

# Service-Information Motorcycle



BMW of N.A.  
Service Department

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Fuel Supply  
& Adjustments

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(2134)

For USA and Canada  
Only

## GASOLINE/ALCOHOL IN BOXER AND K MODELS

It has come to our attention that many oil companies are selling gasoline mixed with up to 10% alcohol. This mixture can cause corrosion in aluminum, brass, rubber, and plastic parts -- all of which can be found in our fuel system.

Attached is a reprint of an article from American Motorcyclist Magazine, September 1984.

This excellent report describes the effects of alcohol on motorcycles. A simple test is provided so you or your customers can determine if alcohol is being mixed with gasoline.

Because of the potential damage alcohol can cause, we have warned against its use in our warranty information and rider's manual:

### Warning:

Use leaded or unleaded gasoline, minimum 91 ROZ. Fuels containing ethanol or other oxygenates (e.g. ethers and ketones) or methanol may cause driveability, starting and stalling problems.

Please display a copy of the attached article in your customer waiting area.

Very truly yours,

BMW OF NORTH AMERICA, INC.

A handwritten signature in black ink, appearing to read 'Richard Dampf', written over a horizontal line.

Richard Dampf  
National Technical Manager  
Motorcycle Group

RD:ch

Att.

# Fill 'er up—maybe

By Bob Anderson and Bill Wood

The past decade has presented one fuel dilemma after another for motorcyclists. In the mid-'70s the gas crisis resulted in a sharp drop in octane ratings that posed a serious problem for owners of high-compression bikes from the late '60s. Within a few years, though, manufacturers were devising new combustion chambers that could pull first-rate power out of second-rate gas.

Next came the advent of unleaded fuel, raising concerns about the continued availability of leaded fuel, for four-stroke bikes made prior to the early 1970s, which require small amounts of lead to cushion the valve seat from the impact of the exhaust valve. But again, manufacturers came up with modern materials that could cope with the extra stress.

Now, just when you've started thinking it's safe to go back to the gas station, a new problem surfaces—the addition of alcohol to gasoline.

There are really three distinct elements of the alcohol controversy, corresponding to the three different types of alcohol that you may find in gasoline: ethanol, methanol and isopropyl alcohol. Although they are lumped together under the name alcohol, each of these additives has slightly different characteristics.

To sort out these complexities, we consulted two acknowledged experts on the subject—Dr. Dean Hill, professor of mechanical engineering at New Mexico State University and a consultant to the AMA and other racing organizations on the subject of fuel, and the people at Spectro Oils of America, specialists in keeping motorcycle engines healthy.

Hill notes that the most familiar alcohol fuel is gasohol, a mixture of 90 percent gasoline and 10 percent ethanol (grain alcohol) that has been touted as a way to stretch available fuel resources. Because ethanol can be made from America's plentiful corn crop, gasohol was a hit with conservationists when it was introduced in the '70s. But it was a failure with consumers. Like all alcohol blends, the ethanol in gasohol did raise the octane rating, but it also raised the price of the fuel, and some engines would buck and sputter on the mixture. As a result, within a year of its introduction, many stations were quietly removing the gasohol name from their pumps.

But that was hardly the end of the line for alcohol blended fuels. In the past few years, oil companies have continued to sell gasoline mixed with up to 10 percent ethanol, sometimes labeling it as an alcohol blend, and unfortunately, sometimes not labeling it at all. As if that isn't confusing enough, methanol (wood alcohol) and isopropyl alcohol (which most of us know as rubbing alcohol), also have found their way into the gasoline we buy, and these two additives rarely carry a label.

So what, you ask. If the oil company

wants to sell me an alcohol mixture instead of straight gasoline, why should I complain? If it was bad for my motorcycle, they wouldn't be allowed to sell it, right? Wrong. Alcohol fuels have some side effects that may make them undesirable and even hazardous when used in your bike.

For instance, all alcohols, but particularly methanol, have a corrosive effect on aluminum, brass, rubber and plastic, materials which are used widely in motorcycle engines and fuel systems. Hill says this corrosion isn't a great problem when fuel is running through the engine, but sitting in the bike between uses it can attack the fuel lines and carburetor.

"Racers who use straight alcohol fuels know that they have to flush out the engine and fuel system after each use," Hill says. The potential for corrosion from a blend that includes about 10 percent alcohol is much less than with straight alcohol, but over a long period of time this corrosion may become a problem.

But that's only the tip of the iceberg. Not all alcohols mix equally well with gasoline, and that can have far more serious implications.

Hill says that isopropyl alcohol makes the ideal alcohol for fuel blending, since it mixes readily with gasoline in any proportion and stays in suspension well. Unfortunately, it's also the most expensive alcohol to produce, so it's rarely found in pump gas.

At the opposite extreme, the worst alcohol for gasoline mixtures is methanol. Hill notes that even at mixture ratios as low as 5 or 6 percent, methanol may begin to separate out of the gasoline mixture. Chemicals called co-solvents can help reduce this tendency to separate, but they don't eliminate it entirely. For this reason, many experts in the field recommend adding no more than 5 percent methanol to gasoline.

However, there's no guarantee that the fuel you buy meets that recommendation, because it can be made from surplus natural gas, methanol is the

cheapest alcohol to produce these days. And, like all alcohols, it does raise the octane of the fuel somewhat. The attraction of raising octane while lowering the price has been irresistible to some oil companies. But more importantly, gasoline distributors have found that "cutting" gasoline with methanol can increase their profit margins. For those reasons, Hill says the percentage of methanol in fuel tends to increase as it passes through various stages in the supply line. That means fuel which started out as an acceptable 3-percent methanol mixture may have 8 percent or more methanol by the time you put it in your motorcycle.

Aggravating the problem of fuel separation caused by too much methanol is wood alcohol's affinity for water. In fact, methanol makes such a good water magnet that, if left uncovered, it will draw moisture right out of the air. This can be a useful characteristic. Drivers in Northern states often add a small amount of an alcohol-based product, commonly called "dry gas," to their cars' gas tanks in winter. The alcohol combines with any moisture in the tank and keeps it from freezing, thereby eliminating gasoline freeze.

But moisture added to an alcohol-blend fuel can increase the chances of the alcohol separating from the gasoline. Hill says that in the case of methanol, which doesn't mix with gasoline very well to begin with, even a small amount of added moisture can trigger separation. And even though ethanol doesn't attract water nearly as strongly as methanol, grain alcohol starts out with a handicap of its own. Hill points out that without an expensive second distilling process, ethanol cannot be made more than 95-percent pure. The other 5 percent is, you guessed it, water.

The end result is that any water added to an alcohol-blend fuel, whether from improper distillation, condensation in the fuel tank or humidity in the air, raises the odds that the alcohol and gasoline will separate. In that separation, the alcohol and water will sink to the

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bottom of the service-station underground tank, your bike's gas tank or perhaps the carburetor float bowl.

When that happens, you could be in

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## Gasoline distributors have found that 'cutting' gasoline with methanol can increase their profit margins.

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for serious trouble. That nearly pure alcohol can drain directly into your fuel lines and go straight to the engine. An engine can be designed to run, and run very well, on straight alcohol—just ask the Indy-car racers or dragster pilots who use it regularly. But unfortunately, your motorcycle's engine is designed to burn gasoline.

The difference between the two fuels is in the air-fuel ratio they require. Gasoline works best with a ratio of between 12:1 and 15:1. That means your carburetor is sending 12 to 15 times more air than fuel to the engine. Straight alcohol, on the other hand, burns best at a ratio of 6:1. Since your carburetor doesn't know whether the fuel coming in is gasoline or alcohol, it continues mixing at the gasoline rate. When the alcohol arrives, that results in an exceptionally lean mixture.

If you're lucky, the bike won't run on that mixture at all, because, as any backyard mechanic knows, leaner mixtures mean higher operating temperatures. Under a heavy load, that can lead to burned pistons and seized engines.

The news is even worse if you have a two-stroke motorcycle. Spectro Oil officials became interested in this aspect of the problem when a customer with a two-stroke bike called to complain about what he thought was a bad batch of the company's pre-mix oil. He said he had used the oil for years and had carefully mixed the oil and gas in the correct proportions for his engine, but his bike had recently seized.

Testing by Spectro showed that the customer had unknowingly bought an alcohol-blend fuel and that moisture had entered the system, causing the alcohol to separate from the gasoline-oil mixture. That meant the engine was sucking in straight alcohol, at a very lean ratio, without any lubricating oil.

Many two-stroke motorcycles now have oil injection systems which would eliminate the lack of pre-mixed lubrication, but they still face the potential of lean mixtures from alcohol fuels. And this may be a good time to consider the fuel you're putting into other two-stroke engines—your lawnmower, outboard-boat motor, chain saw or snowmobile.

What do motorcycle manufacturers have to say about alcohol-blended fuels? We contacted makers of the six most popular bikes in this country: BMW, Harley-Davidson, Honda, Kawasaki, Suzuki and Yamaha, and they were unanimous in their opposition. Typical of their responses was this comment from Carla Harman, public relations manager for BMW of North America: "We specifically warn against the use of gasohol, alcohol additives or any fuel containing alcohol. Alcohol's use results in damage to engine and carburetor parts."

Now that you know alcohol-blended fuels can be a problem, the next question is how to avoid them. If you live in one of the 22 states listed in the chart on this page, your state government is helping you by requiring retailers to label fuels containing minimum percentages of alcohol. Some of those regulations are very strict: for instance, Ohio requires labeling of fuel that has more than 0.3 percent (three-tenths of 1 percent) ethanol or methanol. In other states, the labels aren't required until alcohol levels reach 10 percent, and some states don't require labeling of methanol mixtures at all.

Without an accurate label, there's no easy way to avoid alcohol fuels. Buying your gas from a brand-name station can help, especially if you buy a brand that specifically advertises it does not use alcohol. But you should be aware that oil companies sometimes trade batches

of fuel to relieve logistical and demand problems. That means a Brand X gas station may be selling Brand Y gas one week and Brand Z gas the next. Since the gas-station owner often isn't aware of these switches, he probably won't even know if a bootleg alcohol-blend shipment is delivered to him.

Meanwhile, there are a few things you can do if you get a batch of gas that disagrees with your bike's engine. The easiest way to deal with the problem is to keep adding good fuel whenever possible to dilute the mixture. You can also try dumping out or draining the float bowls on your carburetors, or switching the petcock to reserve and draining some of the bottom mixture right out of the fuel tank.

Finally, if you'd like to be certain that your bike swears off alcohol, you can perform the test described on the page at left. You may get some strange looks from the gas-station attendant when you take a sample before filling up your tank, but that's better than putting up with a bucking engine—or worse.

Like the problems of octane ratings and unleaded fuel that have faced motorcyclists over the past decade, the long-term solution to the alcohol-fuel problem probably will come from the manufacturers. Even today, some bikes are more tolerant of alcohol than others. In the meantime, our best advice is to approach each fill-up with caution, and watch for symptoms of alcohol-ism in your engine.

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### Fighting alcohol-ism

The use of alcohol as an additive in gasoline has prompted 22 states to pass laws requiring the labeling of such alcohol blends. In addition, a number of states are considering such labeling acts. These laws vary widely on the amount of alcohol allowed without labeling.

If you'd like to see such a bill passed in your state, or if you're not satisfied with its existing law, contact your state officials. After all, it's your engine and you shouldn't have to play alcohol roulette every time you fill up.

## Gasoline/alcohol: A simple test

Researching this article naturally led us to be concerned about the gasoline we put in our own bikes. And that started us wondering: Is there any simple test that will reveal the presence of alcohol in gasoline? Here's the answer Dr. Dean Hill gave:

1. Take a graduated cylinder (a glass container that works like a very accurate measuring cup and is commonly available at photo supply stores) and fill it halfway with the fuel you wish to test. The capacity of the graduated cylinder doesn't matter, as long as you fill it exactly halfway.

2. Fill the cylinder the rest of the way with tap water. Again, take extra care to measure accurately.

3. Cap the cylinder and mix the gasoline and water thoroughly. Five or 10

seconds of shaking is enough. Then set the cylinder down and wait a few minutes for the gasoline and water to separate.

4. Look closely at the division line between gas and water. The gasoline will have floated to the top, but the dividing line should still be exactly halfway up the cylinder. If the dividing line is above the halfway mark, that means that some of the fuel you put in has mixed with the water. Hill says that part is certain to be alcohol.

If your graduated cylinder holds 100 milliliters (like ours did), then you put in 50 milliliters (ml) of fuel and 50 ml of water. If the dividing line settles at the 55-ml mark, that means 5 of the 50 ml of fuel was alcohol, and that's a 10-percent alcohol blend.

In a test of six gasoline samples purchased near the AMA office, five samples turned up no measurable amount of alcohol (we ignored any changes of less than 1 ml as possible errors in our accuracy). The sixth sample, purchased from a pump that was marked "Contains up to 10-percent ethanol," showed a change of between 4 and 5 ml (or between 8 and 10 percent).

That honesty on the part of gasoline dealers may be a result of Ohio's strict law requiring labeling of alcohol-blended fuels. Tests conducted in a state without such a labeling law may turn up completely different results. In any case, if you don't trust advertising claims, labeling laws or the honesty of your dealer, this test is one way to be certain your bike stays off the bottle.

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