

Part 1 - Subaru pre-purchase inspection

As we begin the process of converting our Vanagon to a SubaruVanagon we want to start with the best condition Subaru engine we can find. These engines are known for their longevity but it never hurts to take a little extra time and make sure its in good condition before buying the donor vehicle. A compression test is also a good baseline if you've already purchased a donor Subaru Legacy/Impreza/Forester. Fluid checks also indicate whether the owner has taken good care of the car or not - low power steering fluid, for example, could indicate that the owner didn't pay great attention to detail with the maintenance of the Subaru.

This article explains how to do a quick compression test and some basic things to look for when buying a Subaru for a Bus or Vanagon engine swap.

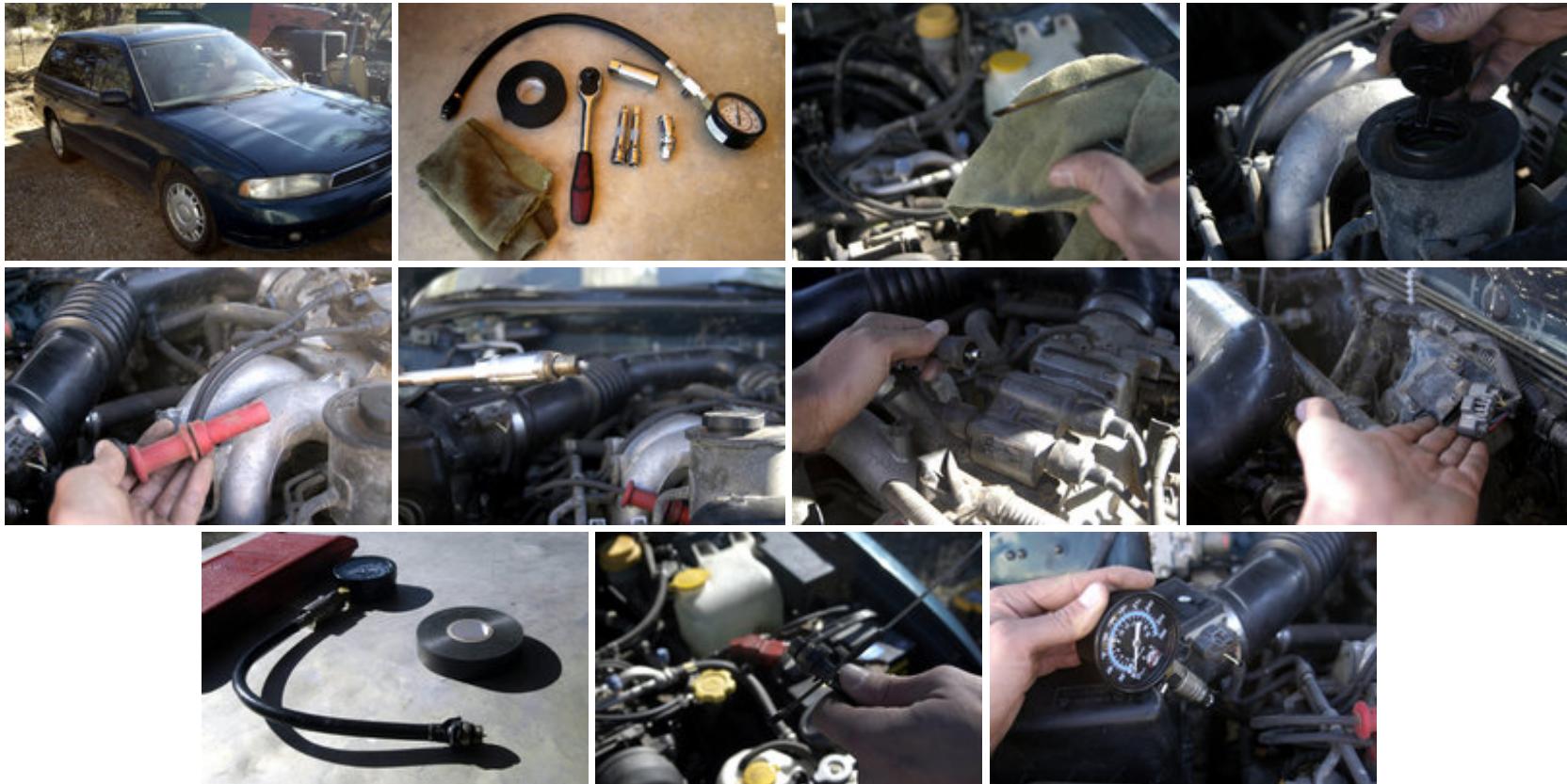
Overview and Approximate Time Needed :

Steps	Process Description	~ Time (min)
1	Check fluids	10
2	Remove spark plugs and unplug Ignitor	15
3	Perform compression test	15
4	Re-install spark plugs, wires, and Ignitor	20
	* Approximate Total Time =	60

*A mechanically inclined person should reserve a half hour to complete this process. For someone new to working on cars, this may take an hour or two.

Tools needed:

1. Shop towels to check fluids
2. Ratchet with extensions and spark plug socket and swivel adapter
3. Compression tester
4. Electrical tape



This Legacy pans out! Aside from a bad throwout bearing, due to faulty clutch linkage at the transmission, we are ready to start our project and have an EJ22 in good shape. Let's move it into the garage and start pulling the engine and wiring harness.

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Part 2A - Removing the Subaru Donor Engine

Removing the Subaru Donor Engine

Removing your Subie donor engine can be an exciting experience or a frustrating one. Learn from my mistake and find a nice warm garage or covered area to perform the following work. The first engine I removed was outside in a friend's yard. It rained on me while I was working and my donor car was almost towed! The following resources should help reduce the time required to complete the engine removal process. I hope that you will not let this step keep you from deciding to swap your engine. It is very manageable if you have all of the tools and do not rush.

95+ vs `90-`94 Model Subaru Legacy Donor Engines

The difference is in the wiring harness. '95 and above will have the OBD2 computer system which is a more sophisticated computer. Although sophisticated, the 95 wiring harness conversion is not more difficult than the 90-94. Plus, an extreme benefit of having the OBD2 computer is that it will provide thorough diagnostic information and the ability to use wireless/digital dash gauges. You can connect your smart phone via wifi and receive realtime information about your engine operation!

Overview and Approximate Time Needed :

Steps	Process Description	~ Time (min)
1	Remove hood, battery, and intake	40
2	Disconnect and label wires from engine	40
3	Disconnect throttle and brake cable	10

4	Disconnect coolant hoses and collect coolant	30
5	Drain oil (not shown in pictures)	20
6	Remove power steering and A/C assemblies	60
7	Remove radiator fan	20
8	Remove exhaust	15
9	Free engine from crossmember	15
10	Extract engine	50
	* Approximate Total Time =	300

*When you factor in rest and prep time, a mechanically inclined person should reserve a full day to complete this process. For someone new to working on cars, this may take 2 days of hard work or 3 days of light work.

Tools you may need:

1. Metric socket set with extension and possibly a swivel
2. Metric wrench set
3. Mechanic gloves
4. Needle nose pliers and channel locks
5. Wood hand clamp and rubber hose cutter
6. Metal shears
7. Pry bar and breaker bar
8. Coolant, Oil, and gas storage containers and catch basin
9. Shop towels and grease remover for hands
10. Engine hoist with appropriate rated chain
11. Appropriate size engine stand

Engine Removal

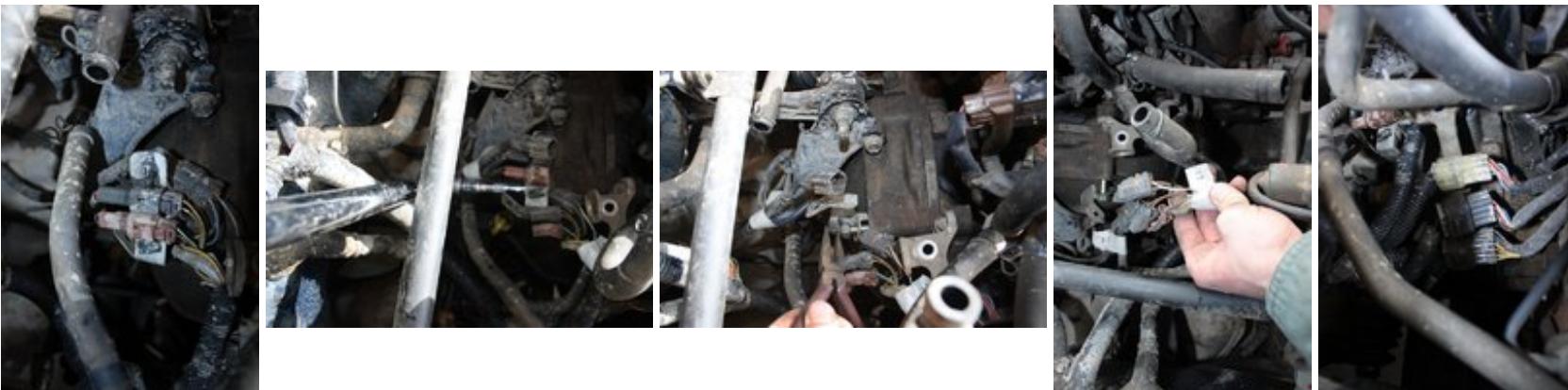
Step 1: Remove the hood, air intake assembly, and battery

The battery and hood removal process should be straight forward.



Step 2: Disconnect and label wires going to the engine wire harness

The trick with the wiring harness is understanding the plastic connectors. If you study the pictures below, you should have a better idea of how the connector works. It may take a reasonable amount of force to separate the connector pieces, but if you take time to understand how the connector works and is designed to separate, you will save yourself a lot of energy and sore fingers.

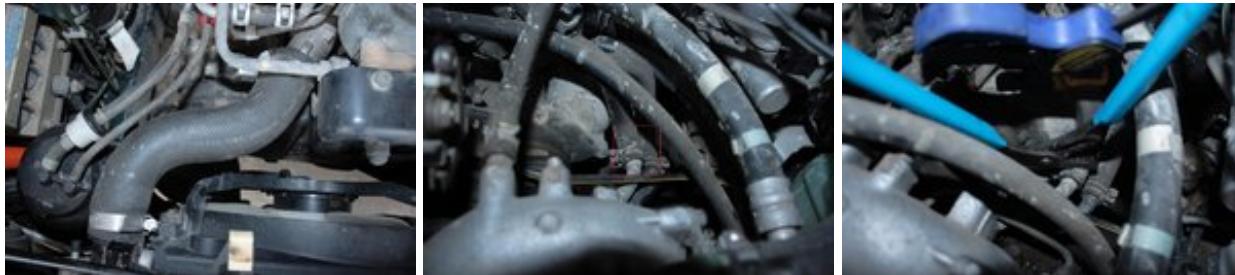




Steps 3 & 4: Cables and Coolant

Don't forget to save the throttle cable. It is not the end of the world if you have to cut the coolant hose to remove it, just try to make a clean cut nearest the end of the hose as possible. You will want as much hose as possible for when you design your new coolant system for the van. I found that it is easier to slide a used hose end over a steel pipe than a cut end due to the slight plastic deformation of the hose end. So, only cut the hose if necessary. Check your local mechanics shops who dispose of coolant often and see if they wouldn't mind disposing of yours as well.





Steps 5, 6 & 7: Drain Oil, Remove Radiator Fans, Remove Fuel Lines, Remove Power Steering, and A/C

We do not include pictures of draining the oil because we assume that you would not begin to remove an engine if you have never changed your oil before. There should not be much fuel in the fuel lines, but try to catch what you can and properly dispose. Make sure there are no open flames when cutting the fuel lines, obviously. You may save the fuel lines for future use. Removing the A/C was a challenge, until I found an extra long extension for my ratchet. Take caution not to rupture an A/C line.



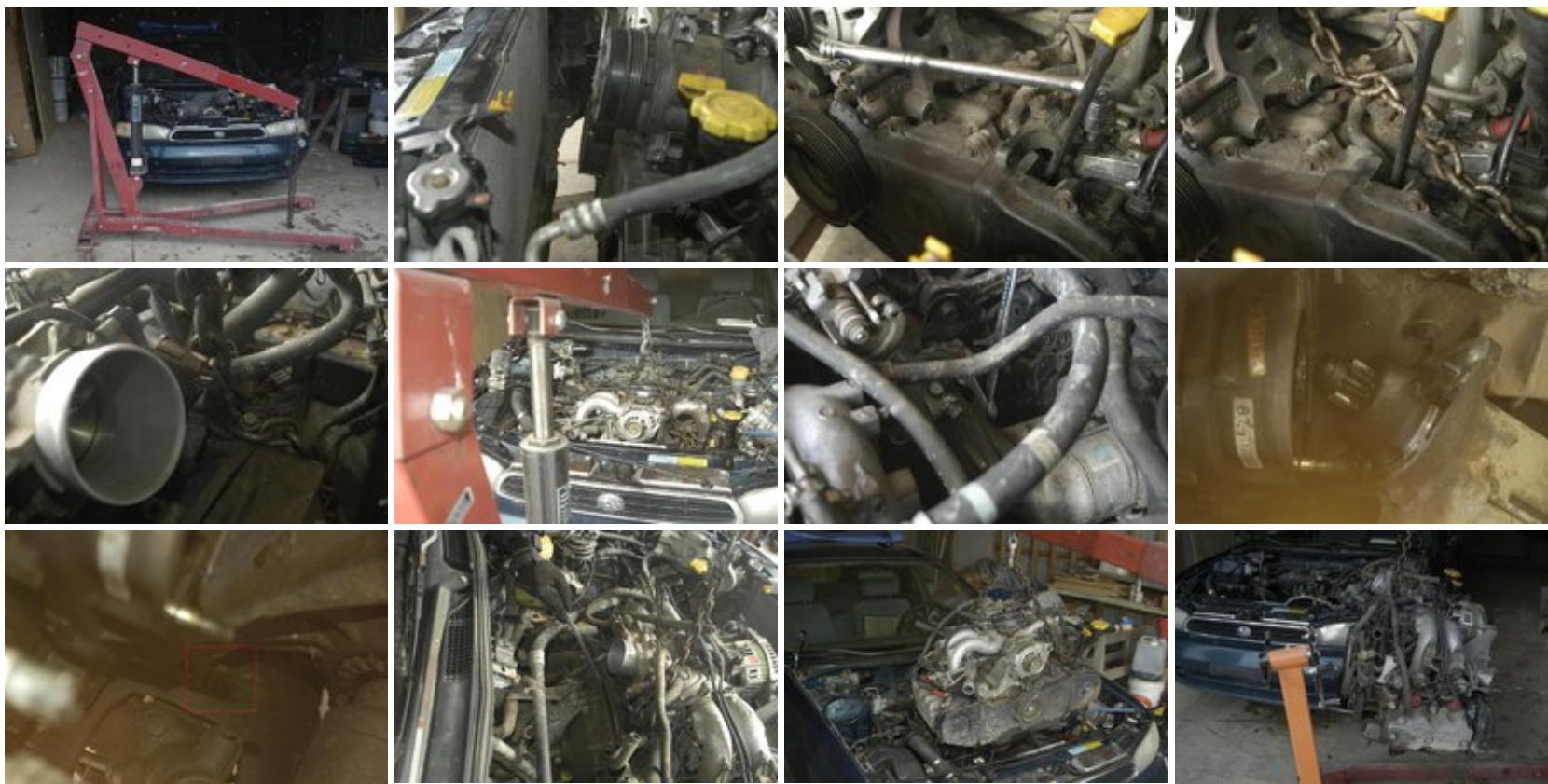
Steps 8 & 9: Remove Exhaust and Free Engine from Crossmember

Most likely when removing the exhaust, some studs may be in bad shape or begin to unscrew from the engine. No need to worry. These studs are cheap and can be purchased online or at your local Subaru dealership. A breaker bar will make your life much easier for these steps.



Step 10: Extracting the Engine

We checked and double checked our rigging before we lifted the engine. Using lots of prying and manipulation, we were able to free the transmission from the engine. We had to pull the engine upward to clear the motor mount and exhaust studs, then outward parallel with the ground, until it released from the transmission. Renting an engine stand was well worth the cost. It specifically helped when it was time for us to change the timing belt and engine oil seals.





Conclusion:

If you are able to find a garage or driveway to perform this work, it will be well worth it. The engine hoist is the way to go. The hoist is easy operate and much safer than other methods.

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Part 2B - Removing the Subaru Wiring Harness

Article Summary

In this article you will learn the basic steps of how to extract the wiring harness from your donor Subaru car. Once again, this is a 1995 EJ22, but the process of harness removal is very similar to other year models. This step can seem challenging at times, but with patience, it is very feasible for a novice mechanic.

Lessons Learned

As you will see in the following steps, the crux of this removal process is removing the dash and structural member behind the dash. If you study the pictures below and find the correct bit for your screwdriver, life will be much easier. If not, you will find yourself like us prying the harness out. Another key step for removing the dash is to remove the bolts under the windshield from the outside of the car. If a wire connector is giving you problems, review the necessary connectors in the next article and if you feel confident that you don't need the connector, snip the wire and move on.

Time Needed

You will notice that this part of the Subaru conversion does not have many finite discrete steps. So, I decided not to time every detail of this process. I can tell you that it took Mick and I both about a day to remove. Therefore, conservatively speaking, it may take you about 3 days by yourself if you are a novice.

Tools You May Need

1. tin snips
2. screwdriver (philips and star shaped if possible to obtain) see pic below
3. socket set (metric)
4. Cro-bar (optional)
5. wire cutters

6. plastic bags to keep screws/bolts/clamps for later use
7. masking tape and marker
8. flashlight (for working under the dash)
9. Needle-nose pliers (for disconnecting connectors)

1st Stage: Take a Walk Around the Bay

Step 1: Make sure your battery is disconnected and your car is in a safe and static position to work on. Okay, now the first and easiest part is to begin freeing the wiring harness from the engine bay. The following pictures and captions will help explain.



Step 2: Collect the necessary mechanical goodies and maybe some optional parts if you want to show off.



Stage 1.5: "Removing" the Driver Side Front Body Panel

We are quickly sailing our way to the cab of the car! This is a quick and mostly self-explanatory step. What I have not shown in these photos is cutting the rubber grommet that separates the engine bay from the area behind the front panel. This can be tedious, but take your time and figure out how to gently push/pull the harness through the engine bay wall as seen in the last photo in this stage.





Stage 2: In the Cab (Dash Removal)

Step 1: Drivers' Side Footwell

Your main objective in this stage is to remove the dash. Therefore, remove any bolt or screw that you believe is holding the dash to the car. There will also be wire connectors to disconnect. If you have trouble with disconnecting a connector and are certain that it is not a needed connector, then cut the wire and don't worry. In case you are wrong and the connector is needed, go ahead and cut/keep the connector for good measure. There are quite a few wires that go to the side doors. Cut these wires. They are not necessary.





Step2: Passenger Side Footwell

Go around to the passenger side and begin removing the numerous bolts. After you have removed the all the bolts you could find and the ones shown on the following slides, you may have to shake the dash and figure out what is keeping it from being removed. Search and find all the snags and you will be ready for the next stage. The key bolts are the ones at the base of the windshield.



Stage 3: Dislodging the Structural Bar and Removing the Harness

This is the fun part. This step is pretty self explanatory. Use safe methods of prying the structural bar loose. You may need a buddy to help you with this.



Conclusion

I learned to be patient and take my time on this step in the conversion process. Finding all of the bolts that keep the dash in place may be challenging but you will succeed. Have fun and enjoy wrenching!

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Part 3 - Create SubaruVanagon Wire Harness

Re-Wiring the Subaru Wiring Harness

I am sure you have probably heard this step referred to as "Wire Hell". We would like to propose that although wires are sometimes intimidating, this step in the conversion process does not have to be a stressful one. First of all, this step does not take as long as you would expect and if you work indoors you may not even break a sweat. For me, this is the relaxing and mentally engaging part of the conversion. Find a table, a room in your house, a cup of coffee, and breathe deepnow release. Ok, seriously though, check out these easy steps and tell yourself "Wires are your friend".

Differences between 1990-1994 and 1995+ Wiring Harness

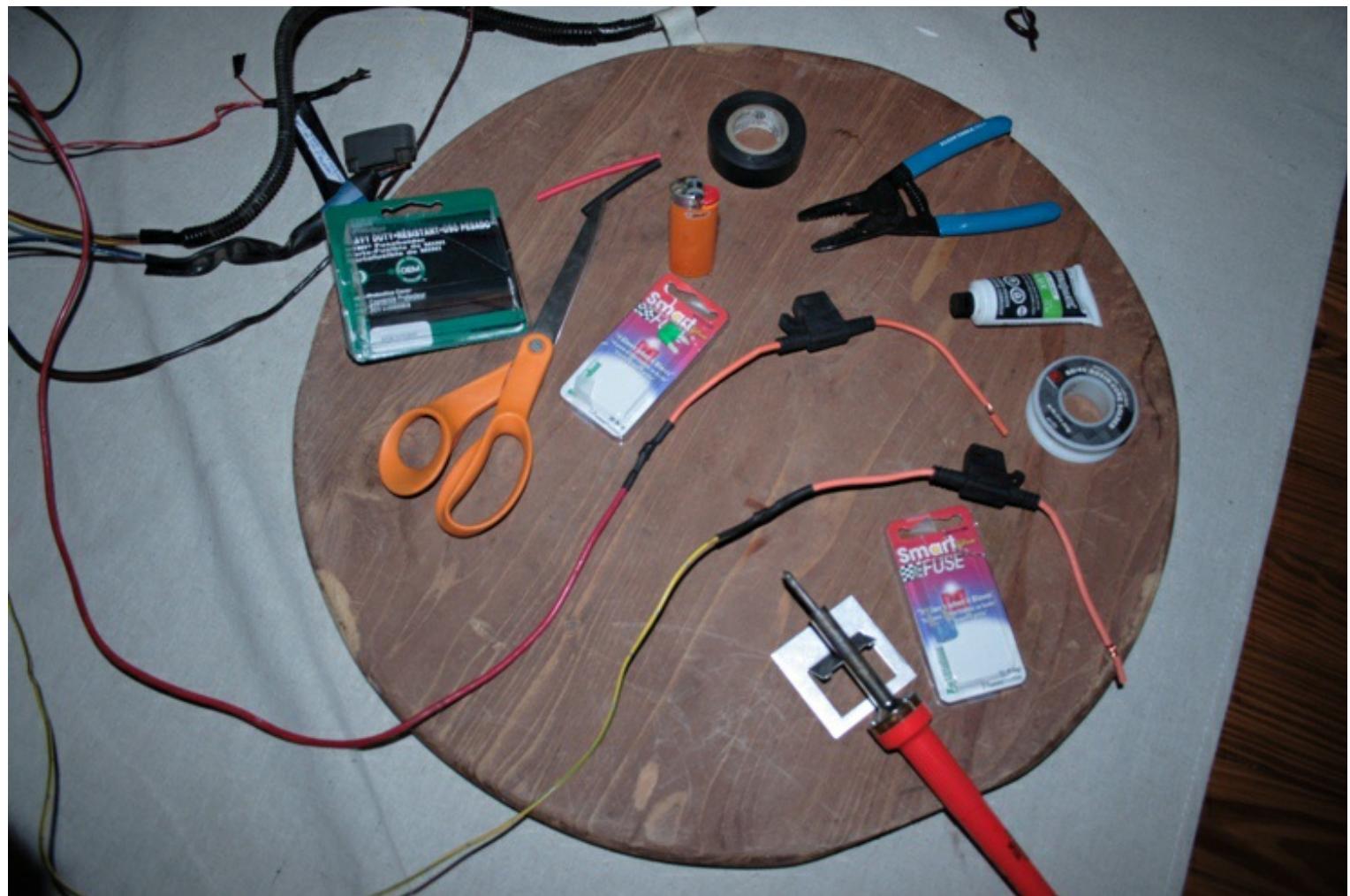
The biggest difference between 90-94 and 95+ harnesses is OBD1 and OBD2 respectively. OBD stands for On-Board Diagnostics. This allows a technician, that's you, to plug into the car's computer and determine fault codes. In 1995+ Subaru cars switched from OBD1 to OBD2. So, you are faced with the question of which year Subaru engine to use. There are pros and cons to both systems, so you will have to decide for yourself. The following article uses a 90-94 wiring harness and engine for the example.

Time Necessary and Step Overview for Subaru Wire Harness Conversion

Obviously, the wire harness conversion will take everyone different amounts of time. If you have soldered wires before, then this should be a breeze and may only take you 16 hours total. The key word here is "total". I, personally, would not attempt an entire wire harness conversion in two days. But if you are in a hurry, it can be done. The bulk of the work is in unwrapping and re-wrapping the wires. I decided to spread the work over the course of a week spending only a couple hours each day. I did not stress out and there was no "Hell". So, my estimate for an entire harness conversion is that it may take you approximately 16 hours. If you don't know what solder is, then it may take you a couple hours longer. Learning how to solder is easy as you will see in the video below.

Tools You May Need:

1. Scissors
2. Wire cutters
3. Electrical tape
4. Solder (make sure it is proper size for electronics)
5. Flux for solder
6. Soldering iron
7. Heat-shrink rubber tubing for electrical wires
8. Lighter
9. A 15 amp and 30 amp fuse holder and fuses (Local auto parts store)



Steps for 90-94 Legacy Wire Harness Conversion

Note: Refer to the attached document to see an ECU pinout for the 90-94 wire harness

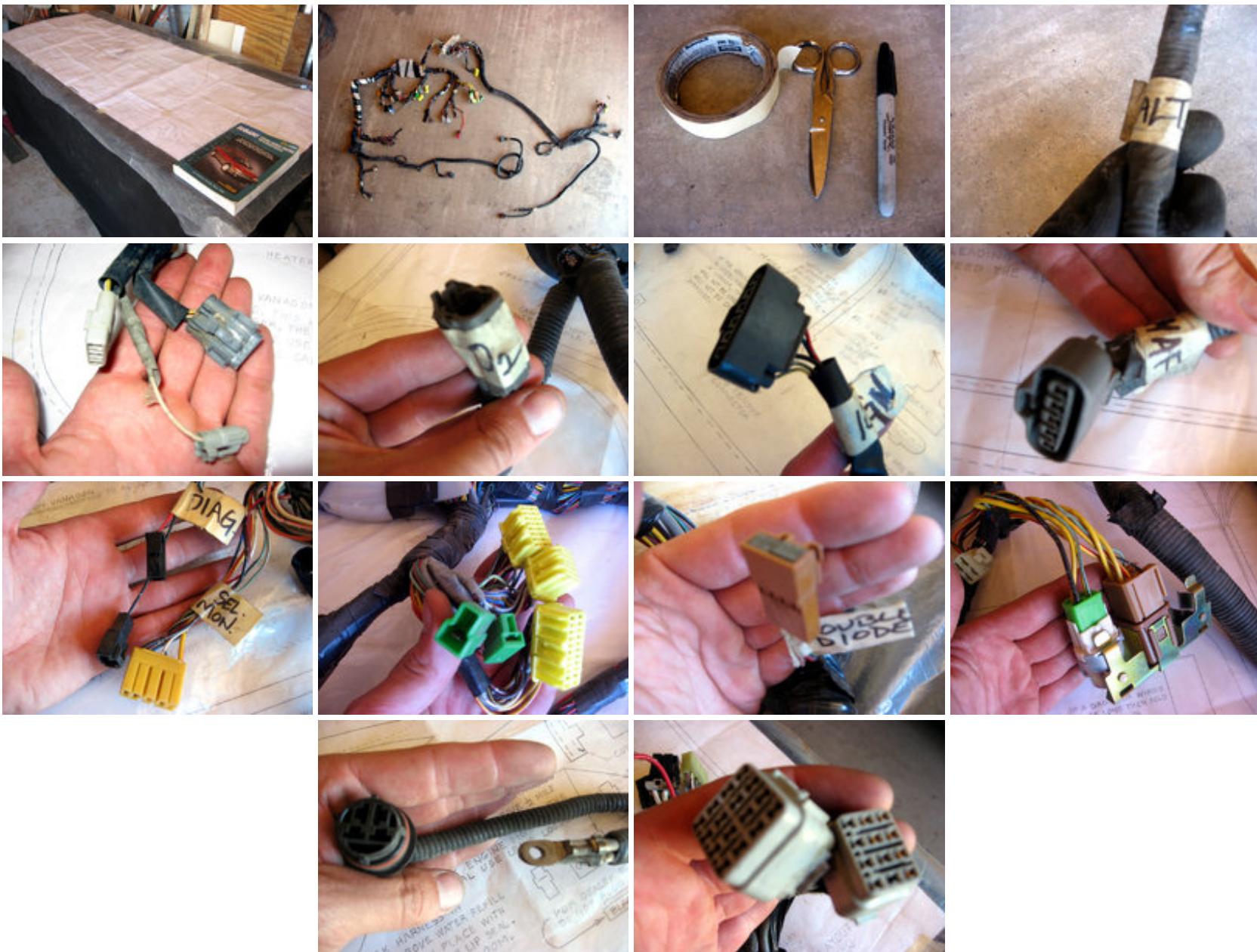
Step 1: Unwrap the black protective plastic and tape from the harness

This is probably self explanatory, but don't forget to use your scissors as they can give your fingers a break from tearing at the tape. Be careful not to cut any wires by accident.

Step 2: Label the required connectors and cut the unnecessary connectors

Label the following connectors (YOU NEED THESE)

Label the following connectors with masking tape and make sure you do not cut the wires attached to these components. After you have labeled the necessary connectors, you may now cut and remove the unnecessary connectors, but do not cut connectors that have wires going in one side and out the other at this time. Try to leave 2 inches of wire on the connectors so that if you mistakenly cut the wrong one, you can solder it back in place.

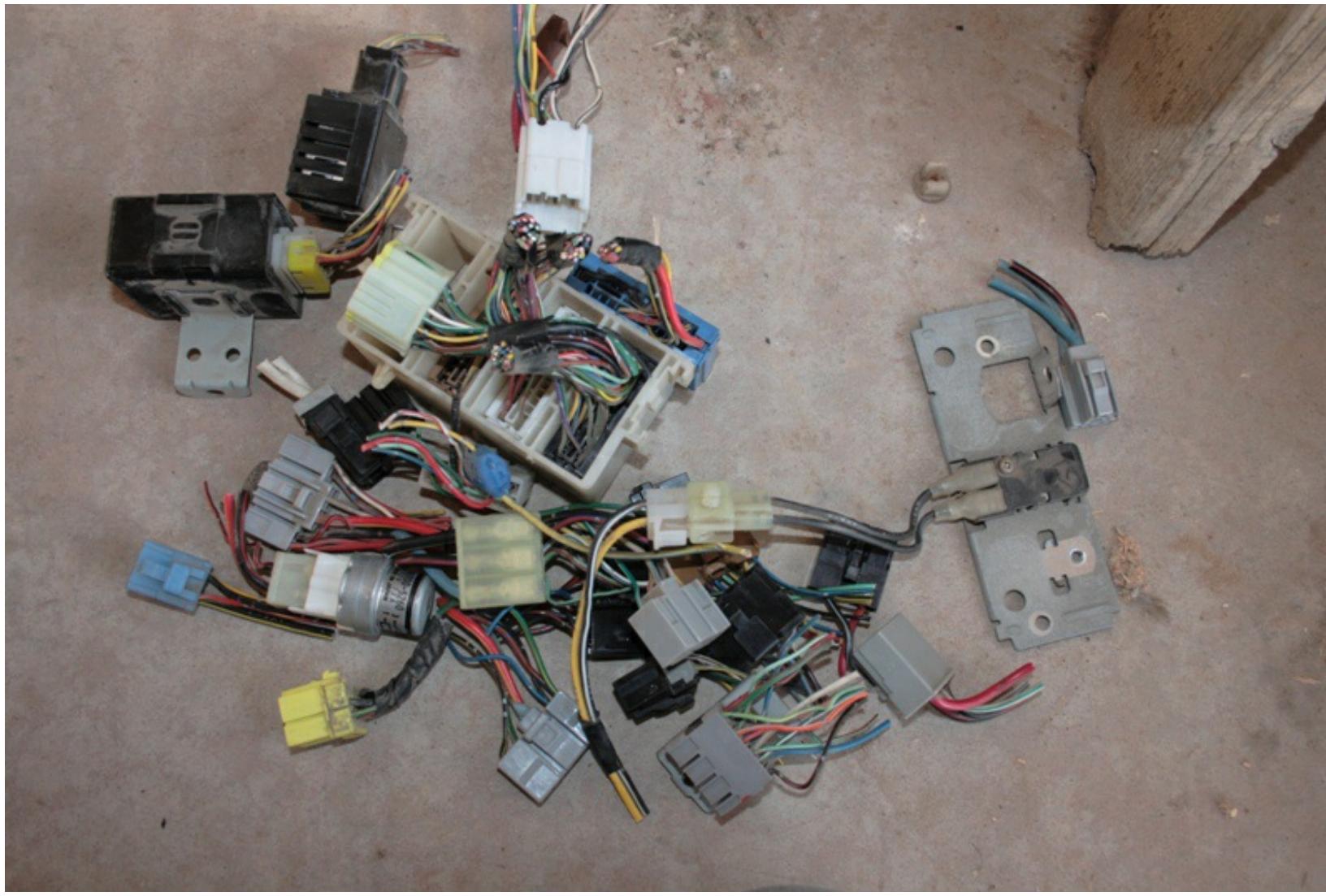


Double Check this list of necessary connectors and make sure you have each one labeled:

1. Ignition Relay (Brown)
2. Fuel Pump Relay (Green)
3. MAF (Mass Air Flow sensor, 5 Pin)

4. O2 Sensor
5. Engine connectors (2 square grey connectors in group)
6. Alternator (1 connector, and two large white leads)
7. Ignitor (6 Pin)
8. Rear engine (3 grey connectors)
9. ECU connectors (4 bright yellow)
10. Brown Double Diode
11. Green diagnostic connectors
12. Select Monitor and Black diagnostic connectors

Here are a few of the connectors we do not need:

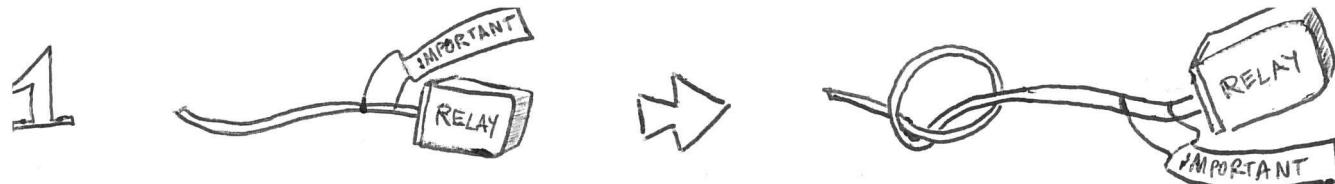


Step 3: Remove the loose wires

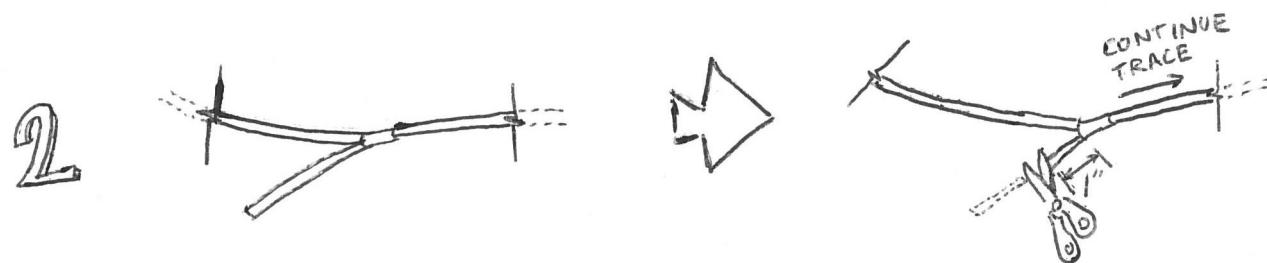
There is a great method to this madness. (This method is based on KEP's instructions)

Now that you have quite a few cut wires, take a loose end of a cut wire and follow it until you find where it ends. There are only 4 possible endings:

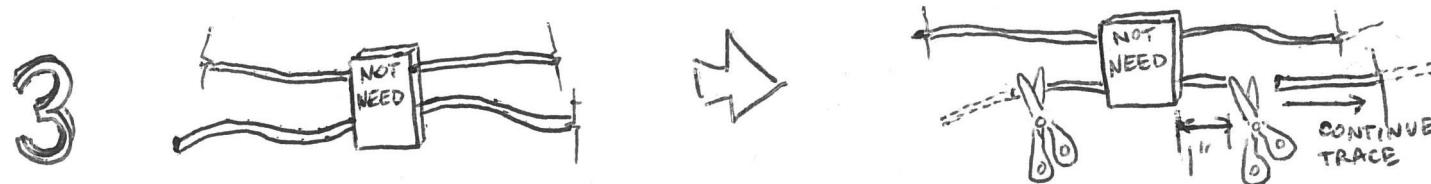
1. End at a necessary connector – Tie a knot at the loose end.



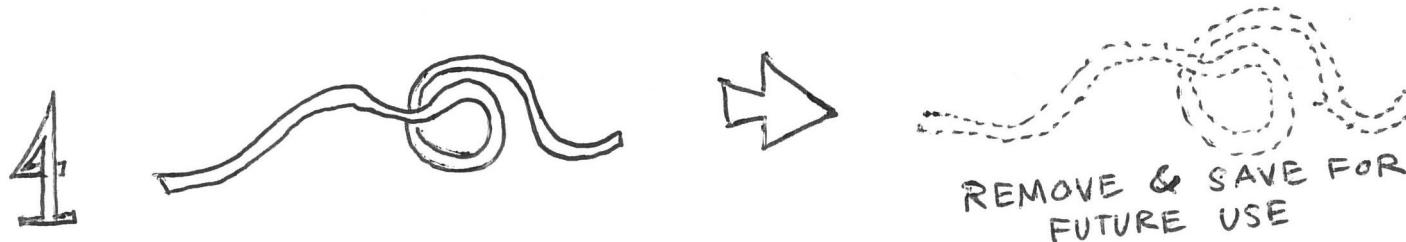
2. End at a wire to wire direct splice- Cut one inch away from wire splice and continue to trace wire. Continue to follow actions 1-4.



3. End at unnecessary connector and travel through to other side- Cut wire at each side of connector and continue to trace wire. Continue actions 1-4.

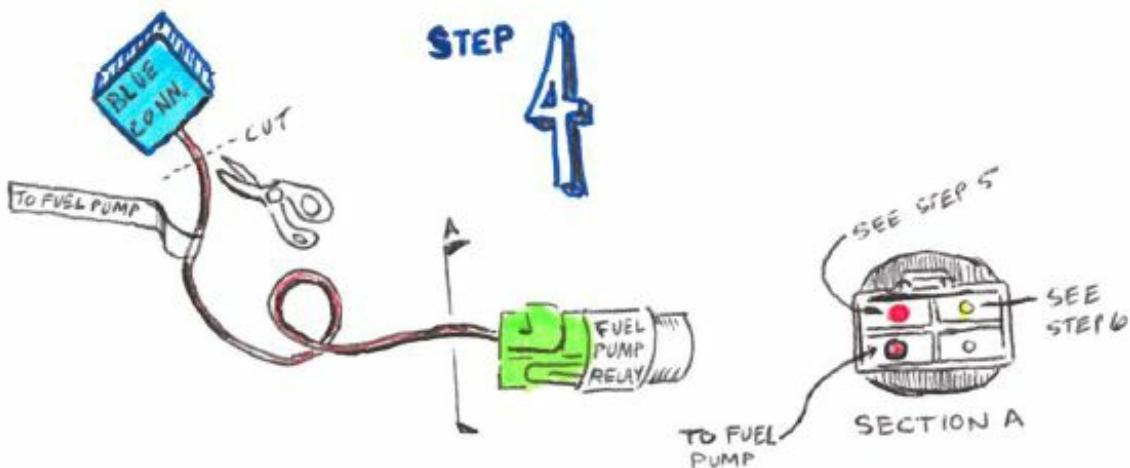


4. End at another cut end- The wire is loose, so remove it and save for future use.



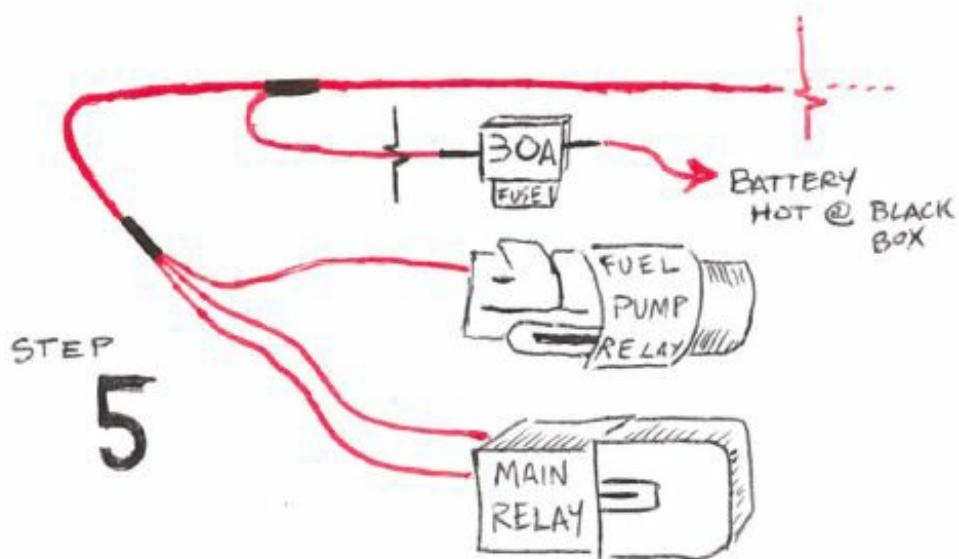
This step can go pretty quickly and I find it fun because you can quickly see the harness shrink in number of wires. Don't get too carried away and cut the wrong wire.

Step 4: Trace Black/Red from fuel pump relay to blue connector. Cut at blue connector and label "To Fuel Pump"

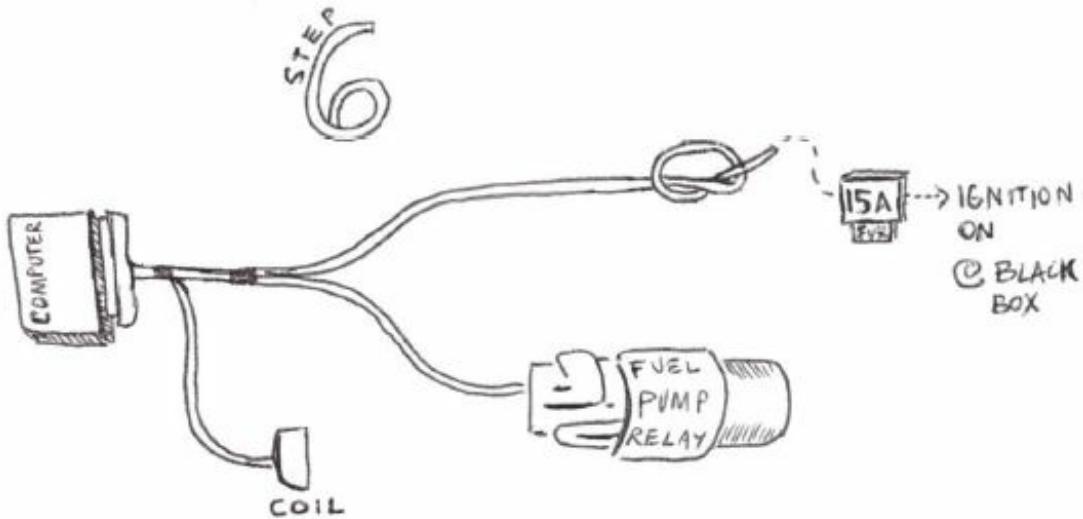




Step 5: Splice 3 large yellow wires from ignition & fuel pump relay to 30A fuse to battery hot

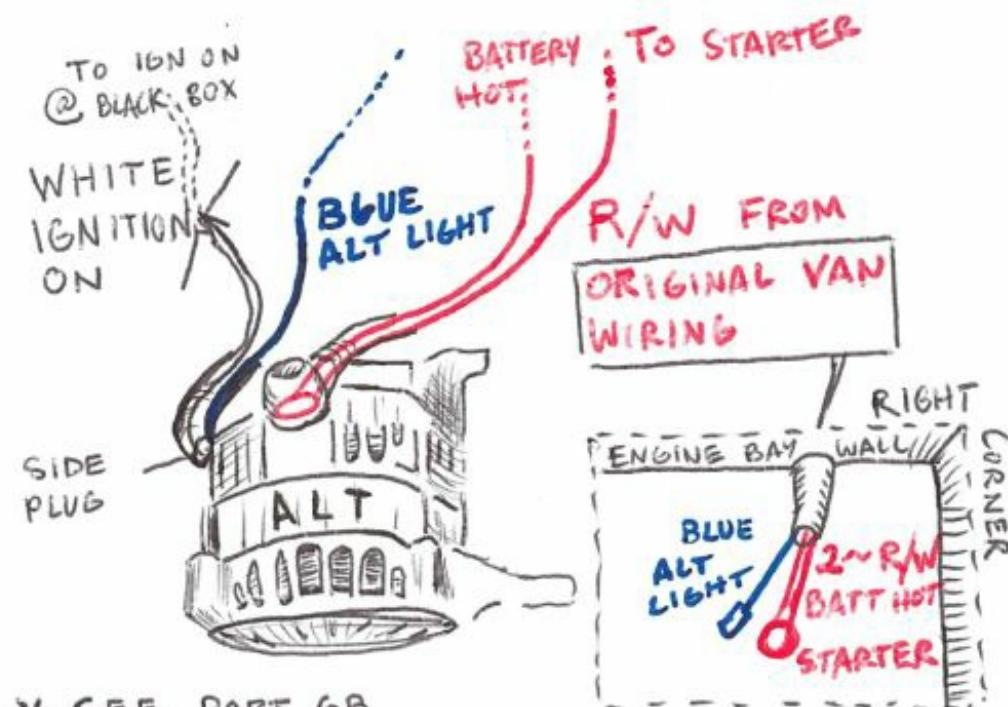


Step 6: Splice yellow wires from fuel pump relay, computer, and coil to ignition on through a 15A fuse



Step 7: What to do with the Alternator Wires?

The wiring that goes to the alternator does not need to tie-into the main harness but I chose to integrate it into the main harness. On the 90-94 harness there are 3 wires in the connector and a large white wire that goes to the post on the alternator. Pictured below is an illustration for a 95' alternator but the idea is very similar. The 3 wires at the connector: Large white to Battery +, yellow to Ignition ON, and Black/White to charge indicator light at the dash.



* SEE PART 6B
STEP 8



Summary:

The wiring harness can be a great joy if you don't let yourself bend to intimidation. This is a very rewarding part of the process and allows you to be intimate with the guts of the Subaru engine swap. You can find ECU pinouts here: <http://busaru.com/services/resources>

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Part 4 - VW Vanagon engine removal

While we wait on our SubaruVanagon parts to come in we can pull the Vanagon's motor and make room for the Subaru EJ22, or other, engine. In this article we will walk through the process we took to label all of the various hoses and wires that we'll need to keep for the Subaru transformation. This step goes pretty quickly and is actually a lot of fun. The hardest, and most fun, part of this step is maneuvering the Waterboxer down, out, and away from the transmission and engine bay. It really helps to have an engine hoist (cherry picker) but a stout floor jack can work as well. I have used floor jacks, ATV/motorcycle jacks, and engine hoists and I really like the stability and safety of the engine hoist if you're planning on reusing or selling the Waterboxer motor. A floor jack is fairly unstable, but it can be done.

Follow along as we remove the tired Wasserboxer from the Vanagon engine bay.

Overview and Approximate Time Needed:

Steps	Process Description	~ Time (hours)
1	Drain fluids and remove coolant hoses	1.5
2	Label wires, vacuum hoses, and fuel lines	1
3	Disconnect Vanagon wiring harness	0.5
4	Jack up Vanagon and prepare for motor pull	2
5	Pull Waterboxer motor	1

*When you factor in rest and prep time, a mechanically inclined person should reserve a half day to complete this process. For someone new to working on cars, this may take 1 day of work.

Tools you may need:

1. Metric socket and wrench sets, 10mm, 12mm, 13mm, 14mm, 17mm
2. Needle nose and Channellock pliers, wire cutters
3. Swivel adapter for sockets
4. Motor oil catch basin and rags
5. Coolant catch basin and rags
6. Masking tape and Sharpie for labeling wires and hoses
7. Engine hoist with appropriate rated chain and appropriate size engine stand

Step 1: Drain fluids and remove coolant hoses

In this step we'll drain all of the fluids and begin disconnecting all of the accessory hoses and bits that tie the Waterboxer motor to the chassis. It's a good idea to have plenty of rags around for oil and coolant spills as We want to keep our garage floors, and the environment, as pristine as possible. This happens to be one of the reasons why we're replacing this old, leaky, Wasserboxer motor.





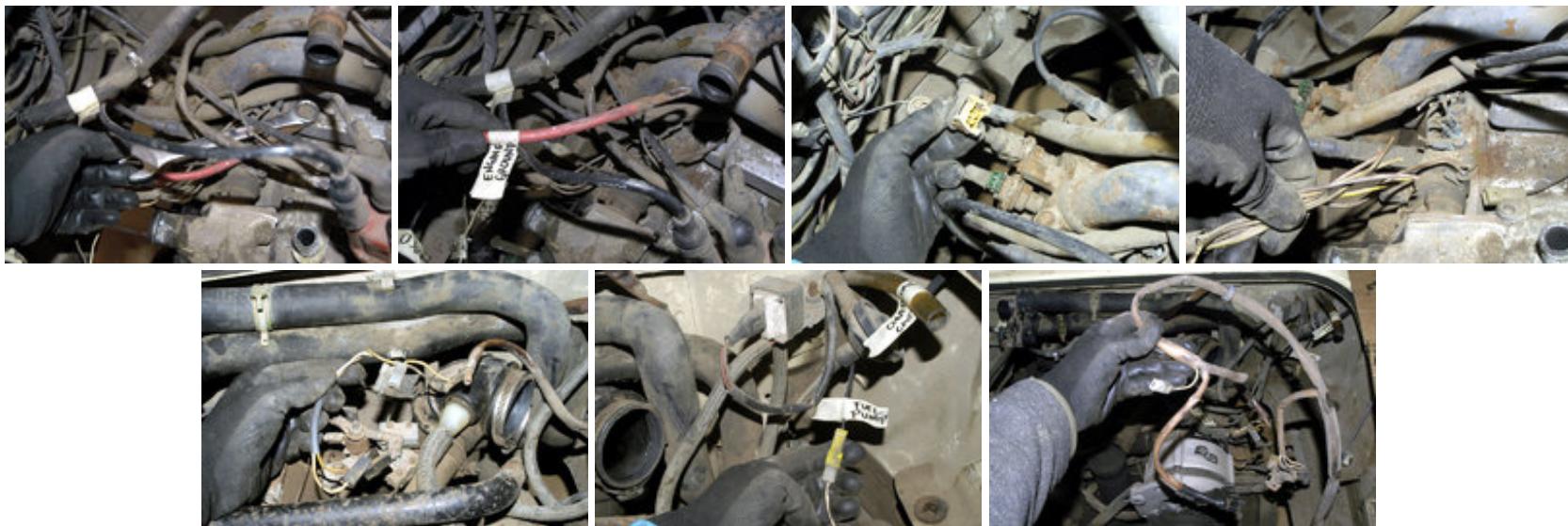
Step 2: Label wires, vacuum hoses, and fuel lines

Now that the coolant hoses are out of the way let's disconnect and label some of the wiring, vacuum, fuel, and throttle connections.



Step 3: Disconnect Vanagon wiring harness

There are only a few wires and vacuum hoses left to disconnect from the motor. A few engine electrical grounds, the fuel injection wiring, and the charcoal canister vacuum lines.



Step 4: Jack up Vanagon and prepare for motor pull

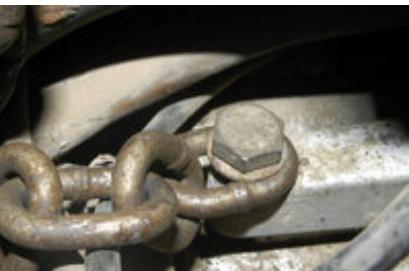
One more thing to remove before the engine is clear for landing - the Oil Fill Tube. If you can, try twisting the plastic filler neck from the metal tube using brute force. Mine was frozen solid so I had to remove the entire assembly. We'll then safely jack up the Vanagon and start the physical disconnection of the motor from the frame and transmission.





Step 5: Pull Waterboxer motor

It is finally time to lower the Waterboxer. All we have to do is to attach the engine hoist to the motor, unbolt the engine crossmember from the frame, and pull the motor free from the transmission. We're almost there!



Summary:

A lot of progress in this step! We labeled all of the relevant wires, hoses, and pieces and removed the Waterboxer from its 30 year old home - not a bad days work! Now that the Vanagon is a little lighter in the rear we can take a scrub brush to the Subaru motor and prepare it for installation into its new home. In the next article we'll take a look at replacing the timing belt, oil seals, and attaching all the goodies that make the EJ22 purr like a saber tooth tiger!

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Part 5 - Subaru 2.2 liter engine preparation

In this article we will walk through the process we took to prepare the Subaru EJ22 engine for installation into the Vanagon engine bay. The process for other Subaru engines is very similar. This may sound intimidating but nearly everything can be done with simple tools, but there is one specialty tool necessary for aligning the clutch. The clutch alignment tool is usually included when you order a clutch kit, but if not then it can be found online or through a Volkswagen dealership.

Most of this step can be done right after removing the engine from the Subaru, but the last two steps will have to wait until you receive the SubaruVanagon conversion parts and have a Waterboxer motor that you can pull the clutch assembly from. Follow along as we show how we prepped our motor for the SubaruVanagon swap.

Overview and Approximate Time Needed :

Steps	Process Description	~ Time (hours)
1	Degrease and clean motor	2
2	Remove timing belt covers and timing belt	3
3	Replace front motor seals	3
4	Install timing belt and covers	3
5	Remove clutch and pressure plate or torque converter	1
6	Replace rear motor seals	1
7	Install adapter plate, clutch, and pressure plate	2
8	Install engine cross-member and exhaust	1

	* Approximate Total Time =	16

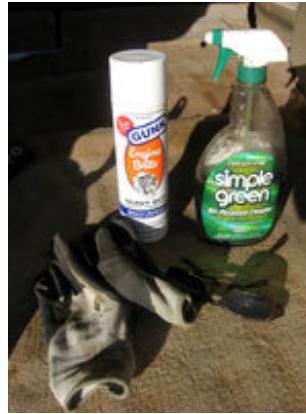
*When you factor in rest and prep time, a mechanically inclined person should reserve a full day to complete this process. For someone new to working on cars, this may take 2 or 3 days of work.

Tools you may need:

1. Metric socket and wrench sets, 10mm, 12mm, 14mm
2. Engine degreaser and parts cleaner
3. Shop towels
4. Wood hand clamps
5. VW Clutch Alignment Tool (specialty tool)
6. Large Sockets and 3" PVC Endcap for tapping in oil seals
7. Large Sockets, 7/8" and 1 1/4" for crankshaft bolts on VW and Subaru motors
8. Engine hoist with appropriate rated chain and appropriate size engine stand

Step 1: Degrease and clean motor

A good idea, if your Subaru is roadworthy and before pulling the motor, is to use a pressure washer at a carwash and degrease the motor in their stalls. They are designed to handle engine grease and this will help keep you clean and speed up the process once the motor is on an engine stand.





We didn't have that option in our case due to a bad transmission in our Subaru.



Step 2: Remove timing belt covers and timing belt

Lets strip the motor to access the timing belt and oil seals on the front side of the motor. This will also allow us to clean up the front side of the motor a little more.





Step 3: Replace front motor seals

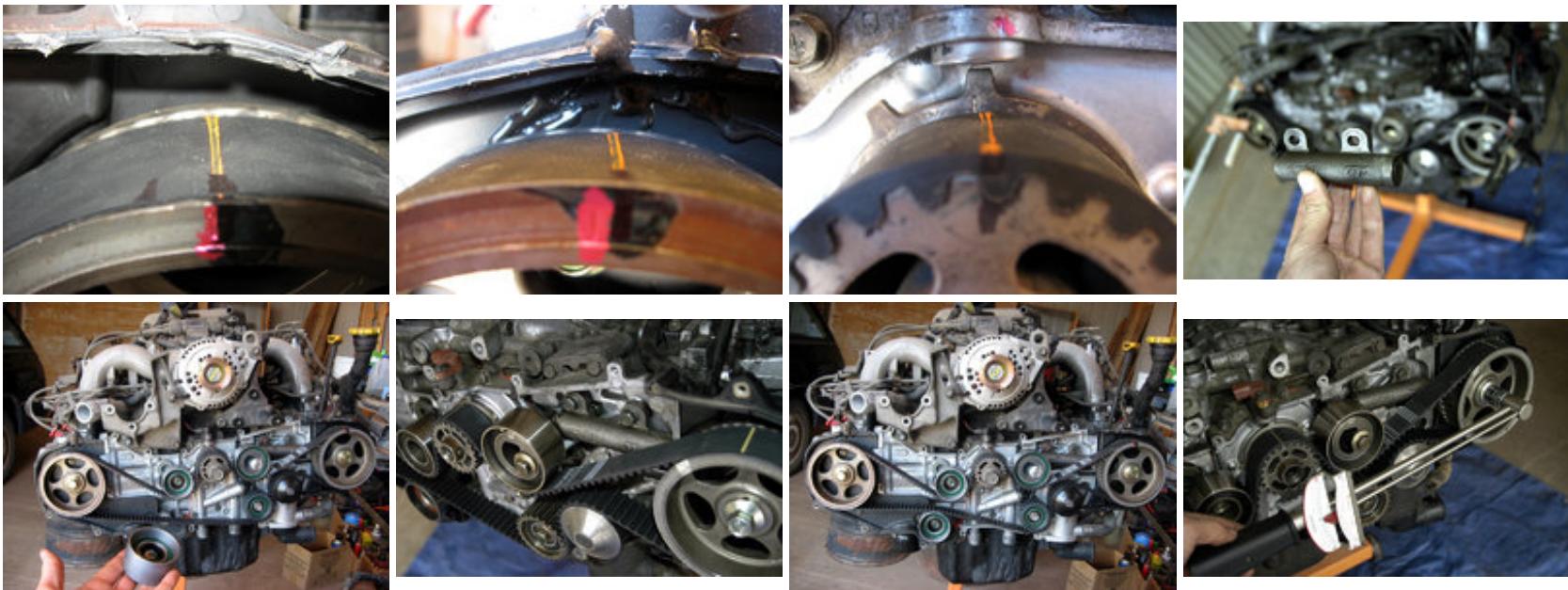
I find this step really fun. This is where the buildup process starts and some real progress happens from here on out. This step ensures your motor will have the best chance at keeping the oil where it needs to be - inside the engine!





Step 4: Install timing belt and covers

This is an intimidating step to the newbie and experienced alike. If you take your time and keep the timing marks close to where they need to be you won't have any problems. The hardest part is making sure everything stays lined up while you snake the new timing belt around the roller bearings.

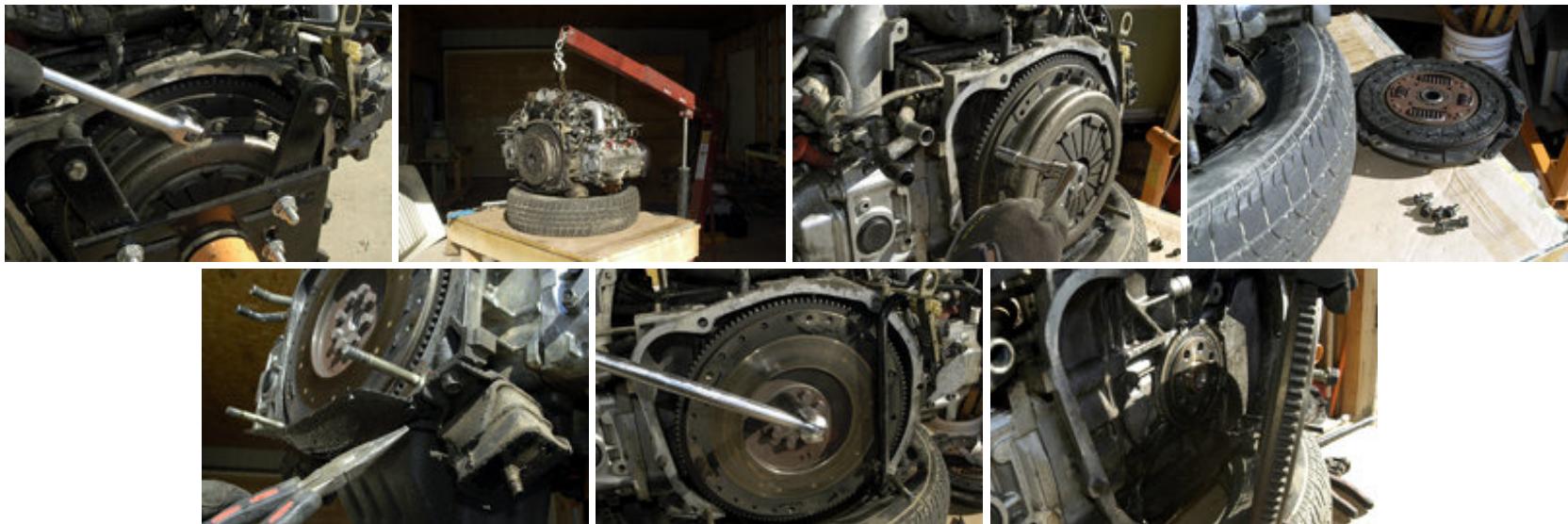




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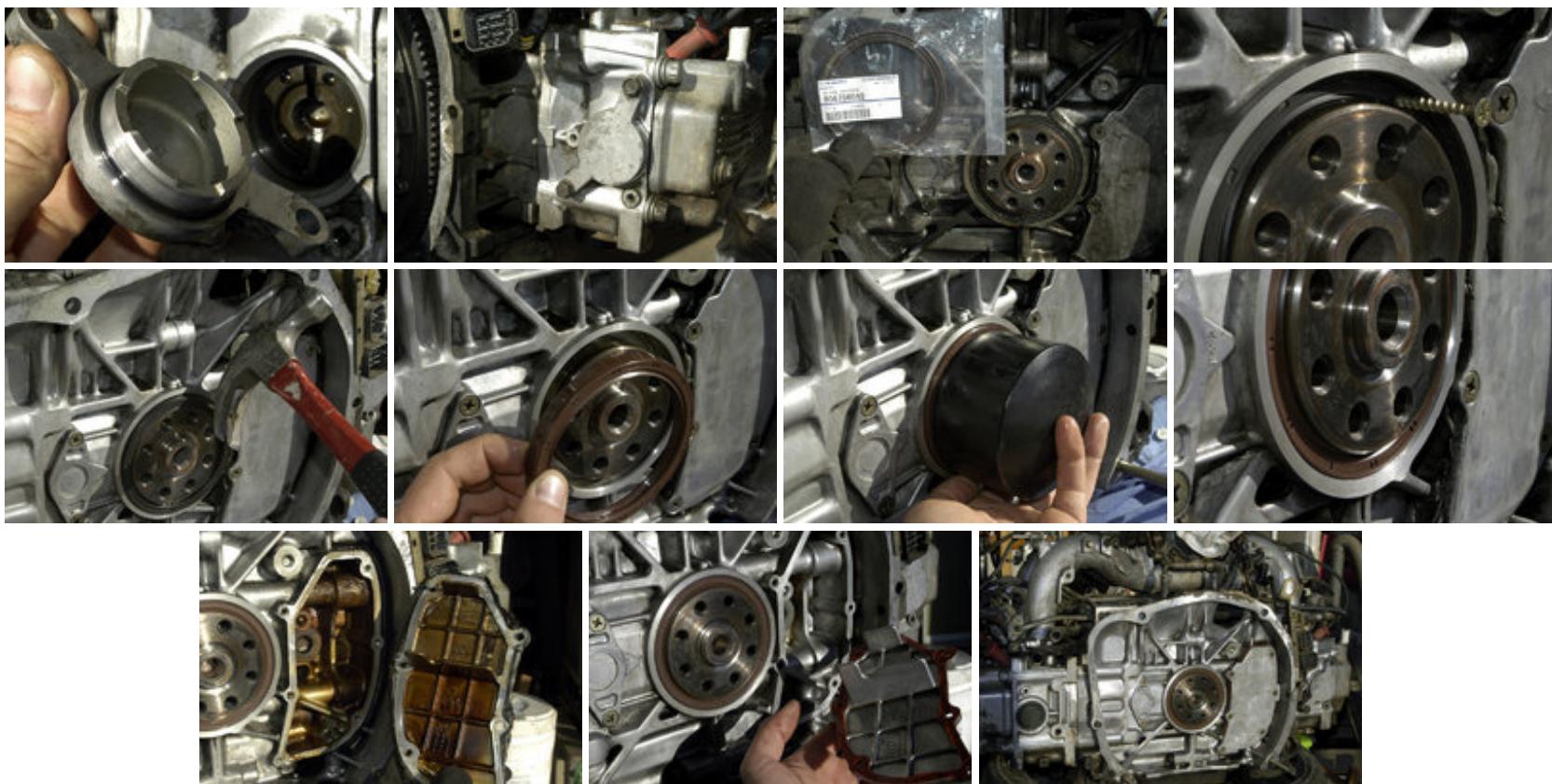
Step 5: Remove clutch and pressure plate or torque converter

Now we'll take the final steps to ready the Subaru 2.2L motor for installation into the Vanagon engine bay. Remove the clutch assembly from the Subaru to grant access to the back side oil seals.



Step 6: Replace rear motor seals

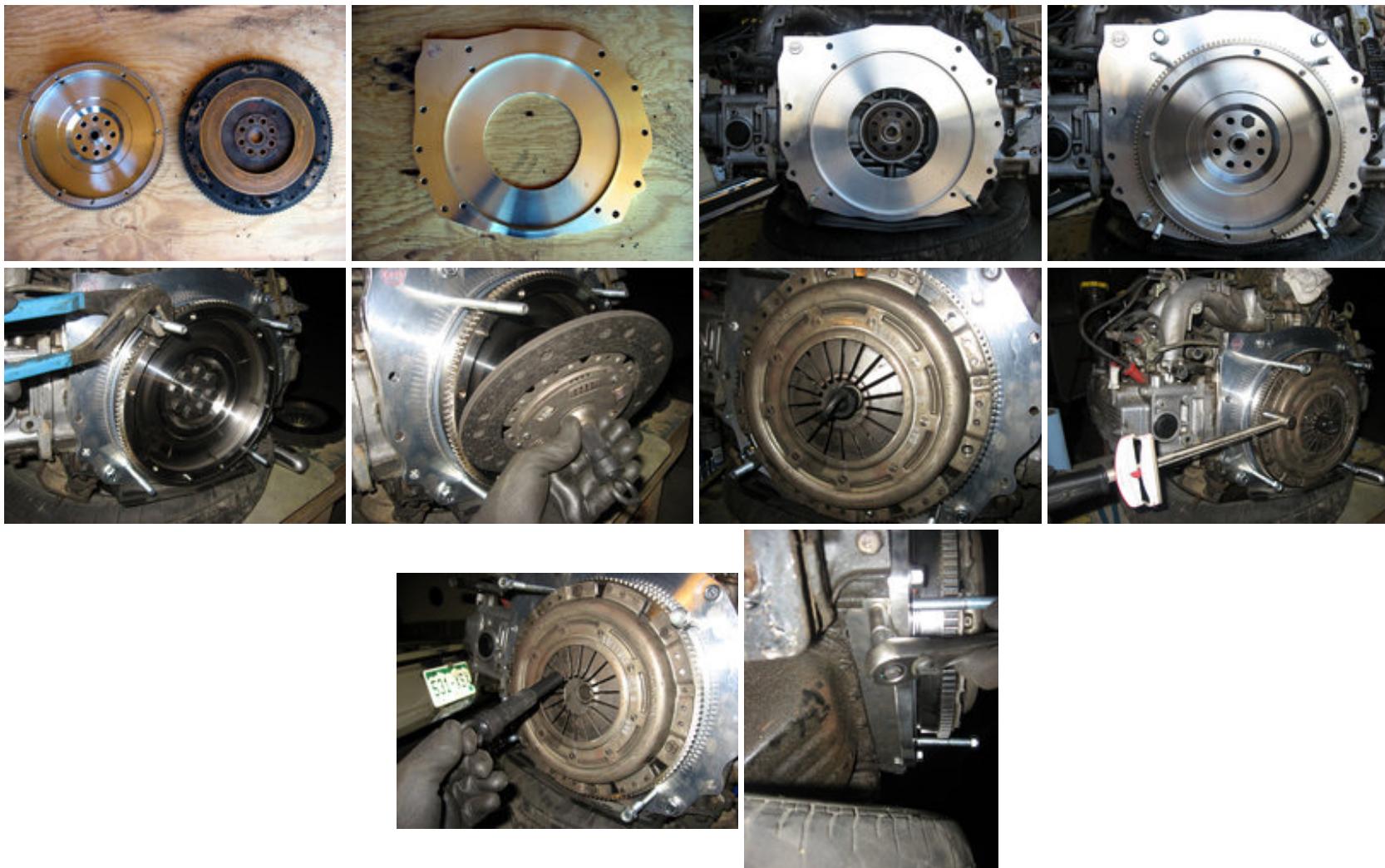
Now we'll clean up the back side and replace the rear main seal. Careful not to tap the rear main oil seal too far into the crank case - it could mean a trip to the Subaru dealership to pick up another oil seal.



Step 7: Install adapter plate, clutch, and pressure plate

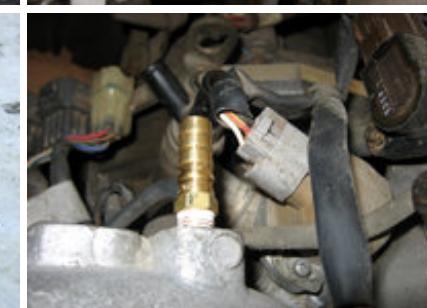
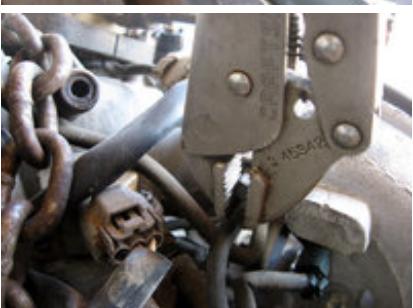
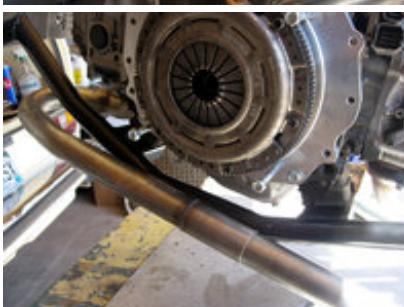
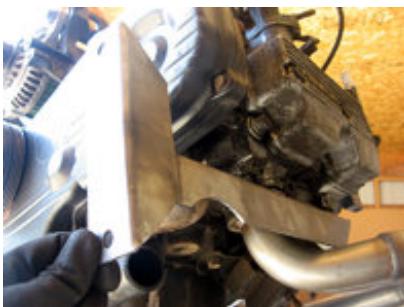
These last two steps can be completed once the SubaruVanagon engine swap parts have arrived, and you've pulled the 1.9L or 2.1L VW Waterboxer or aircooled motor from the Vanagon.





Step 8: Install engine cross-member and exhaust

The last step to prepare the engine to slip into the Vanagon engine bay and mate with the transmission. Doing most of the bolt on of parts from outside the engine bay really saves time and busted knuckles.



Summary:

In this step we cleaned and prepared the motor for installation into the Vanagon's engine bay. The motor is now ready to mate up with the transmission and be

secured to the frame with the engine mount. The next step will document how we cleaned the engine bay and placed the EJ22 into the Vanagon. Our Vanagon is starting to look more and more like a SubaruVanagon!

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Part 6A - Installation of Subaru 2.2 Liter engine

You have reached the heart of the SubaruVanagon motor swap process. This article details how we put our prepped Subaru 2.2L EJ22 motor into the Vanagon. There are several steps to this process so we've broken it up into two major sections - Part 6A, and Part 6B. In part A we prepare the Vanagon for its new powerplant and install the motor. In Part B we will finalize the installation by connecting all of the bits that allow the installed engine to run.

Part 6A and Part 6B are part of one large article and I didn't want to lose any detail by trying to squeeze them into one page so we've broken it up. Follow along as we dive into Part 6A and all that is involved in preparing the Vanagon and moving the motor into its new home.

Overview and Approximate Time Needed:

Steps	Process Description	~ Time (hours)
1	Removing items and cleaning engine bay	2.5
2	Physical installation of EJ22 into Vanagon	3.5
3	Installation of cooling system	4
4	Installation of exhaust system, optional item ¹	2/4 ¹
	* Approximate Total Time =	12/16¹

*When you factor in rest and prep time, a mechanically inclined person should reserve a couple of days to complete this process. For someone new to working on cars, this may take a few days. ¹Optional item: Using Ford F150 or similar muffler instead of bolt on Vanagon application.

Tools you may need:

1. Metric socket and wrench sets, 10mm, 12mm, 14mm
3. Engine hoist with appropriate rated chain
3. Degreaser such as Simple Green and cleaning rags
4. Utility knife
5. Drill with metal drill bits
6. Angle grinder with cutoff wheel or hacksaw
7. Funnel for engine coolant and motor oil
8. Coolant catch basin and small diameter clear hose for bleeding coolant system
9. Optional* Portable air compressor for pressurizing coolant system
10. Optional* Access to a welder for exhaust work

Step 1: Removing items and cleaning engine bay

In this first step we'll strip the Vanagon's engine bay of all the unnecessary items such as the computer, coil, and most of the wiring harness. We will then get it nice and clean and remove the orginal engine tin side skirts and modify the rear tin.





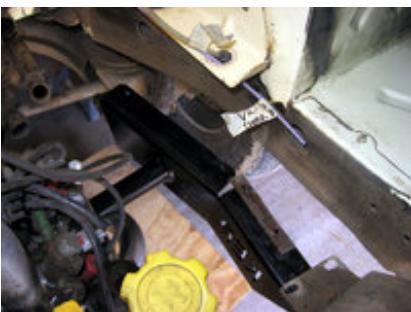
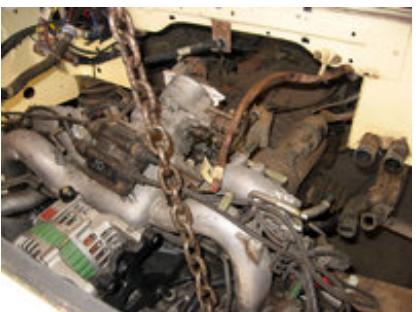
Step 2: Physical installation of EJ22 into Vanagon

Step 2 is a fun one! We finally get to see how the Subaru EJ22 fits into the Vanagon's engine bay. We'll mate the motor to the transmission and secure it to the frame. Take your time and enjoy this step - a lot of work has come down to this moment and deserves a mini celebration when this step is complete.





Now that the motor is mated to the transmission let's attach the motor to the frame and remove it from the engine hoist.





Step 3: Installation of cooling system

Now that the motor is in place we can start connecting all of the individual Vanagon systems. We'll start with the cooling system as that is one of the more complex systems and it helps to have room to work, especially with bulky radiator hoses and messy coolant. I look at this step more as art than a technical headache and try to create a good looking, functional system with minimal design changes to the factory Subaru setup.

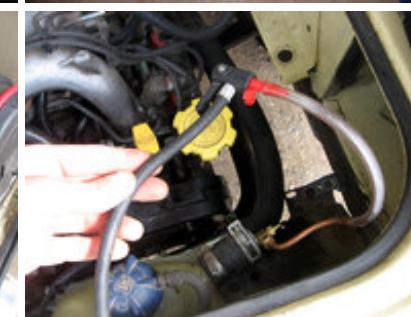
We'll start with connecting the heater hoses and the radiator input to the Subaru motor then we'll move on to the complexity of the hot coolant output to the radiator and air bleeding.



Let's move the coolant bottle location and connect the hot coolant output from the coolant manifold to the coolant bottle and metal radiator input pipe. We'll try to show how elegant this solution is versus the coolant bottle at the middle-right of the engine bay where it tends to get in the way more often than not.



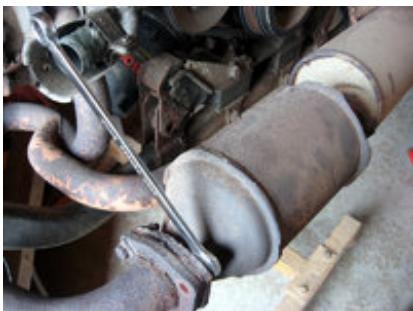
And now lets add a couple petcocks, fill the coolant system, and purge the majority of the air out of the system before our first start of the motor.



Step 4: Installation of exhaust system

With the KEP supplied exhaust header, the stock Vanagon exhaust will bolt right up. KEP also supplies a fantastic muffler bracket to support the weight of the exhaust assembly from the motor which is how Volkswagen designed the exhaust system to originally be. This is, by far, the quickest solution. In this step I chose to use a muffler from another application because of the beneficial characteristics to performance and to the comfort of the driver. The muffler chosen is from a 1996 Ford F150 with a 6 cylinder motor. Some modification is necessary but the benefits far outweigh the work involved in making this muffler work with the SubaruVanagon exhaust system.

First let's look at how to attach the KEP supplied heat shield and attach the original Vanagon exhaust system using the KEP exhaust header and muffler bracket.



Now we'll show you how we used the flanges from the original muffler and adapted the Ford F150 muffler to work in its place. Note - access to a welder is very helpful, but with careful marking you could take the bits and pieces to a muffler shop and have them weld the parts inexpensively.





Finish the installation of the EJ22 into the Vanagon by going to Step 6B on the next page. We document how we installed the intake, fuel, throttle, and wiring systems into our SubaruVanagon.

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Part 6B - Installation of Subaru 2.2 Liter engine

Part 6B is a continuation of Part 6A and resumes the installation of the EJ22 into the Vanagon. In Part 6B we document how we installed the air intake, throttle, fuel, and wiring systems to complete the transformation from Vanagon into SubaruVanagon. Follow along as we examine these areas in detail.

Overview and Approximate Time Needed:

Steps	Process Description	~ Time (hours)
5	Installation of air intake assembly	4
6	Modification of throttle assembly	2
7	Install fuel lines and belt	1
8	Test and installation of wiring harness	6
	* Approximate Total Time =	13

*When you factor in rest and prep time, a mechanically inclined person could finish these steps in a little over a day. For someone new to working on cars, this may take a couple of days.

Step 5: Installation of air intake assembly

In this step we will install the air intake and vacuum lines to the charcoal canister and intake manifold. There are only a few connections that need to be made so this step should go quickly once the cuts and bends are made to the intake duct and vacuum lines. Lets take a closer look!



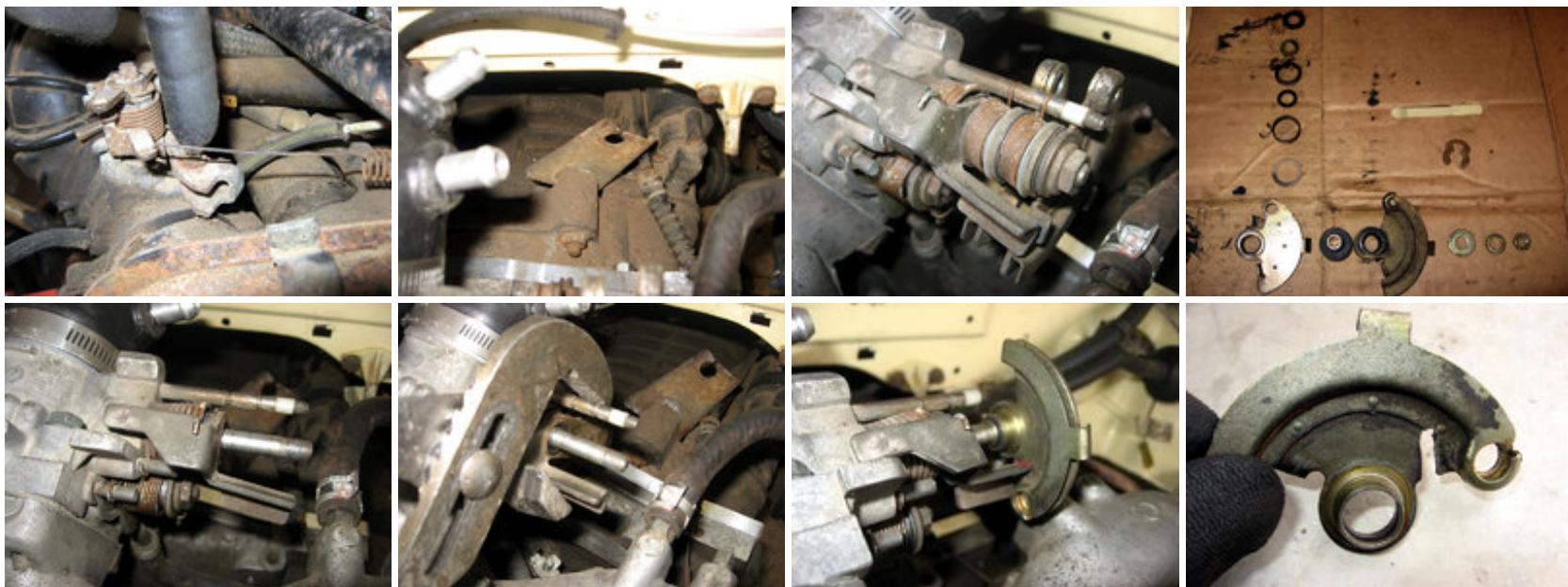
Now that the main intake ducting is in place we can connect the accessory vacuum connections and finish off this step.

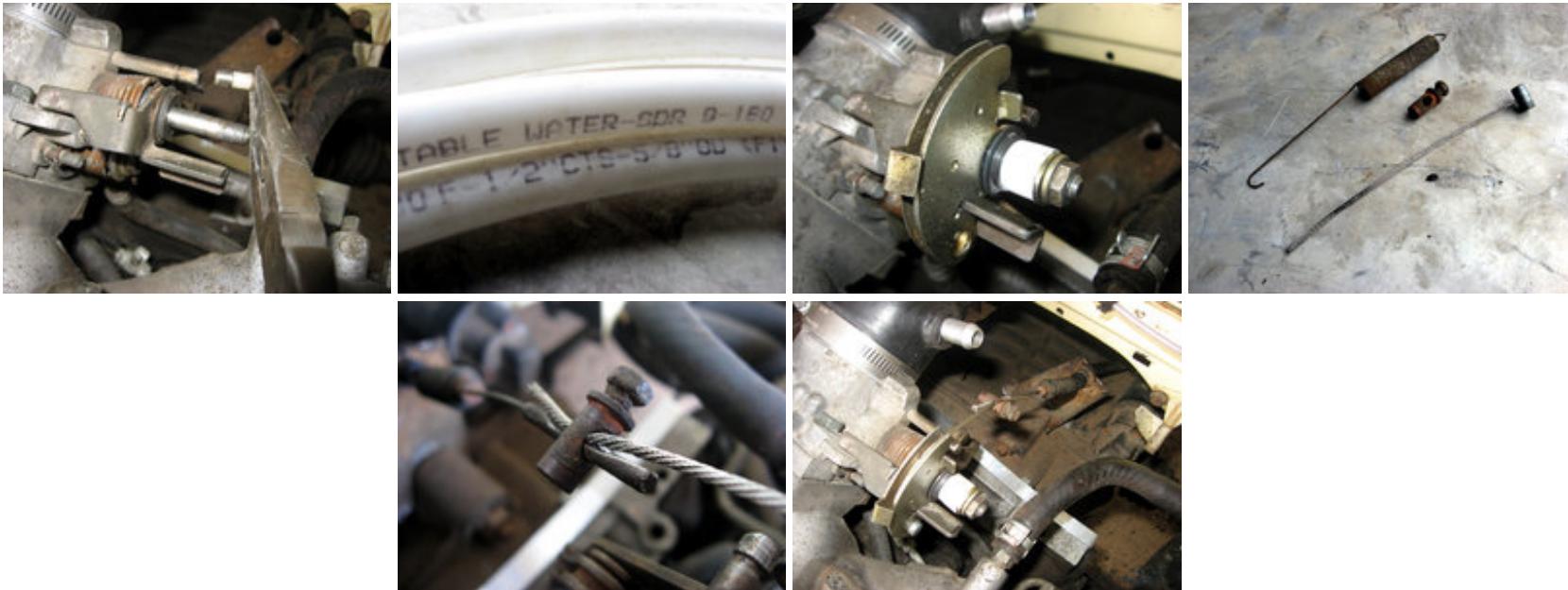




Step 6: Modification of throttle assembly

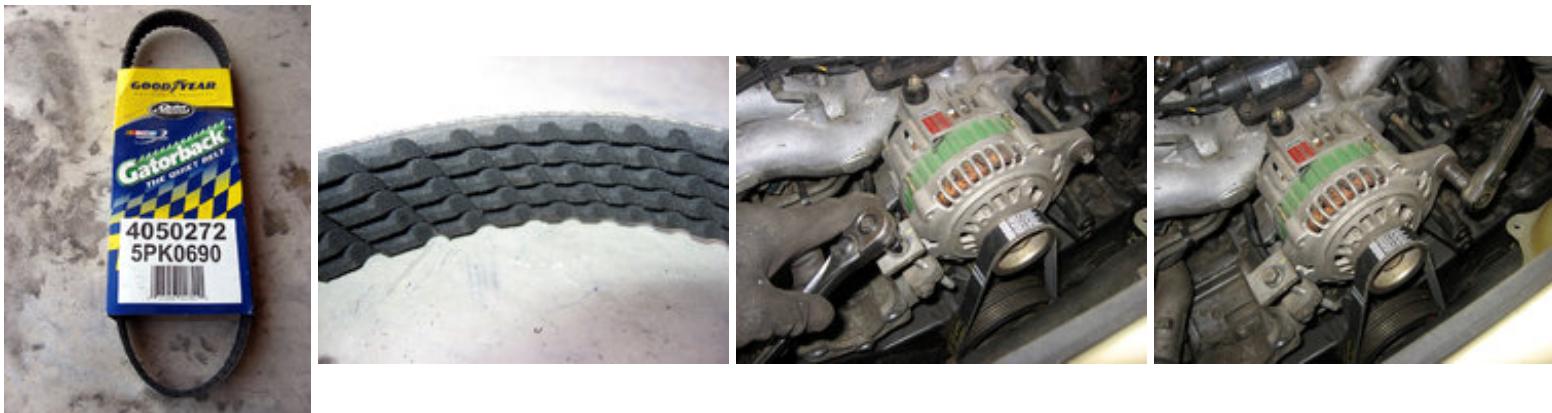
This is one of my favorite steps as it's quick and it results in a very clean arrangement of the throttle mechanism. The use of an angle grinder with a metal cut off wheel or a hacksaw is needed for this step

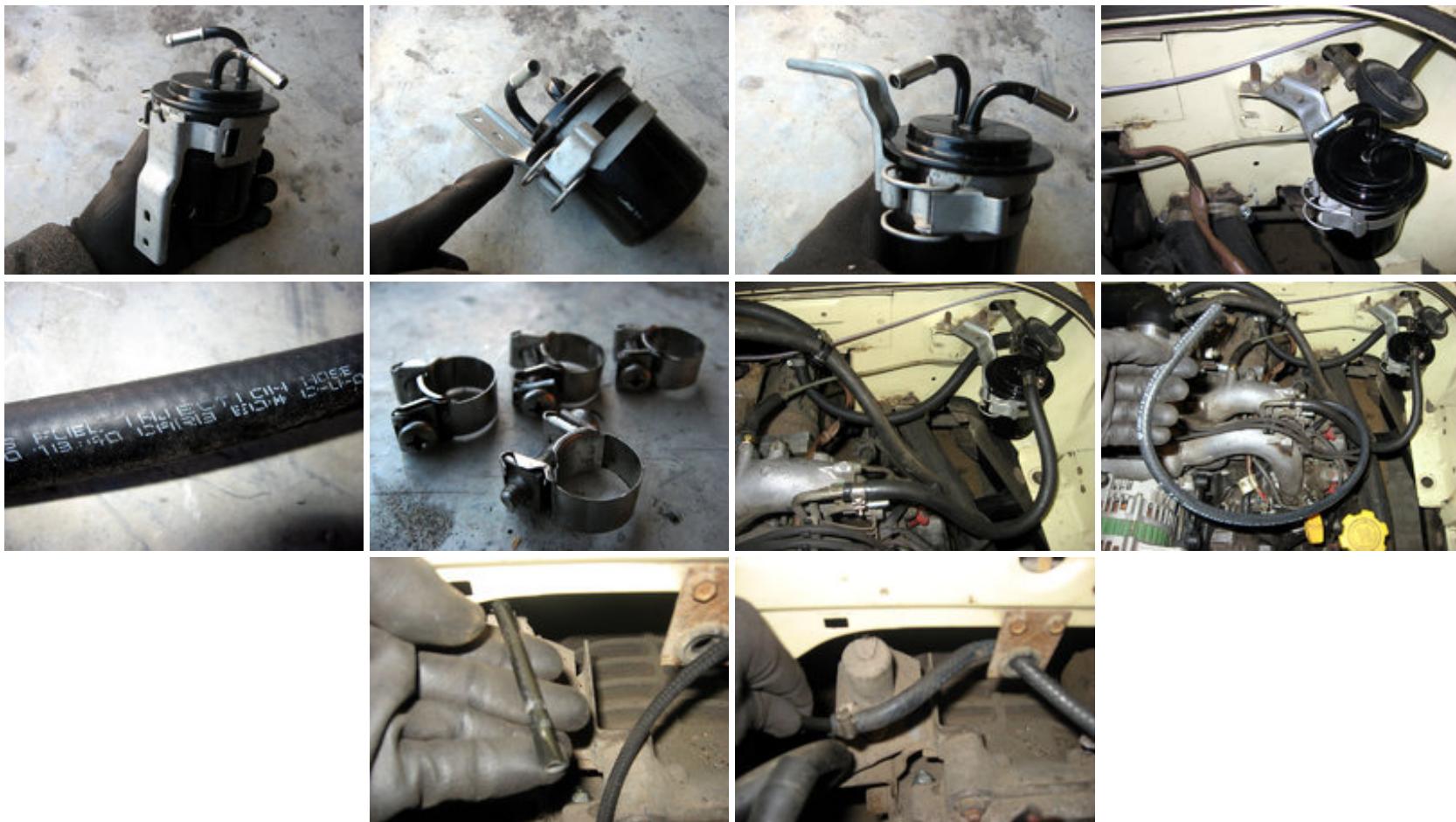




Step 7: Install fuel lines and belt

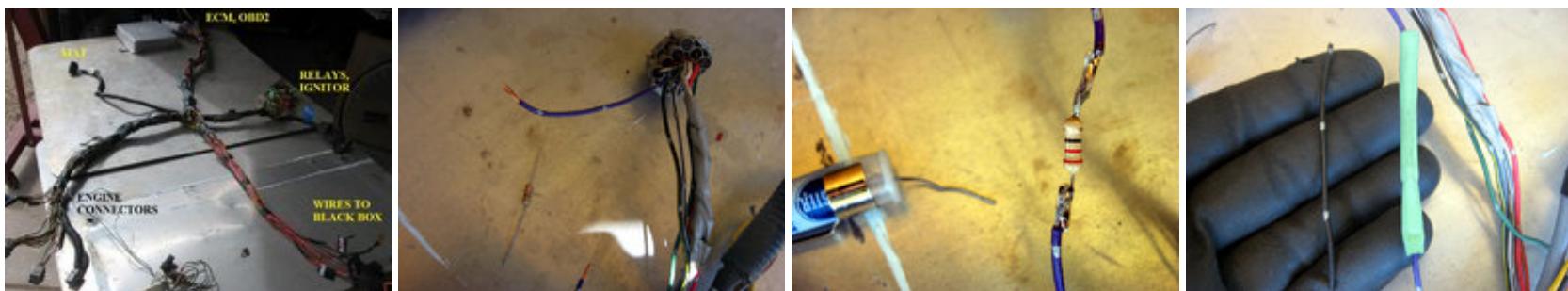
We are getting very close to starting the SubaruVanagon for the first time since the start of the conversion. Follow along as we get the fuel system and belt figured out.





Step 8: Testing and installation of wiring harness

The final major step before the SubaruVanagon is ready for the streets. We will show how we placed the wiring harness, in test form, and start the motor to check for problems in the wiring BEFORE we tape it all up. Remember that before starting for the first time we need to replace the motor oil, fill the coolant system, and connect the battery. But before all that, lets get the wiring harness in so it can be tested.





Once no faults are found with the wiring harness it can be taped up and readied for final installation. Follow along as we create the space for the computer and route the wires to the appropriate locations in the engine bay.





Summary:

We covered a lot of information in Part 6A and Part 6B - Congratulations, you made it! At this point you are probably itching to get your SubaruVanagon out on the open road, but lets be scientific and do some testing. In the next article we will explain coolant purging, troubleshooting, and some final details that will clean up the installation of the Subaru EJ22 into your Vanagon.

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Part 7 - Final Elements of conversion

The project has finally come to this - the last Part. We'll show a few last items to polish off the creation of the SubaruVanagon, then we'll go for a test drive! Enjoy!

Overview and Approximate Time Needed:

Steps	Process Description	~ Time (hours)
1	Belt guards	1
2	Alternator Light Fix	1
3	Testing	1
	* Approximate Total Time =	3

*When you factor in rest and prep time, a mechanically inclined person should reserve a couple of hours to complete this process. For someone new to working on cars, this may take a little longer.

Tools you may need:

1. Metric socket and wrench sets, 10mm, 12mm, 13mm, 14mm, 17mm
2. Angle grinder or hacksaw and metal file
3. Soldering iron and wire connectors

Step 1: Belt Guards

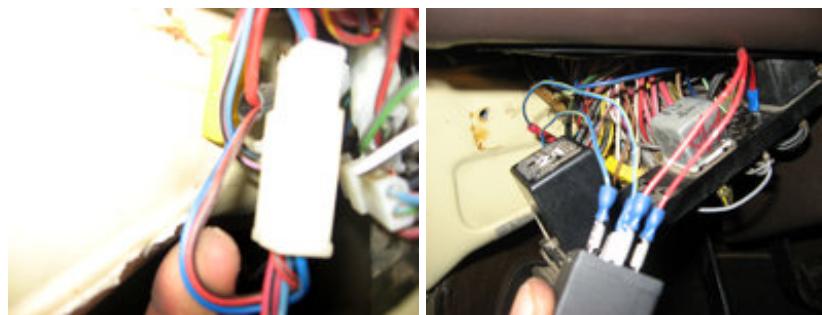
A few safety elements and finishing touches to wrap up the install of our Subaru motor. Belt guards look pretty cool in my opinion - they finish things off a little.



Step 2: Alternator Light Fix

The alternator charge indicator light is super helpful. I had one conversion that I didn't take the time to get this done and woke up to a dead battery... in the middle of nowhere, not good! The belt had loosened and the alternator hadn't been charging the battery. I had unplugged the blue wire from the relay under the drivers seat so the blaring red ALT light would go away and I could forget about that part of the conversion - learn from me and don't do this! Follow along as we put pictures to a great diagram provided by www.subaruvanagon.com





Step 3: Test - The Subaru EJ22 purrs like a kitten... or roars like a tiger when fed

{mp4}ej22running/ej22runningmp4{/mp4}

The Final Test!

Now we'll see the performance gain from going from a Waterboxer to a Subaru. Take a look at the video below for a real world 0-60 test. These tests were performed near Durango, Colorado at an elevation of 7000ft above sea level. Lets have some fun!

{youtube}8UF7U8L65oQ{/youtube}

Summary

We hope you enjoy your new animal. We would love to hear if you've followed along with these articles and if they've helped in any way. We would also love constructive criticism as we're trying to help other van owners really get good information on a basic Subaru swap. Please email busaru@busaru.com to leave some feedback, we'd love it!

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