

# Gasoline – What to use in the Corvair.

By Bob Nichols

Effective January 31, 2023

This article will attempt to address concerns about using today's gasoline in your Corvair.

While the addition of ethanol to gasoline is often discussed, there are other issues arising from the changes in gasoline formulation since the 1960's. The following will discuss the fuel octane, alcohol in gasoline, oxygenated gasoline, and gasoline deterioration.

**History** – Before WWII GM research experimented with high compression engines to improve fuel mileage. The research engines required a higher-octane fuel compared to what was commonly used by vehicles at the time. High-octane fuel cost more to produce and negated the savings from lower fuel consumption. This discouraged further development at the time.

During WWII higher octane gasoline was produced for aviation engines to meet the demand for aircraft to fly farther and faster on less fuel. After WWII refiners were left with over capacity to make higher octane fuel. At the same time the economy was rebounding strongly and the consumer was willing to spend money on higher performance vehicles requiring higher octane fuel. Vehicle manufactures satisfied the demand by producing higher compression engines.

**Octane vs. compression ratio** - The higher the compression ratio, the greater the fuel air compression pressure resulting in more power for a given amount of fuel and air, if the mixture burns properly. When the octane is not adequate for the compression pressure, then the mixture explodes, or ignites prematurely, and can damage the engine. Increasing the octane makes the fuel burn smoothly and will also prevent pre-ignition before the spark plug ignites the fuel air mixture at the proper time.

- **Detonation** – This term is used when the gasoline and air mixture explode. It typically makes a metallic noise like a hammer hitting metal and is commonly called "pinging" or "knock."
- **Pre-ignition** – This term describes when compression ignites the fuel before the ignition spark does. It can cause severe damage to pistons if it continues for more than a brief period. It rarely makes a noticeable sound, but creates high pressure and temperature at the piston that can be destructive.

**Regular vs. Premium** - About 1948 several different octane grades of gasoline became available, but two octane grades were the most prevalent: "REGULAR" and

“PREMIUM”. Regular was typically the lowest octane fuel and premium usually referred to the highest octane fuel.

**Octane Ratings** – The 1960’s gasoline octane ratings were derived differently versus today’s gasoline octane ratings posted on station pumps. During the 1970’s the octane rating process was changed when gasoline was revised to “get the lead out”. The new octane rating is called the Anti-Knock-Index (AKI).

**Getting the lead out!** – In the 1920’s GM and Standard Oil developed the additive tetra-ethyl-lead to boost gasoline octane (sometimes called Ethyl gasoline). When health agencies determined children with high levels of lead in their bodies had developmental problems, the sources of lead contamination were examined. One source was unacceptably high lead concentrations in the air near high traffic thoroughfares. Regulations lowered the amount of lead in gasoline. Eventually no lead gasoline was required to prevent contamination of vehicle emissions reduction equipment. Gasoline octane levels dropped (as well as engine compression ratios) until acceptable alternatives were developed to raise gasoline octane.

**What octane fuel do I need for my Corvair?** – In the 1960’s U.S.A. fuel octane was determined per the Research Octane Number (RON). Later a “real world” Motor Octane Number (MON) was used to better determine a fuel’s octane. This article will not go into the reasoning of why both numbers were added, then divided by two to create the Anti Knock Index number (AKI) that is now posted on U.S.A. and Canadian gasoline dispensing pumps. AKI is not a worldwide standard. While illegal for use in road vehicles, inquiries are made about using aviation 100LL gasoline. Note that aviation gasoline uses the MON octane rating system, not AKI or RON.

**What AKI octane number is appropriate for my Corvair?** - By looking at the various tables online, a “guesstimate” can be made.

**NOTE:** This following guide lines have no scientific evaluation to confirm them. At sea-level, the Corvair engines with a specified compression of 8.25 to 1 use a fuel with an octane that generally corresponds to RON 93 or **today’s 88 AKI**. The Corvair engines with a specified compression of 9.1 to 1 use a fuel that generally corresponds to RON 96 or **today’s 91 AKI**. This guideline is not applicable to the turbocharged engine. Modifying an engine, its carburetion, or ignition, will impact the required fuel octane.

**Alcohol in gasoline** – Ethanol is a type of alcohol primarily used to mix with gasoline. Its effects on fuel system flexible seals and hoses, corrosive issues, and its ability to attract water will be discussed.

**Ethanol** – Ethanol has been used as a fuel in internal combustion engines since the early 1900’s. In its pure form it is NOT corrosive to metal. However, ethanol must be “denatured” for vehicle use that requires additives to make it undrinkable. These additives can be a source of metal corrosion. There is no information the author is aware of that specifies how corrosive ethanol used in gasoline is, but observations

from people with old cars indicate is not an issue if the fuel is not allowed to deteriorate, the same rule applies to gasoline without ethanol.

Ethanol tolerant flexible fuel seals, fuel hose, carburetor inlet valve, and accelerator cup parts are available. At this time only electric fuel pumps are rated for ethanol use. The ethanol status for the Corvair mechanical fuel pumps is unknown. Be aware that non-ethanol approved fuel system parts are also sold!

It is suggested modern seals and hoses that are rated for different fuels, including ethanol be used. NOTE: Some Corvair vendors are now selling ethanol resistant carburetor accelerator pumps cups identified by their blue color.

The consensus is 10%, or less, ethanol in gasoline is not harmful to old car fuel systems using ethanol approved flexible fuel items. Gasoline with a 10% or greater volume of ethanol in gasoline is NOT recommended for use in an old car.

**Water in the fuel** - There is a misconception that ethanol creates water in gasoline. Water in a gas tank has always been an issue with a "vented" fuel system, before ethanol was added to gasoline. Air moving into the tank to replace gasoline being consumed has moisture in it. As fuel evaporates it cools the air just above it and moisture in the air can condense on, and sink into, the gasoline (water is heavier than gasoline). The problem is compounded when a car sits for periods of time and can result in excess water in the fuel system and metal corrosion.

Ethanol will absorb small amounts of water and hold it in suspension. Ethanol is often sold in cold winter climates as fuel "antifreeze" available in small cans to melt ice and absorb the water in fuel tanks and fuel lines. Once the ethanol is saturated with water any excess water must be absorbed with additional ethanol or it remains in the fuel system low spots.

**Oxygenated Gasoline** – The term "oxygenated" is applied to an additive that reduces gasoline emissions. Primarily carbon monoxide emissions. In geographic areas that are prone to temperature inversion layers (that trap pollution), oxygenated fuels are required (typically during the Winter). Different additives have been used; some are now banned as they were found to be harmful to people. Today the most common additive is an alcohol type. The fuel octane rating can be higher vs. non-oxygenated fuels.

**Gasoline Deterioration** – Many different chemicals make up gasoline and the mixtures vary depending on requirements for emissions and octane in different locales. Gasoline does deteriorate with time. Fuel refiners' information should be reviewed to determine how long a brand of gasoline can sit in a vehicle tank and be consumed without damaging the fuel system or engine. The average consensus is a maximum of three to four months after which the gasoline should not be used.

Fuel preservative additives are available, but the consumer must determine if they are appropriate to use. No known gasoline preservative extends gasoline storage indefinitely.