumbscrew.
6. Set the speed control at 1 mm/s and press the motor switch to start the motor.
7. Position the cold light source and stereomicroscope.
8. Advance the knife using the fine advance micrometer. Always advance the knife after the specimen has passed the knife edge on the upstroke.
9. Continue taking cuts until the entire face of the specimen is being cut, or the desired portion of the specimen is reached. Remove slices from the knife edge and specimen with a fine camel's hair brush.
10. Withdraw the knife from the block and rotate the knife stage to the left to an angle between 30° and 45°.
11. Repeat steps 3, 5, 8 and 9 for step c, figure 4-5.
12. Repeat step 10, and position the stage to the right (to a 30° to 45° angle) then repeat steps 3, 5, 8 and 9 for step d, figure 4-5.
13. Using the adjusting wrench, unlock the specimen rotation locking ring and rotate the specimen holder 75° to the left for step e, figure 4-5.
14. Tighten locking ring and face this area (step 13) for step f, figure 4-5.
15. Loosen the specimen rotation locking ring and rotate the specimen holder 30° in the same direction. Secure in place. Rotate the knife stage to the left side of the specimen and trim the fourth face, step g, figure 4-5.
16. Loosen the specimen rotation locking ring and rotate the specimen to the final position for sectioning, step h, figure 4-5.

**Table 4-1. Summary of Precision Trimming Sequence
(shown in figure 4-5)**

Figure	Operation	Knife Stage Position	Specimen Rotation Position
a.	start	—	0°
b.	facing	0°	0°
c.	top side	30° left	0°
d.	bottom side	30° right	0°
e.	holder rotated	—	75° left
f.	right side	30° right	75° left
g.	left side	30° left	105° left
h.	ready for sectioning	0°	90° left

4-6. SECTIONING

Once the specimen has been trimmed, the final preparations can be made for sectioning.

1. Replace the trimming knife with the one which will be used for sectioning. (Refer to paragraph 4-4 for knife installation instructions.) Note that a trough must be affixed to the glass knife.
2. Reset the advance system by simultaneously pressing the reset button while positioning the upper thickness control knob approximately 6 mm (1/4 in) forward of its rearmost position. Release reset button before releasing the upper thickness control knob.

CAUTION

The upper thickness control knob must not be altered once you begin cutting sections. If a change is necessary, the knife stage must be retracted from the specimen and carefully advanced once the thickness control has been changed.

3. Set upper thickness control knob to the desired level between the limits 0 nm to 200 nm. (A suggested starting point is to set the upper thickness control knob at 10 (100 nm), the front panel thickness control dial at 15, resulting in an advance of 150 nm.)
4. Turn handwheel in a clockwise direction through at least one complete cycle. Stop the cycle with the specimen block slightly above its midpoint in the downward stroke, so the cantilever arm is in its forward position. If this alignment was done with the arm retracted, the knife and specimen could be damaged when the forward movement was made.
5. Position cold light source and microscope to obtain maximum magnification of both knife and block.
6. Moving the handwheel clockwise, bring the center of the block to the top of the knife edge.
7. Loosen the fine advance engagement screw (to use the coarse advance micrometer) and advance the knife to within 1 mm of the specimen. The knife advance lock lever must be loose for this adjustment; raise the lever and let it down gently against its stop.
8. Loosen the lateral movement lock and rotate the lateral movement micrometer until the area of the knife which is to be used for sectioning is opposite the specimen. Lock into position.
9. Loosen the knife stage rotation lock. Rotate the stage until the knife is parallel to the specimen block face. To assist in alignment, adjust the height of the block so a reflection of the knife edge can be seen in the face of the block. When the reflection is parallel to the knife edge, the knife is in proper alignment. Lock in position by pressing down on the locking lever.

10. Tighten the fine advance engagement screw.
11. Set the speed control at maximum 3.2 mm/s and manually turn the handwheel while turning the fine advance micrometer one or two microns each cycle until the knife reaches the front of the block. Operating slowly so not to damage the knife, section several trimming slices from the specimen. If the knife seems out of alignment, stop sectioning and realign knife as previously explained.
12. After several sections have been taken, lock the knife stage in place by pressing down on the locking lever.
13. Remove sections from knife edge with a clean brush and fill trough with distilled water or other suitable fluid, to give a flat meniscus and a clear, bright reflective surface near the knife edge.
14. Reduce speed control to about 1 mm/s and press motor button to turn on motor.
15. Continue sectioning; brightly colored sections should appear on the surface of the trough fluid.
16. Gradually reduce the setting on the thickness control dial in steps of one or two units each cycle until the desired thickness of section is obtained.

CAUTION

Do not change the setting on the upper thickness control. If the upper thickness control is altered at this point, the specimen block will advance.

NOTE

- Change the thickness control setting only when the cantilever arm is in return stroke, to avoid vibration during the cutting stroke.
- Depending on the specimen being sectioned, it should be possible to reduce thickness to 60 nm and obtain a uniform ribbon of smooth sections.
- If suitable sections cannot be obtained, refer to Table 5-1 Troubleshooting Chart.

4-7. SERIAL THICK AND THIN SECTIONS

It is sometimes helpful to cut a thick section adjacent to a thin section, for comparison of light and electron microscope images of the same area of the specimen. The by-pass button on the control panel allows this to be done easily.

1. After the last thin section is cut and is clear of the knife, press and hold in the by-pass button for one or more cycles. The section cut on the next stroke after the by-pass button is released will be the thick section.

NOTE

The thickness of the section will be determined by the setting of the thickness controls and the number of cutting strokes by-passed. In most cases, the thickness control dial should be set at maximum after the thin sections have been cut. The advance per cycle will then be twenty times the setting of the upper thickness control knob.

CAUTION

Do not change the upper thickness control at this time.

2. The number of cuts by-passed should be one less than the thickness desired divided by the advance per cut. For example, to get a section of 1.0 μm :
 - a. If upper thickness control knob is set at 10 nm and the thickness control dial set at 20, the advance per cut will be 200 nm.
 - b. Hold the by-pass button in for four cycles and cut the thick section on the fifth cycle.
 - c. If additional 1.0 μm sections are desired, hold the button for the next four cycles, release on the fifth, and so on.
3. To section thin sections after thick sections have been cut, return the thickness control dial to its previous setting. At first, the knife may miss the specimen a few strokes or you may get slightly thick sections because of block distortion, but within a few cycles, thin sections should be obtained.

Section 5. MAINTENANCE

Maintenance procedures include periodic inspection, cleaning, lubrication, lamp replacement and troubleshooting techniques. Should maintenance beyond the scope of this manual be necessary, contact the nearest Sorvall® representative of DuPont's Clinical and Instrument Systems Division.

5-1. PARTS REPLACEMENT

To order replacement parts, telephone (302) 772-6250 in Delaware. Outside the United States, contact your local representative for Sorvall Products. Be sure to provide a description of the part and the serial number of the ultramicrotome.

5-2. INSPECTION AND CLEANING

Regular inspections for general cleanliness, dust accumulation, and for signs of rust on finished steel surfaces, as well as any unpainted surfaces, are recommended.

Cleaning with denatured alcohol or cellusolve, applied with a soft cloth, is recommended. Xylene can be used on steel surfaces where a light film can be retained.

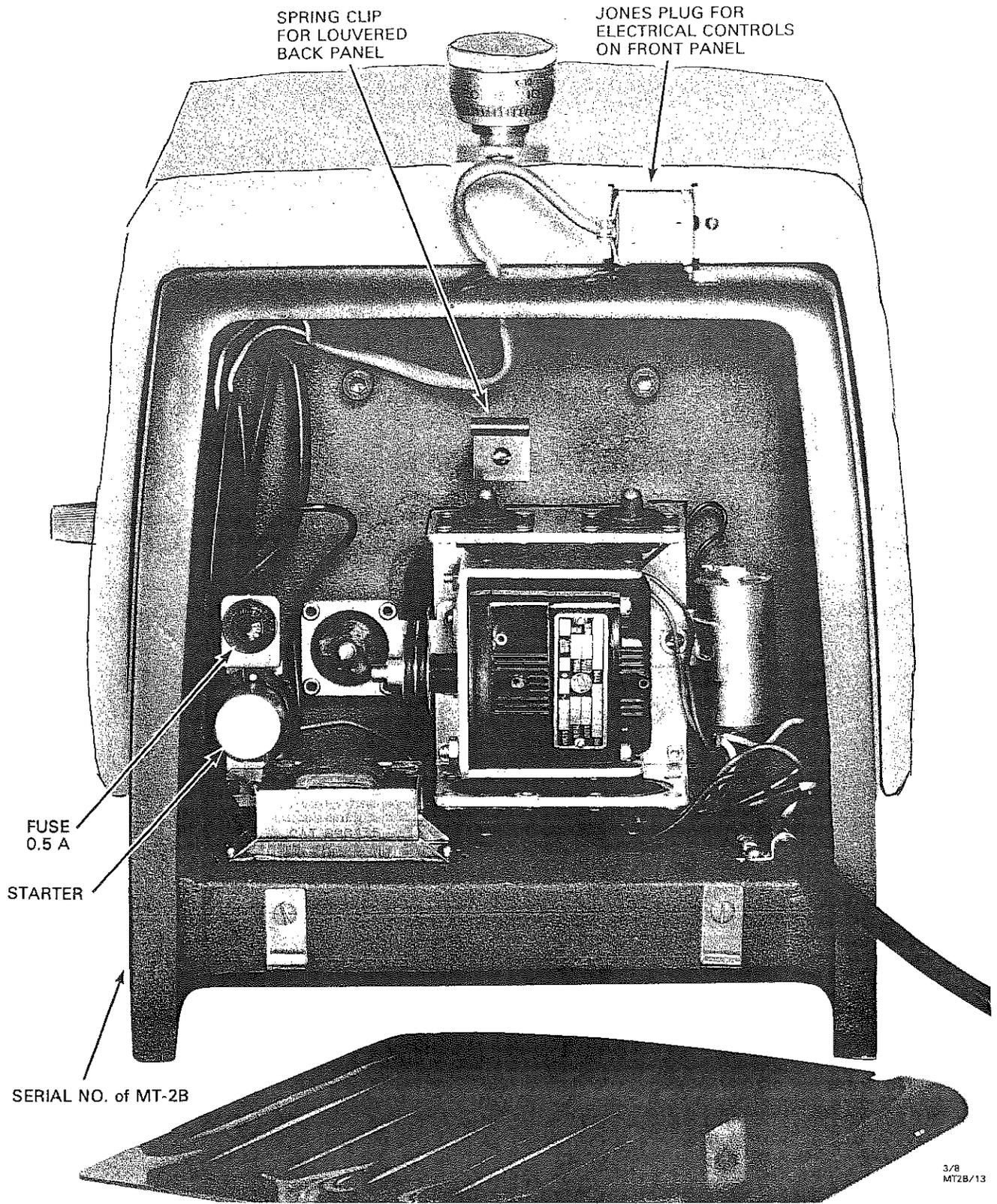
5-3. COVER REMOVAL

WARNING

Unplug the power cord before removing the cover.

To remove the cover for maintenance, proceed as follows:

1. Swing microscope to one side for access to cover.
2. Disconnect Jones Plug from rear of cover (see figure 5-1).
3. Remove handwheel by turning center screw one turn counterclockwise, press in on screw to release, and pull handwheel from shaft.
4. Remove upper thickness control knob by unscrewing counterclockwise. Remove control sleeve by pulling it off.
5. Remove knife stage assembly.
6. Remove specimen holder mount; loosen the tilt locking screw one turn, press in on screw to release, then completely unscrew and remove the screw and pin.
7. Remove the two cover screws from the lower corners of the front panel, and the one screw at the top rear of the cover.



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Figure 5-1. Rear View of MT-2B (Rear Cover Removed)

8. Press reset button and move the upper thickness control shaft to the middle position.
9. With one hand on each side of the cover, tilt the rear up and forward, clearing the upper thickness control shaft. Slide cover forward, raising the front to clear the knife stage rotation lock. Lift the cover clear of the instrument.
10. To replace, reverse the above procedure. Be careful not to hit the upper thickness control shaft when replacing the cover. During assembly, leave the three cover screws about 1/4 turn loose.
11. To replace the specimen holder mount, insert the threaded pin through the holder and the cantilever arm from the left side and attach the locking screw from the right. Replace the control sleeve with the markings forward and be sure it drops in place over the guide pin.

5-4. LUBRICATION

The motor and the advance mechanism should be checked and lubricated every six months (twice a year) as described below:

Motor

WARNING

Unplug power cord before removing cover.

1. Remove cover (see paragraph 5-3).
2. Using bearing oil supplied, apply three or four drops in each of the red-circled holes.

Advance Mechanism

1. Remove cover (see paragraph 5-3).
2. Place two or three drops of bearing oil in each of the seven red-circled holes.
3. Turn flywheel by hand and clean the three cams with a soft clean cloth. Apply a bead of cam grease (supplied) approximately 5 mm (3/16 in) long to each cam and spread it evenly over the cam.
4. Oil the cam reservoir twice a year using oil (Cat. No. 62095) supplied.

5-5. LAMP REPLACEMENT

WARNING

Disconnect power cord from receptacle before opening lamp.

Slide plastic diffuser shield to the right to expose bulb. Replace with 4-W Fluorescent Bulb (Cat. No. 60902).

5-6. FUSE REPLACEMENT

Remove louvered rear cover. Replace with 0.5 A fuse Cat. No. 61050 (see figure 5-1).

5-7. TROUBLESHOOTING SECTIONING DIFFICULTIES

Table 5-1 describes the problem, probable cause and suggested solution to several common problem areas. Should problems arise beyond the scope of this manual contact the nearest Sorvall® representative of DuPont's Clinical and Instrument Systems Division.

Table 5-1. Troubleshooting Chart — Sectioning Difficulties

Problem	Probable Cause	Suggested Solution
Sections appear crumpled, irregular in thickness, alternately or occasionally skipping	Dull or defective knife	Glass Knife - Replace knife Diamond Knife - Clean knife edge with soft wood piece, or move knife to new section
	Improper knife angle	Experiment with other angles in either direction
	Improper block shape	Reshape block
	Block face too large	Reshape block
	Soft block	Cure in oven, if epoxy, at 60° C to 80° C. (140° F to 176° F) for 24 hours or more
Trough fluid adheres to block face when block passes knife	Fluid on specimen side of knife surface	Wipe dry with tissue
	Fluid level too high	Lower fluid level. Reposition microscope if necessary, to maintain image.
Poor results with different blocks and knives (i.e., chatter, inconsistent sections)	Unstable installation	Check for excessive air currents, rapid thermal changes and work table or building vibrations
	Defective microtome	Check controls and mechanisms. If not obvious, call your DuPont representative.