Basic Techniques for Polishing Molds & Tools of the Trade

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Engis Corporation is a leader in superabrasive finishing systems. Since 1938, Engis has been providing customers with finishing solutions utilizing quality equipment, tools and abrasives.

With our vast knowledge of polishing a wide range of materials, Engis sets the standard for superabrasive finishing and polishing.

This booklet has been developed to help guide our customers in the use of commonly-used polishing equipment, tools and supplies for the finishing of molds and mold related tools.

We hope that it will help you understand basic mold finishing techniques and the tools used to perform these tasks. It is the goal of Engis to provide our customers with the best possible products and know-how that is available today.

Our products are sold by local stocking distributors who understand the mold & die business. Give us or your local distributor a call should you require any additional information or assistance.

Thank you for your business!

Stephen Griffin, President

Engis Core Values

⇒ **Teamwork**—Teamwork is the essence of our ability to succeed as a trusted preferred supplier of engineered solutions to our clients. Our overriding loyalty is to the good of the whole organization, requiring us all to learn from each other and to share our skills and resources across organizational boundaries for our customer’s benefit.

⇒ **Respect**—We respect every individual. We draw strength from equal opportunity and diversity, at the same time supporting personal growth and development. We value and all benefit from the entrepreneurial spirit of each individual.

⇒ **Integrity**—Above all, we are committed to integrity in all that we do, always, everywhere.

⇒ **Professionalism**—To be of service to our customers we are committed to the highest standards of professionalism, pursuing innovation, deploying imagination, being open to new ideas and acting decisively and consistently. We are determined to deliver outstanding quality so that our relationships with our clients be long lasting and close.
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TOOLS OF THE TRADE

The reciprocating handpiece, better known as a "profiler", is used for stoning and lapping slots where short strokes can be used.

Angle rotary handpieces are very useful in getting in areas where straight handpieces cannot. Reduces operator fatigue. For use with felt pads and abrasive discs.

Because there are ultrasonic machines available today that shorten this process, the "profiler" is used primarily on large flat and contour areas.

This is a DC power pack that has a variable speed control and is capable of utilizing 3 different handpieces. Quick & precise control change from handpiece to handpiece means no disconnecting and connecting during the polishing operation.

The rotary handpiece is used with mounted points, rubberized abrasives, felt & wood bobs and some diamond pins and wheels.

To really get the job done quickly and comfortably, it is important to use power tools that are versatile and designed with the polisher in mind. Shown above is a very popular system used in more shops today than any other type of polishing machine.

Today, the tools such as those above, offer precision balanced motors and rotary heads that virtually are vibration-free, thus reducing the chance of operator fatigue.

The handpieces consist of a rotary head and a motor. The heads and motors are interchangeable with one another to suit the task on hand. Motors range in speeds from 6,000 RPM to 50,000 RPM and have their own unique torque, allowing for excellent efficiency.

The heads and motors of the power tool system are interchangeable, making for a flexible & efficient polishing.
## TOOLS OF THE TRADE—Rotary

<table>
<thead>
<tr>
<th>Model</th>
<th>Image</th>
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<tbody>
<tr>
<td>Standard Rotary</td>
<td>![Image]</td>
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<tr>
<td>Rotary with an Air Blast</td>
<td>![Image]</td>
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<tr>
<td>Slender Rotary</td>
<td>![Image]</td>
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<tr>
<td>Long Slender Rotary</td>
<td>![Image]</td>
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<tr>
<td>Heavy Duty Rotary</td>
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<tr>
<td>Heavy Duty Angle Rotary</td>
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<tr>
<td>Heavy Duty 120 Degree Angle Rotary</td>
<td>![Image]</td>
</tr>
<tr>
<td>Small Angle Rotary</td>
<td>![Image]</td>
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<tr>
<td>Side-To-Side Swing</td>
<td>![Image]</td>
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</tbody>
</table>

*Flexibility and ease of use are key to completing the mold with speed and accuracy.*
TOOLS OF THE TRADE—Reciprocating

RE11 Minitor

FDL—FDP Air Diprofil

HPF Air Diprofil

FPH—FPC Diprofil

Tools Holders

Files

Felt Bob
TOOLS OF THE TRADE—More Options...

For as long as one can remember, the standard in mold polishing power equipment was the flexible shaft driven "profiler". This is a system that consists of a fractional AC motor, a flexible shaft with outer sheath, the profiler and foot switch with variable speed control. This workhorse could withstand a tremendous amount of use. Generally, when a slot or area of the mold has restricted space, the profiler was the tool selected for the task. The profiler uses wood and brass lapping sticks, files and polishing stones. As with the DC power packs described on the previous pages, the reciprocating profiler's stroke can be adjusted from 0 to 6 or 8 mm, and run at speeds up to 20,000 strokes per minute. Although designed for half the speed, the profiler motors were usually run at the maximum speed. Most polishers prefer the fast speeds because it reduces the polishing times. Below, is a "profiler" in a kit.

The typical profiler kit or set includes a motor, the profiler, flexible shaft and sheath and the variable speed foot pedal. There are models available for tool shank sizes of up to 1/4".

As with the DC motor driven systems, these, too, can be used with rotary tools such as those shown. The disadvantage of this system is lack of speed, vibration, it is not nearly as flexible as the DC units and the hand pieces do tend to heat up quite a bit. The advantages are the constant power even under load and the cost is generally much less than the DC motor driven systems.

There are also profilers available that run on air. The maintenance of these air units is critical. They do require a water trap/filter and lubricator. The advantages of using air profilers are cooler operation and less vibration. This is because the speed is much less due to the built-in regulator on the handpiece.
TOOLS OF THE TRADE -

THE INDISPENSIBLE ULTRASONIC

Ultrasonic polishing systems have been around for some time now. The earlier systems, however, were somewhat cumbersome and difficult to use. Many polishers that "stepped-up" to this technology back then soon abandoned the ultrasonic because of the difficulty and unreliability.

Many of these units are stored in shops under benches, in cabinets and piled into a heap in the corner never to be used again. Even so, they served their purpose for the most part.

Ultrasonic systems are a very valuable tool for the polisher faced with small detailed work; molds with slots, ribs and serrations machined by way of EDM. These are tough jobs, even for the seasoned polisher.

The ultrasonic systems make short work of these tasks. Usually a time savings of up to 80% has been common. This pays for the system in a very short time; usually on the first job.

There are standalone ultrasonic systems available. They consist of a single output power pack and a lightweight ergonomic hand piece. Kits such as the one pictured to the left come with numerous tool holders, polishing stones, files, lapping compound and other tools that are used with the ultrasonic system.

Ultrasonic hand pieces, when powered, will not vibrate in your hand, so it is sometimes difficult to realize when it is on. However, once the tool is put into place on the mold, you will soon find out why polishers praise these systems.

Even though ultrasonic systems of different manufactures vary in the frequency, the better units reciprocate at 30,000 cycles per second. The stroke is up to 45 micron. Now that is fast! Most people relate to their dentist office when they hear the sometimes high pitch of the tool. Tools for this unit will be discussed in the next chapter.
There are many different types of tools used for the finishing of molds. The most common tools that will be discussed in this chapter are as follows:

- Polishing stones
- Polishing stone lubricant
- Felt bobs
- Wood bobs
- Brass
- Wood sticks
- Brushes
- Ceramic stones
- Mounted points
- Rubberized abrasive points and wheels
- Diamond compound
- Felt pads

Before we start, it is important to understand that the polishing of a mold requires complete work area cleanliness at all times. All tools need to be cleaned and kept separated after each use, particularly stone and stick holders that have been subjected to grit and dirt.

Do not use compressed air on or around the mold, particularly when you get to the diamond polishing stage. Any contamination will ruin hours of work. As we go on, you will be reminded of this important point over and over.

### Polishing Stones

Polishing stones are available in different abrasive types; aluminum oxide and silicon carbide. Silicon carbide is generally used in the softer bond stones and aluminum oxide is used in the harder bond stones.

The grits are from 100 to 900 and there are some polishers that may use up to 1200 grit stones.

As there are many manufacturers of polishing stones, we will define the types as "DM" and "EDM", each being the most commonly used stone by polishers. Stones are available that have been designed for different types and hardness's of mold and tool steels and certain finishes required. For the purpose of describing these stones, we will use the Engis Hypez polishing stone types as listed in our product catalog. These will be used later on as we describe the process of stoning of the mold.

Polishing stones can be used by hand with or without a stone holder, with a profiler or with an ultrasonic system.
POLISHING TOOLS

DM stones for general polishing.

EDM stones used for removal of EDM scale.

Holders used with profilers.

Each holder is capable of holding different size ranges of stones. Use with a profiler.

The holders at left are same as above, only for use by hand.

Vise-type stone and stick holder used with a profiler.

Polishing stone lubricant is an important tool for use with polishing stones. It lubricates and maintains the sharpness of the stone.

EACH GRIT USED REQUIRES A SEPARATE CONTAINER OF LUBRICANT. DO NOT MIX!

FELT & WOOD BOBS

Pictured to the left are felt bobs. Typically used with diamond compound to polish edges, corners, radii and other areas. Use a rotary hand piece with a max. speed of 30,000 RPM. Available in different hardness's.

Wood bobs are used for lapping. Used with diamond compound for areas requiring close tolerance and good finishes. These can be shaped and are used with rotary hand pieces. Wood bobs are available in soft and hard varieties.

Note the different shapes that are available.

Wood bobs are available in cone and cylindrical shapes with 1/8" and 1/4" shanks.
BRASS, WOOD STICKS & BRUSHES

Brass and wood are used with diamond compound, either by hand or with a profiler, and can be used with an ultrasonic system. As with the wood bobs, they can be machined to the desired shape. Used for finishing work such as dimensioning prior to polishing.

Brushes come in different shapes and bristle material. The common shapes are the "end", "cup" and "wheel". Bristle materials are generally horse hair and nylon; the latter available in soft and hard bristle.

Wheel brushes are used for radius and slot work, cup brushes for pockets and edges and end brushes for hard to reach areas. Use what you feel is best for the job. All of the above are available in many different sizes.

CERAMIC POLISHING STONES

Ceramic polishing stones have been developed as a virtually non-breakable tool to work slots, ribs and detail work on a mold. Because standard aluminum oxide and silicon carbide polishing stones are brittle and break easily, it is difficult to maintain a shaped tip while polishing tight, narrow and detailed areas. Ceramic stones are made up of ceramic fibers bonded in resin. The fibers run lengthways in the stone. Grit sizes range from coarse, 120, to fine, 1200. They are color coded to identify the grit size. Sizes of the stones range from .5 x 2 mm to 3 x 10 mm. Lengths are available in 50, 100 and 150 mm. Ceramic stones can be used by hand, with a holder by hand, with a profiler, and best used with the ultrasonic system.

There are ceramic stones designed for use with the ultrasonic hand piece which will hold up to the heat.
ABRASIVE PAPER, MOUNTED POINTS & RUBBERIZED POINTS & WHEELS

Mounted points, as they are commonly called, are made of aluminum oxide with a ceramic type bond. They are available in 2 different shape groups; "B" and "W" shapes. Pictured left are B shapes. The W shapes are cylindrical in shape and can be as large as 2" dia. x 1" in height. Shank sizes are 1/8" and 1/4". Available in medium (red) and hard (blue.)
Last, but not least, is the diamond compound. Without it, polishing the mold to a high luster finish would not be possible. Used in conjunction with the proper lapping tools, felt and brushes, as well as technique, the polisher can master the art of polishing molds easily and efficiently.

Diamond compound is available in a very wide variety of formulations. Sometimes the inexperienced polisher can become overwhelmed by the different diamond compounds available.

Mold polishing techniques follow the rule-of-thumb that polishers use; "find what works and stick with it." Many are almost never willing to change the tools they use for polishing molds. This is especially true with diamond compound.

This is the last step in polishing the mold. Careful preparation of the mold for the polishing step has been completed. Now is not the time for mistakes. Therefore, using the proper diamond compound is important. **CLEANLINESS IS PARAMOUNT!!**

Even though there are so many compounds available, mold polishing only requires 2 or 3 abrasive sizes to finish the mold. Diamond concentration level used can be standard or strong. Oil-base compounds are commonly used. With the diamond compound, you will also use a thinner for some areas. Thinners such as pictured right are available to match the manufacturers diamond compound.
UNDERSTANDING DIAMOND COMPOUND

9 (W) 35-MA

Type of diamond used in the formula: MA (monocrystalline), PC (polycrystalline) or NAT (virgin natural)

Diamond concentration shown by a code number, or MED (medium), STD (standard) or STR (strong)

Type of carrier — (W) water-soluble, (OS) oil-soluble or special formula

Micron size of diamond in the compound

The above is the diamond compound identification nomenclature for Engis Hyprez diamond compounds. This will vary among manufacturers.

Diamond compounds are available in a variety of packaging selections;
- 5, 10 & 20 gram syringes
- 5 & 10 gram dip jars

Lubricants or thinners are available in pint, quart, gallon and even 55 gallon drums.

Later on we will discuss the best compounds for polishing molds. Selection and use of diamond compound is important. Compounds are expensive and need to be used conservatively. Liberal use will mean waste in most cases.
### UNDERSTANDING DIAMOND COMPOUND
*Most Popular For Mold & Die Industry*

#### Hyprez DiaMold

<table>
<thead>
<tr>
<th>Micron Size</th>
<th>Product Code</th>
<th>Compound Color</th>
<th>Application</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>1-DiaMold</td>
<td>Ivory</td>
<td>Final Polishing</td>
</tr>
<tr>
<td>3</td>
<td>3-DiaMold</td>
<td>Yellow</td>
<td>Final Polishing</td>
</tr>
<tr>
<td>6</td>
<td>6-DiaMold</td>
<td>Orange</td>
<td>Lapping &amp; Pre-Polishing</td>
</tr>
<tr>
<td>9</td>
<td>9-DiaMold</td>
<td>Green</td>
<td>Lapping &amp; Pre-Polishing</td>
</tr>
<tr>
<td>15</td>
<td>15-DiaMold</td>
<td>Blue</td>
<td>Lapping &amp; Pre-Polishing</td>
</tr>
<tr>
<td>30</td>
<td>30-DiaMold</td>
<td>Red</td>
<td>Rapid Stock Removal</td>
</tr>
<tr>
<td>45</td>
<td>45-DiaMold</td>
<td>Brown</td>
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</tr>
<tr>
<td>60</td>
<td>60-DiaMold</td>
<td>White</td>
<td>Rapid Stock Removal</td>
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#### Hyprez Five-Star

<table>
<thead>
<tr>
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<th>Application</th>
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<tr>
<td>1/10</td>
<td>1/10-FS-480</td>
<td>Grey</td>
<td>Final Polishing</td>
</tr>
<tr>
<td>1/4</td>
<td>1/4-FS-480</td>
<td>Gray</td>
<td>Final Polishing</td>
</tr>
<tr>
<td>1</td>
<td>1-FS-48</td>
<td>Blue</td>
<td>Final Polishing</td>
</tr>
<tr>
<td>3</td>
<td>3-FS-48</td>
<td>Green</td>
<td>Final Polishing</td>
</tr>
<tr>
<td>6</td>
<td>6-FS-45</td>
<td>Yellow</td>
<td>Lapping &amp; Pre-Polishing</td>
</tr>
<tr>
<td>8</td>
<td>8-FS-40</td>
<td>Red</td>
<td>Lapping &amp; Pre-Polishing</td>
</tr>
<tr>
<td>14</td>
<td>14-FS-40</td>
<td>Brown</td>
<td>Lapping &amp; Pre-Polishing</td>
</tr>
<tr>
<td>25</td>
<td>25-FS-40</td>
<td>Mahogany</td>
<td>Rapid Stock Removal</td>
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<tr>
<td>45</td>
<td>45-FS-40</td>
<td>Purple</td>
<td>Rapid Stock Removal</td>
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<tr>
<td>90</td>
<td>90-FS-30</td>
<td>White</td>
<td>Rapid Stock Removal</td>
</tr>
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**DiaMold** Diamond Compound is a diamond polishing compound specially formulated for use in mold & die applications. DiaMold Diamond compound will withstand severe lapping conditions without loss of cutting quality. The use of a stable carrier assures sustained particle suspension throughout the process cycle.

**Hyprez Five-Star** is a universal compound for use in virtually all applications. It is the first diamond compound to combine the excellent cutting ability of natural diamonds and the extended durability of manufactured diamonds in a precision blend that assures faster cutting and long service life.
Standards for surface finishes used in mold making have been established by The Society Of The Plastics Industry, Inc. Above you see a table listing the different finishes. The finishes are achieved starting from “D3” up to “A1”. Following are the SPI finish numbers as they relate to the type of finish.

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<thead>
<tr>
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<tr>
<td>A-1 #3 DIAMOND BUFF</td>
<td>0-1</td>
<td>B-1 #600 GRIT PAPER</td>
<td>2-3</td>
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<tr>
<td>A-2 #6 DIAMOND BUFF</td>
<td>1-2</td>
<td>B-2 #400 GRIT PAPER</td>
<td>4-5</td>
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<tr>
<td>A-3 #15 DIAMOND BUFF</td>
<td>2-3</td>
<td>B-3 #320 GRIT PAPER</td>
<td>9-10</td>
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<tr>
<td>C-1 #600 GRIT STONE</td>
<td>10-12</td>
<td>D-1 #11 GLASS BEAD</td>
<td>10-12</td>
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<tr>
<td>C-2 #400 GRIT STONE</td>
<td>25-28</td>
<td>D-2 #240 ALUM. OXIDE</td>
<td>26-32</td>
</tr>
<tr>
<td>C-3 #320 GRIT STONE</td>
<td>38-42</td>
<td>D-3 #24 ALUM. OXIDE</td>
<td>190-230</td>
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</table>

Photos courtesy of Bales Mold Service

“A1”  “High Polish” finishes (done with diamond compounds)
“A2”  “High Polish” finishes
“A3”  “High Polish” finishes
“B1”  “Paper” finishes (sandpaper, 600 wet)
“B2”  “Paper” finishes (sandpaper, 600 wet)
“B3”  “Paper” finishes (sandpaper, 600 wet)
“C1”  “Stone” finishes (polishing stone up to 600 grit)
“C2”  “Stone” finishes (polishing stone up to 600 grit)
“C3”  “Stone” finishes (polishing stone up to 600 grit)
“D1”  “Dry Blasted” finishes
“D2”  “Dry Blasted” finishes
“D3”  “Dry Blasted” finishes
Photos courtesy of Bales Mold Service
Here Is What We Will Polish

Our basic polishing techniques will take you through the polishing of this plastic injection mold. The mold has been polished to a #1 finish as per the SPI guide on the previous page.

This basic mold requires a reflective finish so that the component will have a good surface when the injection cycle has been completed and also to eliminate possible sticking of the component inside the mold.

The mold pictured above is an example of what the mold will look like after the EDM process. It has the tough crust or scale and pitting that needs to be removed. Pictured below is how our mold will look when the finishing has been completed and the mold is ready for the press.
Here Is What We Will Need

EDM Scale and Pit Removal - Stone Finish Preparation for Diamond Polishing

Step #1 Polishing stone, Hyprez G-EDM 320 grit
Step #2 Polishing stone, Hyprez EDM 320 grit
Step #3 Polishing stone, Hyprez DM 400 grit
Step #4 Polishing stone, Hyprez DS 600 grit
Step #5 Abrasive paper, 600 grit

For each of the stones listed above, you will need a soaking container such as a small bread pan or similar. Place each stone in it's pan and keep separated. Do not mix stones together in one pan! The lubricant we will use is Hyprez Hyprelube polishing stone lubricant.

Here are the power tools needed to complete the stoning operation step #1-5: Reciprocating handpiece, Engis RE-21, P211 Power Pack and Hyprez 299249 vise-type stone holder for the reciprocating handpiece.
**LET'S START…….**

**STONING**

We are going to start the stoning sequence on this mold which is H-13 steel. As already known, the mold has just left the EDM machine and is ready to be finished. The goal will be to bring it up to a #1 finish (refer to the SPI finish guide.) See our finished mold on page 23.

The finish we are beginning will be an EDM finish. The surface has a very hard scale or skin that needs to be removed. Also, EDM leaves "pits" on the surface that need to be removed and made into a smooth, unblemished surface free of any and all defects (see our sample mold on page 16 fig. 2.)

**A little about EDM:**
*EDM stands for Electrical Discharge Machining. The process has revolutionized the mold making industry. Enormous time savings to build the mold is realized and the complexity of the mold leaves little challenge for the EDM process.*

*EDM is a process that utilizes an electrode made of graphite, shaped to the mirror form of the mold cavity. The electrode is "burned" into the mold steel while transforming a flat piece of steel into a sophisticated and complex mold. This is done in a fraction of the time needed by conventional machining methods. Deep pockets, slots and ribs are easily machined into the mold. Now it is up to the polisher to turn the matted gray surface into a surface that will make plastic injection molding possible. The reflective surface not only resists sticking, but will also produce a reflective surface on the part that is made in the mold.*

It is lucky for today's polishers that there are many excellent tools available to make his task a bit easier. One of the tools is the EDM polishing stone. To break through the hard scale left by the EDM process, the EDM stone is the tool to use. Usually orange in color, the EDM stone is available in grit sizes from 120-600 and in different sizes.

Before we start, 4 containers or jars will be required to soak the polishing stones. You will need one container for each grit size used. **DO NOT MIX YOUR STONES!** See page 9 for stone lubricant suggestions.

We are going to use 4 different stones in this process. These are all Engis Hyprez stones: 320 G-EDM, 320 EDM, 400 DM and 600 MS.

**STEP #1**
Let's say that our mold has a rather fine finish, rather than one that has been processed with too much current and will require a coarser stone. We can start with a 320 grit stone. Size of the stone depends on the area being polished. We are going to use the Engis Hyprez G-EDM stone first. This will remove the top layer of hard scale and will leave us with the pit holes that the EDM process produced. Fit the stone in a stone holder. Use the vise-type as shown on page 9. Now place the holder in your profiler. Stone in one direction only until the scale has been removed.
STEP #2
Because we will be using a softer EDM stone with a 320 grit, there is no need to cross cut stone in this step. Stone the surface until the pit holes are completely gone. Keep your stone wet and leave the slurry it produces on the surface. The stone we are using now is slightly softer than the G-EDM and will break down quicker, leaving sharp cutting grains to remove material faster.

CLEAN THE SURFACE COMPLETELY BEFORE CHANGING GRITS!

STEP #3
Cross cut with the 400 grit DM stone at a 90 degree angle from the previous stoning direction. Stone until the stone marks from previous stoning are gone. Remember to keep the stone wet on this step too.

CLEAN THE SURFACE COMPLETELY BEFORE CHANGING GRITS!

STEP #4
Cross the DM stone area with the 600 DS stone in the same manner as the previous step. Be sure not to apply too much pressure in this step and keep the stone very wet. Keeping the stone wet will ensure the stone will not load and make your next step a bit easier.

CLEAN THE SURFACE COMPLETELY BEFORE CHANGING GRITS!

STEP #5
In this step you will use a 600 paper. Cross cut using plenty of lubricant to keep the paper wet and free cutting. The paper sanding is slow and tedious, but necessary to get a good finish.

Many polishers use pressure sensitive adhesive backed paper cut into small strips and pads. They are placed on the end of a wood stick, held in a profiler.

Another tool is called the "Belt Stick". Belt Sticks are made of plastic that holds a continuous looped sanding belt that can be rotated freely by hand to expose fresh paper. These work well because they are easy to hold and change out belts quickly. The tips come in different angles to suit the job on hand.

Now that the stoning process is complete, we need to prepare for the diamond polishing steps.

Take some time to make certain that the area is free of grit, dirt and any contamination. Keep any and all air blast away from the work when diamond polishing. Cover the mold with clean newspaper or cloth when you are not working on it.
Here Is What Will Be Needed To Polish To #1 Finish

Polishing is a very tedious job and requires the know-how and skill developed from years of experience. The professional mold polisher uses equipment and tools that not only make his job easier and efficient, it also enables him or her to complete the job with accuracy and quality.

Today's polishing equipment has been designed with all of this in mind.

- **Angle Head Rotary**
  - Max. 15,000 RPM

- **Standard Rotary**
  - Max. 30,000 RPM

- **Combination DC & Ultrasonic Power Pack**
  - 9, 6, & 3 micron diamond compound

- **Felt bobs, 1/8" & 1/4" shank size. Shape & diameter depends on area to be polished**

- **Diamond compound lubricant/thinner**
Here Is What Will Be Needed To Polish To #1 Finish

Use the cup brush with the angle head rotary for step #6. Use 9 micron diamond with this brush.

Felt discs or bobs can be used in step #8.

Felt pads used with the reciprocating profiler can be used for flat areas and some detail work.

Felt disc holders used with the angle head rotary.

For the last and most important step, you will need tissue. Most preferred is tissue.

PREPARE THE MOLD FOR POLISHING

To finish the mold to the #1 finish, we will need to follow these steps. Remember that it is very important that the work area be kept clean and free of grit, dirt and other contaminants that would otherwise ruin many hours of work.

Having said this, clean the mold thoroughly making certain that all crevices, corners, holes, etc., are also spotless and grit is completely gone.
**LET'S FINISH.......**

**POLISHING**

**STEP #6**
Place a few dots of 9 micron diamond compound on the work piece. Also add a few drops of the lubricant/thinner. Now, with the cup brush mounted in the angle head rotary, power it up and adjust the speed mid-range. The maximum speed, if you will recall, for angle heads is 15,000 RPM. Therefore, a speed of 7,000-8,000 RPM is where you want to start. Watch out that you do not throw the diamond off the brush. If this happens, lower the speed further.

Start moving the brush across the surface slowly. Continue without stopping the lateral movement; doing so will leave swirl marks. When polishing corners, use a end brush; these work well.

Work one direction with the brush raising it periodically to trap the slurry. This method will keep the cup brush cutting action fast. You do not want to just move the slurry around.

Continue the lateral movement using light pressure for about 5-10 minutes. Wipe a small area clean to check the surface to see if the paper marks are gone from the previous step. If not, continue with the brush until the marks are gone.

There is no need to clean the polished area yet. You will use the slurry in the next step with the felt.

**STEP #7**
Don't throw your brush away when you are done. Place it in a container with a lid to keep out contamination. You can use this brush again for another job.

Chuck-up the disc holder into the angle rotary head. The diameter depends on how large of a surface you are polishing. The angle head you are using can handle from 10 to 40 mm diameter disc. Felt discs are available with PSA backing to mount on the disc holder. If you really want to get good use from the felt disc, mount the felt onto an optional Velcro pad and also on the disc holder. This way you can take the felt pad off the holder without disturbing the PSA adhesive and reuse it many times over.

Moisten the felt with lubricant/thinner and run it over the work piece to soak up the diamond slurry. After you have done this, place some new diamond on the work. Run your felt at a right angle to the paper direction. This should remove any leftover marks from the paper step.

You will want to run the felt at a slow to medium speed and use very little pressure. This will prevent what is called "orange peel." Orange peel is caused by heat developed by the felt. Keeping the felt wet and using light pressure will ensure excellent results.

Finish this step off by removing the swirl marks that the brush left. When they are gone,
WE ARE NOW GETTING CLOSE...

STEP #8
In this step, we can either use a 6 micron diamond or a 3 micron diamond. Some polishers would go right to the 3 micron, other may use the 6 micron. If you use a 6 micron, repeat step #7, only make certain that you run your direction at a right angle (90 degrees) from the previous step.

We are almost done with the polishing; just a few more steps. Replace the felt with a new one and then place a few dots of the 3 micron diamond on the work piece. As with the previous operation, moisten the felt with lubricant/thinner and begin the polishing. You will travel in the same direction as the paper step to reduce any lines left by the paper step.

Again, use little pressure and traverse slowly. Continue only until the haze finish from the previous step has disappeared.

STEP #9
This step will require the use of either a felt bob in a hand holder or a felt finger pad. Without removing the slurry from the last step, move in the same direction with your felt finger pad as the last step. Keep moist and rub lightly until the haze from the felt disc or bob is gone.

STEP #10
This is where the tissue comes in. It will be used to finish off the mold, leaving you with a #1 finish.

Fold several pieces of the tissue into 2 or 3 inch squares. Rub the work piece picking up the diamond slurry left from step #9. Continue the rub until there is a nice mirror finish. You can also use cotton with Semichrome polish for the final polish once you have completed step #9.

HERE IS YOUR FINISHED MOLD

LOOKS GREAT!!
TOOLS FOR POLISHING SLOTS, RIBS & SPECIAL AREAS

These special areas require a bit more care, using different tools other than rotary and reciprocating hand pieces.

Today the most popular tool used for slots, ribs and detail areas is the ultrasonic system.

As described on page 7, the ultrasonic is indispensable for use in these complex and difficult areas.

Use the ultrasonic with ceramic stones to remove tough EDM scale in tight areas. Ceramic stones are flexible and resist breakage. It is a fact that this system can save up to 80% time.

Here are some of the tools used with the ultrasonic system making it an efficient time-saving tool.

- Sintered diamond files used for shaping 200-600 grit
- Wood & brass for lapping with diamond
- Plated diamond files
- Ruby & conventional stones
- Ceramic stones
- Round & rectangle ceramic stones
REVIEW OF THE BASIC STEPS

1. Stone out the EDM burn scale with a 320 grit G-EDM stone (Hyprez).
2. Stone cut with the Hyprez EDM stone (320 grit) until the pits from EDM burn are gone. Cut in the same direction as with the G-EDM stone.
3. Using the Hyprez DM stone (400 grit), cross cut at 90 degrees to the EDM stone until marks are gone.
4. Here, use the Hyprez DS stone (600 grit) to remove the stone marks from the previous step, again going across the stone marks of the previous step.
5. A 600 grit paper was used across the previous step’s marks using plenty of lubricant.
6. Step 6 got us into the diamond polish sequence. Here a #9 diamond was used after the mold was completely cleaned and void of any debris or contamination. A cup brush was used with a rotary angle hand piece, micro motor driven with a DC power pack.
7. Using the rotary angle hand piece, we switched to a felt disc. The brush marks from the previous step were worked out completely.
8. This step we switched felt disc and used 3 micron diamond compound to polish out the 9 micron polish.
9. The power tools were put aside and a felt finger pad was used in the same direction of the previous step to remove the marks from the felt disc.
10. We finished with toilet tissue by folding 2-3” squares and rubbing out the remaining compound and until a mirror finish has been reached.

So, there you have it. The basic steps of polishing a mold.

Remember Also:

- Keep your area clean.
- Separate and contain your felt bobs and discs.
- Keep your polishing stones soaked in lubricant, each grit in a separate jar. Do not mix!
- Cover your work whenever you are not working on it.
- Use quality tools and accessories for your job. You will find it doesn't pay to use cheaply-made products. After all, the mold you have polished wasn't cheaply made either!
# Polishing Stone - Applications Chart

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<thead>
<tr>
<th>TYPE</th>
<th>Surface</th>
<th>Tool Steel</th>
<th>Aluminum</th>
<th>Non-Ferrous</th>
<th>Stainless Steel</th>
<th>EDM Method</th>
<th>Hand Profiler</th>
<th>Ultrasonic</th>
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