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EVO: Engine Mechanicals - Sub-03M

Pics and Information on Evo Sportster Heads

Article originally written by aswracing of the XLFORUM with further commentary by NRHS Sales of the XLFORUM and extended with further pics and information. ¹⁾

Some of this information is now outdated as some of these heads have been obsoleted. However, the information itself is very informative regarding the changes and specs on the different stock heads.

Evo Sportster Heads

General Information

There are 4 generations of Evo Sportster heads:

- 1986-1990 (4 speeds)
- 1991-2003 (5 speeds)
- 2004-present (rubber mounts)
- 2007-up (fuel injected)

Casting Numbers

1998 XL1200S Head Castings on Top ²⁾



Interchangeability

Within a given generation, the heads are mechanically interchangeable between the different models, i.e. all bolt holes line up and no needed features are missing.

Valve geometry is the same: 27° intake & 31° exhaust for a 58° included angle and the location of the valve tips is the same.

The rocker box bolt pattern has not changed across any of these generations. A 1986 lower rocker box will bolt right up to a 2006 head and vice-versa.

Crankcase Breathing:

The only thing you need to be aware of is that the crankcase breathing arrangement has changed at each of the generations below.

- 4-speed models provided no facility in the head for a crankcase breather (the blind hole in each head is used to mount the carb).
- 5-speed models incorporated crankcase breathers into the carb mount bolts in the heads (open hole through head).
They also use a different middle rocker box that has a check valve incorporated (aka “umbrella” valve).
- Rubber mount models use an air/oil separator & check valve unit bolted into the lower rocker box. (and do away with the middle rocker box, using a different top cover)

1991-2003 heads have been successfully fitted to 1986-1990 models.

The major difference you need to be aware of is that the spacing between the pushrod holes is different between a 4 speed and a 5 speed models.

This is because the cam box geometry is different and the pushrods are at a different angle.

So pay attention to the potential for pushrod rub where they pass through the heads into the rocker box.

2004-2006 heads have been successfully fitted to 1991-2003 models.

The new heads have the right front bolt hole relocated inboard 1/4”, and also use 7/16” fasteners as opposed to the 3/8 fasteners used on the 1991-2003 models.

You can either modify your existing front mount, or more recently a new mount has become available that solves this issue.

Also, be aware that the 2004-2006 heads have larger fins and will overhang 1991-2003 cylinders somewhat, most noticeable on the left side.

You can use your stock 1991-2003 rocker boxes or use the 04-up rocker boxes, either will work fine.

The 2007 and up fuel injected heads will technically fit older models but they are 1/8 wider in the intake manifold area.

So some folks report sealing issues when using on older bikes.

They also have a different intake bolt pattern so you must use 2007 and up manifold flanges when using these heads.

Anytime you're putting a different set of heads on your bike, you need to be aware of the chamber size & shape.

And also how it relates to the piston you're using (to make sure they're mechanically compatible and will give the desired compression ratio).

883 XL Specific Information

883 heads (ALL GENERATIONS) have a small, 49cc chamber that's approximately 3" in diameter to match the 3" bore of the 883.

The chamber is also more shallow than the chamber in any other Sportster head.

Valvetrain geometry is the same as the other heads except that small 1.580" intake & 1.350" exhaust valves are used.

And the valves are longer to work with the more shallow and smaller diameter chamber.

In stock configuration, these are the worst ports of any XL head, primarily due to the way the bowl area squeezes down to the small diameter valve.

This arrangement causes a lot of turbulence.

The heads respond well to a good porting and seat blending job, particularly when used with a larger valve that better matches the bowl size.

The seats can accommodate the standard XLH1200 valve sizes (1.715 intake/1.480 exhaust) and special longer "conversion valves" are available to do this upgrade.

You can have larger 1.760" Intake and 1.530" exhaust valves with stage 2 headwork (with the right machine shop and parts kit).

When used in an 883 to 1200 conversion, reverse dome (dish) conversion pistons are available to give a workable compression ratio.

Alternatively, the chamber can be relieved and the heads used with flat top pistons.

These heads have an advantage over the XLH1200 hemi chamber head.

The 3" diameter chamber provides a "squish band" around its perimeter when placed over the larger 1200 bore.

The squish band results in more turbulence and a more efficient chamber.

However, the longer valves in these heads are also a disadvantage in that piston to valve contact issues are much more likely.

Be concerned about this if the cams you're using have a high TDC lift figure on one or both valves.

Most sets of 883 heads you come across will be silver in color. 883R and Iron models have black 883 heads.

All are easily identified by the “883” script cast into them adjacent to the chamber.

1100 and 1200 XL Specific Information

1986-1987 XLH1100 HEADS:

These heads are very rare and very desirable.

They came stock with large 1.840” Intake and 1.610” exhaust valves and a 62cc chamber which gave increased compression.

1988-2003 XLH1200 HEADS:

These heads have a 67cc hemispherical chamber, i.e. it's a round bowl with no squish band.

Hemi chambers provide maximum valve unshrouding but also tend to have poorer chamber turbulence.

The 67cc volume gives about 9:1 compression with flat tops at 1200cc. Domed pistons are readily available to raise this number up to 10:1 or higher.

The pistons designed for this chamber have a radiused edge on the domes to fit well inside the hemi chamber shape.

But the irregularity of the chamber (which is just a casting) makes it impossible to achieve a good squish band.

Valve sizes are 1.715” intake and 1.480” exhaust. The stock seats can support only slightly larger sizes. (we fit them with 1.760” intakes and 1.530” exhausts when doing a Stage 2 job. For Stage 3 we change the seats)

The ports on these heads are not particularly good, they have something of a squared off bowl and a low floor.

In other words, these are areas where they need more material. These heads are all black with polished fins.

2004-up XL1200 Heads (all models):

These are the best heads the factory has ever put on a Sportster.

They are virtually identical to the Buell XB heads with 1.810” Intake and 1.575” exhaust valves with 7mm stems.

They have 62cc bathtub shaped combustion chambers. They are either all black or black with highlighted fins.

1998 XL1200S Heads ³⁾



Buell Heads

General Information

There are 2 generations of Buell heads:

- 1995-2002 (tube frame models, aka “tubers”)
- 2003-present (XB models) (last edited in 2014)

1995-2002 Buell heads can be considered the same generation as 1991-2003 Sportster heads.

The rocker box and head breather arrangements are identical, as are the fin sizes.

The front mount holes have the same spacing as the 1991-2003 Sportster heads but use 7/16” NC fasteners.

(exception: 1995-1996 S2 models use a 3/8” fastener on one side and a 7/16” fastener on the other).

2003-present Buell heads can be considered the same generation as 2004-present Sportster heads.

(in that they use large fins and 7/16” front mount fasteners with the right front mount hole moved inboard 1/4”).

The main difference is that the XB head does not provide head breather/carb mount bolt holes.

The bosses are cast in, however, and the holes can be drilled and tapped.

Buell XB models don't need these bolt holes due to the downdraft fuel injection system they come with.

Crankcase breathing is provided on stock XB models through the tops of the rocker box covers.

Buell Specific Information

1995-1996 BUELL S2 HEADS:

These heads are identical to the 1988-2003 XLH1200 heads in all respects except that one of the front mount bolt holes is 7/16” NC instead of 3/8” NC.

So don't be fooled; not all “Buell Heads” are higher performance than Sportster heads.

1996-2003 LIGHTNING HEADS:

This is a head that came out in 1996 on the Buell S1 Lightning model, as well as the 1200S Sportster Sport model.

The 1200S version is black with polished fins and has dual plugs, the second plug being accessible through the hole in the top of the rocker box.

The Buell S1 version is silver and has a single spark plug. Versions of this head were also sold in the Screaming Eagle catalog.

Early versions were silver and carried the "Lightning" script above the pushrod area. A version was sold in black polished with no script.

And finally, a black polished version was sold with the "Screamin Eagle" script and dual plugs. Also, the Buell Blast comes with a version of this head.

The valve sizes are 1.715" intake and 1.480" exhaust (identical to the 1988-2003 XLH1200 head.

The same seats are used so Stage 2 Lightning heads get 1.760" intakes and 1.530" exhausts.

The ports are also identical to the 1988-2003 XLH1200 head.

Later SE versions were advertised as having 8% higher flow than stock XLH1200 heads.

But as someone who's flow tested lots of them, I just haven't seen it. The range of numbers I get has been the same.

The only place this head is different from the 1988-2003 XL head is in the chamber.

Extra material was added, as well as a 10° squish shelf, bringing the volume down to about 62cc.

This gives around 10:1 when paired with flat top pistons. The squish band though does nothing with a flat top.

So the performance increase from this head comes entirely from an extra point in compression ratio.

This extra material in the chamber somewhat shrouds the valves, however, hurting low lift flow.

It gets especially bad when oversize valves are fitted.

When putting larger valves into Lightning heads, we always unshroud the chamber around the valve heavily to improve flow.

This of course raises the chamber volume and requires us to deck the head significantly to get the volume back to 62cc.

Often we'll end up re-cutting the squish band to 15° and just size the chamber out to 67cc instead, and then put the customer into a Thunderstorm type domed piston.

We did, however, offer a 10° piston designed for the stock Lightning head that offers 10.5:1 compression at 62cc.

1998-2002 BUELL THUNDERSTORM HEADS:

This was the second generation high performance head to come out on Buells.

It was introduced in 1998 on the S1W and S3/S3T (the S1 and the M2 retained the Lightning heads in 1998).

In 1999, all models came with Thunderstorms and it remained that way through the 2002 model year.

This head went back to the 67cc volume and instead used a domed piston to raise the compression ratio. The advantage to this is that it heavily unshrouded the valves.

A 15° squish shelf was incorporated into the chamber and matched to a 15° dome angle on the piston. Also, valve sizes were increased to 1.810" intake and 1.575" exhaust. Ports were improved as well, particularly in the bowl.

The squish shelf on a Thunderstorm head is still a casting, however, and as such it's not very accurate.

There's a good sized overhang between the deck and the perimeter of the squish shelf, and core shift often makes the squish shelf uneven from side to side.

So while it's nice to have a squish shelf and the turbulence it generates, it's effectiveness is limited unless you re-machine it.

(which generally requires .030"-.040" to be removed from the deck)

Still, this head performs substantially better than the Lightning or XLH1200 head.

All Thunderstorm heads are black powder coated, without highlighted fins.

2003-up BUELL XB heads:

These heads are virtually identical to the 2004-up XL1200 heads but they do not have provisions for breathers as noted above.

You can drill and tap for breathers though if needed. They come in either silver or all black color depending on model and year.

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<https://www.xlforum.net/forum/vendors/nrhs-high-performance/161314-sportster-heads-general-information?highlight=883r+heads#post4722973>

2)

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