



How To: Detect and Avoid "Pre-Ignition" In Your Engine

By Dick Ray

You might think that pre-ignition would be unlikely in a low-tech, low-compression engine such as a Fairmont single-cylinder, two-stroke. I learned last Labor Day that it can happen.

Pre-ignition is when something inside the combustion chamber is hot enough that it can ignite the mixture before the spark occurs.

This is not to be confused with detonation which occurs when the additional heat from compressing the mixture or using low octane fuel causes it to explode (as in a diesel) rather than burning as it should. Detonation is very destructive to an engine, and remains unlikely due to modern fuels.

The most likely source of pre-ignition is a piece of carbon on the piston which is the hottest thing in the engine. Both two- and four-stroke model airplane engines have a glow plug whose function is to purposely ignite the mixture in this fashion since they have no other ignition system. However, it is not recommended for engines which have to operate over a wide range of speeds.

The trouble with pre-ignition is that you no longer have any control over the timing. If the mixture ignites too soon, it causes the combustion chamber temperature to rise. This in turn causes the carbon to glow hotter and perhaps ignite even sooner, compounding the problem.

It has long been known that a gasoline-fueled two-stroke engine develops the maximum power when operated on the lean side. It has also been made abundantly clear to those seeking maximum power that overdoing it a little leads to a piston with a large hole in the middle. This may be more often due to detonation in high compression engines but could also be precipitated by pre-ignition.

I would personally like to obtain all the power that is available from my RO engine, but I realize the folly of trying to obtain great increases in power.

Instead I would like to see this 45-year-old engine run regularly for another 45 years. This can only be achieved by protecting the insides from conditions known to be harmful.

Okay, back to last Labor Day. While proceeding up the mild grade from Mingo Junction on the ex-Wheeling and Lake Erie trackage on a hot day, and going fast (a relative term considering that the single-cylinder engine is pushing a full cab through the air) I accidentally bumped the ignition switch to OFF. I immediately turned it back on because the sound changed slightly and this is a common happening due to the switch placement. Then I realized that the engine had not quit firing! I turned the switch off again and, sure enough, the engine continued to fire. Pre-ignition for sure! Due to a knowledge of all the bad things that can happen, I immediately reduced the throttle and timer settings from their maxed-out positions and tried shutting the ignition off again. No change.

Then I did the only thing that is effective in that situation. I richened the mixture very, very slightly and found that the pre-ignition condition went away. In the best scientific tradition, I recreated the original problem and the solution with the same result.

Settling back with my pulse back to normal, I recalled that the engine had used more water than usual that day, and I realized that possibly, due to an excessively lean mixture, the engine had been operating in a mode that created significant extra heat in the combustion chamber without making much extra power. By richening the mixture, the power may have decreased imperceptibly but the heat dropped enough to prevent pre-ignition.

Later, when reading about the knock-sensing ignition system in my automobile, I learned that it first richens the mixture slightly and then retards the timing. Apparently, the Robert Bosch Co. agrees with the cure for the problem of pre-ignition.

This experience clarifies an experience I had last summer with a different single-cylinder car. On a long run, it seemed to use more water than fuel. No wonder! It was running dangerously lean while humming right along.

From now on I'm going to forego that last one m.p.h. and richen the mixture while running fast.