

CASE STUDY

PRODUCT - FLEX-HONE® TOOL

APPLICATION - 4 CYCLE KART ENGINES

Use of BRM Flex Hones in Preparation of 4 Cycle Kart Engines



Today, the primary 4-cycle Kart racing engine is the Briggs and Stratton "L" or flat head 5hp horizontal shaft engine. Thousands of these engines have been made over the years for use in a wide variety of applications by Briggs.

While these engines have been replaced by the Briggs Intek OHV engine for commercial application, the Motorsports division of Briggs continues to supply the karting industry with complete L head engines (Raptor series) designed for racing. The L head comes in two versions. An all aluminum cylinder (Cool Bore) and a cast iron sleeve version



(I/C for Industrial / Commercial). Cylinder preparation is very similar between the two and we'll discuss the differences as we go.

Ultimately the OHV engine from Briggs will replace the L head used today as parts begin to run out for

the engine. Briggs Motorsports Division has produced it's first racing version of the Intek and labeled it the Animal. It is a cast iron sleeve engine but it's ring set is a bit different from the older L head design.



BRM's Flex-Hone® and cleaning brushes are an integral part of the proper preparation of a Briggs racing engine. Before discussing the specific application of the various hones and brushes, a bit of knowledge about the Ring set being used today is in order.

On all Briggs L head engines raced today the newer Raptor III piston and ring set is being used for either cylinder type. This piston was designed for Briggs several years ago by Federal Mogul to eliminate a problem with the older style pistons having wrist pin boss failures as the RPM levels have risen over the last 5 years. Today it's not uncommon to see an L head turned in the mid 6000 range and the older piston (designed for commercial 3600 RPM operation) was failing. These failures are all but eliminated by the new piston.

Along with the new piston came an entirely new ring set for the Raptor III piston. This ring set was much smaller, softer and had very low wall tension when compared to the older style piston/rings. With the softer rings, cylinder finish has changed from years past.

The ring set on the OHV animal is a bit different. It's a much harder material than the Flat head rings set so we'll be using a more coarse grit for our final finish.

CYLINDER PREPARATION

L HEAD

Given the fact that we are racing with only a single cylinder, failure to have the best ring seal possible will lead to wasted HP and quite possibly a lost race. Proper cylinder preparation begins with a straight cylinder perpendicular to the crankshaft. Align boring the cylinder to 90 degrees referenced off the crankshaft is essential to the best possible performance. This boring can be done through the use of a mill and boring bar or similar boring device. Most any Kart or machine shop will be able to help you in this job. Once this operation is complete, rigid honing should be used to bring the cylinder to it's proper size and clearance.

On either style cylinder, the boring job should finish the bore to within .002 of final size needed. Next a positive pressure hone such as a Sunnen style rigid hone should be used to bring the cylinder to it's final size. Spring type hones should NOT be used as they will not keep the bore straight. We like to use 220 grit stones to bring the cylinder to within .001 of final size. The next hone selection will depend upon the type of cylinder. On the aluminum cylinder engine we'll finish the last thousandths of clearance with a 280 grit hone set. On the I/C engines we'll use a 400 grit. Whenever you hone a cylinder you must use a torque plate on the block This simulates the stresses put on the top of the block when the head is bolted down. We suggest using 140-160 INCH lbs. of torque on the head bolts for the L head engine. On the Animal use

210 INCH lbs. These plates can be purchased from most any Kart shop.

Final finish for either type is done with the Flex-Hones of the proper material.

320 grit Aluminum Oxide on aluminum bores and 600 Silicone Carbide the I/Cs. The finish we're looking for is referred to as a plateau finish where we're knocking down the small peaks of metal left by the honing stones leaving a smooth, flat wall (plateau). The only



reason we recommend differing final grit sizes is our experience with the resulting ring seal. Prior to using the Flex-Hones for your final finish, the cylinder should be cleaned of the honing slurry left from the positive pressure hone. A clean rag with carburetor cleaner or WD40 will do a good job at this stage.

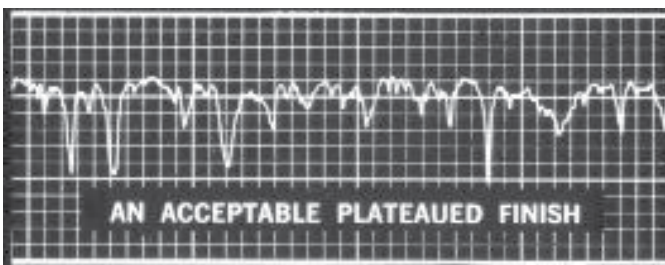
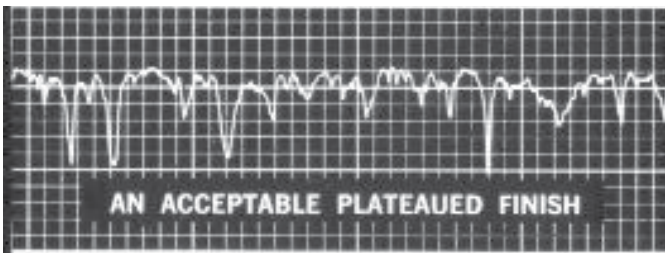
After a thorough cleaning, we recommend BRM's honing oil for either type of cylinder. A little goes a long way here. Just enough to create a slurry when honing the cylinder. While the BRM oil is much preferred on Aluminum bores WD40 can be substituted and a mixture of mineral spirits and 30 weight oil on the cast iron bores. The finish is just much better with the BRM Flex-Hone oil.

We use, at a minimum, a 3/8 variable speed reversible drill run at approximately 400 RPM. Run the drill in it's normal clockwise direction stroking the honing in an up and down motion for 20- 25 strokes. Then reverse the drill and do the same for approximately 20-25 strokes.

ANIMAL

For the OHV Animal we suggest a final bore finish of 320 grit due to the rings set used today. Simply follow the procedure outlined for the aluminum bore flat head.

The size of the Flex Hone for the L head cylinder can be either 2-1/2", 2 5/8" or 2-3/4 " . For the OHV Animal use the 2-3/4" or 3" hones.



For rebuilds on either engine if your cylinder is straight, a quick honing with the appropriate grit will bring the cylinder back into optimum condition for a new piston/ring set. The straightness of the cylinder can only be checked with a quality bore gauge.

CARBURETOR BORE

A very fine finish can be achieved on the stock Briggs Flat head carburetor after reaming near the allowed limit(.695). The carburetor bore will normally not flow as well after reaming as the original finish from Briggs, so the use of a BRM 320 grit AO hone in 18mm is suggested. One trick you can use with the normal 18mm Flex-Hone is to remove approximately one half of the globules and wire leaving approximately 1-1/2" of the globules. This allows much easier use of the hone in the carburetor body.

When honing the Briggs carburetor you must take care not to hone anything but the carburetor bore per the rules. The front recess of the carburetor must be protected as any change here can get you tossed in the Tech room. A 1/2" brass pipe connector with a bit of tape wrapped around it makes a great insert to protect this recess. On the back side of the carburetor it must also be protected from honing in the area prior to the bore (starting at the throttle shaft hole). A piece of clear tape works well here to protect this area.

WD40 or BRM Flex-Hone oil works well on carburetor bores. No polishing of the carburetor bore on the Animal is currently allowed

VALVE GUIDES

When replacing or installing valve guide in the Flat head, final valve fit to the guide is easily obtained by using a 6.4mm(.250) 240 grit Flex-Hone. No lube is needed here when honing the guide for final finish. The proper clearance for the exhaust side is .002 and can run as low as .001 on the intake. Don't go below .002 on the exhaust side due to the expansion created from heat.

Reamers in .2475 and .2485 can be used prior to the Flex-Hone to bring the guide to proper size. The use of the Flex-Hone eliminates any rough edges and insures you'll not experience a stuck valve when you first run the engine. Very embarrassing if you're at the track! The same Flex-Hones can be used on the Animal valve guides with excellent results.

CONNECTING RODS

The Briggs connecting rod for the L head can be honed to both clearance and finish by using both 1/2" and 1" Flex-Hones for the wrist pin and crankshaft areas. For the crankshaft end, we suggest 180 AO grit for clearancing and 320 AO grit for the final finish. For the wrist pin either the 320 or 180 grit AO hones in 1/2" will work fine.

On the wrist pin you're looking for a smooth finish. No more than .001, so very little honing is needed in this area. We like to cut the end off a 1/2" inch Flex-Hone down to around 3" of rod and install it in a drill press. Simply run the wrist pin end up and down on the Flex-Hone.

The crank end is another matter. Most Briggs crankshaft journals will be from .998- .999 from the factory new and the Briggs rods will be from 1.0 to 1.001 in size. You can see that we could have from .001 to .003 clearance with stock parts. Always mic the journal with a good quality micrometer and mic several areas. The use of a caliper is not suggested on the crank journal. It is fine for the rod end.

What you're looking for is a final clearance of .003 between the crank and rod. When we get around .005 clearance you start breaking things, so if the Crankshaft is worn below .997 get a new one. Always measure the crank and rod for the proper clearance!! Prior to honing the crank end of the rod, be sure that the rod bolts have been torqued to 100 INCH lbs. This is the recommended torque spec for the rods bolts and we want to hone the rod at the same torque spec as we're gong to install it.

The World Karting Association rules state that the edges of the rod may not be chamfered nor the edges broken, so we must protect the edges of the rod in this area from the balls of our hone. A simple rod honing fixture can be made from 1" ID pipe to align the rod and hone. This insures proper alignment of the journal end. The 1" pipe is welded to a piece of 1" angle iron and then the middle is cutout to allow for the rod to be inserted. On my unit, one side is built to slide in and out. This allows for a tight fit up against the large end of the rod. A hole is cut to allow the dipper to clear.

For the Animal, the crankshaft journal measures 1.098 and most rods will measure 1.100. Due to the higher RPM level the Animal experiences verses the

L head, we suggest keeping the rod clearance around .002. The use of a 1 -1/8”(29mm) Flex-Hone in 180 and 320 grits work well for the crank end of the rod. The Wrist pin measures .625 so a 5/8” or 16mm Flex-Hone in 320 AO Flex-Hone works here. A similar rod honing fixture can be made for the Animal rod as the rules on chamfering the edges remain the same.

FLYWHEEL SIDE BEARING

On a single bearing 5 HP L head, the sleeve bearing on the Flywheel side can be honed for fit and finish with a 7/8” Flex-Hone of 240 grit, aluminum oxide. Even the newer style DU(bronze type) bushing can be relieved with the Flex-Hone. On older L heads there was no bushing and simply a hole in the block that served as a bushing. Honing this aluminum bushing will help retain oil and prevent early failure.

The Animal is a dual bearing engine so no bushings are used.

INTAKE and EXHAUST PORTS

After porting a very fine finish can be achieved by using a 1” X 1” Flex-Hone of 320 grit. Simply running the hone in and out of the port works very well.



CLEANLINESS

The old expression about cleanliness being next to Godliness is never more true than when you go to assemble you engine. The least little bit of dirt or grime will ruin that fine cylinder finish we worked so hard to obtain so take this section to heart. BRM gives you some great cleaning and polishing bushes to use during the cleaning process. They range from 1/4” for the valve guide to 3” brushes for use in the cylinder.

The easiest method we used to clean a block prior to assembly is to use a 5 gallon bucket and HOT soap and water. Most any detergent will do other than the purple cleaners which tend to stain aluminum. Simply immerse your block in the bucket and start cleaning every hole you can find with the correct brush. The hot water helps the cleaning effort and let the block dry quickly after you rinse it off with clean water. Be SURE and oil all steel parts(cylinder, valve seats etc.) after you dry the block with cloths or air pressure.

As a final check of the cylinder use a white paper cloth to wipe the cylinder with WD40 or carburetor cleaner looking for any sign of dirt. Only if it comes back white are you done.

Well there you have it. Some fairly simple and basic steps to use in the preparation of your 5hp. Have fun racing, always use the premier BRM hones/brushes and be safe.

Jimmy Glenn
Glenn’s Engines

Championship Engine Builder
Author of “Building a Race Ready 5hr Briggs”
Co-Founder of www.4cycle.com
Technical Inspector National Karting Events

