XS750/850 FINAL DRIVE CONVERSION....THAT ELUSIVE 6TH GEAR!

Final Drive Transplant _ Kudos 2 XSChop!

XS750 Final Drive Conversion
"Mod of the Year, 2006!"

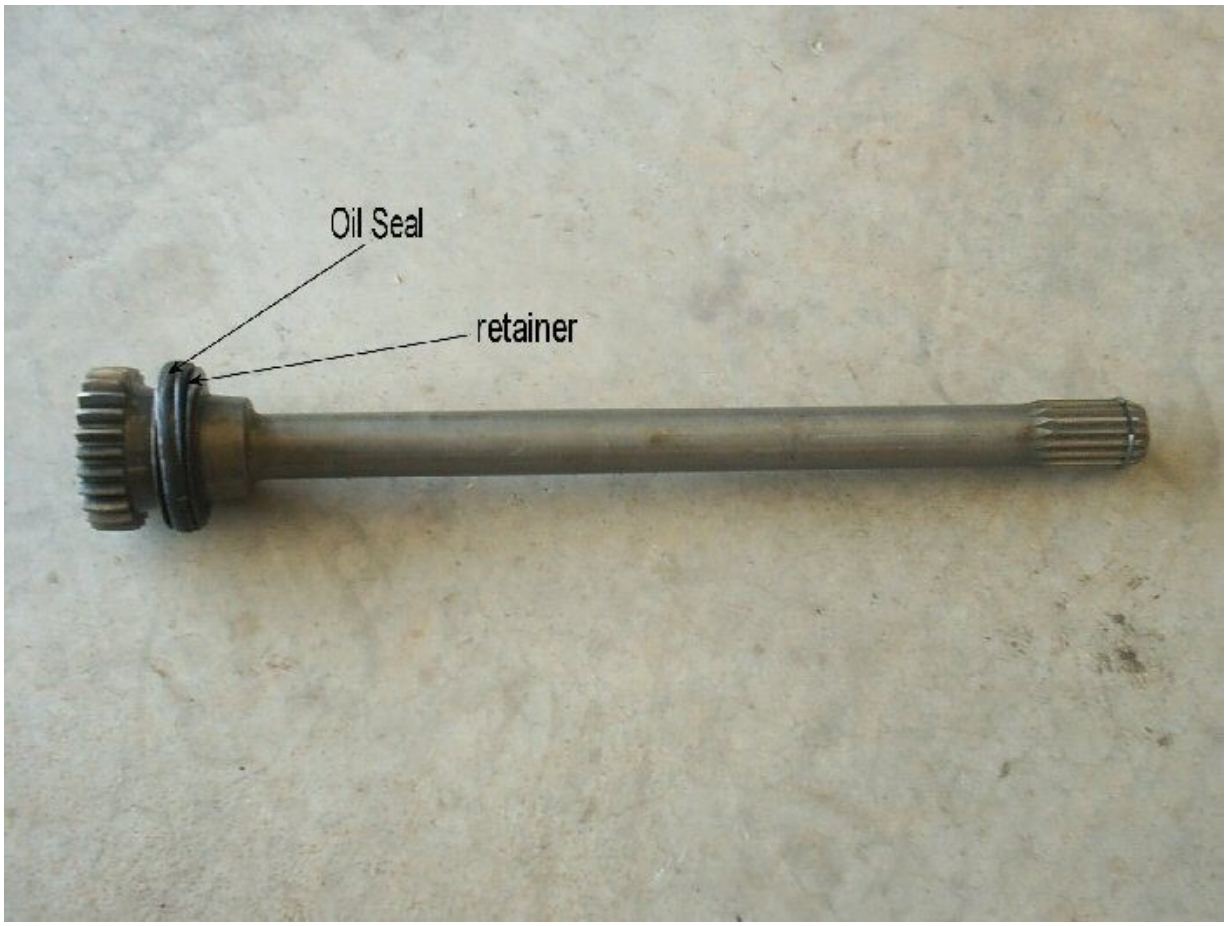
by Cody(Maximan) and XSChop, posted 11-12-06

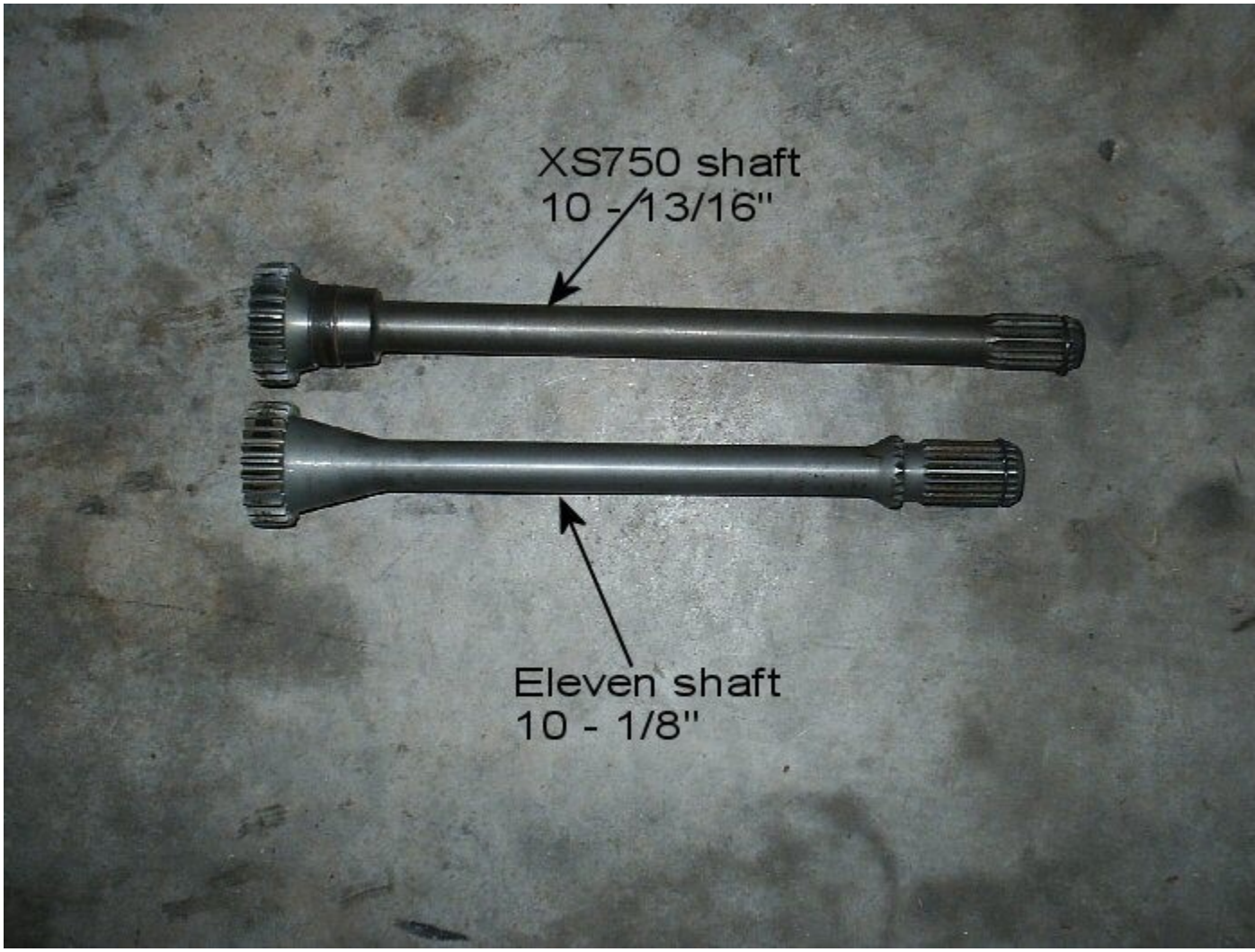
First let me say this is absolutely the most straight forward mod I've ever done to my Eleven. And the results are spectacular. I am so utterly please with this modification I would recommend it highly to any Eleven owner that is not pre-occupied with ¼ mile times. If you want a top end – gas sipping XS11 thismod is the BOMB SCHNIZZLE. You won't regret it. Besides it is so easy to do (other than a few hours of time) you you could easily revert to the OEM drive if you want lower gears.

Secondly I must pay "kudos" to Chop (xschop). I nominate Chop for coming up with the coolest mod for 2006. I'm not sure what inspired him to experiment…and I am not sure I care to know. IT WORKS! The rev reductions are not only real but are very significant. At the end of this procedure I will post my real world results. In short they are outstanding. could easily revert to the OEM drive if you want lower gears.

I stripped all the old paint (silver) off the unit as I will paint it black to match the oem drive. Notice the XS750 has lubrication (spooge) holes in the base of the gear coupling. The 750 shaft also incorporates an oil seal that allows oil to circulate into the

coupling house and lube the drive spline. The seal on the 750 shaft contains the oil in the gear coupling.

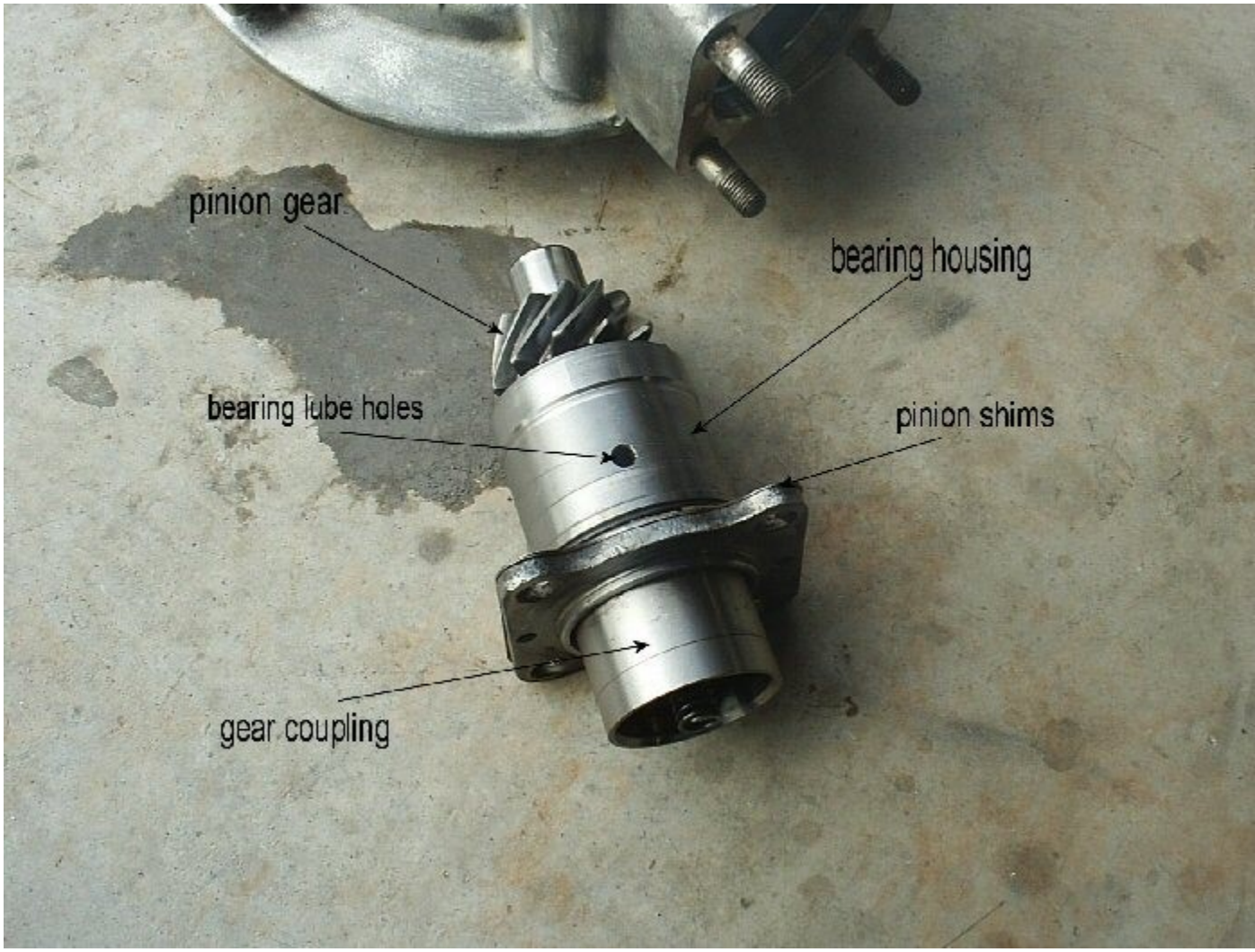



XS750 shaft
10 - 13/16"
Eleven shaft
10 - 1/8"

Also notice how the spline are recessed into the gear coupling. This recession is where the shaft seal seats to retain gear oil. The Eleven does not employ this style of lube system. The Eleven has no “spooge” hole and uses instead grease. Personally I think the Eleven is a superior system. With the Eleven there is no possibility of oil seal failure and thus leaks. So I sealed the spooge holes in the 750 drive with liquid gasket and covered them with a standard ½ flat washer (the perfect size by virtue of serendipity).

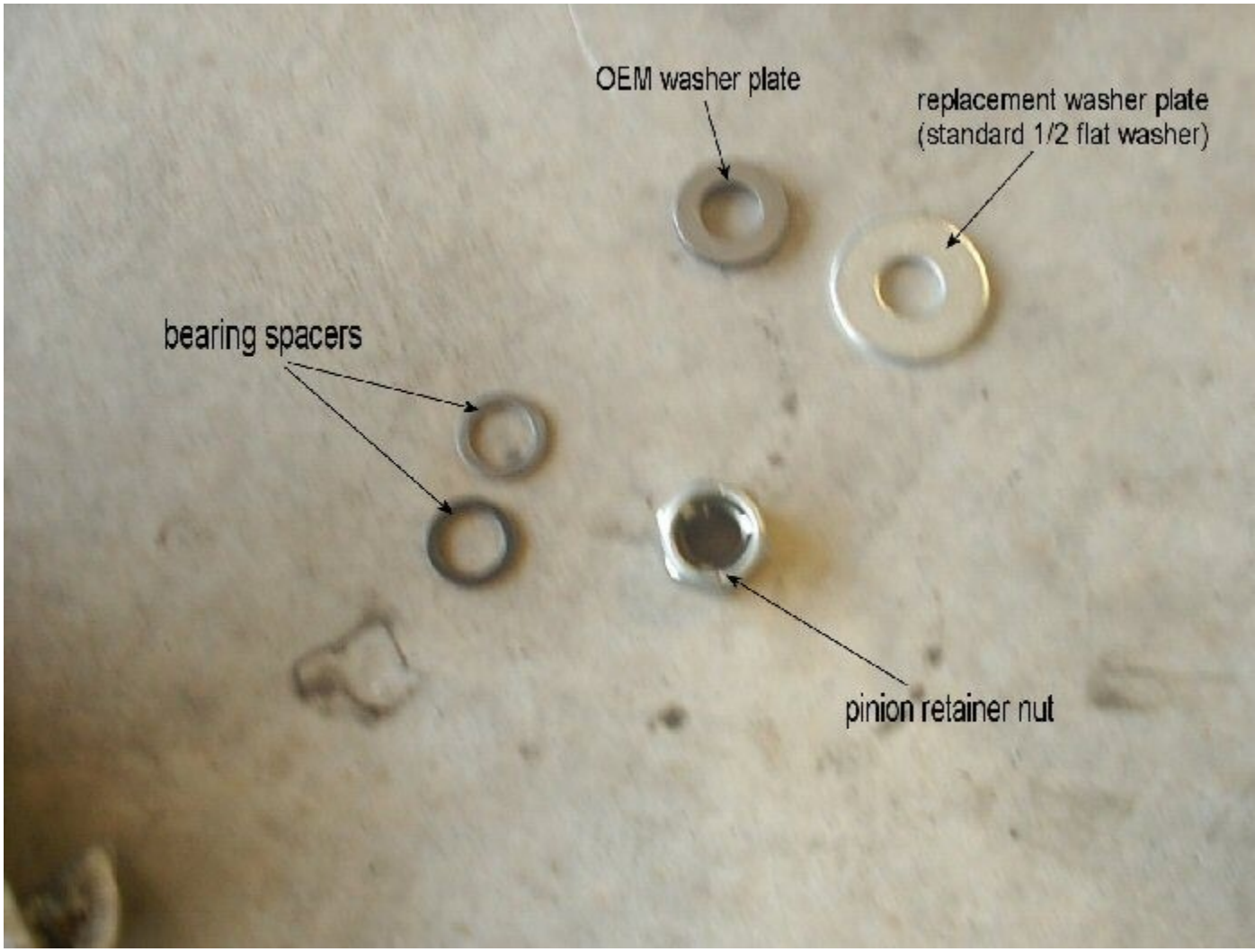
First to remove the pinion retainer nut as seen above you’ll need to have some way to hold the ring gear backup while you break the pinion retainer. I used an old XS wheel I had , then a 22mm socket on an air impact.

Next I removed the pinion assembly. When Chop removed his he said only the gear coupling came out and he never saw the pinion gear. My didn’t break there. The whole pinion assembly came out. No big deal.



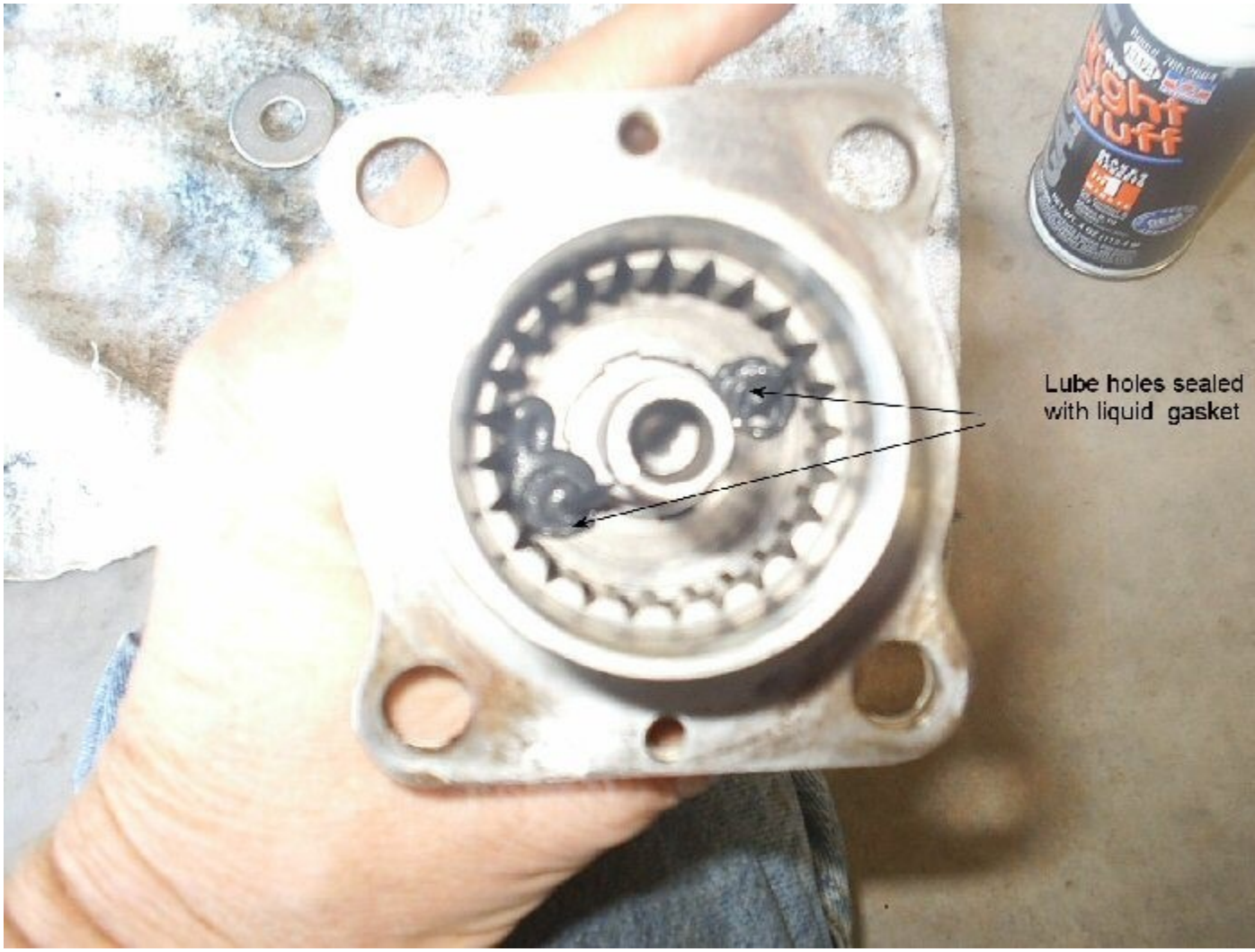
The gear coupling is what receives the splines on the drive end of the shaft. Remember the lube holes and pinion shims. We'll touch on these later.

After tapping the gear coupling on the floor, you should see a retainer nut (22mm) and a washer plate…and maybe a couple bearing spacers. Don't freak if yours doesn't have a spacer. This was the way it was manufactured. I'm guessing slight variations in machining would require different spacers for any individual housing. Much like the pinion and ring gear shims. No two drives are identical with this regard.



The replacement washer (1/2 flat washer) just so happens to be a perfect replacement to seal the spooge holes. I've only ridden mine about 30 miles with no leaks. But Chop has several hundred miles on his unit with no problems.

Next I pumped a little liquid gasket (Right Stuff – NAPA) into the spooge holes. This sealant is very effective especially in low temperature applications (less than 450 degrees). It will seal even on an oily surface. However to be sure …clean all surfaces with carb or brake cleaner and let dry.



Next put a thin film of sealant on the back of the washer. Replace the spacers (if applicable), then the ½" washer, and pinion retainer nut. Then tighten by hand only.

Now put a little sealant around the bearing housing…where it seats back into the drive housing. This will insure a good seal so no gear oil will leak from the interface. Yes yes there is an o-ring seal but I am always extra cautious. Besides the OEM housing appeared to have Yamabond on it upon disassembly.

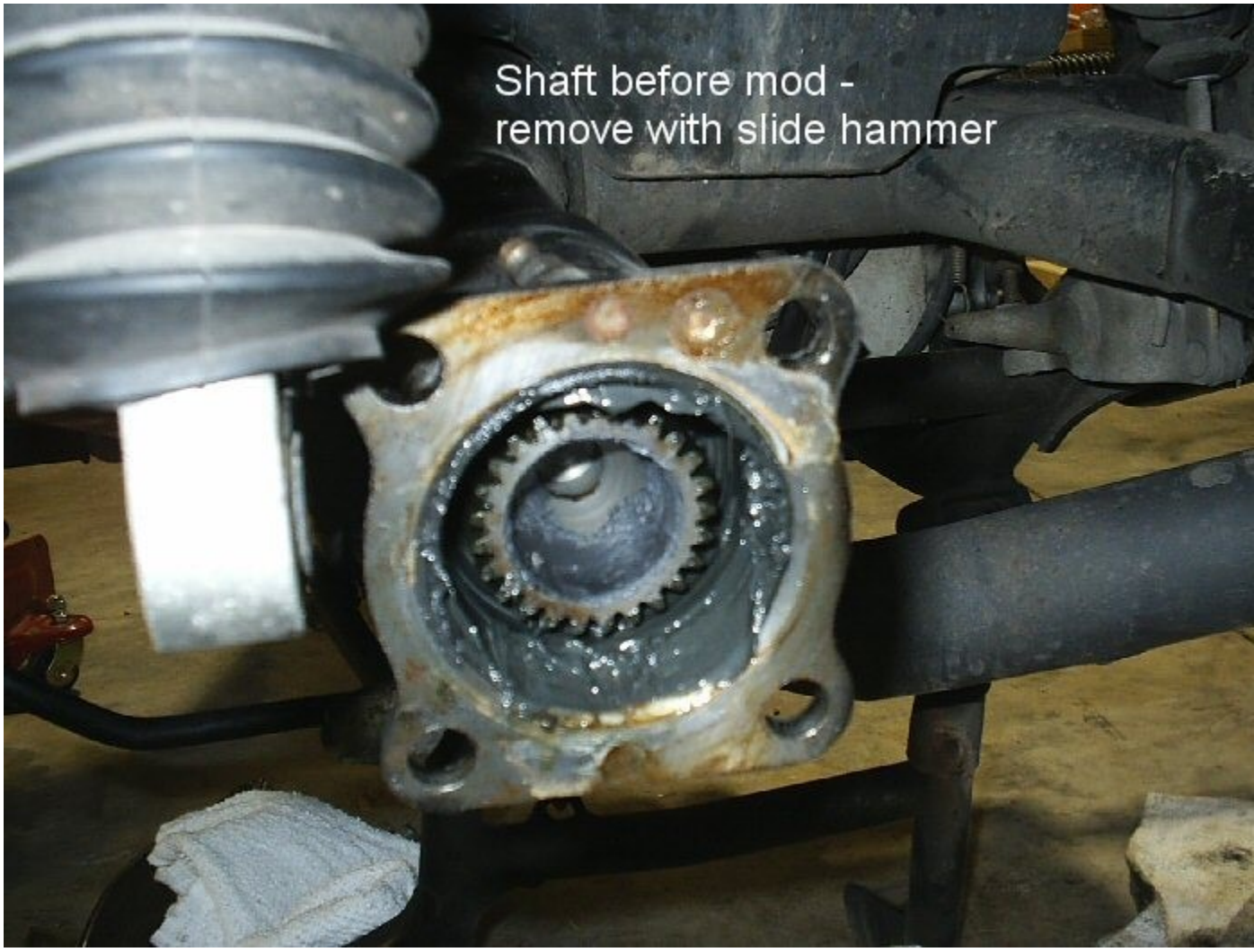
Next slide the re-assembled pinion assembly back into the drive housing. Make sure the pinion shims are in place…and not laying on the floor somewhere. This is critical since the entire drive was shimmed for gear lash at the factory.

Also when re-inserting the bearing housing into the drive...pay attention to the lube hole in the bearing housing. They should line up with the cavitation channels on the inside of the drive housing. These channels allow oil to freely flow from the gear spinning into the lube holes and around the pinion bearings.

Next take a couple of the shaft housing nuts and some extra washers and snug the pinion assembly into the drive housing. This wil seat the O-ring seal and the sealant you just applied to the bearing housing.

I did all these preliminary steps before I ever disassembled the OEM drive. At this point I let the XS750 drive sit overnight so the sealant would cure. I don't think that is absolutely necessary, but I took the precaution.

Next (the following evening) I began the arduous process of field stripping the Eleven's OEM final drive. Remove the rear wheel. Then remove the left shock from the drive housing. Next break the four shaft housing nuts loose from the OEM drive and slide the drive gear coupling out of the shaft housing. After this you'll see the Eleven's shaft remains in it's housing.



Now you can measure the distance of the shaft face to the housing face. Then measure the distance of the XS750 drive housing face to end of the splines. This will tell you exactly how much spacing you need for a collar or length to extend your shaft. Depends on which route you take. In either case it turns out you'll need about 5/8 to 11/16 inches (16 to 17 mm).

Next remove the shaft from the housing. The service manual recommends a slide hammer. And that is what I did. With two bearing puller arms and a slide it popped right out. Pull the circlip off the shaft. It won't be used again.

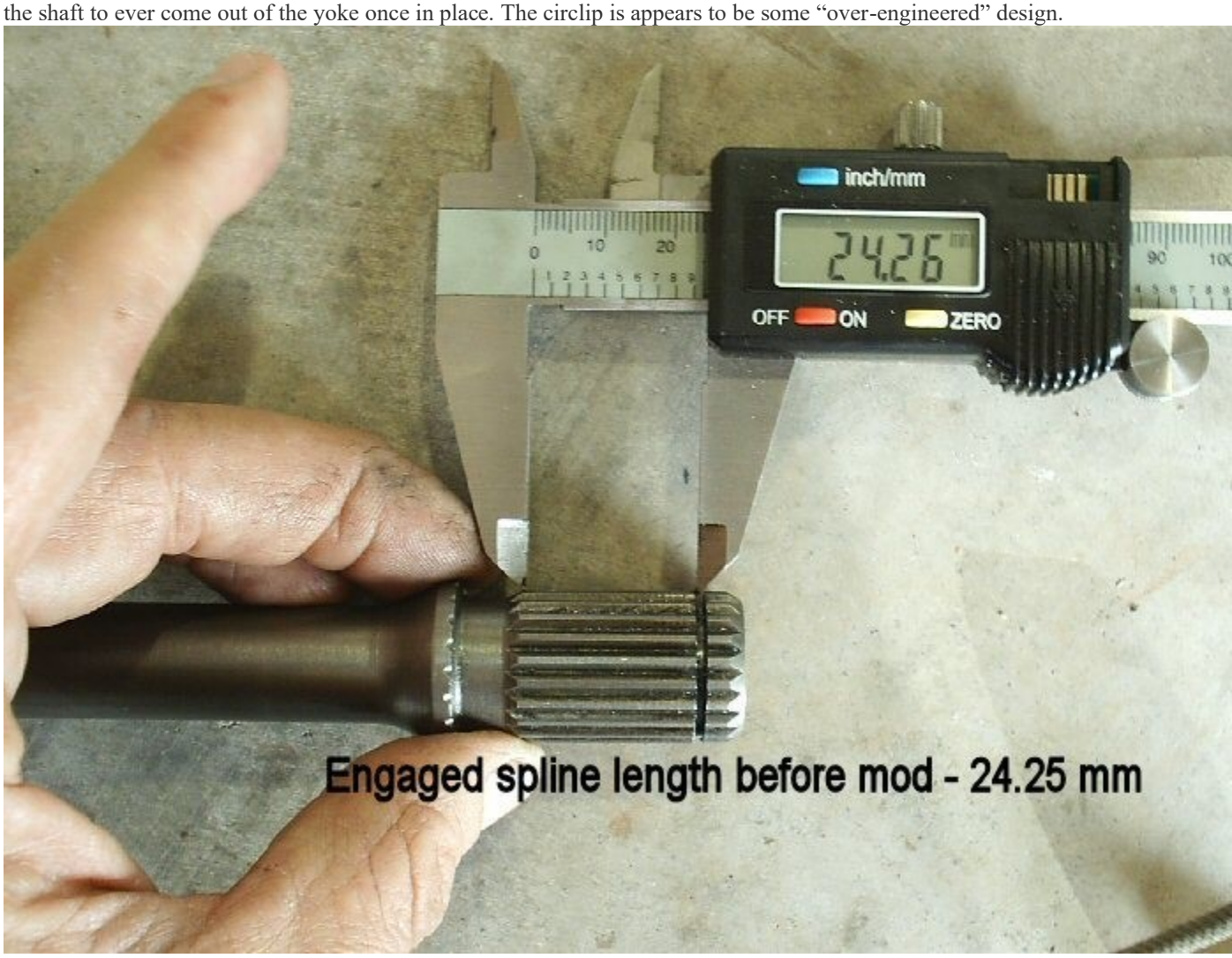
The two options for shaft modification will be discussed here: 1- spacer option ; 2- shaft extension.

The shaft extension will comprise cutting a stock XS11 drive shaft and stretching it by 17mm, using a collar and pins to secure it. I took a spare shaft I had to a reputable machine shop. The machinist told me the only way he could extend the shaft would be to collar and pin it. He said (and I quote)"…that shaft is harder than the hubs of hell…" In order to weld it he would have to heat the shaft and allow it to cool very slowly to soften the thing where he could cut it and weld it. If he tried to TIG the hardened surface he assured me the weld would break. In order to weld it the estimate for the process was not going to be cost effective. So I told him to simply cut it an collar/pin it.

The second option is actually the one I chose for several reasons. One is cost. Another simplicity. But the most important is strength. With a shaft that has been cut …then collared and pinned …the original material has been compromised. Even a welded shaft…if you chose to spend the money…would in my opinion be weaker than the spacer option. Because the original shaft would

still have to be cut …collared and welded.

There is no need to jump through all these hoops when a simple spacer (copper bushing) can be made to effectively accomplish th same task. Upon studying the Eleven's splines that interface with the U-joint yoke I could see that about 24 mm of spline is being utilized. Notice the 3mm or so splines beyond the circlip groove are not used in the OEM configuration. These splines protrude past the u-joint yoke receiver and a circlip holds them in place. I have yet to ascertain why the circlip is there. There is no way for the shaft to ever come out of the yoke once in place. The circlip is appears to be some "over-engineered" design.



Next I cut a ¾ inch copper sweat coupling (like you'd find at a hardware store)…I cut it 16mm long.

Then I slipped it over the shaft. At the drive end of the U-joint spline I slipped a 5/8 x 3/4x 1/16 O-ring to act as a retainer for the copper spacer. It will hold the spacer in place as the shaft spins reducing wear to the copper. I also coated the shaft splines in that area the collar covers with RTV to help hold the copper in place and reduce vibration. I don't know that this is nessecary but It can not hurt. Then at the yoke end of the collar I slipped another O-ring. In theory this will keep the copper from rubbing directly against the yoke housing and should reduce wear to the end of the collar. And again – if the O-ring fails overtime it's no big loss. The o-ring can't hurt anything…it can only help.


5/8 x 3/4 x 1/16 O-ring retainer

After all this modification you can now see there is still 21.5 mm of spline length to engage the yoke. We've only lost less than 3mm of spline length. This should barely compromise the strength of the spline interface. Plus using this mod method we have not compromised the torsional strength of the shaft. And last but not least…this method cost a fraction of the other. Again…kudos to Chop for figuring all this crap out. I am merely the messenger relaying the procedure to all the brethren.

Next I pulled the rubber boot of the shaft housing away where I could hold the U-joint yoke straight to re-insert the shaft. Make sure the shaft is full inserted. Now with the copper spacer the shaft will no longer be recessed into the shaft housing. It should be nearly flush with the end of the shaft housing…actually mine protruded about 1 – 2 mm.

Next I removed the shaft retention spring from the Eleven's pinion assembly and swapped it with the 750 spring. The 1100 spring is slightly longer and should do a better job of keeping the shaft fully engaged at the yoke end. Not necessary…just my method.

Next grease the inside of the gear coupling splines really well. Now slide the 750 housing up into the 1100 shaft housing. You'll have to turn the wheel splines to help line the gear coupling splines up to the shaft so they will lock. When you get it sync'd the drive housing will seat flush against the shaft housing. Install the four housing nuts and tighten.

Don't forget to fill the 750 drive with 90 wt gear oil. What shame to do all this work only to burn up the newly installed drive. Oh yes …and pump the shaft housing full of grease...you know at the shaft housing grease zirk. Dan Hodges tells me the spec calls for 30 cc of grease and that a standard grease gun is 1 cc per stroke. Do the math.

Re-install the rear wheel (grease those splines slightly too)…button and bolt everything back up. Now RIDE!!! And watch you gas mileage FLY!!! You top end speed should be to shabby either.

Cody

Addendum:
quote:

John said:
A couple of things I discovered when doing my swap: 1) Do not remove the small phillips head screw on the flange where the four mounting studs protrude through, and in fact, place a couple of washers on two of the studs, and run nuts down on them snugly. This will prevent the pinion from coming out of the housing when pulling the drive shaft/oil seal out, and possibly disturbing the shimming of the pinion. In place of a slide hammer to pull the driveshaft, you could clamp onto it with a vise grip, and strike the vise grip with a hammer. That will drive it out.
2) Another tip is that the large 1/2 inch washer that Maximan calls for can be substituted with the washer that is in use on the XS11 FD. It is the correct size, and it completely covers the oil return holes. Maximan cautions about reinserting the pinion back in place so that the oil holes line up. Of course if you do not remove the pinion from the housing, then this caution is needless, but if it does

come out, everything will realign when you line up the hole for the small phillips head screw when reassembling the FD.
It truly is an easy swap over, and you will enjoy higher fuel economy, and less wear n' tear on your engine at highway speeds.

In regards to the copper spacer:
Chop used it becasue it was readily available. However...I would seriously consider a steel or bronze spacer. I have not checked mine (copper) since the install but I will in a few days to see if there is any noticable wear. In any case i am going to replace the copper with a bronze spacer.

I was in an oilfield supply store the other day and stumbled upon a perfect spacer. It is a rocker arm bushing for a 346 Fairbanks Morse engine. It is made of bronze instead of copper and actually fits a little better than the copper tubing and the wall thickness is about 1/2 mm thicker. Being made of bronze it should be more durable.

The copper will work but I think this bushing would be a better long term solution. You should be able to get one at any oilfield supply. It is readily available through Arrow Specialty Products. Arrow Specialty can be found on the net. They have offices in NY and OH and other places but most Oilfield supply store would be able to get this common part for you. The Arrow part number is 1009 for a 346 Fairbanks Morse.

You'll have to cut it to length. But you'd have to cut the copper collar to length too.

Arrow Specialty Products handles these parts. The Arrow part number is 1009 in their catalog.

Arrow Engine
2301 E Independence
Tulsa, OK 74110
Phone: (918) 583-5711

But you can probably call these guys and ask for parts:

http://www.kraftpower.com/service.html

Then tell them you need a rocker arm bushing for a 346.

If you have trouble...just e-mail me rocktone@aol.com and I'll get one for ya. I can get one in a few days from a local oilfield supply store.
Cody(Maximan)

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One thing I've picked up on that everyone should be aware of. I did not realize this when I wrote up the procedure.

The torque on the pinion retainer nut IS CRITICAL. As is the preload.

I suggest following the manual. After installing the larger washer to seal the spooge holes on the drive coupling be sure and torque the pinion nut to the specified torque...54-61 ft-pounds for a type one, 75-

105 ft-lbs or there about for a type two. Then double check the bearing preload with the appropriate inch-pound torque wrench.

On a type one it is about 10 inch pounds.

On a type two (read 850) it is 3.4 to 4.3 inch-lbs.

If the bearing preload is not within the specified range damage could result as I found out on mine.

After the 3000 miles trip to west Texas I pulled the drive for inspection. There were some small metal shaving on the magnetic drain plug and the pinon assembly was very loose. MY BAD!!!

I chucked that drive and installed another. This time around I torqued everything back to spec and the bearing preload was fine.

HOWEVER... should you button everything up to spec and the beaing preload is not close to the specified torque in the manual...you should replace the expansion spacer (a crush washer) that is between the pinion gear and the retainer nut. These are only $10 and will assure you the right tolerances are maintained.

So far I know of no one that has had this problem and simply re-torquing everything back to spec should work fine without having to replace the expansion spacer. At least it worked for me on the second drive.
Cody/Maximan.