

Alternative Repair of a snapped Middle Drive Shaft (Yamaha BT-1100 Bulldog)

- Repair by a Yamaha workshop will cost you at least 2500€ -

Symptoms: You will hear noise at the left side of your bike, sense that some part(s) in your bike hit other parts, the speedometer will likely jump up and down. Stop the bike immediately!



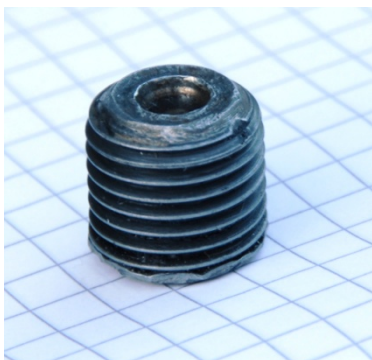
Picture 1. First Inspection:

- Disconnect rod from shift pedal
- Remove left footrest (3 hex bolts)
- Remove speed sensor (1 screw)
- Slide rubber boot backwards.

In case it looks like the picture at left, you are in trouble. The middle drive shaft has snapped.

How did this happen? The author is of the opinion that this is what happened: The nut that holds the yoke of the universal joint has loosened slightly. Now, the yoke can move freely over the splines of the shaft. The author has observed that it can also tilt slightly. When driving, this will result in a slightly wobbling yoke. The wobbling yoke exerts a force at the outer rim of the nut. The nut flange has a rela-

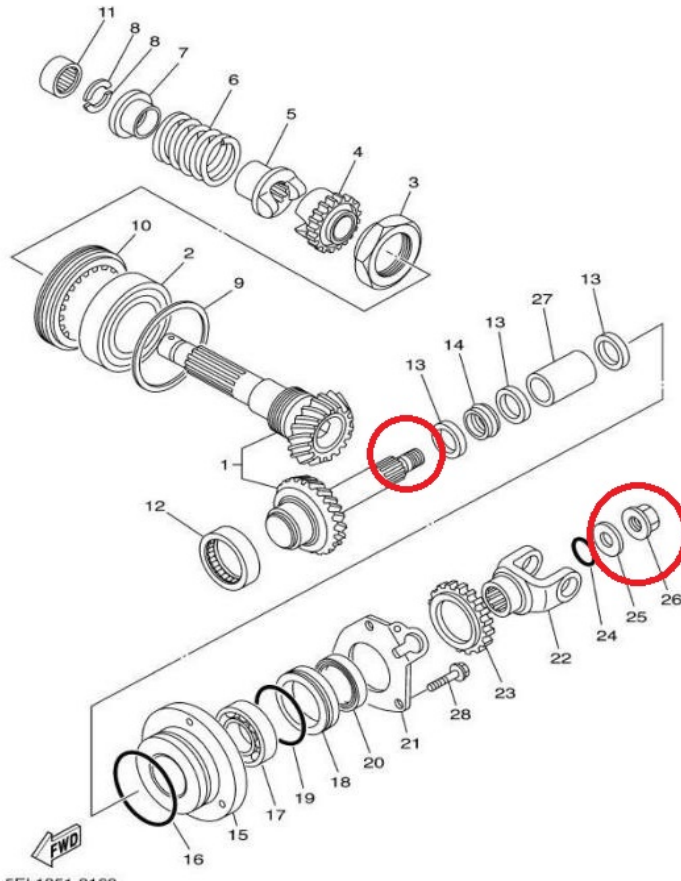
tively large diameter and acts as a lever. The result is a continuously repeating bending force being exerted on the shaft. The shaft has not been designed to cope with this kind of load and snaps. The yoke slides backwards and tilts even more. The yoke and the nut now start to hit the speed sensor and other nearby parts.



Picture 2. According to the workshop manual, the nut should have been secured by applying Loctite and by staking. The author did not observe any traces of Loctite and staking was done inadequately. Picture 2 shows how staking was done. The dent in the thread has no effect at all, the nut was observed to move freely over the broken end of the shaft.

It turns out that this problem has meanwhile occurred so many others. The engine of the BT-1100 is also used for the Yamaha V-Star 1100 and the XVS-1100 Dragstar. Search the internet with keywords such as "XVS 1100 middle drive snapped" and you will be flabbergasted. In the USA, identical problems are reported on [the V-Star 1100 forum](http://www.sloneservices.com/SilverBack/VStar1100-FAQ-04.htm#Drive-Train-Problems) (<http://www.sloneservices.com/SilverBack/VStar1100-FAQ-04.htm#Drive-Train-Problems>).

In Europe, an ever increasing number of incidents is reported on the German BT-1100 forum, but a clear picture of the extent of the problem is not yet available. Yet, it is quite obvious that Yamaha has (had?) problems with design, manufacture, assembly and quality control.



Picture 3. So, what to do next? Yamaha still is in the phase of denial of the problem, does not take any responsibility for the consequences and the Yamaha workshops will charge you at least €2500 for repair. The repair involves disassembly of the complete engine to replace the middle drive (#1 in Picture 3).

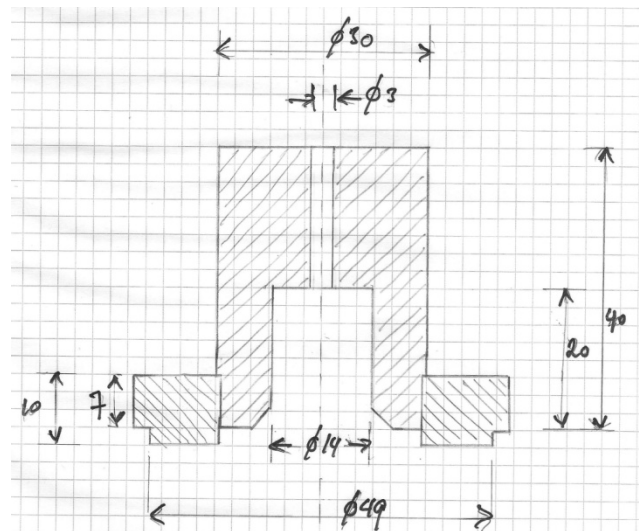
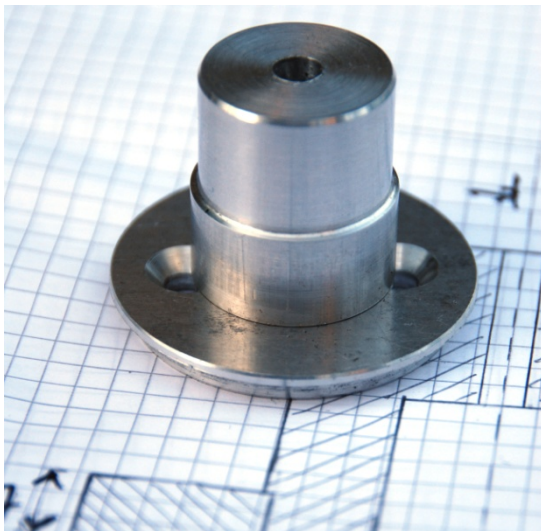
Luckily, the forum in the USA describes a method of repair that can be done without taking the engine apart. The [V-Star Forum](#) describes how the function of the nut can be taken over by a M8 bolt, after a M8x1.25 inner thread has been tapped into the snapped shaft. The only function of nut (#26) is to retain yoke (#22) on the middle drive shaft. Forces acting will be forward forces exerted by the 90 degree middle drive gear and backward forces that result from the drive shaft during movement of the

swingarm/rear wheel . The large rotational force of the shaft is completely transferred to the yoke via the splines in shaft and yoke, the nut has no role to play there.

The repair is not without risk and should be carried out with great caution. Even when you have succeeded to drill and tap into the shaft, there is the risk that the parts of the middle drive are no longer positioned correctly and the backlash is no longer within spec. The workshop manual describes how the positioning of the two parts is done, beginning at page 4-78. In this process, the collapsible collar (#14 in picture 3) is collapsed to some extent. It is obvious that with the alternative repair method, backlash cannot be adjusted. Whether or not the backlash will or will not be correct once the alternative repair has been undertaken, is discussed in section "contemplations on backlash".



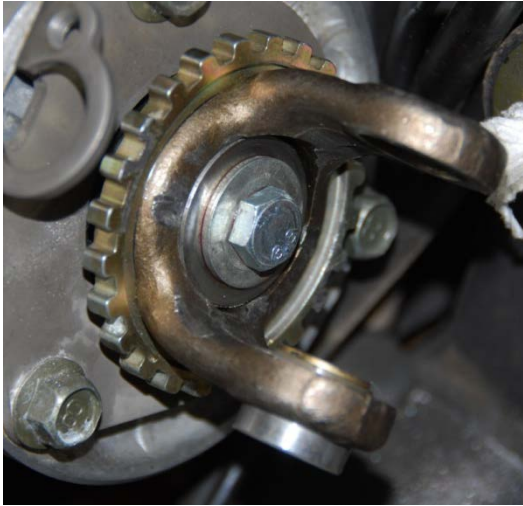
Picture 4. An inner thread must be tapped into the shaft. The engine does not need to be removed from the bike. Lift the bike so that the rear wheel can be removed. If possible, lift it somewhat higher, it will allow you to work more comfortably. Remove both footrests and the left exhaust. Remove the four hex bolts of the final drive. No need to remove the oil from the final drive. Remove the swing arm. You should now have free access to the middle drive shaft. Protect the bearing of the shaft by some cloth.



Picture 5. It is recommended to make some tool that will help you to drill along the central axis of the shaft. The tool depicted here fits in the opening ($\phi 49.2$ mm) of bearing plate #21 in picture 3. The tool in the picture above initially had a 3 mm centre hole. The tool was used to drill a 2.5 cm deep 3 mm pilot hole. Use a high quality drill is (author used a cobalt drill bit) in combination with sufficient oil and repeatedly pull the drill backwards to remove debris.

The pilot hole was subsequently enlarged, using 3, 4, 5, and 6.8 mm drill bits. A 3-stage tap set was used for tapping the M8x1.25 thread, again using sufficient oil. Release the tap frequently!



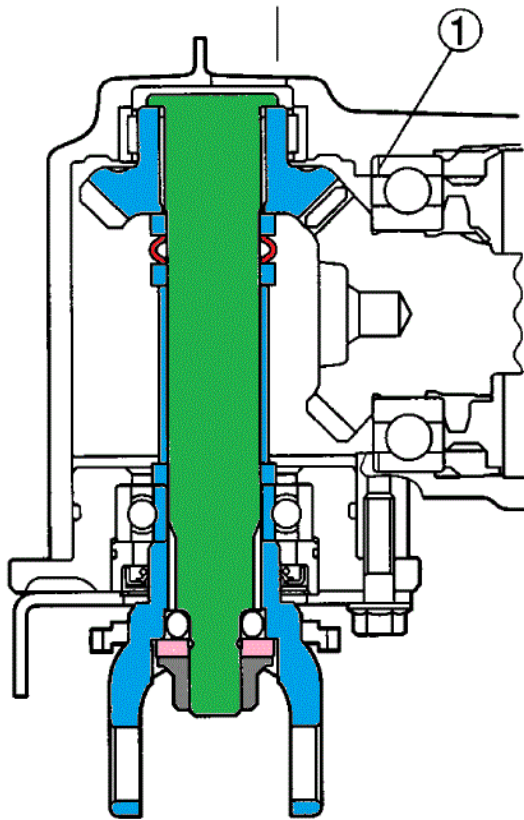


Picture 9. This how is should eventually look like. The author used a 1.5 cm M8 hex bolt, quality 8.8 or better and washer. The picture shows a disassembled universal yoke, but it turns out that disassembly is not needed when a 1.5 cm bolt is used.

Before bolting the yoke to the shaft:

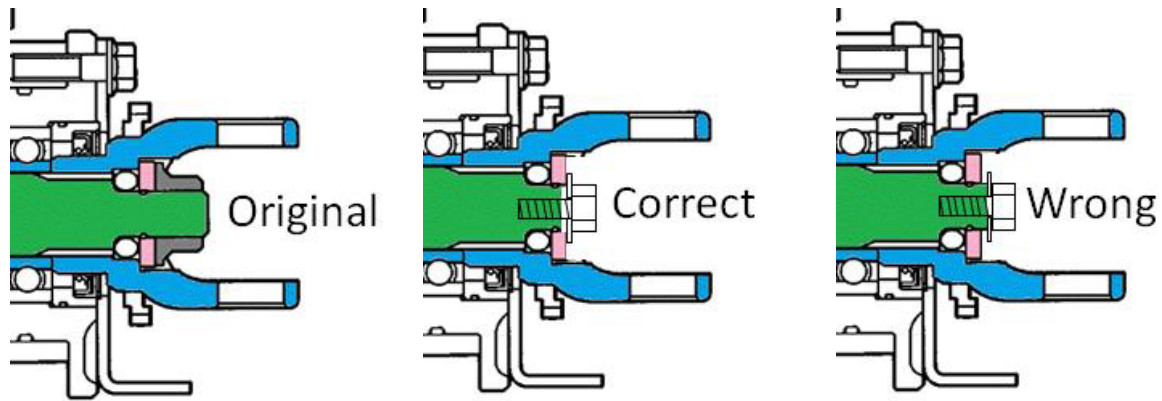
- Degrease threaded hole and bolt!
- Read section "contemplations on backlash".
- Make sure that the shaft is not too long (see below)!

Contemplations on backlash



Picture 10. As stated before, the workshop manual from page 4-78 onwards describes the issue of backlash. Collapsible ring (Red in picture 10) plays an important role in positioning of the drive shaft. At first assembly, the nut is tightened such as to create the desired amount of backlash. The collapsible ring is slightly compressed in this procedure. The author never had the opportunity to study a collapsible ring in detail, but from reading the workshop manual and considerations regarding the role of the ring the author draws the conclusion that this ring is not easily compressed, nor flexible. So, it should retain its compressed status and will only be further compressed if significant forces are applied (that is, when the newly installed hex nut is fastened with high torque).

The author therefore is of the opinion that the backlash as set when the engine was first assembled will be restored when the hex bolt is tightened with mild force.



Next steps in the assembly:

- 1) The snapped shaft may be too long to allow for the repair as described here. In that case, applying the bolt will result in a situation as shown in the far right of the three pictures above. The washer rests on the snapped shaft, and as a consequence, the yoke still is able to move slightly. So, make sure that the situation as depicted in the middle can be realised. This is best checked while the "O"-ring (#24 in picture 3) is not yet in place. If too long, the snapped shaft should be shortened by filing or grinding. Beware of debris entering the engine.
- 2) When OK, remove the bolt, degrease bolt and thread, install "O"-ring #24, washer plate #25, additional washer. Use Loctite red and fasten the hex bolt "till tight". Install swingarm, final gear, rear wheel, etc. Test drive the bike. Be alert for whining noises coming from below.
- 3) After test driving, carry out an inspection as with picture 1. Gently use a screw driver as a lever under the yoke to investigate if play exists between yoke, the washer plate (#25 in picture 3), the additional washer and the hex bolt. If so, revert to step 1 above.
- 4) Good luck and much fun in the repair!

Decline of liability

- All of the above has been well thought over and tested by the author
- Still, author is not liable in case of any damage to goods or personal injuries
- If you want to carry out the repair yourself, be certain to have sufficient skills and good quality tools.