

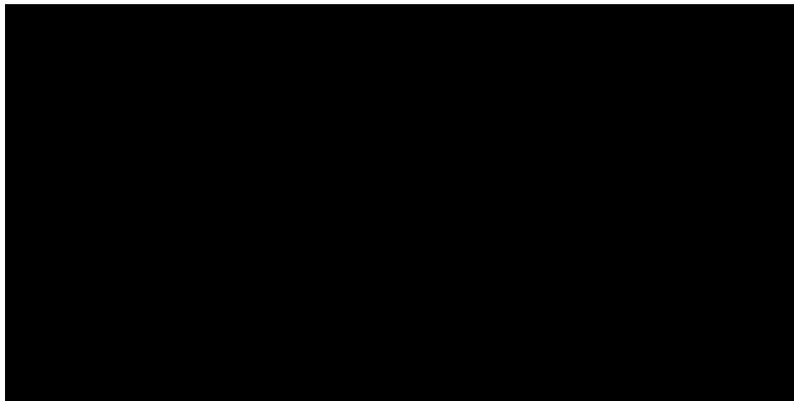
## Carbon Deposits - Overview

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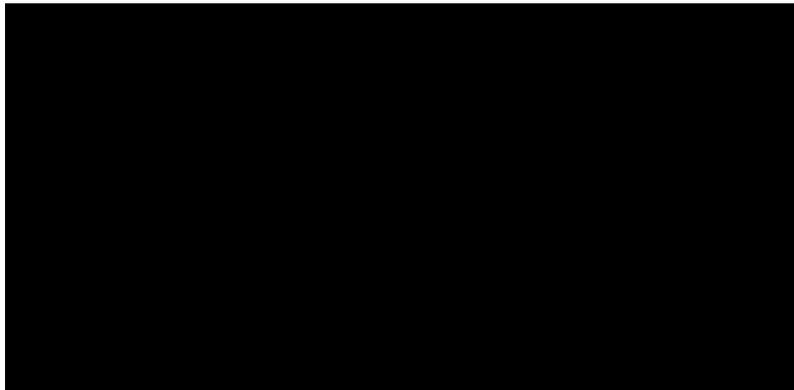
Carbon deposits have been observed, studied and researched since the IC engine was first invented over 100 years ago. They were a subject of great study for Charles Kettering at General Motors (See attached). Further, the IC engine in all its forms was never designed for emission controls. One of the un-intended consequences of EGR and PCV, while they do improve air quality, is the dirty/carbon up the engine which contributes to reduced fuel economy, reduced performance, increased emissions and shorter engine life.

[Exhaust gas recirculation - Wikipedia, the free encyclopedia](#)



**Exhaust gas recirculation - Wikipedia,  
the free encyclopedia**

[Crankcase ventilation system - Wikipedia, the free encyclopedia](#)





- \* Lubricant Quality-Engine oil volatility
- \* Engine Maintenance Schedules
- \* Thermal Stressing of Fuels
- \* Wall Wetting/Fuel Impingement
  
- \* Fuel Droplet Disintegration

These are just a few, the list gets longer when you add conditions that occur with engine cycles and boost.

### **Where Do Carbon Deposits develop in the IC engine?**

- \* The Intake Valves
- \* The Turbocharger
- \* The Combustion Chambers
- \* The Intake Ports
- \* The Exhaust Recirculation System and Valve
- \* The Positive Crankcase Ventilation System and Intake Manifold
- \* The Exhaust Catalyst
- \* The Diesel Particulate Filter

### **What do Carbon Deposits do?**

- \* Carbon Deposits cause the components they are deposited on to run Hotter. Thus engines with deposits run hotter.
- \* Carbon Deposits Reduce certain engine component efficiency
- \* Carbon deposits cause Engine Misfire
- \* Carbon Deposits can significantly alter the fuel calibration further reducing fuel efficiency

- \* Carbon Deposits absorb and desorb fuel reducing fuel efficiency, engine performance and increasing the work load on emission controls. In some cases fuel efficiency has been observed being reduced in excess of 30%
- \* Emission controls fouled by Carbon Deposits can increase emission output
- \* Carbon Deposits can reduce engine lubricant life from soot loading thus reducing piston ring efficiency (reduced compression, reduced fuel efficiency) and reduced engine life. (see attached MIT report).
- \* In rare cases Carbon deposits have been responsible for catastrophic engine failure

### **Known and Unknown**

- \* We know all IC engines have Carbon Deposits
- \* We know Carbon Deposits penalize fuel economy, Engine performance and Emission output
- \* We know that no two engine are the same and no two engines will have the same deposit problems some engine will be far more severe than others
- \* We do not know how much fuel a carbon deposit absorbs and desorbs and there is no known test to calculate this loss.
- \* We do not know of any studies done to calculate the percentage of fuel economy loss in the fleet caused by Carbon deposits
- \* **We know that properly removing these deposits can significantly restore fuel efficiency, Engine performance and restores emission output profile (reduce emissions)**