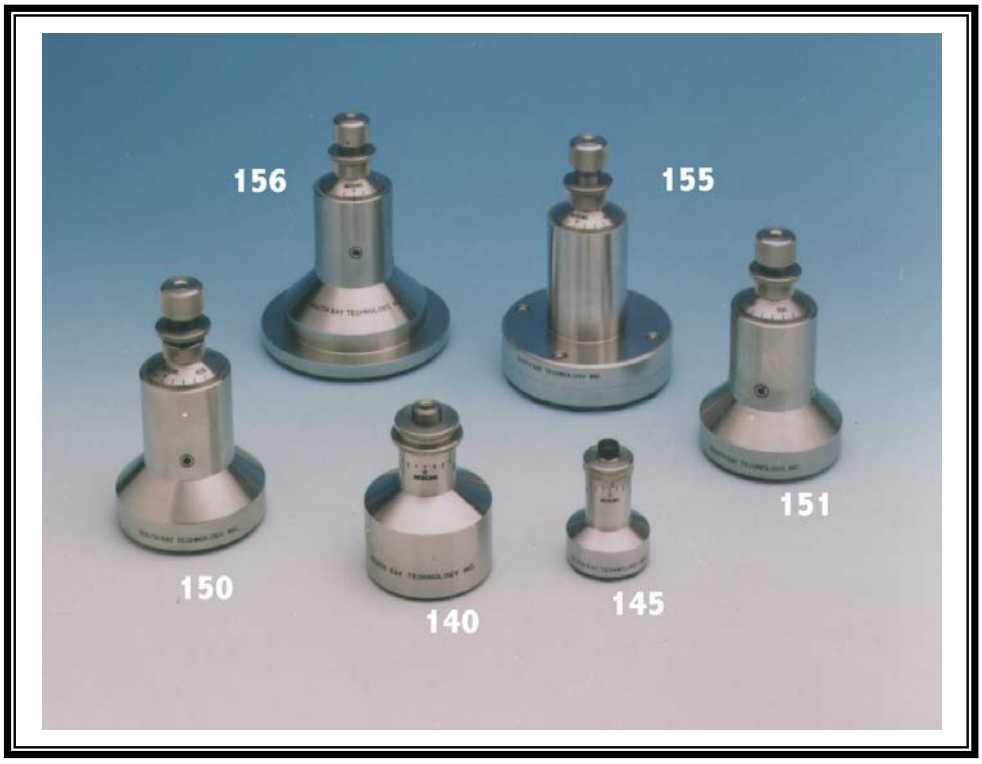
Lapping and
Polishing

CAT # 50150-45 MODEL 145

MICROMETER CONTROLLED LAPPING FIXTURES

Instruction Manual



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Model 145 Instruction Manual

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1.0: Introduction

The Electron Microscopy Sciences Precision Lapping and Polishing Fixtures are designed to accurately produce polished parallel, tapered or critically oriented samples with minimal sub-surface damage. A series of specialized fixtures has been developed for lapping and polishing samples up to 6" in diameter, TEM samples and oriented crystals.

The micrometer method of thickness control employs a dial with 25 micron or finer graduations, which are adjusted relative to the fixture housing to set the amount of material to be removed. To set the dial, the sample is initially zeroed against the lapping plate and then the dial is adjusted to create a gap between the fixture housing and the center slide. This gap corresponds to the amount of material to be removed and gradually decreases, as the sample is lapped or polished, until the final thickness is reached. The load on the sample is variable by adding weights or finger pressure to the top of the fixture. Due to the ease of adjustment a micrometer controlled fixture is generally used when desired sample thickness will vary from sample to sample.

1.1: Shipping Kit Checklist

A list of all of the items included with the Model 145 is listed below. Please check that all the items have been included in the shipping kit.

PART NUMBER	DESCRIPTION	QTY.	CHECK
50150-45	MICROMETER CONTROLLED FIXTURE	1	
	SPECIMEN MOUNTING BLOCK, 0.5" DIAMETER	1	
	LOCKING ROD ASSEMBLY	1	
	ALLEN WRENCH, 0.063"	1	
	ALLEN WRENCH, 0.109"	1	

2.0: Assembly and Construction

The following sections describe the basic layout of the Model 145, accessories that are used in conjunction with the Model 145, as well as other types of lapping and polishing fixtures that are available.

2.1: Fixture Layout

The Model 145 micrometer controlled lapping and polishing fixture is a very simple fixture utilizing a piston assembly that dynamically slides up and down inside the fixture housing. Specimens are mounted to the specimen mount using a low melting point wax and the mount is attached to the center slide assembly with a locking rod placed through the center of the fixture. This center slide can be locked into position using the setscrew on the side of the fixture. Removal of material is calibrated by turning the threaded knob at the top of the fixture, which is graduated in 25μm increments.

Below is a schematic illustration of the lapping fixture and the parts associated with it.

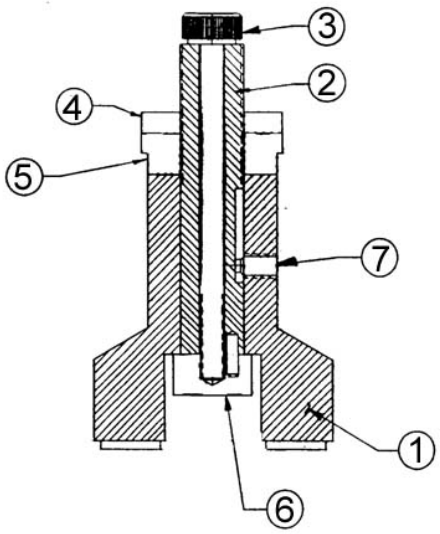

Figure 1: Schematic illustration of the Model 145 Lapping and Polishing Fixture.
1-Housing, 2- Slide assembly, 3- Locking rod assembly, 4- Locking screw; 5- Micrometer dial; 6- Specimen mount, 7- Setscrew.

.2.2: Lapping and Polishing Fixture Accessories

There are many other ancillary accessories available that can be used with the Model 145. Many types of lapping fixtures are available from Electron Microscopy Sciences, which have a wide variety of applications. Other accessories include hand-lapping kits, mounting blocks for different fixtures, and wax mounting accessories that all are used during the lapping and polishing process.

The following sections describe many of the accessories for lapping and polishing available from Electron Microscopy Sciences For specific questions please contact EMS.

2.2.1: Sample Mounting Fixtures

The proper mounting of samples is a critical step in the lapping and polishing process. It is imperative that the sample is firmly mounted parallel to the sample mount surface to ensure accurate results. Typically, samples are mounted using a low melting point wax as an adhesive

and a Sample Mounting Fixture to apply uniform pressure. Sample Mounting Fixtures are designed to both monitor the temperature of the wax and to provide a uniform mounting pressure.

When using a low melting point wax, the mounting block is first heated on a hot plate then a thin layer of wax is melted evenly on it. The sample is placed on the mounting block, appropriate size pressure plate is placed on the sample and they are placed together on the base of the mounting fixture. A spring-loaded rod is then positioned in the center of an indent in the pressure plate while setting the pressure with the height adjustment of the arm. The whole assembly is then placed on a hot plate until the correct temperature is reached and maintained for a short while to ensure a uniform layer of wax between the sample and the mounting block. The assembly is then removed from the hot plate and placed on the Model 125 cooling tray to facilitate the hardening of the wax.

Below is a list of all of the available Sample Mounting Fixtures available

MODEL	DESCRIPTION
MODEL 110	SAMPLE MOUNT (ACCOMMODATES UP TO 2" DIAMETER SAMPLES) (CAT#50160-10)
MODEL 112	SAMPLE MOUNT (ACCOMMODATES UP TO 4" DIAMETER SAMPLES)
MODEL 115	DUAL POSITION SAMPLE MOUNT (ACCOMMODATES 2 SAMPLES UP TO 2" DIAMETER)
MODEL 116	SIX POSITION SAMPLE MOUNT (ACCOMMODATES 6 SAMPLES UP TO 2" DIAMETER)
MODEL 120	HOT PLATE (HOT PLATE USED FOR HEATING SAMPLE MOUNTING FIXTURES)
MODEL 121	HOT PLATE (230 VOLT VERSION OF THE MODEL 120)
MODEL 125	COOLING TRAY (USED TO COOL DOWN SAMPLE MOUNTING FIXTURES; FOR USE WITH MODEL 120) (CAT. 50160-25)
MODEL 10098	SAMPLE MOUNTING KIT (INCLUDES: MODEL 110; MODEL 120; MODEL 125; MOUNTING WAXES)

2.2.2: Hand Lapping Accessories

Hand lapping accessories are consumable kits and accessories that make specimen lapping and polishing a relatively straightforward operation. Consumable kits are designed to give the most amounts of abrasive grit sizes to allow a wide variety of lapping and polishing applications to be accommodated. Below is a listing of the various kits available.

PART NUMBER	DESCRIPTION
MODEL 180	STACKABLE LAPPING TRAY (INCLUDES 12" SQUARE GLASS PLATE FOR ALL HAND LAPPING APPLICATIONS) (CAT. #50162-80)
MODEL 10008	TRIPOD POLISHER FILM KIT (INCLUDES 1 EACH OF PLAIN BACK, 8" DIAMETER DIAMOND FILM OF FOLLOWING SIZES: 0.5, 1, 3, 6, 15, AND 30µM FILM)
AP-K1	PRECISION ALUMINA KIT (INCLUDES 1 LB EACH OF FOLLOWING POWDER SIZES: 0.5, 0.9, 3, 5, 9, 12, 15, 18, 22, 30µM ALUMINUM OXIDE)
SP-K1	SILICON CARBIDE KIT (INCLUDES 1LB EACH OF THE FOLLOWING POWDER SIZES: 1000, 800, 600, 500, 400, 320, AND 240 GRIT SILICON CARBIDE)
BP-K1	BORON CARBIDE KIT (INCLUDES 125G EACH OF THE FOLLOWING POWDER SIZES: 1000, 800, 600, 500, 400, 320, 280, AND 240 GRIT SILICON CARBIDE)

2.2.3: Lapping and Polishing Fixtures

Along with the Model 155 D, Electron Microscopy Sciences offers a wide variety of lapping and polishing fixtures tailored to a wide variety of applications. Listed below are all of the lapping and polishing fixtures available and a brief description of their design and function.

MODEL	THICKNESS	MAX. SAMPLE	DESCRIPTION

NUMBER	CONTROL	DIAMETER	
104	MICROMETER LEG ADJUSTMENT	4" (100MM)	TRIPOD ARRANGEMENT FOR IMPRECISE LAPPING OF LARGE SPECIMENS
130	SHIM	1" (25MM)	PRECISION FLAT LAPPING AND POLISHING
135	SHIM	2" (50MM)	PRECISION FLAT LAPPING AND POLISHING
140	MICROMETER	0.5" (12MM)	USED WITH MAGNETIC MOUNT FOR PREPARING TEM SAMPLES; MOUNT DIRECTLY TRANSFERABLE TO MODEL 51503 AND 51506 DIMPLER STAGES
141	SHIM	0.5" (12MM)	USED WITH MAGNETIC MOUNT FOR PREPARING TEM SAMPLES; MOUNT DIRECTLY TRANSFERABLE TO MODEL 51503 AND 51506 DIMPLER STAGES
142	SHIM	0.5" (12MM)	PRECISION FLAT LAPPING AND POLISHING FOR SMALL SAMPLES
145	MICROMETER	0.5" (12MM)	PRECISION FLAT LAPPING AND POLISHING FOR SMALL SAMPLES
147*	MICROMETER	2.6" (66MM)	PRECISION FLAT LAPPING AND POLISHING FOR SAMPLES
147D*	MICROMETER	2.6" (66MM)	ULTRA-PRECISE FLAT LAPPING AND POLISHING FOR SAMPLES; DIGITAL INDICATOR PROVIDES 1μM RESOLUTION
147E*	MICROMETER	2.6" (66MM)	PRECISION EDGE POLISHING OF ELECTRO-OPTICAL AND RELATED MATERIALS; CAN BE USED FOR FLAT LAPPING AND POLISHING
147DE*	MICROMETER	2.6" (66MM)	ULTRA-PRECISE EDGE POLISHING OF ELECTRO-OPTICAL AND RELATED MATERIALS; DIGITAL INDICATOR PROVIDES 1μM RESOLUTION; CAN ALSO BE USED FOR FLAT LAPPING AND POLISHING
150	MICROMETER	1" (25MM)	PRECISION FLAT LAPPING AND POLISHING
150 MC	MICROMETER	1" (25MM)	PRECISION FLAT LAPPING AND POLISHING; DESIGNED FOR USE ON MODEL 520 MICROCLEAVE™ KIT
151	MICROMETER	1" (25MM)	SAME AS MODEL 150, EXCEPT LOW FORCE FOR FRAGILE SPECIMEN APPLICATIONS
153*	MICROMETER	2" (50MM)	LASER ROD, END POLISHING, ANGLE POLISHING OF OPTICAL AND ELECTRO-OPTICAL MATERIALS
154*	MICROMETER	2" (50MM)	PRECISION FLAT LAPPING AND POLISHING; LOW FORCE FOR FRAGILE SPECIMEN APPLICATIONS
155*	MICROMETER	2" (50MM)	PRECISION FLAT LAPPING AND POLISHING
155D*	MICROMETER	2" (50MM)	ULTRA-PRECISE FLAT LAPPING AND POLISHING; DIGITAL INDICATOR PROVIDES 1 μM RESOLUTION
156*	MICROMETER	2" (50MM)	WIDE BASE MODEL 155 VERSION; LOW FORCE FOR FRAGILE SPECIMEN APPLICATIONS
157*	MICROMETER	2" (50MM)	WIDE BASE MODEL 155 VERSION; PRECISION FLAT LAPPING AND POLISHING

MODEL NUMBER	THICKNESS CONTROL	MAX. SAMPLE DIAMETER	DESCRIPTION
160	VISUAL	2" (50MM)	CHEMICAL POLISHING FIXTURE; TEFLON, VACUUM CHUCK SPECIMEN MOUNTING
162.5 THROUGH 168	MICROMETER	2.5" - 8" (37MM – 200MM)	VERSALAP™ ULTRA-PRECISION LAPPING AND POLISHING FIXTURES; VACUUM CHUCK SPECIMEN MOUNTING FOR WAFER PLANARIZATION AND MEMS APPLICATIONS
170	MICROMETER	2" (50MM)	2-AXIS GONIOMETER; IN SITU LAPPING AND POLISHING FOR CRYSTAL ORIENTATION
195	MICROMETER	1" (25MM)	MULTI-AXIS LAPPING FIXTURE; INDIVIDUAL THICKNESS CONTROL UP TO 6 SPECIMENS SIMULTANEOUSLY; PRECISION OF 5 µM
25010	MICROMETER	1" (25MM)	LAPPING FIXTURE HOLDS MODEL 250 2-AXIS GONIOMETER; LAPPING AND POLISHING FOR CRYSTAL ORIENTATION

*** ALL OF THESE FIXTURES CAN BE ADAPTED FOR VACUUM MOUNTING USING THE MODEL 15501 VACUUM MOUNTING KIT. CONTACT AN EMS REPRESENTATIVE FOR DETAILS.**

2.2.4: Mounting Blocks

A wide variety of mounting blocks are available for use on different lapping and polishing fixtures offered by Electron Microscopy Sciences. A complete listing of these is shown below.

FLAT MOUNTING BLOCKS

PART NUMBER	FIXTURE MODEL NUMBER USED ON	DESCRIPTION
01-03039	142, 145	0.37" DIAMETER X 0.25" THICK
01-03040	142, 145	0.49" DIAMETER X 0.25" THICK
01-03402	140, 141	MAGNETIC MOUNT
01-02928	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	0.75" DIAMETER STAINLESS STEEL MOUNTING BLOCK
01-02905	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK
01-03157	150MC	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK, 18.5° INDICATOR MARKS FOR MODEL 520
01-02929	150, 151, 153, 154, 155, 155DV, 156, 157	1.25" DIAMETER STAINLESS STEEL MOUNTING BLOCK
01-02926	135, 153, 154, 155, 155DV, 156, 157	1.5" DIAMETER STAINLESS STEEL MOUNTING BLOCK
01-02927	135, 153, 154, 155, 155DV, 156, 157	2" DIAMETER STAINLESS STEEL MOUNTING BLOCK

ANGLED MOUNTING BLOCKS

PART NUMBER	FIXTURE MODEL NUMBER USED ON	DESCRIPTION

01-02918	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 0.25° ANGLE

PART NUMBER	FIXTURE MODEL NUMBER USED ON	DESCRIPTION
01-02919	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 0.5° ANGLE
01-02920-01	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 1° ANGLE (WAS PART NUMBER: 01-02920)
01-02920-02	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 2° ANGLE (WAS PART NUMBER: 01-02921)
01-02920-03	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 3° ANGLE
01-02920-04	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 4° ANGLE
01-02920-05	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 5° ANGLE
01-02920-06	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 6° ANGLE
01-02920-07	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 7° ANGLE
01-02920-08	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 8° ANGLE
01-02920-09	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 9° ANGLE
01-02920-10	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 10° ANGLE (WAS PART NUMBER: 01-02923)
01-02973-01	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 20° ANGLE (WAS PART NUMBER: 01-02906)
01-02973-02	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 30° ANGLE (WAS PART NUMBER: 01-02909)
01-02973-03	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 45° ANGLE (WAS PART NUMBER: 01-02959)
01-02973-04	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 60° ANGLE (WAS PART NUMBER: 01-02973)
01-02974	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK 90° ANGLE (VERTICAL POLISHING MOUNT)

PART NUMBER	FIXTURE MODEL NUMBER USED ON	DESCRIPTION
01-02897	130, 135, 150, 151, 153, 154, 155, 155DV, 156, 157	1" DIAMETER STAINLESS STEEL MOUNTING BLOCK DUAL 10° MOUNTING BLOCK

VACUUM MOUNTING BLOCKS

PART NUMBER	FIXTURE MODEL NUMBER USED ON	DESCRIPTION
01-03930-01	155D, 155V, 155DV	2.125" DIAMETER STAINLESS STEEL MOUNTING BLOCK BLANK FOR VACUUM PATTERN *(SEE NOTE)
01-03930-02	155D, 155V, 155DV	2.186" DIAMETER STAINLESS STEEL MOUNTING BLOCK BLANK FOR VACUUM PATTERN *(SEE NOTE)
01-03928-01	155DV, 155V	2.125" DIAMETER STAINLESS STEEL MOUNTING BLOCK 2" DIAMETER VACUUM PATTERN
01-03925-01	155DV, 155V	2.125" DIAMETER STAINLESS STEEL MOUNTING BLOCK 1.87" DIAMETER VACUUM PATTERN
01-03926-01	155DV, 155V	2.125" DIAMETER STAINLESS STEEL MOUNTING BLOCK TUNNEL PATTERN FOR CUSTOM BLOCKS, ¼ PATTERNS *(SEE NOTE)
01-03772-01	147, 147D	2.6" (66MM) DIAMETER MOUNTING BLOCK, BLANK FOR VACUUM MOUNTING W/ CUSTOM PATTERN

* **BLANK VACUUM PLATES CAN BE MACHINED INTO SPECIFIC PATTERNS DEPENDING UPON CUSTOMER REQUIREMENTS. VARIOUS PATTERNS ARE AVAILABLE UPON REQUEST. CONTACT AN EMS REPRESENTATIVE FOR ORDER INQUIRIES.**

VERTICAL MOUNTING BLOCKS

PART NUMBER	FIXTURE MODEL NUMBER USED ON	DESCRIPTION
01-03856-01	153, 155D	2" DIAMETER STAINLESS STEEL MOUNTING BLOCK VERTICALLY MOUNTED SAMPLES (90°); STAR PATTERN, 4 POSITION *(SEE NOTE BELOW)
01-03858-01	153, 155D	2" DIAMETER STAINLESS STEEL MOUNTING BLOCK VERTICALLY MOUNTED SAMPLES (90°); STAR PATTERN, REVERSIBLE, 6 POSITION (MAXIMUM 20MM SPECIMEN LENGTH) *(SEE NOTE BELOW)
01-03855-01	155D	2" DIAMETER STAINLESS STEEL MOUNTING BLOCK VERTICALLY MOUNTED SAMPLES; STAR PATTERN, REVERSIBLE, 6 POSITION FOR 12MM DIAMETER RODS OR 10MM CUBE (MAXIMUM 20MM LENGTH)
01-03758-02	147E, 147DE	2.6" (66MM) DIAMETER MOUNTING BLOCK, VERTICALLY MOUNTED SAMPLES; STAR PATTERN; REVERSIBLE; 3 POSITION

* **SPECIAL CONFIGURATIONS ARE AVAILABLE FOR SPECIFIC SPECIMEN GEOMETRIES. CONTACT AN EMS SALES REPRESENTATIVE FOR ORDER INQUIRIES.**

3.0: Instrument Operation

Using the Model 145 Lapping and Polishing fixture is a simple task. Few moving parts make the unit user friendly and help in making the design simple for virtually all applications. The follow section focuses on techniques for successful operation of the unit as well as guidelines for preparation.

3.1: Basic Setup
(See Figure 1 for Illustration)

The Model 145 must be set up in a specific way to ensure that the specimen is lapped properly and precisely. Instructions for setting up the fixture are given below.

1. Verify the specimen mount is properly installed in the bottom of the fixture housing. The locking rod assembly (#3) should be installed.
2. Loosen the locking setscrew (#7) on the side of the fixture.
3. Place entire fixture onto a hard, flat surface.
4. Turn the top locking nut (#4) counter-clockwise around the slide assembly (#2) to allow adjustment of the slide.
5. Turn the micrometer dial (#5) counter-clockwise until it rises above the housing. This means that the specimen and the center slide will stick out below the base of the fixture. Turn the micrometer dial (#5) clockwise until it is snug against the scale stop. Only a slight drag should be felt before stopping.
6. Tighten the top locking nut (#4) clockwise until it is snug against the micrometer dial (#5). This locks the position of the center slide so that it will maintain its position during the grinding and polishing stages.

See Figure 2 below for illustration of the zero process.

7. Place the Model 145 onto a 180 grit SiC paper disc and grind down the feet parallel to mounting block. This ensures that the specimen holder is parallel with the tungsten carbide feet and will ensure that the surface is coplanar.
8. Clean the specimen mount and tungsten carbide feet thoroughly using a fine brush and de-ionized water.

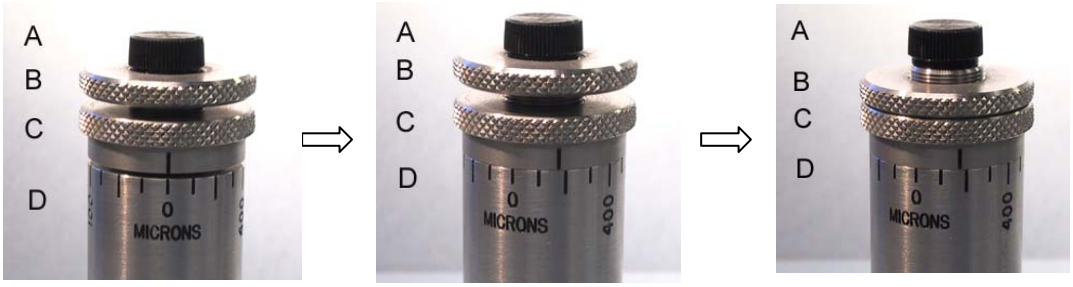

Figure 2: Images of the Model 145 micrometer dial arrangement demonstrating the zeroing process. On the left, the micrometer dial (A) is rotated counter-clockwise until there is a space between the dial and the housing (C). The locking ring (A) is also above the micrometer dial. Next, the micrometer dial is rotated clockwise until it becomes snug on the housing. This is the zero position. Finally, the locking ring is rotated clockwise to lock the position of the micrometer in place.

3.2: Lapping and Polishing Guidelines

Specimen preparation can generally be characterized in three ways: grinding, lapping and polishing. All three mechanisms are used for material removal, but the application of which greatly depends upon the requirements of the specimen, specimen material, and many other factors.

Grinding can be defined as the rapid removal of material from a specimen either to reduce it to a suitable size or to remove large irregularities from the surface. The grinding wheel or plate typically rotates at a high speed and a coarse (> 20 μm), bonded abrasive is used. Care at the grinding stage is imperative in order to avoid permanent changes in structure or severe sub-surface damage. Damage layers are later removed in lapping and / or polishing steps.

Lapping is the removal of material to produce a smooth, flat, unpolished surface. The lapping plate will rotate at a low (<150 rpm) speed and a medium abrasive particle (10-20μm) is typically used. Lapping removes subsurface damage caused by sawing or grinding and produces the required thickness and flatness. There are primarily two different modes of lapping: free abrasive lapping and fixed abrasive lapping. Free abrasive lapping is when abrasive slurry (suspension) is applied directly to a hard lapping plate. Fixed abrasive lapping is when an abrasive particle is bonded to a substrate as with abrasive lapping films and papers. The greatest flatness will be achieved with free abrasive lapping due to the rigid surface of the metal plate, although modern abrasive lapping films have comparable results. Abrasive lapping films have abrasive particles bonded to a thin, uniform polyester substrate and are also capable of producing a very flat surface. SiC papers are much thicker than the film and create the potential for rounded edges on the specimen.

Polishing is the removal of material to produce a scratch-free, specular surface using fine (<8 μm) abrasive particles. Polishing is typically done at low speeds using either polishing cloths or abrasive polishing films. As with lapping, polishing can be done with either free or fixed abrasives. Using free abrasives with a polishing cloth is typical when very small amounts of material need to be removed because the flatness of the specimen can be jeopardized. Utilizing a cloth with a very short nap minimizes the rounding of specimens. Final polishing is usually accomplished using a napless polyurethane pad such as MultiTex with 0.05 μm aluminum oxide or non-crystallizing colloidal silica. Abrasive polishing films have grown in popularity as they provide a very firm, uniform surface on which to polish. Abrasive polishing with diamond or aluminum oxide suspensions are characteristically used and are available in particle sizes down to 0.05 μm. Rounding of the specimen edges is less of a concern with abrasive polishing film due to their flatness and uniform thickness.

3.3: Standard Operating Procedure

Checks

1. Ensure the set screw is loose and allows the piston to freely slide up and down.
2. Ensure the fixture is clean and free of particle contamination.

Procedure (Refer to Figure 1 and 2)

1. Remove the specimen mount by loosening the locking rod assembly (Figure 1, #3) from the fixture and heat on a hot plate at ~ 100°C.
2. Measure the specimen thickness prior to mounting. Make sure the specimen is clean and free of contamination.
3. Apply necessary amount of low melting point wax (MWH 135) to the surface of the specimen mount.
4. Mount the specimen to the specimen mount and allow cooling.

Be sure the wax is uniform and thin across the entire surface of the specimen mount. Use of a sample mounting fixture is recommended, such as the Model 110.

5. Once cool, measure the thickness of the specimen and the specimen mount together. Subtract the specimen thickness from this value to obtain the wax layer thickness. This value will be used to extrapolate how well the specimen is mounted and determine the thickness.
6. After determining the specimen thickness, mount the specimen mount (Figure 1, #6) onto the slide assembly (Figure 1, #2). Make sure that the guide pin on the bottom of the slide assembly is mated with the hole on the specimen mount, and the locking rod assembly is tight.
7. Loosen the setscrew (#7) on the side of the fixture if tightened already.
8. Place entire fixture onto a hard, flat surface.
9. Turn the top locking nut (#4) counter-clockwise around the center slide (#2) to allow adjustment of the slide.
10. Turn the micrometer dial (#5) counter-clockwise until it rises above the scale stop. This means that the specimen and the center slide will stick out below the base of the fixture.
11. Turn the micrometer dial (#5) clockwise until it is snug against the housing. Only a slight drag should be felt before stopping.
12. Rotate the micrometer dial counter-clockwise until the desired amount of material to be removed has been dialed in.
13. Tighten the top locking nut (#4) clockwise until it is snug against the micrometer dial (#5). This locks the position of the center slide assembly so that it will maintain it's position during the grinding and polishing stages.
14. Place onto grinding wheel and lap the specimen to the desired thickness.

4.0: Maintenance

Very little maintenance is required for the Model 145. Some basic guidelines are listed for reference.

1. Do not allow abrasive slurry or particles to dry on the fixture. Thoroughly clean all surfaces when finished with the unit.
2. Disassemble and thoroughly clean the inside of the housing when finished. Do not allow abrasive particles to dry or stick inside.
3. Do not allow fixture to sit inside a water bath for extended periods of time.
4. Do not allow the fixture to be dropped on hard surfaces.
5. Keep specimen mount clean and free of excessive wax at all times.
6. Do not clean the piston with solvents. Wipe the piston with a dry lint free cloth.

5.0: Warranty

What IS covered:

Electron Microscopy Sciences (“EMS”) warrants, to the original buyer only, that the product that is the subject of this sale (a) conforms to EMS's published specifications and (b) is free from defects in material or workmanship. This warranty expires one year from the date of delivery. If the buyer discovers within this period a failure of the product to conform to specifications, or a defect in material or workmanship, the buyer must promptly notify EMS in writing. In no event may that notification be received by EMS later than 12 months from the date of delivery. Within a reasonable time after notification, EMS will correct any failure of the product to conform to specifications or any defect in material or workmanship, with either new or used replacement parts. Such repair, including both parts and labor, will be performed at EMS's expense. All warranty service will be performed at service centers designated by EMS. If EMS is unable to repair the product to conform to the warranty after a reasonable number of attempts, EMS will provide, at its option, one of the following: a replacement product or a full refund of the purchase price. These remedies are the buyer's only remedies for breach of warranty.

What IS NOT covered:

EMS does not warrant (a) any product, components, or parts not manufactured by EMS; (b) defects caused by failure to provide a suitable installation environment for the product; (c) damage caused by use of the product for purposes other than those for which it was designed; (d) damage caused by accidents, disasters such as fire, flood, wind, and lightning; (e) damage caused by unauthorized tampering, alteration, attachments or modifications; (f) damage caused by operation on low or excessive voltages; (g) damage during shipment; or (h) any other abuse or misuse by the buyer.

Warranty Claims

Buyer shall return all defective equipment to EMS’s repair facility by prepaid freight. If EMS provides replacement parts for field servicing at buyer’s facility, Buyer shall return all defective parts to EMS by prepaid freight. EMS reserves the right to inspect parts to verify alleged defects before issuing credit to buyer. All repaired and/or replaced parts will be returned to buyer F.O.B. EMS’s facility at 1120 Via Callejon, San Clemente, CA 92673 USA.

Disclaimer of Warranty

THE FOREGOING WARRANTIES ARE IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Limitation of Remedies

In no event will EMS be liable for any special, incidental, or consequential damages based on breach of warranty, breach of contract, negligence, strict tort, or any other legal theory. Damages that EMS will not be responsible for include, but are not limited to, loss of profits; loss of savings or revenue; loss of use of the product or any associated equipment; cost of capital; cost of any substitute equipment, facilities, or

services; downtime; the claims of third parties including customers; and injury to property. This limitation does not apply to damages caused by breach of the warranty of title and against infringements or to claims for personal injury.

Time Limit for Bringing Suit

Any action for breach of warranty must be commenced within 15 months following delivery of the product.

Allocation of risks

This Warranty allocates the risks of product failure between EMS and the original buyer of the goods. This allocation is recognized by both parties and is reflected in the price of the goods.