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ULTRAPOL

Fiber Lensing Machine

USER GUIDE



Figure 1. ULTRAPOL FIBER LENSING Machine.

A Precision Lapping and Polishing System for polishing sculpted ends on bare optical fibers.

The delivered unit will include the following:

- **A** Base
- **B** Mast.
- **C** Plate
- **D** Weight Kit
- **E** Oscillator

Various supplies – Lapping Films, Lapping Slurries, etc. may also be included, as are tools (such as wrenches) for mounting Accessories.

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APPENDIX A **-** Lapping and Polishing Films

Wiring Diagrams

INTRODUCTION. This system provides for polishing bare optical fibers of 125um and larger with sculpted ends—chamfers, angles and cone shapes.

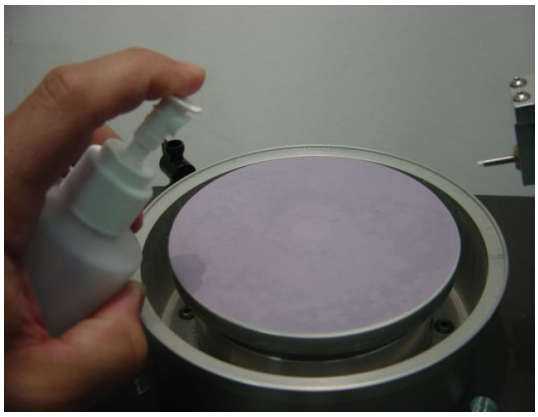
THE BASE

1.0 **Setup**. The Base is set on a workbench surface. It should be set reasonably level (precise leveling is not required).

1.1 **Electrical**. The Base requires a standard 110V 60Hz / or 220-240V / 50 Hz 3-wire electrical outlet, dependent on configuration purchased. The power cord plugs into the Base, at the rear.

1.2 **Coolant**. Application of water for lubrication is an important part of the polishing process.

1.2.1 **Working on single fiber ends** requires very little water. A good method is to use a plastic spray bottle to apply water to the lap surface. A light mist or several drops of water applied to the polishing film surface is adequate.



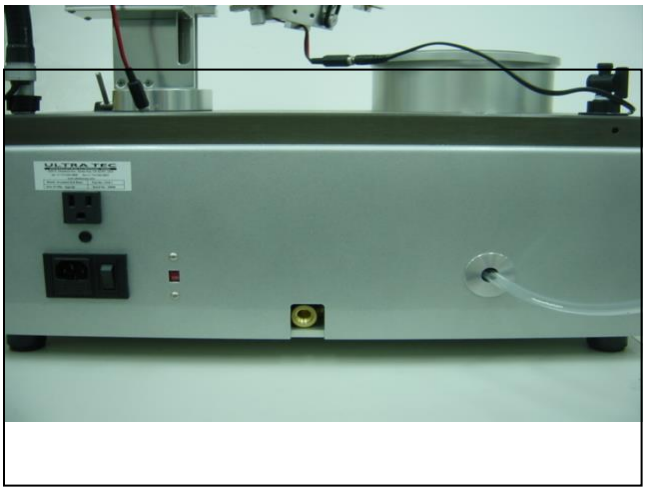
If the users application is only single fiber ends, the spray bottle is adequate, but…

1.2.2 **For applications needing more water,** there is a Faucet at the left rear. The volume of flow from the Faucet is controlled by a valve at its base. On-off setting of flow from the faucet is controlled by a front panel toggle switch. .

1.2.2.1 **Hook-up of Solenoid**. An intake valve fitting with a ¼ NPT extension is pre-assembled, extending from the rear panel (not shown in rear panel photo, below). Connection is made from the pressurized source into the ¼ NPT fitting, and the valve is set to control against excessive flow from the pressurized source. The internal plumbing will handle line pressure, but if the unit is shut down and is unattended, the rear valve should be shut.

1.2.3 **Drain**. The Base needs to be placed for convenient drainage. The drain exits from the rear panel, though a fitting onto which the supplied drain hose is pressed. This drain can be fed into a container (a gallon plastic container is usually convenient). Alternatively, the feed may be directed into the facility drain, if faucets are used.

Back Panel Layout



2.0 Front Panel Layout

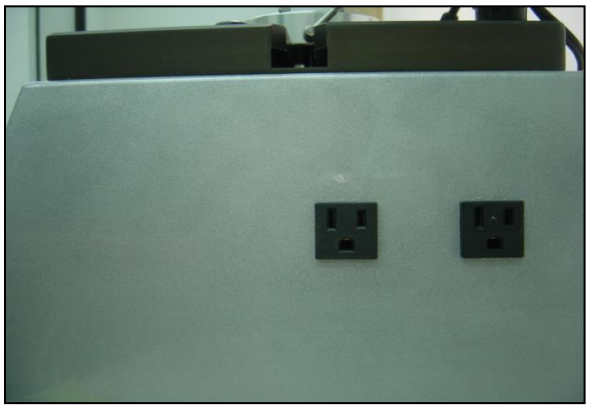
Looking at the Control Panel from right to left, are the following control features: **Main Power Switch**, **Accessory Power Switch** , **Timer Control** section (made up of Timer Mode Selection Switch, Timer Dial, Timer Reset pushbutton), **Lap control** section (made up of On/Off/Directional switch, Lap Speed selection knob and Tachometer readout)), and Solenoid **Coolant control** .



2.1 **Main Power Switch**. This switch controls power for all of the functions, with the exception of the rear socket (located on the back panel) which is for the lamp. The Main Power Switch is used to power-up the system after a shutdown period, and should be moved to the OFF position during shutdown. The Main Power Switch is available as an emergency shut-off.

2.2 **Accessory Power Switch**. On the right-side panel of the Base, there are two sockets that supply 110VAC power. The Accessory Power Switch controls these switched. These accessory power outlets are used for accessories (for example, rotating or oscillating devices).

Side Panel Layout



2.3 Timer Controls

2.3.1 Timer-OFF Mode. There is a rocker switch for "Timer Mode", with ON and OFF positions. In the OFF position, the Platen controls allow for Platen rotation, with no limit on the time period, running time being controlled by the operator.

2.3.2 Timer-ON Mode. With the rocker switch in this position, operation of the Platen can only be done under the set-time condition.

2.3.2.1 Setting the Timer. The digital timer reads in seconds, with settings possible from 0 to 9999 seconds (167 minutes). The settings are made by pressing the buttons for each position on the Timer (units, 10's, 100's 1000's), each settable from 0 to 9—the digits on the Timer change when the buttons are pressed. The upper row will be at 0000, set to read out when the Platen is in operation. (NOTE: The Timer setting can not be modified while in operation—the Timer will run for the originally set time).

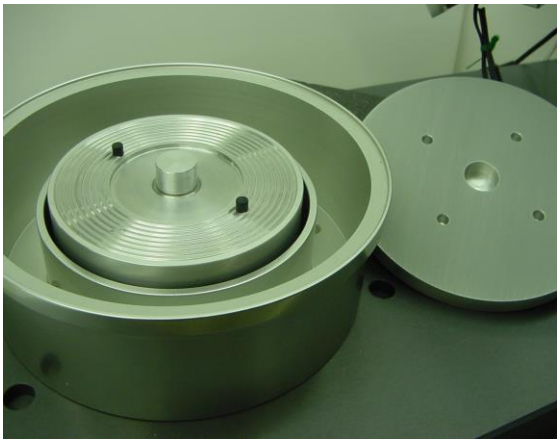
2.3.2.2 Operation of Timer. The Timer Reset pushbutton will activate the Timer and Platen operation—the Timer counts down the set number of seconds at the end of which the operation turns off. The previously set time is retained, and rerunning for that time can be done by again pushing the Timer Reset pushbutton.

2.4.1 **Coolant Control Switch.** Discussed above in section 1.2

3.0 **Operation of the Base—Controlling the Platen and the Lap Plate**. The Base provides a Platen to support and drive the Master Disc (onto which the Grinding/Polishing Pads are set).



The Master Disc is set onto the Platen, locating onto a central aligning plug. Two Drive Pins positioned on opposite sides of the central plug, equidistant from the platen center, drive the Plate during operation. To place the Master Disc onto the Platen, first engage the central plug (it extends higher than the Drive Pins) and then rotate the Disc (resting on the Plugs) until it falls into position. (Note: At very low angles of approach, the Splashguard may interfere with the Mast – when this is the case, the Splashguard can be removed (it is held to the Baseplate by two screws). The amount of splash is small, and can be removed with a paper wiper.



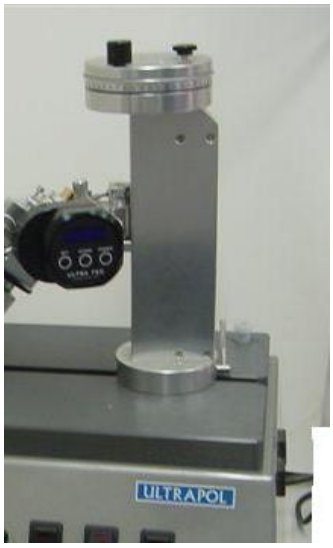
3.1 **On/Off/On Directional Switch**. This three-way switch, located to the right of the Timer, has a central OFF position, and two ON positions—Clockwise (CW) and Counter-clockwise (CCW), for selecting direction of the Lap.

3.2 **Lap Speed selection knob**. This knob is used for selecting speed of the Lap. It can be left in any particular position

3.3.1 **Tachometer Readout**. The Tachometer Readout reads directly, in RPM, .the maximum speed will be approx. 600 RPM.

4.0 FEATURES OF THE UT.1648.1 MICROPOSITIONING MAST

4.1 Mounting. The Mast slides into the track and is locked in place with a Lever (rear, Base of Mast)



4.2 CALIBRATION

The Mast is calibrated before leaving the factory and will maintain accuracy over an extended period. If the system is used constantly (daily) we suggest sending the positioner to ULTRA TEC for calibration once a year (maintainence programs are available).

5.0 MICROSPOSITIONING MAST CONTROLS

5.1 PRESSURE

A steady pressure can be set through use of a Weight Kit. The Weight Kit also acts as a counter-balance control to lighten the downward pressure on the workpiece. The Weight Kit consists of a Hub, an Arm, and Weights (two aluminum and two brass weights-Fig. 1). It mounts as shown in figure 2, held to the Hub facing rear on the Mast--held in rotary position by tightening the knob (Fig 3). When the weight is set toward the rear, as shown in figure 4, it functions to **add pressure**; if it's set toward the front (fig 2 & 5) it functions as a **counterbalance**. It operates with a significant mechanical advantage and some experimentation is the best way to determine and set a desired pressure effect. (Note: in some cases, particularly in the counterbalance position—no weight is added to the pin—just the pin alone provides enough force).



Fig 1 The Weight Kit

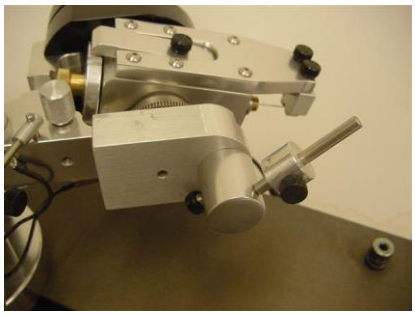


Fig 2 Mounted—in counterbalance position



Fig 3 Rotary adjust position

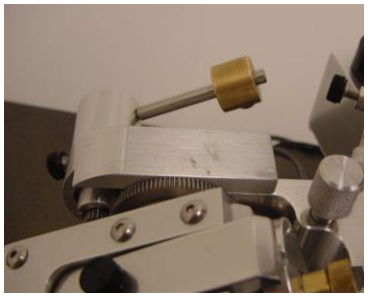


Fig 4 –Weight toward rear—adds pressure

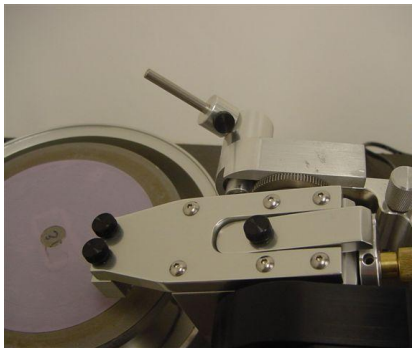


Fig 5 toward front--counterbalance

5.3 AXIAL ANGLE CONTROL

The Micropositioned Head provides variable control of the axial angle. The Digital readout indicates 90 degrees when it is pointing straight out (parallel to the lap surface). So, the reading of 75.00 degrees on the readout (Fig 1) shows that a shallow 15 degree angle will be applied to the workpiece. Setting of the angle is by use of the Angle Stop Setting Knob and the Angle Fine Adjustment Knob (that configuration is shown in fig 2 – with the weight Kit subassembly removed, for visibility).



Fig. 1 Readout

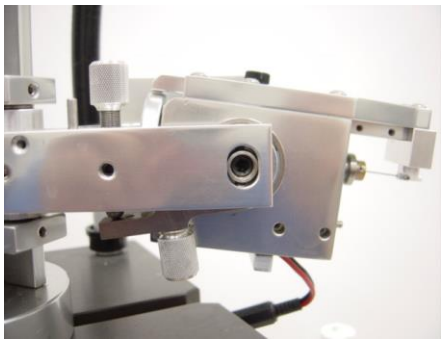
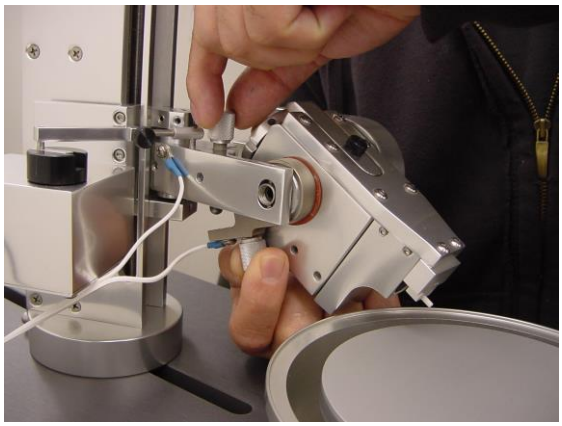


Fig 2 shows Setting Knob (down) and Fine Adjust (up)



To set an angle, loosen the lower Setting Knob until pressure applied to the spindle allows the Block to slip rotationally-- watch the angle readout as the Block's orientation is close-to the desired angle —tighten the Setting Knob--the upper Fine Adjustment Knob allows the dialing in of the exact angle. Notice how (in Fig 3) the operator does this from the front—reaching under to manipulate the Setting Knob (again, the Weight Kit subassembly removed for visibility)

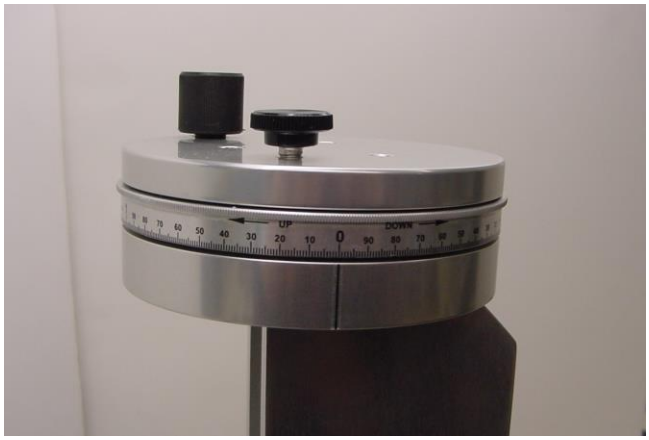
Fig. 3

5.3.1 Digital Angle Display Controls. The Digital Angle Display has been calibrated at the factory before shipment, and for your setup only requires being plugged in—the Power Cord, with its AC/DC Adapter has been supplied.

Basic Operation. The "POWER" button is a push-on/push-off toggle switch. When the power is supplied, the display will blink 99.99 (the display also will blink 99.99 after the power has been shut OFF and then turned ON again – whether it was done purposely, by using the POWER button, or interrupted for any accidental reason). When the 99.99 blinking occurs, swing the Block so that it points up (vertical), and then gradually lower it down to and past the 90 degree (horizontal) position. You will see on the display that near the 90º position, the Angle Dial "finds itself"—the calibration is maintained.

5.4 HEIGHT CONTROL – Z Direction

The vertical height Z position is controlled by a leadscrew that is adjusted by turning the Vertical Knob. The readout is metric, reading like a micrometer. The lower flat knob, turned CCW, allows the Scale to be rotated—convenient for setting and saving a 0 position. CW rotation relocks the Scale so that it rotates with rotation of the entire Vertical Knob.



5.5 RADIAL position control

A four-position index plate controls radial position (see Fig 1) fixed in one of the 90° positions by the Detent, at the top. The Index Plate is rotated into another fixed radial position by, first, lifting the detent, then rotating the spindle to the desired position, and re-engaging the detent. The detent is raised by pressing down on the Top Lever—behind the Black Knob (as shown in Fig 2).



Fig. 1 Index Plate

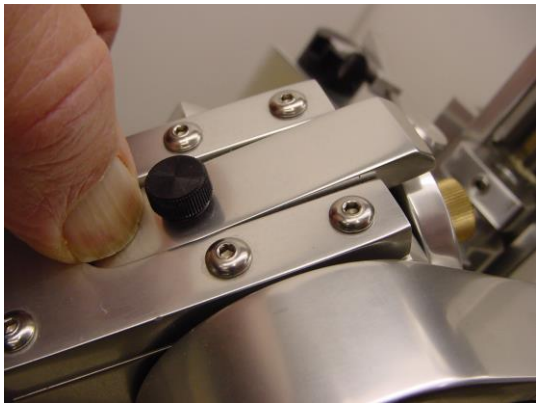
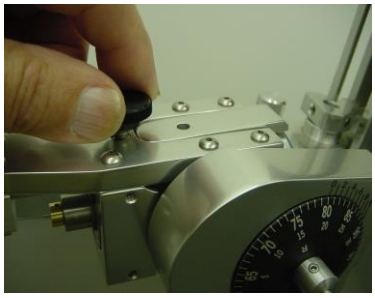


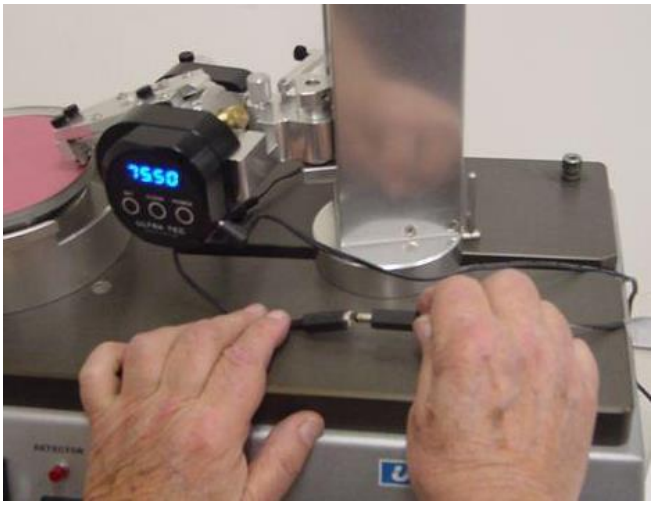
Fig 2

For free rotation (for the generation of a Cone), the detent is raised and held out of engagement by rotating the black knob CW – it will lift the detent –rotate enough to hold the Detent out of engagement with the Index Plate.



5.6 SPINDLE ROTATION (FOR CONE TIPS)

Motorized rotation of the spindle, to allow for the generation of *cone-tips* and *'tapered'* ends on optical fibers or other small optical components. There is a "pigtail" hookup for this feature that should remain unconnected if rotation is not required. It operates from the Accessory panel, through an AC Adapter.



5.6.1 OPERATION OF THE SPINDLE ROTATOR

The rotation is driven by a Drive Motor. It is a 12 VDC motor which is powered by an AC Adapter that plugs into the Base in an Accessory Position—these plug-in positions are on the right side of the Base Enclosure. It is operated by the Accessory Power Toggle Switch on the front panel. Note: If the detent has not been released (see last sentence of 5.5, above) the rotation will prevented – raise the detent to allow rotation.

Instruction For Fiber Polishing

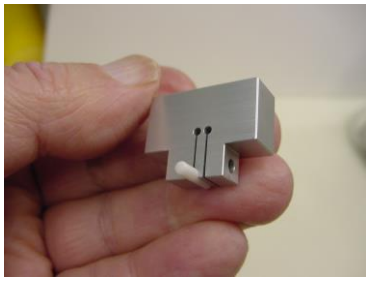
6.0 **NOTE: "SHORT FORM" Guides** for the following operations are attached – Attachment 1 for **FLAT ANGULAR** polish, Attachment 2 for **CONICAL** polish, and Attachment 3 for **WEDGE** polish.

In preparation for working on the fiber, the ferrule tip is formed to the angle desired on the fiber—a step by step instruction is below. In general: The ferrule is formed on a 6 um metal-bond disc. For forming the ferrule, a comparatively wide (3-5 cm) oscillation is used with a fairly heavy pressure. The intersection of the angled face is desired at the top of the ferrule hole perimeter (going slightly over on this is OK). It can be calculated, but ultimately the correct position of that intersection will be confirmed by inspection (with a 10X lens), and "sneaking up on it"--gradually lowering the Z position is the common technique. This final angled face position of the becomes the nominal 0 of the fiber-forming operation.

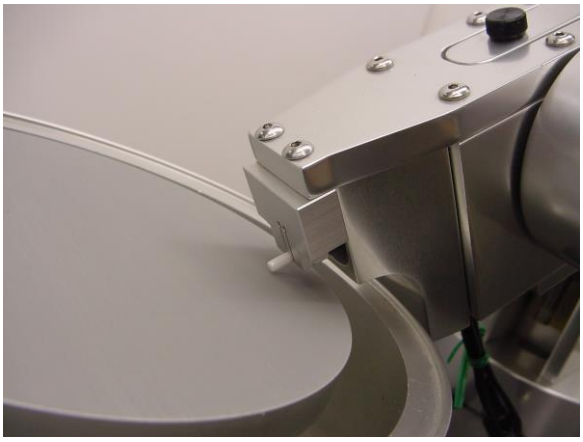
7.0 Preparation of Ferrule

This "Preparation" is only for the initial performance of an operation—it is not an "every-use" requirement. If the machine was last used for the same task, with the same angle, the current ferrule is used with no additional preparation necessary. (Note: you can order a prepared front end—formed ferrule—from Ultra Tec).

7.1 On the Positioning Head, when setting up for a new angle, replace the front-end ferrule (Fiber Guide) with a new one. See the photo (note: this can be done on the Mast)—the visible side set screw holds the ferrule in place—CCW rotation of the set screw allows the Adapter (Front Bracket) to spring open for removal and replacement of the ferrule. Slip out the old ferrule, slip in the new one (rear chamfer on the ferrule engaging the Fiber Guide Tube), and tighten the set screw.



7.2 Mount the 6 micron diamond metal-bond disc onto the Platen.



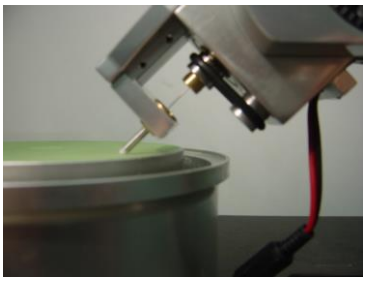
7.3 Set the angle that is desired on the Positioning Head.



7.4 Set the Weight kit in the add-pressure position—with 3 weights.

7.5 Form the Ferrule end—setting a nominal Zero Z position.

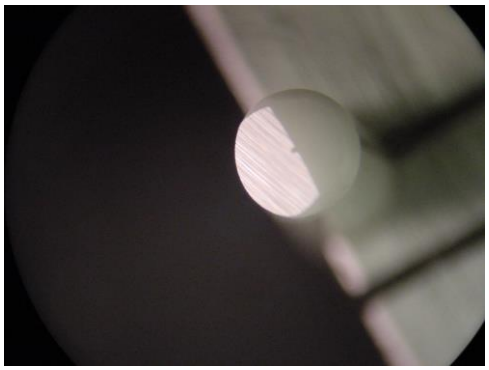
7.5.1 Pre-position the Head relative to the Disc surface, with the end of the ferrule just over the Disc surface—approximately 100 to 150 microns. No precision is required—it is just setting a comfortable starting distance.



7.4.3 Set the axial angle to grind the angle onto the end of the ferrule—it is the same as the angle intended on the fiber workpiece. When complete, the angle will intersect the front face at the top edge of the hole. A 10X Loupe is useful in inspecting the intersection. (A calculation can be made of the dimension from the edge of the ferrule to the top edge of the hole—you may find that to be useful).

7.4.4 Set the lap rotation to a relatively high speed—approximately 150 to 200 RPM. Lower the vertical position until contact is made with the surface of the mylar film—if you have done the calculation described in 3.3, above, take note of this point of contact—the 0 can be set on the Z scale). Apply water as a lubricant (a heavy flow is not needed—using a "squeeze bottle" is sufficient).

7.4.5 Continue to gradually lower the Z position as the grinding continues. With the computed dimension as a guide (or, alternatively, working with just visual observation) and visual confirmation, continue removing ferrule material until complete—when, on the front face of the ferrule the angular plane intersects at or minimally above the hole perimeter.



Replace the coarse 6 UM diamond lap with a 1um mylar pad (see 7.4.5.1, immediately below, for a description of mounting the pad – it is the pad that will be used to polish the fiber) on a master disc. With the Z control, lower the angular tip of the ferrule onto that surface, with the lap rotating, confirming that it is just making contact—it is the reference 0 position-- for subsequent work. Set the Z scale at that 0, and lock it there.

Preparation of the workholding ferrule is complete.

7.4.5.1 Mounting a mylar polishing pad to the master disc. The mylar pads that are used are flexible, approximately 75 microns thick. In general, they will adhere to the Master Disc by a film of water (avoiding the need of adhesive). As a practical means of avoiding lateral slipping of the pad, a short length of double sided tape, perhaps 2-2,5 cm, can be set onto the center of the Master Disc, the Mylar pad set in place (pressed down to the tape), and then, lifting the edge of the pad, a light spray of water can be inserted. When polishing, the fiber will be away from the central area.

8.0 Preparation of the fiber.

8.1 Cleave and strip the fiber workpiece. Examine the end of the cleaved fiber with a microscope—it should be a reasonably even cleaved end, with damage not extending more than 50 microns—an amount that will be removed during the subsequent process.



9.0 Load the fiber.

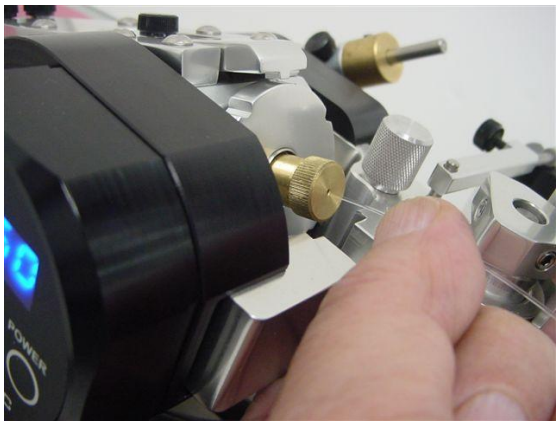
9.1 Prior to loading the fiber, set the counterbalance to apply a light pressure against the Pad surface. The amount of pressure is a matter of experimentation—start with a counterbalanced pressure.

9.2 General Description of loading the fiber. The stripped fiber is inserted through the Brass gripping mechanism at the rear of the Spindle, through the Spindle, and into and through a forward Fiber Guide. Note that the Spindle can be rotated, thus rotating the radial position of the fiber, while the Fiber Guide is fixed and non-rotating. The Fiber workpiece registers on its own outside diameter to maximize concentricity

The fiber is gripped at the rear of the rotational Spindle, the gripping action activated by CW rotation of the Gripping Knob.

9.3 The Loading Action. Before attempting to load, confirm that the Gripping Knob is not tightened (in a tightened condition, passage of the fiber is prevented}. Insert the fiber through the hole and continue feeding-in the fiber until the end of the stripped portion exits the ferrule—the cladding will stop at the rear of the ferrule. There are several transition points along the way which may be sensed as resistance—if one of these is felt draw the fiber back slightly and reapproach—the resistance is usually easy to push by.

When the fiber is seen to extend, slightly tighten the rear Gripping Knob (slightly, so that the fiber still can be pulled through the gripping mechanism).



9.4 Exposed fiber length. The inserted fiber will extend past the end of the ferrule. Grip the fiber at the rear—behind the Gripping Knob—and, observing the front fiber extension, pull the fiber back until the tip of the fiber extends very little past the face of the ferrule , in general, an amount less than the diameter of the fiber—it is useful to use a 10X lens. This extension is less critical for larger fibers because of their inherent strength —but the same general rule applies. The purpose is to assure good support for the fiber tip as it is worked upon. Tighten the Gripping Knob firmly.

10.0 Formed Fiber Ends--The Operation. This section provides recommendations. The final process will vary, of course, the result of experimental development.

Note: Do not use oscillation during the work on the fiber--it introduces variable without any significant advantages. Depending of the condition of the film surface, after it is used (a steep approach [>45 deg.] will be harsher to the surface than a shallow approach [<45 deg.]) the same "channel" can be used repeatedly. Moving over some small amount for the next fiber will allow for using the surface of the film more fully.

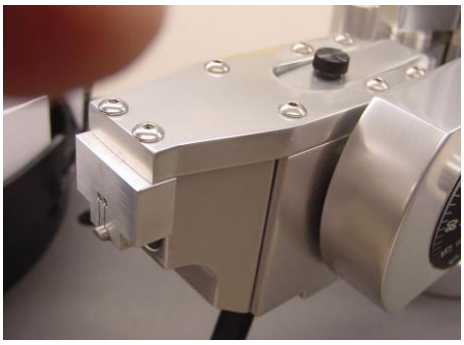
10.1 The counterbalance has been set to a light pressure against the Pad surface.

10.2 Mount a 1 micron diamond Mylar pad onto the Platen surface. (see 7.4.5.1)

10.3 Raise the Vertical Mast position (Z) to approximately +300 microns from Zero Position and lower it to approximately +150 to +200 (this to remove backlash). The intention is to have set a position that holds the fiber periphery slightly higher than the lapping plate surface—a start up “safety buffer”.

10.3.1 CONIC TIP. If a conic tip on the fiber is needed, activate the rotation.

Note that to allow the rotation, it is necessary to retract the detent that fixes the position of the Index Plate at the rear of the Spindle (see paragraph 5.5). That retraction is done by turning the top black knob CW which raises the back end of the lever (as can be seen, below), thus raising and holding the detent, allowing the Index Plate to rotate freely.



10.4 Apply a small amount water to the surface (a “squeeze bottle” with DI water or filtered water is adequate—a “small amount” being 2 or 3 squirts).

10.5 Gradually lower the workpiece toward the pad surface. As the lowering is performed, contact of the fiber with the pad will occur near the calculated position—again, (more commonly) this can be performed empirically. The initial removal is very small—the peripheral edge of the fiber making the contact with the surface of the mylar pad. Continue to lower, slowly and gradually—the fiber material will remove quickly on the 1 micron diamond surface. As the material is removed, the rotational speed may be increased (likelihood of breakage reducing as material is removed) to 60 and to 100 RPM. At a height position of approximately +10 to +20 microns, stop.

If the desired tip configuration is a FLAT SINGLE ANGLE, or CONIC, the forming is now complete. If a WEDGE shape is desired, rotate the Spindle 180 degrees—thus rotating the fiber—and repeat.

If a higher level of polish is required, replace the I micron diamond pad with an Ultrafilm pad and continue the operation. It is not necessary to lower the position more than a few microns for the extra polish step.

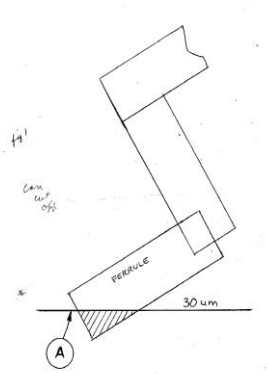
NOTE: “SHORT FORM” Guides for the above operations are attached – Attachment 1 for **SINGLE ANGULAR** polish, Attachment 2 for **CONICAL** polish, and Attachment 3 for **WEDGE** polish. Also, Attachment 4 is for **PERPENDICULAR** and **SMALL ANGLE** tips.

Attachment 1

This is a fast step-by-step instruction. It is important to review the main body of this User Guide to obtain specific information about the mechanisms and controls

SHORT FORM GUIDE for FLAT ANGLE FIBER TIPS

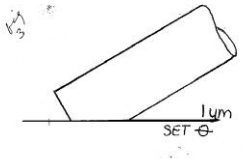
1. **SET UP--Prepare the Fiber Guide** (front-end ferrule).



Grind the Angle. Using the coarse 30 micron diamond film, grind the desired angle (surface A) onto the ferrule (fig. 1). Looking at the front face of the ferrule, the angle should intersect at the top edge of the hole (fig.2).

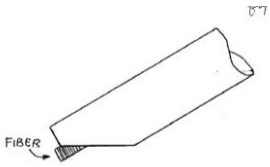


Set the reference 0. With the Ferrule prepared, set a 1 micron diamond film onto the Platen, and set the angled end of the ferrule onto it (fig.right). Let the machine run for a minute or so, confirming the flush condition of the angled surface against the film. Set the 0 on the Z direction control Knob—it is the reference for further work.

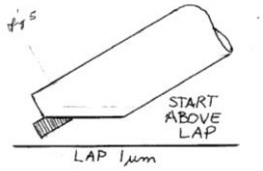


2. **FORM THE FIBER TIP**

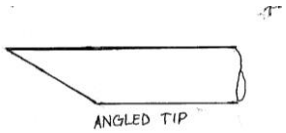
Insert the stripped fiber, observing that it extends from the front of the ferrule. Use a 10X Loupe to observe, and set the extension of the fiber past the front face of the ferrule by some minimal amount—less than a fiber diameter. Lock the gripping mechanism (a light tug on the fiber will confirm that it is gripped sufficiently).



Grind/polish the angle.. Raise the Z position so that the fiber is above the lapping surface. With a light pressure, no oscillation, and a slow lap speed (40-60 RPM), gradually lower the fiber. The fiber will contact the lapping surface and, as material is removed, the lap speed can be increased to 100 RPM. Lower the Z position, stopping between the reference 0 and +10 microns. Dwell for about 45 seconds. It is complete. (See NOTE, below).



Polish. For many applications, the polish obtained from the 1 micron diamond is sufficient. If a finer surface is required, before removing the fiber, change the lapping film to a finer diamond, or Ultrafilm, or other Oxide polish medium. Allow the fiber to dwell on that surface.



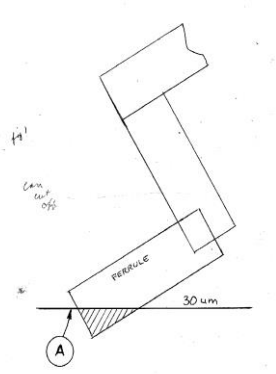
NOTE. In many applications, depending on the material, the angle, and the amount of exposed fiber, for subsequent fibers it is possible to just leave the Z position where it is at 0 to+10, and just raise and lower the fiber-loaded spindle (like setting a needle onto a phonograph record). Obviously, where practical, this is a significant time saver, and worth the experiment to try.

Attachment 2

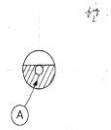
This is a fast step-by-step instruction. It is important to review the main body of this User Guide to obtain specific information about the mechanisms and controls

SHORT FORM GUIDE for CONICAL FIBER TIPS

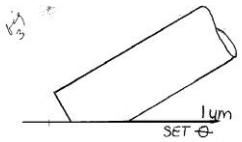
1. **SET UP--Prepare the Fiber Guide** (front-end ferrule).



Grind the Angle. Using the coarse 30 micron diamond film, grind the desired angle (surface A) onto the ferrule (fig. 1). Looking at the front face of the ferrule, the angle should intersect at the top edge of the hole (fig.2).

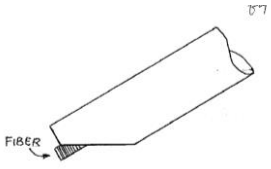


Set the reference 0. With the Ferrule prepared, set a 1 micron diamond film onto the Platen, and set the angled end of the ferrule onto it (fig.right). Let the machine run for a minute or so, confirming the flush condition of the angled surface against the film. Set the 0 on the Z direction control Knob—it is the reference for further work.



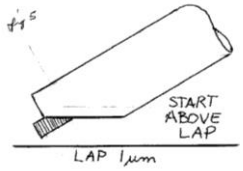
2. **FORM THE FIBER TIP**

Insert the stripped fiber, observing that it extends from the front of the ferrule. Use a 10X Loupe to observe, and set the extension of the fiber past the front face of the ferrule by some minimal amount—less than a fiber diameter. Lock the gripping mechanism (a light tug on the fiber will confirm that it is gripped sufficiently).

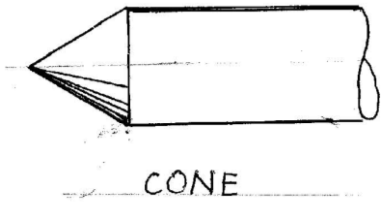


ROTATION. Using the Black Knob**,** raise and hold the detent from the rear Index Plate so that it can rotate. Turn ON the rotation.

Grind/polish the angle.. Raise the Z position so that the fiber is above the lapping surface. With a light pressure, no oscillation, and a slow lap speed (40-60 RPM), gradually lower the fiber. The fiber will contact the lapping surface and, as material is removed, the lap speed can be increased to 100 RPM. Lower the Z position, stopping between the reference 0 and +10 microns. Dwell for about 45 seconds. It is complete. (See NOTE, below).



Polish. For many applications, the polish obtained from the 1 micron diamond is sufficient. If a finer surface is required, before removing the fiber, change the lapping film to a finer diamond, or Ultrafilm, or other Oxide polish medium. Allow the fiber to dwell on that surface.



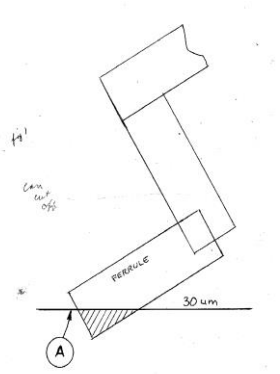
NOTE. In many applications, depending on the material, the angle, and the amount of exposed fiber, for subsequent fibers it is possible to just leave the Z position where it is at 0 to+10, and just raise and lower the fiber-loaded spindle (like setting a needle onto a phonograph record). Obviously, where practical, this is a significant time saver, and worth the experiment to try.

Attachment 3

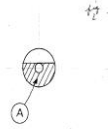
SHORT FORM GUIDE for WEDGE FIBER TIPS

This is a fast step-by-step instruction. It is important to review the main body of this User Guide to obtain specific information about the mechanisms and controls

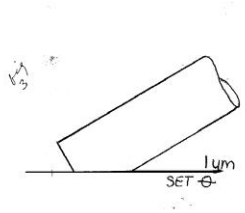
1. **SET UP--Prepare the Fiber Guide** (front-end ferrule).



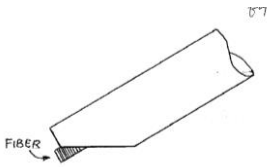
Grind the Angle. Using the coarse 30 micron diamond film, grind the desired angle (surface A) onto the ferrule (fig. 1). Looking at the front face of the ferrule, the angle should intersect at the top edge of the hole (fig.2).



Set the reference 0. With the Ferrule prepared, set a 1 micron diamond film onto the Platen, and set the angled end of the ferrule onto it (fig.right). Let the machine run for a minute or so, confirming the flush condition of the angled surface against the film. Set the 0 on the Z direction control Knob—it is the reference for further work.



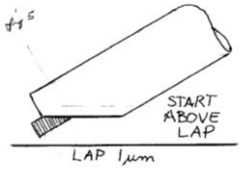
2. **FORM THE FIBER TIP**



Insert the stripped fiber, observing that it extends from the front of the ferrule. Use a 10X Loupe to observe, and set the extension of the fiber past the front face of the ferrule by some minimal amount—less than a fiber diameter (fig. 4). Lock the gripping mechanism (a light tug on the fiber will confirm that it is gripped sufficiently).

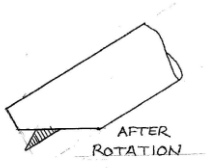
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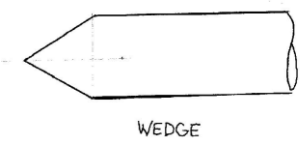
Grind/polish the FIRST angle.. Raise the Z position so that the fiber is above the lapping surface (fig. 5). With a light pressure, no oscillation, and a slow lap speed (40-60 RPM), gradually lower the fiber. The fiber will contact the lapping surface and, as material is removed, the lap speed can be increased to 100 RPM. Lower the Z position, stopping between the reference 0 and +10 microns. Dwell for about 45 seconds. It is complete (fig.6). (See NOTE, below).



Polish. For many applications, the polish obtained from the 1 micron diamond is sufficient. If a finer surface is required, before removing the fiber, change the lapping film to a finer diamond, or Ultrafilm, or other Oxide polish medium. Allow the fiber to dwell n that surface.

Grind/polish the SECOND angle. Raise the detent from the rear Index Plate and Rotate the position of the Spindle/fiber by 180 degrees – reengage the detent in the new position. The resulting physical position of the fiber is as shown in fig. 6. Return to the slow lap speed—the fiber is less supported in this second-angle position—and repeat the grind/polish as above.

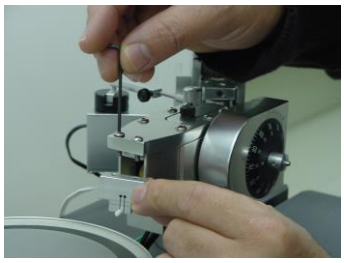




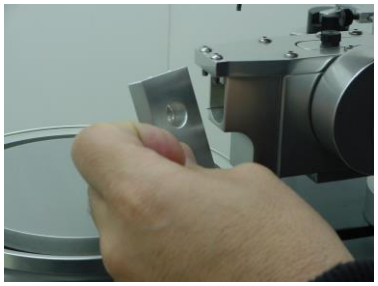
NOTE. In many applications, depending on the material, the angle, and the amount of exposed fiber, for subsequent fibers it is possible to just leave the Z position where it is at 0 to+10, and just raise and lower the fiber-loaded spindle (like setting a needle onto a phonograph record). Obviously, where practical, this is a significant time saver, and worth the experiment to try.

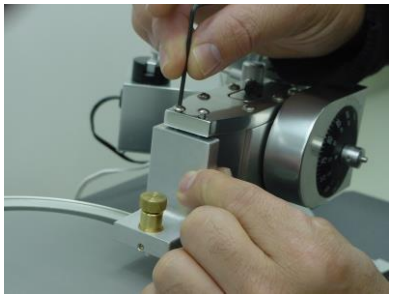
Attachment 4 Perpendicular and Small-angle Polishing on the Fiber-lensing Mast

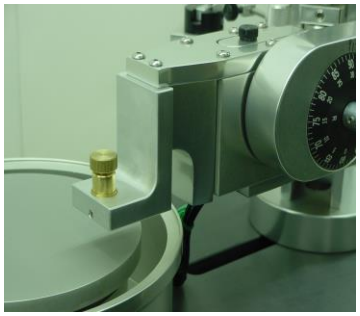
For this purpose, use the L-shaped Adapter. To mount that adapter, go through the following steps:

1. Remove the standard formed-tip Adapter 

2. Mount the L-shaped Adapter. Note the clearance hole for the tube—slip it over the tube, and tighten the screws.

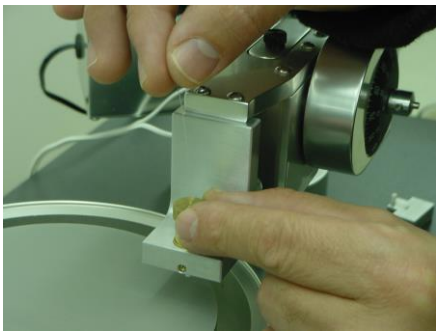






For a perpendicular end, it is ready. If an angle is to be polished onto the fiber, prepare the Adapter by grinding-on the desired angle onto the Extending ferrule—for example, if an 8° angle is desired on the fiber, grind an 8° Angle onto the front face of the ferrule—the angle needs to extend past the fiber hole--it need not extend completely across the face (but if it does, that is OK).

The fiber is stripped, inserted into the brass holder so that the fiber barely extends from the ferrule, and held in position by tightening the rear threaded retainer knob.





Note that the ferrule can be replaced—it is held by a set screw, reached through the front face.

APPENDIX A - LAPPING AND POLISHING FILMS

5" PSA Backed Discs

Order No.	Micron Size	Quantity
M-8230-1	0.1	5
M-8231-1	0.5	5
M-8232-1	1	5
M-8233-1	3	5
M-8234-1	5	5
M-8237-1	6	5
M-8235-1	9	5
M-8236-1	15	5
M-8238-1	30	5

5" Plain Backed Discs

Order No.	Micron Size	Quantity
M-8430-1	0.1	5
M-8431-1	0.5	5
M-8432-1	1	5
M-8433-1	3	5
M-8434-1	5	5
M-8437-1	6	5
M-8435-1	9	5
M-8436-1	15	5
M-8438-1	30	5

Silicon Carbide Polishing Film 8" diameter

5" PSA Backed Discs

Order No.	Micron Size	Quantity
M-8203-1	0.5	100
M-8221-1	1	100
M-8202-1	2	100
M-8222-1	3	100
M-8223-1	5	100
M-8224-1	9	100
M-8225-1	12	100
M-8226-1	15	100
M-8227-1	20	100
M-8228-1	30	100

5" Plain Backed Discs

Order No.	Micron Size	Quantity
M-8403-1	0.5	100
M-8421-1	1	100
M-8402-1	2	100
M-8422-1	3	100
M-8423-1	5	100
M-8424-1	9	100
M-8425-1	12	100
M-8426-1	15	100
M-8427-1	20	100
M-8428-1	30	100

ULTRAFILM Polishing Film 5" (203mm) Plain & PSA backed

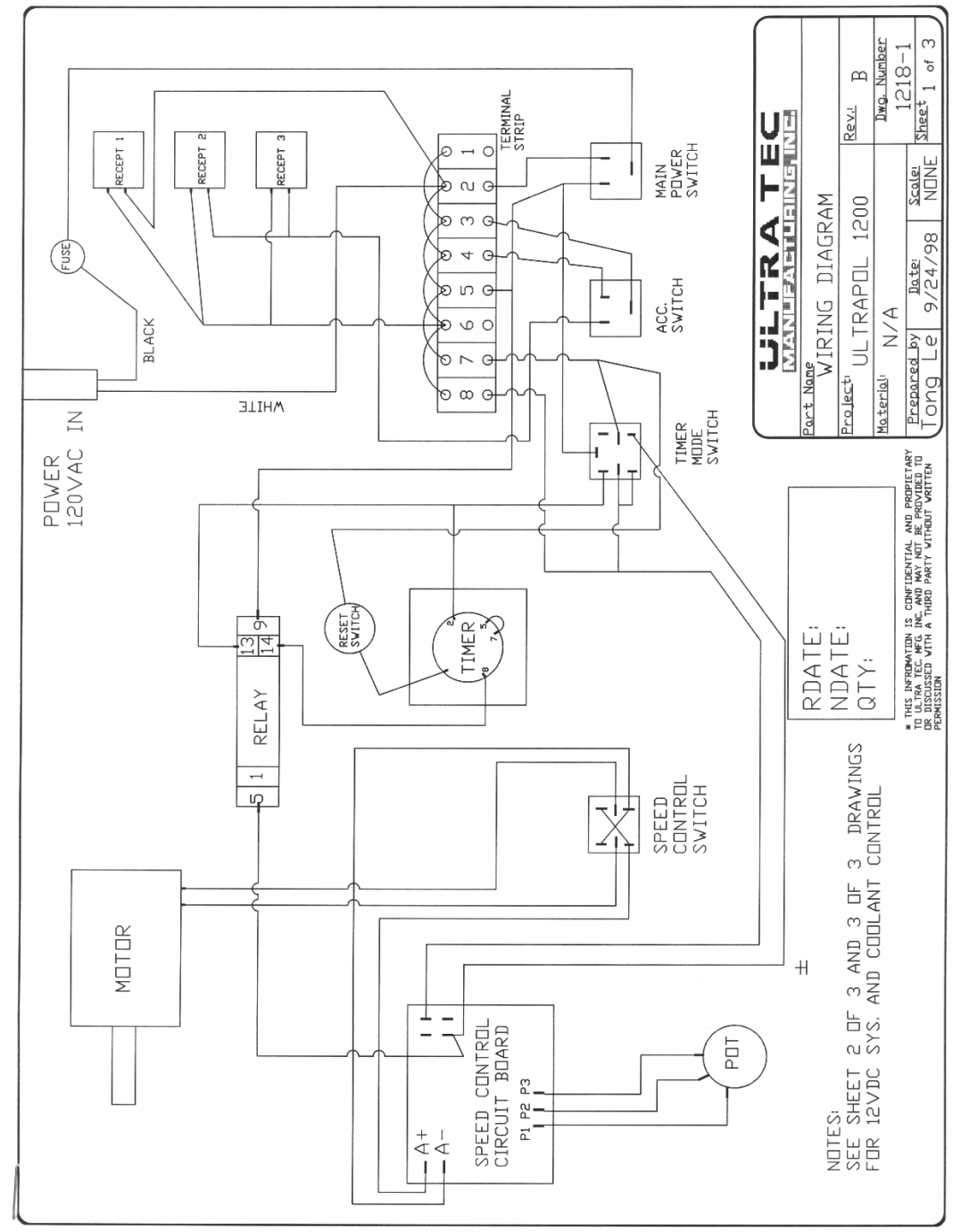
5" PSA Backed Discs

Order No.	Micron Size	Quantity
M-8250-1	ULTRAFILM B	100
M-8251-1	ULTRAFILM 1	100
M-8252-1	ULTRAFILM 2	5
M-8253-1	ULTRAFILM 3	5
M-8254-1	ULTRAFILM 4	5

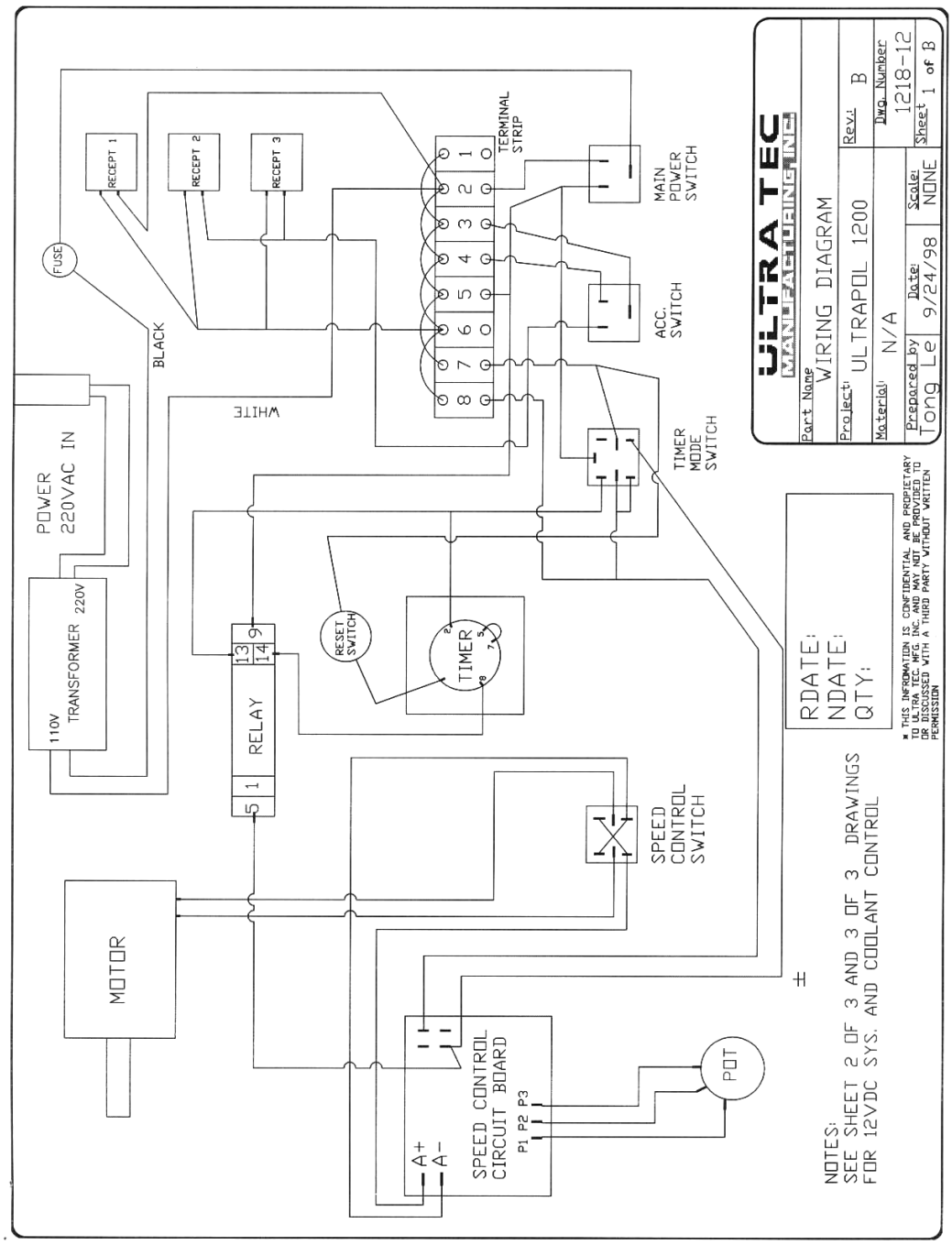
5" Plain Backed Discs

Order No.	Micron Size	Quantity
M-8450-1	ULTRAFILM B	100
M-8451-1	ULTRAFILM 1	100
M-8452-1	ULTRAFILM 2	5
M-8453-1	ULTRAFILM 3	5
M-8454-1	ULTRAFILM 4	5

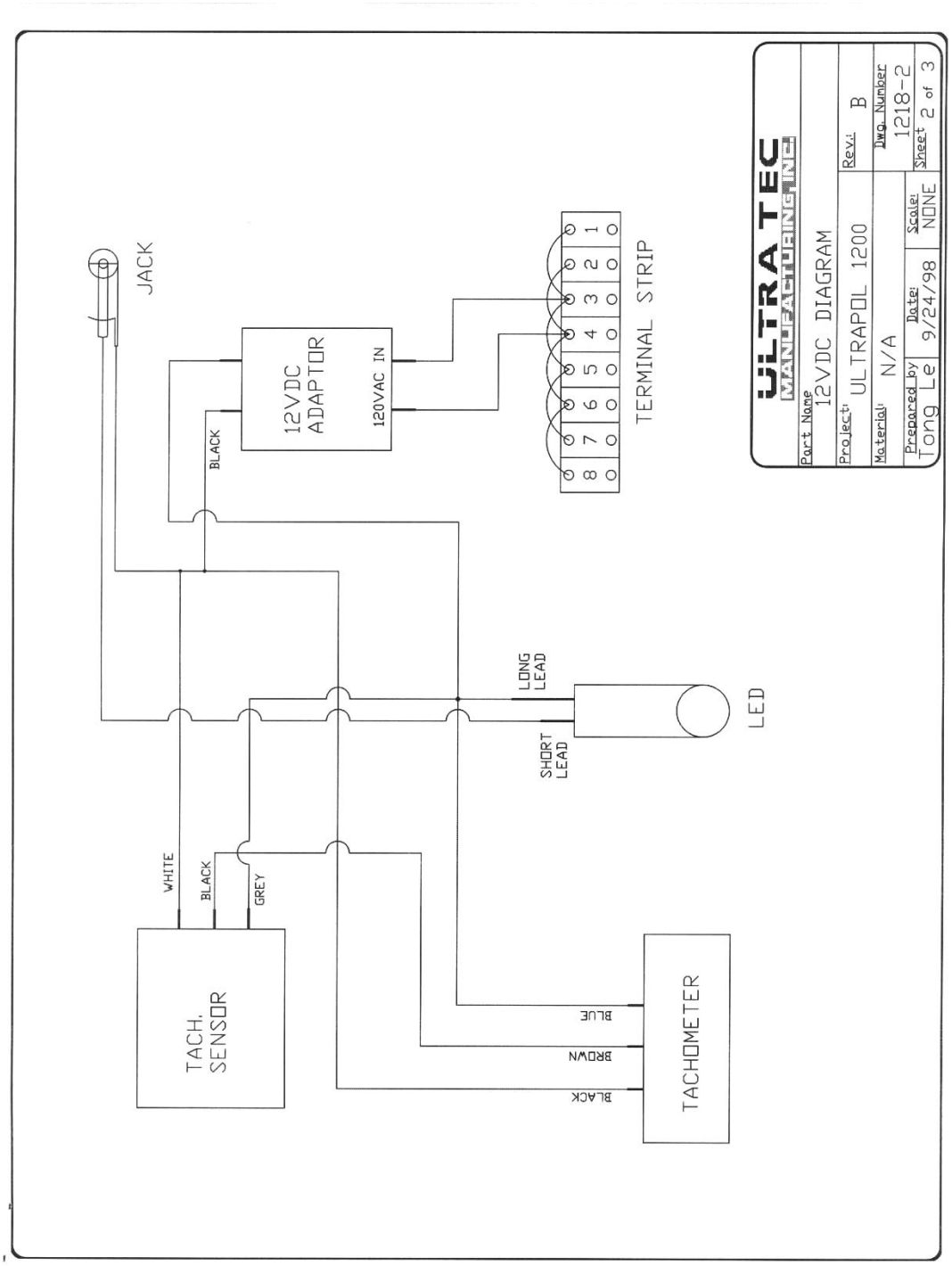
Wiring Diagram



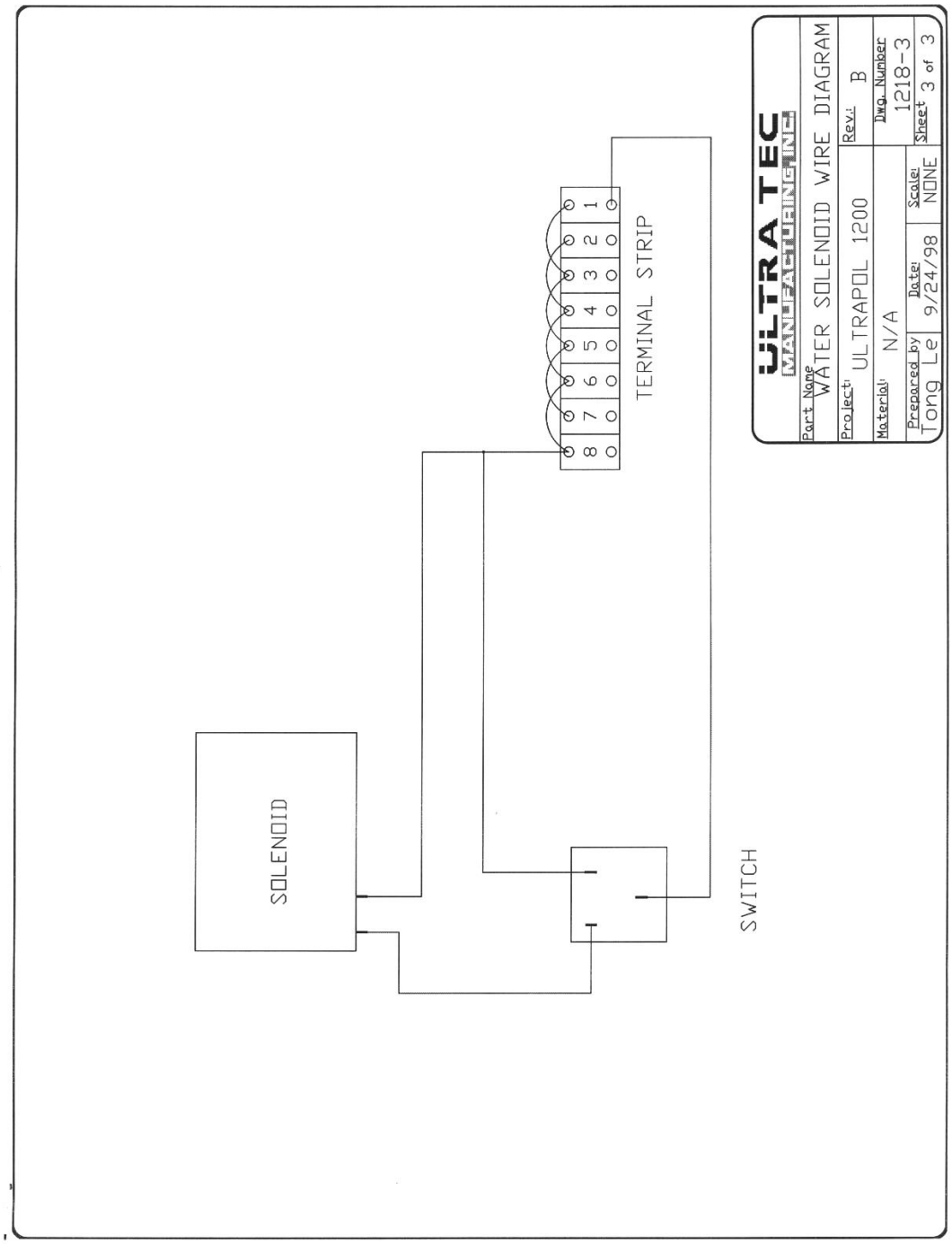
Wiring Diagram



Wiring Diagram for 12V Circuit



Wiring Diagram for Coolant Control Circuit



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