ULTRA TEC

V5 CLASSIC FACETING MACHINE

Right side Mount

USERS MANUAL

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1607.5CDR Rev2-2015

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TEST REPORT

Each machine is tested prior to shipment. These are the test results for unit_____.

- **SPINDLE CONCENTRICITY** (.0005" in max – 12.5 µm)_____ By:
- **DOP-TO-SPINDLE OFFSET** (.001" in max - 25 µm) _____ By:
- **PLATEN VERTICAL RUNOUT** (.0003" in TIR – 7.5 µm)_____ By:
- **PLATEN PARALLELISM** (.0004"/inch - 10µm)_____ By:

WARRANTY

This warranty extends to the supplied machine only. Ultra Tec is not responsible for any collateral losses in which the supplied equipment has been involved.

The Ultra Tec Faceting Machine has a lifetime warranty, for the original purchaser, for defects in material and workmanship of all mechanical parts. Excepted are electronic components, which have a one year warranty, and parts which may require replacement because of wear, including motor brushes, flexing springs, rubber drive cones, and bearings. (If the unit is used under commercial factory conditions, the warranty periods are two years and four months, respectively). Excluded from the warranty are problems resulting from misuse, wear, modification, or accidental damage.

If the unit fails to function properly, consult your representative or call the factory. If it is found to be necessary to return the unit, send it in its shipping container, prepaid, with a note that briefly describes the problem.

Ultra Tec will correct the problem by repair or replacement and return the unit to you. Ultra Tec is not responsible or liable for unauthorized repairs, alterations, or any contingent damages.

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INTRODUCTION

The Ultra Tec Faceting Machine has been manufactured since 1965, and stands alone as the World's finest faceting equipment. It represents years of development and research, and it offers the user unrivaled precision and repeatability.

The Ultra Tec approach is to provide a design which is direct, simple, and which does not compromise the gem-cutting task. Ultra Tec equipment allows maximum accuracy, brilliance, and yield from the rough material.

The Ultra Tec Faceting Machine is manufactured by trained crafts people who understand the equipment and the need for its precision machining and assembly. These people are proud of their efforts. The warranty page of this manual shows the test results signed by the person who performed the final calibration.

We welcome you to the family of Ultra Tec Faceters. We believe you will become an enthusiastic Ultra Tec user. Word of mouth recommendation has been an important factor in our growth and we sincerely want you to join that growing group of satisfied Ultra Tec owners.

ABOUT YOUR ULTRA TEC FACETING MACHINE

In using your Ultra Tec, keep in mind that it is a precision device, capable of exceedingly fine angular and linear settings. It is, nonetheless, a rugged machine that will provide you with many years of use. Normal cleanliness with minimal care will give you many hundreds of faceted gems.

As with any electro-mechanical device, there can be occasional problems--and if you experience one, re-read the Owner's manual for the function involved, to assure that you are performing the operation correctly. If you still experience a problem, communicate with your Ultra Tec representative or with the factory.

LEARNING TO FACET

Having a teacher is good, but you can learn to facet without a teacher--many people have. These pages can help, and with one or another of the available instruction books you will find rather rapid success. If you can get some good advice, so much the better. As you proceed, tasks that seem difficult will become easy.

Remember that faceting is a "doing" process. A pound of thinking and pondering will not be as helpful as an ounce of trying. Working with the equipment--getting a "feel" for it and for the gem material, will allow you to progress rapidly.

1.0 UNPACKAGING THE UNIT

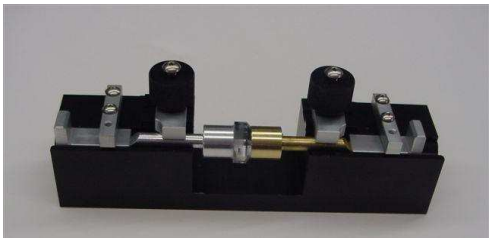
The machine comes in protective packaging which you may want to save, along with its box, in the event that future shipment or storage is necessary. These are the included items:

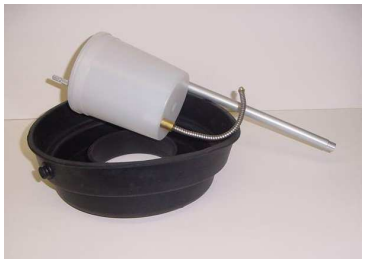
The **Mast** is packaged in a separate box.

Tabling Adapter, and **Alignment Bar**

AC Adapter, Calibration Block and **wrenches**

set of **Dops**, **wrenches,**……. **Transfer Fixture**…….. **Splashpan, Drip Tank,** and **Drain Hose**… **Retention Screws**





and, The **Base**. To Remove the Base from the box, reach under the wood support base and lift.

2.0 SETTING UP

2.1 THE BASE

The Ultra Tec Base can be placed on a tabletop, or it may be mounted permanently into a workbench. For permanent mounting, the cutout dimensions are 7 7/8" by 18 1/2". As a template for the cutout, use the Wood Base—the cutout corresponds to the inside dimensions—you can trace that with a pencil

2.1.1 ELECTRICAL HOOKUP

Setting the base on a long side, you can see that the electrical power cord is coiled next to the motor, extending from the speed control. On 110VAC machines, the Power Cord is long enough to plug into a standard grounded wall outlet. 220 VAC machines have a jumper that connects to a standard computer power cord, so that the connection to the wall outlet (which varies from location to location) is accommodated.

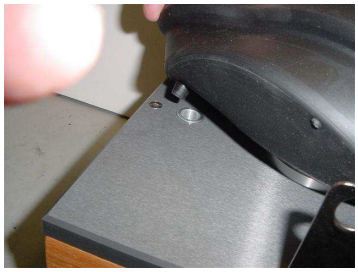
2.1.2 THE DRAIN HOSE

The Drain Hose slides through the aluminum bushing on the back of the wood base, and fits onto the bottom of the aluminum Drain Funnel underneath the base plate. Attach the Drain Hose—push on firmly.

Lead the Drain Hose through the bushing in the rear wall of the Wood Base (or, if you have mounted the Base into a desk top, you may want to direct the Drain Tube straight down), and then to a container--a gallon plastic container is good. Be sure the hose does not kink, and that there are no loops in the hose on its way to the container—these are things that would prevent draining).

2.1.3 SPLASHGUARD

The splashguard is molded rubber, resistant to normal lapidary fluids (as a faceting lubricant, we recommend water with a few drops of clear dish-washing detergent).



When setting the Splashgaurd into position on the Base, be sure that the drain molded onto the Splashguard is set into the Drain Funnel in the Baseplate.

To hold the Spashguard in place, wet the retaining buttons and press them into the holes in the brackets. The Splashguard is easily removed for cleaning—to do that, press out the rubber retaining buttons from the brackets and lift up the Splashguard. To reinsert, wet the buttons and press them back into the brackets.

For girdle grinding, the rim of the Splashguard is held down by the Hold-down rods providing access to the lap. When the operation is complete, the hold-down rods are disengaged and the Splashguard returns to its regular shape.

2.1.4 THE DRIP TANK

The Drip Tank post slips into a fitting in the corner behind the Splashguard. Place the Drip Tank onto the post, position it, tighten the set screw, and it is ready. The flow rate is adjusted by turning the valve stem, and the water shuts off with an easy pressure. Avoid over tightening the valve. The tank fits snugly enough on the post so that it will not vibrate out of position, but loose enough for you to rotate it to the position you wish.

If you have purchased a FAUCET, rather than the Water Tank, it fits into the same fitting in the Baseplate.

2.1.5 THE PLATEN

The Platen is permanently attached to the Spindle—a sub-assembly that rides in permanently lubricated ball bearings. When a lap is placed onto the Platen, take care that the undersurface of the lap is clean and is held down by the Safety Nut.

2.1.6 THE LAP HOLD-DOWN NUT (Safety Nut)

The Lap Hold-Down Nut is cinched down to hold the lap in place. It is machined of Delrin, which is soft enough to prevent damage to a gem which is accidentally bumped (the reason it is called a “Safety Nut”). It should be adjusted firmly as it holds the Lap in place—the resilience of the Delrin Material will snug into firm position.

2.1.7 THE SPEED CONTROL

The variable electronic speed control converts AC current to DC, which the motor requires, and of course sets the speed.

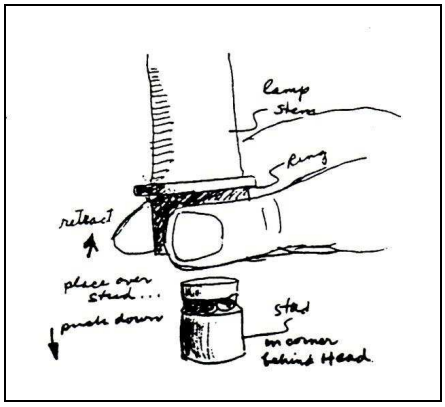
The left-side Switch is a toggle for ON-OFF. The right-side switch is for selecting clockwise (CW) or counter clockwise (CCW) lap rotation -- it has a central off position and two directional positions.

The central knob is a speed selector. The incremental positions of the speed selector are not exactly linear, but may be considered as each increment providing an added 100 RPM up to number 7 (700 RPM at that point), and approximately 50 RPM per increment on the remainder of the dial. The top speed is approximately 1850 RPM. When using the directional switch, set the rotation so that the lap direction is not running into the gem.

When changing lap direction the motor should be off or running at a low speed. Repeated changing of direction at high speed tends to demagnetize the motor, which results in higher speeds, but lower torques. Don't worry about the occasional forgetting of this rule--just don't flick the switch back and forth for fun. The speed selector can be at any setting when turning the motor on or off.

2.1.8 THE LAMP

If you have purchased a lamp, it mounts onto the stud already assembled in the base, in the corner behind the head. The lamp mounting lock has a snap-on design. Pull back the nylon ring, place the lamp onto the stud, and push down the ring. You will feel the ring snap into the down position, where it holds the lap securely.



2.2 THE FACETING MAST

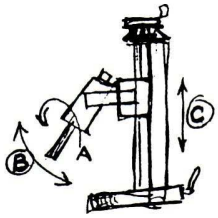
2.2.1 MOUNTING THE MAST ONTO THE BASE.

After setting the Base in position, mount the Mast onto the Base. To mount the Mast, slip the nut into the keyhole, and slide the Mast forward into the slot. The Mast may be positioned in any convenient position along the slot. To lock the Mast into any particular position, turn the locking lever clockwise until you can feel it become snug. The nut (that fits below the Baseplate) can be adjusted so that the lever locks in a convenient position.

The Digital Angle Dial has a power cord with an AC/DC plug-in Adapter. Connect the Adapter into a standard power source (110VAC-220VAC), and the Jack into the Angle Dial case on its lower right side (see the illustration in the section READING THE DIGITAL ANGLE DIAL). It has been calibrated at the factory. When you turn it on for the first time, the display will blink 99.99 (this happens at any time the power has been interrupted for any reason). As the 99.99 blinking continues, swing the Spindle (Quill) so that it points up (vertical), and then lower it down toward and past the 90 degree (horizontal) position. You will see on the display that the Angle Dial "finds itself"—it now reads the correct angle.

3.0 THE BASIC CONTROL FEATURES OF THE FACETING MAST

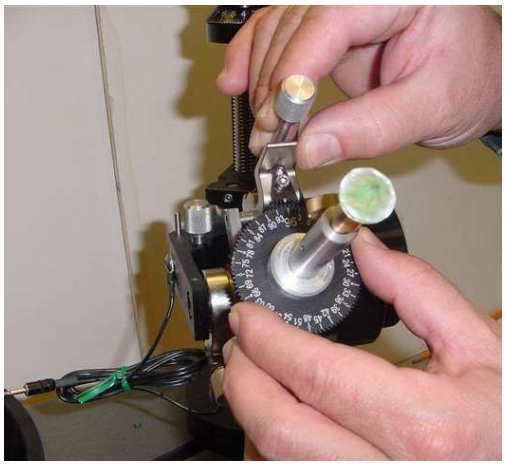
All faceting machines have three characteristics that the operator controls (A) rotational angle, (B) axial angle, (C) height.



The precision and repeatability of the faceting machine in accomplishing these basic functions are what determine the brilliance and quality of the faceted gem.

Read the following sections and practice a few settings so that you become familiar with the controls.

3.1 CONTROL OF THE ROTATIONAL ANGLE—INDEXING



Your Ultra Tec is supplied with an assembled 96 Index Gear and gear segment detent. The 96 Index Gear is the most commonly used in gem design, but also prominent is the 64, ands also used and available a 32, 72, 77, 80, and 120 .

The index position is changed by lifting the Rocker (which holds the gear segment detent), rotating the gear to the desired position, and resetting the detent.

3.1.1 FREE ROTATION (often called "FREE- WHEELING"--this is often used in forming a round girdle on a stone), the detent can be held in a disengaged raised position by lifting the Rocker and engaging the rear latch (as shown).

The Spindle (Quill) can now rotate freely

The latch can later be released by lifting the Rocker again--the latch is spring-loaded and will snap back—the detent will now re-engage with the Index Gear.

3.1.2 CHANGING TO A NEW INDEX GEAR—ALIGNING TO THE KEY

When you change the Index Gear it is always necessary to re-align the keying—that is, to align the Index Gear 0 position at a 90° relationship to the Dop Alignment Pin (thus making the Pin parallel to the Lap surface). When doing this, also set the Index Vernier at a 0 position.

The tool for accomplishing the alignment is the Alignment Bar that is included with your machine (it looks like a little "hammer").

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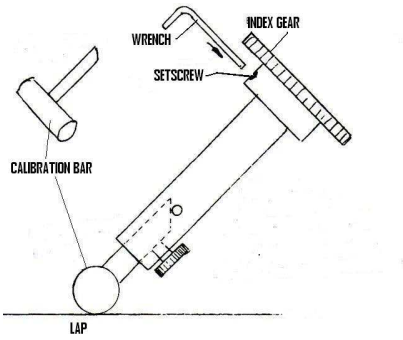
Faceting instructions call for use of particular Index Gears. Although transposing from one gear to another often can be done, it is easier to use the specified gear.

1. To change an Index Gear, first remove the Dop-retention screw from the Quill. Then, loosen the set screw in the hub of the Index Gear and slide the Index Gear forward, off the spindle. Also, remove the Detent (a gear segment)--it is held by a screw (there may be a washer behind it).

2. Now, install the new Detent and tighten the screw. Slide the new Index Gear onto the Spindle, and snug the setscrew slightly (so that the Index Gear can still rotate on the Spindle). Re-assemble the Dop Retention Screw into the Quill.

<u>Re-aligning the Index Gear to the Dop Alignment Pin.</u>

1. Place your best flat lap onto the platen.



2. Set the Mast axial angle at about 40°±5° (not at all critical). Engage the Detent with the zero position on the Index Gear (the Index Gear is still in an able-to-slip mode). Verify that the Index Vernier is set at a 0 position.

3. Insert the Alignment Bar into the Spindle, engaging the rear chamfer with the Alignment Pin, press it in firmly and lock it in position.

4. Onto the surface of the Lap, set a piece of paper—about 3 inches square (a piece cut from a shiny page in a magazine is good to use—it is very parallel). Set the paper onto the Lap—that is the "landing site" for the Alignment Bar, in the next step.

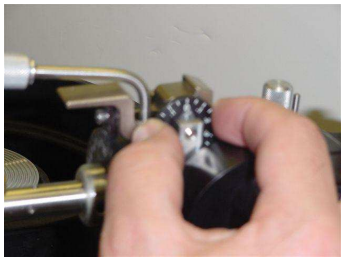
5. With the Angle Dial set at the approximate 40°, set the peripheral surface of the Alignment Bar onto the lap surface (that is, onto the paper)—press it down so that it is flush to the paper (the Angle Stop does not have to be engaged). As the pressure is applied to the Bar, the Quill will rotate within the Index Gear (remember, the Index Gear was set at 0 and still in an able-to-slip mode). Holding the Alignment Bar flush against the paper, tighten the setscrew on the hub of the Index Gear. Done.

If you are not replacing the Index Gear, but you do want to re-align the keying, set the Index Gear at 0, loosen the setscrew sightly that holds the Index Gear to the Spindle (so that the Index Gear can rotate), and then follow steps 3-5, above.

3.1.3 THE INDEX VERNIER (Cheater)

The Index Vernier is for making rotational (indexing) adjustments. Each line is on the Dial is 0.1°.

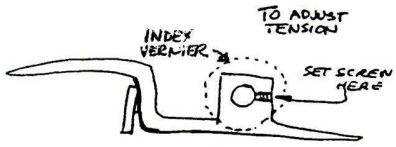
The Index Vernier is used if there is a need to align crown facets to existing pavilion facets (after completing transfer of the stone), and, it is also used for slight adjustments when polishing (from which it gained the name of "Cheater" since it was making up for imperfections in alignment). The Index Vernier is also used in a few gem designs that ask for intermediate indexing positions.



If it is necessary to make a correction to the stone's rotational position, turn the Index Vernier Dial very gradually. Rotating the dial in a clockwise direction will rotate the stone (as viewed head-on) in a clockwise direction, and, of course, counterclockwise rotation of the Dial results in counterclockwise rotation of the stone. The "correct" starting position for the cheater is at 0—aligned to the 0 position of the Index Gear. See the section 3.1.3.2, below.

3.1.3.1 Index Vernier Tension.

The tension on the Index Vernier is set at the factory. If the tension should loosen, the index Vernier dial may "walk" from its set position as the result of repeated indexing. (Note: In normal operation, the dial moves with the Rocker and so the Dial moves off position when the Rocker handle is raised, and, when the Rocker is lowered, the Dial returns to the earlier position. If it does not return--that's "walking"). If walking happens, increase the tension on the Index Vernier by tightening the setscrews that bear on the Index Vernier screw. These set screws are in the Rocker back-facing surface—tighten very gradually.

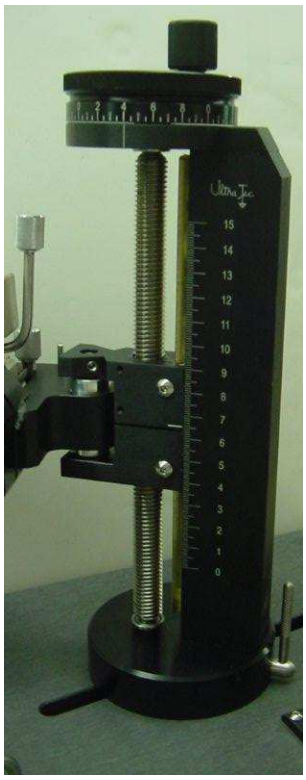


3.1.3.2 Verifying the 0 position of the Index Vernier

If, during the faceting of a stone, you used the Index Vernier more than just one or two increments, it is a good idea to verify the 0 position before starting on another stone—that is to assure that the 0 position on the Index Gear is at a right angle to the Alignment Pin in the Quill. To do this, use the Alignment Bar:

1. Place a good flat lap onto the platen.
2. Set the Mast axial angle at about 40° (not critical), and set 0 on the Index Gear.
3. Set the Index Vernier at the 0 position you think is right
4. Insert the Alignment Bar into the Spindle, engaging the rear chamfer with the Alignment Pin--lock it in position. Raise the vertical position so that the Alignment Bar is above the Lap surface.
5. Gradually lower the vertical position—until there's an initial contact between the Bar and the Lap. Stop and look—the contact will not be "perfect" (because nothing in the World is perfect)—in any event, you are looking for a big error. If the Index Vernier is off by a full rotation there would be a gap at the non-touching end of .020" (.5 mm)--big. If you have that gap, rotate the Index Vernier to the "right" 0 – if you don't have the gap, you're OK—go on to your faceting.

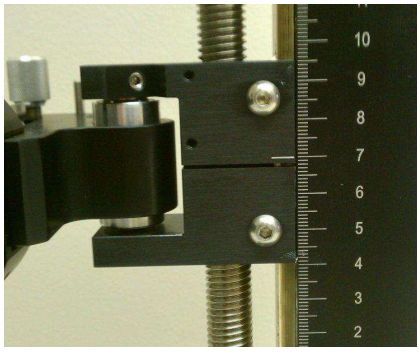
3.2 CONTROL OF HEIGHT—VERTICAL POSITIONING.



READING THE VERTICAL POSITION. Notice that the numbering on the side of the Post goes from 0 at the bottom, and rises as the vertical position goes up. The marked numbers on the Post are centimeters – with 10 line divisions (millimeter markings) between the marked numbers. On the Vertical Knob, the Dial has marked numbers representing tenths of a millimeter . It reads similar to a micrometer.

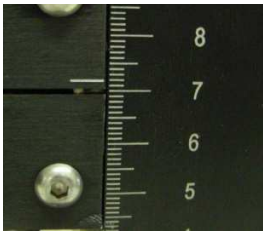
Here is an example – do the following steps in sequence and you will learn how to read the exact vertical position:

A Rotate the Vertical Knob, moving the position of the Riser Block, to where the indicator line on the Riser Block lines up exactly with a numbered position on the Post (let's say 7). When you look at the Dial on the Vertical Knob it is at 0 – showing that the vertical position is 7.000.



Next step…

B Rotate the Vertical Knob CW so that the indicator on the Riser Block lines up exactly 2 divisions past the 7. When you look at the Dial it shows 0, – confirming that the vertical position is 7.200. Next step…



C Watching the Vertical Knob Dial, rotate the Vertical Knob CW so that the indicator mark lines up with the number 4. When you look down at at the Post you will see that it indicates a position that is higher than the 2nd line above the 7, but less than the 3rd line. This vertical position is 7.240.

Next step…

D Watching the Vertical Knob Dial, rotate the Vertical Knob CW so that the indicator mark lines up at the first mark after the number 4 (half way to number 5). This vertical position is 7.245 – direct reading of the scale to 50 micron accuracy.

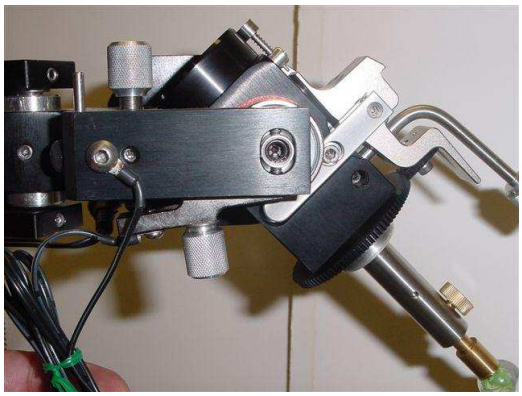
E Now, still watching the Vertical Knob Dial, rotate the Vertical Knob CW a bit more, so that the indicator mark line is half way between the 4.5 and the 5 (by eye – you are in the space, but, as you see, it allows good judgment of half-way). The position is 7.2475. Actually, it is reasonable to interpolate by eye a quarter division of the space – so, if you rotate the Vertical Knob CW a little bit more – to where the indicator is ¾ of the way from 4.5 to 5 – the position is 7.487. So, you are working in 12 micron increments – positions that are easily repeatable.

CONTROLLED STONE DIMENSION. The logic of numbering upward, 0 at the bottom of the scale and 150 mm at the top (the V2 was the reverse) is that relates more directly to the stone size. Since the diameter of the stone gets larger as the vertical position goes up, it is logical that the scale would go up correspondingly. And, since the vertical position is continuously calibrated on the Ultra Tec, it is possible cut calibrated sizes by reading the scale directly (something not possible on other faceting machines, where the vertical position is not calibrated).
It works for round stones, rectangular stones, and also for the cut corner dimensional positions on a rectangular stone – reading directly on the vertical scale without needing to cut-measure- cut-measure the stone with a calipers. (on the Ultra Tec Website, in the "Library" there's a paper, *Controlling a Particular Stone Size*, that steps you through the process.

3.3 CONTROL OF THE AXIAL ANGLE – THE ANGLE DISPLAY

The Digital Angle Display provides excellent accuracy for the most important axial position. It provides readings that are accurate to 0.01 degrees (more recent gem diagrams do show settings of 0.01 accuracy—older ones typically show 0.1 degree).

3.3.1 SETTING THE ANGLE--USING THE ANGLE STOP AND THE FINE ADJUSTMENT CONTROL



The Angle Stop is used to set the axial angle. It works in conjunction with the Fine Adjustment Knob.

Here's a photo looking at the *back* of the Mast—at the angle-stop mechanism—so that you can see what's going on. You can see the Angle Stop Locking Knob, pointing down from the Angle Stop, and the Fine Adjustment Knob, pointing up from the upper Yoke surface.

When you *use* these angle setting and adjusting features, you will not be looking at them, rather, you will be working with them as you look at the front of the Mast, as is shown in the photo and text below.

To set an angle: 1) Hold the Spindle (or the Handle as in the photo) with your left hand, and with your right hand, reach under the Yoke and grip the pointing-down Locking Knob (see this done in the photo to the left). 2) Loosen the Lock Knob (which eases the tightness of the grip of the Angle Stop)—as you loosen the Lock Knob, push up on it, holding the end of the Angle Stop in contact with the bottom of the Fine Adjustment screw. 3) Still holding the Spindle with your left hand, and still holding the Lock Knob with your right hand (keeping the Angle Stop in place), with your left hand move the angular position of the Spindle (slipping the nylon clutch in the Angle Stop) until the Angle Dial readout shows the desired new angle. 4) With your right hand, tighten the Lock Knob (you've been holding it) firmly and let go. 5) Dial-in the precise angle setting on the readout with the Fine Adjustment Knob. Practice it (it's complicated to write this description—but performing the task is easy and it quickly becomes an easy natural thing to do).

3.3.2 READING THE DIGITAL ANGLE DISPLAY.
The Digital Angle Display reads the angle directly. It 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. (If, for any reason, the calibration is lost—an unexpected event—there is a re-calibration instruction

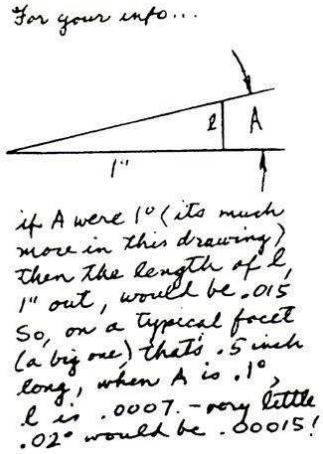
3.3.2.1 Digital Angle Dial Controls.

The "POWER" button is a push-on/push-off toggle switch. When the power is supplied, the display will blink 99.99 (the display 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 Spindle (Quill) so that it points up (vertical), and then lower it down to and past the 90 degree (horizontal) position. You will see on the display that the Angle Dial "finds itself"—the calibration is maintained.

3.3.2.1.1 The Beeper. There is a "BEEPER" that signals reaching the STOP position. It is optionally ON. The SET button turns it ON. The "CLEAR" button turns it OFF.

3.4 CONTROL OF FLATNESS
This control is built into your Ultra Tec. The runout of the master platen is less than .0003 of an inch. (less than 8 microns).

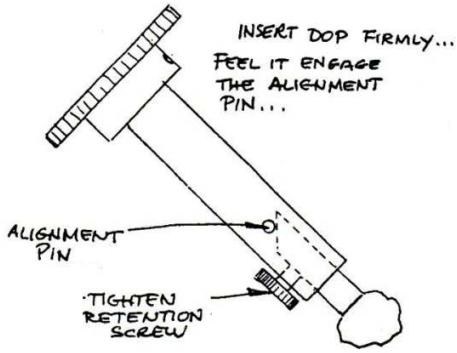
Laps are manufactured to be suitably flat, but their accuracies vary, and all laps have some degree of error. The important lap is the one used prior to the polishing operation, usually a 1200 or a 3000 lap. You will be able to detect *any* runout on a lap, however small, but keep in mind that a highly detectable .002 inch runout on a 6 inch lap represents on angular error of only .02 degree. So, do not be overly concerned when the stone makes contact at one place on the lap, but not in another--the actual error may be very small, perhaps only a ten-thousandth of an inch—a few microns.



● A "TIP" -- Because no lap is "perfect" in its flatness, when faceting, on *any* lap, become accustomed to lifting the stone from the lap surface in about the same location—probably best toward the center. That will tend to minimize the out-of-parallel variation of the lap from place to place. It will become a good habit.

4.0 STANDARD TOOLS AND TECHNIQUES ***Other than controls, there are these important "how-to's in using the machine: Inserting and holding the Dop, using the Tabling Adapter, using the Transfer Fixture:***

4.1 DOP INSERTION and RETENTION



The back end of the dop has a 45 degree angle chamfer (see note 1, below). The chamfer aligns with a transverse pin in the spindle--the Dop Alignment Pin.

The Dop Alignment Pin is at a right-angle to the Dop-retention Screw. When inserting the Dop, it is best positioned so that the chamfer on the Dop slips under the Alignment Pin on the side away from the Dop-retention Knob. Push in the dop firmly, and tighten the Dop-retention Knob.

If you want to override the indexing mechanism--the effect of the Alignment Pin--pull the dop slightly forward, disengaging it from the Alignment Pin--the dop can then be freely rotated.

Note 1--The precision of the angle (nominally 45°) is not at all critical, and can be added manually, by eye, using a sander (it does have to be flat). Dops of 6.4mm and down can be done on the machine, using a sanding paper.

Note 2--V Dops and Emerald Dops, which are used for designs with long girdle facets, need not have a rear keying chamfer. The long girdle facet makes it easy and better to align off the stone itself--setting the facet against the lap and then locking the retention screw.

An alternate to the Retention Knob.

You have been provided with two alternative retention screws – headless. The main advantage of the headless retention screw is that it does not have to be removed to mount the Tabling Adapter – when mounting the Tabling Adapter (see 4.2, below) turn the screw inward so that there is no extension of it above the Quill's outer surface. So, it never requires dis-assembly.

It also allows more clearance when working on the girdle of a small stone – clearing away the Knob.

The headless retention screw is a material that that will not disrupt the surface of the Dop and has also been machined to optimize holding force - do not use a steel set screw.

Why two? Well, when the headless retention screw is used, it stays with the Mast, so there is no reason to lose it – but, put the second one someplace safe, just in case (Put it with the Retention Knob).

4.2 THE TABLING ADAPTER. Used to work on the table of the gem, it points the dopped gem straight down at the lap (it's often called a "45° Adapter", since, when it is used, the axial angle is set at 45°).

To assemble it to the Spindle, remove the Dop Retention Knob (or, if you are using the headless retention screw, turn it in so that it is below the outside diameter surface of the Quill). Slip the Tabling Adapter onto the Spindle, until it stops. Slightly snug the set screws which hold it to the Spindle.

Alignment: Set the axial angle at 45°. Bring the bottom surface of the Tabling Adapter down onto the lap surface, and when it is flat from side to side, lock the set screws.

4.2.1 Tabling—some accessory choices.

You may wish to use a Tabling Aligner (shown on the left), an accessory for fast accurate alignment of the Tabling Adapter. The Tabling Aligner fits directly to the hole that holds the dop—eliminating several tolerance errors, and provides good "feel" of the flush setting onto the lap surface

NOTE: You may prefer a 90° Adapter. Although positioning the stone for inspection in progress, is not as convenient as with the 45° Adapter, the 90° Adapter provides truer adjusting of the parallel position. The 90° Adapter is also useful for very large stones, where one may run out of height with the 45° setting (although, if *many* large stones are to be worked on, it is better to use a Two-inch Base to raise the height of the Mast, allowing continued use of the 45°). The 90° Adapter and the 2" Base are available accessories.

4.3 THE TRANSFER FIXTURE. The Transfer Fixture is made from one piece, assuring its stability and accuracy. The ends of the Transfer Fixture are matched "V-Blocks", mirror images each other--so there's no rule for which side to put the original dop or the new (receiving) dop. Use whatever feels comfortable. Also, the Transfer Fixture can be set on end, with the V's vertical--something you may find useful.

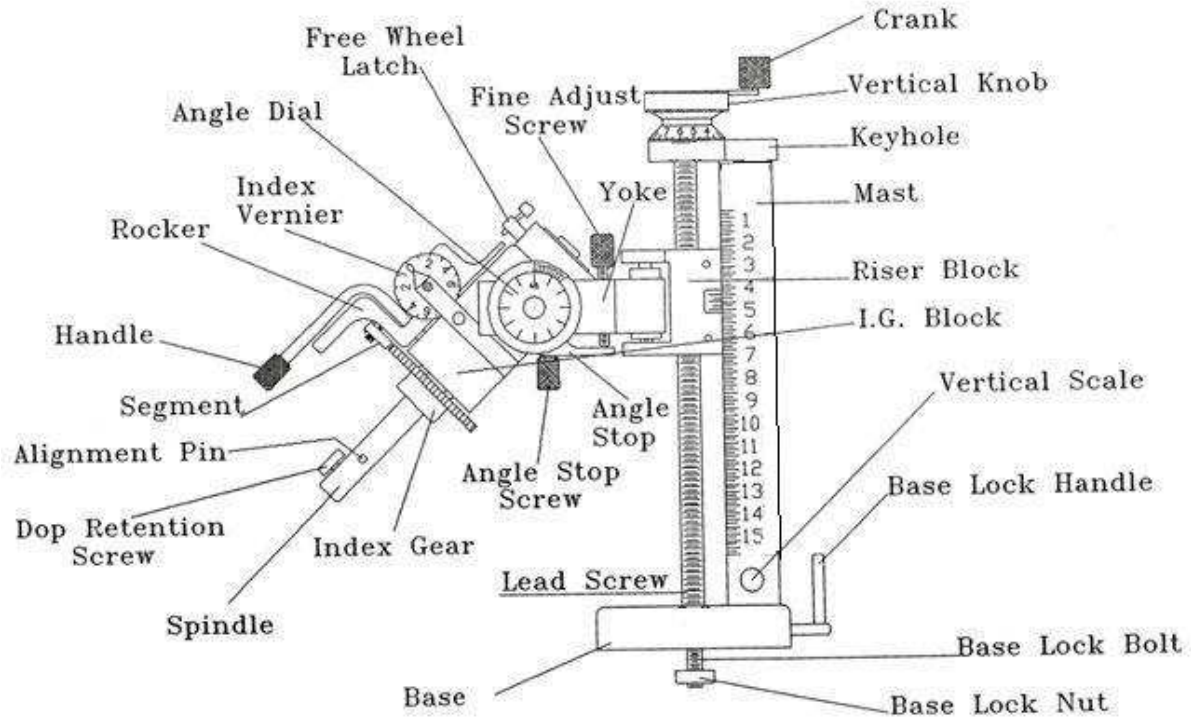
On each V-Block, there is a clamp for holding the dop in position in the V (or, with light tightening, allowing a dop to slide in the V), and a pusher that aligns the key at the end of the dop and pushes the dops together. Brackets that bridge over the pushers have nylon-tipped set screws that bring pressure on the pusher, keeping it in its track, as it slides.

When the clamps are loosened, they can be turned sideways, getting them out of the way for easy insertion or removal of dops. The chamfer of the keyed dop can face up or down in lining up against the pusher.

5.0 MAINTAINING AND ADJUSTING YOUR ULTRA TEC

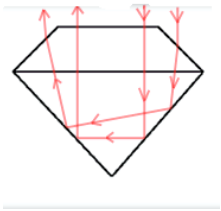
- Your Ultra Tec should be covered when not in use, or stored in a clean place.
- All bearings are lubricated and sealed. It is not necessary to lubricate bearings.
- It is a good idea to lubricate the Dovetail occasionally. Use a tissue to clean the dovetail, and then apply a light film of grease.
- The drive mechanism does not normally require adjustment. The rubber shock mounts on the motor can be compressed more or less for any adjustment that may be necessary.
- To protect the accuracy of the Mast keep the base clean and free of abrasive, especially around the sliding area. The smooth plate surface allows easy cleaning.
- The Index Vernier adjusting screw should be oiled once a year. If it feels too loose, it may be adjusted by tightening the set screw in the rear of the index latch rocker
- The motor Speed Control is designed to operate our special motor. Do not alter or add to the circuit. If the motor has been disconnected from the control be sure the leads are reconnected before plugging in the power cord.
- Calibration of the digital Angle Dial is permanent—see that section
- Adjustments and calibrations are best performed at the factory. If this is not practical, communicate with us and we will assist you either verbally or with written procedure.

5.1 NOMENCLATURE



6.0 THE FACETING PROCESS

6.0 THE BASICS



The faceting process consists of taking a rough stone (it's called "rough") grinding a series of faces (or facets), and polishing those facets. The facets are positioned at very particular angles so that the light reflects from the pavilion and out through the crown. The proper angle, the one which assures reflection is different depending on the material being used--and that's the angle used for the "main" pavilion facets (friendly name: "the Mains").

The steps of faceting consist of a rough grind, a fine grind, and then a polish. The exact number of steps, and the sequence, can vary but it always ends with the polishing.

The discs that hold the grinding or polishing material are called laps and most typically they have an eight inch diameter. Modern grinding laps have a diamond compound of some particular size (mesh) bonded to the surface of the lap. The higher the mesh number, the finer the lap. Coarse laps, used for initial grinding range from 100 mesh to 600 mesh. Typical pre-polish laps are 1200 mesh or 3000 mesh. Polishing is done with various types of compounds, like diamond, aluminum oxide, or cerium oxide, in particle sizes of 14000 to 50000 mesh—applied in powder form onto a polishing lap (Tin, BATT, Phenolic, and various others). There are also “Ultra Laps”—mylar films to which the polishing media is adhered.

The rough stone is cemented to a metal dop, and the dop is inserted into the Spindle which positions the stone for grinding and polishing against the rotating lap. The pavilion side is done first, after which the stone is cemented to another dop ("transferring"), holding to the pavilion, to complete the crown. After the stone is complete it is removed from the dop, cleaned up--and there it is.

Now, if you are a "natural-born" faceter, you know enough to start. More than likely, you'll need some help, at least from the various books available. If you can obtain instruction from a teacher, that will give you a fast start (and we may be able to aim you at a teacher--call us). Most importantly, "have at it"--faceting, like 99% of everything else in the World is best learned by doing.

6.1.1 SELECTING ROUGH MATERIAL

Almost any inexpensive material can be used for the first stone. The goal of your first attempt at faceting should be to learn your machine's various functions and controls. Even though it is your first stone, it will be one of which you are proud. It will undoubtedly include some mistakes, however, and it is best to save valuable material for later on. So. as most beginner instructions do, we recommend quartz—nice pieces of citrine or smokey quartz are inexpensive and readily available. Now, a bit of caution, quartz—in some cases—may give you some difficulty in polishing (that difficulty usually goes away if you reverse the Lap direction of rotation),

If you happen to have access to synthetic Spinel, that is a nice start-out material. It is an easy cutting and polishes very easily. An advantage of synthetic material is that you don't have to worry about inclusions, fractures, etc. The synthetic material will be "clean". Being a nice regular shape, it will also be easier to align on the dop, something which is more difficult with typically irregular natural material. Synthetic materials are formed in "boules", which are cylindrical--sort of carrot shaped. It is easy to get a slice about 1/2 inch in diameter and about equally deep, a good size for a first time effort.

When you do use natural materials there are quite a few things to consider in making a purchase of rough. The most important factors are the shape of the rough--what size and type of gem will produce--and whether the rough stone is free of flaws (cracks, veils, inclusions, bubbles, etc.). The first time you purchase rough, ask someone to help you (including the man selling—he’s not there to “trick” you—he wants you to come back again),

and, observe others making a purchase. Don't feel intimidated by what seems to be a mysterious process. You will be surprised how quickly you develop skill in detecting flaws, particularly when you are about to exchange your own hard earned cash for it.

6.2 LEARNING TO FACET

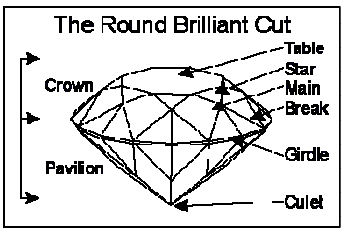
Faceting is a craft which offers many levels of accomplishment, and we have never met anyone who could not succeed at a personally satisfying level, (and often a profitable one as well). The rate at which people progress varies in relation to their aptitudes and learning experiences, but you will make progress and you will find even your beginning efforts will be gratifying. In the long run, some faceters attain Masters ranking by entering competitions; many more involve themselves in selling their gems to a market that is available for the unique custom cutting you will be able to perform; almost all follow the craft for personal relaxation and enjoyment. There are ample rewards for everyone.

Many people are completely self taught, including some very good faceters. Of course it is good to have a teacher if possible, particularly in the very early stages--even a few hours of instruction will give you a running start. Almost as good would be a faceting friend whom you could call upon for advice or just to confirm that you are doing the process correctly. As you gain experience you will find that most advanced learning comes from talking to other faceters. If you are all on your own, however, don't fret about it--you can do it.

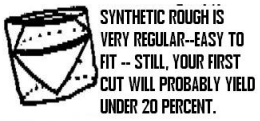
We recommend: Faceting for Amateurs by Glenn Vargas. This is the "bible" of faceting, with several good "how-to" chapters. There are other how-to books—all of them good—and these days, the Web has much information—including designs. And of course, there is the basic start-out how-to information that is in this Owner's Manual. Also, keep your eye on the Ultra Tec Website (www.ultratec-facet.com). And not least--think about joining one of the several Faceting Guilds—even if you cannot go to their meetings, their newsletters are valuable.

6.2.1 GETTING STARTED--

Not everyone teaches faceting in exactly the same way. Listen to what others have to say (if you know he's an experienced faceter). On the other hand, there's nothing wrong with using this text now, as is, and saving other advice for later.

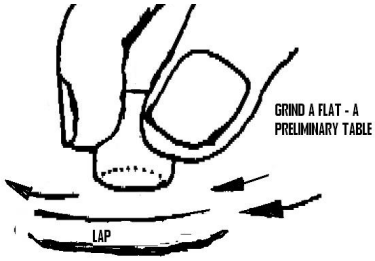


The cut that will be described here is a Standard Round Brilliant. It is the most common cut in the world. It is a good design for learning basic terminology and basic techniques. After you've done it, move on to other designs-- the merit of your faceting equipment is that it allows you to do things that native cutters with primitive equipment cannot do. You will find cutting custom stones is much more challenging and rewarding (including financially).



Now, back to the first-time stone. Having obtained a piece of material examine it to determine what would be the best orientation of the stone so as to maximize the yield. As you go on, there will be other considerations which affect the way you orient the stone for faceting, particularly color and cleavage characteristics But for your first stone, just consider the yield.

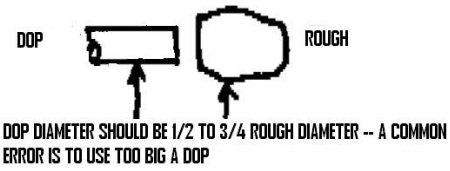
6.2.2 THE FIRST CUT – A PRELIMINARY TABLE

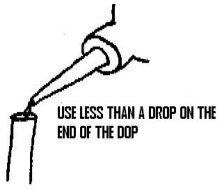


Having determined where the table should be, hold the stone in your fingers and using a 260 grit lap, grind a "preliminary" table--you need a surface large enough for attaching the dop. This surface will provide you with a reliable reference surface for the cutting of the stone.

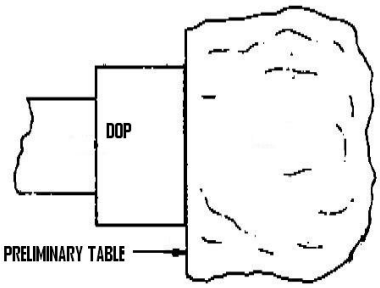
6.2.3 DOPPING THE STONE

The stone is cemented to a dop--the process is called "dopping". Select a flat dop which ranges between 1/2 and 3/4 of the projected diameter of the stone. Clean both the stone and the end of the dop in denatured alcohol (obtainable at your hardware store). Wipe these items dry with a lint-free paper towel. Place just enough adhesive on the end of the dop to coat the surface (*see the note below). Bring the preliminary table in contact with the end of the dop. The adhesive we recommend gives you about 30 seconds to position the stone--that is plenty of time and you will find you can position the dop by eye surprisingly well. In your first attempt you may use more adhesive than needed; you need less than a drop. Too much will cause the setting up process to take a longer--if you have applied too much, you can wick it off onto a bit of paper.



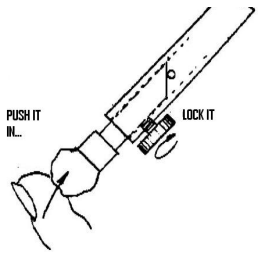


Hold the stone and dop together under finger pressure for approximately 30 seconds. Run a very light bead of adhesive around the stone and set it aside for at least five minutes to assure a good bond. Not very difficult. (Do be sure to observe the caution notes on the bottle--this type of adhesive bonds skin very effectively). After the waiting time, tug a bit on the stone to satisfy yourself it has adhered well.



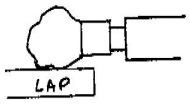
We recommend is a "super glue", specifically Loctite 404, available from Industrial suppliers. It is expensive compared to others, but we found it more reliable, and still only a few pennies per dopping. If you don't have an Industrial supplier nearby,, you can get Loctite 404 from us.

Insert the Dop into the Spindle, so that the chamfer on the dop engages the alignment pin in the Spindle--push it in snugly. Tighten the Dop-retention screw (it tightens with a normal CW action).



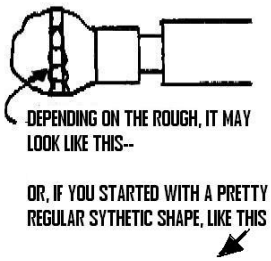
6.2.4 CUTTING THE GIRDLE

On this step, and the ones that follow, we refer to diamond plated laps as "coarse" (260-360 mesh), "medium" (600-1200), "fine" (1200-3000). Use the coarse lap where you are removing a considerable amount of material, and switch to the medium lap to finish the facet—thus avoiding deep scratches. In general—on large stones there's a lot of work to do with the coarse lap, and on small stones, hardly any (you will quickly learn which lap is appropriate). This instruction assumes the stone is about ½ inch (12-15 mm)



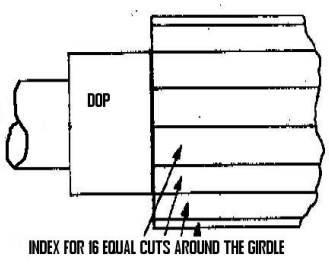
The first step will be to cut the girdle. Place a coarse lap onto the platen. To preform the girdle set the Angle Dial at 90.00 . Set the Index at 3 (the first setting of the Standard Brilliant Design). Start the lap turning at a speed setting about 6 or 7 (yes, you can slow it down if that speed makes you nervous—later on, you may be speeding it up). Set the Water Tank so that it is dripping at a rate of one or two drops per second, and clip down the edge of the Splashguard so it doesn't interfere with the stone's reaching the lap. Position the Head so there is no danger of the spindle hitting the lap.

Girdle Facets – set Angle Dial at 90.00
96 Index at: 3, 9, 15, 21...etc…steps of 6…to 93



Using the vertical knob, lower the stone toward the lap until it makes initial contact. When you feel it, hear it, and see the Angle Dial readout go over the 90.00 setting, continue to lower the vertical setting a few divisions on the Vertical Knob, and grind a flat—the Angle Dial will read 90.00. As you do that you will be holding the handle, applying a relatively light and consistent downward pressure as you sweep the stone back and forth across the lap surface. You will see when the Angle Dial has returned to 90.00 (and, you will feel and hear when the cutting action stops).

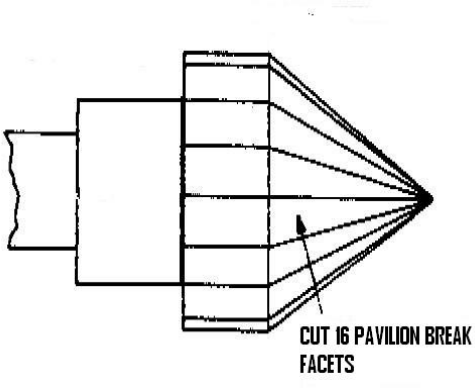
Then index around the Index Gear, repeating the cut 16 times (on a 96 gear the stopping points are 3,9,15…..in steps of 6.., to 93. You may have to lower the vertical position to get the girdle facets to join—to obtain nice even facets. As you work, you can see there is considerable material to remove, but as you reach the stop, come up against it lightly and consistently.



If you want a round girdle (it has gone a bit "out-of-style" these days), you would now place the machine into the "free wheeling" mode and round off the points. It is recommended that the series of flats always be placed on the stone before rounding. (watch the Angle Dial and be sure that the readout finally shows 90.00 all the way around, as you remove the high points).

6.2.5 FORMING THE PAVILION – BREAK FACETS

Now, the pavilion can be formed – the Break Facets are done first.



You are still using the coarse lap (switch to a medium lap as you approach the target angle—or, use a medium lap all the way—it's not so slow). Set a speed of 4 or 5 (later on, when you are more comfortable with your faceting, you will--probably--increase the speeds). The water drip, from the Water Tank, is at a rate of one or two drops per second.

Set the Index Gear at 3 (same settings as for the girdle). Set the Angle Dial at 45 degrees.

Set the stone down onto the lap, in the quadrant of the lap nearest to yourself, lower the vertical position a bit (so you get a reading higher than the 45.00), and slowly sweep the stone back and forth from the center to the edge of the lap and back, grinding a flat. Watch the Angle Dial go down—and finally reach the target of 45.00. You can repeat this—and as you get closer to where the facets will join at the tip (the "culet"), switch to the medium lap. You can observe where that depth of cut is getting closer by cutting several of these index positions (say, at 3 and the opposite index, 51)—repeatedly examining the stone as you adjust the depth of the cut

Then, with the medium lap, continue going down in vertical position—repeatedly examining the stone as you adjust the depth of the cut—the vertical setting—until the facets come to a tip at the bottom (or *almost*--it will be the Main facets that finally form the tip—the "culet"). That establishes the final depth for the Break facets.

With the first break facet in place at Index position 3 (and another position too, at 51), move to the next index position. Proceed to add the remaining break facets, in the sequence shown:

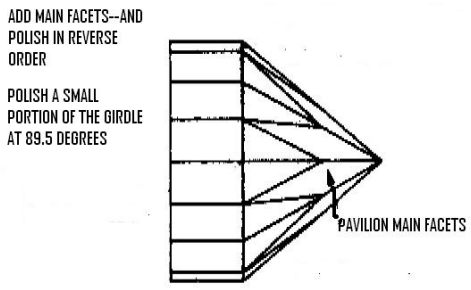
Pavilion Break Facets—set Angle Dial at 45°:
96 Index at: 3, 9, 15, 21...etc…steps of 6…to 93

Now, proceed to the:

6.2.6 PAVILION MAIN FACETS

In doing the main facets (the "mains") you will be removing very small amounts of material, so continue with the 1200 mesh lap. Approach this *slowly and carefully* since the material will be removed very quickly. Inspect often. The main facet positions are:

Main Facets--Angle Dial setting at 42°:
96 Index at: 96 (0),12, 24, 36, 48, 60, 72, 84



As you do this, inspect the stone and observe how the mains develop--after just barely grinding you can see the beginnings of the break facet. This observation helps you understand the faceting process, and after some experience you will know exactly where a new facet will appear.

The mains are cut until they meet the girdle, as shown in the sketch. Make note of the position of the vertical adjustment.

6.2.7 PRE-POLISH

The “medium” lap used (1200), for many materials, also serves as a fine-enough pre-polish lap—but the polish takes a fairly long time. You can very much speed up the polishing process by going back over the already applied facets with a finer lap—say, a 3000—which makes the final polish very fast. Just repeat the entire sequence with the fine lap.

It was not until the mid-1980’s that 3000 mesh laps appeared on the scene, however, and prior to that the 1200 lap was the standard pre-polish lap.

There is a considerable art and science to polishing techniques—including what particular pre-polish laps are best—all usually depending on the material used.

But, since this is a “start-out” lesson—let’s move directly to the polish step from the 1200 mesh lap.

6.2.8 POLISHING THE PAVILION

The technique of polishing that is recommended here is the use of Ultra Laps (these laps have the polishing medium deposited on a mylar film.. This is one particular method—it is fast, allows the use of the abundant water for lubrication, and does not demand too much by way of developing skills (you will no doubt use many additional polishing methods as time goes by). Ultra Laps do cause a very slight rounding of the edge of the facet--but when (and if) you get to worrying about that, you will have become a good faceter and know a lot about various polishing methods.

In polishing this first stone, use an Aluminum Oxide Ultra Lap. Flood the surface of the pre-polish lap (the 1200) with water and place the Ultra Lap onto it.. Then tighten the Safety Nut. Press out the air bubbles you see through the mylar--wet the surface of the Ultra Lap and push the bubble out with your fingers. The water on the surface of the 1200 lap will be adequate to hold the mylar down while it is used for polishing--adhesive is not needed.

Set down the stone onto the Ultra Lap surface—you’ll need to do a little raising of the vertical position to compensate for the Ultra Lap—resetting the target 40.00. Having done that—the facet on the lap—the angle setting at 40.00--back off the fine adjustment screw about a half turn. The 40.00 reading is maintained by the stone on the lap surface. Turn on the motor and set a slow speed--2 or 3 on the speed control dial. Polish in the same way you had been previously grinding, -- you can bear down to speed the polishing (you will see some fluctuation of the set 40.00—reading some lap error—that’s OK)will take a long time).

Lift the stone to inspect the surface-- you need to position the lap so the light glances off the surface and allows you to see the grinding scratches. You will see the polish as it gradually develops. Don’t settle for less than an excellent polish—NO scratches. If the facet is being stubborn about polishing, you can try reversing the direction of the lap—that often helps.

Having completed the polishing on one facet, continue with the others, and having completed the main facets go on to the break facets. Note that you are polishing in reverse order to the grinding sequence.

As you use the Ultra Lap you will wear away the polishing medium, or it may seem to slice off in places. You can continue to use the Ultra lap as long as there is some area in which to polish--running the stone over a bare or bumpy spot does no damage. The individual Ultra lap should take you through at least several stones.

When you finish polishing the last break facet, you have finished the pavilion. Make a last inspection to satisfy yourself with the quality of the polish.

You are ready to Transfer the stone--cementing the pavilion onto a new dop, so that the Crown can be completed. Remove the dop/stone from the spindle.

6.2.9 TRANSFERRING

Read the section on the Transfer Fixture which explains how the dops are set into the fixture. In setting the dops into the fixture, see that the key (chamfer) on the dops are firm against the edge of the pushers", aligning the dops radially.

Set the new cavity dop into a V-block of the Transfer Fixture. Select a cavity dop which covers about 2/3 of the pavilion. Tighten the clamp on that dop. Into the opposing V-block, set the initial dop. Tighten the clamps so that it allows the initial dop to slide when pushed on by the "pusher".

Be sure the surface of the cavity dop is clean, and apply a drop of adhesive (or less than a drop--not too much) to the holding surface. Slide the initial dop--pushing it with the "pusher" to maintain its radial position--so that the pavilion is pressed firmly into the cavity dop, and lock the position by tightening the clamp on the initial dop, with the stone under some pressure into the cavity dop. With a toothpick (or whatever) put a small fillet of cement around the stone where it exits the cavity dop. Set the Transfer Fixture on end, the old dop side down--and wait. This is a good time to get a cup of coffee, or tea -- 10 minutes will probably be sufficient for the adhesive to set up, but longer is better.

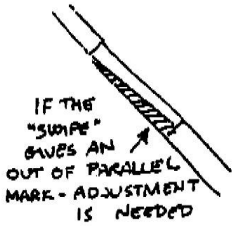
When you remove the stone, do it carefully--loosen the clamps and get them out of the way-- you now have cavity dop-stone-flat dop, and the original flat dop has to be removed. It's a complicated-sounding instruction, but it's easy: you need an alcohol lamp, a small damp cloth, and small pliers. Light the alcohol lamp. Hold the stone with the damp cloth (to keep the stone cool when heat is later applied), with the cavity dop resting in your palm (avoiding a stress between the stone and the cavity dop), and hold the old dop in the flame. As the dop warms, hold the stone firmly in your fingers (with the damp cloth), and use the pliers to apply a side pressure to the heated dop--and at some point the dop will separate from the stone--it sort of pops off. (In this process, don't make the mistake of removing the wrong dop(!)--a message from the Voice of Experience).

You are ready to facet the Crown. Insert the dopped stone into the Spindle and lock the position.

6.2.10 CONFIRMING ALIGNMENT WITH THE PAVILION FACETS

The Crown Facets are usually cut to align with the Pavilion facets--the keying arrangement will provide a reasonable alignment, but some adjustment may be needed. Use the Index Vernier.

To check the alignment, place a 1200 lap on the platen, set the index position of a facet, set the angle at about 85° and with the lap turning slowly, slide the stone across the lap. If the resulting mark is parallel to the edge of the girdle on the pavilion side, you have verified the alignment. If some amount of out-of-parallel is observed, make a correction by rotating the Index Vernier. Having completed the alignment, you are ready to proceed with faceting the crown.



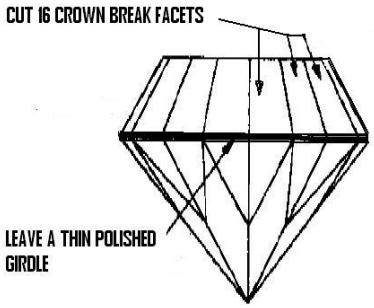
6.2.11 FORMING THE CROWN – BREAK FACETS...

Proceed in a way similar to the faceting of the Pavilion, use the coarse lap only for removal of much material—finish setting the facet with the medium (graduated to a pre-polish) lap.

Proceed cautiously and inspect often.

Break Facets –set the Angle Dial at 52°
96 Index at: 3, 9, 15, 21...etc…steps of 6…to 93

Cut the break Facets so that they meet at points along the girdle—leave a thin polished girdle of 2 or 3% (this is a guess--don't worry about it--your judgment in this will improve with time)-remember, it was polished previously.

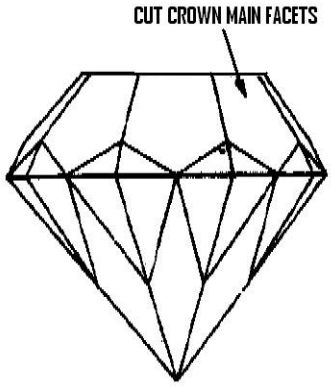


6.2.12 CROWN MAIN FACETS

Again, proceed cautiously and inspect often.

Main facets – set Angle Dial at 40 degrees
96 Index at: 96 (0),12, 24, 36, 48, 60, 72, 84

Cut the Main Facets so that they meet at points along the girdle.

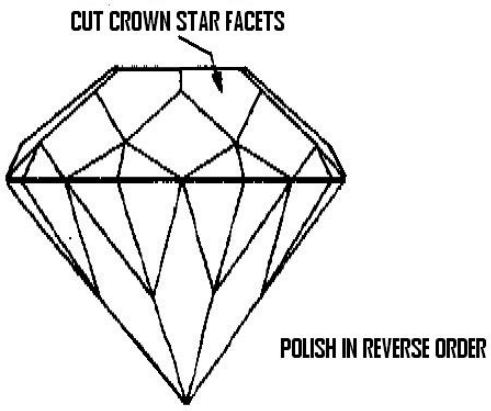


6.2.13 STAR FACETS.

Again, proceed cautiously and inspect often.

Star Facets - set Angle Dial to 25 degrees
96 Index 6,18,30,42,54,66,78,90

Cut the Star Facets to meet the points of the Break Facets.



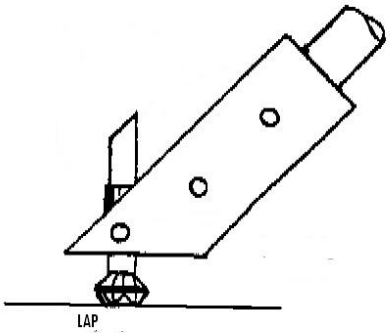
6.2.14 POLISHING OF THE CROWN FACETS

Polishing of the Crown Facets is done in the same way as the polishing of the Pavilion, and again, in reverse order. When you have finished polishing the Crown Facets, you are almost there-- the table is what remains.

6.2.15 THE TABLE.

Remove the dopped stone from the spindle. Place the Tabling Adapter onto the spindle (read the section about the Tabling Adapter).

Completing the Table. When you become more skilled you will find the rough table that was put on for the initial dopping is very close to the final table position. In this first attempt you will probably find there is still significant material to remove, and that you need to use the 260 lap before the 1200 lap to get to the final position of the Table Facet. If you are close to the final position you can start out with the 1200 lap.



Grind the stone to the final table position--and polish as with the facets. The table, compared to the other facets, is a very large facet and patience is needed in the polishing. Because of the relatively large surface areas, the polishing operation can be noisy--a squeaky noise (extra water with a few drops of detergent can be helpful). Steady firm pressure and slow lap speed will reward you with a well polished table--and a completed stone.

Remove the stone as you did after the first dopping--and you have it. Congratulations.

APPENDIX 1

TABLE OF FACET ANGLES

We thank Louis Roth for this table. Lou comments: *The cutting angles in this chart represent opinions, round-offs, and compromises, so please use it as a "handy guide" and not Gospel. If you see errors, or learn some later information, we'd appreciate your communicating with us*.

TABLE OF FACET ANGLES

SPECIES	SPECIFIC GRAVITY	HARDNESS	R.I.	******CROWN*****				*PAVILION**	
				MAIN	STAR	GIRDLE		MAIN	GIRDLE
AMETHYST	2.66	7	1.54	43	27	46	49	43	45
ANDALUSITE	3.1	7 7.5	1.63	43	28	47	49	39	41
APATITE	3.15	5	1.64	43	28	47	49	39	41
AQUAMARINE	7.75	7.5 8	1.56	42	27	46	48	43	45
BENITOITE	3.6	6 6.5	1.75	37	22	41	43	42	44
BERYL	2.75	7.5 8	1.56	42	17	46	48	43	45
BERYLLIONITE	2.8	5.5 6	1.55	42	27	46	48	43	45
BRAZILIANITE	2.9	5.5	1.60	42	27	46	48	43	45
CASSITERITE	6.95	6 7	1.99	35	20	39	41	41	43
CHRYSOBERYL	3.6	8.5	1.74	37	22	41	43	42	44
CITRINE	2.66	7	1.54	42	27	46	49	43	45
CORUNDUM	4.0	9	1.76	37	22	41	43	42	44
CUBIC ZIRCONIUM	5.8	8.5	2.14	35	20	40		40	40.5
DIAMOND	3.52	10	2.41	35	20	39	41	41	43+
EMERALD	2.75	7.5 8	1.56	42	27	46	48	43	45
EPIDOTE	3.35	6 7	1.73	37	22	41	43	42	44
EUCLASE	3.0	7.5	1.65	43	28	47	49	39	41
FELDSPAR	2.6	6 6.5	1.53	42	27	46	48	43	45
FLUORITE	3.2	4	1.43	41	26	45	47	45	47
GARNET (ALMANDITE)	4.1	7.5	1.83	37	22	41	43	42	44
GARNET (ANDRADITE)	3.85	7.8	1.89	43	28	45	49	40	42
GARNET (GROSSULARITE)	3.62	7	1.73	37	22	41	43	42	44
GARNET (PYROPE)	3.7	7	1.70	37	22	41	43	42	44
GARNET (RHODOLITE)	3.85	7	1.70	37	22	41	43	42	44
GARNET (SPESARTITE)	4.15	7.8	1.80	37	22	41	43	42	44
GARNET (UVAROVITE)	3.75	7.5	1.87	37	22	42	43	42	44
GOSHENITE	2.75	7.5 8	1.56	42	27	46	48	43	45
HELIODOR	2.75	7.5 8	1.56	42	27	46	48	43	45
IOLITE	2.8	7 7.5	1.54	42	27	46	48	43	45
KORNERUPINE	3.3	6.5	1.67	43	28	47	49	39	41
KUNZITE	3.2	6 7	1.66	43	28	47	49	39	41
MORGANITE	2.75	7.5 8	1.56	42	27	46	48	43	45
OBSIDIAN	2.45	5.5	1.48	42	27	46	48	43	45
OPAL	2.1	5.5 6.5	1.65	41	26	45	47	45	47
PERIDOT	3.3	6.5 7	1.65	43	28	47	49	39	41
QUARTZ	2.66	7	1.54	42	27	46	49	43	45
RUBELLITE	3.15	7 7.5	1.64	43	28	47	49	39	41
RUBY	4.0	9	1.76	37	22	41	43	42	44
RUTILE	4.25	6 6.5	2.61	32	15	34	36	41	41.5
SAPPHIRE	4.0	9	1.76	37	22	41	43	42	44
SCAPOLITE	2.6	5 6	1.56	42	27	47	48	43	45
SPHALERITE	4.0	3.5	2.37	35	20	39	41	41	43
SPINEL	3.55	8	1.71	37	22	41	43	42	44
SPODUMENE	3.2	6 7	1.66	43	28	47	49	39	41
TITANIA	4.25	6.5	2.90	32	15	34	36	41	41.5
TOPAZ	3.5	8	1.61	43	28	47	49	39	41
TOURMALINE	3.15	7 7.5	1.64	43	28	47	49	39	41
ZIRCON	4.6	7.5	1.93	35	21	39	41	41	43

APPENDIX 2 - RE- CALIBRATING DAD.

It is NOT expected that you will have to do this (but, there has been one reported case of calibration not having maintained itself, so, as a matter of caution, this instruction has been provided—and a Calibration Block included in your delivery). This instruction is the same as the one included with the DAD when it is purchased separately, as an add-on upgrade

Calibration is not difficult to do, *but follow the steps carefully*. Don't worry about it—if you make a mistake, you won't hurt anything—you'll just go back and start over.

1 Point the Spindle UP.

2 Plug the Power Cord into a live 110VAC or220 VAC socket.

3 With the Spindle still pointed UP, depress the CLEAR button and

hold it down as you plug the power jack into DAD.

On the display, 90.00 will appear, and flash – it remains flashing when you take your hands away.

4 Readying the Base of the machine. Remove the Splashguard and set a smooth and flat Lap onto the Platen—your favorite pre-polish Lap will do.

5 SETTING 90 DEGREES.

5.1 Set the Calibrating Block onto the Lap Surface.

5.2 With the Angle Stop loose, lower the vertical position—approaching the 90 degrees (represented by the top surface of the Calibration Block)--it's OK to "ride it down", resting on the Block, as shown (the display is still flashing 90.00—it's prompting you to set the 90 degree position). Gradually lower…lower…THERE.

How do you KNOW it's "there"? As you lower the position, and the Spindle is evening out against the top surface of the Calibration Block, you watched as the gap closed … closed…slowly closed…adjusting with the Vertical Knob--seeing what light comes through the gap. When the light is pinched-off—it's THERE. 90 degrees.

Hold it there and **press the SET button ONCE**. The display changes from 90.00 to a flashing 00.00 – prompting you that setting the 0 degrees position is next.

(whoops—did you press it more than once? Start over—back to 4.3—pull the plug—replug and proceed. raise up—lower—confirm that the Spindle is flat against the Block-- **press the SET button ONCE**).

On to the last step.

6 SETTING 0 DEGREES

6.1 Raise the Vertical Position. As you do that, allow the Spindle to point down…down…as the Riser Block goes up. You have to raise the position high enough so that the end of the Spindle, when it's pointing straight down, is above the surface of the Lap.

The display is still flashing 00.00.

When you get it so that it's about pointing straight down, as in the second photo above, lock the Angle Stop there. It will permit you to use the Fine Adjustment Knob to dial-in the 0 degree position in the next step

6.2 Set the Calibration Block back onto the Lap (it's probably easier to angle the position of the Mast on the Baseplate, as in the second photo, above. It gets you a bit more room).

You will now go through a 0-setting procedure that's pretty much the same as the prior 90 degree procedure—except, with gravity no longer helping, it will be watching the gap…watching…watching…adjusting with the Fine Adjusting Knob…until the light showing through the gap is pinched off. It's there at 0 degrees.

Hold it there and press SET – *ONCE*. You've done it. DAD is installed and ready to use.

(There's a similar "whoops"—did you press twice? Start over—back to 3—power off—reset 90-- reset 0—this time you'll remember the press-once rule).

ABOUT DAD…

You will see, as you swing up the Spindle from that 0 position toward the 90 degrees, it is reading all the way—each angle---each .01 angle. If you keep raising the Spindle past 90, it will read up to 99.99, and then stop.

Maintaining Calibration. Calibration is not lost if the power for some reason is interrupted—or, if you turn it off on purpose. Just turn the power back on, bring the Spindle to a pointing up position—it will flash 99.99. As you swing the Spindle down, it still says 99.99, but it stops flashing—and when you get to the 90 degree position it starts reading the angles.