

FLEX-HONE[®]

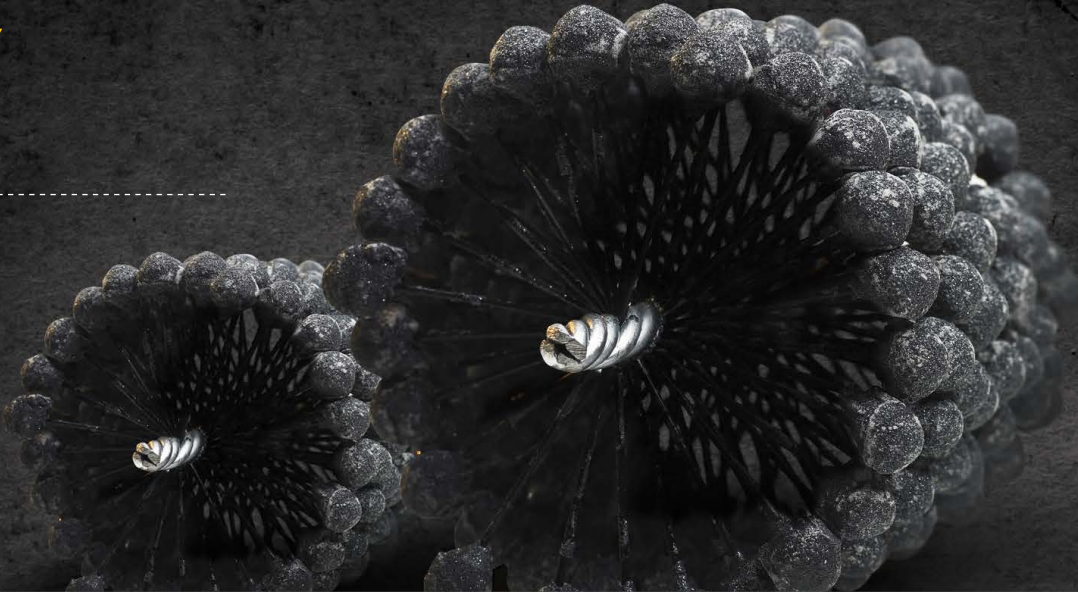
RESOURCE GUIDE

Information on Tool Selection, Grit Selection,
Suggested RPM's and More

GENERAL APPLICATION AND SELECTION OF THE

FLEX-HONE[®]

TOOL



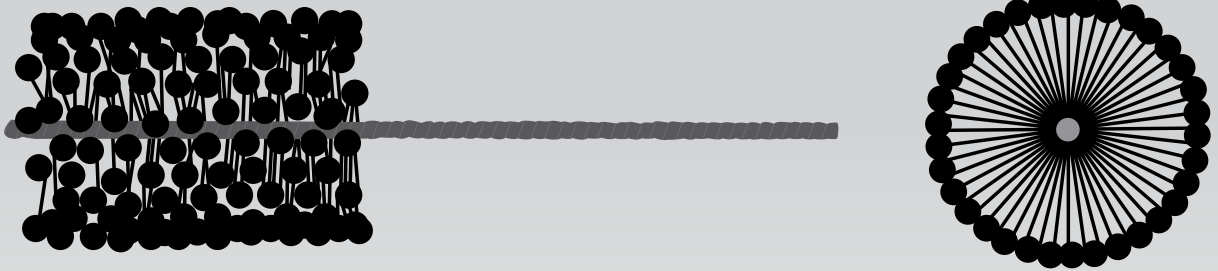
The Flex-Hone[®] Tool is a resilient, flexible honing tool used to improve the internal surface finish while also being able to deburr a bore or cylinder. It is comprised of abrasive globules laminated onto the ends of flexible nylon filaments. Its unique construction allows the tool to be self-aligning, self-centering and self-compensating for wear. The tool provides the benefit of removing loose, torn and folded metal and creating a substantially flat or plateau surface. An additional important application for the Flex-Hone Tool is burr removal from cross-drilled holes and slots.

The Flex-Hone Tool is manufactured in 8 different abrasive types and 11 different grit options in a wide selection of sizes to work on a broad variety of base materials and surface finish requirements. The tool is produced in diameters from 4mm to 36".



DIAMETER SELECTION

Tool diameter is determined by the nominal bore size in which the tool is to operate. The Flex-Hone Tool is always produced and used in an oversize condition. The degree of oversize creates a soft cutting action. **For example, a 1" Flex-Hone size is ordered if a 1" bore is to be finished and the tool is provided oversized. If the bore size is between standard Flex-Hone sizes, the next larger standard Flex-Hone should be selected.** For instance, if the nominal bore is 1.093", then the 1-1/8" Flex-Hone is ordered.



ABRASIVE SELECTION

IF THE BASE MATERIAL IS:

BRUSH RESEARCH SUGGESTS:

Mild steel, stainless steel and cast iron

Silicon Carbide

Aluminum, brass, bronze and softer metals. For deglazing Nikasil cylinders, we suggest 240 AO

Aluminum Oxide

Low carbon to medium carbon steels, stainless steel and cast iron.

Zirconia Alumina (Z-Grain). Z-Grain is also beneficial when you are looking for longer tool life than SC

Medium to high carbon steels and heat-treated steels to 50 Rc. It is also useful in titanium.

Boron Carbide

For a final polish on many materials

Levigated Alumina

For carbide, ceramic, hardened tool steel

Diamond

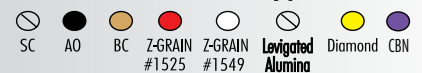
For high nickel alloy steels

CBN

OTHER ABRASIVE OPTIONS:

Ceramic available on special request. Ideal for harder materials.

Abrasive Type



Color Marked on Stem of Hone

GRIT SELECTION

The amount of work to be performed and the degree of surface finish improvement required govern grit selection. Coarse finishes may require progressively finer Flex-Hones to meet final surface finish requirements. In very general terms, final finish will be in the following ranges. This chart is intended to offer a starting point in selecting a grit but the final selection must be verified by actual trial.

GRIT

FINISH RANGE

800-LA (2500 MESH)	Ra 3-10 (.05 – .2 Micrometer)
600	Ra 8-12 (.2 – .3 Micrometer)
400 (800 MESH)	Ra 10-20 (.3 – .6 Micrometer)
320	Ra 18-30 (.5 – .7 Micrometer)
240	Ra 24-32 (.6 – .8 Micrometer)
180 (170/200 MESH)	Ra 30-40 (.7 – 1.0 Micrometer)
120	Ra 35-50 (.9 – 1.4 Micrometer)
80	Ra 45-64 (1.2 – 1.6 Micrometer)
60	Ra 60-80 (1.5 – 2 Micrometer)
40	Ra 70-125 (1.7 – 3.2 Micrometer)
20	Ra 125-250 (3.2 – 6.3 Micrometer)

Grit Type



Color Marked on Tip of Hone

ABRASIVE/GRIT OPTIONS

GRIT SIZES

ABRASIVE TYPES

	20	40	60	80	120	180	240	320	400	600	800
SC = Silicon Carbide	X	X	X	X	STANDARD			X	X	X	
AO = Aluminum Oxide	X	X	X	X	X	X	X	X	X	X	X
BC = Boron Carbide	X	X	X	X	X	X	X	X	X	X	X
Z Grain - Alumina Zirconia											
No. 1525 (25% Zirconia/75% Alumina)			X	X	X	X	X				
Z Grain - Alumina Zirconia											
No. 1549 (40% Zirconia/60% Alumina)					X	X	X				
Diamond	Diamond is available in mesh 170/200, 800 and 2500										
Levigated Alumina	Available in extra fine grit only										
CBN	Available in mesh 170/200, 800, 2500										
Ceramic	Available on special order										

SUGGESTED RPM

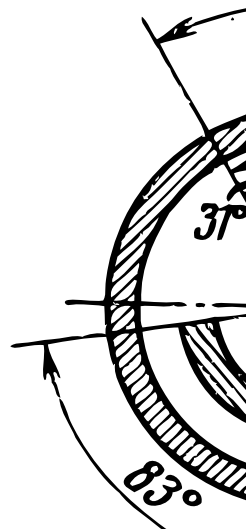
HONE DIA.

RPM

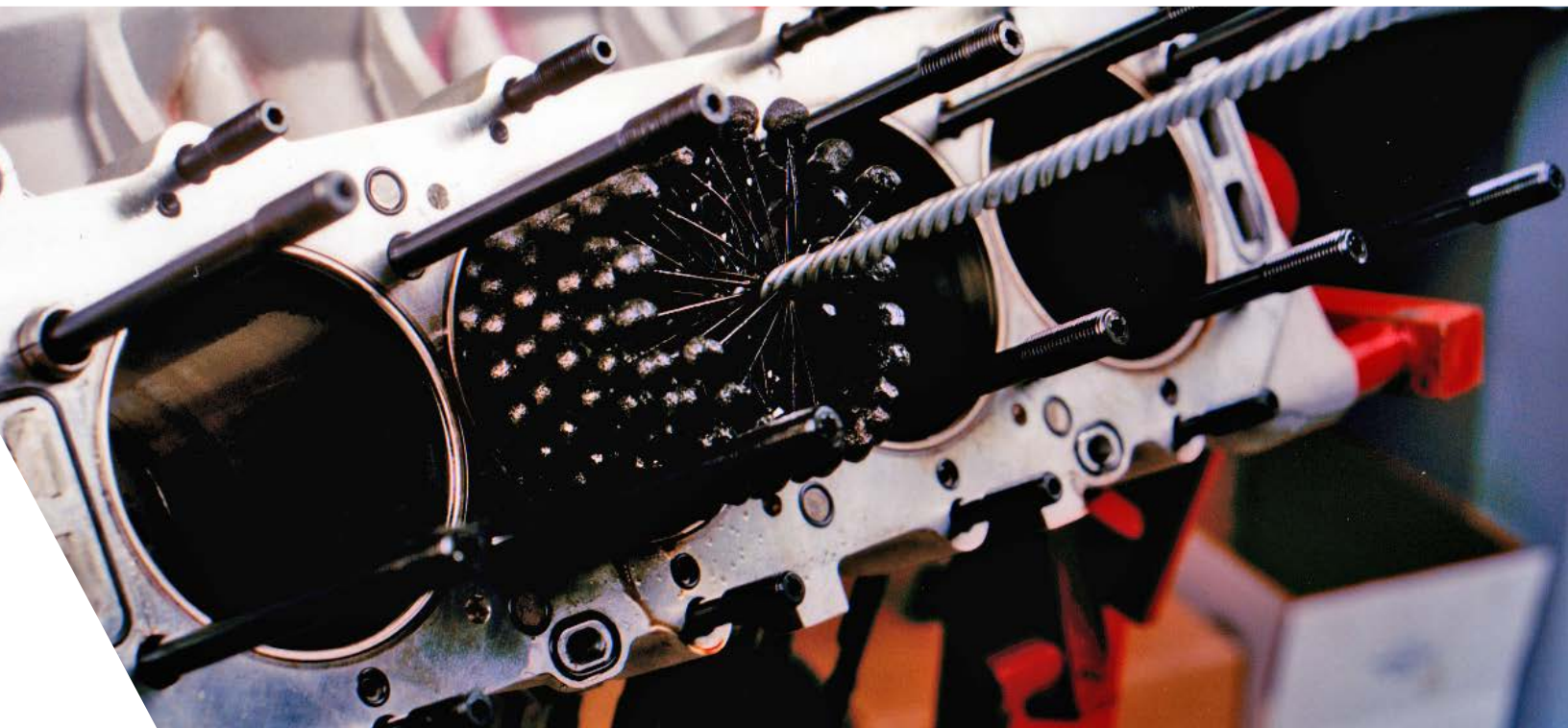
The Flex-Hone Tool is a low RPM tool. Specific RPM is dependent on the diameter of the tool and the application. General speed ranges are given but, again, machine trials are required to verify the parameters.

The smaller the hone, the faster the speed.
The larger the hone, the slower the speed.

Hone Dia.	RPM
19" to 36"	60 - 120 RPM
12" to 18"	125 - 200 RPM
8" to 11"	225 - 300 RPM
4" to 7 1/2"	350 - 600 RPM
2" to 3 3/4"	600 - 900 RPM
1/2" to 2"	900 - 1,000 RPM
4mm to 1/2"	1,000 - 1,200 RPM

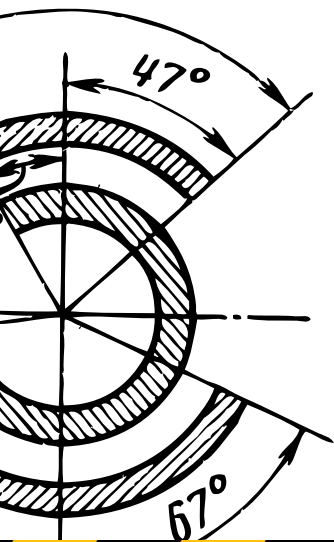


ITS UNIQUE CONSTRUCTION ALLOWS THE TOOL TO BE SELF-ALIGNING, SELF-CENTERING AND SELF-COMPENSATING FOR WEAR.



SUGGESTED STROKE RATE

Stroke rate is a function of Flex-Hone diameter, stroke length and cross hatch angle specification, if any. High crosshatch angles require faster stroke rates. The larger diameter tools might feed as slow as 100-120 IPM while the smaller diameter tools with high cross hatch angles might require feed as high as 250 IPM.



SUGGESTED LUBRICATION

The Flex-Hone Tool **always requires the use of a lubricant or honing oil**. Finer surface requirements dictate better quality honing fluids be used. BRM offers a very high quality oil specifically developed for the Flex-Hone Tool, which is our Flex-Hone Oil. Other acceptable fluids include: water soluble oils, mineral oils, motor oils and cutting and tapping fluids. The goal is to prevent tool loading and to ensure exposure of fresh cutting particles. Solvents should be avoided, as they tend to degrade the adhesive bond in the tool.

FREQUENTLY ASKED QUESTIONS ABOUT THE FLEX-HONE® TOOL

HOW EASY IS IT TO USE?

It is very easy to use. The abrasive globules each have independent suspension that assures the Flex-Hone to be self-centering, self-aligning to the bore and self-compensating for wear. No time-consuming training or setup is needed.

WHAT'S THE DIFFERENCE BETWEEN A FLEX-HONE® AND A BALL HONE®?

There is no difference. The Flex-Hone and Ball Hone are both trademarked names for our tools. We market the tool under the name Flex-Hone, but a common name is Ball Hone. Some people also refer to the tool as a dingleberry hone, grape hone, bead hone, bottle brush hone, glaze buster/breaker hone, or flexible hone, but we do our best to dissuade the usage of those terms and to promote Flex-Hone. In any case, if it says BRM, you've got the best.

WHAT RPM DO I SPIN IT AT?

The RPM will vary with the size of the tool and will range from 60-1200 RPM. The smaller the hone, the faster the speed. For a 1" tool, for instance you will want to be at around 800 RPM, for a 3" tool, you should be near 700 RPM, for a 6" tool, you'll be nearer to 450 RPM and so on. These are just guidelines and optimal performance for each specific application will be found with a bit of experimentation and testing.

HOW DO I KNOW WHAT GRIT/ABRASIVE TYPE I HAVE?

The grit and abrasive type is identified by two key markings, one on the stem and one on the tip. The stem markings identify the abrasive type and the tip markings identify the abrasive grit.

WILL IT REMOVE TOO MUCH MATERIAL?

No. The Flex-Hone is a surface finishing tool, not a material removal tool. We are reducing the rough peaks of a surfaces microstructure and typically we only remove a small amount of material.

WHY IS THE TOOL I GOT LARGER THAN WHAT I ORDERED?

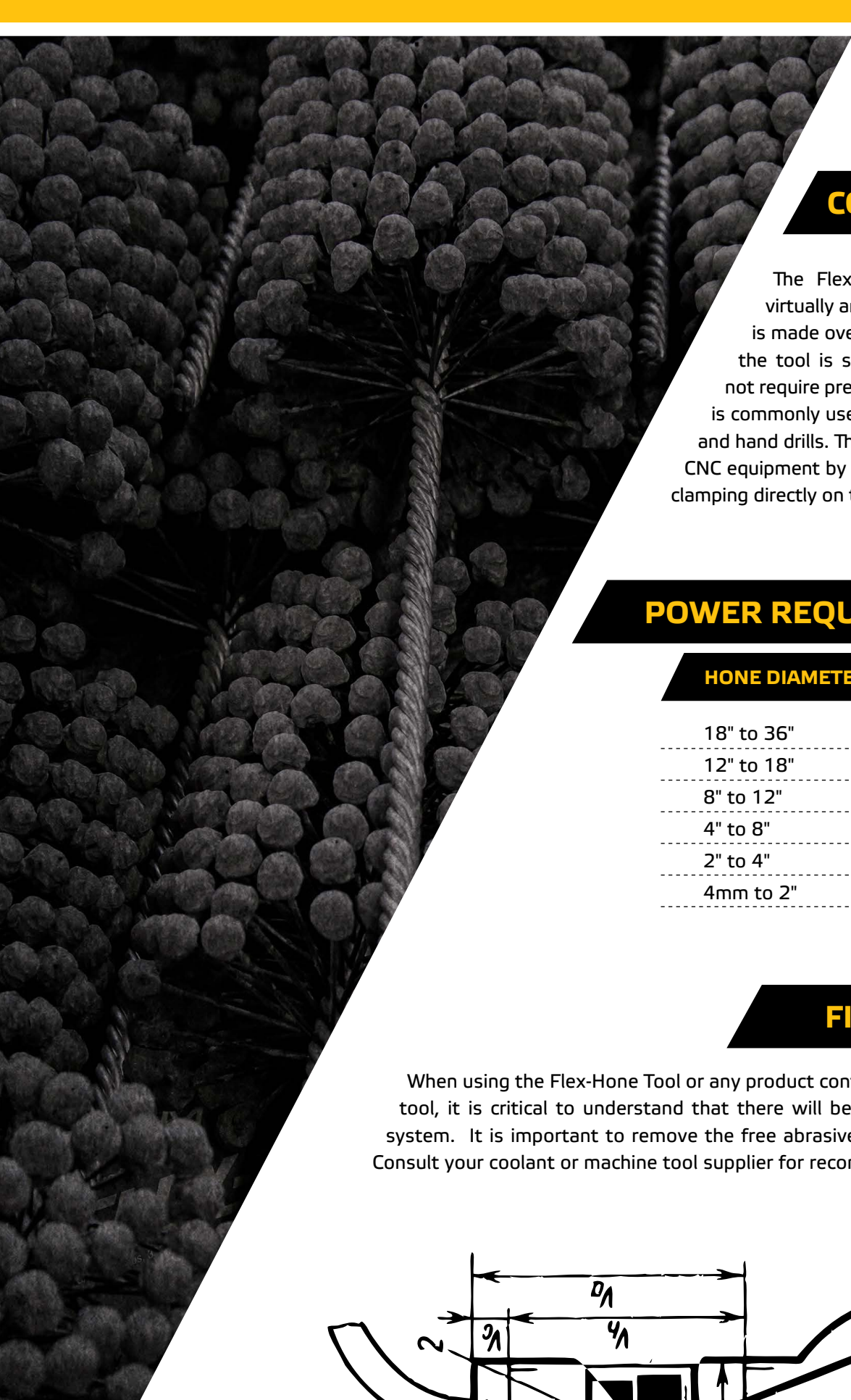
Because the tool needs to be slightly oversized to function properly. The tools should always be ordered to the true ID of the bore to be worked, and then they are manufactured with the correct oversize.

I HAVE A TAPERED OR A STEPPED DIAMETER HOLE. WHAT CAN I DO?

Contact us. We can design and manufacture tapered Flex-Hone Tools and stepped or multi-diameter Flex-Hone tools in any of our abrasive types and grits.

HOW LONG DOES IT LAST?

This is a very frequently asked question and the hardest to answer as there is no single answer. For many end users, one Flex-Hone Tool will last forever. For our high volume OEM customers, however, this is a bigger issue. The life of the tool will vary due to the following: Tool diameter, grit size, abrasive type, beginning roughness of the work piece, desired roughness of the work piece, stroke rate, rpm, material type, lubricant used, and many more. If you need more tool life for an ongoing application, please contact our technical staff to help you determine key points that may improve the longevity or number of parts worked per tool.



COMMON SETUPS

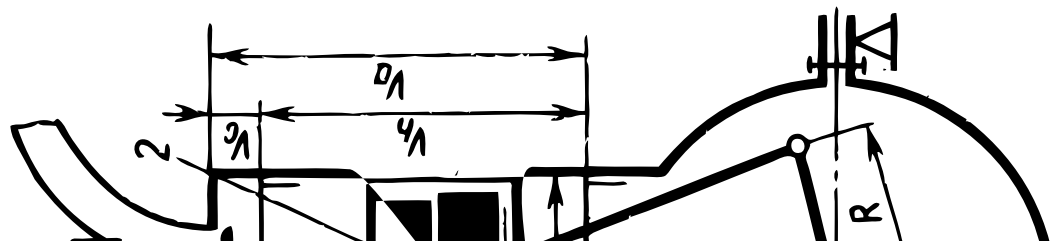
The Flex-Hone Tool can be used in virtually any rotating spindle. Because it is made oversized for any given diameter, the tool is self-centering so the parts do not require precision fixturing. The Flex-Hone is commonly used in lathes, mills, drill presses and hand drills. The tool can also be mounted in CNC equipment by means of a Jacobs type collet clamping directly on the stem wire.

POWER REQUIREMENTS

HONE DIAMETER	HORSEPOWER
18" to 36"	1-½ hp to 5 hp
12" to 18"	¾ hp to 1-½ hp
8" to 12"	½ hp to ¾ hp
4" to 8"	⅓ hp to ½ hp
2" to 4"	¼ hp to ⅓ hp
4mm to 2"	⅙ hp to ¼ hp

FILTRATION

When using the Flex-Hone Tool or any product containing abrasive on a machine tool, it is critical to understand that there will be free abrasive in the coolant system. It is important to remove the free abrasive by means of coolant filters. Consult your coolant or machine tool supplier for recommendations on filtration.



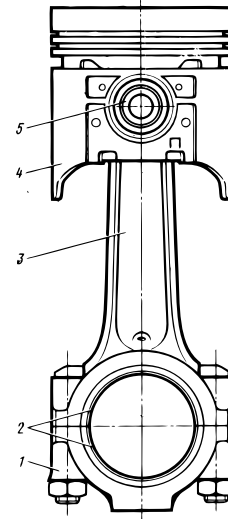
UNDERSTANDING SOME OF THE FLEX-HONE® BENEFITS

THE FLEX-HONE IS USED TO DEGLAZE CYLINDER WALLS.

What is Deglazing?

In a gasoline or diesel engine, the pistons ride up and down within the engine maintaining a tight seal via the piston rings. Over time, the constant rubbing of the rings against the cylinder wall can polish it to a very smooth finish. This creates problems in two ways. First, the lubricating oil in the engine will not adhere properly to the mirror smooth surface, and friction is increased. Secondly, while breaking in newly installed piston rings, a minute amount of wear must occur between rings and cylinder wall in order to seat the rings properly, and ensure a gas-tight seal. If the cylinder walls are too smooth, this wear will not occur, with the rings "skating" over the polished surface.

In order to correct the situation, a mechanic can take the engine apart, and deglaze the cylinders, with a Flex-Hone Tool. This creates a roughly 45 degree angle crosshatching of tiny grooves in the cylinder wall, and restores the engines performance.



THE FLEX-HONE IS ALSO USED FOR CROSS HOLE DEBURRING.

What is Cross Hole Deburring?

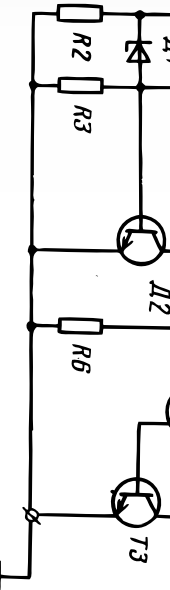
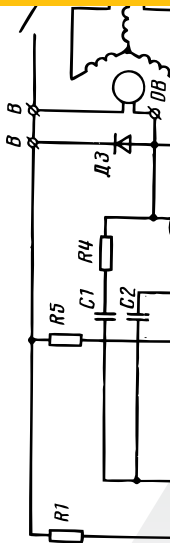
Metal is machined using many processes in order to create pieces of specific shape and size. For example, metal may be drilled, welded, molded, cast, trimmed, slit or sheared. These procedures often create ragged edges or protrusions. The raised particles and shavings that appear when metal blanks are machined are referred to as burrs, and the process by which they are removed is known as deburring.

Deburring may be accomplished by one of several methods. Abrasive substances may be applied, or abrasive cloths may be used to rub the metal in order to remove thin shavings and small notches, as well as to polish the piece.

Deburring and polishing may be necessary for more than one section of a metal component, since burrs and shavings can occur on seams as well as edges. All surfaces need to be completely smooth.

Deburring is important for quality, aesthetics, functionality and smooth operation of working parts. It is also important for safety. Even a small notch can cause moving parts to catch, creating the potential for accident, injury or unnecessary delay in production. Rough edges can also cause injury when individuals are required to handle blanks. Each of these preventable problems can cost companies a great deal of money.

Deburring greatly improves the quality and functionality of metal and wood pieces, making it a necessary use of time and a cost effective process.

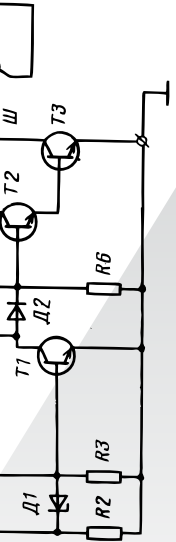


THE FLEX-HONE IS USED TO IMPROVE SURFACE FINISH AND CREATE A PROPER PLATEAU FINISH.

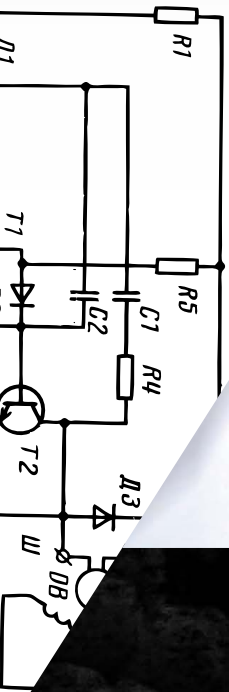
What is a Plateau Finish?

BRM pioneered the concept of a plateau finish and is a strong supporter of the benefits of a cross hatch plateaued finish. The concept involves removing the peaks produced by prior machining operations and creating a substantially flat or plateau finish. A plateau finish created by the elimination of peaks allows rings and seals to seat without damaging their edges. The cross hatch pattern will aid in lubrication control and retention, reduce seepage in hydraulic and pneumatic applications and promote longer seal life.

The Flex-Hone Tool is available in a variety of abrasive types and grit selections to provide the optimum surface finish on any base material. Using the Flex-Hone Tool for surface finishing allows the sizing tools to do their jobs quickly and accurately without fighting surface finish. The Flex-Hone is also used in adhesive bonding applications where a rougher surface is desired for bonding integrity.



CROSS HOLE DEBURRING TIP



When deburring cross drilled holes using the Flex-Hone, it is helpful to first stroke and rotate the tool in a clockwise direction and then remove the tool from the bore, reverse the spindle and then stroke and rotate in a counterclockwise direction. This promotes a more symmetrical deburring pattern and prevents the burr from folding back into the cross-hole.

THE TOOL PROVIDES THE BENEFIT OF REMOVING LOOSE, TORN AND FOLDED METAL AND CREATING A SUBSTANTIALLY FLAT OR PLATEAU SURFACE.

SIZE INFORMATION



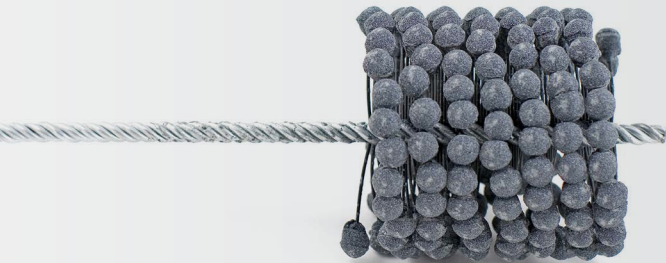
BC FLEX-HONE®
STANDARD DUTY
4MM - 3/16" ARE 6"
OAL
BAL. 8" OAL



Order by Bore Size

Catalog Number	Catalog Number	Catalog Number
BC 4mm (.157")	BC 12mm (.472")	BC 1 1/2" (38mm)
BC 4.5mm (.177")	BC 1/2" (12.7mm)	BC 1 5/8" (41mm)
BC 3/16 (4.75mm)	BC 14mm (.552")	BC 1 3/4" (45mm)
BC 5mm (.197")	BC 5/8" (16mm)	BC 1 7/8" (48mm)
BC 5.5mm (.217")	BC 18mm (.709")	BC 2" (51mm)
BC 6mm (.234")	BC 3/4" (19mm)	BC 2 1/8" (54mm)
BC 6.4mm (.250")	BC 20mm (.787")	BC 2 1/4" (57mm)
BC 7mm (.276")	BC 7/8" (22mm)	BC 2 3/8" (60mm)
BC 8mm (.315")	BC 15/16 (23.8mm)	BC 2 1/2" (64mm)
BC 9mm (.354")	BC 1" (25.4mm)	BC 2 5/8" (67mm)
BC 9.5mm (.375")	BC 1 1/8" (29mm)	BC 2 3/4" (70mm)
BC 10mm (.394")	BC 1 1/4" (31.8mm)	BC 2 7/8" (73mm)
BC 11mm (.433")	BC 1 3/8" (35mm)	BC 3" (76mm)

GB FLEX-HONE®
STANDARD DUTY – 13 1/2" OAL



Order by Bore Size

Catalog Number	Catalog Number
GB 3 1/4" (83mm)	GB 4 1/8" (105mm)
GB 3 1/2" (89mm)	GB 4 5/8" (118mm)
GB 3 3/4" (95mm)	

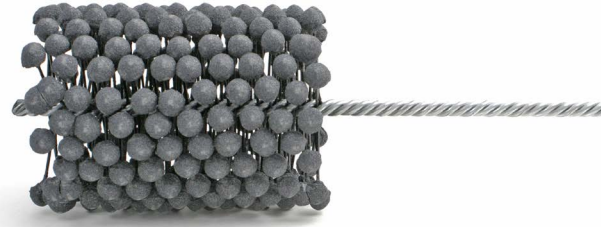
Order by Bore Size

Catalog Number	Catalog Number
GBD 3" (76mm)	GBD 5" (127mm)
GBD 3 ¼" (83mm)	GBD 5 ½" (140mm)
GBD 3 ½" (89mm)	GBD 6" (152mm)
GBD 3 ¾" (95mm)	GBD 6 ½" (165mm)
GBD 4" (101mm)	GBD 7" (178mm)
GBD 4 ¼" (108mm)	GBD 7 ½" (190mm)
GBD 4 ½" (114mm)	GBD 8" (203mm)

GBD FLEX-HONE®

HEAVY DUTY

3 - 4 ½" DIA. ARE 13 ½" OAL
BAL. 17 ½" OAL



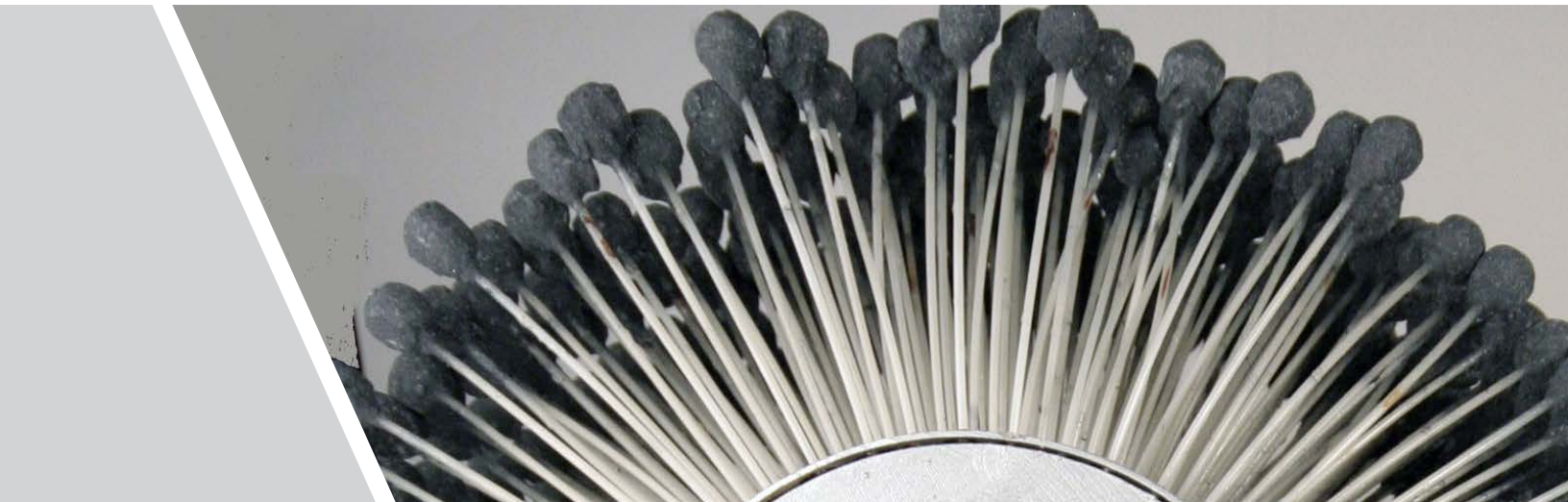
Order by Bore Size

Catalog Number	Catalog Number
GBDH 8" (203mm)	GBD 12½" (318mm)
GBD 8½" (216mm)	GBD 13" (330mm)
GBD 9" (228mm)	GBD 13½" (344mm)
GBD 9½" (241mm)	GBD 14" (355mm)
GBD 10" (254mm)	GBD 15" (381mm)
GBD 10½" (267mm)	GBD 16" (406mm)
GBD 11" (280mm)	GBD 17" (432mm)
GBD 11½" (292mm)	GBD 18" (457mm)
GBD 12" (305mm)	

GBD FLEX-HONE®

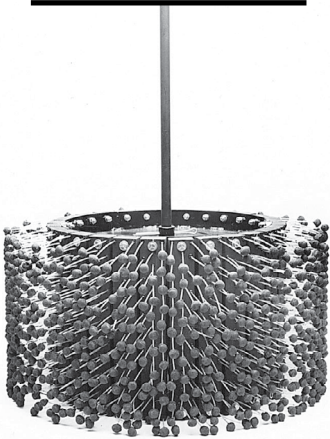
HEAVY DUTY WOOD CORES

8 - 18" DIA. ARE 34" OAL



SIZE INFORMATION (CONT.)

GBDX FLEX-HONE® EXTRA HEAVY DUTY 19 - 36" DIA.



Order by Bore Size

Catalog Number	Drum Dia	Section	# of Sections on Drum	Shaft Dia.
GBDX 19" (483mm)	11½"	A	22	¾"
GBDX 20" (508mm)	11½"	B	22	¾"
GBDX 21" (533mm)	11½"	C	22	¾"
GBDX 22" (559mm)	11½"	D	22	¾"
GBDX 23" (584mm)	15½"	A	29	¾"
GBDX 24" (610mm)	15½"	B	29	¾"
GBDX 25" (635mm)	15½"	C	29	¾"
GBDX 26" (660mm)	15½"	D	29	¾"
GBDX 27" (686mm)	19½"	A	36	1"
GBDX 28" (711mm)	19½"	B	36	1"
GBDX 29" (737mm)	19½"	C	36	1"
GBDX 30" (762mm)	19½"	D	36	1"
GBDX 31" (787mm)	19½"	E	36	1"
GBDX 32" (813mm)	24½"	A	44	1¼"
GBDX 33" (838mm)	24½"	B	44	1¼"
GBDX 34" (864mm)	24½"	C	44	1¼"
GBDX 35" (889mm)	24½"	D	44	1¼"
GBDX 36" (914mm)	24½"	E	44	1¼"

GBDX Replacement Sections Available for Above GBDX Flex-Hone®



Catalog Number	Section	Grit Size	Overall Trim
GBDX-A	Section	120SC	4 1/8" (105mm)
GBDX-B	Section	120SC	4 5/8" (118mm)
GBDX-C	Section	120SC	5 1/4" (133mm)
GBDX-D	Section	120SC	5 3/4" (146mm)
GBDX-E	Section	120SC	6 3/8" (162mm)

BE CREATIVE!

The Flex-Hone® Tool is highly customizable and can be made in a variety of shapes and sizes to suit your specific finishing requirements. Flex-Hone Tools can be made to finish tapered surfaces, slots and grooves, double diameter cylinders and spherical cylinder ends. Custom shapes and sizes, custom connectors, custom abrasives types and a wide array of grit selections are only a phone call away. If your part surface could benefit from a Flex-Honed finish contact our technical department for a custom design and quotation. **Contact technical@brushresearch.com**



Flex-Hones for Adhesion Applications

Flex-Hones can be manufactured in grits as coarse as 20. This is a fast and effective solution to roughen the surface for adhesive bonding.



SPECIALTY FLEX-HONES

MADE FOR YOUR NEEDS

The Flex-Hone finishing process that was originally developed to finish automotive and industrial cylinders has grown to include brake rotors, firearms, sporting goods, musical instruments, aircraft engine components and hydraulic valves. Now, parts as diverse as a shotgun chamber to an aircraft landing gear receive the benefits of a Flex-Honed finish.



ACCESSORIES

FLEX-HONE® OIL

Specifically formulated for use with the Flex-Hone® in honing all types of metals. Contains a blend of honing and lapping oils, a lard oil to prevent galling of aluminum, a moisture dispersant, a non ionic surfactant wetting agent to assure complete lubrication of the surface and a special additive to help keep the metal cuttings and containments in suspension. Emulsified, anti-bacteria agent.

Part Number

FHP	½ Pint Bottle
FHQ	1 Quart Bottle
FHG	1 Gallon Bottle
FH5G	5 Gallon Bottle



CYLINDER WASHING BRUSH

Made with 6-12 Nylon for efficient cleaning of cylinder walls after honing. Use with detergent and warm/hot water as recommended by Caterpillar, etc. Special diameters to 14".

Part Number	Diameter
03390	2" Dia.
03391	2½" Dia.
02640	3" Dia.
10A312	3½" Dia.
10A4	4" Dia.
10A412	4½" Dia.
10A5	5" Dia.
10A512	5½" Dia.
10A6	6" Dia.
10A612	6½" Dia.



PIPE NIPPLE ADAPTERS & EXTENSIONS

Available for Flex-Hones. Must be designated on order. Although available separately they are intended to be factory attached when ordered.

Part #	Diameter	Flex-Hone® Sizes
832A	8-32 Adapters	8mm - 11mm
18NPT	⅛" NPT	12mm - 3"
14NPT	¼" NPT	3" - 5½"
38NPT	⅜" NPT	6" - 8"
12NPT	½" NPT	8" - 12"
34NPT	¾" NPT	12 ½" - 18"



Extensions for use with pipe nipple adapters	
18 x 18	⅛" NPT x 18" w/coupling
18 x 36	⅛" NPT x 36" w/coupling
14 x 18	¼" NPT x 18" w/coupling
14 x 36	¼" NPT x 36" w/coupling



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