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INSTRUCTION MANUAL

48000

High speed beveler for micropipette tips larger than 1µm

Serial No._____

www.wpiinc.com

032416

CONTENTS

ABOUT THIS MANUAL

The following symbols are used in this guide:

This symbol indicates a CAUTION. Cautions warn against actions that can cause damage to equipment. Please read these carefully.

This symbol indicates a WARNING. Warnings alert you to actions that can cause personal injury or pose a physical threat. Please read these carefully.

NOTES and TIPS contain helpful information.

Fig. 1—The complete MBS system includes the 48000 MicroBeveler, along with an illuminator, a PZM Stereo Zoom microscope with a tilting base and a variety of accessories.

INTRODUCTION

Micropipette tips larger than one micron are easily bevelled with WPI's Model 48000 MicroBeveler, as well as other small glassy materials. Somewhat smaller tips are also possible using 0.1µm abrasive lapping disks.

The MicroBeveler platen rotates very smoothly, insuring smooth grinding action. It can turn either clockwise or counter-clockwise at speeds ranging from 600 to 6000 rpm. Adhesive-backed alumina or diamond lapping disks, available with different grades of grit, can be applied to and removed from the platen surface leaving no adhesive residue. The MicroBeveler is shipped with a 1 micron alumina lapping disk already mounted on the platen.

The MicroBeveler is mounted on a steel base, 22 × 28 × 1 cm (8.7 × 11 × 0.4 in.), providing a stable surface for mounting a magnetic stand and micropositioner.

Power for the MicroBeveler is provided by an external modular DC power source and power line cord matching a user-specified line voltage of either 120 or 240 volts AC.

Included with the MicroBeveler are three alumina-coated lapping disks (0.3, 1, and 3 micron grit) and a lapping disk alignment tool to assist in applying the self-adhesive disks to the platen. Also included is a small screwdriver to remove the surface plate hold-down screws.

Parts List

After unpacking, verify that there is no visible damage to the sensor. Verify that all items are included:

(1) **48000** MicroBeveler
(1) **48300** Tilt Base with PZM Mounting Ring
(1) **48200** PZM Tool Holder
(1) **15934** Beveler Disk Plate (replacement)
(1) **7484** Disk Plate Screws
(1) **14471** Power Supply Switching 120-240 with one of the following:
- **3600** Line Cord 110 V US
- **3302** Line Cord 240 V British
- **3301** Line Cord 240 V European
- **14088** Line Cord 240 V Australian

(1) Instruction Manual

Unpacking

Upon receipt of this instrument, make a thorough inspection of the contents and check for possible damage. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed damage should be reported at once to the carrier and an inspection requested. Please read the section entitled "Claims and Returns" on page 11 of this manual. Please contact WPI Customer Service if any parts are missing at 941.371.1003 or customerservice@wpiinc.com.

Returns: Do not return any goods to WPI without obtaining prior approval (RMA # required) and instructions from WPI's Returns Department. Goods returned (unauthorized) by collect freight may be refused. If a return shipment is necessary, use the original container, if possible. If the original container is not available, use a suitable substitute that is rigid and of adequate size. Wrap the instrument in paper or plastic surrounded with at least 100mm (four inches) of shock absorbing material. For further details, please read the section entitled "Claims and Returns" on page 11 of this manual.

INSTRUMENT DESCRIPTION

1. The MicroBeveler's DC power input jack is located at the rear of the unit. Required input voltage is 12 volts DC. Connect the output of the external DC power supply (provided) to this jack, then plug the power supply line cord into an AC power main. This "switching" power supply will accept 120 or 240 VAC.

2. To install an abrasive lapping disk on the MicroBeveler platen, remove the four screws on the platen hub with the screwdriver supplied. It is suggested that the you start with an abrasive disk of 0.1 micron grit until experimental results suggest the use of a different grit. Refer to Fig. 3 before mounting a lapping disk to the platen.
3. Mount the lapping disk on alignment tool grit side down. Peel the protective backing off the lapping disk, taking care to avoid dirt or dust sticking to the adhesive. Check that the beveler platen is free of dust or dirt before fitting it onto the alignment tool and pressing the lapping disk onto it. Finally, make sure there is no dust or dirt on the bottom of beveler platen or motor hub before they are again secured to the motor shaft. Turn the directional control either clockwise or counter-clockwise from the central "stop".

OPERATING INSTRUCTIONS

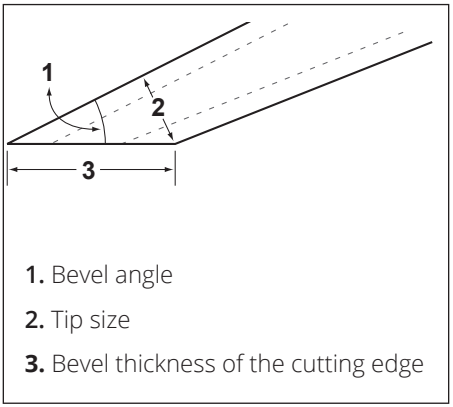
Beveler Terminology

Bevel angle–The angle between the axis of the micropipette and the horizontal plane.

Tip size–The maximum outer diameter across the base of the beveled tip.

Bevel thickness–The length of the cutting edge.

Getting Started



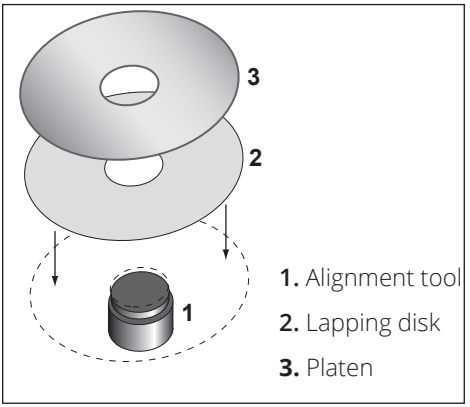


Fig. 2—(Left)
Fig. 3—(Right)

1. Mount a micropipette in the tool holder. Adjust the positioner to bring the micropipette close to the front center edge of the beveler abrasive disk.
2. Set the bevel angle visually to approximately 25 degrees (preferred range is 20-35 degrees—see Fig. 2).
3. Set up the microscope so that the pipette and the disk surface are in the field of view, using a light source tangentially grazing the beveling surface.

NOTE: The visibility of the pipette can be greatly improved by lighting it internally using an illuminated fiber connected to the pipette shank. This is easily done with an optional fiber optic cable assembly (#**48025**) and WPI's **FO-150** Fiber Optic Illuminator.

NOTE: It is best to use tips with an initial tip diameter only slightly smaller than the expected beveled tip size.

4. Set the microscope magnification to minimum and advance the pipette until it is in the field of view.
5. By adjusting the tilt base screw in small increments, advance the pipette tip toward the lapping disk until the pipette's reflection is seen in the disk surface. If no reflection is seen, adjust the illumination. Slowly advance the pipette tip until it "meets" its reflection. At this point, the pipette is in contact with the lapping disk.
6. Bevel the pipette until the cutting edge meets the lapping disk. Then, back off and bring the pipette in view of the eyepiece reticle. The tip size and thickness can now be measured.

CAUTION: You must wait until the lapping disk stops spinning before changing the direction of rotation.

Tip Size and Surface Area

The surface area of a normal pipette may be found by using the formula (refer to Fig. 2):

where **x** is the tip size in microns.
The surface area of a beveled pipette may be found by using the formula:

$$A = \frac{\pi x^2}{4}$$

where **x** is the tip size in microns and **y** is the thickness in microns.

$$A = \frac{\pi xy}{4}$$

Glass Information

1 mm Standard Glass	1.0 mm OD, 0.58 mm ID
1 mm Thin-Wall Glass	1.0 mm OD, 0.75 mm ID

The ID-to-OD ratio of the glass tubing remains unchanged when the glass is pulled.

Beveling Information

The 48000 MicroBeveler can easily bevel pipette tips from one micron to over 100 microns. The best results are achieved by selecting the proper lapping disk to use in beveling a pipette of a particular size or profile. When a larger pipette tip (>10 microns) is to be beveled, it should be pulled so the tip is only a few microns smaller than the desired final size: it is much easier to bevel to size when only a minimum of glass must be removed. Most larger pipettes pulled in this manner can be beveled with the 0.3 micron alumina disk.

During the beveling process, some grit is worn down or removed from the abrasive

surface, leaving the surface a little coarse and causing fine chips in the edges of the pipette. Rough beveling should be done on the used part of the disk. The smoothness of the tip can be improved by beveling the pipette to within a few microns of the desired tip size and then moving to a fresh spot on the disk. This procedure will give you the sharpest of tips and a very smooth cutting edge. If a thicker tip wall thickness is desired, changing from alumina to diamond grit or going to a large grit size may be necessary. Another thing to keep in mind is that the sharpness of the beveled edge is dependent on the grit size.

Most larger tips bevel easily at angles up to or above 45 degrees. The best bevel angle is between 20 and 35 degrees. It is possible to bevel tips at 90 degrees, if necessary, by first beveling the pipette at a slight angle and then repositioning it to 90 degrees for the final beveling.

MAINTENANCE

A safety shield around the platen of the MicroBeveler protects you from flying debris. ***Do not try to remove this shield.*** Disassembly could damage the instrument's motor or electronics.

If the safety shield becomes dirty, you can use any antistatic cleaner/polish to renew the surface. Be careful to use only as much cleaning solution as necessary to get the job done and not so much as to leak into the motor assembly. After cleaning and before the beveler platen is reassembled, closely inspect the area of the motor housing to be certain it is dry.

Other than normal cleaning and inspection of cords and power supply for damage, there are no other maintenance requirements. The motor requires no oil or other lubricant. In fact, the addition of oil will damage the motor to the extent of making it completely unusable.

Cleaning Glass Dust from Tip

In some cases it might take longer to bevel a tip in the 1µm range, because the tip is very long and tends to bend and ride along the beveler platen surface. If the tip appears to have a slight bend to it, you have advanced the pipette too far onto the beveling surface. It is best to advance the pipette until you see a slight vibration at the tip, then stop advancing and let the lapping disk grind the surface until no vibration is seen. Then, the pipette is finished.

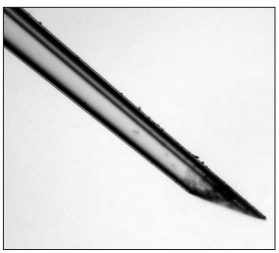


Fig. 4—Original bevel, showing dust.

Sometimes small tips break off as soon as the pipette touches the disk surface; in most cases, going to a finer grit size solves the problem.

Some scientists have noted that if micropipettes are filled with distilled water and left standing overnight, the glass undergoes slow hydration and its chemical composition changes. These changes in physical properties promote a smoother abrasive action during beveling. The advantage is more obvious with smaller tips.

Fig. 5— Final tip face (1µ film used). (Photo courtesy of Dr. Huanghui Tang, Northwestern University.)

Though tip plugging is only an occasional minor problem when beveling fine tips, it becomes significant when beveling relatively large tips. As the tip is enlarged, a greater accumulation of glass and abrasive particles migrate up into the tip. Extremely large tips (> 10 microns) may be easily cleaned by power flushing or ultrasonic cleaning. Small and mid-range pipettes (< 10 microns) are almost impossible to power flush and sometimes break if ultrasonically cleaned. Tip plugging can be reduced by back-filling the pipette with distilled water. This has a cooling effect on the tip and allows the chips to be suspended in a pool of water which may easily be washed out.

When beveling some mid-range pipettes, a small glass chip will form at the bevel edge. This chip will appear to be attached as it is very difficult to remove. To prevent this chip from forming, apply a very small amount of distilled water to the beveling surface using a small, fine watercolor brush. The water has a cooling effect on the beveled surface and the chip is eliminated. Only a very small amount of water is needed. Excess water clouds the field of view and makes it impossible to see the tip through the bevel shield.

A commonly used method of cleaning the pipette tip for *in vitro* research:

1. A quick wash in 12% hydrofluoric acid after grinding.

2. Rinse several times in three HPLC grade water baths.

You can also use an ultrasonic bath for step 2. However, the pipette must go through step 1 before ultrasonic cleaning. Otherwise, the tip will shatter in the ultrasonic bath. The hydrofluoric acid not only removes debris but also removes microscopic cracks created during grinding, making the tip much stronger. Because of the toxicity of hydrofluoric acid, step 1 should be done in a vented hood.

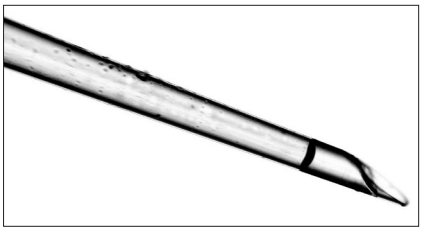


Fig. 6—Final tip edge. (Photo courtesy of Dr. Huanghui Tang, Northwestern University.)

Exercise caution when handling hydrofluoric acid—use proper eye and skin coverings. The longer the pipette is left in this solution, the more rounding effect it will have on the bevel edge.

ACCESSORIES

Auxiliary Equipment

Lapping Disks—alumina disks with 0.3, 1, or 3 micron grit; diamond disks with 0.1, 0.5, 1, 3 micron grit.

Light Source—Z-LITE Fiber Optic Illuminator; fiber optic cable and pipette holder assembly #48025 may be used with the Z-LITE to internally illuminate the pipette.

Microscope—binocular stereo microscope model PZM3, using 20X eyepiece with reticle.

Lapping Film—Alumina		
0.3µm	**48015-03**	*white*
1µm	**48015-10**	*lime green*
3µm	**48015-30**	*pink*

Lapping Film—Diamond		
0.1µm	**48014-01**	*green*
0.5µm	**48014-05**	*tan*
1µm	**48014-10**	*purple*
3µm	**48014-30**	*rose*

Optional Accessories

Part Number	Description
48015-03	Lapping Film, Alumina, 0.3 micron (50-pack)
48015-10	Lapping Film, Alumina, 1 micron (50-pack)
48015-30	Lapping Film, Alumina, 3 microns (50-pack)
48014-01	Lapping Film, Diamond, 0.1 micron (3-pack)
48014-05	Lapping Film, Diamond, 0.5 micron (3-pack)
48014-10	Lapping Film, Diamond, 1 micron (3-pack)
48014-30	Lapping Film, Diamond, 3 microns (3-pack)
48025	Fiber Optic Cable for Pipette Illumination
15934	Replacement Beveler Disk Plate
48300	Tilt Base Assembly for PZMIII binocular head
48200	PZM Tool Holder
Z-LITE	Fiber Optic Illuminator 115 V
EJA	Replacement Lamp
501352	Precision Zoom Microscope (head with 10x eyepieces)
502012	20x Eyepieces (pair)
48200	PZM Tool Holder
504128	10x Eyepiece with Reticle, 0-90°, 200 divisions per mm
504129	20x Eyepiece with Reticle, 0-90°, 200 divisions per mm
UBATH-Y	Ultrasonic Cleaner - 110V
UBATH-B	Ultrasonic Cleaner - 220V British
UBATH-Z	Ultrasonic Cleaner - 220V Euro
13740	Ultrasonic Detergent (4 lb.)
48025	Optical cable & pipette holder to fit Novaflex housing
FO1MPH	Replacement holder for up to 1.5 mm glass

SPECIFICATIONS

This unit conforms to the following specifications:

Beveling Surface ..... 3.5 inch diameter disk
Abrasive Material ..... alumina, diamond
Speed of Rotation ..... 100-5400 RPM
Motor ..... reversible, variable speed
Power Requirements ..... 120V, 60Hz or 240V, 50Hz, 20VA to supplied power supply

Dimensions:
Base Plate ..... 22 × 28 × 1cm (8.7 × 11 × 0.4")
Overall Height ..... 8cm (3")
Shipping Weight ..... 13 kg (29 lb.)

APPENDIX A: SETTING UP THE MBS ASSEMBLY

1. To install the microscope on the tilting base, slide the microscope into the ring mount and tighten the tension knob to secure it. See Fig. 7.

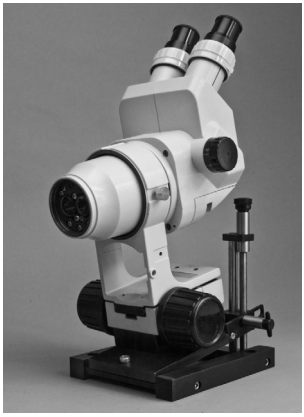


Fig. 7—Microscope in base

2. Screw the ring light adapter (WPI #**13338**) into the end of the scope as shown in Fig. 8 When properly installed, it will look like Fig. 9.

Fig. 8—(Left) Installing the ring light adapter
Fig. 9—(Right) Ring light adapter, properly installed

3. Place the tool holder plate from the tool holder assembly (WPI #**48200**) over the end of the ring light adapter, rotate into proper position and tighten the black thumb screw on the tool holder plate. It is shown at the bottom of Fig. 10.

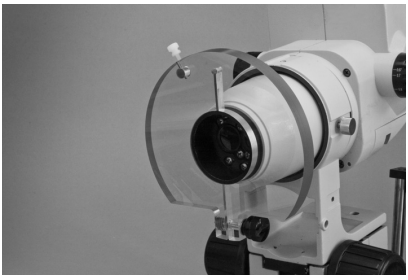
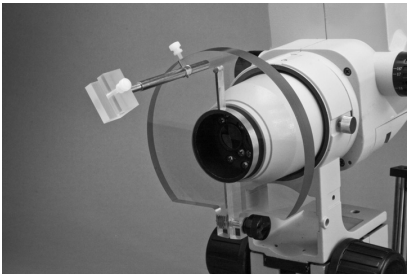


Fig. 10—Tool holder plate installed

4. Slide the tool holder bar from the tool holder assembly (WPI #**48200**) into the hole in the tool holder plate as shown in Fig. 10. Rotate it into proper position and tighten the white thumb screw on the top of the tool holder plate.



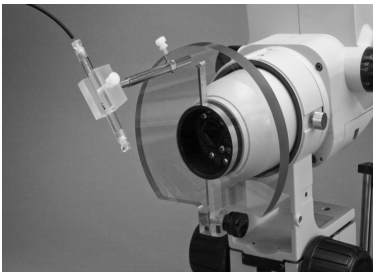
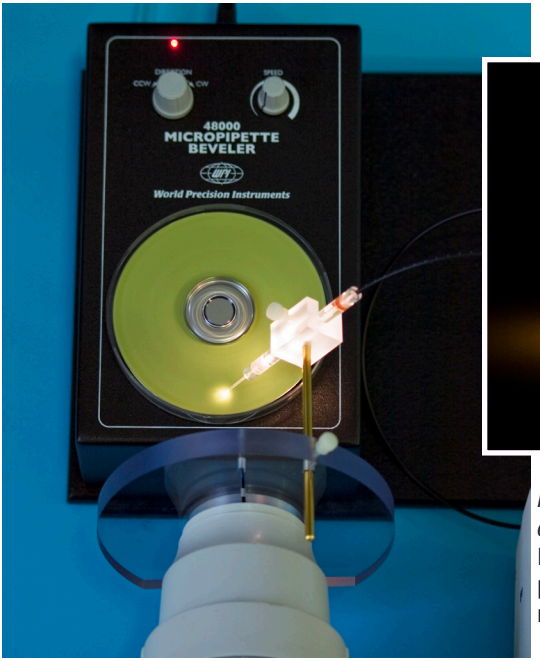


Fig. 11—(Left) Tool holder bar installed
Fig. 12—(Right) Pipette holder installed

5. Insert the pipette holder from the fiber optic cable assembly (WPI #**48025**) into the tool holder assembly as shown inFig. 12. Insert the other end of the fiber optic cable into the 16mm Z-LITE aperture and tighten the thumb screw to hold it in place.



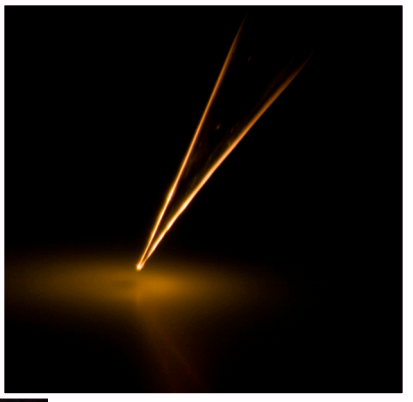


Fig. 13—(Left) 48000 Beveler in use as seen from above
Fig. 14—(Above) Lighted tip of a pulled pipette as seen through the microscope

DECLARATION OF CONFORMITY

WORLD PRECISION INSTRUMENTS, INC.
175 Sarasota Center Boulevard
Sarasota, FL 34240-9258 USA
Telephone: (941) 371-1003 Fax: (941) 377-5428
e-mail wpi@wpiinc.com

DECLARATION OF CONFORMITY

We: World Precision Instruments, Inc.
175 Sarasota Center Boulevard
Sarasota, FL 34240-9258
USA

As manufacturers of the apparatus listed, declare under sole responsibility that the product(s):

Title: Micro Pipette Beveler Model 48000-J

to which this declaration relates is/are in conformity with the following standards or other normative documents:

Safety: EN 61010-1:1993 (IEC 1010-1:1990)

EMC: EN 50081-1:1992
EN 50082-1:1992

and therefore conform(s) with the protection requirements of Council Directive 89/336/EEC relating to electromagnetic compatibility ans Council Directive 73/23/EEC relating to safety requirements.

Issued on: **18th July 2005**

Mr. Cliff Bredenberg
President
World Precision Instruments, Inc.
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Sarasota, FL 34240-9258 USA

Suyi Liu, PhD.
Vice President of Research
World Precision Instruments, Inc.
175 Sarasota Center Boulevard
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WARRANTY

WPI (World Precision Instruments, Inc.) warrants to the original purchaser that this equipment, including its components and parts, shall be free from defects in material and workmanship for a period of one year* from the date of receipt. WPI's obligation under this warranty shall be limited to repair or replacement, at WPI's option, of the equipment or defective components or parts upon receipt thereof f.o.b. WPI, Sarasota, Florida U.S.A. Return of a repaired instrument shall be f.o.b. Sarasota.

The above warranty is contingent upon normal usage and does not cover products which have been modified without WPI's approval or which have been subjected to unusual physical or electrical stress or on which the original identification marks have been removed or altered. The above warranty will not apply if adjustment, repair or parts replacement is required because of accident, neglect, misuse, failure of electric power, air conditioning, humidity control, or causes other than normal and ordinary usage.

To the extent that any of its equipment is furnished by a manufacturer other than WPI, the foregoing warranty shall be applicable only to the extent of the warranty furnished by such other manufacturer. This warranty will not apply to appearance terms, such as knobs, handles, dials or the like.

WPI makes no warranty of any kind, express or implied or statutory, including without limitation any warranties of merchantability and/or fitness for a particular purpose. WPI shall not be liable for any damages, whether direct, indirect, special or consequential arising from a failure of this product to operate in the manner desired by the user. WPI shall not be liable for any damage to data or property that may be caused directly or indirectly by use of this product.

Claims and Returns

Inspect all shipments upon receipt. Missing cartons or obvious damage to cartons should be noted on the delivery receipt before signing. Concealed loss or damage should be reported at once to the carrier and an inspection requested. All claims for shortage or damage must be made within ten (10) days after receipt of shipment. Claims for lost shipments must be made within thirty (30) days of receipt of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim is settled. In some instances, photographic documentation may be required. Some items are time-sensitive; WPI assumes no extended warranty or any liability for use beyond the date specified on the container

Do not return any goods to us without obtaining prior approval and instructions from our Returns Department. Goods returned (unauthorized) by collect freight may be refused. Goods accepted for restocking will be exchanged or credited to your WPI account. Goods returned which were ordered by customers in error are subject to a 25% restocking charge. Equipment which was built as a special order cannot be returned.

Repairs

Contact our Customer Service Department for assistance in the repair of apparatus. Do not return goods until instructions have been received. Returned items must be securely packed to prevent further damage in transit. The Customer is responsible for paying shipping expenses, including adequate insurance on all items returned for repairs. Identification of the item(s) by model number, name, as well as complete description of the difficulties experienced should be written on the repair purchase order and on a tag attached to the item.

** Electrodes, batteries and other consumable parts are warranted for 30 days only from the date on which the customer receives these items.*

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