

XS650 Starter Gear Fix

Below I documented the fix for the slipping 4th starter gear. I want to add the original poster/author is below. All I did was test and post pictures to what he is writing about. I applied this fix years ago to a kick starter spring the same way with success.

The reason why the starter slips and spins out because the spring has lost its tension or was never set properly. This is what I found.



The spring has to be at 6 pounds. I found when it gets to 4 pounds it slips. I tested this on 3 other bikes. They were all at 4 pounds and all of them slipped, whether they were new aftermarket, used aftermarket, OEM or otherwise.

That extra 2 pounds makes the difference.



The factory spring tension rate is shown in a clip from the manual at right.

I have tested two of MikesXS starter kits and one worked fine and the other just spun.

2) Starter switch	
Manufacturer	HITACHI
Model	A104-70
Ampage rating	100A
Cut-in voltage	6.5V
Winding resistance	3.5Ω
3) Starter clip friction tension	2.2 ~ 2.5 kg (4.9 ~ 5.5 lb)
4. LIGHTING SYSTEM	

This is what I've found on the adjustment. You can only squeeze the spring in a vise. No matter how hard you squeeze you only achieve 6 pounds.

So if you don't have a scale you will be in spec. Just don't over squeeze on the vise and deform the spring.



Here is what I've also found. On the left is MikesXS spring.

Notice the flat sides to fit the new gear. To the right is a OEM NOS spring, it's fatter-just not ground flat.

When I put a NOS spring on MikesXS gear you only get 4 pounds. If you squeeze the spring, you get 8 pounds so that is the best set up.

NOTE: if you put a OEM spring on a OEM gear you will only get 4 pounds - the spring must be tightened in a vise.



You really cannot bend it on the bike – it must be taken apart which means removing the right hand engine case cover and the clutch assembly.



The OEM part number is shown at right.

Below is a post describing how to fix the dreaded XS650 starter problem. You could probably just remove the slipping gear and squeeze the spring and you would be fine.

Electric starter problems on the XS650 are very common, and almost always due to a non-functioning #4 gear, the one that slides down the Bendix helix and engages the ring gear on the flywheel. Symptoms are a starter that does not engage, a starter that just grinds ineffectually, or a starter that kicks out if the engine does not start immediately.

The usual remedy is to replace the gear complete with its spring clip, but there is an easy way to fix erratic and non-functioning starters without changing the #4 gear, even if the gear is showing signs of severe wear.

When people remove the offending gear it is often badly worn, and they assume that is the reason the starter does not work. But exactly the converse is true. In fact, it is not that the starter fails to engage because of a worn #4 gear: gear #4 wear because the starter is not engaging – and that is because the hairpin spring on the gear is too loose.

One will find in removing non-functioning #4 gears from an XS650 that there is still lots of tooth left. The Bendix on a car will continue to engage till the teeth are completely snapped off, and even then will turn the engine jerkily. One usually changes them to avoid damage to the ring gear on the flywheel, rather than because they won't engage. It's not the worn teeth on the #4 gear that prevents engagement.



The reason the starter does not engage is because of the spring clip on the #4 gear has lost its tension. The manual calls for about 5 lbs. tension required to rotate the clip in its groove on the gear. The tension found on the new ones can be up at about 8 lbs. You will invariably find that the tension required to move the clip on non-functioning starter gears will be down to about 2 lbs. or less. This can be measured using a fishing scale as shown above.

A description of what is happening is below.

Because the # 4 gear is light and does not have enough inertia (resistance to being rotated from a state of rest), Yamaha designed in the spring clip to increase the inertia. This restrains the gear from turning on the Bendix when the Bendix shaft is initially rotated by the starter motor. So, as the Bendix rotates, the helix on the Bendix shaft forces the gear down the shaft and into engagement, because the gear will slide before it will turn. Once it gets to the end of the Bendix, by which time it is fully engaged with the flywheel ring gear, it has no option but to turn, it has nowhere further to slide.

When the spring tension in the clip is too weak, there is not enough restraint, so instead of the gear resisting turning, it just spins with the Bendix shaft, does not move down the shaft fully, and is not forced into engagement. It goes down just far enough to grind off its teeth against the flywheel ring gear.

All that is necessary to get a starter gear working, no matter how worn the teeth, is to bend the clip so it gets back to a minimum of 5 lbs. required to move the clip. All that is needed to do is drain the oil, remove the kickstart lever, brake lever, foot rest, and disconnect the tach drive cable at the side cover. Then remove the right hand side cover.

The best way is then to remove the clutch basket and dismount the #4 gear from the bike. I haven't yet tried to do this fix with the clutch still mounted on the bike and the #4 gear in place, but this may well be possible. I am pretty sure that on the newer units where the loop of the spring clip bears against the floor of engine case the that the loop will be visible just under the forward lower edge of the clutch assembly, and you will be able to reach in and do the following without further disassembly. On the older units with the clip with the skinny loop inside the recess in the crankcase, the clutch will definitely have to be removed and the gear dismounted.

In any case, just use heavy pliers, such as linesman's pliers, or a Vise grip, to squeeze the loop of the clip closed so it bends a little and the clip then grips the gear tighter. If you do remove the gear from the bike, lever the clip off the gear using a screwdriver, squeeze the loop of the clip in a vise, and remount it on the gear. Check the tension with a fishing scale, if it is less than 5 lbs., squeeze the loop a little more to tighten it on the gear.

You can test it immediately, even before remounting the clutch:

- pull the spark leads so the oil-empty engine does not start, and;
- hit the starter button.

I bet your starter will now work, no matter what the wear is on the #4 gear teeth.