

STOP AND GO SAVINGS

Cummins' latest stop-start system, based on its Euro 6 ISB engines, will save fuel and reduce emissions. Brian Weatherley believes bus and heavy truck operators should sit up and take notice

If anyone doubts the potential of stop-start systems to slash operating CV costs, especially on city buses, comments from Cummins Engines systems engineering leader Bill Lamb should change their minds. At a preview of its stop-start system for the ISB engine range, ahead of the official launch at Kortrijk Busworld, he said: "On a London bus, an average 45% of time is spent idling... That gives a massive [potential] for fuel savings, plus other benefits."

Cummins' decision to develop stop-start for its 4.5- and 6.7-litre four- and six-cylinder (respectively) ISB engines is a timely example of 'push-pull' - with

bus operators pushing for ever lower fuel costs, while legislators pull engine manufacturers beyond the Euro 6 emissions standard, including in terms of CO₂. As Lamb explains: "Euro 6 regulations have got NOx and particulates down, but we need to keep the focus on CO₂ in all duty cycles. [Stop-start] is something that can help."

But reducing greenhouse gases is just one of stop-start's attractions: NOx emissions remain critical, too. "In city centres NOx is getting a lot of focus from a local air quality standard," observes Lamb. "We feel that from our customers as they go into certain towns and cities." His point: stop-start

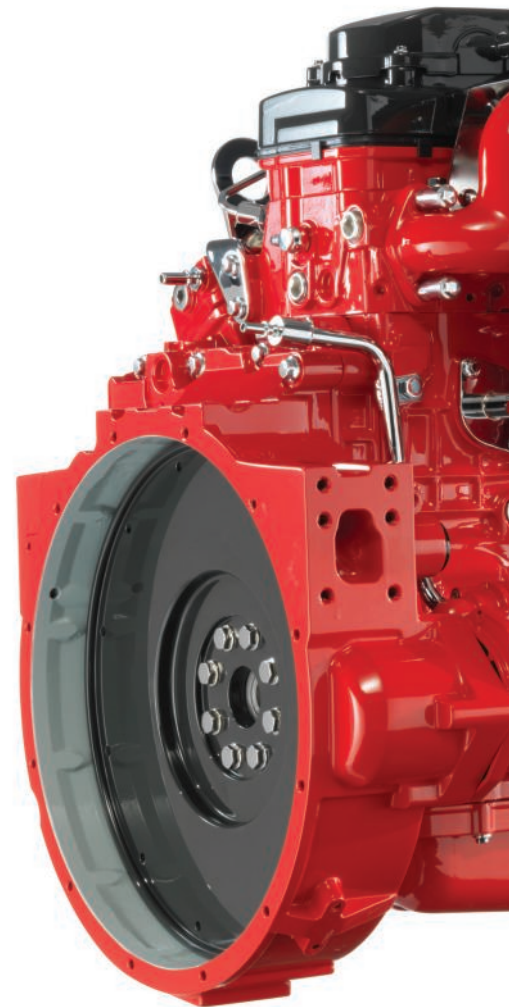
is not just about saving fuel; it's also about cutting emissions overall by curtailing unnecessary engine idling.

NO MEAN FEAT

However, creating a stop-start system for city bus operations has required significant modifications to Cummins' Euro 6 ISB range (see panel), not least to handle the punishing starting regimes, as well as the higher compression ratios and heavier engines on urban buses. "This isn't like a car engine where the change required to implement a stop-start is pretty minimal. This has taken serious re-engineering. Even the parts that we're not changing had to be validated to this mode of operation."

As part of its product development the Darlington-based engine maker conducted an in-depth examination of duty cycle data from all over Europe, including major cities. "London is pretty bad," confirms Lamb. "You can have up to 60, 70, or even 80 stops an hour, which is vast."

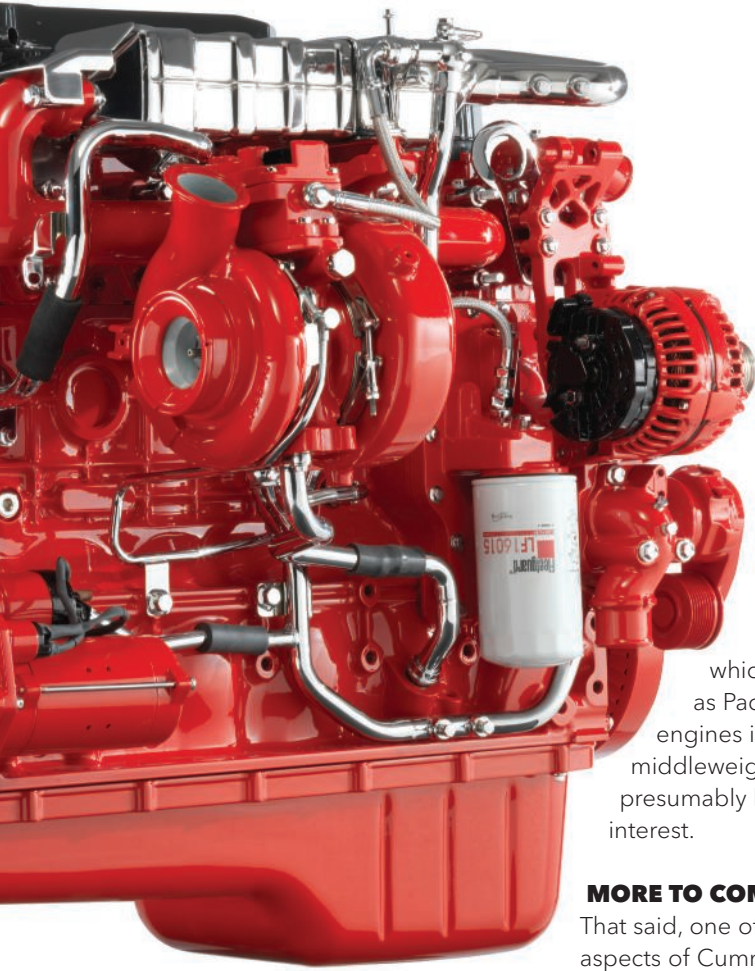
Cummins gave its stop-start system an intensive workout during the



Stop-start changes on ISB

Modifications to Cummins stop-start ISB engines include a new flywheel, ring gear, starter-motor and con rod/crank bearings, along with a new electrical harness. The Darlington-based engine maker has also adopted a Melco (Mitsubishi Electric) starter-motor, which is "significantly more robust than a standard unit and good for over 200,000 starts."

It also uses a 'soft start' system that ramps up the engagement torque of the pinion to avoid wear. On the engine management side, there's a new speed sensing system and ECM calibration. OEM chassis customers will also be able to adopt their own strategy for integrating Cummins' ISB stop-start into their ranges, which could include fitting a simple on/off control in a dashboard and upgraded batteries, depending on duty-cycles. However, the alternator doesn't have to change.



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Meanwhile, the most obvious users will be bus and coach operators currently running ISB-powered vehicles.

Likewise, DAF Trucks – which fits the ISB (badged as Paccar PX-5 and PX-7) engines in its LF light-middleweight truck range – will presumably be watching with interest.

For now, as green bus incentives – particularly for hybrids – continue to attract attention, Lamb believes Cummins stop-start could be timely. “Hybrids are prohibitively expensive without incentives [but] we’re moving to a market where there are fewer subsidies. So we are getting most of the fuel economy and CO₂ benefits, but at very low cost. Our target is to significantly enhance the total cost of operation... Everyone is familiar with stop-start, it’s a logical extension to the commercial vehicle market.” **TE**



development and testing phase, with its product validation programme including some 4,250,000 stop-starts in both test cells and bus and truck field trials, using eight vehicles with six OEM partners. It will shortly release a launch fleet of 100 buses with performance then closely monitored. Thereafter, full production will start at the end of the Q1 2016.

Meanwhile, Lamb reports impressive results from initial ISB stop-start installations. “We’re getting quite big reductions in CO₂ and improvements in fuel economy in the order of 4–7%. We also see a reduction in NO_x, particularly on urban duty cycles, where it’s going to be most effective.”

So far Cummins has not issued a list price for stop-start as an ISB option, though it says payback will be under two years. And while that may vary according to OEM implementations, Lamb says: “This may be difficult hardware, but it’s not that high-cost hardware.” He also says that Cummins will assess uptake before making a decision on whether or not to make it standard fitment. To date, the only Euro 6 truck chassis offered in the UK with

MORE TO COME

That said, one of the more interesting aspects of Cummins’ stop-start is that the current ISB-based system is just the first step. Although Cummins has no plans to introduce stop-start on its larger 8.9-litre Euro 6 ISL engine, the company says the technology “could be adapted”. Moreover, a future phase in the programme looks set to feature sister company Cummins Generator Technologies’ integrated starter generator (*TE*, April 2014, page 28).

Driving with Cummins stop-start

Transport Engineer recently had the opportunity to try Cummins’ ISB-based stop-start system at first hand, with a brief drive of an early installation of Cummins’ ISB-based stop-start system in an ADL Enviro400. The vehicle – operated by Stagecoach out of its Merseyside depot – proved easy to use. My E400 double-decker was powered by the 250bhp ISB 6.7-litre engine coupled to a Voith four-speed auto box.

The system is activated when the bus is brought to a halt and the park brake applied: thereafter engine-shut-down is virtually instantaneous. Upon releasing the park brake the engine fires-up smoothly and promptly, although the bus’s brakes remain applied until the throttle pedal is depressed (like Hill-Hold).

In use, the system performed exactly as expected. To avoid driver frustration in creeping traffic, it isn’t activated until the vehicle’s road speed exceeds 10km/h. It also has several safety overrides, including when reverse is selected.

But while operators’ bottom line benefits are obvious, the system offers other less obvious wins, too. With the engine turned off at a bus stop, passengers will appreciate the lack of vehicle noise and vibration, while passing pedestrians will also experience lower kerbside emissions.