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# EVO: Engine Mechanicals - Sub-03A

## Cylinder / Head Bolt Issues and Repair

### Sub Documents

See also in the Sportsterpedia:

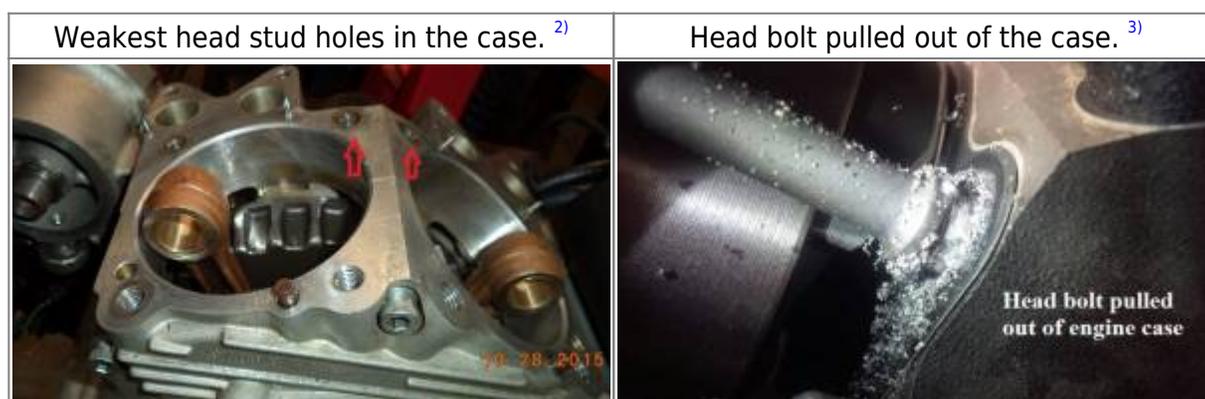
- [Time-Sert Repair on Engine Case Cylinder / Head Stud Hole](#)
- [Warped or Damaged Thread Repair](#)

### Loose Head Bolt Studs

A big concern about the studs becoming loose is the threads being stripped in the case. The two side by side bolt holes on the right side in the pic below are each drilled into the opposing holes and tapped.

So each hole is depending, in part, of the strength of the other.

With the bolts loosening, it is at least suspect that the threads or the hole strength is compromised. <sup>1)</sup>



There is a procedure in the manual for tightening the studs before installing the cylinders and heads. Basically you put a steel ball on top of the stud, then a head bolt cap on top of that. The ball allows you to achieve spec'd torque and still remove the nut without unscrewing the stud from the case.

This 'sets' the studs into the case in addition to the torque applied to the head bolts.

Without the initial torque on the studs, they are totally dependent on the torque of the head bolts.

But they shouldn't back out unless either they weren't installed right to begin with or the hole has been stripped / compromised.

If a stud is backing out, it could have simply be from it being installed improperly to begin with. It is possible that the stud turned when the head cap nuts were removed.

Heat plays a role in what happens to the studs / nuts also and can lock the cap screw tighter than the stud is to the case.

So it is possible that the top nut was just tight to the stud before breaking loose.

First try and remove any studs that back out and check the threads in the case as well as the stud.

It is also possible to burr the stud threads by dropping them on installation and subsequently ruin the case threads when turning the stud in.

Sometimes the studs will stretch upon torque (especially too much torque).

If this happens, the wrench will say you hit torque, but when you release pressure, the stud spins with you back to it's relaxed state.

In that case, you did not get to final torque. Just something to think about when torque'ing the heads.

Be aware that the stud itself could stretch (or twist in the middle).

You can feel when this happens. It takes longer to get to torque due to the stud turning with you in the middle.

Always follow the torque sequence in the FSM and or your engine builder /supplier when installing the head bolts.

This will also cause a leak if not done properly.

## Soaking the threads for easier removal

Soaking the threads is usually advised before attempting to remove them.

Due to the angle of the block, it's not possible to actually leave anything next to the threads since it will simply slide down the block.

So a 'holding chamber' was made to let the oil sit and penetrate the threads.

The block was cleaned of oil and wiped down with acetone on a rag.

The a small piece PVC pipe was silicone to the block and let cure.

Lube oil (in this case cutting oil) was poured into the PVC to soak the stud threads overnight.

This made removing the stud with an 18" pipe wrench easier the next day.



Homemade jig for soaking the cylinder stud with penetrating / lubricating oil for easier removal

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# Stud Removal

## Using stud removal tools to loosen the stud



## Using a pipe wrench to loosen the stud

A propane torch works well to melt or loosen old Loctite (red or blue) on the threads.

Catch the stud down low, but not so low as to run the wrench into the block.

Lay some rags over the bore, find a small piece of plywood even a short 2x4 block, drill a hole in the middle and slide it down the stud.

Then clamp the stud with the pipe wrench on top of the wood.

Set the jaws of the wrench over the stud, adjust then to the stud.

Use one hand to cup over the wrench and stud and the other on the handle.

You'll get more even torque if you can let your body lean into the handle as well.

It may scare you when the stud breaks loose. It'll make a cracking noise which is normal.

The wrench won't turn all the way around due the the other studs in the way.

So you'll have to remove the wrench and get another grip to continue turning until it gets loose enough to turn by hand.

Once you get to where it doesn't take so much torque to turn it, you can use double nuts on the top threads if you prefer.

The pipe wrench is mainly to break torque. It's easier to get out of hand and damage something if it's not needed after that.

If the pipe wrench slips, you may need to adjust the wrench so the stud is closer to the inside teeth.

You may need to loosen the jaws to move the stud back.

The wrench doesn't have to be tight against the stud to grip.

It works by the magic of binding onto the stud.

It's important to hold center on the wrench and stud with one hand.

You can try getting a grip by tilting the handle up with just a little pressure and then back level.

You just have to find a way to make the wrench bind against the stud.

If the wrench doesn't grip, make it bind on the stud. <sup>5)</sup>



## Using Double Nuts / Jam Nuts

Install 2 nuts on the top threads and torque the two nuts to 35ft pounds or higher. Be aware the tall studs can stretch if it takes too much torque to break them free. Be sure to use rags around the bore so as to not get any debris in the engine while removing the stud(s).

Three jam nuts used here. <sup>6)</sup>



## Cleaning the Case Threads

The threads on the head studs as well as in the case need to be clean and free of rust / debris and they need to be straight in order to obtain proper torque on the heads.

The photos below are of before (L) and after (R) chasing the case threads with a 3/8"x16 tap. The dirty threads will add preload to the torque readings and can easily give false readings on the wrench which could affect head gasket performance.



7)



8)

## Stripped Case Threads

These could be repaired with Heli-coils.

But the repair must be straight with no wobble when drilling.

So it's best to split the cases and take them to a reputable machine shop to have that done.

In the pic below, notice the small clearance between the studs and the holes they run in.

The case threads have to be in perfect alignment to the stud holes in the cylinder.

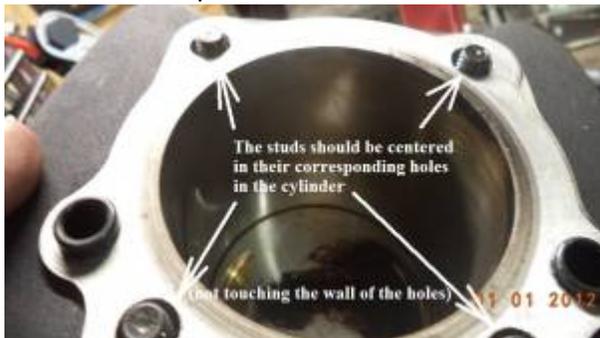
If not, the cap nuts will not fit on the studs to install them.

The stud would have to be wedged to get the nuts on.

This puts the nuts in a bind when using torque.

It will effectually hit torque on the wrench way before the nut is actually that tight.

It can also warp the studs.



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Hippysmack of the XLFORUM

<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-motor-top-end/197474-leaking-head-gasket-loose-head-bolts/page2?t=2074117&page=2>

2) 4) 7) 8) 9)

photo by Hippysmack

3)

photo by Blue Scoot of the XLFORUM

<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-motor-top-end/198541-repairing-cylinder-studs-cases/page5#post4360678>

5)

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<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-motor-top-end/197474-leaking-head-gasket-loose-head-bolts/page6?t=2074117&highlight=head+gasket&page=6>

6)

photo by A 4 liter V8 eater of the XLFORUM

<https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-era-specific-and-model-specific/frame-mount-evo-sportster-talk-1986-2003-models/148266-building-a-90-inch-sledge-hammer/page11#post3236162>

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