Honda CVCC

Honda first introduced its Compound Vortex Controlled Combustion, or CVCC design in 1975. It was a pretty revolutionary concept for its time. Back in the Dark Ages of auto emissions, most stumbling attempts at emission control were add ons that caused many driveability problems, and actually reduced fuel economy.

In an effort to reduce emissions and raise fuel economy, engineers leaned fuel mixtures. Then they leaned them even more. Fuel/air mixtures got so lean, in fact, that getting them to burn became a problem.

The CVCC system attacked these problems head on. In addition to the normal intake and exhaust valves found in each cylinder, Honda added a third auxiliary valve to each cylinder. This tiny valve was designed to feed a small amount of a rich fuel mixture into a small pre-combustion chamber. At the same time, a larger volume of a much leaner mixture was fed into the cylinder past the regular intake valve.

Then when the spark plug ignited the small, rich charge from the precombustion chamber, it went off with enough of a bang that it lit the very lean mixture in the cylinder—a mixture too lean to burn properly on its own. This redesigned cylinder head became the heart of the CVCC system, and survived in one form or another in different Honda vehicles through the 1987 model year.

Hoses, Hoses Everywhere

One of the more intimidating aspects of the CVCC

system is the large number of vacuum hoses. The first time you open the hood on one of these vehicles, you may be tempted to just move on. In addition to the jungle of hoses, the concept of a three-barrel carburetor also takes some getting used to.

The purpose of this article is to familiarize you with some of the general operating principles and components of this very integrated system. We'll start by helping you recognize some common components of CVCC systems. We'll also look at some problems that ought to be eliminated before a carb teardown.

Our sample engine is a 1.5L engine that was married to a manual transaxle and certified for 49 state operation. In addition to the general operation of this particular engine, we'll try to point out some differences found on California and high-altitude engines as we go along. But remember, there's no substitute for the information on that underhood sticker, and engine specific diagrams when things get really sticky.

Keihin Three-Barrel

That Keihin plays a very important role in the CVCC system. It's custom designed. One float chamber feeds the primary and secondary bores to the intake manifold. A third, auxiliary bore is responsible for the fuel needs of the auxiliary precombustion chamber. Proper adjustments of float levels and fuel mixture are critical. Propane enrichment is recommended by Honda to properly set the idle mix. California spec cars may require either a special MAS access tool or removal of the carburetor to drill out the anti-tamper plug.

Look for a follow up article on specific repair and adjustment procedures for the Keihin in a coming issue. Unfortunately, it won't all fit in this one article.

A Talk With Honda Techs

Randy Hall of Hall's Honda in Lancaster, California specializes in Honda repairs and had some interesting observations about the CVCC system.

• Mixture adjustment is the last thing you want to do on one of these cars. Mixture adjustment is seldom done except during a carb overhaul. The most likely problems to hunt down and correct when a car runs badly are the simple ones—dirt in the carb, a fundamental ignition problem, or a kinked or leaking vacuum hose. Always start with the basics.

• Some 1984-86 Civics want to start and fast idle when cold, but die soon after. Check the insulator below the carburetor for a vacuum leak with some spray carb cleaner, and replace it if necessary.

• Check the air intake door on the air cleaner snorkle. Preheated intake air is very important when the engine is cold, and under certain weather conditions. If a customer complains that his car quit running, but restarted and ran properly after sitting for a while, he may have been the victim of carburetor icing. This is most likely to happen when outside temperatures are about 40 degrees F on very humid days. It can happen at warmer temperatures, however. The preheat control has to be working properly to avoid this problem.

• Some folks call it rev-tuning. Some call it the helping hand. You rev the engine and place your hand over the carb throat. If one small piece of dirt is plugging the idle circuit, you may free it. If the bowl is full of crud, however, you'll only finish plugging the rest of the carb with dirt. If this happens, it's a sure sign the carb needed a complete overhaul anyhow.

Ron Money of Motorcars Acura in Cleveland, Ohio added these tidbits from his 15 years as a Honda technician:

• Always check the advance mechanisms in the distributor when troubleshooting. There was a high failure rate of vacuum advance units, especially the ones with the metal housings. If you throw a timing light on the car and can't even see the timing mark, suspect the advance unit. Also check for sticking weights in the centrifugal advance mechanism. Starting in 1979, the advance unit had vacuum applied whenever the engine was running, and failure of these units increased since they were working all the time.

• Don't forget something as simple as fuel percolation when you troubleshoot hard-start-hot conditions. Sometimes a seemingly complicated problem can be cured with something as simple as a better grade of fuel.

• When checking for very small vacuum leaks at the carburetor insulator base, the same propane enrichment tool you use to set the idle mixture works well. It may help you find leaks that may not respond to a shot of carb cleaner.

• On 1984-85 Civics with sticking chokes, check the paper gasket between the choke element and the carb. The gasket can break and fall inside the choke, jamming it.

• Don't forget to check the camshaft lobes for excessive wear. On 1983 and older engines, the number 4 cylinder intake lobe is especially vulnerable to excessive wear when oil changes are ignored. If you disassemble the rocker shaft for cleaning or repair, compare the rocker arms. If one of the rockers has a thicker shoe where it rides on the camshaft lobe, that arm belongs on that same lobe of the camshaft. It's the one next to the distributor.

• 1979 Accords and Preludes had some problems with carbon build up in the precombustion chamber. This carbon would restrict fuel flow and cause a lean mixture in the precombustion chamber.

• If carburetor flooding occurred for whatever reason, check the charcoal canister for saturation. A fuel soaked canister may not be a problem on a cold engine, but will give you a very rich mixture when the engine is hot.

David Beckwith of Beckwith Import Service specializes in Honda repair. He added the following:

• Valve adjustments are important. But they must be done properly. A number of Honda cars that had the

valves adjusted improperly at 15,000 miles are worse off than cars that had their first adjustment at 30,000 miles. Honda recommends that valves only be adjusted when the engine is cold. That means the cylinder head temperature should be less that 38 degrees C (100 degrees F).

To be sure the engine is cold enough, remove the valve cover on a warm engine. If an oil change is included in the service, do that next. This will help cool the engine more quickly. Give the fresh oil on the head a chance to absorb some of the heat. Then place a thermometer in a pool of oil in the cylinder head. If the head temperature is still too high, wait for it to cool, or your valve adjustment will not be accurate.

• The valve adjustment specifications on the underhood sticker are given in both inches and millimeters. Any number of cars have shown up with the valves adjusted at 0.015 inch and sounded like it. The specification on the underhood sticker was 0.15 mm or 0.06 inch. This sounds ridiculously simple but happens more often than you'd think, especially if the customer tried adjusting the valves himself.

• The sedimentor and hose between the air cleaner housing and valve cover had a tendency to fill with condensation and freeze shut on very cold days. The insulation added by Honda helped slow this freezing for a time after shut down in cold weather. If the car sat overnight, however, this hose could freeze solid. Once this happened, the crankcase would pressurize and force oil past the valve cover gasket. If this condition is not corrected by a thorough cleaning of the sedimentor and hose, enough oil can be lost to damage the engine.

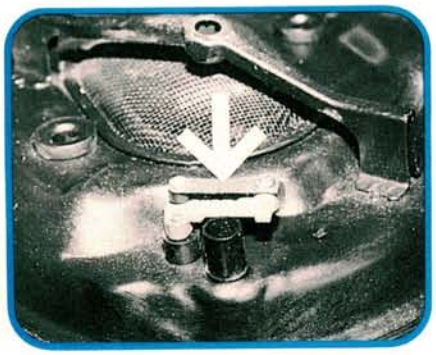
—By Ralph Birnbaum

1

Several Honda technicians complained about replacement air filter cartridges that distort the rubber sealing rings in the air cleaner housing. If the replacement air filter has rubber sealing surfaces top and bottom, it may be too thick. The additional thickness distorts this seal and allows dirt to enter the carb throat.

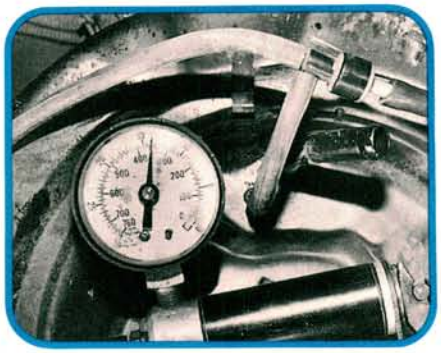
2

Check the air intake door control diaphragm to make sure it isn't ruptured. Even if it holds vacuum, check for smooth movement of the door itself. Make sure it moves from fully open to fully closed with no unscheduled stops in between. A bad intake door can result in cold hesitation or carburetor icing.



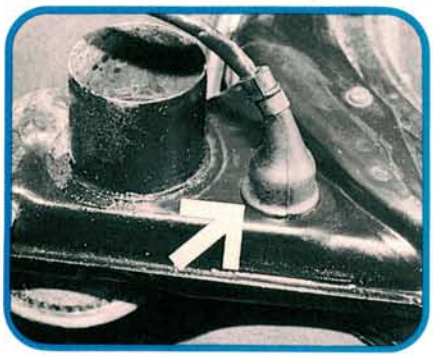
3

We removed the small protective cover on the air bypass valve in the air cleaner so you could see it better. This bi-metallic spring opens when intake air is warm, and vents vacuum away from the air intake door. The door then opens to outside air. A tiny vacuum leak like this also raises hot engine idle slightly.



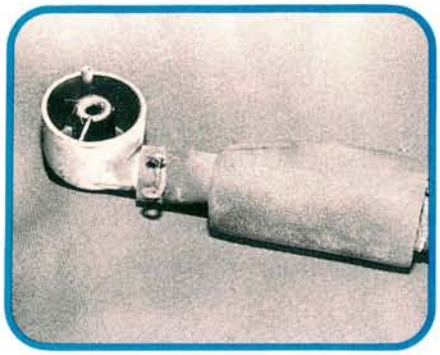
4

Hook your vacuum pump to the delay valve at the tee between the air intake door and the bleed valve. When intake air is cold (forget engine temperature), this circuit should hold vacuum to keep the vacuum door in the warm air intake setting. Cold, wet air can ice the carb even on a warm engine.



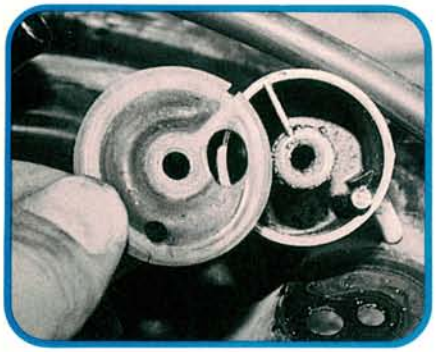
5

Below about 50 degrees F, this air intake temperature sensor connects a 5 ohm resistor to the choke coil heater circuit. This added resistance reduces voltage to the choke coil. The choke element heats more slowly and opens more slowly as a result, providing a richer mixture for a longer time.



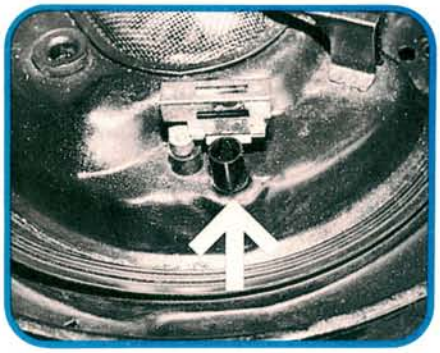
6

This short hose and plastic sedimentor connect the air cleaner and the valve cover. The sedimentor itself screws into the base of the air cleaner and acts as a water trap. The foam insulation on the hose helps hold engine heat and slows icing in the hose that can block crankcase breathing.



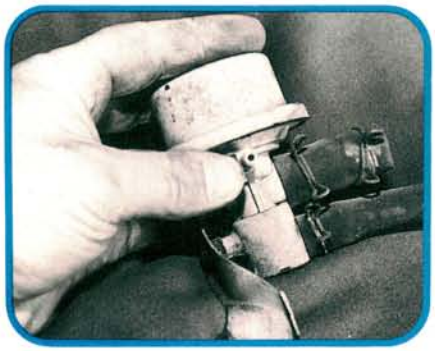
7

The sedimentor is separated from the air cleaner housing by a rubber gasket. This gasket can swell over a period of time and block the holes between the sedimentor and the housing. If you replace the gasket, align it properly so it doesn't block the breather holes. Don't overtighten the screw.



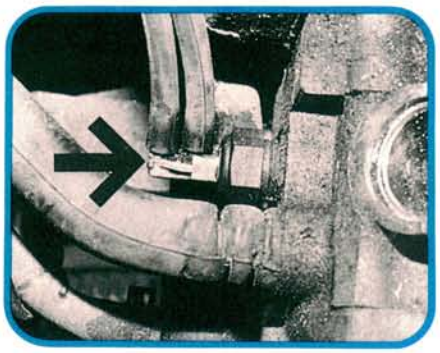
8

One more thing about the air cleaner. The tube right next to the air bleed for the air intake door is connected to the anti-backfire valve. There should be NO vacuum here at idle. If there is, the ABV is sticking in the open position, causing a direct manifold vacuum leak at idle.



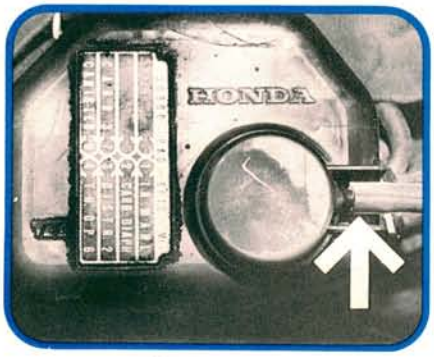
9

The ABV is activated by this control port that connects to manifold vacuum. A *drastic* increase in manifold vacuum opens the valve during deceleration and draws air from the air cleaner directly into the manifold. Normal, constant manifold vacuum at idle should not open the valve.



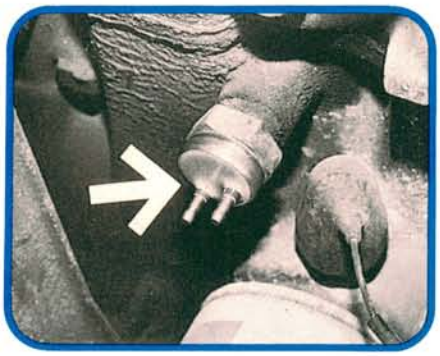
10

The thermo valve is opened and closed by changes in engine coolant temperature. With cold coolant, the thermo valve is open to a vacuum vent. This vacuum leak keeps the choke opener diaphragm from opening the choke too quickly. As the valve closes, the vent closes and full vacuum opens the diaphragm.



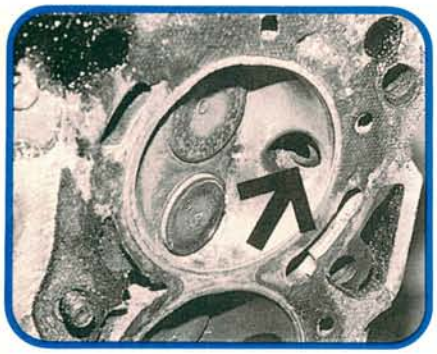
11

That vacuum vent line connects to this cap on the control box cover. There's a small foam filter inside the cap. If the vacuum line from the thermo valve isn't venting vacuum, even though the valve is open, pull the line from the valve to the box and make sure you can blow through it.



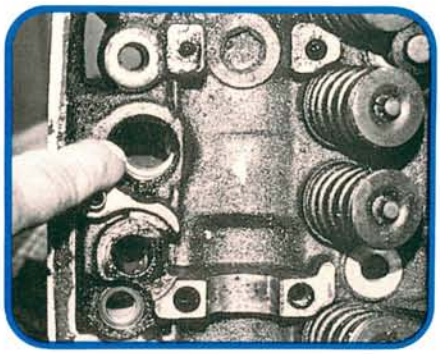
12

The choke opener and the fast idle unloader are not the same thing. The choke opener is operated by the thermo valve, as we noted. The fast idle unloader is controlled by this thermo switch. When the engine is cold, this switch is closed and supplies voltage to an electrically controlled vacuum control solenoid.



13

Fuel from the auxiliary throat on the carb passes through passages in the intake manifold and cylinder head until it reaches these precombustion chambers. The tip of the spark plug fires the mixture through a hole in the prechamber cup. This little charge ignites the main fuel/air mixture.

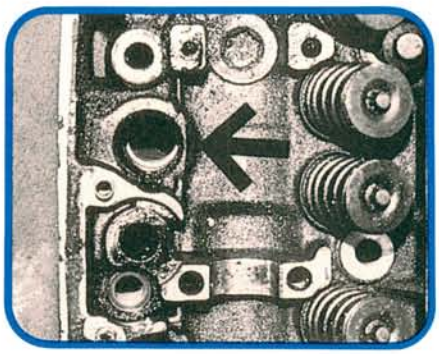


14

Even though Honda made a tool for removing the prechamber cups from the camshaft side, the cups can really carbon up and stick in place. These were really carboned up. The only way we could remove them was to drive them out through the head from the combustion side.

15

Part of the problem with this engine had to do with a bad auxiliary valve oil seal. The spark plug tip was completely coated with oil deposits. It might have glowed in the dark, but it sure wasn't firing. Prechambers can fill with oil or carbon deposits to a point where they shut off the fuel completely.



16

If you do remove the prechamber cups for any reason, clean the bores in the head. This can be a tough job and may take time. Carbon deposits can be very heavy. If the prechamber and auxiliary valve aren't square, tight, and clean in the head when you reinstall them, you'll end up with a vacuum leak.

17

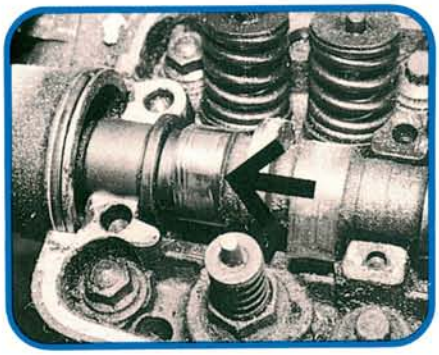
When you reinstall the auxiliary valve and prechamber cup, replace the two copper sealing rings. One seals between the face of the auxiliary valve as shown. The other sits at the base of the bore in the head and seals against the bottom of the prechamber cup.

18

Timing—both camshaft and ignition timing are very important to this engine. Please take a second to check that vacuum advance. We've mentioned this before, but a bad advance can mislead you into advancing the ignition timing so far that you get a nasty ping or cause internal engine damage.

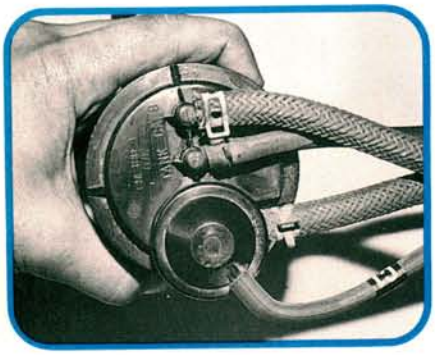
19

Cam belt tension and proper adjustment are also critical. This belt was so loose that it had jumped time. The cam was retarded two full teeth. It still idled, but had no power. It ran like there was a potato stuffed in the tailpipe.



20

We had numerous reports of excessive wear on the lobe next to the distributor. If you do have a miss on number 4, don't forget to check this cam lobe. Sources told us that some wear is to be expected here, and that minor wear may not cause a problem. This one is pretty well trashed, however.



21

Carburetor flooding can happen for any number of reasons: a heavy float, a broken float, or debris in the needle valve. If flooding has occurred, make sure the charcoal canister has not become fuel soaked in the process. You'll end up with an extremely rich mixture no matter how you adjust the carb.

22

One last tip. If the engine has gotten very hot for any reason, the exhaust manifold could be cracked beneath the sheet metal cover. The leaks may be small enough that you won't hear them, but exhaust will enter the preheat tube to the carb snorkel, giving you the equivalent of a huge, full-time EGR valve.