

How Does VTEC Work???

A common question that is asked by many people new to Honda automobiles is what is VTEC and what does it do. Below is a great explanation of what it is and how it works from How Stuff Works

VTEC is an acronym for Variable valve Timing and lift Electronic Control. It is a mechanism for optimizing air/fuel mixture flow through the engine.

An internal combustion engine converts the chemical energy stored in fuel into thermal energy. The increased thermal energy within a cylinder causes the pressure to build. This pressure acts on the pistons and the result is a mechanical force rotating the crankshaft. This mechanical force is measured as crank torque. The ability for the engine to sustain a certain level of crank torque at a certain RPM is measured as Power. Power is the rate at which the engine can do work. This conversion process is not 100% efficient. In fact, only about 30% of the energy stored in the fuel is actually converted into mechanical energy.

Physics says that for a given efficiency level, a higher rate of fuel consumption is needed for the engine to generate power. So it becomes obvious that if you want more power, you need to increase the rate of fuel combustion. One way to achieve this goal is to have a bigger engine. A bigger engine with larger cylinders will be able to combust more fuel per rotation than a smaller engine. Another method is to pre-pressurize the fuel/air mixture and cram it into an existing engine size. Thus even though the cylinder size stays the same, more fuel is combusted per rotation. This second method is referred to as forced induction.

Honda chose to explore another method: keep the engine size the same, but turn the engine faster to consume more fuel. Here is an analogy: You want to move foam peanuts from one bucket to another with a cup. You can increase the size of your cup, compress/cram as much peanuts as possible into the cup each time, or you can just move the cup faster. All three methods move more peanuts. Honda uses the last method. And again, more fuel combusted equals more power generated by the engine.

As the engine speed is increased, more air/fuel mixture needs to be "inhaled" and "exhaled" by the engine. Thus to sustain high engine speeds, the intake and exhaust valves need to open nice and wide. Otherwise you have what is akin to asthma: can't get enough air/fuel due to restrictions.

If high-speed operation were all we have to worry about, Honda wouldn't need to implement VTEC. Indeed, race engines that operate mostly at high RPMs do not utilize any mechanism like VTEC. But street cars used for daily driving spend most of their time with the engine at low RPMs. Valves that open wide for high RPM operation contribute to rough operation and poor fuel economy at low RPMs. These undesirable traits are directly against Honda's design goals.

The solution that Honda came up with is the VTEC mechanism: open the valves nice and wide at high RPMs, but open them not as much at low RPMs. So now you have an engine with smooth operation at low RPMs, and high power output at high RPMs.

And that is basically what VTEC is. It's nothing magical. The idea has been around for a long time. Honda's VTEC is just a very simple, elegant and efficient implementation that is extremely effective at achieving its design goal. Honda automobiles are the first among modern automobiles to utilize this mechanism in such a large scale of distribution.