Audi 5000 Turbo Emission Overview

It used to be that we thought of emission overviews as a guide through a maze of vacuum hoses. They were hooked this way and that to every conceivable kind of thermo-vacuum switch and vacuum operated gizmo in the universe.

We've thought of emissions problems in terms of faulty thermo-vacuum switches, or kinked or leaking vacuum hoses. Now we need to think of fuel and emission controls as integrated parts of a system.

More and more cars are using something we might call an Engine Management System. The old vacuum controls are giving way to electro-mechanical devices controlled by a central computer.

The Audi 5000 Turbo is such a car. The 5000 has existed in this basic format since the 1984 model year. There have been changes and refinements to the system since that time, but five model years down the road, this technology is hardly science fiction. It's time we started to shift our thinking to electrical, instead of vacuum controls.

We're going to highlight some of the components you'll meet in this system and give you pointers on retrieving fault codes from the computer. This system allows you not only to check system inputs, but to run component output checks as well.

Know Your Car

It's very important to remember that this system, like similar systems, has gone through ongoing product changes and refinements. We'll attempt to familiarize you with some of the common components, their general locations, and the roles they play. But it's virtually impossible for us to list all the variations on this theme and the appropriate test procedures for all the years of production.

One of the most important lessons to be learned here is that your library is about to become as indispensable as your tool box. Not following the specified repair and adjustment procedures for the make and model car you're working on just doesn't make sense.

Audi has offered vehicle specific information to you aftermarket technicians in the form of a microfiche information system. It includes service repair manuals, wiring diagrams, and believe it or not, service bulletins. They are currently offering a package deal that includes a starter set of microfiche sheets and a microfiche reader as well. It is attractively priced and we encourage those of you who work on these vehicles to do yourselves a favor and look into this.

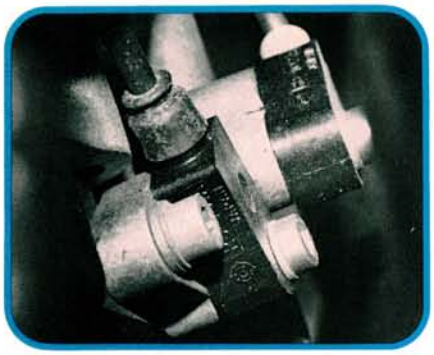
For further information contact:
Audi Product Service Publications
c/o Dyment Distribution Services
P.O. Box 360740
Strongsville, Ohio 44136

Cautions

There are some things to keep in mind before you dive into this system. You can actually do more damage to yourself and to the car by using inappropriate test procedures and equipment than if you just left things alone in the first place. Not solving a problem is bad enough without making things even worse than they have to be.

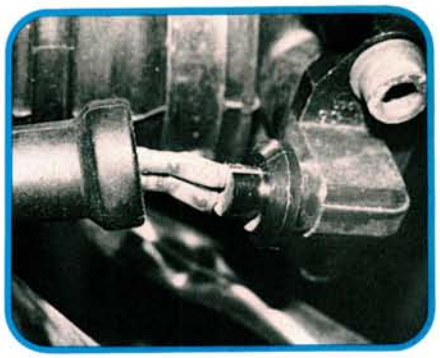
- Always ground a disconnected coil wire during tests requiring you to crank the engine. The high energy coil has enough secondary amperage available to damage your body. Just as importantly, we don't want any stray secondary voltage sneaking back through the primary circuit. The primary side is a low voltage circuit, and can easily be damaged by lightning from the coil or coil wire.
- Never disconnect any secondary cables with the engine running.
- Never wash the engine while it's running. (That includes the old spray bottle and water trick to find leaking plug wires.)
- Never replace the ignition coil with a conventional coil.
- Never disconnect wiring to the ignition system with the ignition on.
- Never use fast charging of the battery except in an emergency and then for no more than 15 seconds at a *maximum* boost of 16.5 volts. Let the battery settle down for one full minute between each attempt.
- Never do any electrical welding without disconnecting both battery terminals.
- Never disconnect the battery with the engine running.
- Never apply voltage to the control unit. The system has its own output checks. Use them.
- Never shut off the key if you want to retrieve fault codes from the computer memory. The computer does not have permanent memory. Turn off the key and you erase any fault codes that have been stored.

—By Ralph Birnbaum



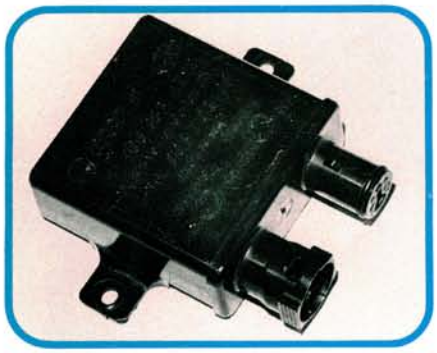
1

These two sensors are on the left upper lip of the bell housing. The speed sensor counts flywheel teeth as they whiz by. The computer uses the sensor signal to calculate engine speed. The other sensor, the reference sensor, sends a message when a pin in the flywheel passes by. Don't swap sensor locations.



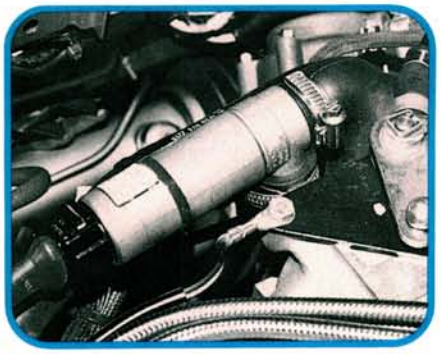
2

The air intake sensor is soldered to the wiring harness. Located in the intake plenum on early cars, it helped correct timing for boost above 1.0 bar at colder temperatures. On 1986 and later cars, it's in the intake hose and helps limit boost when cold, denser air could provide too much boost.



3

Excuse us if we go back in time for a moment. 1980-83 models used this little item called a digital idle stabilizer. It helped stabilize idle speeds by changing ignition timing. You had to disconnect and by-pass this unit to set base timing. Later models do not use this device.

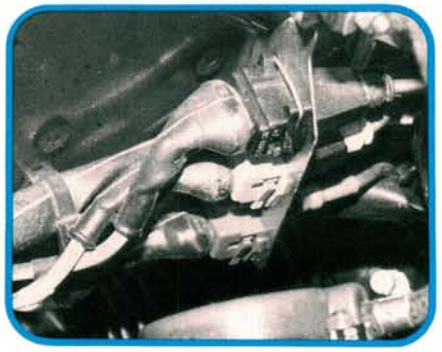


4

The auxiliary air regulator used on earlier models has been replaced by an electrically operated idle air stabilizer. Introduced in 1984, it controls idle circuit by-pass air to increase engine speed for cold operation and keeps idle speeds stable when accessory loads are applied.

5

Your trusty voltmeter is still a friend indeed when it comes to checking oxygen sensor activity, performance, and range of operation. The Audi uses a heated sensor that reaches operating temperature far sooner than the old sensor which relied on exhaust heat to warm it enough to wake it.

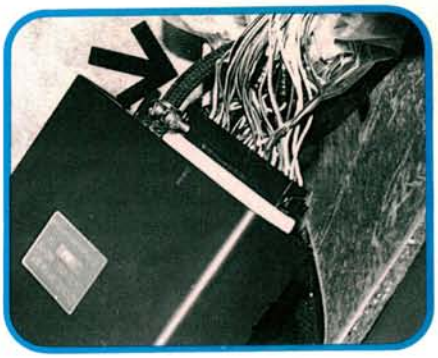


6

These three snap connectors, located on the firewall are for the 1) reference sensor (black in color), 2) speed sensor (gray), and 3) knock sensor (red). These are good test points for taking sensor readings, but please don't mix and match when reconnecting them. Refer to specs for your car.

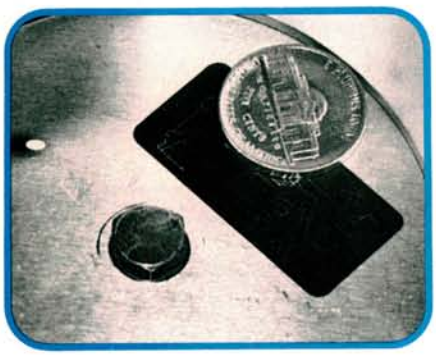
7

If you're not familiar with these connectors, you may use some unfavorable vocabulary with them the first time around. I've seen many of these connectors broken. Some had the spring retainer clips bent or missing. To separate this type connector, simply compress the spring (arrow) as you pull it apart.



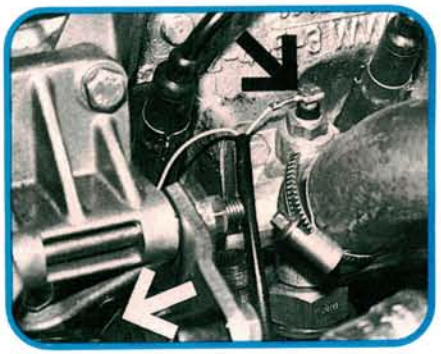
8

The control unit is hidden behind the right front kick panel. A manifold pressure sensing tube (arrow) connects the unit to the intake manifold. Pressure in the tube is converted to an electrical signal used to adjust timing and acceleration enrichment. It also operates the boost gauge.



9

On early cars, the sensor plate sat flush with the base of the cone. Since 1986, a new fuel distributor has an air gap between the control plunger and the sensor plate arm so the plunger can rest against a sealing o-ring. The spec is an engine-off 2 mm, or a nickel's worth below the cone base.

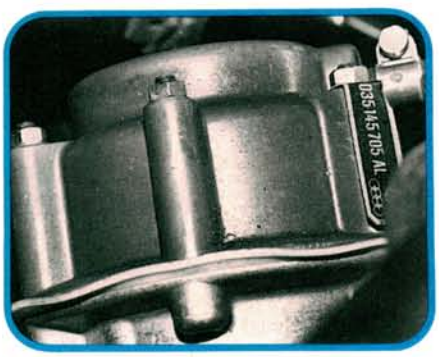


10

The temperature sensor below our black arrow is a NTC or negative temperature coefficient sensor. It sends the ECU a message that is used for idle stabilization control. The engine temperature sensor for fuel/ignition control is hidden below the pump bracket at left (white arrow). Don't cross the wires.

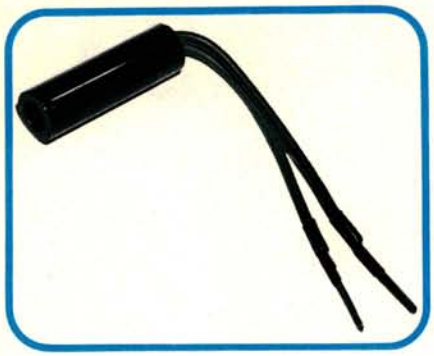
11

The wastegate frequency valve is near the ignition coil. As of 1986 it is used to provide digital boost control. This is used when the engine is cold to limit maximum boost pressure by venting the wastegate upper chamber to vacuum. This opens the wastegate sooner.



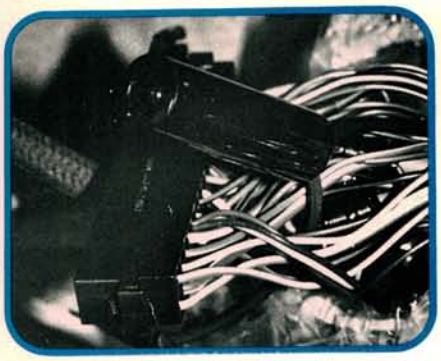
12

At normal operating temperature, digital boost control keeps the wastegate closed longer by diverting boost pressure to the wastegate upper chamber, ensuring that maximum boost will be reached and controlled, even at higher altitudes, where atmospheric pressure may affect wastegate operation.



13

You can fabricate a small LED with two leads to test computer inputs and outputs. The LED won't damage circuitry and will flash whenever there's a signal going over the wires. Don't just start poking around with your old test light. It can pass enough juice to damage delicate circuits.

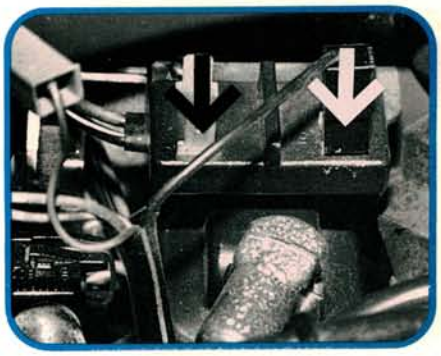


14

Here we are checking an input circuit signal right at the control box block connector. The tester can also be used to check signal outputs to components like the wastegate frequency valve, cold start valve, charcoal canister shut off valve, and the oxygen sensor frequency valve.

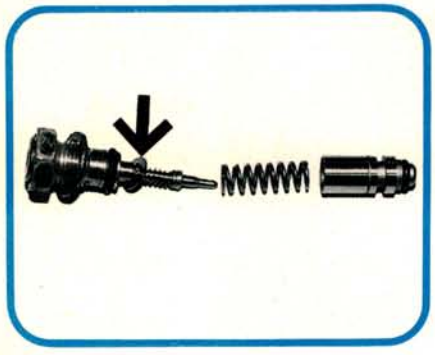
15

This coil looks too small to scare you, but it'll put out 40,000 volts at about 7 amps! Be careful not to zap yourself or a loved one during tests. Coil checks are very important, since a partially open or a shorted coil can cause a number of problems including hard starting when the engine is cold.



16

Disconnect both wires and check coil primary resistance (only 0.5-1.5 ohms) at these terminals on the block above the coil. Check secondary coil resistance (6.5 to 8.0 K ohms) between the number 1 terminal (black arrow) and the coil wire terminal (coil wire disconnected and key off).

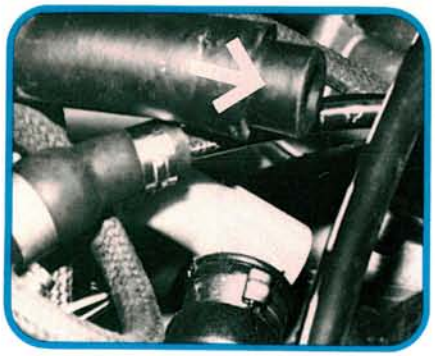


17

System pressure is adjusted as before. A change in shim thickness changes system pressure. The more you shim the valve, the higher the system pressure. Less shims mean less pressure. Don't forget to check system pressure when you troubleshoot. Always refer to pressure specs for the car you're working on.

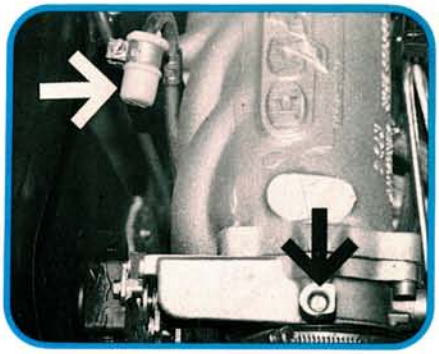
18

Improper idle speed and CO adjustment can cause some serious driveability problems. You'll think there's something seriously wrong with the car, especially when the engine is cold. Before you adjust anything, remove the rubber cap from this charcoal canister vent line.



19

On the 1986 model (shown), disconnect the hose to the valve cover gasket and plug it. The cap removed in the previous step works nicely. On 1984-85 models, you'll have to remove both crankcase breather hoses from the valve cover and plug both openings on the connector.



20

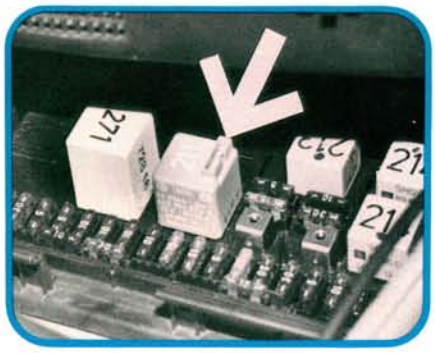
Connect an exhaust analyzer to the test tube (white arrow). Remove the green plastic connector from the terminal number 1 (black arrow back in photo 16). This puts the idle stabilizer at fixed duty and lets you adjust base idle with the idle by-pass screw (black arrow in this photo.)

21

Adjust idle speed to specifications. If you can't adjust idle speed within allowable limits, check the idle stabilization unit and related wiring. Don't forget to reconnect the green wire at the connector block above the coil when you're finished or the idle air stabilizer will stay at fixed duty.

22

Check the underhood sticker for the CO setting. Duty should be between 22 and 58 degrees and fluctuate slightly. If an adjustment is needed, set duty between 38 and 52 degrees. CO should be between 0.3 and 1.2 percent. CO adjusts as it did on the old K system.



23

The fuse panel is located on the left side of the tray below the cowl. Our arrow points to the fuel pump relay. At first glance, you might think that there's a fuse missing. There isn't. By installing a fuse and waiting four seconds before removing it, we can retrieve computer fault codes.

24

Drive the car and run the engine to 3000 RPM with a minimum 1.0 bar of boost. Do not turn the key off after the drive or you'll erase the fault memory. Install the fuse in the pump relay as shown for four seconds. Installing the fuse starts the diagnostic sequence. (See our charts.)

Checking Fault Codes—Inputs and Outputs

As we mentioned, you can retrieve fault codes from the computer memory in the event of a component failure. Newer models also have the computer exercise five key components so you can check their operation.

Earlier models had a similar fault retrieval method that used a combination of both the flashing dash light and tachometer readings. Once again, we apologize, but you'll just have to check the repair manual for the specifics.

We *have* included a sampling of input-output checks on 1986 and later applications. At least you can get a flavor for the system and its operation. Then you'll have some idea how to use repair manual specifics.

Input Testing

Assuming the car runs at all, take it for a test drive and do the following:

- Briefly raise the engine speed above 3000 RPM.
- Make sure you get a boost gauge reading above 1.0 bar at least once during your drive.
- Run the engine at wide-open throttle at least once.

Do not turn the key off after your drive. This will erase memory and you'll have to repeat the test drive sequence. Install a spare fuse as shown in step 24 above. Remove the fuse after four seconds.

If there are any faults recorded in the system, the engine control indicator light will flash once for 2.5 seconds to inform you that it is about to transmit codes. It will then go out for 2.5 seconds before beginning to transmit.

The light will flash on for one-half second. Then it will go off for one-half second. Count the number of "short" flashes until the light goes off for another full 2.5 seconds. If you had two short flashes before the light paused, the first digit of the code is a two. If the next series has three short flashes, the second number is a three, and so on. Each fault code has four digits.

The code will be repeated until you cancel the sequence by turning off the key. Or you can ask the computer to go on to the next fault (assuming there is more than one) by reinserting the fuse in the fuel pump relay for four more seconds.

Faults may indicate a bad component or a wiring problem that keeps a signal from being sent or properly received.

This chart should help you interpret the codes. After making your repairs, erase memory by turning the key off. Then drive the car again as before and recheck for fault codes.

Output Testing

Since 1986, the Audi's computer will send messages to five key components. You'll be able to hear these components run or click as each one is activated.

To run the tests, turn off the ignition to erase any stored memory. Turn the key back on and insert the fuse again for four more seconds. Remove and reinstall the fuse to go on to each succeeding step. A code will be displayed to tell you which component is being activated.

Since the fuel pump runs through all the tests, you may want to disconnect the cold start valve except when it's being tested to prevent too much fuel from being injected into the intake.

Code	Fault	Code	Fault
1111	Control Unit	2123	Full Throttle Switch
2111	Speed Sensor	2121	Idle Switch
2112	Reference Sensor	2312	Coolant Temperature Sensor
2113	Distributor Hall Sender	2322	Intake Air Temperature Sensor
2221	Leaking or Plugged Pressure Hose to Control Unit	2342	Oxygen Sensor
2222	Pressure Sensor in Control Unit	4444	No Faults Recorded
2141	Knock Regulation (Engine knock is causing maximum ignition retard)	0000	End of Diagnosis
2142	Knock Sensor		

Step	Code	Component Checked
1	4433	Fuel Pump (the pump should continue to run through all the steps)
2	4441	Frequency Valve (the valve will work at 50 percent duty until the next step)
3	4442	Wastegate Frequency Valve (you should hear the solenoid switch on and off during this step)
4	4443	Cold Start Valve (Should switch on and off for about 10 seconds)
5	4343	Charcoal Canister Shut-Off Valve (switches on and off until test is completed)