



MicroBeveler 48000

High-speed beveler for micropipette tips larger than one micron



World Precision Instruments, Inc.

USA

International Trade Center, 175 Sarasota Center Blvd., Sarasota FL 34240-9258
Tel: 941-371-1003 • Fax: 941-377-5428 • E-mail: sales@wpiinc.com

UK

Astonbury Farm Business Centre • Aston, Stevenage, Hertfordshire SG2 7EG
Tel: 01438-880025 • Fax: 01438-880026 • E-mail: wpiuk@wpi-europe.com

Germany

Liegnitzer Str. 15, D-10999 Berlin
Tel: 030-6188845 • Fax: 030-6188670 • E-mail: wpide@wpi-europe.com

Internet

www.wpiinc.com • www.wpi-medical.com
www.nitricoxide.net • www.pipetter.com

www.wpiinc.com

INSTRUCTION MANUAL

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World Precision Instruments



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 and Council Directive 73/23/EEC relating to safety requirements.

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


Suyi Liu, PhD.
Vice President of Research
World Precision Instruments, Inc.
175 Sarasota Center Boulevard
Sarasota, FL 34240-9258 USA

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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 10 days after receipt of shipment. Claims for lost shipments must be made within 30 days of invoice or other notification of shipment. Please save damaged or pilfered cartons until claim settles. 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.
- WPI cannot be held responsible for items damaged in shipment en route to us. Please enclose merchandise in its original shipping container to avoid damage from handling. We recommend that you insure merchandise when shipping. The customer is responsible for paying shipping expenses including adequate insurance on all items returned.
- Do not return any goods to WPI without obtaining prior approval and instructions (RMA#) from our returns department. Goods returned unauthorized or by collect freight may be refused. The RMA# must be clearly displayed on the outside of the box, or the package will not be accepted. Please contact the RMA department for a request form.
- Goods returned for repair must be reasonably clean and free of hazardous materials.
- A handling fee is charged for goods returned for exchange or credit. This fee may add up to 25% of the sale price depending on the condition of the item. Goods ordered in error are also subject to the handling fee.
- Equipment which was built as a special order cannot be returned.
- Always refer to the RMA# when contacting WPI to obtain a status of your returned item.
- For any other issues regarding a claim or return, please contact the RMA department.

Warning: This equipment is not designed or intended for use on humans.

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

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 0.1 micron 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.

Unpacking and Setup

Upon receipt of this instrument, make a thorough inspection of contents and check for possible damage. If a return shipment is necessary, use the original container. 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 100 mm (four inches) of shock absorbing material.

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.

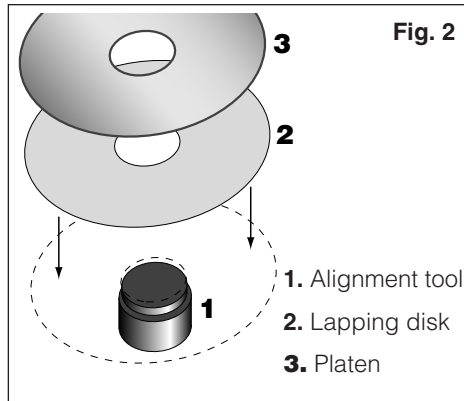
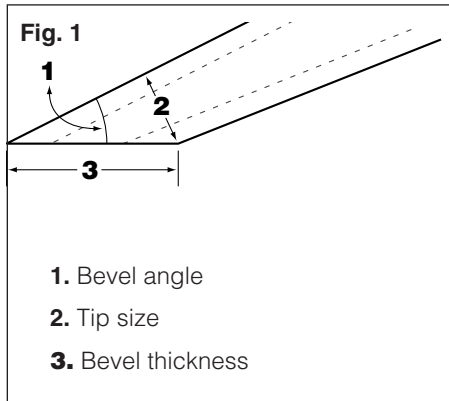
To install an abrasive lapping disk on the MicroBeveler platen, remove the four screws on the platen hub with the screwdriver supplied. It is suggested that the user start with an abrasive disk of 0.1 micron grit until experimental results suggest the use of a different grit. Refer to Figure 2 before mounting a lapping disk to the platen.

Mount 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”.

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.



Operating Instructions

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. Set the bevel angle visually to approximately 25 degrees (preferred range is 20-35 degrees—see Figure 1). 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.

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.

It is best to use tips with an initial tip diameter only slightly smaller than the expected beveled tip size. Set microscope magnification to minimum and advance the pipette

Lapping Film—Alumina

0.3 micron	48015-03	<i>white</i>
0.1 micron	48015-10	<i>lime green</i>
3 micron	48015-30	<i>pink</i>

Lapping Film—Diamond

0.1 micron	48014-01	<i>light green</i>
0.5 micron	48014-05	<i>tan</i>
1 micron	48014-10	<i>purple</i>
3 micron	48014-30	<i>red</i>

Accessories Available from WPI

Illuminator

Fiber Optic Illuminator 115 V.....	NOVA
Replacement Lamp	EJA

Zoom Microscope

Precision Zoom Microscope.....	501352
20x Eyepiece	501372
PZM Tool Holder.....	48200

Half-Liter Ultrasonic Tank

Ultrasonic Cleaner.....	UBATH
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Micropipette puller

Two-stage Microprocessor-controlled Puller.....	PUL-2
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Optical Cable

Optical cable & pipette holder to fit Novaflex housing.....	48025
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Specifications

Beveling Surface	3.5 inch diameter disk
Abrasive Material.....	alumina, diamond
Speed of Rotation.....	100-6000 rpm
Motor	reversible, variable speed
Power Requirements	120 volts, 60 Hz or 240 volts, 50 Hz, 20 VA to supplied power supply
Dimensions:	
Base Plate	22 × 28 × 1 cm (8.7 × 11 × 0.4 in.)
Overall Height	8 cm (3 in.)
Shipping Weight.....	13 kg (29 lb)

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—Novaflex Fiber Optic Illuminator; fiber optic cable and pipette holder assembly #48025 may be used with the the Novaflex to internally illuminate the pipette.

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

Microbeveler Parts List

MicroBeveler	48000
Tilt Base with PZM Mounting Ring.....	48300
PZM Tool Holder	48200
Beveler Disk Plate (replacement).....	15934
Disk Plate Screws.....	7484
Power Supply Switching 120-240.....	13519
Line Cord 110 V US.....	3600
Line Cord 240 V British.....	3302
Line Cord 240 V European	3301
Line Cord 240 V Australian.....	14088

until it is in the field of view. 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. 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.

Warning: 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 Figure 1):

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

where **x** is the tip size in microns.

The surface area of a beveled pipette may be found by using the formula:

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

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

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

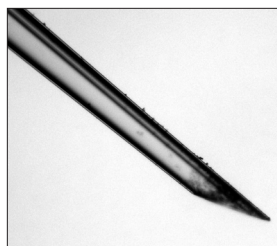
The 48000 MicroBeveler can easily bevel pipette tips from one micron to over 100 microns. The best results are achieved by selecting the proper lapping disk to use in beveling a pipette of a particular size or profile. When a larger pipette tip (>10 microns) is to be beveled, it should be pulled so the 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.

Cleaning Glass Dust from Tip



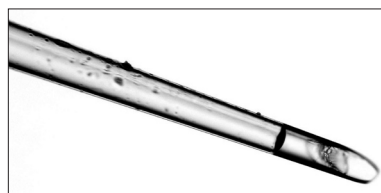
Original bevel, showing dust.

In some cases it might take longer to bevel a tip in the one micron 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. At this point, the pipette should be finished.

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

Some scientists have noted that if micro-pipettes 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 of this procedure is most obvious with smaller tips.

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



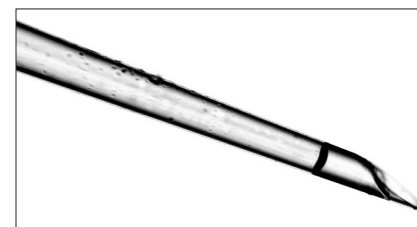
Final tip face (1 μ film used). (Photo courtesy of Dr. Huanghui Tang, Northwestern University.)

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.



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

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.

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.

Maintenance

A safety shield around the platen of the MicroBeveler protects the user 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.