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"Headwork", What is Done When an Ironhead is Rebuilt

FOR YOUR INFO

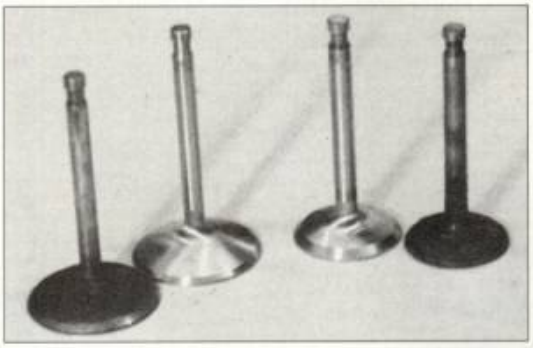
OLD IRON

HEADWORK

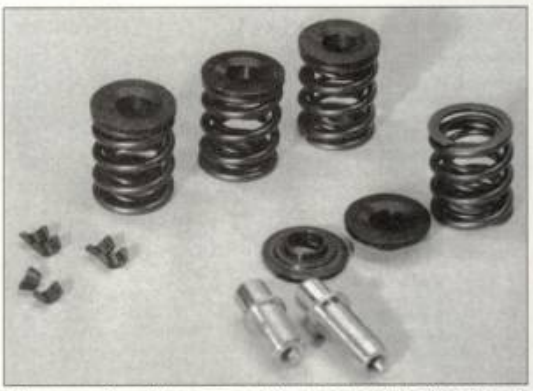
What Is Done When An Iron Head Is Rebuilt

Text and photos by Tom Hurd

Like many Sportster owners, I love old Ironheads. They look great, go pretty well and are easy to work on. But the truth is, you'll have to do upper end work much sooner on a pre-Evo Sportster than on the newer techno-improved XL of today. It's just a fact of life. And you'll know it's time to have the heads freshened up if your bike is low on power, or smokes a little too much on start-up, or puffs smoke when you back off on the throttle while still in gear, i.e., coasting to a light. Any of these faults are an indication of head distress and the need to remove the heads for some repairs.



Manley stainless steel valves are lighter, stronger and better flowing than the stock units. The Manleys are the silver ones; the others are stock valves.



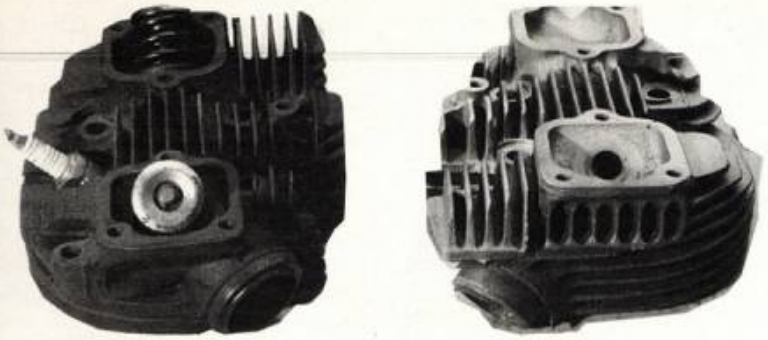
These springs (two per set), upper collars (on top of three of the spring sets), valve locks (two per valve), and guides (only one exhaust and one intake is shown) are all Manley components. The lower collars (one is showing with the others under the spring sets) are H-D units. Manley does not send lower collars with the kit because the stock units work fine.

Getting the heads off the cylinders is not a difficult process. Just follow the procedure outlined in your shop manual. We plan to cover this in an upcoming issue. When the heads are finally off, get them to a reliable machine shop. A reputable shop will boil and blast the heads clean, replace defective valves and guides and correctly fit them, cut the valve seats, and check the valve springs for proper clearance. Just how all this is done is what I'll be explaining and showing you in this "For Your Info." Be sure to refer to the appropriate photo as you follow along. It'll make it a lot easier to understand what is done to properly rebuild an iron Sportster head.

Once your heads are at the machine shop, they will be completely disassembled and placed in a cleaning tank. This removes most of the old paint and carbon residue. The heads are then glass-beaded — like sandblasting — to remove remaining carbon and rust. This leaves the heads looking like new (photo 1). At this point, it should be noted that the only original parts you will re-use are the basic head castings and the lower spring collars. Everything else will be replaced with updated (better) parts. You'll get more life out of your heads.

Manley Performance of Lakewood, New Jersey has a complete line of quality replacement parts for Harley-Davidson cylinder heads. Manley's stainless steel valves are lighter, sleeker and stronger than stock H-D components. These valves are available in bright swirl polished finish or a very tough black nitrited finish for more extreme conditions. We chose to use the traditional bright finished valve we've always had success with. We also used Manley's valve guides and spring kit. It's best to use matched parts from a single manufacturer. Mixed and matched parts don't always fit together well which leads to extra work and more cost to the customer. Besides, Manley's spring kit is a neat little package. Our P/N 99217K contains springs that are good for cams with up to a .490" lift. The kit also contains high performance steel upper collars (retainers) and a set of hardened valve keys. This setup has 20% more pressure than stock and fits with no machining required.

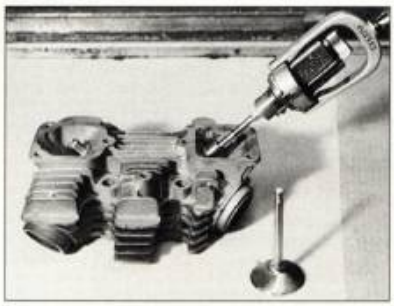
Back to the valve job. As a general rule, I don't like to drive out valve guides from a head until it has been cleaned. Carbon that has been baked onto the guide is tough and can make guide removal difficult. It can even cause damage to the cylinder head. Sportsters have two different valve sizes so two different valve guide drivers are needed. The intake guide requires a 5/16-inch driver and the exhaust guide needs a 11/32-inch. As for the actual removal, the procedure is simple. The guide is gently but firmly driven from the combustion



Old and dirty head on the left; old and clean one on the right. Notice the aluminum upper spring collar (retainer) on the left head. Never use aluminum retainers!

Machinist Bob Sommer removes the old valve guides using a guide driver. These drivers come in different sizes.

Bob then installs the new guide using plenty of engine lube and the correct driver so as not to crack the guide. I have never found it necessary to heat an iron Sportster head to install guides. If the guide is going in that tight, something's wrong.



If the guide-to-stem clearance is too tight, the guide is opened up with a Sunnen guide hone to get the proper clearance.

Even a new valve should be lightly faced just to be sure.

Valve seats are cut with a piloted cutter set. There are three different cutters; one for each angle of a standard three-angle valve job.

Next, lubricate the valve stem with a good assembly oil and place it in its guide.

chamber-side of the head up through the top of the head with the appropriate guide driver (photo 2).

After discarding the old guides, the valve guide bores in the head should be brushed out and inspected. If the bores are galled, the opening must be reamed to the next oversize to clean them. After reaming, oversized outside-diameter guides will be used. Oversize guides are also used if the old guide came out too easily.

The new valve guides are then driven in from the top of the head (photo 3). The guide and the bores in the heads must first be lubricated with a good engine pre-lube. A lot of pre-lube is used because it's better to have a little mess than to have a guide gall on the way in. As for how far they must be driven in, Manley guides have a built-in stop. The guide is driven in until the stop firmly contacts the top of the head. The guide bore is checked to see if the driver burred it. If it did, a tapered reamer is gently used to remove the burr.

Once the guides are all in place, the new valves are tried in their new guides. The valve stem should move freely and smoothly in its guide. If it doesn't, the guide is checked again for burrs. If it's not a burr, then the inside diameter of the guide may be too tight. To check this, a tool called a ball gauge is placed in the guide bore and expanded until it can just be removed from the guide. The dimension of the ball gauge is then noted. The diameter of the valve stem is measured. The difference between these dimensions is the stem-to-guide clearance. It should be .0015"-.0020" for the intake valve and .0020"-.0025" for the exhaust. If it is too tight, a guide or Sunnen guide hone will open the clearance (photo 4). Usually the stem clearance with Manley valves and guides is perfect right out of the box.

At this point, it's time to take a light cut on the valve face (photo 5). The valve face is the band on the outside diameter of the valve that actually contacts the head. It's about 1/8" wide and is usually a 45-degree cut. Note the illustration. Even new valves should be cut. A valve that's been dropped can be out-of-round, meaning no longer a perfect circle. The valve and seat must be a perfect circle or they will not do their jobs properly or at all. The light cut checks that all is as it should be.

Machining the valve seats in the head is the next step. Valve seats are cut with a piloted cutter set (photo 6). At this point, I would like to explain what a "three-angle valve job" is. It's not magic. A three-angle valve job on a head is the industry standard. Anything else is substandard. There are many fine setups for cutting or grinding valve seats in a head. Whichever is used, the basic procedure and end result are the same.

Put the lower collar in place around the valve guide. The upper collar can now be put into position with the two valve locks holding it. A caliper or snap gauge is then used to measure the distance between the outside flats of the two collars.

The first of the three angles will be a 45-degree cut (see Illustration A). This cut matches the 45-degree cut of the valve face. These two 45-degree angles will contact each other and result in a seal that will hold the fuel/air mixture in the cylinder as it is compressed for ignition. Where the seat contacts the valve face is very important. The contact area should be about .020" from the outside edge of the valve.

The second angle to be cut into the head's valve seat is a 30- or 31-degree cut, above the 45-degree seat. This makes the seat narrower and brings it in from the edge of the valve face. The width of the 45-degree seat is then measured.

The third angle of the valve job is next. It's a 60-degree cut and it goes under the 45-degree seat cut. As this cut is made, it removes the bottom of the 45-degree seat and so narrows it. The machinist takes cuts a little at a time while measuring the seat width with a vernier caliper, until the desired width is reached. One bonus of a properly cut three-angle valve job is that the three angles create an arc — a radius — which helps the flow of gases in and out of the cylinder. I like to have a .040" wide intake seat and a .060" exhaust seat on a street-driven machine as the end result. A seat that's too wide may get hot spots by trapping glowing carbon bits between the valve and the head. A valve loses its heat through its valve seat. Too narrow a seat can burn because it's too narrow to dissipate heat fast enough.

Some of you may have heard of a "five-angle valve job." Well, that's just a three-angle job with two extra cuts. Looking at the three-angle illustration, one of the extras is a 15-degree cut on top, after the 30- or 31-degree cut. The other is a 75-degree cut done on the bottom after the 60-degree cut. And that's it. These two extra cuts give the seat area a better radius which improves the flow of gases in and out of the cylinder.

The measurement of the caliper or gauge is taken with a vernier caliper. If the proper clearance is not gotten, adjustments are made.

Most shops use an air-operated valve spring compressor. It's easier and safer to use than the manual-type. Also, its one-handed operation makes it easier to install the valve locks.

Here are the finished assemblies; neat, clean and much better than stock. Just tape 'em and paint 'em.

As for lapping the valves, if the machinist and machines are accurate, it is not really necessary. In fact, some people don't want their valves lapped while others feel ripped off if it's not done. The answer here is to talk to the machinist who is doing the work and see what he recommends. Make your decision and specify what you want done.

At this time, all the parts get a thorough bath. All of the guides and bolt holes are brushed out and everything is checked to be sure there are no glass beads left anywhere in the heads from the earlier blasting.

Now lubricate the valve stem with a good assembly oil and place it into its guide (photo 7). The Manley valve spring kit did not include the lower collars because the stock ones are to be reused. The lower collar fits over and around the valve guide. This collar also fits snugly into the bottom of the valve springs and thus keeps the valve spring centered around the valve stem. At the top of the valve stem is the upper collar which does the same job as the lower collar. However, the upper collar does not fit around the guide. Instead, it is held in place with two valve locks.

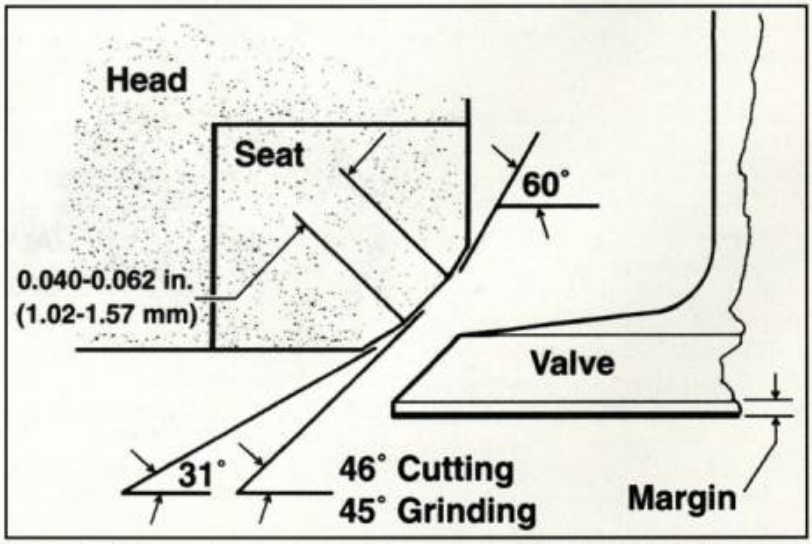


Illustration A: Here's a three-angle valve job; an industry standard. This illustration, copied from a factory service manual, is courtesy of The Harley-Davidson Motor Company.

These locks fit into the notch cut into the end of the valve stem (photo 4).

Between the upper and lower collars is the space where the valve springs go and where the spring height must be measured. To do this, the lower collar is put in place around the guide. Next, the upper collar is put into position with the two valve locks holding it. Some shops put a light-pressure spring between the collars to help keep the upper collar in place. A caliper or snap gauge is then used to measure the distance between the outside flats of the two collars (photo 8). Take the measurement of the caliper or gauge with a vernier caliper. Manley's required spec is 1.310". If this measurement is too high, shims can be used under the lower collar to make corrections. If too low, the head can be cut to get more clearance.

When all four springs have been checked, it's time for the final assembly. The lower collar is placed into position, as are the valve springs and the upper retainer. Using a good valve spring compressor, the whole assembly is compressed until the notch on the valve stem protrudes enough from the opening in the upper retainer to insert the two valve locks (photo 10). When the valve locks are in their notch, the spring compressor is released. The assembly then gets a visual check to see that everything is seated right.

After all the valves receive the same treatment, the heads are done and ready to be painted (photo 11). If you do the painting, be sure to tape off all areas that are not exposed when the heads are reassembled onto the engine. You don't want paint inside the engine cavities where it may flake off and clog an oil passageway. After the paint is dry, the heads are ready to be reassembled onto your engine. ■

SOURCES

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