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REF: General-MSR 05

Hunting Down Sportster Noises

See also Using a Stethoscope or Other to Hunt Down Engine Noises in the REF section of the Sportsterpedia.

Noise and Vibration are normal for a Harley. [1)]
In fact, they are an amalgamation of vibration, sort of a syncopated pandemonium. [2)]
Harmful noises are hard to determine without a well trained ear and these engines make a lot of noise anyway. [3)]
Plus the sound travels through the cases to places other than where it originates.
So critical listening is a must as a noise on one side of the engine may sound more like another area instead.
There was an article in Cycle World back in '83 that said the noises a healthy Ironhead makes would be considered terminal on other makes. [4)]
In becoming familiar with the “normal” noises, you can just keep an ear out for abnormal ones as you're speeding down the road.
They all sound a little different though, which is really unique. [5)]

Of course the closer you are to the point of origin of a noise the louder it will be. [6)]

You sometimes get random noises too and they are generally chassis related.
Some noises are almost too quiet to hear normally, so if you can hear them, you probably have a problem there.
Some noises only occur at certain rpm's.
Gears can be too tight in which case they “whine”. Too loose and they make a clicking sound that's really hard to pick up.
Larger bearings like mains “rumble” when they are worn, but also if they aren't getting enough oil for whatever reason.

Mechanic stethoscope. [7)]	A wooden dowel for a listening tool. [8)]


Critical Listening

If you find that it is an internal engine noise, don't go straight to your tool box and put your blinders on. [9)]
It's hard to check oil pressure, cylinder compression, timing or locate the noise if the motor is in now little pieces.
If you call or ask other mechanics for help, they are going to ask those questions also. It sounds kind of iffie when you answer;
The oil pressure was OK or the compression was good. What hurts is when you say to yourself, I didn't check it, I don't know what it was.
Pin that noise down with a stethoscope or similar tool. Make some notes (like the noise is RPM related, I hear it in the front cylinder, it's loudest under load)
You are assuming the role of Mechanical Detective and a good detective solves the case with some deductive reasoning but mainly by collecting facts.
Just keep this in mind. Noise don't mean a “broken part”.

Some noises are caught up in the same frequencies as other noises on the bike.
You have to decide what you're listening to and where it's coming from.
Noises travel (or transfer) all over the engine and the bike.
Sometimes blocking out certain known noises can help you hear others.

There is the fact of listening and then there is the process of critical listening when diagnosing noises.
In example, listen to any recorded song.
Then play it back and only listen for a certain instrument and block out the others.
That's critical listening.
Apply that to the engine parts as they move.

Comparing Noises From Other Bikes

Imports are liquid cooled, and that in and of itself kills a lot of engine noise that would normally get to your ears due to: [10)]

- Closer tolerances allowed by liquid cooling.
- The insulating effect of having water surrounding the cylinder.

The Sporty engine has a rep for being loud anyway. They make noise and lots of it.
Ring flutter or injector noise, a rattle in 5th as you are on the power, clanks etc.
It's all just part of the “experience”.
If your in doubt, find another Sportster owner and listen to his / hers (most people will be glad to help out a fellow owner).
You can also take it to the dealer although that probably wont be of as much help.

Noise From Vibration

Harley-Davidson uses a common crank pin, meaning that both pistons travel up and down together at the same time. [11)]
So all the weight is being thrown back and forth causing vibrations and the very particular “proprietary” sound or rumble.
Keeping the motor above 3000 rpm's will smooth the vibrations out dramatically.

We can learn to live with it if we know what some of the symptoms are, or we can try to reduce it in many ways. [12)]
Look for loose fasteners and hardware.
The engine and transmission mounts that are loose especially the top motor mount. Check the transmission sprocket to see if it is tight.
The exhaust system can act like a giant tuning fork if not properly supported. Make sure all brackets are tight.
Worn wheel bearings.
Out of service shocks.
Improperly adjusted drive belt and primary chain.
Worn or damaged tires.

Lean carburation and bad or poorly tuned ignition modules can cause vibration.
(especially if the module offers independent timing adjustments for the front and rear cylinders)
Need to first find the cause of the vibration, then rule out safety issues such as tire wear and loose fasteners.
Need to keep it from reaching the three points where your body contacts the bike: the seat, handlebars and footpegs.

Timing can cause vibrations.
A lot of the vibration depends on the rpm and gear you are riding in. These motors do not like to be lugged. [13)]
Move the timing 1 degree more advanced and test ride. Then move it one degree retarded from original setting and test ride.
You will find you can tune out some vibrations at certain rpms moving the timing slightly. [14)]

Tires can cause vibrations.

Worn or under-inflated tires can develop cupping in the tread that can create a lot of vibes. [15)]
You might not notice them all the time, but they can create a buzzy ride at certain speeds.

The key is to maintain your bike and keep it properly serviced.
Vibration is usually more of a combination of the above factors mentioned.
When you have two pistons connected to the same flywheel, vibration is going to happen whether you like it or not.
Thats why we can put a band-aid on it or just not worry about. It's there and not going away any time soon.
Vibration is just the nature of the beast.

Front Forks

At a full stop with the bike idling, you apply the front brake and the bike gets a vibration like a buzz in frequency. [16)]
It disappears when you release the brake lever, and comes back as soon as you apply the brake.

As the engine rotates (picture the crank moving) the inertia tries to move the bike slightly fore and aft. [17)]
The wheel absorbs this motion by rolling very slightly , maybe 1/16“ or less.
By applying the front brake, you stop the movement of the tire so the oscillations of inertia go to the forks and back into the bike.

Vibration in the forks can appear like a dance or like the forks are about to break.
This can shake the brake pad(s) or lights, mirrors and any part on the front can be subject to making noise.

Motor Mounts

Engine mounts may very well be the most ignored maintenance point. [18)]
You can loosen them after working on the engine, run the bike to let the engine “settle in” to the mounts and then torque'em back down.
It may help with vibration issues.
You can also torque the motor mount bolts and put a small line (fine permanent marker) across the bolt and the nut. [19)]
That way can easily spot if the bolt/nut has moved and loosened.

Ironheads / Rigid mount Evos

The frame mount sporty is designed to get rigidity from the engine mounted to the frame. [20)]
Loosing one mount therefore will weaken the overall construction (and increase vibration).

The reason for so many engine mounts is also rotational loads the engine develops. [21)]
Something like when a muscle car shakes the engine when you rev it.

If you are building a bike, chances are you will make performance mod's to the engine.
That means when you “jump” on the throttle, you will be putting a bunch of rotational stress on the other motor mounts.
If you get rid of too many motor mounts, then you risk having the engine breaking free.

Symptom:
Vibration, growing stronger with higher RPMs, can be violent. [22)]

Condition:
Loose / missing motor mount bolts.

The greater the RPMs, the more vibration especially when you lose a motor mount bolt.
Make certain all the mount bolts are not only there, but are properly torqued as well.
One bolt can make that much of a difference.

Rubber mount Evos

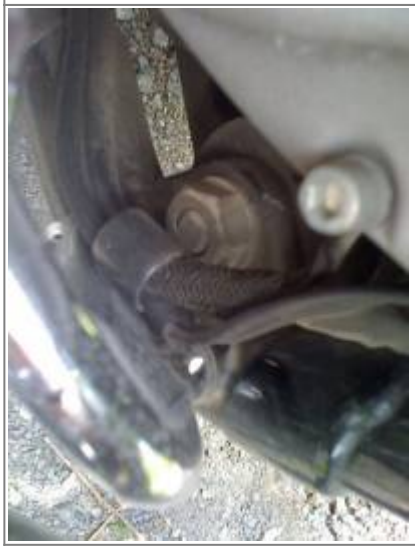
There shouldn't be that much vibration on rubbermount bikes.
You should feel some but not enough to make your feet numb. [23)]
Keeping the motor mounts in specs makes all the difference in the world. [24)]
Tip: If your mirrors are blurry, check your motor mounts.

The front motor mounts are notorious for loosening up. [25)]
Also check the condition of all the motor mount rubber isolators, they can deteriorate from age.
If you over tighten the front mount, you're compressing the mount making it stiffer. [26)]
This leads to less give and a much higher chance of cracking the front mount.

Check the large thru bolt (1” hex head) in the front rubber motor mount. [27)]
It's in the front of your bike below the voltage regulator under the oil filter. [28)]
There's your rubber mount with the big bolt going through it.
If there is no thread showing where the nut is on the bolt, check tightness.
Threads are normally past the end of the nut ranging from 1-2 threads to 1-1/2“ or so. [29)] [30)]
So if it's flush or so you may need to retighten it or at least check it.
As long as it's up to torque (and Loctite was applied), you're good. [31)]
You can remove the right foot peg and rear brake pedal to gain access to the nut.
You may only need to take the bolts out of the front peg mount and rotate it out of the way to get a torque wrench on that nut. [32)]
You can used an open end wrench on the bolt head also.

Also, when looking at the front lower motor mounts from under the bike, the rubber mounts seem to sag downward just a bit. [33)]
This should be somewhat normal as the engine puts downward pressure on the mount when setting.
Both front and rear mounts can sag like this. [34)]
The rears you can't tell from the outside but when you remove the swingarm, you can see the pivot pin is not centered.
You can swap the rear rubbers left to right and the pin will be centered again.
That way, the sag is 'flipped over' and the engine weight is working against it.

However, this won't work with front mounts because they are LH and RH parts.

Front lower motor mount bolt. [35]	1 year old (2011) 1200C front mount sag. [36]
	

Check the top isolator link mount bolts (the ones that bolt to top of the front head). [37]
If they come loose, add some blue Loctite to the threads and re-torque them.

Handlebars

Handle bars are kind of like tuning forks. [38]
They'll have a place that they want to resonate.
To change the resonant frequency one can either lengthen the forks or weight them down.
The more you lengthen them the lower the resonant frequency will be, but they will also vibrate farther at that frequency.
If you weight them down the resonant frequency will be lower, but they won't vibrate with significantly more travel.
The optimal weight (if there is such a thing) would be different for different style bars.

Helpful suggestions:
These are not a fix to end all problems, but to possibly lesson some of them if you're having excessive vibration problems in the bars.

- **Inspect / Replace the mounting bushings**:
  There should be a certain amount of “play” that the OEM rubber bushings should have when installed. [39]
  If they are tightened too much, with zero slack in the bushings, the rubber is compressed and you essentially have a rigid mounted bar.
  The over-compression of the rubber bushings negate the ability of them to help with the vibration.
  If you loosen the bars enough to have more play, it helps a lot.
  And, since some use use a bolt which feeds up into the risers, there is no nut on the bottom to loosen. [40]
    - The compression of the bushing is dictated by the thickness of the top clamp and the length

of the spacer in the bushings.
There are steel caps that cover the bushings. That is your bolt spacer and your torque guide. [41)]
Those washers are 'shouldered' to wrap around the outside of the bushing. This keeps them from wallowing around.
If the bushings are worn out or the washers are deformed-it's a losing battle.
You are either gonna have bad vibes or 'rowing' bars.
- You put enough pressure on them to compress the collars and stop when you see the washers starting to flex.
These washers get deformed from people cranking down on the bolts.
If the bolts don't fit snugly in the bushings, you need sleeves.
You can do this with some kind of metal tubing, heat shrink tubing, electrical tape, or a larger bolt.
Ace Hardware has a pretty good selection of bronze, rubber, and neoprene bushings also.

- **You can try and shim the bushings** to get the bolts tight without compressing the bushing too much. [42)]
You might try a compression sealing washer from an Evo or other Big Twin spark plug for a shim washer to use on the mounting bolts.
You can stack a few of them (two, maybe three per bolt) until you get the right amount of play.
Then, torque the bolts to spec and not have the bars feel like they are “solid” rubber mounted.
  - The bushing shim effectively adds length of the inner sleeve.
The shouldered washer then goes over the shims, and you now prevent the over-compression of the rubber bushing.
You can torque to spec without distorting the shouldered washers.

Bushing shim [43)]

- You can also lesson some vibration in the bars by replacing the stock mounts with polyurethane bushings.
  - This is a debatable answer however. Some have reported the poly-bushings made the vibes worse. [44)]

Poly bushings on an 09 1200N. [45)]

- **Adding weight in one form or another the handlebar ends**:
  With internal weights, fill the bars with enough silicon to fully encase the weight.
  That way, the weights touch the bars and they harmonize the vibs better. [46)]

1. When replacing the grips, you can tape up 2 rolls of pennies (or nickels if they'll fit) and slip one inside each handlebar end. [47)]
   - Wrap the rolls in electrical tape (making a solid slug) and then a little dab of RTV on each end to glue them into place. [48)]
   - In adding silicone in the hole, then shoving the pennies in, [49)], the silicone gives cushion between the pennies and the bar. [50)]
     As the bar pushes forward (in the course of vibrating), the pennies try to remain still.
     The silicone between the bar and pennies compresses and elastically collides with the pennies.
     This lessens the momentum applied to the pennies, thus lessening the forward movement of the bar.
     Same for the other direction —→ Equals less of the annoying vibrations.
   - It should significantly reduce vibration transmitted to the grips while riding.
     The thing that this trick does to help with the vibrations is to lower the resonant frequency of the bars so that it doesn't buzz your nerves to numbness.
2. You can wrap the ends of two steel rods with rubber tape until they fit in the bars snugly (not tight). Cover them with silicone / construction adhesive and shove them in the bars until flush. [51)]
3. You can buy a set of bar end weights.
   - Barsnake is a very thick rubber which is installed inside your handlebars to reduce vibration. Available in solid form, or as a liquid which is poured into the bars and then solidifies. [52)]

Horn

Symptom.
Front cylinder noise.
May sound like a noisy lifter or piston slap at certain revs. [53)]

Condition.
Front horn vibrating against the frame down tubes.

Fuel Tank

Symptom.
Vibration noises.
May sound like engine noise.

Condition.
Slightly loose fuel tank mounts will cause the tank to vibrate especially at higher RPM and may sound like the top end is about to come apart. [54)]
Of course, a good way to see if it is your gas tank making noise is to press your hand down on it while riding.
If the noise stops then you've found it.
Tighten up the mount bolts and maybe try some lock-washers and Loctite on them.

One problem with the fuel tank is that the bolt holes in the tabs are much larger than the OD of the bolts.
If your tank doesn't have rubber spacers, this can be a source of noise.
A homemade rubber washer (made from ~3/16” slices of oil line) can be installed between the metal washer and the tab.
When tightened, the rubber squishes into the space - no more vibration.
You may have to re-tighten a couple of times after riding as the rubber finds its way in.

Homemade fuel tank mount isolators. [55)]

Another source of fuel tank noise is a gas cap that doesn't fit tightly. [56)]
You can also push on the tank or the cap while riding to check for noise.
Also, the tank itself will amplify the normal racket when it's near empty, even though it and the cap are tight.
You can tell when it's about time to stop for gas when you hear the engine noise echoing around in the tank.

Oil Tank

Symptom:
Rattling noise on the right side of the bike.

Condition:
Loose oil tank cover. [57)]

You can glue a piece of rubber to the inside of the cover.

Noises From Loose Objects

Apparel

Any loose snaps or buttons on shirts, jackets etc. will flap around in the wind.
Any of those on or near your helmet can repeatedly slap against it.
Noises will range from an occasional tap to a sudden feeling of riding in a hail storm.

Helmet

The snaps holding the visor on the helmet can slap against it in the wind. The metal clasp on the chin strap can also do this if you forget to tighten it.
This can result in metallic crackling noises coming from one side or the other of the bike. [58)]

You can add a few rubber washers stretched around the snaps to stop the noise.

Straps / Hold Downs

Secure all straps and hold down cords etc. especially when not in use.
It's best to keep them in a saddlebag or home when not in use.
Some will simply pull a bungee cord tight over the seat to keep it there until you get home.
If the hooks aren't tightly pulled, they can come loose and possibly end up in your rims.

Jiffy Stand

The spring on the kick stand gets weak over time. This allows the stand to reside lower while riding. During left hand corners, it will scrape the ground. Replacing the spring is pretty simple though.
When you check the side stand spring, be sure to look at the bushings as well (if applicable). They are also a wear item. [59)]
Have someone hold the bike up, fold the kickstand up and shake it. There should be almost no movement at the pivot. [60)]

Shrouded Noises

With a half helmet and no windshield; [61)]
Up to 60 MPH it sounds like a hundred or two very busy blacksmith shops.
Over 60 it was just the wind.

Windshield

A windshield can direct noises straight at you while riding.
It makes them more pronounced where little things sound a lot worse than they are.

Helmet

Helmet style also plays a part in how much noise you here.
A full helmet covers your ears and will mask 'close' sounds and how loud sounds are in general.
(foam mounted on the inside for sound/heat purposes)
You can actually be riding and loose a muffler and still wonder what the new noise is.

A half helmet doesn't cover up noises as much as it makes them louder.
Your ears have a front seat to all of the noises from your bike as well as the wind whisking past them.
It also accentuates little noises that make you wonder.

Exhaust Pipes

Granted, loud exhaust pipes are part of the Harley experience.
However, the louder the pipes are, the harder it is to hear other noises in the engine.

Noises After Dropping the Bike

Symptoms:
New noises coming from wheel areas.

Conditions:
Bent rotors:
Rocks / debris stuck between the caliper and rotor (especially on gravel driveways). [62)]
Caliper knocked loose / damaged. [63)]
Fender rub from bent or tweaked fenders. [64)]

Electrical Noises

VOES Switch

The VOES switch makes a chirping sound when it's switching. [65)]
This is normal.

Generator Noises

The generator should be 2 or 3 times noisier than the other points.
Generators are notorious for sounding like marbles are clattering around in a bucket. [66)]

New, out of the box, generators are a little loud until they are worn in. [67)]
The bearings, shaft and even the brushes take a few miles to settle down.
Aftermarket generator gear quality is not the highest, or the parent material the gear is machined from for that matter.

If the generator is suspect, you could take the genny out. [68)]
Fab a blank off plate to cover the opening and start it and run it for a very short period of time and see if it goes away.

Engine Noises

Do this before you do anything else, try to locate the noise before you tear it down. [69)]
Determine which side of the engine it's on, then whether its top end, cylinder or crankcase.

Low or insufficient Oil Supply

Symptoms:
Oil light stays on.
General tapping, knocking, excess heat, engine shutdown and much more.
(especially noisy lifters / valves)

Conditions:
Low on oil.
Stuck closed oil check ball.

Worn or defective oil pump.

First response, check for piston skirt, or perhaps lifter damage. [70)]
The lifter rollers will survive on oil mist, except maybe under sustained maximal rpm where the oil provides a bit of cooling.

If the bike sits for a long period of time, the oil may settle at the bottom of the engine. [71)]
This may leave the top end with not much oil at all.
The valves and / or lifters could make some noise until the oil pushes them back up.
The noise should go away after a few miles.

Vacuum Leaks

Vacuum is normally intake related as in the carburetor or intake manifold.

Symptoms:
Vacuum leaks are usually more of a hissing sound and are a constant noise.
Or a constant whine and not pulsating with the piston stroke.

Conditions:
Split, leaking, missing or obstructed vacuum lines on any of the vacuum operated devices and respective hoses. [72)]

Visually inspect lines and vacuum operated devices. [73)]
Also inspect any rubber fittings or caps for cracks or splits (especially around Voes or Map sensors, if applicable).
You can use a stethoscope to probe any of these areas also.

Inspect for carb gasket leaks and all areas around the intake manifold.

Knock / Ping / Detonation

Overheating can be caused by poor octane fuel (knocking/pinging). [74)]
It does not have to be audibly pinging to be causing damage.
When it gets to the point where you can hear it, it is pretty severe.
But, the subtle detonation you do not or barely hear that tears the motor up.

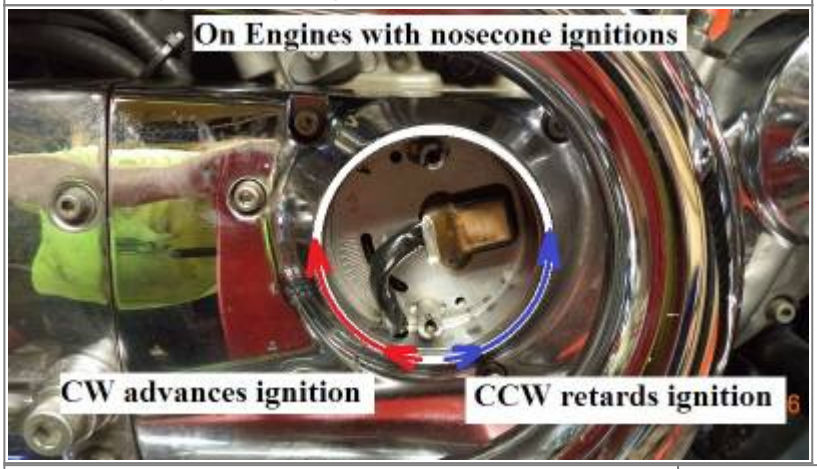
Detonation can and will put a hole in a piston and/or scorch valve landings. [75)]
It is also most likely to cause damage to the ring landings. [76)]

Symptoms:
Sounds like a little gnome inside the cylinder tapping the sides with a little hammer.
It's also akin to sounds of marbles in your cylinder. [77)]
Detonation sounds (and feels) nothing like valve train noise, normal or oil starved. [78)]
A low level knock coming from the cylinders, most noticeable at idle.

Conditions:
Fuel octane level too low.
Lugging the engine.
Carburetor jetting too lean.
Timing too advanced.
Conversions that are not compatible.

Try draining the carb and adding some octane boost to the tank. If the noise goes away, it's detonation. [79)]
If not, check your timing. It may be too advanced.

Nosecone ignition timer plate [80)]



This piston is just about to break from too much cylinder pressure. This is from a race motor using Nitromethane [81)]

Broken piston from detonation. (883/1200 conversion) [82)]

Backfire

Backfiring through the carb is almost always a timing issue. [83)]
Backfiring through the exhaust pipes is almost always an issue with leaking O-rings on the manifold.

Noise Cadence or Rhythm

The cadence (timing) of noises can give clues to what part of the engine to inspect. [84)]
Listen to the timing of the noises.
Some things happen at what can be deemed as “full time” while others happen at “half time” or “quarter time”.

In example:

- Noise at every crankshaft revolution could lend to crankshaft, rod bearing or piston problems.
- Noise at every two crankshaft revolutions could lend to cam, cam bushing, lifter or valve train problems.

If need be, you could run a stopwatch and count the number of times you here the noise in a minute. [85)]
Then compare that to crankshaft rpm to find the actual rhythm of the noise.

Rocker Box

Symptoms.
Ticking or tapping sound.
May sound like a lifter.

Conditions.
The rocker arm shafts have a notch in them that a mounting bolt is supposed to butt up against which locks the rocker arm shafts in place.
However, the bolt hole is too large which leaves a gap there.
This gap allows the shaft to slightly rotate and hit the bolt which causes an annoying ticking / tapping noise.
Consider Rocker Lockers to stop the shaft from pivoting.

When using high lift cams, the valve springs may rise up and tap against the rocker box.
Open the top and look for witness marks. Add clearance to areas that are toruching.

Symptom.
Hissing sound.

Condition:
Bad umbrella valves. [86)]

Heads

Symptoms:
A whine and chirping sound like a bird in the intake or carb. [87)]

Condition:
Head gasket leak.
You can feel around the heads for air leaks while the engine is running.
You can also perform a leak down or compression test on the cylinders.
Or you can use a stethoscope or rubber hose to listen for air leaks around the gaskets.

Symptom:
Clanking at the head / cylinder joint. [88)]

Condition:
Loose head bolt.

Pistons

Symptoms:
Known as “Piston Slap”, a hit / knock / clanking in the top of the cylinder / rocker box. May only show up as a sudden loud clanking on startup.

Condition:

- Piston slap is usually caused from too little piston to valve clearance where the valve(s) end up hitting the top of the piston.
  It can be a slight tap or a hard knock depending on how little clearance between the piston and valve affected.
- It is also possible for the piston to hit the head(s) in the wrong circumstances and cause a tap or knocking noise.

Affects:

- From piston to valve impact:
  - Some or possibly all of these: bent pushrod, bent valve, witness marks on the piston or valve affected, hole in piston from valve to piston contact.
  - The force from impact of piston to valve contact can be transferred through the rocker arm to pushrod→cam (and bearings/bushings)→pinion shaft gear→beyond.
    - On 88-up models, the weakest link may be the woodruff key on the pinion shaft that can shear from impact.
  - Impact can damage the valve guide which can lead to oil gunk on the valve stem.Upon cold startup, the gunked up oil on the stem locks it in place. [89)]
- From piston to head impact:
  - Possible cracked head or busted piston / rings, increased heat etc.

Known Causes:

- From piston to valve impact:
  - Can be caused from cams being installed out of time.
  - Can be caused from too long of pushrods or adjustable pushrods out of adjustment (being too long) especially after installing high lifts cams.

    - Also, a spun pinion gear (88-up) will set your timing off and both intake and exhaust valves can hit the pistons and bend valves and pushrods. [90)]
        - A spun pinion gear is usually caused from the woodruff key shearing and the pinion gear turned off it's timing mark, throwing the cams out of time.
    - Can be caused by worn/damaged rod bearings or flywheels out of true.
    - Testing: Place a stethoscope on the exhaust flange to listen for piston slap. [91)]
      If it is piston to valve contact, it will most likely show up on the exhaust flange.
      You would need to touch the stethoscope probe directly to the flange. You can also test the intake port.
- From piston to head impact:
    - Can be caused by worn/damaged rod bearings or flywheels out of true.
    - Can be caused from improper installation.
      Using a flywheel assembly from a previously destroyed engine without inspecting rod bearings and runout.
      Always rotate the crank while the jugs are off and check for smooth feel and check up and down play in the rods.
      It helps to have a quiet atmosphere. Dump oil on the bearings and listen all the way around in neutral.
      Then spin it over by hand in before buttoning up. You can check the squish band dim with solder.
    - Also, if the squish band has a layer of soot thick enough to touch the piston, it'll make piston slap noises. [92)]

In the video below, the flywheel assembly from previous engine damage was used WITHOUT inspecting further damage to the assembly.
While the exact cause is not known on the new build, you can hear the piston making contact with the head in the video.

Short video (L) and Pics of a 2000 Sportster with rear piston hitting the head. [93)]

100-noise_piston_slap_on_2000_sportster_by_groovemeisterus.mp4

Light witness marks from piston contact with valve. [94)]

Heavy witness marks from piston contact with valve. [95)]

Symptoms:
A hit or knock at the bottom of the cylinder.

Conditions:
A mis-aligned crankshaft can result in piston skirt slapping at the case opening. [96)]
Bearing issue: Knocking really beats the pistons, rings and bearings up. [97)]
You may have beat a rod bearing into submission.
Typically, stock crank pins and rod bearings are the weakest point in a sportster lower end.

Connecting Rods / Crankshaft / Flywheels

Connecting rod bearing failures generally exhibit noise, visible clearance indications, piston to valve contact, and/or secondary damage in the form of a high levels of steel debris circulating through the engine. Verify that one or more of these symptoms is present and quantified prior to attempting to qualify the rod bearing condition. [98)]

Symptoms:
A loud rod rapping sound up top. [99)] It also may have a whirling sound.
It may sound like the noise is half the speed of the engine RPM (if counting both cylinder lopes). But it's actually at 1 revolution speed.
Rod noise should be loudest when the engine is floating (not accelerating and not decelerating)as in cruising down the highway. [100)]
That's when the rods have the least pressure holding them against the bearing surface.

Condition: Wrist pin bushing failure.
Verification: Remove the wrist pins and check pin to bushing clearance and also roundness of bushing itself.

Condition: Rod bearing failure.
Verification: Check for up and down movement of each rod at several points of it's rotation.
Removing the pistons and grabbing each rod bypasses the error factor of piston side play.
Also, you can hold the rod just under the piston with one hand like choking a chicken and pull up on it. [101)]
Then use your other hand in a fist to hit the top of piston like a hammer action. A bad crank will make a very loud knocking sound as you do it.
Henceforth known as the “Wedge Test”.

In the (L) video below, you can hear the rapping at 1:1 engine speed.
The (R) video is a bearing test as described by XLForum member “wedge” and performed by XLForum member “onadraw”.

Video: Lower front rod bearing failure [102]	Video: The “Wedge Test” for bearing failure. [103]
100-noise_lower_front_connecting_rod_rapping_by_onadraw.mp4	100-noise_lower_rod_bearing_test_by_onadraw.mp4

Symptom:
A deep grinding sound on the bottom. [104]
A deep internal sounding 'bang' or knocking. [105]

Condition:
Rod bearing / crankshaft failure.

Symptom:
Engine shakes bad enough to tear up some parts.

Condition: Flywheels are out of true. This can crack the cases in short order. [106]
If fly wheels were out of balance, it'd vibrate like hell all the time even sitting still just raising the rpm's. [107]
Verification: Check pinion shaft runout.

Cylinders

Ironhead cylinders bolt to the case, then the heads bolt to the cylinders.
A loose cylinder bolt can make a clanking sound.

Cams / Cam Cover

Symptoms: A spinning or whirling sound. [108]

Condition:
Loose fitting sounds near each cam, the pinion shaft bushing or the idler gear (if applicable). [109]
Too much end play, worn cover / case bushings or case roller bearings (respectively).
Noise can also come from an unmatched cam set including idler gear (if equipped).
Note: While investigating this noise look for discolored cam gears. [110]
A spinning cam bushing creates excess wear and will discolor the cam on the side of the failed bushing.

What causes cam gear noise?:
Whenever a roller lifter in a Sportster engine passes through maximum cam lift, the forces on the cam gear teeth change direction. [111]
If there is more than .002“ backlash, the change of force and direction will result in an audible “click” as the backlash moves from one side of the tooth to the other.
Gear noise always occurs at idle and lower engine RPM. Stock EV Sportster cams are made with different

gear sizes.
They are color coded by size and selectively fitted to engines at the factory to a minimum backlash which results in reduced gear noise during engine operation.
Andrews Products cam gears for EV Sportsters are made with gears in the middle of the size ranges so there is only a small chance of cam gears fitting too tight.
Cam gears which have excess backlash may rattle or “click” during operation. This clicking sometimes sounds like lifter noise.
Unlike whining gears, rattling gears will not cause gear tooth failure or engine damage. If you don't mind the noise, it won't cause any engine problems.
Gears which are operating without enough backlash (fitted too tightly) will whine during operation.
This condition is serious and can cause localized gear overheating, tooth surface failure and engine damage.
Cam gears which fit too tight must be corrected with smaller size cam gears.

When installing the cam cover, it is important that the cover is drawn to the crankcase as evenly as possible. [112)]
Not only will this ensure sealing to the crankcase, but it can have a positive impact on cam gear noise.
During the initial assembly of the engines, Harley began using a new sequence for torquing the cover fasteners.
The fastener torque remains unchanged at 80-110 in / lbs.

Lifters

Hydraulic lifters depend on a working check valve to function properly.
Grit in the oil supply can get between the check valve and it's seat.
This would effectively deflate or collapse the lifter.

86-90 engines especially are susceptible to lifter noise due to their oiling system design.
The intake lifters are fed oil directly from the feed galley.
However, the exhaust lifters are fed from the intake lifters thru a drilled hole between the bores.
In theory, the intake lifters get more oil pressure than the exhaust lifters.

Symptom:
High pitched clacking / tapping sound attenuated by engine speed. [113)]
Noise will probably travel to the rocker box and will be at half engine rpm.

Conditions:
Low oil supply to the lifters.
Collapsed lifter.

Check with a stethoscope or other for the same approximate noises at each lifter.
A collapsed / bad lifter will cause a moderate to severe clacking or tapping noise depending on how bad the lifter is. [114)]
It would be rare if all of the lifters were collapsed.
Listen for one to sound very different from the others.

Lifters are oil pressure dependent. [115)]
A noisy lifter at idle may quiet down with throttle applied.
An over heated engine might carbonize an oil way or similar oil path.

There are 2 major causes of solid lifter failures, oil temperature, and the most common is fuel contamination in the oil. [116)]
If you suspect a lifter failure, first cut open the oil filter and look for metal debris.
If debris is found, then pull the cam cover and start looking for the source of the debris.
Once a motor is contaminated in this fashion (to be fixed right) it needs a complete rebuild to eliminate all the debris and damage caused.
Any other repair may just be a patch job at best.

In the event you don't happen to have an oil filter installed, scrape out the bottom of your oil tank and see what's living in the sludge down there. [117)]

The sooner you catch it the better.

86-91 lifter noises could also be attributed to intermittent lack of oil due to the pressure regulator sticking open.
The valve could have debris under it keeping it open.
This will send some normal oil flow straight to the gearcase-crankcase and back out the scavenger pump to the oil tank.
(instead of thru the normal engine passages)

Pushrods

Adjustable Pushrods

Symptoms:
Same sounds as a ticking lifter.

Conditions:
Pushrod adjustment.

With adjustable pushrods, the rod adjustment can be an issue. [118)]
Too tight will leave the valves open off their seat.
(which will be even more noisier as the valve(s) slap against their seat)
Too loose will cause noise when the valve slaps onto the seat.
For an exhaust pushrod, you can hear at the exhaust, the sound of the fuel burning almost as if it were exploding. [119)] If a pushrod is too loose you will hear a louder click sound at it's lifter block.
If you adjust the pushrods on the looser side, you will hear this click on the exhaust pushrods.
(slightly louder than at the intakes)
Also check for a loose locknut. [120)]

Solid Pushrods

Valves

Symptom:
Popping noise in the exhaust (or intake) along with a misfire. [121)]

Condition:
Broken valve spring. They do break on occasion.

Symptom:
Valve tapping up top.

Condition:
Poor clearance between the valve spring and the rocker box.
Check clearance in the rocker box area of the valves.

Symptom:
Valve train clatter, power loss and backfiring through exhaust on short trips. [122)]

Condition:
Exhaust valve is beginning to stick.

Primary

The primary is a big hollow chamber and it will amplify any noise coming from anywhere in the engine. [123)]

- **Symptom: Whining or Chirping Noise**
  A primary chain that's adjusted too tight can make a whining or chirping noise. Reportedly, the chirping noise can come on after some full throttle and hard shifting when the primary chain is too tight / bike hot. [124)]
  Condition: Chain out of adjustment
  One method of adjusting a tight primary chain: With the bike hot and running in neutral, loosen the nut, turn the adjuster in until it starts to whine, then back it off 1/4 turn. [125)] Then ride it and make sure it's not whining any longer.
- **Symptom: Rattling noise**.
  A rattle that you cannot adjust out is a sign of a stretched chain. [126)]. If your primary chain is too tight, that can cause a vibration that is felt in the pegs. [127)]
  Condition: Stretched Chain
- **Symptom: Rattling or Squeaking Noise**.
  The sprocket nut can work loose and the noise is from the rotor eating itself up on the crank splines. If it's bad enough, it can end up breaking the end of the crankshaft off. [128)]
  Condition: Loose sprocket nut.

- **Symptom: Squeaking Noise**.
  A squeaking noise seemingly from the area of the generator. [129)]
  Condition: Loose / damaged chain adjuster.

75 primary adjuster damage. [130)]



- **Symptom: Rattling Noise**.
  Conv90 submitted video of noise from the primary side:

100-noise_on_buell_by_conv90.mp4

- **Symptom: Rattling Noise**.
  The tensioner shoe can be loose and rock side to side enough to sound like a lifter problem. It will rock fore and aft into the primary cover.
  From the cam side of the bike, it'll sound like it's a lifter bouncing around. It's a slow intermittent hollow banging noise. It may only make noise at idle when the chain is least tight.
  - **Condition: Loose Primary Chain Adjuster Shoe**.
    Below is a short video by Conv90 of the XLFORUM showing the hollow noise created.

100-noise_primary_chain_adjuster_shoe_by_conv90.mp4

- **Symptom: An extra and constant noise inside of the primary case**.
  An extra and constant noise inside of the primary case (even / after adjustment of the primary chain adjuster). [131)]
  Condition: Loose compensator nut / flywheel sprocket shaft nut.
  Once the sprocket on that shaft gets loose enough, it will chew the end of your fly wheel. [132)] If this is the case your motor must come out and the cases split to fix it.

Transmission / Clutch

Cyclical noises longer in duration than engine revolutions could be primary chain, compensator sprocket or clutch basket bearings. [133)]

Symptom:
A pronounced “thunk” sound when shifting gears. [134)]

It's fairly normal to hear it when moving from neutral to 1st gear. It doesn't happen at specific RPMs. [135)]
It shouldn't happen when shifting gears while riding.
But, sometimes you'll hear it while shifting too slow.
Don't baby the shifter. You have to put a little effort into changing gears sometimes.
Shifting too slow can give a loud click or several consecutive ones sometimes.
It's believed to be the gears meshing together.
It's also associated with the clutch plates sticking together with the thicker oil when cold.
Others will back the bike up in gear and then walk it forward before starting the bike to release the plates from each other.

It doesn't happen with the engine shut down.
In reality, some will shift into first before starting the engine with the clutch pulled in to avoid the clunk.
You

Symptom:
Squealing like a car's serpentine pulley bearing going bad. [136)]
The noise is louder with the primary inspection plug removed.

Condition:
Bad clutch throw-out bearing.
Usually a bad throw out bearing is most noticeable when pulling in the clutch lever.
Ride around a bit and keep pulling the clutch lever and see if the noise coincides. [137)]

Condition:
Warped clutch discs or worn clutch hubs can also cause clunks because the clutch cannot totally disengage. [138)]

Drive Belt / Chain

Symptom:
Clunk sound in the drive train with initial on or off throttle.
Further description:
At any speed and in any gear, you can roll on the throttle firmly and hear a clunk sound from the drive train. [139)]
Then when you abruptly let off the throttle, you hear the same clunk sound.
This has happened on a brand new bike and has been noted on many others as well.

Condition:
The cause is not widely known.
However, the condition has been deemed by dealership inspections as well as owners to be a normal sound.
It may simply be backlash on the tranny gears due to varying forces of on/off throttle.

Putting the bike on a stand / rear wheel off the ground and in gear while turning the rear wheel, [140)]
There's a definite loud “clunk” from deep inside the gearbox.
Obviously, there has to be some give in the transmission line somewhere.
There's no cush drive on (U.S.) bikes so there's nothing to soften the take up.

Some clunk is normal, too much clunk is not. [141)]
The only way to tell is to ride a few other bikes, or get someone who has ridden a few other bikes to ride yours.
Make sure all the sprockets are tight.
They all have some rotational play, but should not have lateral play (twist) on the shaft.
Some have had the nut on the front rubber belt drive loosen up.
Running the belt with more slack may help absorb some of the shock. [142)]
Primary chain adjustment seems to have no affect on the clunking noise.
Check for play in the clutch basket.
Consider softer rear adjustment or longer shocks.
Also check your throttle cable adjustment.
The clunk is worse if you snap on / off the throttle quickly.
And those bumps in the road can sometimes jerk the throttle, so having the cable adjustment set right does help.
Running the belt a little on the loose side helps. [143)]

Belt

Symptom:
Squealing noise.

Condition
Dirty belt. [144)]

Condition:
Loose pulley. [145)]

Noise may not be noticeable at low speeds. [146)]
If the pulley gets loose, inspect the pulley, bearing and race for possible replacement.
Also check the teeth on the sprocket for sharp edges which can break the belt. [147)]

Symptom:
Chirping sound at the belt. [148)]

Condition.
Loose belt.

If you get it too loose it will chirp from sliding sideways on the front sprocket.
If it doesn't chirp, and if it's not tight, the bike will feel better and handle better in corners as you accelerate.
Some run the drive belt a little looser than what the manual calls for. [149)]

The belt's not going to “skip” unless it's so loose that it's actually sagging. [150)]
When the belt is about to break (i.e., from stone damage), the 'clunk' of putting it into gear (clutch pulled in) sometimes causes the belt to break. [151)]

A tight belt doesn't make noise. The damage caused by a tight belt is what makes noise. [152)]

Chain

Look for witness marks where the chain may be slapping nearby objects.

Slack in the chain can make it slap the oil tank. [153)]
You may not be able to make it hit the tank by hand when lifting the chain when parked.
But while riding, the chain can move more than by hand.
It also sounds like marbles in a can. On hard acceleration, it can rattle because of the chain being pulled tight.

The chain can also slap on the chain guard. [154)]

Symptom:
Popping sensation with no noise but just a feel.

Condition:
Worn teeth on the drive sprocket.

Putting a new chain on a badly worn sprocket and it will be a junk chain in a few miles. [155)]
With bad sprockets the chain will stretch to match the sprockets.
The opposite, a stretched chain will carve the sprockets.
It's a good idea to replace the chain and sprockets together.
It's cheaper in the long run, and less annoying.

Worn sprocket. [156)]

Tires / Wheels / Brakes

Tire Rub

Clearance is important between the tires and fenders, fender / light / saddlebag bolts etc.
It is especially important to check when swapping to bigger tires than stock sizes.
Tires can expand when heated.
An “X” amount of clearance will change under use. Always check clearance around the tires with this in mind.
Any tire rub is dangerous. There is no such thing as minor tire rub. [157)]

The shocks are meant to bottom out (before the rear tire rubs) and prevent tire rubbing. [158)]
If your rear tire is rubbing / contacting the underside of the fender, you have the wrong shocks.
If you take the shocks off and lower the bike gently, you can measure the distance between the shock mounts at the lowest position.
(that provides adequate tire clearance)
Or you can put on only one shock and bottom it out to check clearance.
One problem with lowering blocks is the possibility of bending, especially the cheaper ones, loosing tire clearance, and causing a blow out.

It should be noted that one tire manufacturer's tires may be slightly more narrow / wider than the same size tire from another company. [159)]

Symptoms:
Rubbing noise.

Conditions:

Tire out of alignment.
Look for witness marks on the tire.
Check / adjust alignment.

Bent fender.
Wrong or worn wheel spacers. [160)]
Check front alignment from wheel to fork on both sides before adjusting the fender.
For the rear, the wrong spacer(s) throws out the alignment on the rotor and belt alignment.

Tire rub from belt due to wheel misalignment. [161)]

Condition:
Loose belt rubbing the belt guard / debris deflector. [162)]
Remove the belt guard, check for witness marks inside it.
Inspect anything that could have contact with the belt.

Condition:
Running a tire that is too tall / wide.
Tire rub from docking hardware, lights, etc.
Tire rub on the underside fender.
Either can most noticeable as a rubbing sound when going over bumps.
(as obviously it wasn't noticeable upon installation).

The tire below is an Avon MT90 16 (same as stock Dunlop size 130).
It is slightly wider than the Dunlop.
Bridgestones are reportedly almost 1/2” wider than others. [163)]
The shocks were also lowered on this bike.
However, the bolt for the rear sissy bar attachment rubbed into the tire.

Tire rub from docking hardware bolt. [164)]

Symptom:
Rubbing / whapping noise'

Condition:
Only one part of the tire rubbing the fender.
Possible causes are the bead seat uneven or spoke wheels 'out of true'. [165)]

Bearings

Symptom:
Screeching noise.
Grinding noise.
Popping sound.

Condition:
Dry / damaged bearings.
A bad bearing will usually transfer heat to the hub and as it gets worse. [166)]
If you suspect a bearing, feel the hub during / after a ride for heat buildup.

Tread Noise

Symptom:
Low level moaning sound over some surfaces (may sound like a snare drum). [167)]

Condition:
Different tire tread patterns can have their own sounds over different riding surfaces.
This is more of an annoyance than anything harmful. As long as the sound is consistent rather than intermittent, it is fine.
(as in something punctured the tire and repeatedly hitting the road on cadence)

Symptom:
Tire rubbing against other parts.

Condition:
Improper clearance between these objects due to aftermarket tires, bent fenders extruding bolts behind fenders and etc.
See below.

Front wheel specific

Symptom:
Rattling noise from wheel area. [168)]

Condition:
Loose right leg pinch bolt.

When the axle (and wheel) is assembled, the pinch bolt in the right leg is completely loose. [169)]
This allows the axle to fully clamp the hub bearings (inner races) tightly to the left leg.
(holding the axle itself with a screwdriver thru the hole in the axle head and tightening the axle nut)
With the axle securely clamped to the left leg, you now tighten the right leg pinch bolt in order to secure the axle to that leg.
This allows each fork leg to be independently attached to the axle to maintain proper fork alignment.

'Checking tightness of all bolts after working on your bike' goes without saying.
However, checking the bolts are especially important when someone else works on your bike.
From HD dealerships to indies, pinch bolts have been reported to have been loose and spinning around after receiving the bike back.

Rear wheel specific

You need 2 people, 1 to roll the bike and 1 to see where the noise is coming from. [170)]
Or, it would be easier if you could lift the wheel and spin the tire to find the noise.

Symptom:
Rubbing noise. [171)]

Condition.
Improper wheel alignment.

It's important, when installing the rear wheel, to center the wheel using a homemade alignment tool as in the FSM.
Else, the tire can rub against the belt which eats at the rubber on the tire.

Brakes

Symptom:
Squealing sound coming from the wheel area.

Condition:
Brake squeal, common with disc brakes, is caused by the brake pad vibrating against the caliper piston or caliper backing plate.
This condition can be aggravated by disc runout, caliper misalignment, or glazed pads. [172)]

Brake pads not retracting off of and rubbing against the rotor.
Any time you remove and then replace the caliper you're probably not going to get things to line up exactly where they were before.
A few thousandths difference will mean that the pads and disc need to wear together to mate up again.
You may hear a harmless light contact at the new “high spots” that will go away as the disc and pads mate up again.
You will hear the same thing (only much more pronounced) when you install new pads because the disc and pads have to wear in to one another again. [173)]

Always check for loose brake calipers.
If the wheel isn't centered exactly where it was before a tire swap, you may get a little noise for a while (from the brake dragging). [174)]

If noise does not stop with the application of the front or rear brake, then it may not be a brake issue. [175)]
Pull the caliper, hang it off the fork leg in a safe manner and ride the bike around the block. wedge of the XLFORUM [176)]
You can put a block between the pads and tape it inside so that you can't push the pucks out too far by mistakenly using the brake. Keep aware that you now only have brakes on the other wheel. Listen for the noise (and don't use that brake lever while you do this).
If the noise goes away, clean that caliper good.
Make sure you still have the tin's behind the pads and then use a bit of anti-seize or brake quiet to grease the backs of the pads.
Also grease the backs of the tins so that they can't vibrate and create a high pitched squeal.
Make sure the clip springs are in correctly and lightly greased with anti seize too.
(wheel bearing grease will do the job also)

Exhaust

Symptoms:
The exhaust note (pitch) changes to a more hollow sound.
A blown gasket or a header that worked its way loose will be noticeably louder. [177)]

Condition:
Gasket leak or blew out.

Symptom:
Loose vibration sound.

Condition:
Loose bolts.

Check for loose heat shields and mounting bolts.
You can use a stethoscope or a piece of oil line to listen for leaks at the mounts and joints.
Or, you can put an old damp towel over the exhaust pipe and run your scoot for a few minutes. [178)]
After the engine cools down, look carefully over the engine for the telltale smudge of black soot which points to an exhaust leak.

Symptom:
Popping noise in the exhaust (or intake) along with a misfire. [179)]

Condition:
Broken valve spring. They do break on occasion.

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