FJ62, Version 2F-E

by Arron Thompson

During the summer of 2002, we bought our first Land Cruiser, a 1989 FJ62. A couple weeks later we had some major engine trouble in the form of a spun rod bearing (which cracked the crank). Not too happy, I began the complete rebuild of the 3F-E. I had it bored 1mm over, crank replaced, cam/lifters reground, rotating assembly balanced and the head completely rebuilt. It ran great once it was back on the road. It was good around town, good on the highway and good off-road. It fit our family very well. Fast forward 15,000 miles, the engine was just getting worn in when the rear main seal blew out and all the oil went with it. Needless to say, it again spun a rod bearing. We parked it that September of 2004 to decide its fate. Keep it or just sell it "as is" and find another one?

I didn't want to rebuild that 3F-E again and decided to research a small block Chevy swap. It seemed that the folks that had done a 350 transplant were happy with the performance. But the adapters were expensive and I'd have to find a donor truck with EFI. The EFI is why we bought the FJ62 instead of an FJ60 and I really didn't want to lose that particular feature. The last thing I needed to consider was passing the local emissions test. Then while perusing the internet, (what would we do without the internet?) I found a two paragraph essay on swapping a 2F block into the FJ62. It stated that the swap was easy and that it ran well after it was done. This swap was intriguing to me because of four main reasons. One, the 2F has a longer stroke, so under the 3F-E head it should produce more torque at a lower RPM. Second, I had limited time in which to complete the swap and the short block could be built before I took out the other engine. This would save me waiting a week for the engine shop to machine everything. Third, there were no expensive adapters to buy. And four, it would still be a Toyota when I was done. I tried to find the person who wrote the essay but to no avail. I then asked the Yahoo-based 3F-E list what they thought and if they knew of anyone else who had done this swap. Mark Hawley's name popped up (of Metal Tech Cage) and I sent him an e-mail. Indeed he had done this swap but he sold the rig shortly after. He said the torque increase was noticeable. He also told me of some of the drawbacks of the swap: the intake rubbed on the hood liner, new accessory brackets needed to be made, and an extra leaf had to be added to the front spring packs.

So it had been done. That was good enough for me. If it bolted up to the transmission and to the engine mounts, I could figure out the rest. I printed Mark's email so that I could go over the details and make notes of what I needed. My wife also read the email from Mark and pointed out some little things that would need to be addressed (and that it's the little things that add up quickly in an automotive project). This was an important point. Do not forget the little stuff. I assured her that it would go smoothly and that in doing it this way, I could have the 2F short block built and ready to go before my spring break. Then it would only be a matter of taking out the old and putting back the new. We decided to move forward with the project and keep our FJ62.

Thus I set out to find a 2F short block. The first engine I found was a long block about three hours away, a 1975 2F. I thought this would be good enough for my project and it was soon time to take a road trip with my sons to pick it up. When I got it back home I posted on IH8MUD.com about this engine. Members were quick to point out that it may not work with this swap as there were no mounting points for

Engine Comparison Chart

Model	2F	3F (non-US)	3F-E
Displacement (cc)	4230	3955	3955
Horsepower @ RPM	135 @ 3600	144 @ 4200	155 @ 4000
Torque (ft-lbs) @ RPM	200 @ 1800	203 @ 3000	220 @ 3000
Bore	3.70"	3.70"	3.70"
Stroke	4.00"	3.74"	3.74"
Compression Ratio	7.8 : 1	8.1 : 1	8.1 :1

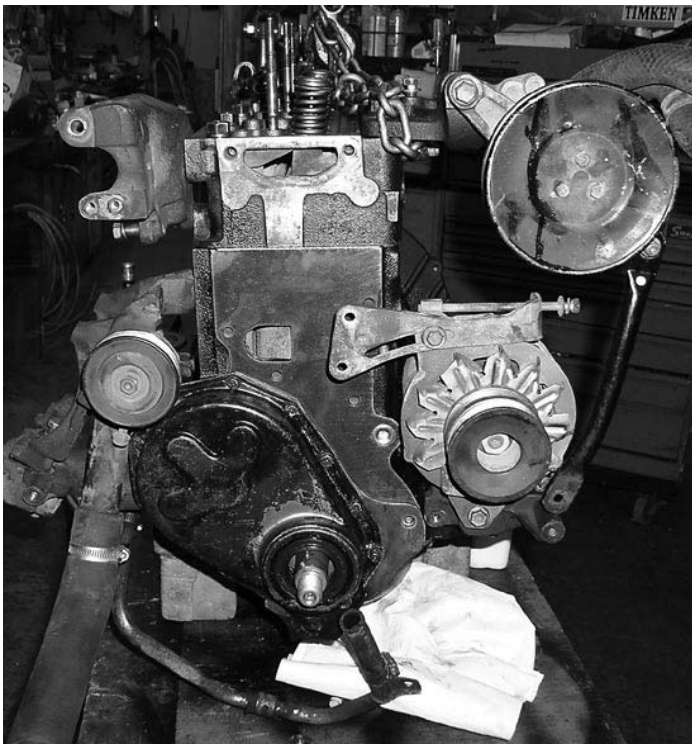
There are some clear differences between the 2F, 3F (non-USA with carburetor), and 3F-E engines. There is a 1/4" difference in stroke, but the best difference is the low RPM torque of the 2F. Also notice the increase in horsepower and torque when EFI is added into the mix.

modern day accessories such as A/C, power steering and the smog pump. It was also pointed out that the early 2F engines had domed pistons that would not work with the 3F-E head. I decided to sell the engine and look for a newer 2F short block.

Once I found my late model 2F, I set out to get it to the engine machine shop for the rebuild. Again I went whole hog with it as far as things that will make it more reliable and longer running. It was bored .5mm over, balanced, and the crank was reground to .010" under. I used the cam and head from the 3F-E. Other parts that I used were: 2F water pump, 2F lifters, 2F pushrods, 2F timing gears (because they are all metal but 3F-E gears will work also), 2F side cover (modified), 3F-E head gasket, 3F-E valve cover (the 2F valve cover could work also), 3F-E oil cooler, 3F-E thermostat housing and the 3F-E manifolds (exhaust and intake).

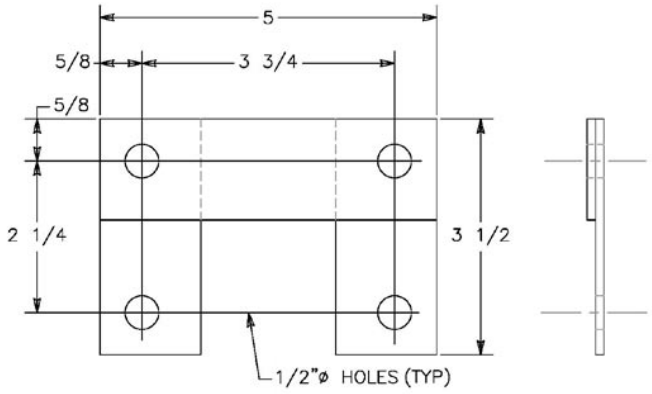
I used pushrods from a 2F. The top one is from a 1975 2F and the bottom one is from the 3F-E. I used new ones from Clevite (PN 21-3270) that are intended for the 2F.

Once the engine was put together I set it on a table to help me design the mounting of the accessories. It wasn't as tough as I thought it would be to orient the accessories. The main problem was that the 3F-E block measures 9-1/4" from the oil pan mounting surface to the deck while the



Setting the engine on a table made it easy to mock up the required brackets for the accessories (I didn't have the water pump at this point).

A/C Pump to Engine Mount Bracket



NOTES:

1. For best fitment of main body, tack weld together while on engine.
2. Keep holes as square as possible to keep pullies aligned for belts.
3. Refer to pictures for correct orientation.

MATERIALS:

1' x 1" x .125" flat stock

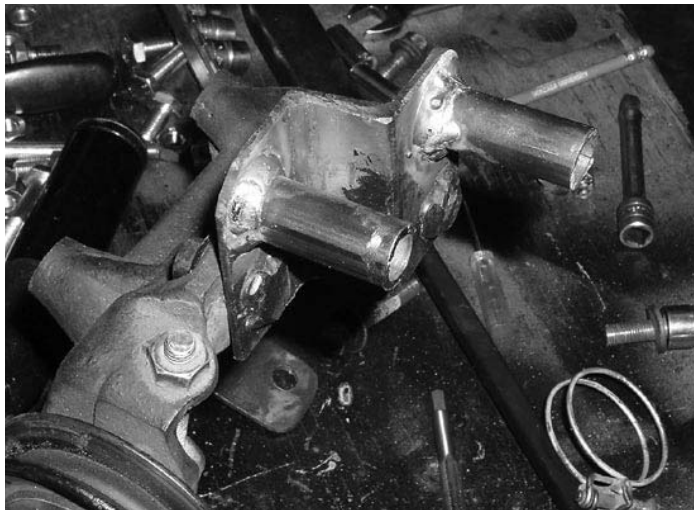
(2) bolts for AC pump to new bracket

(2) nuts for bolts

(2) lock washers

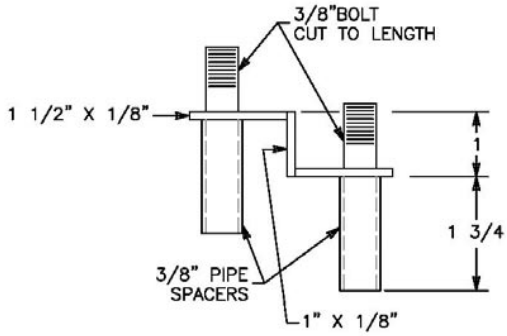
(2) 10mm x 1.25 pitch—bracket to mount

To clear the water pump main outlet I had to move the A/C pump out 2-1/4". This is the mount that I made from 1-1/2" x 1/8" steel, drilled to match the A/C pump mount.



A/C to power steering adapter bracket bolted to the A/C mount.

A/C Pump to Power Steering Bracket



NOTES:

1. For best fitment of main body, tack weld together while on engine.
2. Keep holes as square as possible to keep pullies aligned for belts.
3. Refer to pictures for correct orientation.

MATERIALS:

1' of 3/8" pipe

2' x 1.5" x .125" flat stock

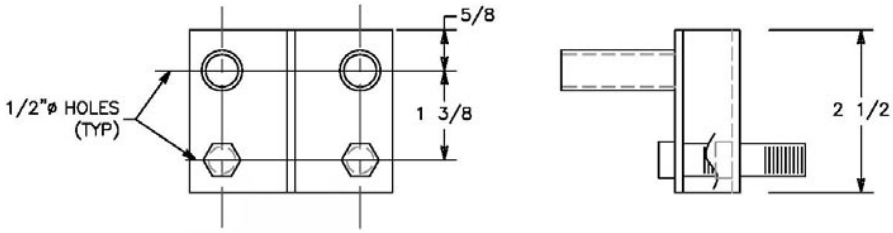
1' x 1" x .125" flat stock

(2) bolts to weld in as studs

(2) nuts for bolts

(2) flat washers

(2) lock washers

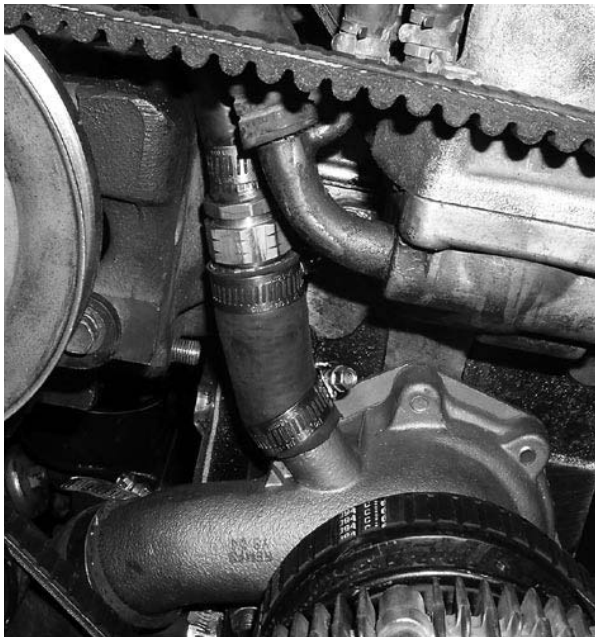


2F measures 11-3/8". The accessories mount to the 3F-E head and to the engine mounts. So all I did (at first) was extend the original A/C mount to the P/S mount with common hot rolled steel. The alternator, smog pump and power steering were all bolted up to the original mounts. After I thought that I had all the brackets figured out, I set the engine into the engine bay. At this point I was still waiting on the 2F water pump. Unbeknownst to me, that small part would cause some bracket redesign and other fitment problems—the water pumps differ by design between the 3F-E and the 2F, and this gave me more problems than any other single item. The 2F water pump was a little more bulky and the outlet that leads from the radiator was now in the way of mounting the A/C pump in the stock 3F-E location. I needed to move the A/C out away from the engine about 2" to clear the water pump and the short radiator hose. As it turned out, moving the A/C out also meant it would move up since the engine mount is angled. This meant that I would have to shorten my original top bracket. To move the A/C mount out, I made a simple little mount that bolted to the engine mount and to the bottom of the A/C mount. I then added some spacers to my top bracket after it was shortened. For the spacers I used 3/8" pipe welded onto the plate steel bracket. This worked well and was simple to make, and the mounts were still very rigid after I bolted everything together. I did use some longer bolts with the new bracket. When making brackets for moving the A/C pump, I had to be very sure that they were square to each other and that the pulley was still true to the rest of the belt pulleys in the system. I took my time while drilling the holes with the drill press.

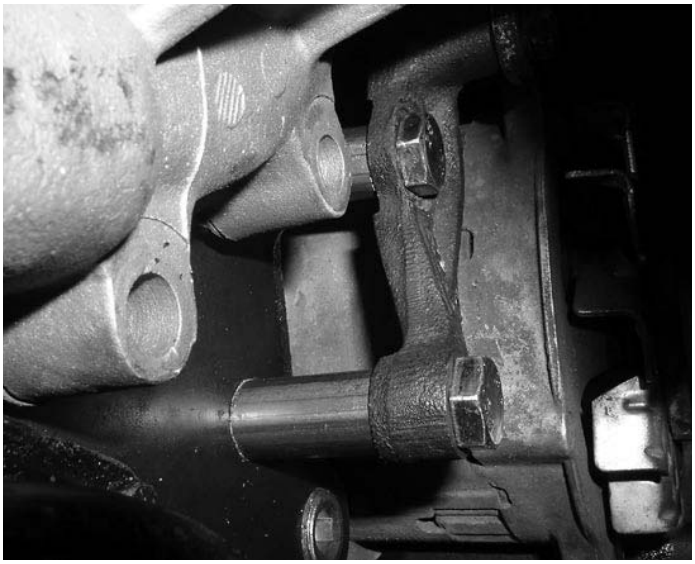
There were still two more problems with the 2F water pump that had to be worked out. The idler pulley for the large belt didn't bolt up to the water pump as it had before, and the heater hose outlet was 1" instead of 5/8". For the idler pulley, the way it was cast made it impossible to use without modification. I decided to take a chance and grind down the web between the mounting holes to clear the outlet that leads to the oil cooler. Doing this wasn't as bad as I had feared. I cut out as little material as possible so that it cleared the water pump. To fix the heater hose dilemma, I bought a brass reducer and a short piece of 1" I.D. hose to connect it to the water pump. Also, the 2F water pump doesn't have enough outlets/inlets. The coolant hose that runs from the 3F-E thermostat housing to the water pump must be blocked off.

A clear view of how much material was removed from the idler pulley bracket.

The idler pulley for the large belt had to be ground a little to clear the water pump outlet.

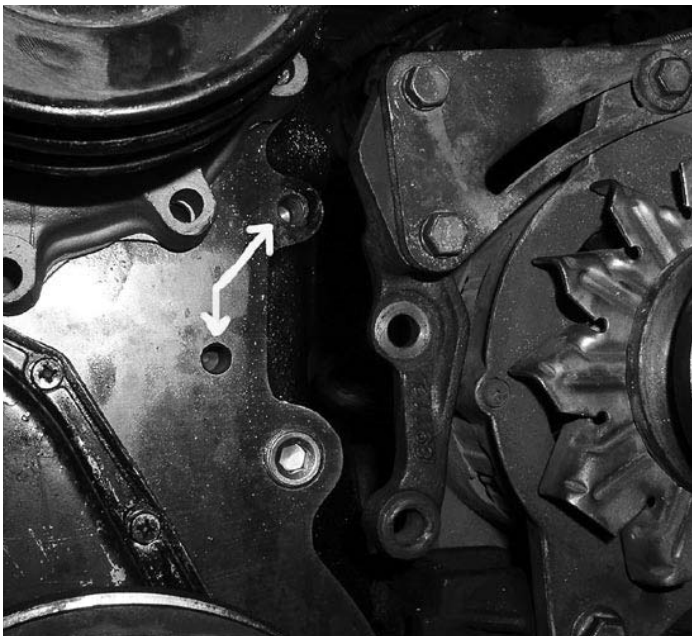


The 2F water pump has a larger output than the pump from the 3F-E. I bought this adapter from a local hose shop.



The upper mount for the alternator previously bolted up to the water pump but is now mounted to the block using spacers made from 3/8" pipe.

I extended the smog pump support brace using 1" x 1/8" stock doubled up and kept it as low as I could so that I could use the original hoses.



These two extra holes (see arrows) are the ones I used to bolt up the top mount for the alternator.

The next issue was the top mount for the alternator. It previously bolted to the water pump studs, but since I used a 2F water pump that wasn't going to work. On the bright side, there were two unused threaded holes on the front of the block that lined up perfectly with the top mount. There was only one problem: they were too far away to bolt up correctly. Again, I made some spacers from the 3/8" pipe and used longer bolts to attach it to the block. This was a simple and effective fix for the alternator's top mounting point.

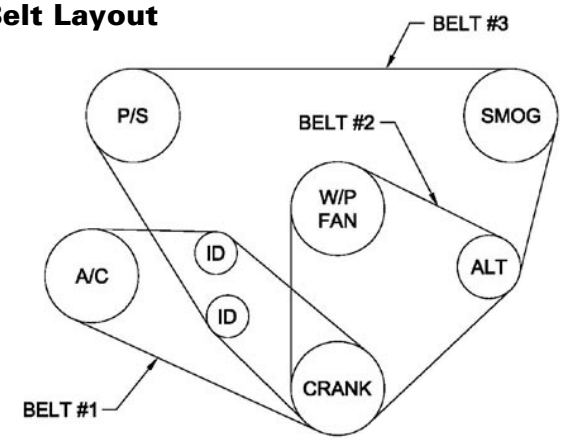
The smog pump required a simple fix also because it still used the mounting point on the head. The support tube came up short because of the taller block. For this I used 1" x 1/8" flat stock doubled up to make it 1" x 1/4" to extend it to the mounting point on the engine mount. I kept the smog pump as low as I could so that the two existing hoses could be re-used.

Because of the taller block, the 2F side cover would need to be used. However, you have a choice of which parts you would like to use. Either use the 2F side cover (as originally designed with the PCV) with the 2F valve cover, or modify the 2F side cover by removing the tube and welding it closed and make use of the 3F-E valve cover. I cut off the PCV tube and welded the 2F side cover and used the 3F-E valve cover.

There were various fitment issues that had to be addressed when the engine was set into place. The very back exhaust and intake manifold bolts were even more difficult to get to than before. They weren't impossible but they took a long time for me to get them to the correct torque specifications. I recommend that they are put on before the engine is set into the engine bay. You'll also notice that when the engine is in and the exhaust manifolds are on, your exhaust falls short of bolting back up. I had anticipated this and needed a new exhaust from front to back anyway. If your exhaust is new, just have the existing pipes extended up to the exhaust manifolds. The valve cover is also a little more difficult to put on. There is a lip on the firewall that is in the way in conjunction with the rocker shaft assembly. It still goes on, but takes more time to twist and turn and wrangle into place.

Once all the accessories and idler pulleys are on but before replacing the radiator, it was time to figure out what size belts to use. I had never done this before so I just took my old belts to the auto parts counter and asked for longer ones. Three times to the store and I finally got one belt to fit. The guess and check method is not a great way to calculate belt length, however, and I found out that there are two ways to get a closer estimate. One is to run a tape measure around the pulleys to get the length. The other is to cut your old belts, wrap them around the pulleys and measure how much they are short (or long). I did both just to make sure and to avoid another trip to the parts counter.

Belt Layout



NOTES:

1. Belts Numbered in Order Put On
2. For the part number of the belt, the first two numbers are the series and the last three are the length. Example: 22685 is series 22 and 68.5 inches long.
3. Belt #3 should be 22695 for the P/S to sit level.

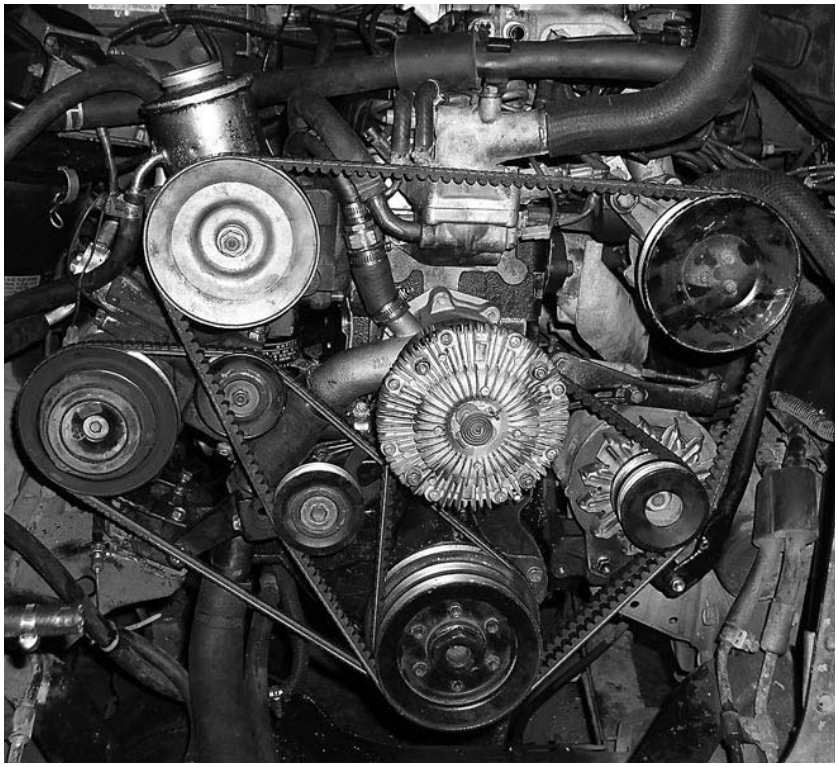
MATERIALS:

Belt #1 Dayco 17510
Belt #2 Dayco 22425
Belt #3 Dayco 22685

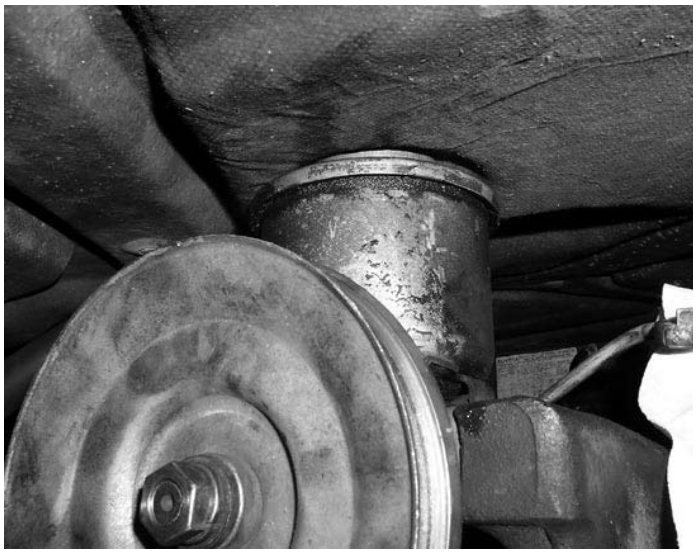
The last fitment problem I had was the fan shroud. The 2F water pump shaft is oriented about 3/4" higher than the one on the 3F-E. This caused interference between the fan and fan shroud. I decided to cut the original fan shroud in half and bolt the bottom half to the radiator. Many of the guys on the 3F-E list had done this very modification to their fan shrouds with great results. I now see the benefits of this setup as well. With the top of the fan shroud off, the belts and water pump are easily accessible. I work in a sheet metal shop during the summer so I plan on making a new top half of the shroud after work. But I wonder if a shroud from an FJ60 would work without modification? This would make things easier yet.

This was my first experience swapping in a non-original engine and it was fun for me. It wasn't too tough, no heavy fabrication skills were required and it's still a full Toyota Land Cruiser. The swap did require a welder, a drill press with a good vise, a grinder, and extra time. If I had the opportunity to do this all over again, I would. If this is something that you would like to pursue with your FJ62, the full size photos and drawings will be posted at http://www.steelnthings.com/TLCA/2Fswap.

Driving it home that first time, I could feel a difference in the way it drove. When the gas pedal was pushed to the floor, the torque was right there. I had to be careful though because I only had exhaust manifolds, no muffler or catalytic converters. It sounded fine to me but it was a bit loud. I drove it without exhaust for only about a mile to get it home. After the exhaust was finished I was finally able to drive it without fear of the noise police. It felt good to be behind the wheel again. And the power was great! I'm embarrassed to report that I will not have any type of fuel mileage figures to report until the "honeymoon" period is over. It just feels so good to have it get up and go with authority. I can't wait to take it off-road for some wheeling. It will be nice to have that torque down low in the RPM range where it can be used. Highway driving has also improved. With summer in full bloom now, I will have even more of a feel for how it runs when we go camping with the roof rack loaded, kids strapped in, and the dogs in the back. My hope is to be able to keep up with traffic more effectively on the hills. And as this engine wears in, more power and better fuel economy should be the result. When it's time for the 3F-E in your FJ62 to be rebuilt, take a close look at your options and this 2F-E swap.



At long last the correct belt sizes. The longest one allows the power steering to sit level.



With the power steering in the stock location and sitting level, it will rub a little on the hood liner.

Photos, illustrations and charts by Arron Thompson