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REF: Engine Mechanicals - Sub-01Q

Lifter Comparisons

Tappet Flats

This is in consideration of induced noise from the use of high lift cams.

The factory lifter is up to the job from the point of view of the hydraulics. ¹⁾

However, the factory lifter's weaknesses are lack of available travel and less durable axle bearings.

It's possible to machine the flat longer on a stock lifter. ²⁾

But, it's a difficult piece to clamp and it's also hard as a rock.

Tappet axle failures are the most common problem when you use lots of spring pressure.

Which is why JIMS uses a bigger axle and more rollers and now they're force feeding oil to it.

On 91-05 bikes, the lifters were prevented from rotating via use of tappet "anti-rotation-pins" (which came in two different styles). ³⁾

In 2006, they changed the design to a plastic "anti-rotation-device" or ARD.

One thing you need to pay attention to when using high lift cams is the tappet pin clearance. ^{4) 5)}

Without enough clearance, the tappet will contact the pin and make a racket.

The generally accepted minimum clearance is .060": (with the cam positioned at full lift, lifter sitting on top of it, use a magnet to pull the lifter up until it stops)

You want it to move .060" at least.

A .590" lift cam on a stock base circle will cause the tappet to run into the pin.

Maybe not on a roll-through, but almost certainly with the motor warm and running.

If you get a lot of valve train noise, check it. Simply unscrew your pins and look for contact marks.

They tend to get a little smiley face impression on them when the tappets are hitting them.

The lifters can hit the pins with less lift than that.

Jims lifters have longer flats on the tappets, but roller failure has been reported while using them.

Pin damage from lifter ⁶⁾	Tappet and pin wear ⁷⁾
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Stock vs Jims lifter tappet flat comparison. ⁸⁾

Notice how the wear ring extends down below the machined area of this S&S lifter a little. ⁹⁾



Other Useful Links

Here is a good [tech video from Hammer Performance](#) on installing lifters that also addresses the tappet flats.

91-05 Anti-Rotation Pin Upgrade

See also [91-99 Lifter Pin Upgrade to 00-05 Lifter Pin Screws](#) in the EVO section of the Sportsterpedia with pics of the process.

91-05 lifter pins are only supported on the front side. ¹⁰⁾

The back side of the pin bore is not drilled through so the pin just kind of hangs there near the back wall of the bore.

The 00-05 screw in style is a much better design because it's supported on both ends.

The hole for the pins is drilled into the back side of the bore into the case.

While your engine cases are at the machine shop, you may want to upgrade to the 06 style screw-in pins.

You can also do this yourself at home with a hand drill with some careful planning.
You have to drill each hole deeper and then tap the outer portion to update to the new style.



Internals

OEM 2000 and Up vs SBC Lifters

Comparison of OEM 02 style Sportster lifter (18538-99A) and an aftermarket Crane Cams lifter (10530) for small block Chevy's. ¹³⁾

From left to right you can see the retaining clip, pushrod seat, piddle valve, plunger / spring, and lifter body.

The way these parts work is both simple and complex. For a better description, see [how a hydraulic lifter works](#) in the Sportsterpedia.

The plunger is inserted into the lifter body, where the clearance is .0002" or so.

The hole in the side of the lifter body is what allows oil to flow into the lifter.

This oil fills the plunger. From there, the oil flows out through the piddle valve and through the hole in the pushrod seat up the pushrods.

As in below, the parts in the stock HD lifter are pretty clear.

As you can see, almost all of the parts are exactly the same.

The only difference is the feed hole in the lifter body.

See the close-up in the third pic below.

The actual size of this hole doesn't particularly matter because the space it feeds is so small.

(remember, .0002" clearance with a .842" bore does not add up to a lot of oil volume)

The piddle valve is what controls oil flow to the top end, and as you can see that is exactly the same.

The bleed down rate is controlled by plunger-to-body clearance.



Aftermarket Lifters

Stock lifters in, most cases, are more than adequate for your engine.

An important factor in when to change lifters is the length of the [tappet flats](#) as mentioned above.

This is a critical measurement when installing high lift cams.

Otherwise, on stock motors, it shouldn't be necessary unless you have a lifter fail. And then, replacing with stock lifters should be fine.

As an example, the Buell XBRR uses the stock lifters and it spins 9000rpm. ¹⁷⁾

High performance lifters are especially helpful as a piece of preventative maintenance when high spring pressures are used. ¹⁸⁾

The longer flats also allow higher lifts.

Other Useful Links

This is a very good XLFORUM discussion thread on [lifters and high lift cams](#).

Feuling lifters

Gateman Lifters

Four different models are available for XL's. ¹⁹⁾

Common features include:

- 3D CAD Designed and CNC Machined for Maximum Accuracy
- Heat Treated Chrome Alloy Steel Lifter Body for High Strength

- Precision Machined and Heat Treated Internal Components
- Check-ball Metering for Precise Control and Low Noise
- 100% Select-fit Components for Precise Leakdown Rate
- 100% Flow Checked Pushrod Socket for Precise Oil Metering
- Hardened, Tempered Certified 52100 Steel Roller, Axle, Needles

The four available models are:

- GP1023
 - High Performance for 00-05 XL's
 - Triple Oil Feeds for Robust Oil Supply and Quiet Operation
 - Single Locator Flat for Proper Orientation to Oil Supply
 - Extended Body and Locator Flat for Higher Lift Capability
 - Oil Feed on Locator Flat to Lubricate Guide Pin
 - Oil Feed to Roller Bearing Needles
 - Slower Bleed Rate for Quiet Operation
- GP1021
 - Stock Replacement for 00-up XL's
 - Precision Staked Axle for Maximum Retention
- GP1022◦Stock Replacement for 91-99 XL's
 - Full-floating Roller Axle for Durability
- GP1020◦High Performance for 86-90 XL's
- Inner Race Style Roller Bearing for Increased Reliability
- Orbital Riveted Axle Clamps Inner Race to Roller Slot
- Superior Durability Compared to "Big Axle" Designs
- Surpasses OEM 18523-86 and S&S® No.33-5341

The GP1021 works great on all 00-up XL's.

It's a nice, high quality piece, and it's priced competitively with the factory lifter.

The GP1023 does not work with the plastic anti-rotation device used on 06-up models.

For one thing, it only has one tappet flat, and the anti-rotation device needs both flats.

It is also lengthened on the top side for use with small base circle cams.

However, that lengthening on the top is another reason it won't work in 06-up models.



Jims lifters

The JIMS lifters have the machined area up higher as compared to the stock lifters. ²⁰⁾



S&S Lifters

S&S (33-5350) lifters ²¹⁾



V-Thunder lifters

V-Thunder 850-1 lifters.

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¹⁾

aswrcing of the XLFORUM

<https://www.xlforum.net/forum/vendors/hammer-performance/139198-well-been-doing-some-thinking-excess-valvetrain-noise/page2?t=1510606&page=2>

²⁾

aswrcing of the XLFORUM <http://xlforum.net/forums/showthread.php?t=341901>

³⁾

aswrcing of the XLFORUM

<https://www.xlforum.net/forum/vendors/hammer-performance/139198-well-been-doing-some-thinking-excess-valvetrain-noise?t=1510606>

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<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-engine-conversions/59164-i-think-i-screwed-up-with-new-cam-install?t=322680>

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<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-bottom-end/43338-base-circle-size?highlight=lifter+pins#post897331>

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<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-engine-conversions/153000-bad-tappet-noise-from-high-lift-cams?t=1647586>

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<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-engine-conversions/153000-bad-tappet-noise-from-high-lift-cams/page2?page=2&t=1647586>

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<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-engine-conversions/177032-a-tale-of-two-sporty-s-and-brand-new-dream-or-1250-was-fun-how-about-100/page3?highlight=lifter+pins#post3827139>

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<https://www.xlforum.net/forum/vendors/hammer-performance/139198-well-been-doing-some-thinking-excess-valvetrain-noise?t=1510606>

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Scuba10jdl of the XLFORUM

<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-bottom-end/159217-lifters-comparison?t=1706033>

14) 15) 16)

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<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-bottom-end/159217-lifters-comparison?t=1706033>

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<https://www.xlforum.net/forum/vendors/hammer-performance/160789-gateman-lifters-now-available-from-hammer-performance?s=73d24db8f0756ef41c6215fd92ad0055#post3437771>

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<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-bottom-end/186414-s-s-lifter-identification-help?t=1993359>

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