DIESELING IN SPARK-IGNITION ENGINES

A gasoline (spark ignition) engine can sometimes act as a compression ignition engine under abnormal circumstances, a phenomenon typically described as "pinging" or "pinking" (during normal running) or "dieseling" (when the engine continues to run after the electrical ignition system is shut off). This is usually caused by hot carbon deposits within the combustion chamber that act as would a "glow plug" within a diesel or model aircraft engine. Excessive heat can also be caused by improper ignition timing and/or fuel/air ratio which in turn overheats the exposed portions of the spark plug within the combustion chamber.

Fuel and fluid characteristics

Diesel engines can operate on a variety of different fuels, depending on configuration, though the eponymous diesel fuel [[12]] derived from crude oil [[13]] is most common. Good-quality diesel fuel can be synthesised from vegetable oil [[14]] and alcohol [[15]]. Biodiesel [[16]] is growing in popularity since it can frequently be used in unmodified engines, though production remains limited. Petroleum-derived diesel is often called "petrodiesel" if there is need to distinguish the source of the fuel.

The engines can work with thicker, heavier oil, or oil with higher viscosity, as long as it is heated to ease pumping and injection. These fuels are cheaper than clean, refined diesel oil, although they are dirtier. The biofuels straight vegetable oil (SVO) and waste vegetable oil [[17]] (WVO) can fall into this category. Moving beyond that, use of low-grade fuels can lead to serious maintenance problems. Most diesel engines that power ships like supertankers are built so that the engine can safely use low grade fuels.

Ethanol [[18]] is also used in some cases, since it has a high octane rating [[19]] which means it can be highly compressed before spontaneously igniting. One way this is used is in E95 fuel [[20]] which actually contains 5% gasoline along with 95% ethanol.

Normal diesel fuel is more difficult to ignite than gasoline because of its higher flash point [[21]] , but once burning, a diesel fire can be extremely fierce.

Diesel applications

The vast majority of modern heavy road vehicles (trucks), ships, large-scale portable power generators, most farm and mining vehicles, and many long-distance locomotives have diesel engines. However, in the U.S. they are not as popular in passenger vehicles as they are in Europe as they are perceived as being heavier, noisier, of having performance characteristics which makes them slower to accelerate, and of being more expensive than petrol vehicles. In addition, before the

mandatory reduction of sulphur in on-road diesel fuel to 15 parts per million, which will start at 15 Oct 2006 (2006-10-15) in the U.S. (1 June 2006 (2006-06-01) in Canada), diesel fuel used in North America has higher sulphur content than the fuel used in Europe, effectively limiting diesel use to industrial vehicles.

In Europe, where tax rates in many countries make diesel fuel much cheaper than petrol, diesel vehicles are very popular and newer designs have significantly narrowed differences between petrol and diesel vehicles in the areas mentioned. One anecdote tells of Formula One driver Jenson Button, who was arrested while driving a diesel-powered BMW coupe at 230 km/h (about 140 mph) in France, where he was too young to have a petrol-engined car hired to him. Button dryly observed in subsequent interviews that he had actually done BMW a public relations service, as nobody had believed a diesel could be driven that fast. The BMW diesel lab in Steyr, Austria is led by Ferenc Anisits and is considered to be a leader in development of automotive diesel engines. Similarly, Mercedes Benz had a successful run of diesel-powered passenger cars in the late 1970s and 1980s. After a hiatus in the 1990s with relatively few diesel cars in its lineup, Mercedes Benz has revived diesel cars in its newer ranges with an emphasis on high performance versus the older models' lack thereof.

High-Speed

High-speed (approximately 1200 rpm and greater) engines are used to power lorries (trucks), buses,tractors, cars, yachts, compressors, pumps and small generators.

Medium-Speed

Large electrical generators are driven by medium speed engines, (approximately 300 to 1200 rpm) optimised to run at a set speed and provide a rapid response to load changes.

Low-Speed

The largest diesel engines are used to power ships. These monstrous engines have power outputs over 80,000 kW, turn at about 60 to 100 rpm, and are up to 15 m tall. They often run on cheap low-grade fuel, which require extra heat treatment in the ship for tanking and before injection due to their low volatility. Companies such as Burmeister & Wain and Wärtsilä (e.g., Sulzer Diesels) design such large low speed engines. They are unusually narrow and tall due to the addition of a crosshead bearing. Today (2005), theWärtsilä-Sulzer RTA96-C turbocharged two-stroke diesel engine is the most powerful and most efficient prime-mover in the world, with cylinder bores of 960 mm (37.8 in) and stroke of 2500 mm (98.4 in), producing up to 80,080 kW (107,390 hp) in the 14-cylinder configuration.

The zeppelins [[22]] Graf Zeppelin II and Hindenburg_disaster [[23]] were propelled by reversible diesel engines. The direction of operation was changed by shifting gears on the camshaft. From full power forward, the engines could be brought to a stop, changed over, and brought to full power in reverse in less than 60 seconds. This was done before reversible pitch propeller[[24]]s for aircraft had been perfected. Reversible diesel engines have also been used in tugboats, ferries and other watercraft. [25] The weight and complexity of a gearbox in the power train is avoided by employing a reversing camshaft. The penalty is a dead interval during which the engine is inoperative, after which it was generally restarted with compressed air [26].

A few airplanes have been built that use diesel engines, such as the Junkers-powered Blohm & Voss Ha 139of the late 1930s. This is quite rare because of the high importance of power-weight ratios in aeronautical applications, and the development of kerosene-powered jet engines and the closely-related turbopropengines. However, this may change in the near future. The newer automotive diesels have power-weight ratios comparable to the ancient spark-ignition designs common in general aviation aircraft, and have better fuel efficiency. Their use of electronic fuel injection, and sophisticated engine management systems also makes them far easier to operate than mass-produced spark-ignition aircraft engines, most of which still usecarburetors. Combined with Europe's very favourable tax treatment of diesel fuel compared to petrol, these factors have led to considerable interest in diesel-powered small general aviation planes, and several manufacturers have recently begun selling diesel engines for this purpose. The Diamond Twin Star is currently one of the very few general aviation aircraft manufactured with diesel engines. It can be twice as efficient as a comparable twin aircraft due to the diesel engines made by Thielert. Another major advantage for aviation users is that diesel engines can be fuelled with jet fuel, which is produced in a much greater quantity thanavgas. See aircraft engine.

Also, some motorcycles have been built using diesel engines.

Current and future developments

Already, many common rail and unit injection systems employ new injectors using stacked piezoelectriccrystals in lieu of a solenoid, which gives finer control of the injection event.

Variable geometry turbochargers have flexible vanes, which move and let more air into the engine depending on load. This technology increases both performance and fuel economy. Boost lag is reduced as turbo impeller inertia is compensated for.

A technique called accelerometer pilot control (APC) uses a sensor called an accelerometer to provide feedback on the engine's level of noise and vibration and thus instruct the ECU to inject the minimum amount of fuel that will produce quiet combustion and still provide the required power (especially while idling.)

The next generation of common rail diesels are expected to use variable injection geometry, which allows the amount of fuel injected to be varied over a wider range, and variable valve timing similar to that on gasoline engines.

At least in the US, diesels will slowly face displacement by tougher emissions regulations. Other methods to achieve even more efficient combustion, such as HCCI (homogeneous charge compression ignition), are being studied.

Modern diesel facts

Fuel passes through the injector jets at speeds of nearly 1500 miles per hour (2400 km/h) – as fast as the top speed of a jet plane.

Fuel is injected into the combustion chamber in less than 1.5 milliseconds (one and a half thousandths of a second) – about as long as a camera flash.

The smallest quantity of fuel injected is one cubic millimetre – about the same volume as the head of a pin. The largest injection quantity at the moment for automobile diesel engines is around 70 cubic millimetres.

If the camshaft of a six-cylinder engine is turning at 4500 rpm, the injection system has to control and deliver 225 injection cycles per second.

On a demonstration drive, a Volkswagen 1-liter diesel-powered car used only 0.89 liter of fuel in covering 100 kilometers – making it probably the most fuel-efficient car in the world. Bosch's high-pressure fuel injection system was one of the main factors behind the prototype's extremely low fuel consumption. Production record-breakers in fuel economy include the Volkswagen Lupo 3L TDI and the Audi A2 3L 1.2 TDI with standard consumption figures of 3 liters of fuel per 100 kilometers. Their high-pressure diesel injection systems are also supplied by Bosch.

In 2001, nearly 36% of newly registered cars in Western Europe had diesel engines. Austria leads the league table of registrations of diesel-powered cars with 66%, followed by Belgium with 63% and Luxembourg with 58%. Germany, with 34.6% in 2001, was in the middle of the league table. By way of comparison: in 1996, diesel-powered cars made up only 15% of the new car registrations in Germany.

In 1998, for the very first time in the history of the legendary 24-hour race at the Nürburgring, a diesel-powered car was the overall winner – the BMW works team 320d, fitted with modern high-pressure diesel injection technology from Bosch.

Source : http://engineering.wikia.com/wiki/Diesel_engine