

Gunsmiths have searched for years for a method of polishing both shotgun bores and chambers to remove roughness and impart a mirror smooth finish. This is done to improve performance and enhance the internal appearance. After extensive testing and field evaluation, the **FLEX HONE** has been developed to meet this need. Because of the unique design of the **FLEX HONE**, a superior finish in the bore or chamber can be obtained quickly and easily. As an added bonus, the only power equipment actually required is a  $\frac{3}{8}$ - $\frac{1}{2}$ " variable speed, electric hand drill! When you get right down to it, the system is so extremely simple and efficient that the most difficult part of the job is explaining the need and benefit of this procedure to a potential customer! Don't overlook this aspect!

We recommend the actual polishing procedure be done in privacy: **NOT** in front of the customer. The reason being that while the normal retail gunsmithing charge is as much as \$40 to \$50 per bore, the job can usually be completed in less than ten minutes. Remember, you're not only selling your actual labor and time but also knowledge and know-how.

### HOW SMOOTH IS SMOOTH?

We often use the phrase, "as smooth as glass", yet glass is not really very smooth! In fact, it's quite rough. To prove this point, perform the following simple experiment. Select a piece of glass such as a windowpane, glass desk top or even a mirror. Using the forefinger and middle finger, very lightly slide your fingers across the surface of the glass. It will feel smooth. Now, remove the cellophane wrapper and repeat the performance.

When you use the cellophane, it will feel as tho' the glass surface was covered with sand! This is the true surface, as the cellophane has simply amplified the roughness of the glass to the nerve endings in your fingertips. In effect, you are using a mechanical aid to the nerve endings in the same manner that a microscope would aid your eyes.

We also speak of a surface having a "mirror finish". In reality, what we see is an optical illusion. Apparent smoothness can be dependent upon the point and distance from which a surface is viewed. For example: a plowed field viewed from a distance and 90° from the plowed rows will appear quite smooth. This changes drastically if we view that same field from 0° and straight down the rows. Optical illusions are created by both the point of view and distance. Bear with us a bit longer and you will understand what all this has to do with a shotgun barrel bore.

We often refer to a tool as "cutting metal cleanly". Again, looks can be quite deceiving. A tool does not "cut" or "slice" metal. Actually, metal is torn away by the cutting tool. Under magnification it is quite apparent that the tool leaves a very rough and jagged surface. There are **NO** exceptions to this.

### THE SHOTGUN BARREL

A shotgun barrel is normally constructed in the following manner. First, a barrel blank is drilled, removing the bulk of the unwanted material. Next, the bore of the blank is reamed to size either one or more reamers. The reamers tear bits of metal from the bore wall as they rotate through the barrel leaving behind a jagged surface. In addition, their rotation "plows" very thin furrows into the wall in a circular pattern.

Even with all these "imperfections", if we were to look through the freshly reamed bore, it would appear to be highly polished and have a "mirror finish". In reality, we are viewing the surface from a distance and we are looking at the circular imperfections from a 90° angle; the same way we viewed the plowed field. What you see is **NOT** what you have!

### PLATEAUIING

Before we go further, we need to look at a few terms which are essential to our understanding of the **FLEX HONE**. **PLATEAUIING** has to do with achieving a flat plane or flat surface. For our purposes, **MICROSTRUCTURE** relates to viewing a surface directly from above through a magnifying instrument such as a microscope and thus seeing the composition of the material

# BROWNELLS® FLEX HONE® SYSTEM

FLEX-HONE SIZE	FINE BORE	MED. BORE	CHAMBER	ONE GA. SET
10 ga	#080-607-210	#080-606-110	#080-608-510	#080-605-010
12 ga	#080-607-212	#080-606-112	#080-608-512	#080-605-012
16 ga	#080-607-216	#080-606-116	#080-608-516	#080-605-016
20 ga	#080-607-220	#080-606-120	#080-608-520	#080-605-020
.410	#080-607-241	#080-606-141	#080-608-541	#080-605-041

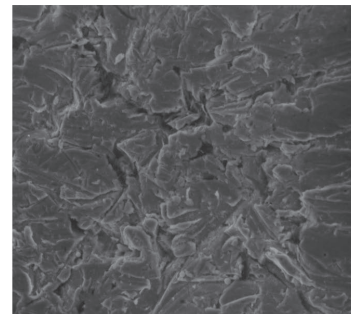
READ & FOLLOW THESE  
**INSTRUCTIONS**

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in minute detail. **MICROPROFILE** is basically the same except that the observation is made from a side rather than from directly above.

The following photographs are of the Microstructure of a shotgun barrel bore viewed under magnification. The left one shows the jagged surface of the metal resulting from the normal tearing of the material by the tool bits during manufacturing. The right shows the bore surface vastly improved after application of the **FLEX HONE**. If viewed from the end of the barrel, the



"As Manufactured" shotgun barrel at 1000X magnification shows rough surface from normal tooling.



The same barrel at 100X magnification after **FLEX HONE**ing. Note removal of most of the "peaks".

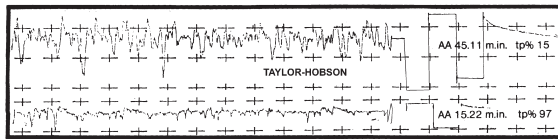
untouched barrel would appear "mirror smooth" when, in reality, it is not. After using the **FLEX HONE** the bore would appear somewhat smoother, although the Microstructure of the bore surface is much, much smoother.

If we were to cut a section of a shotgun barrel and make a Microprofile of

the surface, it would look similar to the Rocky Mountains; that is, a series of high peaks and deep valleys. If we drew an imaginary line through the center of the profile, we would obviously have peaks extending above and valleys below the line.

In the measurement of a Microprofile, some yardstick or unit of measurement is a necessity: so the term "AA" is used and simply means the highest peak and lowest valley. Next, a number is added after AA, such as 45.11 M. in.. This number is a measurement, in Microinches (M.in.), from the top of the highest peak to the bottom of the lowest valley. Obviously, if the number is smaller, this would mean fewer high peaks or a series of "plateaus". Thus, a low AA number and more plateaus would indicate a smoother surface. The second unit of measuring is "TP%" which is the percentage of the surface area that is made up of plateaus. The greater the percentage, the smoother the surface. A theoretically "perfect", smooth surface would have a TP% of 100.

The **FLEX HONE** actually removes the tops of the peaks during the honing process. This lowers the AA number and since we have turned sharp peaks into plateaus, we increase the TP% in the process. The accompanying Microprofile is that of a semi-automatic shotgun barrel manufactured by a well-known arms company. The barrel is new, right out of the box. The top measurement is "as received"; the bottom measurement of the same area



Top graph shows "Peaks and Valleys" in an "As Manufactured" shotgun barrel. Lower graph is the same barrel after FLEX HONEing. "Peaks" have been greatly reduced.

is after polishing with a **FLEX HONE**. Note that the top scale shows an AA reading of 45.11 M.in. from the top peak to the lowest valley point. After **FLEX HONEing**, the AA scale has been reduced to 15.22 M.in., slightly more than a 300% improvement in smoothness! The top scale of the "as received" barrel has a TP% of 15 of the area scanned. After **FLEX HONEing**, the total plateauing percent of the area has been increased to 97% resulting in a 650% enlargement of plateaued surfaces.

## THE PRACTICAL EFFECTS OF PLATEAUIING

The practical benefit is that by reducing the peaks, we decrease friction. Friction is the prime enemy of efficiency as it offers undesirable resistance to any object moving across a surface. The one-piece plastic shot protector acts somewhat like a piston as it moves down the shotgun bore. If we decrease resistance or friction, we obviously allow the shot protector to move down the bore more efficiently and consistently. This will increase shotshell performance and enhance the shot pattern uniformly.

One other factor well worth noting relates to the plastic fouling in the bore. Anyone looking at the end of a shotgun barrel after several shots have been fired will notice streaks of plastic that have been stripped from the shot protector adhering to the bore surface. This plastic buildup will slowly increase and thereby change the choke diameter to bore diameter ratio which in turn, adversely affects the shot pattern. The plastic fouling is due to a rough bore surface. Plateauing with **FLEX HONE** virtually eliminates this problem resulting in much more consistent patterns. In addition, the entire bore is more easily cleaned, since less foreign matter will adhere to the surface.

## CROSS HATCHING

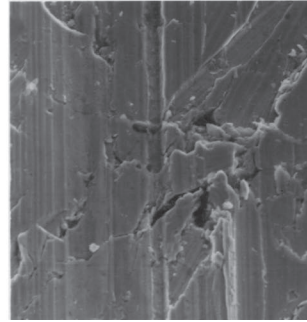
The many circular grooves cut into the bore walls during the drilling and reaming operation remain unseen under normal conditions. If you were to cut open a shotgun barrel, the imperfections are easily visible with the unaided eye and more so under magnification. These indentations or circular scratches are a breeding ground for rust. As the rust accumulates, it slowly builds up and presents an obstruction to the shot protector as it moves down the bore. Friction inside the bore is dramatically increased. In addition, the rust is often covered by plastic particles stripped from the shot protector and continues to develop despite all cleaning efforts. Needless to say, this is more easily cleaned, since less foreign matter will adhere to the surface.

You cannot remove a scratch in metal. The only way to eradicate it is to reduce the surface around the scratch by polishing until that surface is of equal depth to the pit or scratch. If you polish with or parallel to the scratch, its depth will increase as you remove the surrounding surface material. Angle polishing eliminates this possibility.

The **FLEX HONE** is constructed to automatically hone a circular scratch depth. You are, in effect, producing a multitude of additional very fine scratches and at the same time, reducing the height of the surrounding surface. This results in a much smoother surface as well as the elimination of the initial scratch.

The first photo below (at the 1000X magnification) shows such original circular scratches. The second photo (at the 100X) is of the same area and

was taken after **FLEX HONEing**. The original scratches were virtually eliminated by the cross hatching effect of the **FLEX HONE**.



At 1000X circular scratches are evident.



After **FLEX HONEing**, scratches are replaced by cross hatch (100X).



## WARNING



Never attempt to disassemble or reassemble a firearm unless you are absolutely certain that it is empty and unloaded. Visually inspect the chamber, the magazine and firing mechanism to be absolutely certain that no ammunition remains in the firearm. Disassembly and reassembly should follow the manufacturer's instructions. If such instructions are not immediately available, contact the manufacturer to see if they are available. If they are not available at all, then you should consult other reference sources such as reference books or persons with sufficient knowledge. If such alternative sources are not available and you have a need to disassemble or reassemble the firearm, you should proceed basing your procedures on common sense and experience with similarly constructed firearms.

With regard to the use of these tools, the advice of Brownells Incorporated is general. If there is any question as to a specific application it would be best to seek out specific advice from other sources and not solely rely on the general advice and warnings given.

## THE FLEX HONE - AND HOW TO USE IT

The reaction to the **FLEX HONE** upon seeing it for the first time is usually one of skepticism because of its simplicity and uncomplicated appearance. It is a cylindrical hone with a "soft" cutting action as opposed to the heavy grinding or shearing action of a rigid hone. It consists of a twisted steel rod covered with a tough nylon sheath to prevent damage to the shotgun bore. On the hone end, nylon bristles used with each hone nodule to provide a constant spring pressure, are bonded to the twisted wire shaft. The series of bristles and nodules are attached at an angle to increase the spring pressure as well as to enhance cross hatching. Rotation is normally provided with a 3/8" variable speed electric drill.

The **FLEX HONE** has a number of notable features. It provides constant pressure to the walls of the bore. Most importantly, it removes "peaks" and creates a plateau surface as well as polishing away any surface distortions.

The **Barrel FLEX HONE** consists of two grits; - **Medium-Coarse** for bores that are pitted or exceptionally rough, and **Fine** for new bores or to provide the final polishing touches to a bore that has already been honed with the **Medium-Coarse** tool. It is available in diameters of approximately .803" for 12 gauge; .737" for 16 gauge; and .682" for 20 gauge. Use of a larger diameter hone in a smaller bore is also **not** recommended since the excessive pressure will cause rapid wearing of the nodules. In selecting the appropriate grit, follow the old rule of using the minimum grit that will get the job done.

The **Chamber FLEX HONE**, available in **fine** only, is sized approximately .853" diameter for 12, .803" for 16 and .737" for 20 gauges. Use the **FLEX HONE** for the designed gauge for the reasons already presented. The use of a **Barrel FLEX HONE** in a **chamber** is **not** recommended as it will not provide adequate pressure to the nodules.

When received, remove approximately 1" of the nylon sheath covering the rod from the end opposite the hone. This is to provide good contact surface with the drill chuck. When not in use, the tools should always be stored in a rack to prevent damage to the hone. The 32" length of the bore tool is sufficient for most barrel lengths. The tool may be started from either the chamber or muzzle end of the barrel. In normal use, insertion from the chamber area is preferred since it is somewhat easier.

The **special FLEX HONE Oil** **MUST ALWAYS** be used for maximum cutting efficiency and to prolong tool life. The oil is specifically blended for this purpose and contains special honing and lapping oils, plus an anti-galling agent, a moisture dispersant and a non-ionic surfactant to assure proper lubrication of the surface and to keep metal particles and contaminants in suspension. When used with the **FLEX HONE**, a slurry is created that

accelerates the honing action of the tool and is extremely important. Use sparingly, as only a small amount is needed to create the slurry. Do not clean away this slurry during the honing process! **NOTE YOU MUST USE FLEX HONE OIL - ALL OTHER OILS WILL DESTROY THE ABRASIVE "BALL" AND VOID ALL GUARANTEES!**

Before starting the honing process, clean the bore of any powder fouling, leading and plastic fouling. The bore should be **CLEAN** and **DRY** before honing. Leaving any traces of bore cleaner or solvent may cause breakdown of the abrasives and **MAY DESTROY THE ABRASIVE "BALL" AND VOID ALL GUARANTEES!**

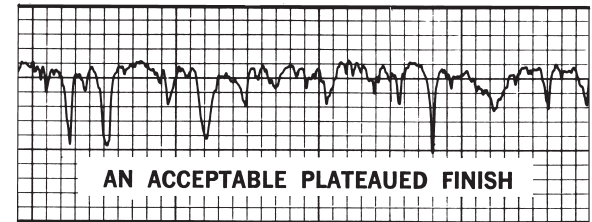
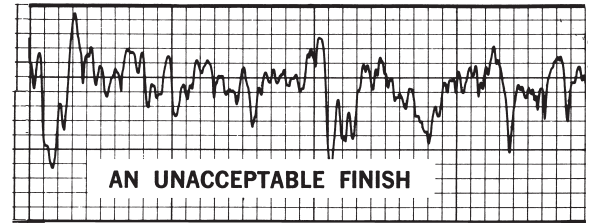
With the hone shaft chucked in a drill and the barrel secured in a horizontal position in a padded vise, apply **FLEX HONE Oil** sparingly to the hone. Insert the hone in the chamber and then, starting the drill at slow speed, move the hone into the bore of the barrel. Increasing the speed of the drill to  $\frac{3}{4}$ -full speed, allows the tool to begin honing as you push the hone slowly but steadily toward the muzzle. When it reaches the muzzle, allow it to protrude slightly from the bore. Pull it back through the bore at the same slow and steady rate as it rotates at  $\frac{3}{4}$ -full speed. Repeat this three or four times and then remove the hone. Clean the bore with mineral spirits, TCE or similar cleaner to remove oil slurry; follow with clean patches until all oil and residue is removed. Now, closely examine the bore. The sequence may be repeated as many times as you think necessary for the completion of the job.

Full plateauing is normally obtained within a very short time, one minute or so of using the **FLEX HONE** in the bore. If circumstances dictate, two minutes may be necessary but the plateauing effect is diminished thereafter and little is achieved with the same grit tool. Honing and plateauing is normally at a maximum when first using the Medium hone for two minutes followed by the Fine grit hone for an additional two minutes. The honing action, while obtaining the desired plateauing effect, actually removes very little metal. In fact, there is so little enlargement of the bore that measurement of this is extremely difficult even with a very precise bore micrometer. For all the practical purpose, the dimensional change is of no consequence and can be ignored. The smoother bore - actual, not illusionary - will give superior pattern results after **FLEX HONEing** if compared to patterns produced prior to **FLEX HONEing**.

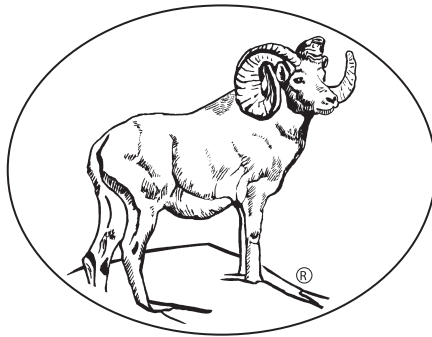
All of us at Brownells are very proud of the **FLEX HONE** System and believe that it will be of great benefit to you and your customers. If you have any questions, problems, comments or suggestions, don't hesitate to contact

our Technical Support Department.

Reassemble the firearm according to the manufacturer's instructions. Check for proper functioning using **ACTION PROVING DUMMIES**. Make sure **ALL SAFETY MECHANISMS** are fully functional as designed and approved by the manufacturer. If these tests prove satisfactory, test-fire the firearm with live ammunition in a **SAFE** and **APPROPRIATE** manner. **IMPORTANT!** Start the live ammunition tests by first loading an **ACTION PROVING DUMMY**, then a live round, into the magazine. Only after several tests have been conducted in this manner should additional rounds be placed in the magazine and fired.



The difference between an acceptable all "valleys"; no "peaks" plateaued finish and an un-**FLEX HONEd**, barrel.



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