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Automotive Definition Of The Term Detonation

The AERA Technical Committee offers the following information on the automotive term detonation. Don Goodsell gives the definition below in his book Dictionary of Automotive Engineering. This book can be purchased at bookstores under ISBN 1-56091-683-4 and offers the following reference.

Detonation: Rapid and uncontrolled combustion. Detonation can occur in the cylinder of a spark ignition engine when operating on a fuel of inadequate octane rating, or with ignition timing too far advanced. It is informally called "pinging". In discussions on this condition in the AERA technical department, we refer to detonation as an abnormal combustion process. Where as, normal is a controlled amount of air/fuel ratio mixture entering each cylinder at the correct operating chamber temperature. The compressed, "charged" mixture is then ignited at a precise moment by the ignition system, that starts a small flame kernel which is followed by a smooth controlled burning, when the combustion process is normal. Anything that alters the air/fuel ratio, chamber temperature or ignition timing, will effect the combustion process.

The following are items that will effect the combustion process; camshafts that alter valve timing from OEM specs, a different combination of pistons or cylinder heads altering compression ratio, wrong octane gasoline, engines that burn oil, a non functioning EGR system, vacuum leaks or restricted exhaust systems. Listed below are some of the results of abnormal combustion process in a gas engine.

1. Piston, Ring Land or Piston Ring Breakage.
2. Head Gasket Armor Distortion or Burn Through.
3. Tuliped Intake Valves.
4. Burned Cracked or Distorted Exhaust Valves.
5. Cylinder Head Cracks in Combustion Chamber.
6. Connecting Rod Bearing Damage on Upper Shell first, leads to complete failure.

Once detonation starts, it propagates with each combustion process. As the temperature and pressure in the cylinder increases, creating a violent uncontrolled burning. The exhaust stroke is no longer capable of evacuating enough temperature from the combustion chamber. Modern engines have more electronic controls for engine management systems than engines built even ten years ago. Those controls, when operating correctly, prevent detonation by retarding the ignition system. Engines without electronic spark control rely on the driver to determine if detonation is present and to correct the problem.

The AERA Technical Committee

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