1.8t Coil Pack Conversion for the Audi AAN 20vt

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Introduction

I've been developing this conversion in my head for a number of years because I always thought that, eventually, our OEM coils would no longer be made and I wanted a back-up plan for my car. In the last four or five months, I noticed that I was getting some missing/bucking under WOT, and high boost, at high speed. I figured coil (or POS) but I didn't want to spend the money on replacing old (but perhaps robust) technology when newer technology is out there.

I know all about the 1.8t coil pack recall on some of the Bremi-made coil packs but I think that VW/Audi is through all that now. For whatever reason (excess supply, the need to do some good PR), these coil packs are now very reasonably priced. Since I had the need and the price was right (about $200 - $250 for the parts versus the OEM equivalent of about $900 for five coils, two OEM POS units and five spark plug connectors), I decided to make the conversion.

This conversion is intended as an alternative to the original equipment (OE) ignition system that uses two 3-channel power output stages (POSs) and five individual coils each with a replaceable sparkplug connector. The 1.8 t coil pack conversion described herein works but there are no guarantees about improved performance or freedom from failures. The 1.8t coil packs have built-in POS units as well as coils and plug connectors. At the time of writing this, these 06B 905 115L coil packs were about $30 each. In comparison, the OE POSs were about $150 each (and you need two) and the OE coils were about $115 each (and you need five). So even if the odd 115L coil pack fails every once and awhile, they are far less expensive than the original ignition system.

Before you start the installation you should have read the following:

- The Parts Shopping List
- The Pin-outs
- The POS function (optional, if you are just trying to figure out whether you have a OE POS problem)
- The Installation Instructions

These sections are available by clicking on the bookmarks on the left hand margin of this document.

Remember, I am NOT a trained Audi research and development engineer. I take NO responsibility for the success or failure of this conversion. YMMV.

The 1.8t coil pack conversion: Parts Shopping List

To do this conversion, you need the parts listed below. They are mostly “dealer” (or independent supplier) parts. For some, you will need to be “inventive” and/or go to a wrecking yard to scrounge some VW parts:

1. 5 units of 06B 905 115L late model 1.8t coil packs (which are POS, coil and plug connectors all in one) should be about $25 each. Note the "L" is very important. DO NOT ACCEPT ANYTHING ELSE - unless they are known to be better. (NOTE: The B6 S4 4.2L V8 coils probably will work too – but they cost about 50% more and they are trimmed in orange rubber)

2. 5 units of 4B0 973 724 empty four wire connectors (to mate to the 115Ls) (about $10 each) (Seems expensive but they are worth it)

3. 10 pieces of 000 979 133 A - two female spade connector pig-tails (NOTE: If I had this to do over again, I would search out the equivalent empty pins and crimp/solder continous pieces of wire rather than spicing these into the system.) (About $4 each piece). These pins go into the rear of the 4B0 973 724 four pin connectors.

4. 25 pieces of 357 972 741 A - wire sealing grommets (red) for the 4B0 973 724 connectors and 000 979 133 A wires (about $0.30 each). They seal the wires into the 4B0 973 724 connectors. Install BEFORE you connect the wires to anything else.

5. 5 pieces 6X0 971 921 A - two-part plastic boots for the 4B0 973 724 connectors. (about $3 each). At first I thought they were cheesy but they are actually quite slick. They are designed to retain 1/4" “convoluted” split wire loom which helps to corral those wires.

6. 3 pieces of 000 979 134 - two male spade connector pig-tails (again, I would search out a source of empty male pins and forget slicing these in)

7. Two, four-pin male spade connectors to fit into the four pin female spade connectors that carry the signal from the ECU (and a ground) and normally fit into the four pin end of the POS units (N122 and N127). You can search for something better but I found that there is a four pin, left tail light, connector PN 191 972 704 from a the mid-90's Jetta IIIs (might also be in some Audis because the plug has both VW and OOOO molded into it). These connectors are female "pin" power plugs but they have the exactly correct pin spacing for the the OEM POS input connectors. They need to be modified/transgendered. But this is pretty easy.

I bought two of these taillight plugs with the four wires and connectors (each). By removing the female pins (from the connector side with two bent paper clips to push the retaining pins in), you can salvage eight pins for use in the other connector projects (if you want to save a few $). Once the female pins are out, you need to trim off 4 mm on the nose of the connector and then remove all the protruding bits. I used an X-acto saw

(that I have had for 40 years when I used to make models as a kid). Don't trim much more than 4 mm or when you load the male pins, 000 979 134 (come 2 to wire, you need 5 so three wires), they will push right through (don't ask how I know this). I think it works out that if you cut right through the center of each O in the OOOO symbol, the amount removed is just right. You load the 000 979 134 pins from the back.

Once the pins are in, you can see how the newly re-gendered connector fits into the POS connector. Spacing is correct but there is a lot of exposed, non-waterprood, non-connected, plastic to deal with. I used zap strap(s) and some high temp red silicone to solve this problem.

8. 2, three pin (male) power connectors to receive switched power going to the primary side of the coils. These connectors are on the connector rack on the fire wall and are the two beside the 02 connector. You need to replace them because when you remove the OEM coil pack, you disconnect and remove these connectors. I cruised a wrecking yard and found that the solution is the end of a dead three wire VW O2 sensor (e.g. 90 to 92 Jetta II). You need two. The male pin connector even has the grove to slip into the firewall bracket and fits the power connector perfectly. I crimped on purple power wires that will be connected to Pin No. 1 on each of the five coil pack connectors.

9. Labling tape (1/2" masking tape) so you can keep all the wires organized as to where they are going or coming from.

10. Colour-coded wire, butt connectors and good crimpers, and/or soldering iron, solder and heat shrink tubing, 1/4", 3/8" and 1/2" plastic wire loom, zap straps, etc.

11. Instructions and/or the S4 and 1.8t wiring diagrams (See the Pin-out section)

The assembled parts should look like this:

1.8t Coil Pack Conversion: The Pin-outs

The 4 pin 1.8t 06B 905 115 L Coil Packs have their pins numbered. The function of these four pins is as follows:

Pin 1 = switched power to the primary side of the coil - connect to the yellow power input wires on the firewall metal connector rack via the scrounged VW three pin O2 sensor connectors from item No. 8 in the parts shopping list.

Pin 2 = Ground for built-in Power Output Stage - connect to pin number 2 (brown white wire) of the 4 pin connector feeding power output stage (POS) N122 (the one for cylinders 1,2 and 3). Use one of the regenderized Jetta III taillight connectors (shopping list item No. 7) to make these connections to the OE ECU to OE POS four pin connectors, as per the pin-out below.

Pin 3 = The 5 V DC signal from the ECU to control the POS switch. Use the regenderized Jetta III taillight connectors (shopping list item No. 7) to make these connections to the OE ECU to OE POS four pin connectors, as per the pin-out below.

Pin 4 = Secondary Coil Ground - connect to corner bolt of cam cover where the OE coil pack ground was located. Use a ring-type terminal under the bolt.

Reference for the above (to check): Page 97-371, Wiring diagram No. 41/4 of the Jetta/Golf IV repair manual Edition 11/99)

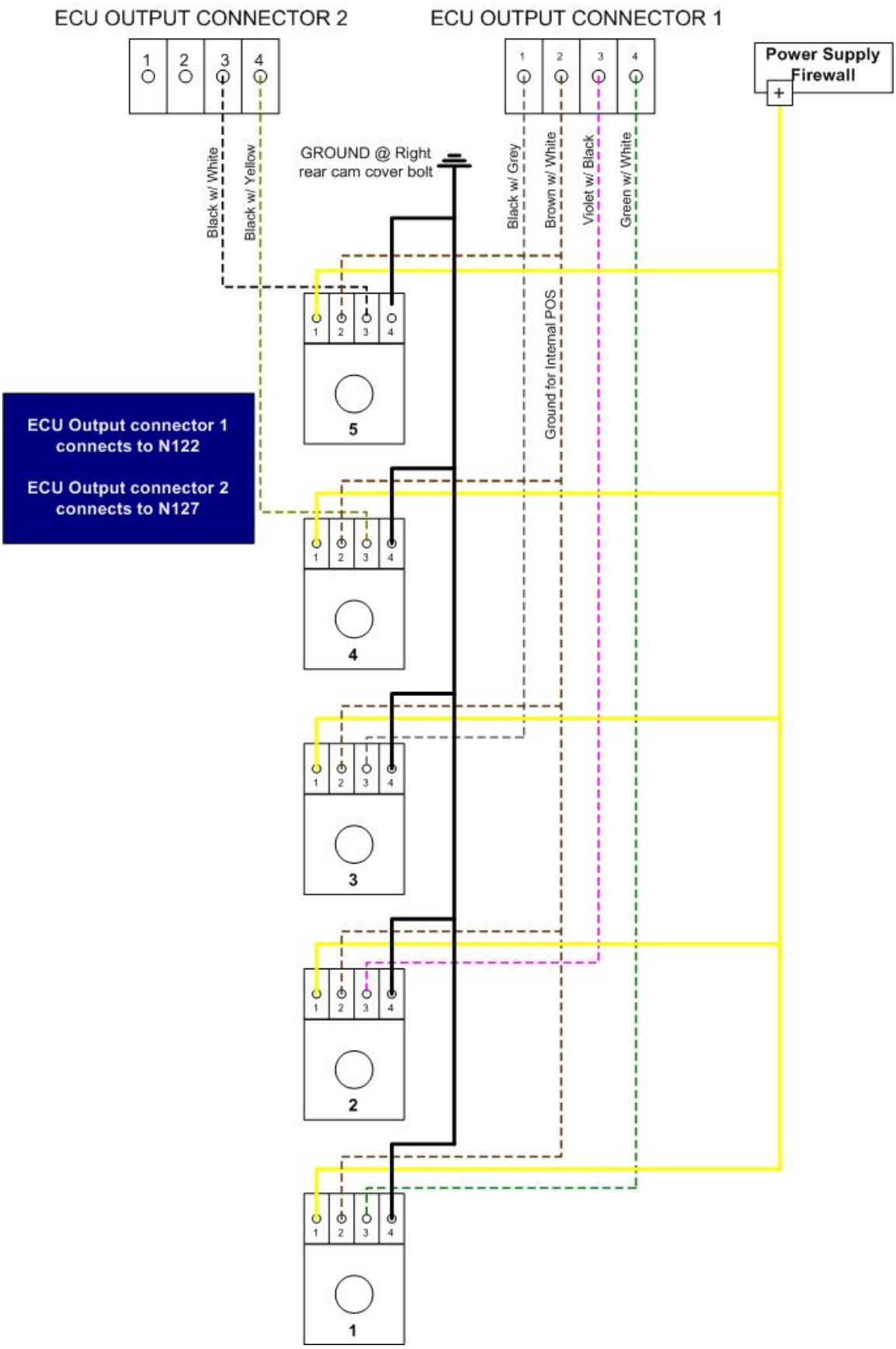
The POS control wires come from the 55-pin ECU connector. Three for cylinders 1, 2 and 3 are in one four-pin connector that goes to POS N122. The other two, for cylinders 4 and 5 are in the four-pin connector that goes to POS N127.

You need to connect Pin 3 of the 1.8t coil packs to the respective cylinder's ECU wire via the regenderized Jetta III taillight connectors. The ECU to OE POS pin- outs are as follows:

ECU pin 1/55 = Green with a white stripe for cylinder No.1 (N122 connector Pin 4/4)
ECU pin 2/55 = Violet with a black stripe for cylinder No. 2 (N122 connector Pin 3/4)
ECU pin 23/55 = Black with grey stripe for cylinder No. 3 (N122 connector Pin 1/4)
ECU pin 20/55 = Black with yellow stripe for cylinder No. 4 (N127 connector Pin 4/4)
ECU pin 21/55 = Black with white stripe for cylinder No. 5 (N127 connector Pin 3/4)

NOTE: The S4 Bentley on page X52/Electrical pg. 24 is wrong about cylinders 4 and 5. The above is correct. Pin 2/4 of the OE POS connectors is the Primary coil ground that the POS controls. Check the POS Bookmark to learn more about how the POSs work and the OE pin outs and why the Bentley is wrong.

The resulting Wiring Diagram is on the next page (courtesy of Daniel “spiralsmurf” Brook, based on an early version by “audiquattro75”)


ECU OUTPUT CONNECTOR 2
ECU OUTPUT CONNECTOR 1
1
2
3
4
Power Supply
Firewall
+
Black w/ White
Black w/ Yellow
GROUND @ Right
rear cam cover bolt
Black w/ Grey
Brown w/ White
Violet w/ Black
Green w/ White
Ground for Internal POS
ECU Output connector 1
connects to N122
ECU Output connector 2
connects to N127
5
4
3
2
1

The 1.8t Coil Pack Conversion: The Installation Instructions

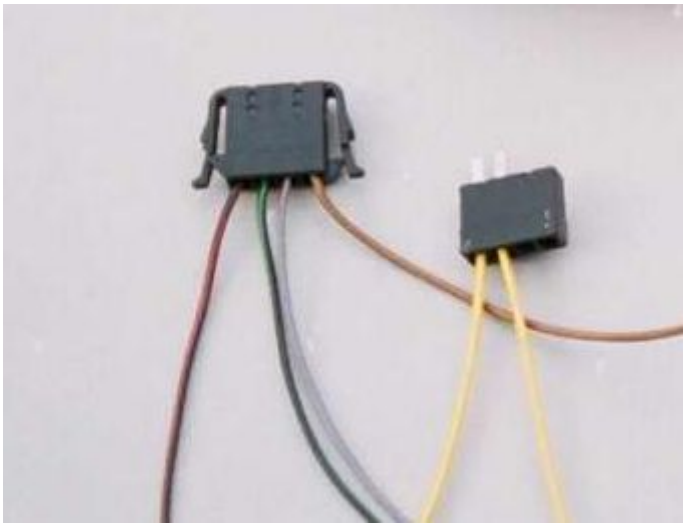
Once you have the parts and understand the pin-outs and the wiring diagram, you can proceed:

BEFORE YOU GO OUT TO THE CAR:

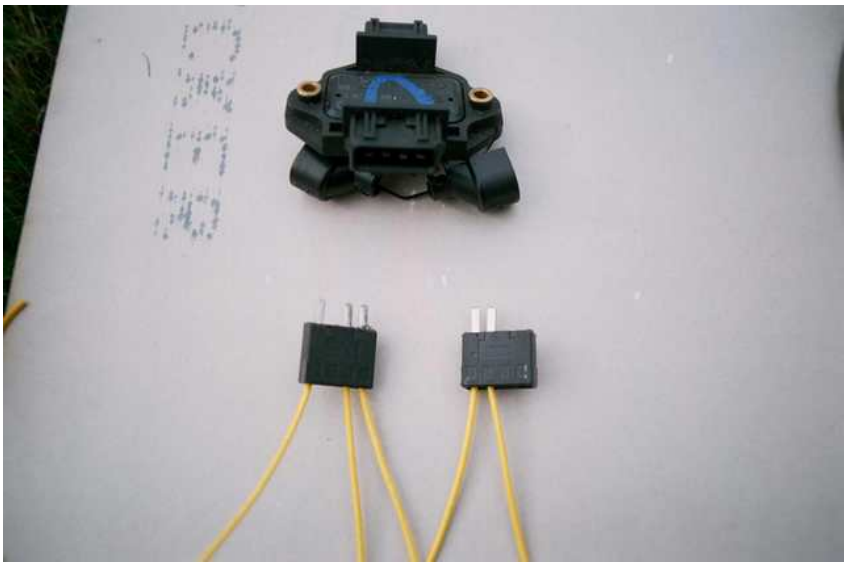
1. Load the 20 female pins into the 5, four-pin coil pack connectors. If you purchased the pins as the two-pin, yellow-wired pigtails, snip the wires in the middle before you load the pins. For me, the pins did not want to slip into the connectors as easily as I would have wanted. I had to push them in with a metal tool (from the rear) so the front of the pins were in the correct position. Add the red silicon wire sealant grommets. Once you are done, try a connector in a 115L coil pack. Try removing the connector (press down on the square bail and pull back).

2. Regenderize the Jetta tail light connectors as per the parts list. Load four male pins (and wires) into one and two pins in the other (in Positions 3 and 4). Add the red silicon wire sealant grommets.

The "before" picture is below (with one "regenderised" to male and the original one still female):



The two completed “regenderized” connectors looked like this (note I added a fourth pin in position 2 for the POS ground after this photo – OE POS is to show pin spacing):



3. Cut the wires on the two, 3-pin Jetta O2 sensor connectors so there is 12" to 14" of wire.

Here is a photo these two connectors after I added wire (I thought the wires were too short - they weren't):

4. Trim and modify the 115L coil packs as shown in the photo below. You need to end up with a ribless band of silicon rubber about 6 to 8 mm high under the hard plastic part of the coil pack tube. The ridge on that hard plastic part of the coil pack tube needs to be removed (I used a Dremel and great care to ONLY take the ridge away). The bottom half of the square(ish) plastic box needs to be removed. Find a F5DP0R sparkplug. Practise

pushing the 115L down onto the spark plug. It should go down far enough so the coil pack clips over the hex part of the spark plug.

The 115L on the left has been modified to fit the AAN; the one on the right is the way they come out of the box:

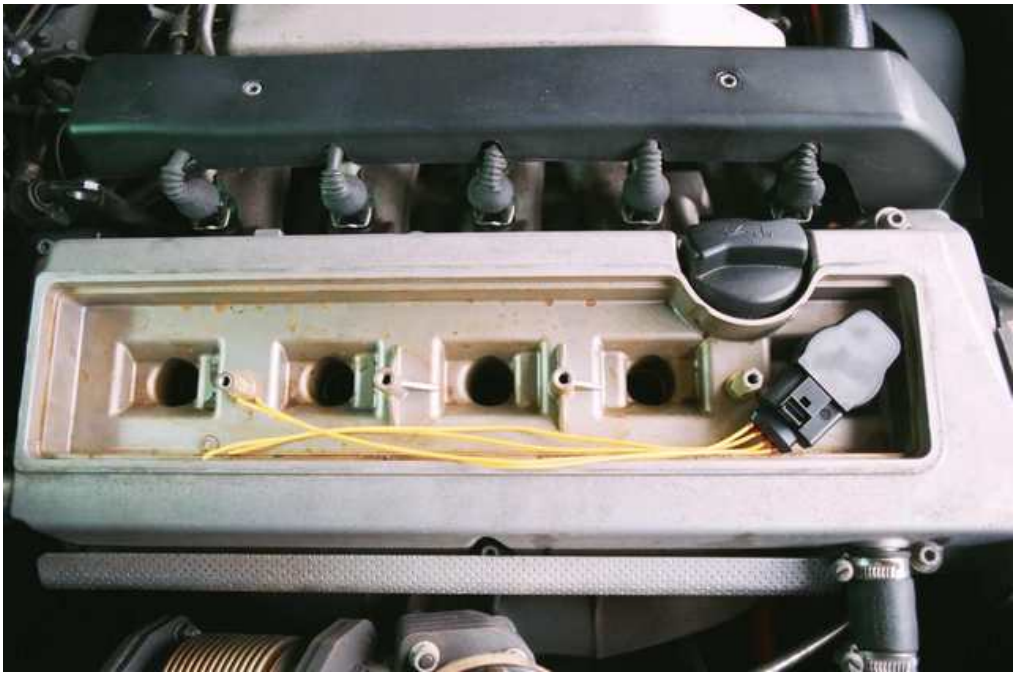
OUT AT THE CAR:

1. Remove the OE coil pack. Remove and save the four 5 mm hex socket bolts. Disconnect the coil pack from the two POS units and the two power connectors on the firewall and the single ground wire to the passenger side rear of the cam cover. Remove the coil pack gently and store in a safe place. If you follow these instructions, if need be you can go back to the OE system within 20 minutes if something seriously goes wrong with the coil pack conversion.

2. Check your spark plug torque. 22 lb-ft. Tighten only. Never back off and re-tighten. Do all five. (Two of mine were loose-ish).

3. Grab one of the trimmed 115L coil packs and pull the rubber ring you left down off the coil pack. Now try installing the coil pack down onto the spark plug. It should go down far enough that the top of the coil pack is about 1/4" (6 mm) below the top of the cam cover. You should hear the coil pack "snap" (click) onto the spark plug. Try this on another spark plug. Measure the distance down to from the cam cover. Remove the trial 115L and replace the rubber ring you removed a few minutes ago. Try installing the coil pack again. It should go down the same as before but you will not hear the click/snap because the rubber ring prevents the sound from leaving.

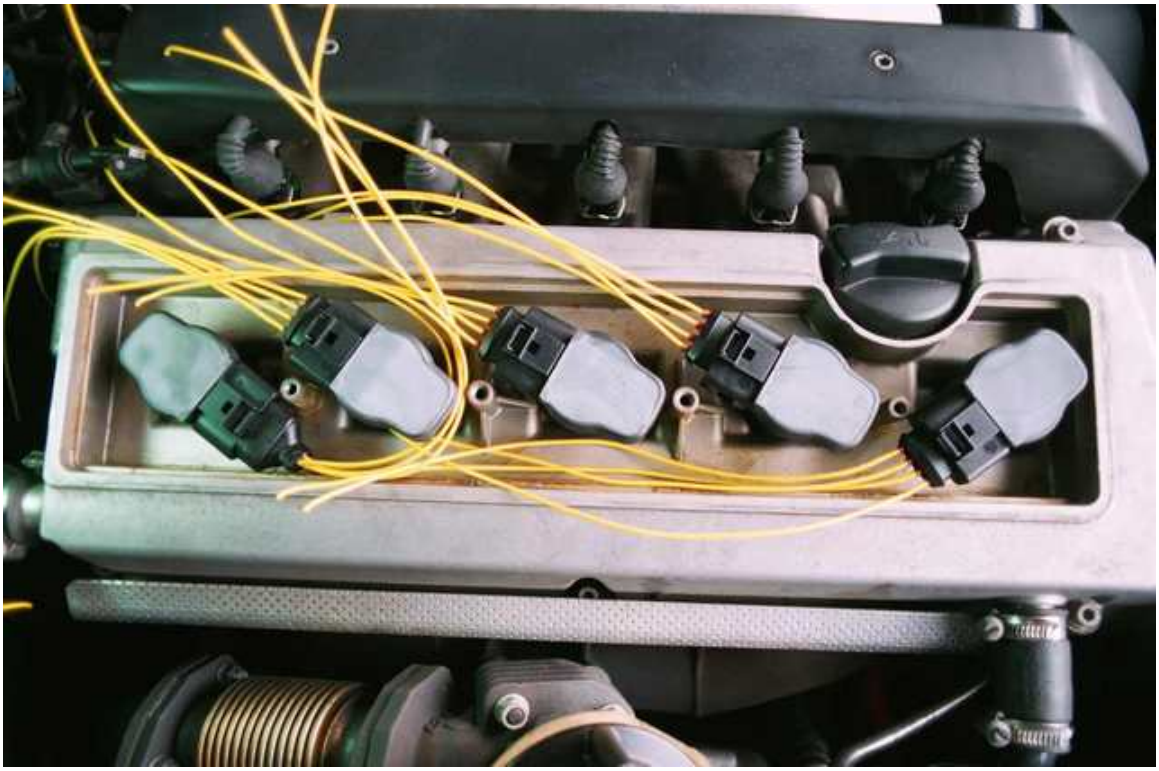
Here's a photo of trialing a trimmed 115L in Cylinder No. 1:



4. Coil pack orientation is a variable but you need to decide before you start the wiring. IF you do not use the snap-on caps to corral the wires coming out of the connectors, you can point the coil packs to the 7 o'clock position as shown in this photo (from Don Smith, the 2nd known person to do this conversion):

However, if you do use the snap-on caps (which I recommend for neatness), then I found that the best orientation was as follows: No.1 (at the front) - 7 o'clock. No. 2, 3 and 4 - 10 o'clock and No.5 (at the rear of the engine) - 5 o'clock. Even with this, the a corner of the snap-on cap and the 115L itself need to be slightly trimmed on No. 1 and No. 5 to get a little clearance.

This second orientation, showing all twenty wires that you have to connect is shown below:



5. Once you have decided on the coil pack orientation, then you can start the wiring process. I left the coil packs in their respective holes, oriented as desired but NOT pushed all the way down (yet). This makes connecting the coil pack connectors easier.

6. You need to be methodical in doing the wiring, and remember to put the heat shrink over the wire at the correct time. Connections can be crimped or soldered. IF you are crimping, I recommend a racheting crimper (more power and more precision) AND using butt connectors that have built in heat sealant (which you activate like when you shrink heat shrink). The objective is a good mechanical connection with no chance of moisture problems.

7. I started with wiring all of the No. 1 pins on the coil packs to the switched power connectors (the Jetta 3-pin O2 sensor connectors installed into the metal connector rack on the firewall). I started at the front with Cylinder No.1 and moved towards the rear, planning how I was going to route the wires, as I went. Note: Because my No. 1 coil pack was pointed to 7 o'clock and I wanted to run the wires on the intake side of the cam cover

well, those wires had to loop a bit around to get past coil pack No.2. Likewise, for No. 5, those wires had to loop around coil pack 4 (on the coil pack 3 side) and actually join the "harness" before coil pack No. 4 wires. Because I didn't think I could get a solder connection to the O2 sensor wires, I used crimped butt connectors. I think only cylinders 1 and 2 required extension wires. No. 3, 4 and 5 where direct connections between the pin pig-tail wires and the O2 sensor wires.

NOTE: Since doing this, I am wondering why each cylinder needs its own power wire. Another way to go MIGHT (YMMV) BE to run a single 12 or 14 gauge feeder wire from one fire wall connection and then "tee" into that wire with the Pin. No. 1 wires. This would result in fewer wires and less congestion in the wiring harness.

8. Then I did the Pin. No. 3 connections to the ECU wires. This is the one you really have to make sure that you don't make a mistake on. Study the Pin-out text again. You need to connect Pin. No. 3 of Coil Pack No. 1 to the green wire wire position (Pin 4) of the four pin regenderized Jetta taillight connector (stuck into the POS No. 1 (N122) connector with its boot pulled back so you can see the ECU wire colours and positions). Watch your wire routing again. Extend wires as required. Pin 3 Coil Pack 2 goes to the Violet Purple position (Pin 3 on the 4 pin Jetta taillight connector). Pin 3 Coil Pack 3 goes to the Black Grey position (Pin 1 on the 4 pin Jetta taillight connector). Pin 3 Coil Pack 4 goes to the Black Yellow position (Pin 4 on the other Jetta taillight connector (the one with only two pins) stuck into the POS No. 2 (N127) connector with its boot pulled back to expose the ECU wires). Pin 3 Coil Pack 5 goes to the Black White position on the second Jetta taillight connector (Pin 3 of 4).

9. For the coil pack POS ground, I used a single wire and T'd in the wires from Pin. 2 of the coil pack using solder and heat shrink. I did this by routing the a 14 gauge brown wire from around the firewall, along the intake side of the cam cover well. Coil Pack No. 1 was a straight "butt" type connection. For the other four connections, I routed the Pin 2 Coil Pack wire to where I thought I wanted the "T" connection to occur. Then I very carefully stripped off about 1/2" (13 mm) of the 14 gauge wire cover. I cut the yellow wire to the appropriate lenght and stripped off about 5/8" of insulation. Then I wrapped the exposed yellow wires around the open 14 gauge wire section and soldered them together. Then I cut a section of heat shrink about 1.5" long and slipped it over the 14 gauge wire from the firewall end and then over the connection I just made. The "T" becomes more of a "Y" but it works. Shrink the tubing (I used careful application of heat from my Weller soldering iron). Continue on with 3, 5 and 4 (remember my order) or whatever makes sense for your coil pack arrangement. The final connection is to Pin 2 of the 4- pin Jetta taillight connector - to the brown white wire position. (This wire ends up connected to the intake manifold ground terminal).

10. For the coil ground, Pin No. 4 on the coil pack connector, I followed the same procedure as with the POS grounds except the final terminal was a ring connector that goes under the same ground connection 5 mm hex socket bolt you removed to remove the OE coil pack ground.

11. The next thing is to snap all the four pin coil pact connectors into their respective coil packs and then push the modified coil packs down as far as you had measured when you first trialled their installation and heard the "click".

12. Tie wrap the Jetta taillight connectors into the ECU POS connectors. Check that all your tools are out of the engine bay and that there are no loose wires anywhere. At this point, the result should look something like this:

13. Start the engine. It should start right up and run smoothly. (Mine did - Yay!!) If it doesn't stop the engine and recheck everything - a connection wasn't done correctly. Find it and fix it. Continue until the engine starts and runs fine. Then stop the engine.

14. With the engine off but everything fine, corral the wires with the snap-on coil pack boots, 1/4" NYLON convoluted tubing fits right into these connectors (NOTE: DO NOT USE CHEAP POLYETHYLENE tubing - IT MELTS (BTDT)) See below:

The real shiny black plastic is where the cheap polyethylene plastic was melting.

To solve this (I hope), I removed the melted black PE loom and used Taylor Sho-tuf "Chrome" nylon convoluted tubing in various sizes and tie wraps to corral the wiring as much as possible. At the Jetta taillight connectors, I used red High Temp Silicon sealant to seal the end of the connectors. This is the current final product:

15. Keep a spare prepped coil pack in the trunk and enjoy.

Detailed Power Output Stage (POS) info for those that care

I needed to type this up anyway for the 1.8t coil pack instructions so I thought I would do it while there is POS "talk".

The AAN is a five cylinder car (Duh), therefore there are five spark plugs. The 3B before the AAN only had one coil and a more or less conventional Hall-effect distributor (c/w rotor and five wires). The engine engineers at Audi figured out that IF they provided each cylinder with its own coil, then the engine could make more horsepower (about 10 DIN hp more), bringing the nominal flywheel hp up from 217 to 227 hp (220 to 230 DIN hp). The trouble was they needed some kind of computer controlled switch to fire these coils in the correct order and at the correct time. Enter the POWER output stage or POS, not usually confused with piece of sh*t but eventually, yes, they all are. But I digress.

The AAN has two three channel POS units mounted on the firewall (they were made for six cylinder cars). These devices are named N 122 for cylinders 1, 2 and 3 and N127 for cylinders 4 and 5 (with one spare channel). Each POS has four pins on one side and three on the other. The four pin side is the side where the ECU signal comes in. The three pin side is connected to the primary side of the coils. The primary coils wires are black and are labled with their cylinder number. They are NOT the input TO the coils as often thought. They are actually the outlet for the current flow FROM the primary side of the coils. The power feed TO the primary side of the coils are yellow wires that come from the two white three pin connectors on the metal connector rack on the firewall. The ignition-switched 12 V power is fed from these connectors to the primary side of the coils. However, the primary side of the coil has no ground so normally there is no current flow or, as a result, spark. The ground is actually through the POS unit and pin 2/4 and its white-striped brown (BR/W) wire.

The ECU (engine management computer, with the aid of a signal from the crank position sensor (and cam position sensor during starting)), sends a 5 VDC (or so) signal to the respective channel on one of the POS's, Inside the POSs, there three transistorized switches that, when triggered by the ECU's 5 V signal, send the 12 V current FROM the Primary coil to ground (through pin 2/4). With the "gate" open for current flow through the primary coil, this rush of current in the primary coil, "excites" the secondary coil which in turn produces a high voltage current that rushes to the nearest way out, which in this case is the spark plug.

The OE POSs fail because inside there are some very fine wires that seem to get brittle with age and/or heat. These wires break or crack, resulting in poor or intermittent current flow. We call that missing or hesitation.

Internally, in the POSs, Pin 1/4 connects to Pin 3/3, Pin 2/4 is a ground (brown with white stripe that eventually goes to the intake manifold), Pin 3/4 connects to Pin 2/3 and Pin 4/4 connects to Pin 1/3. Rember that. Draw a diagram if needed.

For POS N122, a green wire with a white stripe comes from Pin 1 of 55 in the ECU

connector, representing Cylinder No. 1, and connects to Pin 4/4. The corresponding wire from the primary coils is connected to Pin 1/3 on the three pin side. A violet (purple) wire with a white stripe comes from Pin 2 of 55 in the ECU connector and connects to Pin 3/4 of N122, representing Cylinder No. 2. The corresponding wire from the primary coils is connected to Pin 2/3 on the three pin side. Pin 2/4 is the Brown with white stripe primary coil ground wire. A black with grey stripe wire comes from pin 23 of 55 in the ECU connector and goes to Pin 1/4 of the N122 POS for cylinder No. 3. The corresponding primary coil wire goes to Pin 3/3.

Got that? Good because that comes from the Bentley wiring diagram (pg. 24/X52), Scott Mockry's website (for the ECU pinout) and a convenient photo of an X-ray of a POS that I happed to have.

Now it gets tricky. For the second POS, N 127, the Bentley is **wrong!** I will tell you the truth but you can easily comfirm what I say below by checking the wires yourself.

First, the ECU feed for cylinder No. 4 is a Black with yellow stripe from pin 20 in the 55 pin ECU connector. For No. 5, it is a black with white stripe from Pin 21/55 in the ECU connector. The tricky bit is the Bentley mislabled what happens to these two wires when they connect to the four pin side of the POS. The BK/Y (Cylinder no. 4) wire connects to Pin 4/4 (which is correct in the Bentley) BUT the Bentley shows the primary coil wire from Cylinder 5 going to Pin 1/3 on the three pin side. That is WRONG. Its primay coil no. 4 that goes to Pin 1/3 and primary coil no. 5 goes to 2/3, which corresponds to the black with white stripe wire from ECU 21/55 going to Pin 3/4 on the four pin side of the N 127 POS. As always Pin 2/4 on N 127 is the POS-switched ground for the primary coils.

If you were paying attention, Pin 1/4 and Pin 1/3 on N 127 are normally not used. This is the spare channel (the POSs were made for six-cylinder cars). This allows the potential to swap connectors and/or pins when one POS channel fails. However, this is a one time fix. When the second channel fails, you're done.

This <u>will</u> be on the exam.

;>)

Dave F.