

From Doug's Heavy Metal Gallery, the Dreaded Ferret Starter removal

This article is VERY long as it is principally made from emails that flew back and forth on the "Ferret-Heaven" mailing list when Floyd, a US Ferret owner balked at having to do an engine pull (as popular opinion had it) to change his starter motor.

8/4/01

Floyd

I went out to see if the Ferret would start tonight and it would not start. I could hear the starter turning and the bendix turning but it would not engage the flywheel. I check the voltage of the batteries with a voltmeter and it only dropped to 25 volts while trying to crank it so it is not the batteries.

Has anyone else had this problem and if so how did you handle it? I just can't see myself having to pull the engine to fix this. There must be something that I can do. Any ideas guys?

9/04/01

Andy

I hate to really disappoint, but if its the same problem I had on my ferret then its an engine out job. On mine the gear would not engage properly, there is a small piece of steel that pushes and pulls the gear into and out of mesh with the flywheel. This had broken and also broken the starter gear.

13/4/01

Floyd

Hello Ferret lovers. Is there anyone on this list that has actually replaced the starter on a Ferret themselves? Not had it done, but done it themselves. I would like very much to talk with anyone who has replaced the starter. Please contact me. On the list is fine. Thanks.

13/4/01

Doug

When I first got my Ferret the starter failed only a few days later (sometimes, you can just get lucky, as had it failed at the transport yard I would have been out of pocket quite a bit!). Not having any intention what so ever of doing an engine pull just to get a starter motor out (even one that had locked into engagement with the ring gear), I succeeded in doing so insitu. It can be done. However I will state that was over 10 years ago, I was considerably thinner and more supple and it did involve the non-intended usage of quit a few spanners. Not to mention sore ribs and dizziness from hanging upside down in the engine bay. Re-installing the starter is no fun either."

And yes, I did re-install that stupid bolt in the almost impossible to reach location.

14/4/01

Floyd

To start it off I will ask a couple of questions that are not clear in the manual.

Doug

Having read your questions I am afraid I am going to pull the rug right out from under you..... all I did was remove the engine decking and the tubular cross member, nothing else other than the starter.

I did warn you I was younger, fitter and more determined then.

Floyd

(86.c.) Remove the exhaust pipes. Do I have to remove the exhaust manifold from the engine?

Doug

From what I have read of others opinions, I would be VERY reluctant to touch that manifold. Leave it happy and snug where it is unless you have no other option. Then re-think your descision to unbolt it and if it is really worth the risk. Also, where will you get another exhaust manifold gasket from?

Floyd

I definitely do not want to remove more than is necessary.

Doug

You get the idea then.

Floyd

(86.e.) Disconnect the tachometer drive. I assume that one of the big electrical cables coming out of the starter is a tachometer drive.

Doug

Not as I recall; are you sure you are not reading the instructions for an engine pull? I have looked through my EMER's and they read nothing like what you have quoted, please state the exact call up of the EMER you are using?

I have been going through my parts book but can't find any reference to the tacho cable, I know its got one, but need to stick my head in my vehicle and trace it. Knowing the way they designed things it would not at all surprise me if they had driven it off the ring gear with a tacho generator, but off the starter drive is just too weird for even the Poms.

Floyd

large black cables going into the starter and just don't want to start yanking without knowing something about them.

Doug

2 x cables, which you undo the clamp on each, wiggle and slide off.

1 x small cable with knurled retainer with a quick thread, undo about 1 turn and pull out.

Floyd

(86.g.) Remove the screws and lift out the starter assembly. Yea right! Any advice on how many screws there are? Two or three? and I guess the ones on the bottom needs an octopus to get at it?

Doug

3 mate, and yes you do need to be an Octopus to get to that bottom one. I tackled it first so that I wouldn't have the weight of the starter hanging on the most awkward bolt. Keep in mind that I improvised with tools and at that time weighed about 10 Stone (5'10" high) = young, skinny and supple! Looking at my spare starter, the design is such that you cannot just make up a large extension for a socket and get to the stupid thing that way as the body of the starter is fatter than the neck where the bolts are located.

It is all such a while back I now don't recall how I did it. But a suggestion would be one of those angle drive socket adaptors, then extension bars and a ratchet handle, as this rings a vague bell with me. Alternately, cut and shut a ring spanner in some way that you can get it on that 3rd bolt and do the old "1 flat at a time" undo marathon.

Sorry I can't give you a blow by blow account. I do remember that the starter did not want to budge even after I had all the bolts undone and that it was bluddy heavy and awkward to get up and out.

I also seem to recall going in from the crew compartment after removing the battery box and working by feel and with a mirror and lead light, but stuffed if I can remember whether or not that ploy was successful?

15/4/01

Doug after reading your answers I am more confused than ever about the tachometer drive??? I need to do some research on that. No motor removal. It is under removing the starter only.

Go to Simonides, then to the files section and at the bottom go to Ferret, All Types Unit Repair Manual. Then go to paragraph 86 which is jpg No.31. This to indicates that the starter can be replaced at Unit level without removing the motor. I guess the manual was written for someone who has graduated from their Ferret Mechanics school because it sure leaves a lot to be desired for a bloke in Texas. This entire action ends up being:

- > Doug see if the attachment stayed attached when sent to Ferret-Heaven.
- > If it did I sent you the page.

It was indeed attached. I will need to have a look in my Ferret and get back to you. Hopefully within the next 12 hours.

16/4/01

Andy

- > I and my brother had a good giggle at the jpg attacment.....

Doug

Knowing you pair, if it is even remotely possible you will find a way to do it. Knowing the glib

way those military manuals are written (I have a personal score to settle with the joker who wrote the instructions on how to remove the petrol tank from a Greyhound), I fully understand why you find it so amusing.

> 1 Thin yourself down for a couple of days.

For those of you that haven't seen Andy, you don't realise just HOW THIN he is suggesting you get.

> 2 Simply remove engine covers.

Takes 2 people and actually is about the simplest thing you can do on a Ferret.

> 3 Remove internal exuste pipes (You did use stainless bolts and > copper slip when assembling them last....didn't you)

Bet the MOD didn't.

> 5 Find a spanner that you dont want anymore.

Agreed. Don't make the mistake I did (on another job) and use one out of a set and then discover that the manufacturer doesn't make any that size any more and the new type are too long to fit your contoured kit.

> 6 Now mod it so that its too short to get any leverage on it, use > this to remove the bottom bolt.

Yep, it needs to fit between the belly and RHS engine bay wall.

> 7 After 7 hours and plenty of swearing, take out engine.

Fun eh? I regard this as a LAST resort. Haven't seen me turn beetroot red hanging upside down in my Greyhound engine bay have you?

> 8 Remove starter and replace with new one.

Only if you can buy one. Lucky sods you lot, out here we have to fix what we have got. That is why mine is happily whirring with a set of mine cage winder brushes in it, carefully resized of course. Just to keep the record straight these were the ones that came out as "worn out" from the winder and would have been bin-ed!

> Time taken to take out engine and replace - 12 hours, approx..

Of that I have no doubt.

On the subject of engine bay covers (correct term is "decking") the ledge on which they sit on

mine and the covers themselves, show welded up bolt holes. It appears my vehicle is so early that it was produced with a bolt down frame and that only the hinged covers had the 3/8" square drive fast action locks. You can see that it would appear to have been modified later to the normal 2 fast action locks (what are they really called?).

Does anyone else's vehicle show this mod? Bruce? Yours is from the same batch as mine?

(I received an answer from Bruce saying that it was a standard mod for Ferrets.)

16/4/01

Doug

I have been and had a look at my Ferret and it isn't that hard to do the starter. I can reach down under the starter to the hard bolt without removing anything.

But should you need room then you can remove the right angle exhaust elbows from the manifold proper as they are held on by allen screws.

The 2 loose pipes will then fall out.

The tacho drive is the black sheaved cable which goes over the starter at 90° and is held to the engine by a large nut of about 1 1/4" AF.

Easy to get off and hang out of the way.

Then undo the clamps on the 2 heavy cables going to the starter and pull them off along the axis of the starter. Then unscrew the centre light duty cable to the starter.

Now lay along the top of the pannier with your feet towards the front of the vehicle, you can then reach down to the starter with your left hand.

Depending on how dexterous you are you should be able to get to that hard bolt with an open ended spanner or with a cut down ring spanner.

Do note that there are only 3 bolts holding the starter in NOT 4.

Have a go and let me know the result.

17/4/01

Andy to Floyd

Can we not start at the beer, and end at the beer and just miss the bit in the middle. Though that doesn't help you. I suspect that you can as Doug says get the starter out with the engine in place, my problem was that the bolt was damaged so we didn't really stand a chance. Easier to take the engine out.

Put it down to experience.

17/4/01

Hi,

When I got mine the starter motor clutch went in short order, this could have been my fault for over spinning it and getting it too hot, I don't know. What I do know, is that it's a bastard of a job. BUT you don't have to remove the engine or gearbox as per the instruction manual. When we did it, we spent an age removing as many bolts as possible from the engine compartment side, then removed the battery box and I think an engine stay aswell, then we had access to the other bolts. I can't remember if the starter came out through the engine bay or the fighting compartment, but we did decide that with hindsight it would only be a two hour job, not the eight hrs we spent trying to do it from the engine compartment side. Hope that helps. All the best.

Warwick

00DC89

18/4/01

Having learnt this technique the hard way, I know it to work. Remove all wiring etc.

Using as many long socket extentions as possible onto as many bolts as can undone from the engine bay side.

Remove battery box and engine stay.

Undo the rest of the bolts by reaching through from the fighting compartment.

When we did this it took us about seven hours of swearing and getting nowhere before we sussed the battery box route, after which we had it done within 2 hrs. It is not easy as access is poor, but it is a LOT easier than removing the engine. There is no need to remove the exhaust manifolds.

The instructions are a bit vague as it 4 years ago I did this, and the old memory blurs a bit.

Warwick

00 DC 89

20/4/01 Andy to Floyd,

Nuts and bolts on Ferret, Sarracen and Saladin that thread into steel are nearly always UNF (unifide national fine) from 1/4 UNF upwards. If the bolts are in aluminum then they are NUC (unfide national course). Below 1/4 UNF or UNC then the bolts and nuts are usaly 2BA (British assotiation) (approx 3/16 in diamiter) The only metric bolt and nut I've come across is on the windscreen wiper moter.

20/4/01

Floyd

Well I have begun the removal of the starter. It is dark and I don't have a drop light, but I do have lights on a tripod. The good news is that I have a keyed battery disconnect on the ground side of the 2nd battery and therefore I did not have to remove the air filter to get to the battery to disconnect it. I just turned the disconnect off and removed the key.

I removed the engine upper deck and access doors next. I found the best way is to lift it up enough to slide it off the back of the Ferret. It is not too heavy for two people to carry even with the doors left on it. I did not want to create any opening or closing problems with the doors by driving the pins out. So far I have decided not to remove the exhaust pipes unless I absolutely have to later on. After all it has already been said that you could remove the starter without removing the exhaust pipes even though the manual says to remove them.

Next I spent a couple hours removing the tachometer cable that was attached to the engine above the starter like the manual said to. No wrench was made that will fit the nut at the accessible angle available and the space available. So with big hands I proceeded turning the nut about 1/8 of an inch at a time. The wrench had to be reversed after each 1/8 of an inch. I believe that it will be harder to replace than to remove. At least it is already in the hole when you remove it. Some advice here. Tie a hefty nylon string to your wrench and secure it someplace before starting. If you drop the wrench it will go under the motor where you can not reach it. My grown son laughed at me when I tied the string to the wrench, but quit laughing when he dropped the wrench just seconds after starting on the nut. It did go under the motor, but we were able to retrieve it with the string.

We now removed the power and control cables from the starter. This is the only thing beside the motor deck that went well. Be sure to mark them if not marked so that they are replaced in the right polarity. The top power cable or actually the left one depending how you look at it had a white band around it for marking the polarity. It did not look factory.

Next we attempted to remove the bottom bolt holding the starter to the motor. We chose this one first in order not to have any pressure on it (weight of the starter) if the others were removed first. Well it has been hours and so far we were not successful. Lots of cussing and many cuts and scrapes later we have given up for the night. How in the hell can you remove something that you can not see or feel or find for that matter? I am a very unhappy camper. There is a design flaw here. Had I designed it, you could have gotten it out a hell of a lot easier and without pulling the motor too. If that bottom bolt was lowered just enough to clear the starter (less than 1 inch) then a bolt with a 12 inch long head would stick out beyond the starter and you could just put a wrench on it and remove it. If you didn't want the 12 inch head then you could just use a 12 inch extension on your ratchet and easily remove it. Like it is, the bolt is recessed above the diameter of the starter. I am looking at the new starter to see where it is and I still can't find it, see it or touch it. It is now after Midnight. In the morning I plan on going to a tool store (50 miles away) and look for a miracle tool or something. I refuse to pull the engine. I don't have the tools or place to do it.

21/4/01

Floyd

Well we started fresh this morning by driving 50 miles to pick up some special tools at Sears that we figured would work on the removal of the starter. None of them worked. We tried all kinds of tools that almost would go around corners and still nothing worked. There just is not any room to do anything. After 4 hours of hard work we did succeed in removing the starter.

First thing you should know is that you really need to remove the breather pipe that is bolted to

the motor above and to the right of where the tachometer screws into the motor. This pipe runs down and then across to the left and down again. The manual does not mention this pipe in the removal sequence. I don't understand why. Once it is removed and once tachometer cable is removed it gives you unobstructed access to the starter which means that you can now use tools on the one and only top bolt, but this bolt is the last one to remove. We removed the gas tank petcock cover plate on the bottom of the hull of the Ferret. This finally gave us access to the bottom and side bolt of the starter. There was no room for any tools that were normal. By the way the bolts in a starter are 9/16 size. Ended up using 5 inch long (short) 12 point 9/16 wrench. Bent the closed end to the left some and down and up some to form a kind of step looking thing and it then did what was necessary to fit and we removed the bolts. The exhaust pipes that mounted on the hull side had to be removed to create a hole large enough to extract the starter. Upon inspection, we could not see anything wrong with the gear on the flywheel or anything wrong with the starter so it must be electrical and on the inside.

The new starter went on quite fast compared to taking it off. Experience is everything. We were experts by now and it only took 30 minutes to put it back on and that included the bad bottom bolt. We got everything put back and was ready to give the starter a crank. Well you could hear it try to engage the flywheel, but it just would not engage. Sounded like teeth grinding but would not engage. I was feeling like I was about ready to be sick by now. Then I decided to try to help the starter out by turning the hand crank about a quarter of an inch at a time while trying to start the Ferret with the starter. Sooner or later the teeth must line up. After several tries the starter finally engaged and started the Ferret. It sounded like hell, but each time it got better and better except for the times that it did not want to disengage. I hope that all it needs is breaking in. Maybe the parts will wear to fit each other or what ever is the problem wears and fixes itself. Since this is a factory rebuilt starter I don't know what to say. I do know that there is no adjustment on the starter being mounted. I don't know how long the starter has set on a shelf somewhere either. Could be as long as 40 years I guess??

I hope that I never have to do this again. Does anyone know who stocks starter parts so I can rebuild the old one for a spare?

21/04/01

Floyd

You may want to save these instructions on how to remove and replace a Ferret starter without pulling the engine.

1. Remove upper engine deck in total. No need to remove doors and cause a door problem. Two people can handle the deck OK.



Picture is taken from left rear of vehicle and shows just how "full" a Ferret engine bay really is. Thing that looks like 4 bottle brushes is the Oil Cooler.

2. Disconnect 24 volt ground at the battery.

3. Disconnect cables at starter. Tie string on them and raise them high as possible out of the way and tie off.



4. Remove breather pipe being careful not to destroy gasket. The manual never mentions this step, but it is necessary if you don't pull the engine.



5. Disconnect tachometer cable from engine block just above starter.

6. Remove exhaust pipe from body and two loose pipes. Do not remove any exhaust components bolted to engine.



2 loose pipes removed leaving the elbows attached to the exhaust manifold. Bevel box outlined in red.

7. Do not remove top starter bolt at this time. This is the last bolt to be removed.

8. Remove access plate to right side gas tank drain plug to have access to bottom of starter.

9. You will need a 9/16 inch 12 point box end wrench that that is no longer than 5 inches. If you don't have one you will have to cut one off so that it will be no longer than 5 inches. Then bend the box end to the left about as much as you can bend your head to the left. Then bend the box end so that it kind of forms a step. Go across then down and then across. This will take some experimenting to get it right. Once you try to put the wrench on the bottom starter bolt it will become obvious how you must bend the wrench. Save this wrench for future use as it is now a required item in your kit.



Starter outlined in red.

10. Remove the bottom bolt first. Breaking it loose with a short wrench and no space is very hard. Being able to only move the bolt a 1/8 of an inch or less at a time and having to change the wrench position again and again over and over is normal.

11. Remove the middle bolt next.

12. Remove the top bolt last and now you can remove the starter.



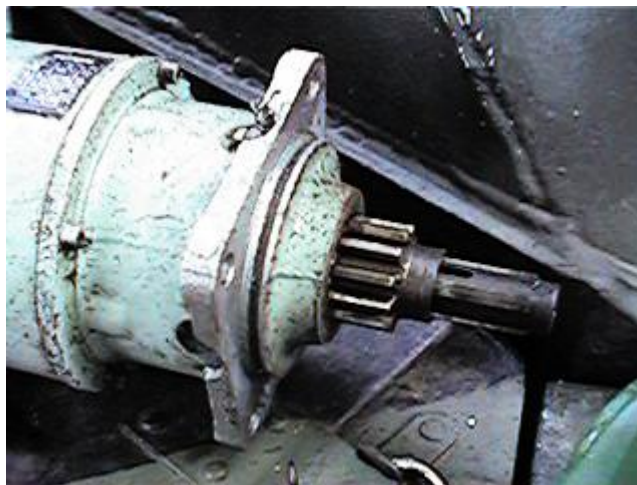


13. Replace starter by reversing the process.

Note: It took about 12 hours of trying every kind of tool and every way imaginable to try to remove the starter without pulling the engine. Once we figured out the only way possible without removing the air cleaner, batteries and gas tank; it took only 30 minutes to remove the starter after modifying the wrench. The starter is easier to replace than remove.

This last picture shows the starter removed. Look closely and you can see how the engagement gear first slides outwards on the shaft along the straight splines and is engaged into the ring gear. Once it reaches the limit of its travel, then the starter motor turns.

Also note the "O" ring on the neck of the starter for water sealing the engine.



Subsequently I received the following update from Floyd:

The **PROBLEM** of the new starter not engaging or disengaging has been solved. The new starter came covered with cosmoline. It most likely had sat on a shelf some place for years. Maybe even 20 or more years. The cosmoline was extremely sticky and thicker than normally seen. I failed to remove all of it and I do mean all of it. It was so thick and sticky that the gear can hardly travel the shaft to engage and so thick and sticky that it can not easily travel back to the starting

position to disengage. Now I have to physically "WEAR" the cosmoline off the shaft and gear from use or remove and clean the starter. NO WAY will I remove it while it works.

The Fix

When using a new or factory rebuilt (British rebuild) starter for a Ferret that has cosmoline on it **YOU MUST REMOVE ALL TRACES OF COSMOLINE FROM THE SHAFT AND GEAR.** Once this has been done physically move the gear back and forth to see if it sticks any where. If not, then a little light grease is in order and then install.

From Scott in the USA:

Doug,

Just finished changing out the starter in my ferret. After reading the articles on your site I was prepared for the worst. My mechanic removed the old one in my driveway with a few standard wrenchs in about 30 minutes. Installation was also not a major problem, but I wasn't here to time it. Granted, my guy is good, but no ferret experience. No special wrench, no engine removal. Just thought you might want to add a second opinion to the articles.

Sounds like Scott has a really good mechanic!

Many thanks to all whose knowledge contributed to this article and in particular Floyd (USA) for his list of instructions and the pictures.