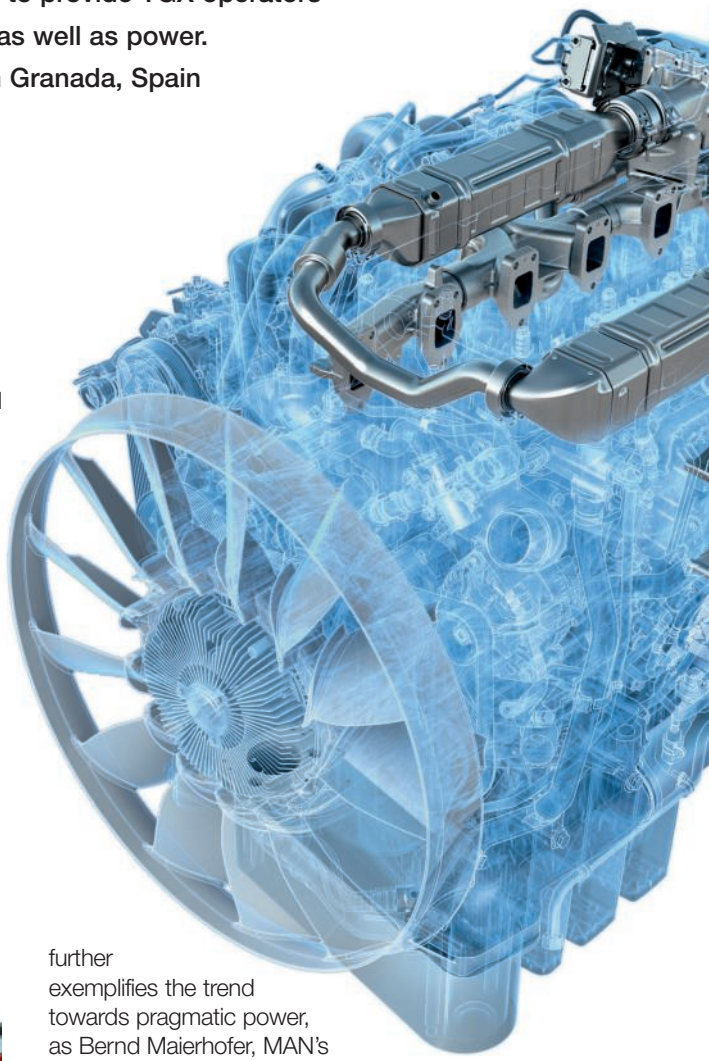
Pragmatic

With its new Euro 6 D38 diesel, MAN wants to provide TGX operators with a big engine that offers fuel efficiency as well as power. Brian Weatherley reports from test drives in Granada, Spain

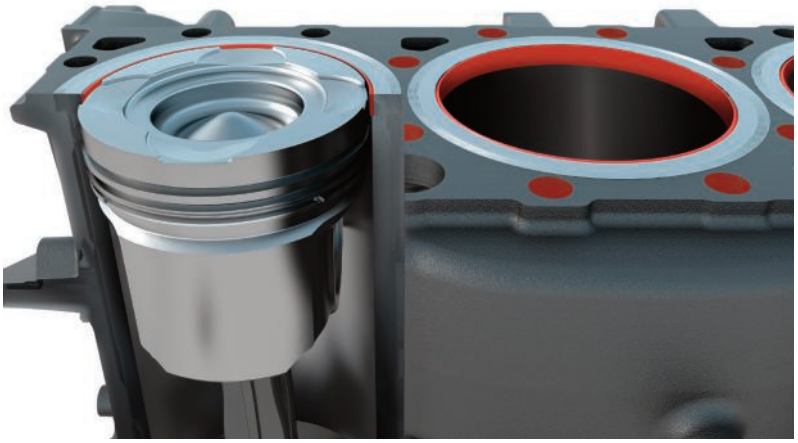


Right: MAN's D38 high power engine, showing the twin cooled paths for high-pressure EGR

While there's nothing quite like a fire-breathing flagship tractor for drawing truck show visitors to a manufacturer's stand, those same OEMs freely admit that the volume market for artics continues to sit resolutely between 430–480bhp, and not just in the UK. Right across Europe, sales of 500bhp-plus tractors, though significant, remain in the minority. That hasn't stopped truck makers from vying to build 'the world's most powerful series production truck' in a battle that's already seen the 700bhp/3,000Nm barrier breached by both Volvo and Scania.

There may well be a justification (and demand) for that power in Scandinavia. But in the UK at least, the number of operators needing more than 600bhp can probably be counted on the fingers of both hands, and they're likely to be hauling loads above 200 tonnes, too. Which is why, in recent months, there has been a distinct cooling towards ever more prodigious horsepower, especially from the Germans. Long before Mercedes-Benz launched its 15.6-litre OM475LA in-line six last year, rated at up to 630bhp and 3,000Nm, it admitted that it had no desire to build Europe's most powerful tractor. What mattered, it said, was torque, not power.

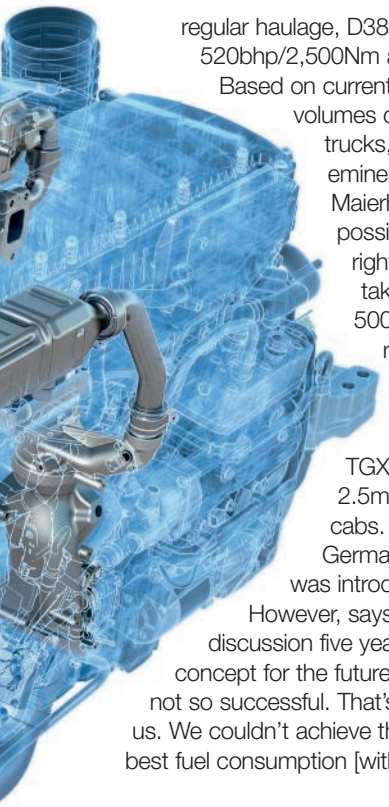
Below: novel piston design and fire ring



MAN's new Euro 6 15.2-litre D38 engine, due for launch at the Hanover IAA Show in September, further exemplifies the trend towards pragmatic power, as Bernd Maierhofer, MAN's board member responsible for research and development, confirms. "We've been talking to a lot of our customers and they've been telling us, 'We need performance but not at the expense of efficiency'. That's why we developed the D38, which is the most reliable, and powerful, but also one of the most efficient engines. We wanted to minimise total cost of operation, which is why [this] new unit won't set new power records."

In fact, the Munich-based manufacturer is offering its straight-six 15.2-litre D38 with a top rating of 640bhp and 3,000Nm torque, that's strictly reserved for heavy haulage chassis up to 250 tonnes gcw. For

power



regular haulage, D38 is pegged at 520bhp/2,500Nm and 560bhp/2,700Nm. Based on current fuel costs and sales volumes of ultra high-horsepower trucks, that strategy looks eminently sensible. And while Maierhofer reckons D38 has "the possibility to increase a little", right now MAN's objective is to take a 20% share of the 500–600bhp sector with the ratings it's got.

D38 takes over from the D28 16.2-litre V8 as MAN's big engine in its TGX flagship range, with the 2.5m-wide XL, XLX and XXL cabs. D28, jointly developed with German manufacturer Liebherr, was introduced in 2007 at 680bhp. However, says Maierhofer: "We had a discussion five years ago on the right engine concept for the future. The V8 was powerful, but not so successful. That's what our customers told us. We couldn't achieve the best performance and best fuel consumption [with the V8]."

Benefits of in-line six

Swapping to an in-line six has yielded several benefits – not least a 160kg weight saving on D38, thanks to an aluminium flywheel housing, incorporating the rear engine mounts, and a GRP sump and rocker cover, which also reduces noise. Overall, D38 weighs in at 1,340kg: 200kg more than the equivalent 12.4-litre Euro 6 D26, currently rated up to 480bhp.

But while D38 shares many features with MAN's lower displacement stable mates – such as two-stage turbocharging, common rail fuel injection and cast iron/vermicular graphite block, cylinder head and crankshaft main-bearings – it also introduces several innovations. These include a top-down cooling system, said by MAN to be a first for diesel truck engines. As the name suggests, coolant is pumped from the top of the engine to the bottom. Priority is given to coolant flow around areas of the cylinder head subjected to highest thermal stress, including the injectors and exhaust valves. MAN reckons top-down cooling not only "guarantees high cooling capacity evenly for all cylinders", but also means it can be managed with comparatively low flow. This also benefits fuel consumption, as it allows the use of a lower power pump.

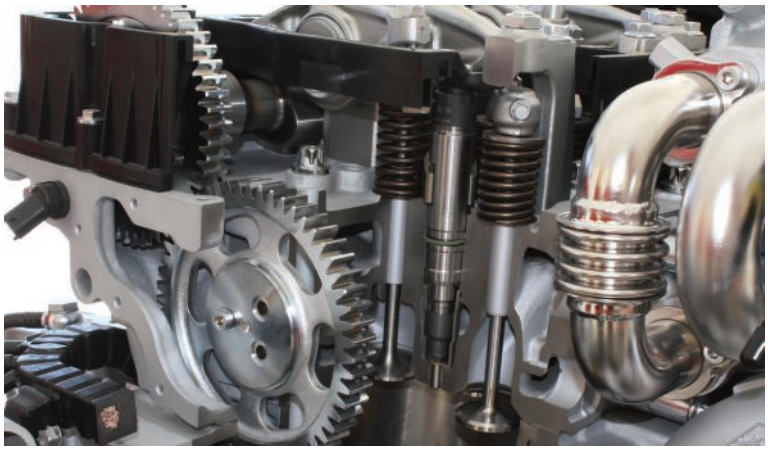
Another novelty is its domed inlet and exhaust valves. A curved valve disk virtually eliminates valve head distortion, ensuring optimum valve seating, and thereby increasing service life of both valves and seats – as well as reducing clearance adjustment frequency. On D38, it's only every second oil change.

D38 also uses eight head bolts per cylinder, which enables uniform clamping between the cylinder head and block, so preventing cylinder liner distortion and also delivering optimal sealing between the piston rings and liners. MAN says this arrangement results in lower oil consumption, as well as extended head gasket service life.

Meanwhile, low-height, forged steel pistons ensure a reduced surface contact with the cylinder well, providing greater service life for both pistons and liners. Equally, at the top of each cylinder liner, MAN now fits a fire ring to minimise oil/carbon deposits – again, reducing liner wear.

D38 uses the latest Bosch high-pressure, common rail fuel injection system, with peak pressures of 2,500bar. This electronically-controlled system allows for precisely metered pre-, main- and post-injection to optimise combustion efficiency and fuel economy, while reducing particulates. No additional cooling of the ECU (engine control unit) is required, and all major cables on D38 are routed in foam-filled cable harnesses to cut cable vibration, further aiding service life.

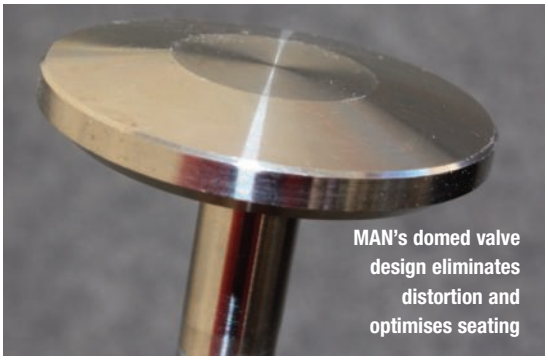
To meet Euro 6, D38 uses a combination of cooled high-pressure EGR (exhaust gas recirculation) with SCR (selective catalytic reduction)



MAN's top-down cooling cutaway: coolant is pumped through the engine from top to bottom

and a DPF (diesel particulate filter). Unlike its smaller-displacement siblings, the D38's recirculated exhaust gases are cooled in two stages, with the exhaust flow initially directed into a high-temperature EGR cooler, integrated into the engine coolant circuit. It's then fed through a second low-temperature cooler, which is part of the charge air cooling system. The benefit of the two-stage approach is very low NOx, meaning the downstream SCR system has less to do. Indeed, MAN has cut the D38's AdBlue dosing by some 65%, compared with previous Euro 5 models.

Despite the increase in engine displacement, and the greater volume of exhaust gases, D38 TGX chassis retain the same exhaust silencer/SCR dosing-unit dimensions as D20/D26 engines. Active regeneration of the DPF is not normally required and MAN says the replacement/cleaning cycle will be 500,000 km. Then, oil change intervals are comparable to previous Euro 5 TGX models, depending on the lube used and application. For operators using low SAPS oils, 100,000km drain periods are quoted.



MAN's domed valve design eliminates distortion and optimises seating

As for fuel consumption, MAN says a Euro 6 D38 is up to 3% better than an equivalent D26 540bhp engine at Euro 5. That's partly down to "an entirely new powertrain" on the TGX, says Maierhofer. And he cites the latest direct-top Tipmatic/AS-Tronic II auto gearbox with faster shifts on the top three ratios, fuel-saving EfficientRoll (MAN's version of eco-roll) and an 'idle away' function, which makes use of D38's high-torque at low revs.

Beyond combustion

MAN also now has its own GPS-based predictive cruise control, called EfficientCruise, as an option on the TGX D38. This automatically adapts the engine's performance based on the approaching terrain and includes ZF's powerful Intarder. Depending on the terrain, EfficientCruise offers fuel savings up to 6%.

Following the adoption of a smart APM (air pressure management) system on its previous EfficientLine models, MAN fits the same twin-cylinder unit on TGX D38. The APM only switches on the compressor when required – on long-distance motorway work, it can be disconnected up to 90% of the time, further reducing fuel consumption.

Last but not least, MAN has beefed up the performance of its existing EVB (exhaust valve brake), which currently delivers 340kW of retardation. The new, more powerful, Turbo EVB uses a flap in the inlet-air trunking just ahead of the first turbocharger, which, when partially closed, speeds up the air passing through the turbochargers. That results in a greater volume being forced into the engine, which acts as a compressor when EVB is activated. The Turbo EVB's increased braking capacity is 600kW at 2,400rpm. It will initially be offered on the 640bhp D38 in TGX heavy-haulage chassis in 2015, before being rolled out on regular haulage trucks.

More details on the 640bhp TGX heavy-haulage chassis are expected when D38 sees its officially unveiling at the Hanover IAA show in September. Meanwhile, Maierhofer says: "With the new engine performance range, our Euro 6 portfolio is complete. We're confident that D38 will quickly establish itself as the benchmark in its class." TE

On the road

It's hard not to be impressed by this machine. Driving TGX D38 trucks at 560 and 520bhp on the test route around Granada in Spain, the 15.2-litre engine's torque back-up and low-speed pulling-power were obvious. While many manufacturers boast that their engines "can lug down to below 1,000rpm", D38 does it for real, maintaining a steady 80km/h below 1,000rpm in top gear on level roads without any fuss.

However, the test route included a number of punishing 5–7% motorway climbs up to 5km long that would have a 450bhp fleet-spec tractor gasping. Hauling 40 tonnes, both the 520 and 560 TGX test tractors dug in tenaciously at 1,500–1,600rpm and held a steady 65km/h climbing hard. At mid-range speeds, the TGX D38 has equally serious pulling power between 1,100–1,300rpm.

MAN's D26-powered TGX always had very low interior noise levels, and the same is true with D38 – although when you need it to work, you get a powerful rumbling noise, indicating just how much grunt is under your right foot.

While some might question the need for EfficientCruise, for mixed-terrain with pre-set maximum and minimum speeds, it's hard to fault. In particular, the four-stage Intarder (part of the EfficientCruise spec), backed up by the fifth-stage EVB, does an excellent job at holding back a fully-freighted artic on a steep incline – already identified by EfficientCruise which automatically dials in the necessary secondary braking.