

# ETHANOL: *DEMONIC OR DIVINE?*

Is E10 an enemy of your collector car fuel system?  
A study by Kettering University attempts to find out.

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**IN** folklore, whenever something mysterious happens it's blamed on a witch, fairy, or even Bigfoot. In the collector car world, ethanol is often the accused — being denounced for everything from poor drivability to corroding fuel tanks, blocked fuel lines and leaking carburetors.

In 2007, Hagerty decided to see if ethanol was truly the arch villain that rendered old cars fuel-leaking garage ornaments. The company partnered with Kettering University's Advanced Engine Research Laboratory to develop the first test that closely duplicated a collector vehicle's use cycle, with the goal of finding out exactly how these fuel systems were affected by long-term exposure to low ethanol-blended gasoline. The initial findings might surprise you.

**TODAY'S FUELS:** Modern gasoline blends are far removed from those for which most collector vehicles were designed. Since 1992, oxygenates — additives to complete combustion — have been required in gasoline as part of a pollution control strategy. Ethanol is a favored oxygenate because it is less toxic than others (such as MTBE) and is a renewable energy source.

However, many of the rubber seals, gaskets, diaphragms and fuel lines used in cars built before the 1980s are known to be incompatible with pure ethanol. What wasn't known was whether lower concentrations of ethanol would degrade these components and corrode the zinc, brass, lead and aluminum of hard fuel lines, tanks and carburetors.

Many studies have been conducted in the past decade to determine the effects of ethanol-blended fuels on modern automobiles. A 2007 Australian study found numerous examples of material incompatibility in new car components immersed in E5 (gasoline mixed with 5 percent ethanol) and E10 (gasoline mixed with 10 percent ethanol). Not surprisingly, a 2008 study funded by the corn- and ethanol-producing state of Minnesota found no ill effects in components exposed to E20 (gasoline mixed with 20 percent ethanol). Neither study addressed the issue of older vehicles and E10, which is the most commonly available fuel today.

**PRELIMINARY RESULTS:** After several months and a full 3,000 hours of testing, the Hagerty study found that there was no difference between the performance of the SU carburetors (from a 1962 MGA) running E10 and the ones flowing E0 (gasoline without ethanol). The carburetor jets were unobstructed, the needle valves and floats were functioning properly and

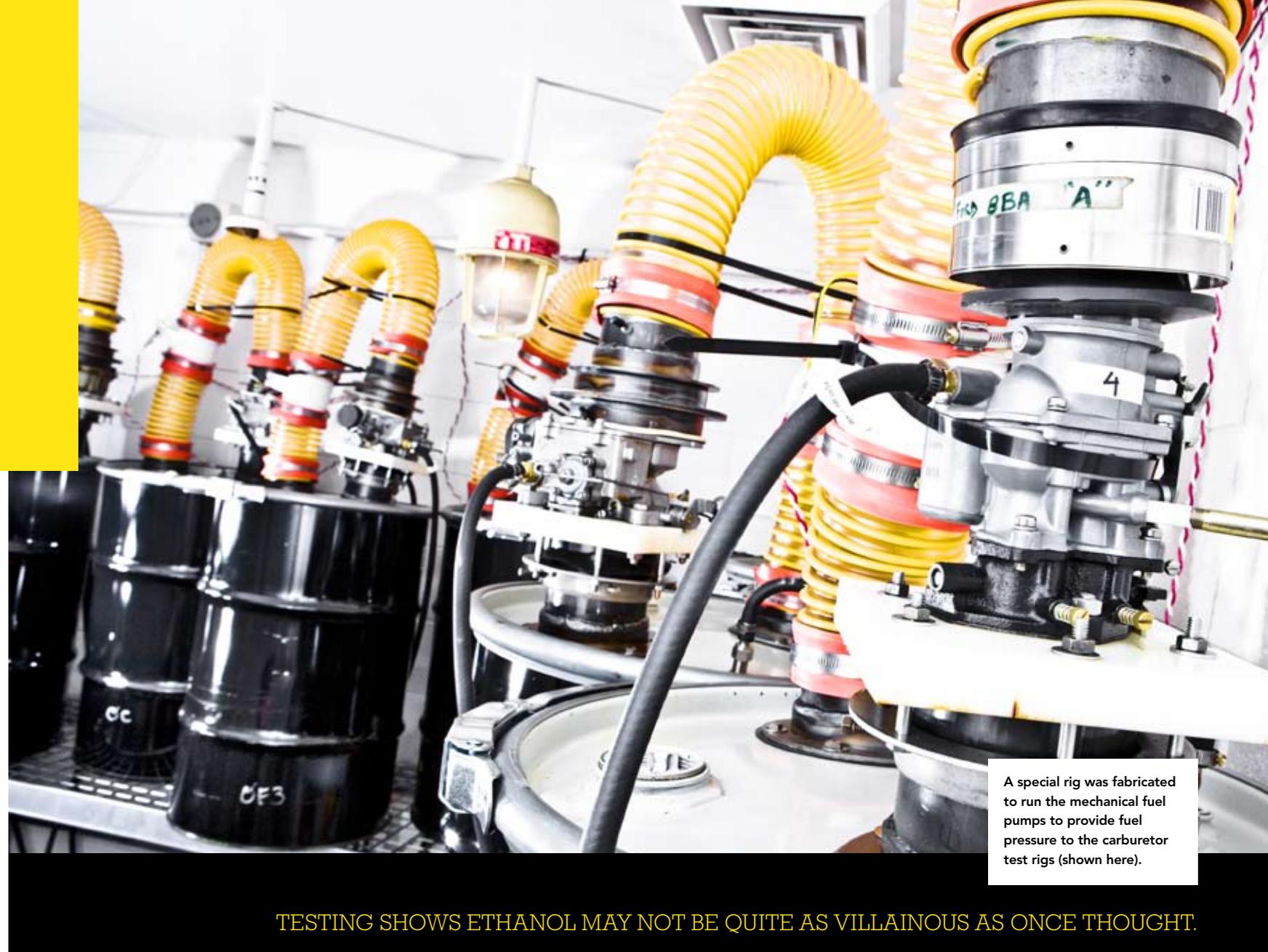
the throttle shafts were moving freely. Both fuel pumps continued to put out more than 3psi and were flowing fuel at an acceptable rate — regardless of the fuel.

Short-term performance on E10 was unaffected, but there were indications that operating an SU-equipped vehicle over a long period of time may require more frequent fuel system maintenance to replace seals and remove varnishes and particulate buildup on components, such as the dashpot damper, the inside of the dashpot and on the throttle shaft. Softening or cracked seals and gaskets could allow leakage, and the varnish could impede throttle shaft operation. The only other noticeable concern was corrosion inside the steel drum used as a fuel tank, suggesting that it may be prudent to coat or seal steel fuel tanks.

According to a publication of the Renewable Fuels Association, "... regardless of the materials selected, fuel system components do not last forever and will eventually deteriorate to the point where replacement is required." This thought is echoed by the Environmental Protection Agency, which suggests upgrading the fuel system of cars built before 1986 with "modern replacement parts." In other words, both organizations (which promote ethanol) acknowledge that using gasoline containing ethanol in older vehicles requires additional — and sometimes costly — measures.

**THE STUDY:** Most ethanol tests, including the above-mentioned Australia and Minnesota studies, are built around long-term immersion of components in various concentrations of ethanol-blended fuels. The Kettering team, led by mechanical engineering professors Dr. Greg Davis and Dr. Craig Hoff, ran a test that more closely simulated the duty cycle seen by most occasional-use vehicles. Exposure to the fuel was followed by a resting period during which parts were exposed to air. Given such exposure, soft parts swelled in use and shrank as they dried, while metallic parts exposed to air were subject to corrosion.

Knowing that the vast majority of collector vehicles are from the 1950s, '60s and '70s, six sample fuel systems were selected: 1948 Flathead Ford, 1958 Volkswagen Beetle, 1962 MGA, 1963 Ford Falcon, 1969 Chevrolet



A special rig was fabricated to run the mechanical fuel pumps to provide fuel pressure to the carburetor test rigs (shown here).

TESTING SHOWS ETHANOL MAY NOT BE QUITE AS VILLAINOUS AS ONCE THOUGHT.

Bel Air and 1970 Chrysler New Yorker. These fuel pump and carburetor combinations represented hundreds of thousands of collector vehicles.

The test was limited to just the fuel system, which meant sourcing carburetors and their corresponding fuel pumps, as well as fuel lines. One set was needed for flow testing with E0, while another was employed for flow testing with E10. A third set was used for splash testing. When the actual testing was complete, metallurgical engineer Dr. Chuck White dissected and examined the parts.

In theory, the flow tests were simple. A test rig design was developed that contained a steel barrel that served as a fuel tank, a fuel pump and its matching carburetor, and a fan and all necessary plumbing. A dozen test rigs were needed because there were six different fuel systems to test with both E0 and E10. Due to the differences in the carburetors, custom mounts were required, which made fabrication a lengthy process.

Another essential study element included drip testing, during which sectioned components were repeatedly sprayed with fuel (both E0 and E10)

for five minutes before drying for 55 minutes. It sounds simple, but it was challenging setting up a safe system through which fuel would be constantly sprinkled onto components and recycled without risking fire or explosion.

A 1,500- to 3,000-hour target was set to ensure the validity of the program, which continued as of late December 2008. Although the SU carburetors and fuel pumps from the 1962 MGA had successfully completed the 3,000 hours of cycling on and off, test results of the other fuel systems will be reported on in future issues of *Hagerty's*.

So what can we conclude thus far? The results from the tests with the SU carburetors and fuel pumps suggest that E10 can be used in older vehicles, although the owner is likely to be faced with the additional costs associated with sealing fuel tanks and cleaning and rebuilding fuel systems more frequently than in the past. However, it's best to be cautious about reading into these preliminary results until the tests of the five other fuel systems are complete. Until then, it's safe to assume that you can continue to drive your collector vehicle using E10; it may just cost you more in the long run.