

A step too far?

New heavy-duty truck and bus engines must now conform to the latest iteration of the Euro VI standard: Euro VI D. The standard ensures compliance over a greater range of operating conditions, particularly sub-optimum, finds Richard Simpson

The Euro VI D standard, which comes into force on 1 September for new vehicles, was introduced after a European Commission assessment of the emissions outputs of Euro VI engines in use. A so-called 'work-based window' is used to measure actual NOx emissions for engine speeds and loads. Engine speeds and torque outputs are read from vehicle's ECU over time, to determine instantaneous engine power. Instantaneous work is calculated using this power and the time differential in the data collection. Work is then summed until the target amount of work is accumulated. The emissions levels are then calculated for that window of work.

Euro VI D engines must conform from 10-100% of maximum torque output, while previous models only required conformity from 20% of output up. Conformity must also be achieved at 10-100% of vehicle payload. This reflects concerns that the SCR systems used to control NOx output were not fully effective when exhaust gas temperatures were low.



Besides operation at lower loads, engines must now also be in conformance before they are fully warmed up, with conformance achieved when coolant temperatures reach 70°C, or within 15 minutes of engine start. There are also tighter checks on AdBlue quality and the functionality of the on-board diagnostics system. Cummins says that these measures have achieved a 25% reduction in NOx emissions from buses when compared to the first Euro VI A engines of 2015.

A limit on particulate amounts, as well as weight, came in with the original Euro VI standard, in recognition of the perception that smaller particulates were more injurious to health. The particulate count must now be measured in service by a portable emissions-measuring system before approval is gained.

INDUSTRY RESPONSE

Individual manufacturers have adopted different strategies in achieving Euro VI D conformance.

DAF undertook major revisions of

its MX engines (pictured opposite page) at Euro VI C, which, combined with driveline changes and chassis modifications, led to claimed like-for-like fuel savings of 7%. But the changes made for Euro VI D are small by comparison. DAF Trucks marketing manager Phil Moon says: "Developing Euro VI D engines has not meant significant change for DAF. If the SCR temperature drops below 200°C, then extra fuel may be dosed into the engine: this is done by the seventh injector on the MX engines and an additional injection pulse into the combustion chamber on the smaller FR and GR engines.

"Operators constantly running at low speeds and weights may see a small increase in fuel consumption as a result, but for long-haul, heavy-duty work there will be no difference at all."

In contrast, Volvo has made some performance tweaks to its 11-litre engines with increased outputs: the 365bhp engine has been updated to 375, the 404 to 424bhp and the 444 to 454bhp. Turbocompounding technology makes a return to Volvo's

Big changes are under way at MAN, where its complete engine range is undergoing major revision. The first step occurred over a year ago with the launch of two engines; a third came at this year's CV Show

454 and 493bhp 13-litre engines, with waste energy from the exhaust stream being recovered by an additional turbine downstream of the hot side of the turbocharger and returned to the flywheel by reduction gearing. There are new pistons and valve seats, too, and a new turbo on the 493bhp version. While peak outputs remain unchanged, the 13-litre engines benefit from up to 300Nm of extra torque.

There are new exhaust PM filters and a new SCR substrate with extruded vanadium, which allows the deletion of the seventh injector on some engine models. It is no longer possible to mount the SCR unit vertically as was done on some chassis, but a vertical tailpipe can still be specified if required. This has necessitated a chassis repackaging on twin-steer front-axle models.

New engine ECUs have doubled the memory to 8MB. Volvo is also introducing a new oil spec. VDS 5 is low viscosity to aid fuel economy and has increased anti-oxidation properties to extend its lifetime. The changes to the 13-litre engine will improve fuel economy by about 2%, Volvo claims.

BIG CHANGES

Even greater changes are under way at MAN, where its complete engine range is undergoing major revision. The first step occurred over a year ago, when new SCR-only 4.6- and 6.9-litre engines, the D0834 and D0836, replaced the previous EGR and SCR engine fitted to the TGL and TGM distribution trucks. Together, these engines cover the 158–316bhp range. Then at this year's Commercial Vehicle Show, MAN debuted the 9-litre D1556 engine which is fitted to lighter versions of the TGS regional and TGX long-hauler trucks, with outputs ranging from 325 to 395bhp (pictured above). Again, this engine uses SCR only for NOx control.

MAN's best-selling engine is the



12.4-litre D26. The latest D2676 version sees each power rating boosted by 10hp and 100Nm, to cover the 424–503bhp range. This engine, and the largest 15.2-litre D3876, both retain MAN's combined SCR with EGR NOx control. The D3876 covers the 533–631bhp range and is only available with the long-haul TGX cab. Its D38 received a power boost at Euro VI C, but other improvements are incorporated at VI D. These include: a 40% increase in oil change interval, new steel pistons with optimised rings, a top-down cooling system, and a two-stage turbo. A plastic sump saves weight.

Single-stage turbocharging on the D26 is among the modifications that save 80kg over the predecessor, while injection pressures have been raised and internal friction reduced with new pistons, rings, crankshaft and bearings. There is new material in the catalytic converter and an improved PM filter. An inlet throttle valve is used to raise exhaust temperatures when required and allows PM filter regeneration when driving in light-load conditions. Approval to use ultra-thin 0W-20 oil

on D38 and D26 engines is expected next year.

The D08 also features an intake throttle, and deletion of the EGR system with other changes over the prior engine save up to 103 kg. A novel change prepares for a high-output water-cooled Frigobloc alternator to power a cargo fridge direct from the truck engine.

Also, a new single-cylinder air compressor is installed on all engines. This is constantly driven, but features a third valve which vents compressed air into an expansion chamber when it is not required to replenish the truck's tanks. Much of the energy is returned on the downward stroke of the compressor's piston, as the third valve is held open after top dead centre.

Further reductions in parasitic drag come across the range from a new alternator; in normal use this balances output against the current demands of the truck, and only produces sufficient current to recharge the batteries when the truck is in over-run. Not only does this save fuel, it also extends battery life by avoiding overcharging. **TE**