

100E into E83W will go (just)

(The story of how Noddy, an E83W pick-up, received a 100E engine)

After much blood sweat and tears Noddy's heart transplant has been successfully carried out, he is now powered by a 100E engine with all its own ancillaries intact.

Was it worth it? Yes, if only for the challenge of overcoming all the problems along the way. But the real benefit is the extra power (35 instead of 30 bhp) and revs (4000 instead of 3500 rpm). Five more hp might not sound much but if we assume that perhaps 15 hp are absorbed in transmission losses and friction then the real increase is from 15 to 20 hp which is 33% more ummph. And because of the low overall gear ratios of the E83W the extra 500 safe rpm can all be converted directly into extra top speed. As a bonus we also get luxuries like a water pump, thermostat and oil filter.

Much comment and advice has appeared in the magazine since I first asked Bryan Baker for information from his archives. Several people mentioned some of the well known mods such as the sump and the starter motor but nobody seemed to know all the problems so I thought it might be useful to someone in the future to document the whole process while it's still fresh in my mind.

The 93A engine came out on 10th February 2003 and the 100E was first started on 9th March with the first run up the road on 13th March. Bearing in mind that I am retired and spent most days working on the job, you'll see that it's not something to be undertaken lightly. The 100E engine went in three times before it could be finally bolted up.

I'll start with a bare list of problems or items to be modified then explain how each of them was overcome.

- 12 volt electrics
- Shape of sump
- Position of oil pick-up in sump
- Timing cover and engine bearer
- Length of starter motor shaft
- Starter switch
- Overall width of engine from dynamo to oil filter
- Radiator hoses
- Exhaust down pipe
- Bell housing bolts
- Length of oil filter
- Position of throttle linkage
- Position of choke cable
- Length of wires to dynamo
- Starting handle bracket
- Oil dip stick and tube



'Noddy', the vehicle in question.

Because the 100E is equipped with 12v electrics its starter motor will require a 12v supply. It's probably safe to assume that anyone contemplating an engine upgrade on an E83W will have already upgraded the electrics to 12v.



Original sump marked-up for cutting.



Deep part cut and moved back.



Part-way through the welding process.

The shape of the sump (deep part at the front) is the most obvious problem when considering the installation of a 100E engine in any 'upright' Ford. They have their front axle and steering rods just below the front of the engine. The way to do it when converting a car has been well documented but the E83W has heavier steering and suspension and more ground clearance than the cars so even the deep part is well clear of the track rod. The photographs show various stages of the sump conversion which basically involves moving the deep part further back. It's not straightforward (nothing is) because the sump tapers towards the front and has a bulge at the side to accommodate the oil pump. If I were starting again the new front lower edge would be radiused rather than the sharp corner as shown, this turned out to be a very close fit to the flange on the chassis front cross member. During the welding process it is advisable to screw or clamp the sump flange to a suitable flat surface to avoid distortion. After welding fill it with paraffin to check for leaks.



Oil pick-up pan in new position.

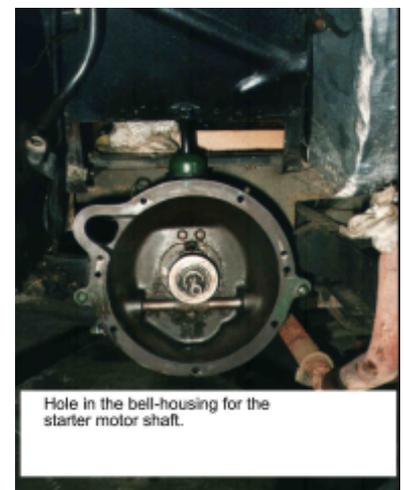
With the deep part of the sump repositioned it is necessary to move the oil pick-up but not by as much as when modifying for installation in a car. The necessary shift can be achieved by careful bending of the pipe between pick-up and pump. It is easier to check this when the main sump welding has been done but before all the holes are plated over. This allows you to see where the pick-up is fouling the sump during the bending process.



The timing chain cover after grinding to allow room for the water pump.

It is not practical to use the 100E engine mountings, which are on the sides of the engine, so the timing cover casting of the 93A must be retained in order to use the original engine front mounting bar. The castings are interchangeable but the old one will require a bit of grinding on the top edge to clear the water pump body. The picture shows that you should avoid being too heavy handed or the sealing face will be lost at this point.

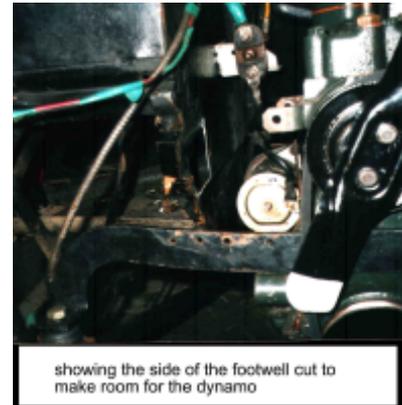
Another well-documented mod that has to be done before the engine is installed is to make a hole in the bell housing to allow clearance for the 100E starter motor shaft which is longer than that on the 93A. It has been suggested that the whole 'bulge' of the bell housing is cut or knocked off but that seems a bit crude. My method was to drill a circle of small holes, knock the middle out, then open out and clean up the hole with a small grinding wheel in the electric drill. It is difficult to know the exact position of the



Hole in the bell-housing for the starter motor shaft.

hole and I found that a trial installation was necessary. The future plan is to make a tin cover for the part that sticks out, but this is low priority.

Another useful purpose of a trial installation was to assess the width problems of the oil filter and the dynamo. Because the 100E has a water pump and therefore the fan is on the front of the engine there is no other practical position for the dynamo than it's own bracket on the side of the engine. As shown in the photographs, it is just possible to modify the tinwork of the driver's footwell to allow room for the dynamo (even when the fan belt is fully adjusted) and still leave room for the dip switch and to get your foot on the clutch pedal. Because the dynamo is mounted lower than on the E93A engine it is necessary to make up new leads from the voltage regulator.



The problem of the oil filter is more difficult to overcome. The recent picture in the February 2003 edition of SVN shows one method, the flanges of the chassis are heated and folded inwards. I decided this was too brutal and meant losing the left hand suspension bump stop which is fitted under the chassis member at that position. Another solution is to retain the small rear timing cover casting from the 93A which would expose the oil holes in the block. These are the points at which the old 'export spec' remote-mounted oil filter pipes are connected. These holes can be tapped with a bsp thread to take the relevant unions. A filter kit is available but it costs the best part of £100. Apart from the cost I wanted to keep as many of the 100E parts as possible, so another solution was needed.

The oil filter casting overlaps the chassis by less than an inch so the rather radical method used was to move the front of the engine 22mm to the right. This meant a bit more tin bashing to make room for the dynamo but everything just went in. The top of the engine mounting bar is flat in the crucial area so it is only necessary to drill two new bolt holes and push the front of the engine to the right. A slight joggle in the bar ensures that the central part still lies flat across the front of the timing cover and the ends align with the engine mountings. In order to allow the gear-box to also swing to the right the two heavy tie rods must be slacked fully off and once the engine position has been finalised suitable spacers will be needed so that the tie rods can be properly tightened. I found that about 5mm of spacers were required at the front of the left hand rod and the rear of the right hand rod. The prop shaft and universal joint will have no problem coping with the angle of the engine, they already cope with much greater angular movement in the vertical plane.



Having sorted out all these problems I thought it was safe to bolt the engine finally into place but another previously unreported snag was to be revealed. During previous trial installations only 3 or 4 bell housing bolts had been used but now, when trying to put in all the bolts, I found that one of them could not be started in its thread. I tried for ages, thinking it must be a damaged thread or that the hole was slightly misaligned. It eventually dawned on me that not only was there no thread, there wasn't even a hole! So, after marking the position of the missing hole, it was out with the engine once again. The 100E uses an extra bolt in its bell housing but most of them are still in the 93A positions except at one point two bolts are used on the 100E in

place of one on the 93A. After carefully drilling and tapping a new hole in the back of the 100E flange the engine went back in for the third time.

At this point it was realised that although the dynamo didn't foul the bodywork it was not possible to fit its pulley because of the position of the engine bearer bar. The remedy, as illustrated in the pictures, was to cut a piece from the top of the bar and, to retain the strength, weld it back on the bottom. By the way, you can use the 93A dynamo but it is necessary to use the pulley from the 100E due to the narrower section of the fan belt.

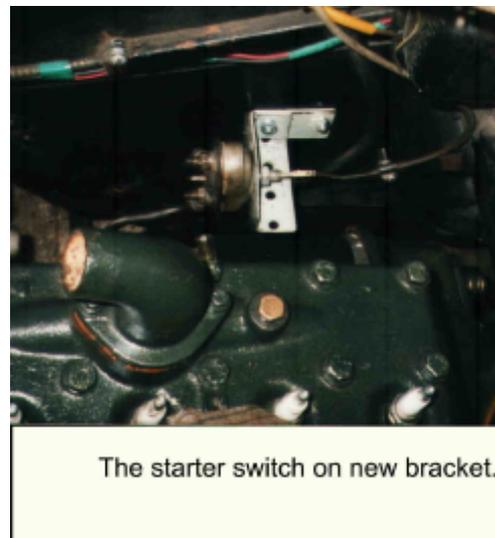


So now the engine was bolted in place and the dynamo could swing through the arc necessary for fan belt adjustment. A new hole was drilled in the engine bearer bar for the end of the dynamo adjustment link. With the oil filter casting clear of the chassis side member the filter bowl could be fitted. Contrary to earlier advice I had thought that it would not be necessary to shorten the filter bowl as is required on 'upright' car conversions but unfortunately the centre bolt comes directly above the axle beam and, when fitted, comes lower down than the bottom of the suspension bump stop. Using the oil filter as the bump stop didn't seem like a good idea so 42mm was carefully sawn off the top of the filter bowl. The centre bolt required the same degree of shortening. The best solution would be to run the thread further down the bolt and then cut the end off but no means were available at the time to cut the required thread. It was therefore done the hard way, saw 42mm out of the middle of the bolt and weld it together again. The filter element also needs the same reduction in length. I found this could be achieved by the careful use of a sharp knife. If it's the type with metal end plates these should both be retained so that it seats properly top and bottom.

If the 100E manifolds and carburettor are to be used (and you won't get the full power increase without them) there are two further problems to be overcome. The exhaust front-pipe will need heating and the first bend slightly straightened. The exhaust stub of the 100E manifold is angled slightly towards the rear whereas the 93A manifold points straight down. The manifold is also wider and may be a close fit to the inner wing panel. I had previously made a detachable panel under the front wing to allow easier access to the exhaust flange and the petrol pump so this was increased in size and the shape altered to take some of the curve out of the inner wing panel. There is plenty of spare room under the front wings, Ford could have allowed more spanner space under the bonnet in the first place.

The 100E uses a remote switch for the starter motor which is mounted on the engine bulkhead. To avoid changing the E83W starter cable I mounted the 100E switch on a bracket fixed to the side of the driver's footwell at a point just above the starter motor. The battery leads from the 100E are just about the right length in this position.

The major snag with the new position of the dynamo is that there is no longer room for the throttle pedal linkage which extends around to the inner face of the driver's footwell. To allow it to operate above the dynamo the cable anchorage bracket needs moving to a different position on the side of the footwell and the



pedal rod has to be cut and re-welded to suit the new angle. Because of the different carburettor, that part of the old throttle linkage that used to be bolted to two studs near the back of the cylinder head needs to be re-positioned. I made a new bracket which is held at two different head studs and brings the linkage in between the carb and the distributor. The Bowden cable may also need to be lengthened.

The different carburettor also creates a problem for the choke cable. My solution was to shorten the cable and fit it further left on the dashboard so that it aligns with the carb.

Radiator hoses can be made up from a combination of 100E and E83W hoses, the radiator end of each hose coming from the E83W, and the engine end from the 100E. A short length of straight pipe is needed to join the two pieces of each hose. I found that the stub pipe in the side of the block is available as a spare part, this was ideal for joining the bottom hose. Unfortunately, the pipe needed for joining the top hose is a different diameter so pipe had to be found from elsewhere.

There was already a water temperature gauge fitted on the 93A into a complicated fitting in the top hose but the 100E head has a tapped hole specially for it. Until a suitable heater can be found the two heater fittings on the cylinder head have been joined by a short length of ½ inch hose.

One small job caused by moving the engine to the right is to cut off and re-weld the top of the starting handle guide bracket so that the handle will find its way to the dog on the bottom pulley. If this job is left until the engine is installed but before refitting the radiator and grille it makes it easier to get the proper alignment.

The last job is one that I hadn't thought about until filling the newly installed engine with oil. The 100E has its dip stick on the other side of the engine and it's not very long. This makes it very difficult to reach in the E83W. Luckily the tube and dipstick from the 93A can be used directly in the 100E which brings the top of the stick nearly up to cylinder head level and, therefore, much more accessible.

It's early days yet but having now covered over 100 miles the benefits are certainly worth having. Noddy's maximum speed on the road may not be significantly higher due to limitations of steering and brakes but you get up to that speed very much quicker which should improve the journey times. Top gear will get you up slightly steeper hills than before and E83W owners will know how frustrating it can be on a hill that you can't quite hold on to top gear but the engine will rapidly go to dangerously high revs in second. Another unexpected improvement is in the degree of control during warm-up. The cold-start mechanism of the 100E carb makes the first couple of miles much easier when leaving home. I will update this story after a few thousand miles have been covered just in case any nasty problems arise, but at the moment I'm glad I did it.

So what next? It's probably about time the back axle was looked at to find out why it has been making such awful noises for years.