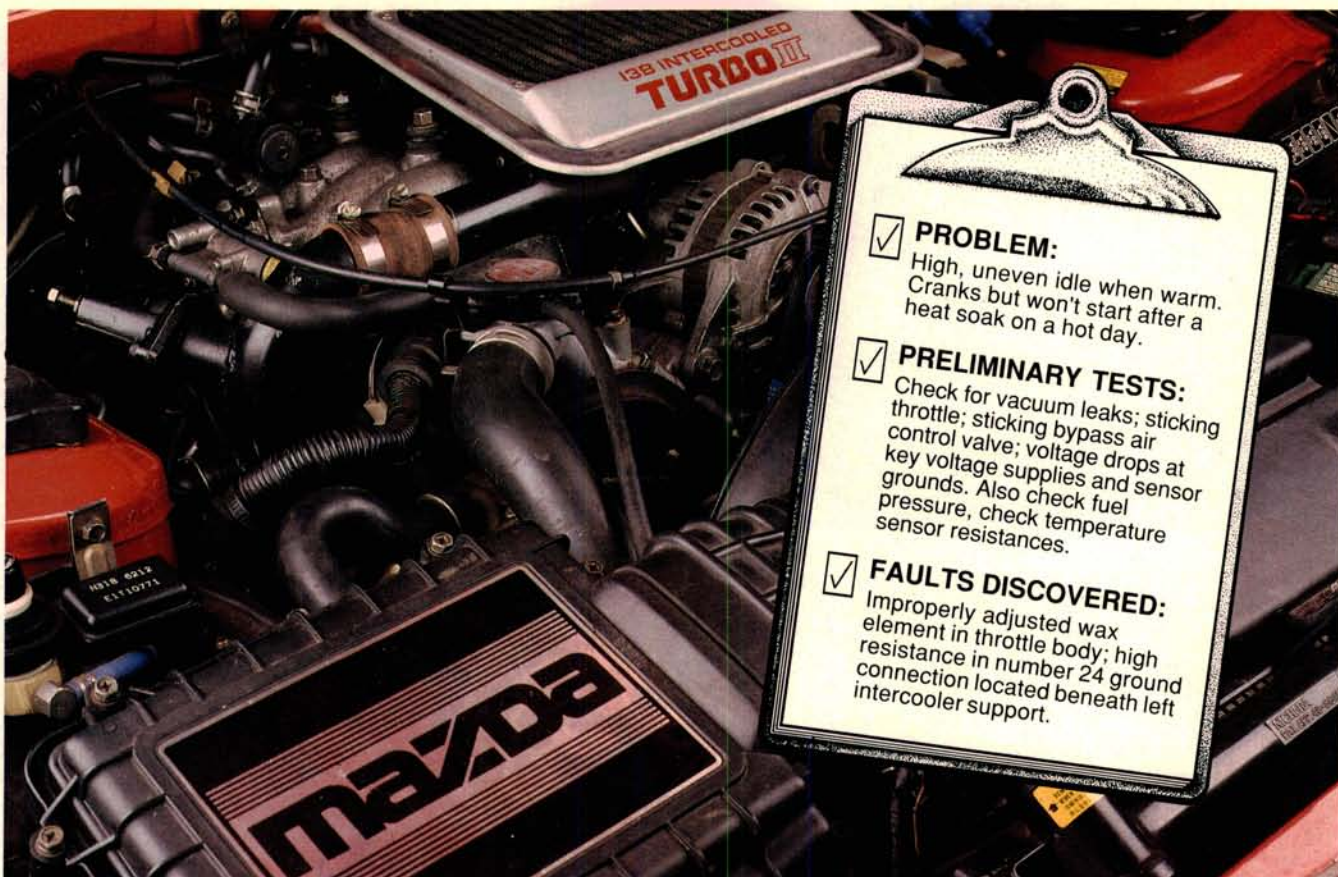


DRIVEABILITY CLINIC



Mazda RX7 Turbo

This month's Driveability Clinic deals with a combination platter of problems on a 1987 Mazda RX7 turbo.

The car would start easily when cold and performed well under acceleration. But once the engine warmed up, the idle would hang at about 1500 to 1800 RPM. The idle was uneven, and an occasional misfire would rumble through the exhaust system. Then, after shutting the engine down and allowing it to heat soak on a hot day, it would crank with enthusiasm—but refused to restart. At that point, a 20 minute rest in the shade with the hood raised was the only cure.

If you like Rubik's Cube, you'll love the fuel injected turbo version of the 13B rotary. The addition of the turbo required engineers to dig deep into their trick bag of tight-fit packaging. Most normal tests and adjustments are possible without proving your skills as a contortionist. But as we'll see, this particular car suffered from problems which required us to wade into the maze of brackets, bolts, and hoses beneath the intercooler.

Onboard diagnostics for this system are limited. There is a diagnostic plug out under the hood which

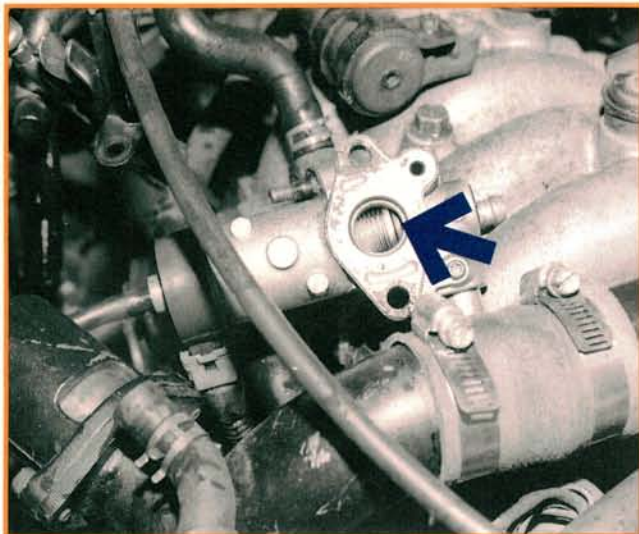
will allow you to monitor O₂ sensor activity, and retrieve a limited number of stored faults (assuming there are any). But as you might suspect, we got "no help" in that area.

So it was back to basics for us as we attempted to ferret out the cause or causes for our problems. Then, just when we thought we'd mastered the beast, when we thought we'd finally tamed it, it double crossed us and sent us back to the drawing board.

One area you may find interesting is the throttle body mechanism. It is not something you'll want to remove and replace unless you're forced into it. But since we had it off anyhow, we thought you might like to see some of its major components, and some of the problems they can cause.

We couldn't fit everything into one article. In fact, we won't be able to do a totally comprehensive coverage in two articles. But we hope to point out some key points. Next month we'll finish this job, showing the last minute wrinkle which almost drove us daffy, and list a number of common test points and adjustment procedures for this system.

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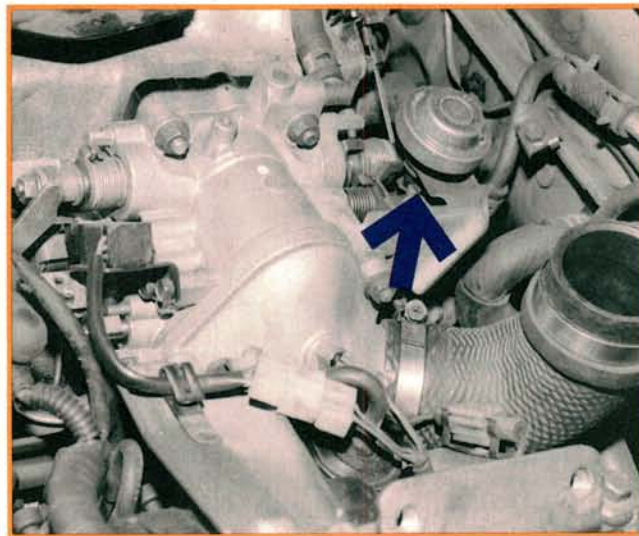
1 One possible cause of the high idle problem is the Bypass Air Control (BAC) valve which regulates idle speed by controlling the amount of air which can “detour” around the throttle plate. If the BAC sticks open, a lot of air travels around the throttle, increasing engine speed. The mechanical action of the BAC is easy to test. Unbolt it, flip it over as we’ve done, and power up the solenoid in the BAC. The BAC valve should open when energized, and close when power is removed. With power removed, make sure the valve is fully closed (arrow).



3 As we swing the intercooler off to the side, we find that a rat’s nest of debris has accumulated beneath it. The functional hood scoop force feeds pieces of leaves and twigs, and a lot of dirt through the intercooler. We do some house cleaning and lube the throttle shafts and mechanisms (both primary and secondary). We also check an often overlooked item, the relay rod for the oil metering pump connected to the front of the throttle shaft. The metering pump injects additional oil into the engine in response to throttle opening. If it binds or rubs on something, it can also hold the throttle open.

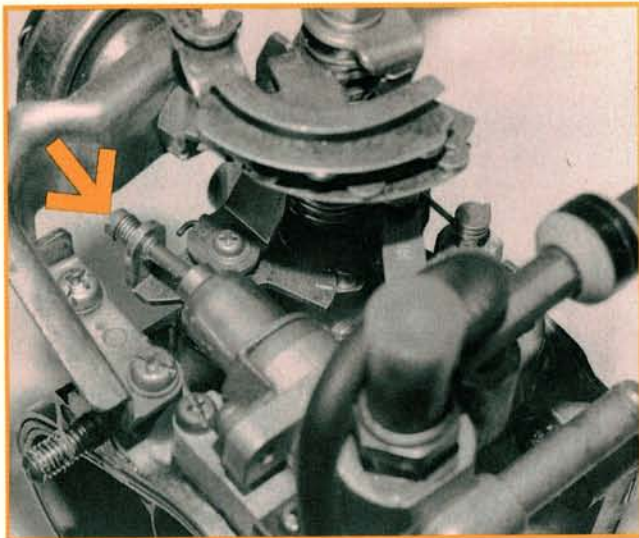


2 Another possible cause of our high idle is a sticking throttle, or an improperly adjusted throttle cable. The air-to-air intercooler on the turbo sits over the throttle body. This partially blocks our access to the throttle shaft mechanisms. We are able to reach down with a long screwdriver, and press the throttle arm against its stop. By placing pressure on the arm, we’re able to bring the idle down. When we remove the pressure, the idle climbs back to 1500 RPM. This is beginning to look like a mechanical problem in the throttle body. We remove the intercooler for a closer look.

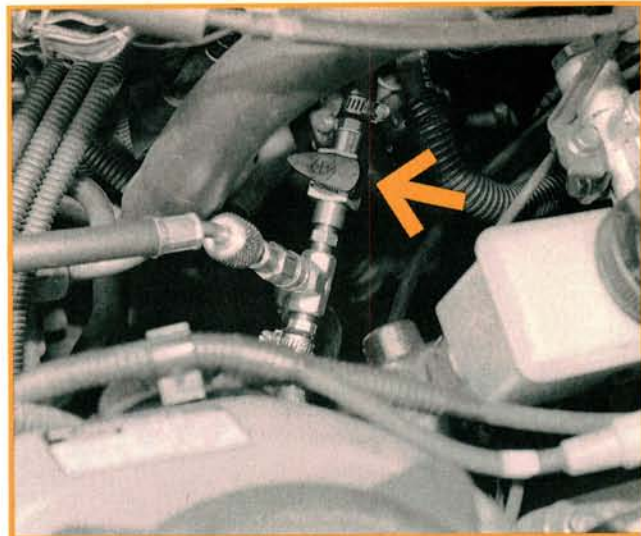


4 The throttle body is a fairly complicated piece of equipment. There’s a thermo wax element located on the backside of the throttle body. Think of it as a first cousin to a fast idle cam on a carburetor. Due to its location, it is very hard to see when the throttle body is installed. But its adjustment screw is temptingly placed out in the open. A pocket mirror indicates that the element is holding the throttle open even when the engine is warm. A closer look leads us to suspect that some indiscriminate screw turning has been going on. Normally, this screw never needs to be touched.

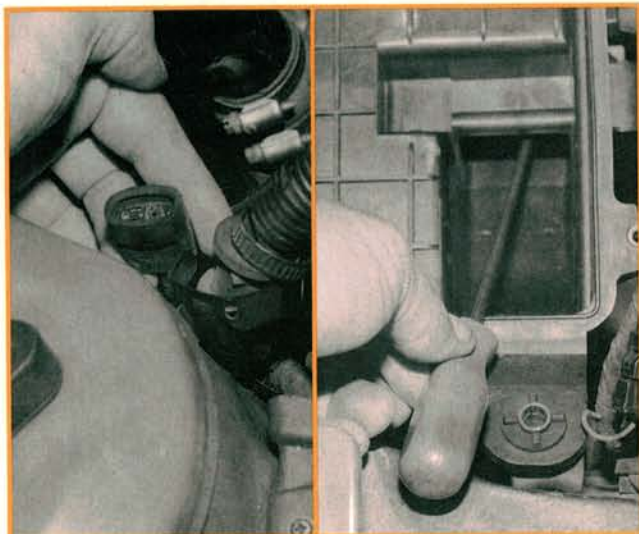
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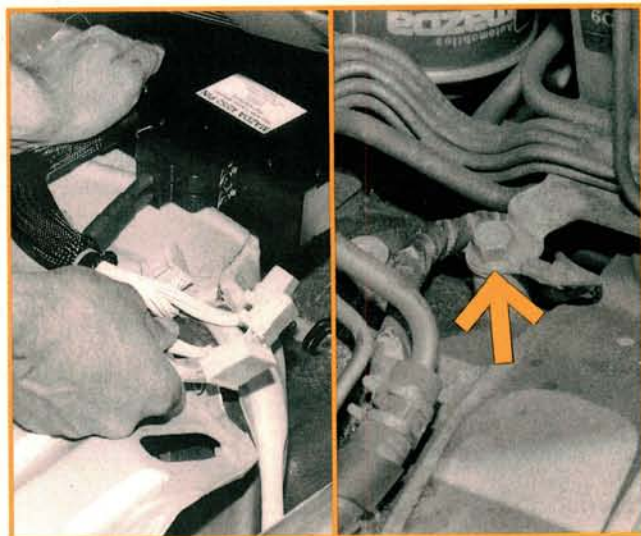
5 Well, it's decision time. Do we remove the throttle body for a closer look, or try to simulate the hot start problem now while we can still run the engine? We decide to turn in the adjusting screw on the wax element (arrow) to bring down the fast warm idle. This is a guesstimate for now, but we aren't sure if the partially open throttle is contributing to the hot start problem. We reinstall the intercooler and take the car for a spirited drive. Then we park it with the hood closed and let it hot soak. After a 20 minute sit, it cranks but won't start. We check spark and compression. Both are good.



6 We include fuel pressure tests as a part of a thorough diagnosis. We tap into the pressure line between the fuel filter and the fuel loop. (The shop manual tells you to unplug the fuel pump and run the car until it stops to relieve fuel pressure. What they don't tell you is that the connector is buried behind the trim panel on the left rear shock tower.) We bleed off the pressure at the fuel filter instead. Then we tee into the pressure line between the filter and fuel rail and install a shutoff valve between the gauge and the loop so we can dead head the pump (briefly) to test maximum pump pressure.

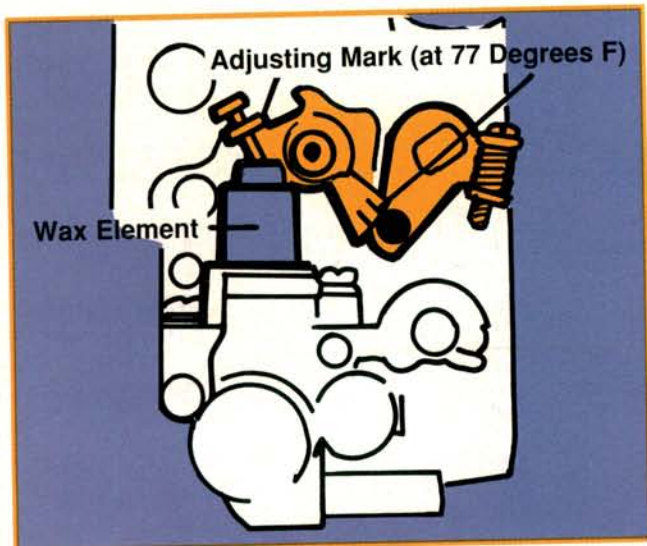


7 There's a jumper plug for the fuel pump on the inside of the right front strut tower. To run the pump, turn the ignition ON and jumper across the terminals. Another way to run the pump is to remove the air filter, turn the key ON, and open the flap in the air flow meter. This also checks the pump contacts in the air flow meter and pump wiring. Dead head, regulated, and rest pressures are all good. Vacuum to the pressure regulator is controlled by a solenoid (orange), so we follow procedures and check regulated pressures with the solenoid both ON and OFF. So far everything checks out okay.

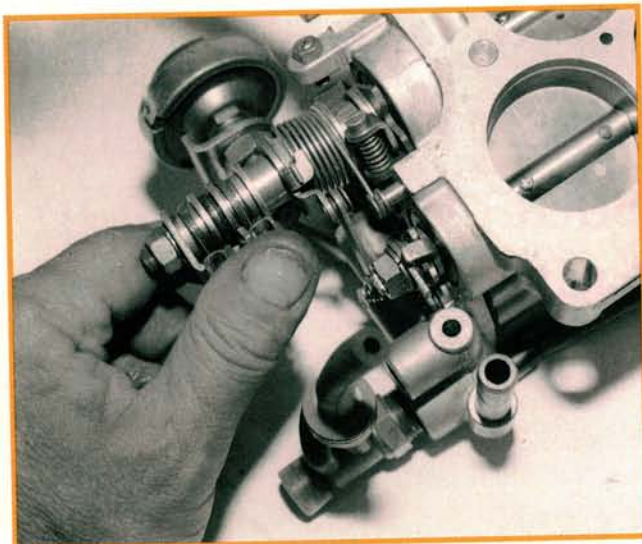


8 We decide that it's time to pull back the carpet on the passenger side floorboard and hook up our breakout box. Tests of voltage supplies, sensor resistances, and grounds are all within specs, except one. It seems we have a high voltage reading at ground terminal 24 when we crank the engine hot. Ground terminal 24 has been mentioned in other magazines as a cause of many electrical problems in this car. But have you ever seen it? Probably not. That's because it's bolted to the engine below the left intercooler support bracket (arrow).

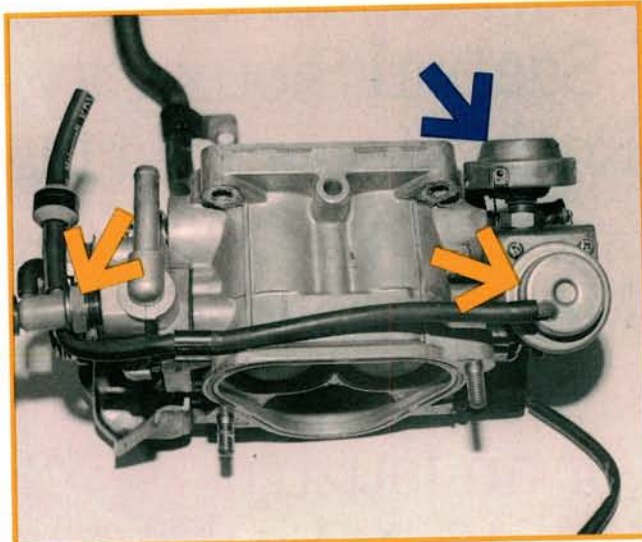
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9 The intake plenum needs to be removed to get at the intercooler support bracket bolts. (Our large photo on the last page of this article will show you some of the things to keep in mind if you ever need to R&R the plenum/throttle body for any reason.) With the throttle body removed, we check and correct the adjustment of the wax element (which had been tampered with). Adjust it as shown in our illustration. Then run hot water through the element to make sure it expands properly, and that the roller and cam separate completely with the element fully extended.



11 As a key grounding point for the engine sensors, the number 24 ground can cause all sorts of problems when it starts dropping voltage. We clean and tighten the connection and test the circuit cold. (Later on, we use the breakout box to retest the 24 ground hot, to verify that our voltage drop is gone.) Finally, we double check all the adjustments in the throttle body: the wax element adjustment, the fast idle screw, the primary throttle opening when the secondaries begin to open, and so on. There are too many specs and adjustments to list here, so please refer to the manual.

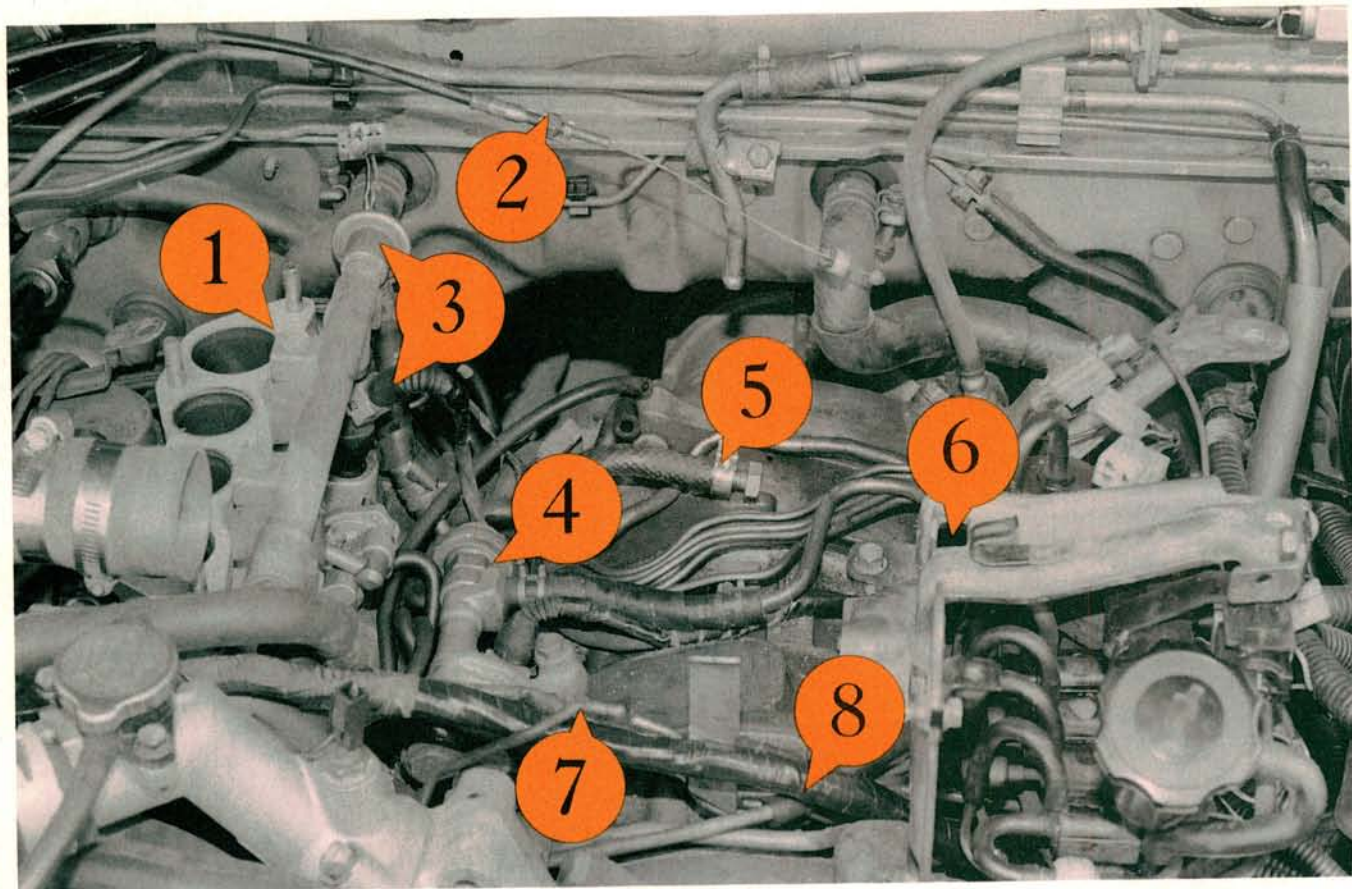


10 There are even more things to check on the throttle body while it's off. The left white arrow in our photo points to a thermo vacuum switch. It allows vacuum to pass to the actuator (right side white arrow) which locks out the secondaries when the engine is cold. Remember, there's vacuum at the actuator COLD. The black arrow points to the throttle damper (dashpot, if you choose). Normally, the damper acts as a cushion, easing the throttle down slowly to its closed position on deceleration. But it can get dirty and stick. Another possible cause of a sticking throttle.



12 There are a lot of hoses and connections to remember when you reinstall the plenum/throttle body assembly. Vacuum hoses, coolant hoses, gaskets, electrical connections, the oil metering pump rod, and of course the throttle and cruise control cables. Check the condition and routing of all the wiring sandwiched beneath the plenum. The main cable in our photo showed signs of chafing. Not a problem yet, but taping and rerouting were in order. Next month we'll take you through more basic tests and adjustments, and show how the best laid plans of mice and men went awry at the last moment.

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UNDERHOOD COMPONENT LOCATOR GUIDE

With the intake plenum and throttle body removed, you start to realize how many things are hidden beneath them. We decided that a reference photo, showing the locations of certain key components might be useful if you haven't had one of these apart yet.

- 1** The right side of the intake plenum (Mazda calls it the Dynamic Chamber) is sealed to the manifold with a gasket. Half of the old gasket came along peacefully—the other half thumbed its nose at us and stayed behind. You may want to have a replacement gasket handy when you start.
- 2** Cruise and throttle cables hook to the backside of the throttle body. It's easier to pull the plenum up and away a bit before disconnecting them. Improper adjustment of either could also cause a high idle.
- 3** Number 3 points to the fuel pressure regulator and one of two injectors in the Secondary (upper) fuel rail. You can't even see the injectors with the plenum installed, so if you suspect that leaking injectors are a problem, now is the time to make your repairs.
- 4** The Primary pair of injectors sit in the lower fuel rail. The pulsation damper located at the inlet

side of the rail is there to absorb pulsations in the fuel line from the fuel pump.

- 5** This short (and we mean short!) hose connects the engine water jacket to the thermo wax element in the throttle body. It is just long enough to reach between the two with the plenum installed. Getting at the hose is a real lose—lose proposition. You can't remove the plenum to disconnect the hose because you can't remove the hose to lift the plenum. Same thing happens when you go back together. The plenum has to sit almost all the way down before the hose will reach, and then you can just barely reach the hose. Eyes in your fingertips would help a lot.
- 6** This bracket supports the other end of the intake plenum. The number 24 ground terminal we repaired bolts to the engine below this bracket.
- 7** This is the relay rod which travels from the throttle linkage down to the oil metering pump. The metering pump injects a measured amount of oil into the engine. If the rod or pump stick or bind, they can hold the throttle open.
- 8** This is the location of the main wiring harness shown in photo 12. It's a tight fit through this area, so be careful to inspect the harness for chafing. Retape it if necessary, then tie it off so it won't rub again.