



# *Keep on running*

Lubricant specialist Castrol is working closely with leading automobile manufacturers to extend engine oil life and meet ever more stringent emissions control standards. *Chris Skrebowski* investigates

**N**orthern Europe is recognised as the most demanding environment in the world for motor oils. High efficiency engines, high speed driving, tightening environmental controls, innovative automobile manufacturers and knowledgeable consumers, all combine to demand the very highest levels of 'liquid engineering'.

Against this backdrop, the 'impossible dream' for car owners and car manufacturers alike, is for an engine oil that offers improved fuel economy, multi-year service intervals, and is suitable for both diesel and gasoline engines. However, within BP Castrol the word 'impossible' is taken as a challenge, and the recent completion of a five-year collaborative development with the Volkswagen (VW) group means that the 'impossible dream' has just moved a very significant step closer.

Over the last nine months Castrol has been supplying the VW group – VW, Audi, SEAT and Skoda – with a service fill oil, for all makes and models, that meets the car manufacturer's specifications for extended drain intervals and increased fuel efficiency. The new oil allows the VW group to offer its customers service intervals of up to 50,000km for diesel engines and 30,000km for gasoline engines and is referred to as the 'longlife service concept'. Not only does this offer the motorist the convenience of less servicing, it also reduces considerably the amount of used oil for disposal.

'Devising test procedures and field trials to evaluate lubricant performance and engine protection across myriad driving styles, climates and conditions presented an interesting challenge,' says David Hall, Castrol's consumer product development manager. 'Test developers at VW and Castrol produced a range of extremely severe tests to ensure the long-drain interval concept was robust and could safely be introduced into the market. These tests and specifications are amongst the most demanding so far required for a motor oil.'

Surprisingly, one of the most demanding environments for motor oil is low mileage, stop-start urban driving, when full engine working temperatures are rarely attained and lubricant additive chemistry remains unactivated. This represents one of the extreme environments that need to be tested in the course of product development. A three-year test involving a large fleet of low mileage vehicles was developed and carried out at Castrol's Pangbourne research facility in Berkshire in the UK. This test is many more times severe than real life but proves beyond doubt that the new lubricant is well capable



of handling the large amounts of fuel and water that condense into the lubricant under these conditions. Although the VW involvement in this trial is complete, Castrol is now continuing it with some of these cars into their fifth year – with no oil change.

In parallel with this low mileage testing, and to stress the oil differently, Castrol performed a number of high speed, mileage accumulation tests in which the drain interval of the engine oil was 'pushed to the limit'.

'Some of these long-drain cars clocked up more miles in a month than most VW customers would in a year,' says Hall.

While the drain intervals in these cars are not being revealed, Hall indicates that most drivers would change their car before Castrol is changing the oil in these tests.

Another requirement of VW was to improve the fuel economy possible with this new lubricant concept. Although there is a widely accepted industry test

engine and procedure to measure this parameter, VW went a step further again and introduced a 'rolling road' vehicle test to ensure improved performance in their engines and cars. An Audi A4 car with a high performance gasoline engine was run through a precisely defined driving cycle in Pangbourne to investigate the effect of lubricant parameters on fuel economy. This testing critically defined a number of the finished

lubricant's physical properties, as fuel economy was found to be linked to the viscosity of the lubricant at high and low temperatures and under conditions of high shear.

### Three in one

The VW lubricant requirements were initially covered by two specifications: VW503 00 for gasoline engines, which needed highly thermally-stable lubricants giving the lowest possible oil thickening and oil consumption; and VW506 00 for diesel engines, requiring lubricants with extreme carbon deposit protection at the high temperatures present at the top of the diesel pistons – up to 300°C.

Combining these two requirements is extremely difficult as the lubricant additives used to prevent deposit formation in the diesel engine impact negatively on the oil thickening behaviour in gasoline engines. This 'fine balancing' of the different appetites or requirements

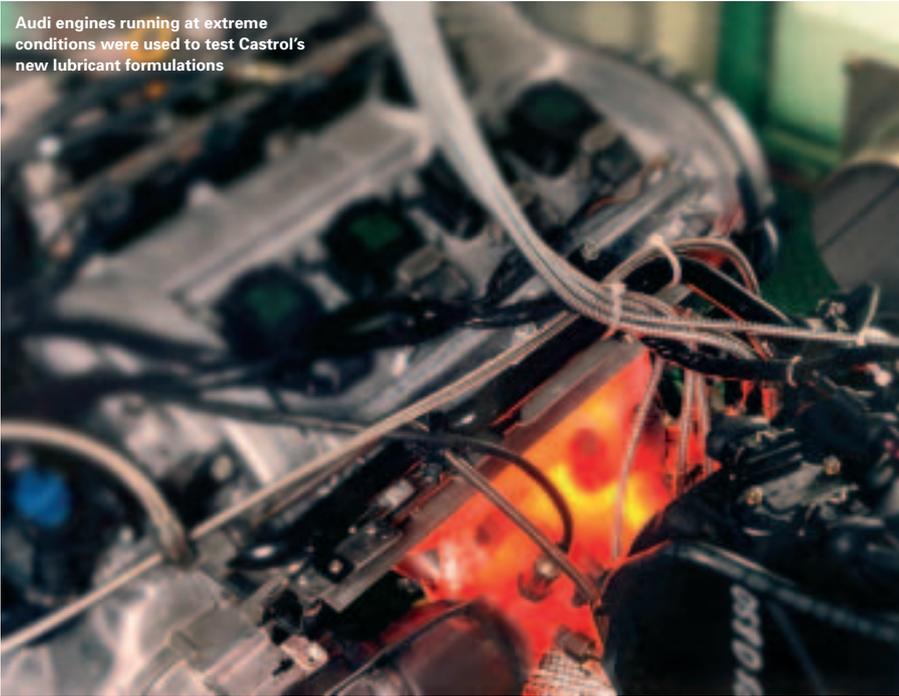
of each engine type in one lubricant, demands highly specialised skills from the lubricant formulator.

Originally VW invited four lubricant companies to attempt this development, including Castrol's strongest competitors. Hall is immensely proud that Castrol was the first company to be able to meet the targets.

During the course of the five-year project, VW developed its innovative pump nozzle

With long-drain lubricants, Castrol expects to expand its customer base

Audi engines running at extreme conditions were used to test Castrol's new lubricant formulations



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diesel engine, which posed a whole new set of lubrication challenges, particularly with regard to engine wear, and prompted the issue of a further specification, VW506 01. To test this, a 1000-hour radionuclide test was developed by VW which could quantify microscopic wear rates in the engine, measured in nanometres – one millionth of a millimetre – per hour. Very few lubricants pass this engine test. There is quiet satisfaction at Pangbourne that not only did Castrol meet these requirements but to date it is also the only company to be able to offer one lubricant to cover all three engine specifications – SLX Longlife II.

#### Extended life

To understand the current drivers in developing new motor oil formulations – and to appreciate how far things have come – we need to turn the clock back to the early 1980s. At this date the typical service interval for engines was 7500km or 6 months. In the mid-1980s manufacturers started to move to drain intervals of 15,000km or 12 months, marketed as the 'annual service'. This was a powerful selling point and was rapidly adopted by all the major vehicle manufacturers.

The SLX Longlife II lubricant oil that Castrol has just developed for VW is capable of service intervals up to 50,000km. As Mike Lynskey, Castrol's technical support manager for Europe puts it: 'We have stolen a march on the others'.

Both the car manufacturing and motor oil lubricants businesses are highly competitive,

and any significant innovation is rapidly emulated. According to Lynskey, the current position is that BMW has already moved to a longlife specification with one grade for most road cars. Castrol was again the first lubricant developer to meet the requirements for the BMW Valvetronic engines now being supplied in the new BMW 3-series. Other motor manufacturers are likely to follow suit shortly.

The stage is set for other car manufacturers, starting with those which focus on high performance vehicles, to move to extended drain intervals of two years or more, helping them to keep the cost of ownership down. Without giving away any commercial secrets, Hall indicates that Castrol is at the forefront of these developments. By being ready and able to offer long-drain lubricants, Castrol expects to expand its customer base and increase its share of the market. For example, when the Ford Motor Company launched its new long-

drain specification in December last year, it was clear that Castrol had a product which fulfilled this specification from the first day it was launched.

Engine design is also being influenced by other factors, explains Hall. 'While car manufacturers are driving motor oil quality with their requirement for longer drain intervals, legislation is driving it in terms of emissions reduction. Engine design is now largely being driven by emissions legislation, although this directly interacts with the pressure for greater fuel economy. Regulations will require emissions system durability of 160,000km in 2006. This means emissions from a vehicle which has covered this distance must meet the same limits as when the car was new. There can be no degradation of the aftertreatment devices, such as catalytic converters in exhaust systems. We're not there yet and it is an exciting technical challenge.'

The 2006 requirements he refers to, laid down by the European Union, will almost certainly require the removal of sulphur, phosphorous and metal compounds that are the basis of today's additives used by lubricants formulators to bring high performance and durability. 'The new standard will require a fundamentally different approach to lubricant formulation. But we thrive on meeting impossible challenges,' he concludes. ■

*Chris Skrebowski is editor of Petroleum Review magazine.*

Lab tests at Castrol's Pangbourne facility

