An introduction to inductive ignition.

There are a number of ways to control engine ignition on large gas engines. This factsheet introduces inductive ignition systems, with a brief history and analysis of the major advantages of this type of system over other types of ignition system.

Inductive ignition systems have existed since 1908, developed by Charles Kettering who also developed the first practical engine driven generator.

The design has been improved over the years but the most significant recent development has been the introduction of Insulated Gate Bipolar Transistors (IGBT); these have allowed the design of extremely accurate, high spark energy inductive ignition systems.

A single operation is carried out by a transistor turning on the current to the ignition coils primary winding. This 'charging' stores energy in the coils magnetic circuit. The current is then switched off. As the magnetic field begins to collapse the coil tries to resist the drop in current causing the voltage in the secondary winding to rise rapidly, this high voltage breaks down the air/fuel mixture in the spark gap allowing a spark to pass, causing ignition of the air/fuel mixture.

The most significant advantage of inductive ignition systems is that inductive coils are generally more efficient than capacitive discharge coils as they can provide longer spark duration that can ensure complete combustion, especially on lean burn and turbo charged engines. The ability to provide longer spark duration is because inductive coils only provide enough energy to cross the spark gap; the remaining energy from the ignition coil is used to maintain the spark. Capacitive discharge coils release almost all of their energy instantaneously, therefore considerably reducing the amount of energy available to maintain the spark.

With inductive ignition systems more energy can be delivered to the secondary winding of the coil than in a capacitive ignition system. In fact, with the same power supply current draw, up to five

times more energy can be delivered to the secondary winding of an inductive ignition coil than to a capacitive discharge coil. Typically a capacitive discharge system will deliver a maximum of 10 millijoules of energy compared to an inductive ignition system delivering more like 50 millijoules of energy and potentially in excess of 100 millijoules. This large difference in supplied energies will mean an inductive system can provide spark duration of 2000 microseconds or more in a single spark, compared to 600 microseconds for a capacitive system.

With inductive ignition systems the time taken to charge the ignition coil is called the 'Dwell'. This dwell can be increased or decreased for differing engine applications. If longer spark duration is required to improve combustion of lean mixtures or engines with large cylinders the dwell time is increased, inputting more energy into the primary coil. Dwell time is decreased when there is more than enough spark energy to combust the mixture, this decrease will reduce spark plug wear, therefore increase spark plug life.

The high energy and long, programmable spark durations are a considerable advantage since they provide better ignition of lean or non-homogenous air/fuel mixtures. In many cases engines that are unable to meet emission standards with capacitive discharge systems can be bought into compliance with electronic inductive ignition systems such as those manufactured by Gill Sensors & Controls.