VM MOTORI S.p.A.

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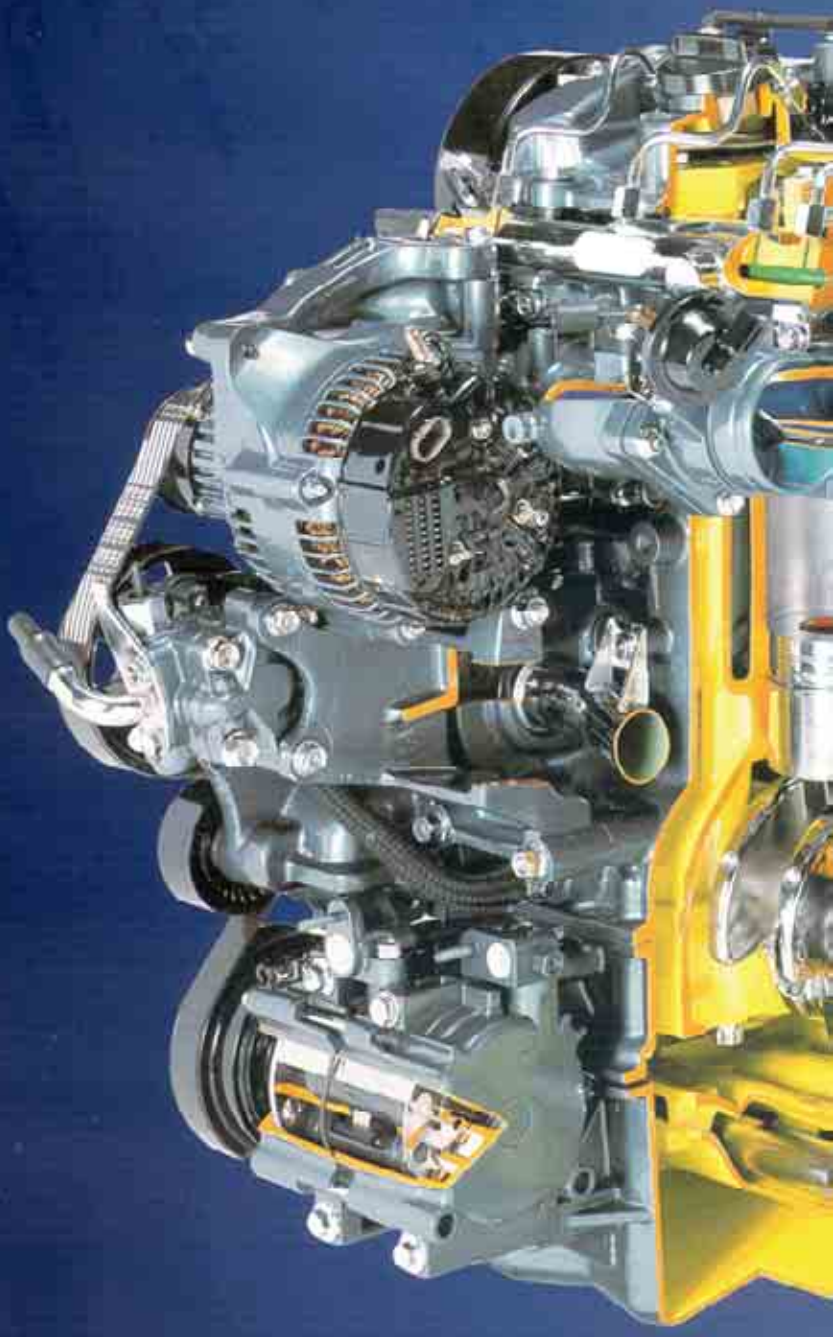


Automotive Power

Automotive Power

The diesel car market is going through a period of unprecedented growth. All across Europe diesel car penetration is growing to record levels as drivers switch from conventional gasoline engines to vehicles fitted with a new generation of diesel engines.

The diesel engine has gone through something of a revolution. Long gone are the days of the slow, high capacity, normally aspirated engines which powered family cars fifteen years ago. Talk now is of diesel cars which qualify as performance cars in their own right. Each time a car is launched, scribes write that the diesel version is now the pick of the range. Talk is of diesel engine penetration reaching 50% across the European market.

Pressure has therefore increased on manufacturers and diesel engine producers to keep the pace of change. We are confident that VM Motori is one of the best placed to capitalise on this.

A few years ago VM, anticipating the need for a wide range of diesel engines, started to develop a new range of modular engines to add to its existing range of two valves per cylinder indirect injection engines. The result is a range of four valve per cylinder engines fitted with the latest in common rail injection technology and which comply with all known emission regulations.

Add this to the proven project management skills which have allowed us over the years to tailor out engines to particular vehicles and assist the customers in getting the vehicles to market in record time, and the future looks particularly bright.

We are confident that we offer a unique service to manufacturers all around the world. We have the engines, the will, the skill and above all the enthusiasm to ensure that any project, no matter how large, can be achieved to the total satisfaction of all, from the manufacturer right up to the end user.

This then, is the VM Motori automotive engine range.

425 OHV

85 kW (115 CV)
2500 cc - 4 Cyl. - 8 Valve

This is the engine which started it all and which today continues to epitomise all that the VM engines are in terms of design simplicity, flexibility, robustness and ease of maintenance: a 2.5 litre four cylinder, eight valve indirect injection diesel engine which is available for both longitudinal and transverse applications, and can be fitted with a mechanical, semi electronic or fully electronic fuel injection pump.

This engine has been designed and constructed in such a way that it has become the basis for all the current two valve VM engines. This particular unit is also notable for having been fitted in cars, vans and trucks all over the world and has a reputation for consistent reliability and performance.

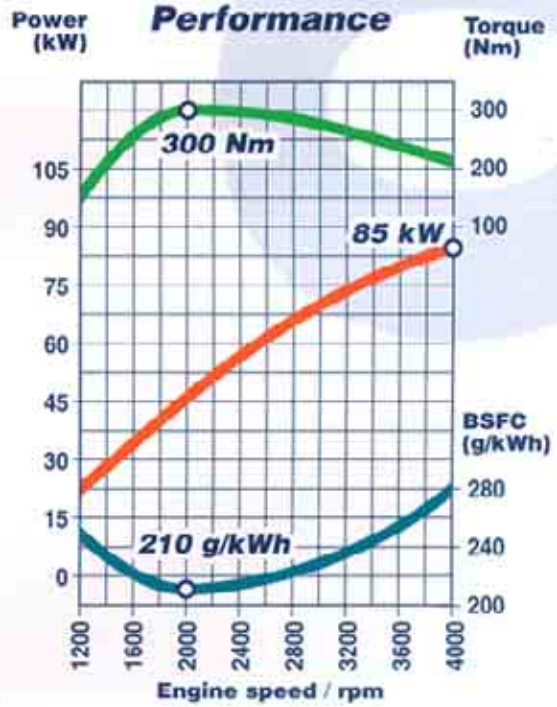
Featuring a turbocharger with an optional intercooler, individual aluminium cylinder heads and an electronically controlled and modulated EGR (exhaust gas recirculation) cooler, this engine complies with all of today's emissions rugulations whilst at the same time matching competitors in performance and cost. Match this with design simplicity and the resulting ease of servicing once in use, and customers find that they have bought one of the most cost effective diesel engine solutions.

Basic Engine Data:

Combustion System	Indirect injection
Configuration	4 cylinders in line
Displacement	2499 cc
Bore and Stroke	92 x 94 mm
Max Power	85 kW (115 CV) @ 4000 rpm
Peak Torque	300 Nm @ 2000 rpm
Compression Ratio	18:1
Specific Power	34 kW / litre
Min. BSFC	210 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron
Cylinder Heads	Individual aluminium
Emission Control Devices	Electronically controlled modulated EGR
Valve Train	Lateral camshaft in cylinder block, 2 valves per cylinder with hydraulic lash adjusters
Injection System	Electronically controlled pump type
Emissions	Euro II

Dimensions and Weight:

Length	669 mm
Width	615 mm
Height	680 mm
Weight (dry)	208 kg



531 OHV

103 kW (140 CV)
3100 cc • 5 Cyl. • 10 Valve

The benefit of the modular concept behind the 425 OHV is that different capacity engines can be quickly and simply evolved from the basic structure. The result is this five cylinder indirect injection engine with a capacity of 3.1 litres.

Developed specifically with low speed torque and economy in mind, this engine has been applied to some of the most famous of SUVs and is in use all over the world. Renowned for its refinement and impressive power output, it remains one of the best sellers in our engine range.

The 531 OHV shares many of the features and much of the simplicity of the 425 OHV. Turbocharged and intercooled, featuring two valves per cylinder, additional technical features include individual aluminium cylinder heads, lateral camshaft in the cylinder block, an electronically controlled modulated EGR and electronically controlled fuel injection.

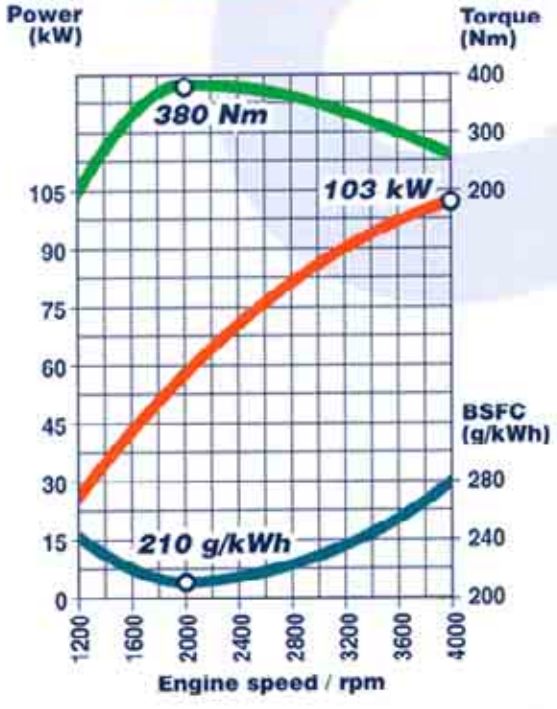
Basic Engine Data:

Combustion System	Indirect injection
Configuration	5 cylinders in line
Displacement	3125 cc
Bore and Stroke	92 x 94 mm
Max Power	103 kW (140 CV) @ 4000 rpm
Peak Torque	380 Nm @ 2000 rpm
Compression Ratio	18:1
Specific Power	33 kW / litre
Min. BSFC	210 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron
Cylinder Heads	Individual aluminium
Emission Control Devices	Electronically controlled modulated EGR
Valve Train	Lateral camshaft in cylinder block, 2 valves per cylinder with hydraulic lash adjusters
Injection System	Electronically controlled pump type
Emissions	EEC 96/69 – EEC94/12, US Federal 90

Dimensions and Weight:

Length	782mm
Width	615mm
Height	685mm
Weight (dry)	250kg

Performance



638 OHV

118 kW (160 CV)
3800 cc - 6 Cyl. - 12 Valve

It is often said that there is no substitute for cubic capacity. Whilst the emergence of forced induction has reduced the need for large capacity diesel engines in passenger cars, there remains a requirement amongst commercial vehicle manufacturers and operators for a large capacity, low cost diesel engine.

The largest of the conventional diesel engine family, and based on the very same modular structure as the 425 and 531 OHV engines, the indirect injection six cylinder in line 638 OHV is best suited to commercial and heavy passenger vehicle applications.

Designed specifically for low speed durability and power, this engine features separate aluminium cylinder heads, two valves per cylinder with hydraulic lash adjustment, a turbocharger with optional intercooler and electronic EGR. This engine complies with all current European emissions regulations.

Basic Engine Data:

Combustion System	Indirect injection
Configuration	6 cylinders in line
Displacement	3749 cc
Bore and Stroke	92 x 94 mm
Max Power	118 kW (160 CV) @ 4000 rpm
Peak Torque	415 Nm @ 2000 rpm
Compression Ratio	18:1
Specific Power	31.5 kW / litre
Min. BSFC	210 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron
Cylinder Heads	Individual aluminium
Emission Control Devices	Electronically controlled modulated EGR
Valve Train	Lateral camshaft in cylinder block, 2 valves per cylinder with hydraulic lash adjusters
Injection System	Electronically controlled pump type
Emissions	EEC 96/69 – EEC94/12, US Federal 90

Dimensions and Weight:

Length	898 mm
Width	615 mm
Height	690 mm
Weight (dry)	300 kg

Performance

R 425 OHV

87 kW (120 CV)

2500 cc - 4 Cyl. - 8 Valve

Whilst based on the modular concept of the popular 425, 531 and 638 OHV two valve engines, VM have further developed this engine in the light of further demands for reduced fuel consumption and emissions. Of particular importance is the switch to a direct injection configuration which has led to a 16% decrease in fuel consumption. This change was relatively easy and required little investment thanks to the simplicity of the base engine design. A cost saving which has been passed on to VM's customers in the form of most competitive pricing.

The first of the updated engines to feature the latest in common rail technology for reduced emissions, this engine is one of the most cost effective ways for a vehicle manufacturer to comply with the EU. 3 regulations.

Technical features include two valves per cylinder with hydraulic lash adjusters, a turbocharger and optional intercooler. The engine has individual aluminium cylinder heads. EGR cooler and the very same adaptability in terms of application and modular design as the 425 OHV.

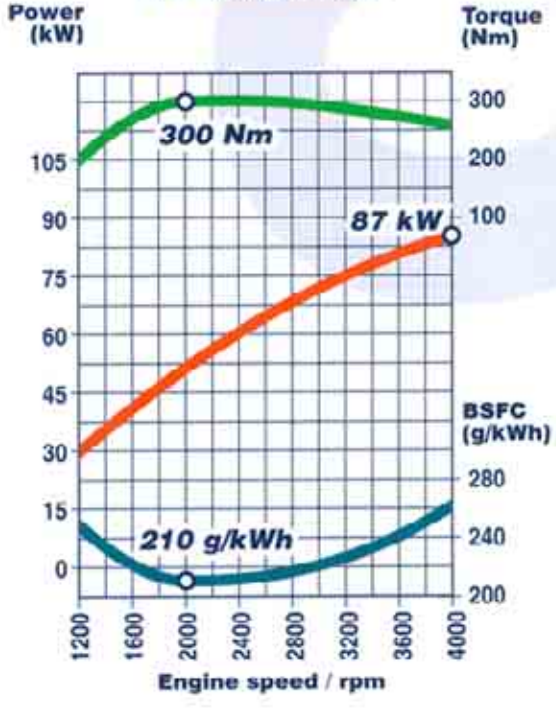
Basic Engine Data:

Combustion System	Direct injection
Configuration	4 cylinders in line
Displacement	2499 cc
Bore and Stroke	92 x 94 mm
Max Power	87 kW (120 CV) @ 4000 rpm
Peak Torque	300 Nm @ 2000 rpm
Compression Ratio	18:1
Specific Power	34.8 kW / litre
Min. BSFC	210 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron
Cylinder Heads	Individual aluminium
Emission Control Devices	Electronically controlled modulated EGR
Valve Train	Lateral camshaft in cylinder block, 2 valves per cylinder with hydraulic lash adjusters
Injection System	Common rail CP1
Emissions	EU. 3 LDT

Dimensions and Weight:

Length	669 mm
Width	615 mm
Height	672 mm
Weight (dry)	208 kg

Performance



R 531 OHV

110 kW (150 CV)

3100 cc · 5 Cyl. · 10 Valve

Demand has increased not only for medium, but also for larger, capacity diesel engines for passenger vehicles. VM Motori is always ahead of the market, predicting likely demands and trends. The result of this has been a comprehensive review of all the two valve per cylinder engines.

The second of the direct injection common rail engines developed from the modular 425 / 531 / 638 OHV family, this engine shares many of the technical features and benefits of the R 425 OHV including separate aluminium cylinder heads, an electronically controlled modulated EGR and two valves per cylinder with hydaulic lash adjustment.

This engine complies with EU. 3 emissions standards and features the additional benefit of reduced fuel consumption and smoother running. The beneficial effects of the new configuration and injection system, over and above the low speed torque inherent in the base indirect injection 531 OHV engine, mean that this engine is an ideal power plant for a new SUV.

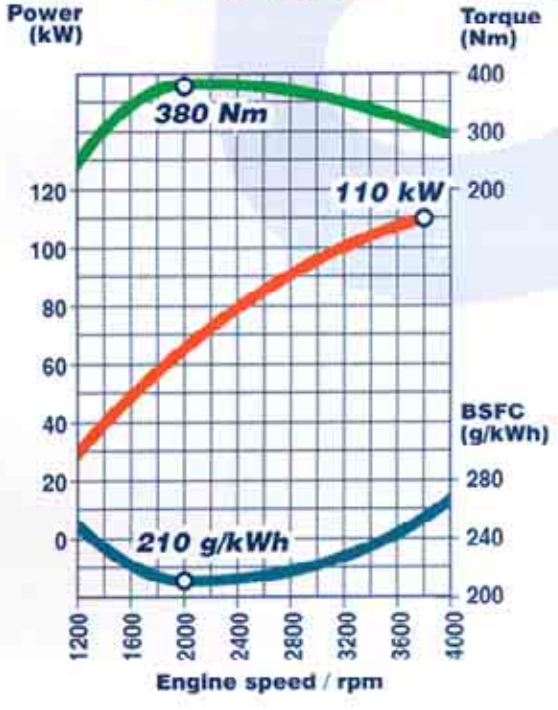
Basic Engine Data:

Combustion System	Direct injection
Configuration	5 cylinders in line
Displacement	3125 cc
Bore and Stroke	92 x 94 mm
Max Power	110 kW (150 CV) @ 3800 rpm
Peak Torque	380 Nm @ 2000 rpm
Compression Ratio	18:1
Specific Power	35.2 kW / litre
Min. BSFC	210 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron
Cylinder Heads	Individual aluminium
Emission Control Devices	Electronically controlled modulated EGR
Valve Train	Lateral camshaft in cylinder block, 2 valves per cylinder with hydraulic lash adjusters
Injection System	Common rail CP1
Emissions	EU. 3 LDT

Dimensions and Weight:

Length	782 mm
Width	615 mm
Height	685 mm
Weight (dry)	250 kg

Performance



R 638 OHV

125 kW (170 CV)

3800 cc • 6 Cyl. • 12 Valve

The direct injection version of the 638 OHV, this engine features the latest in common rail technology and meets all current emissions standards relating to light duty trucks. As with the 638 OHV upon which it is based, the engine features six cylinders in an in line configuration with two valves per cylinder with hydraulic lash adjusters and separate aluminium cylinder heads.

Additional benefits over the standard indirect injection 638 OHV include a greater level of refinement, a notable improvement in fuel economy and, of course, compliance with the Euro III emissions regulations.

This engine is tailor-made for customers who are seeking a heavyweight, yet economical, diesel solution to the latest in emissions regulations for light duty trucks.

Basic Engine Data:

Combustion System	Direct injection
Configuration	6 cylinders in line
Displacement	3749 cc
Bore and Stroke	92 x 94 mm
Max Power	125 kW (170 CV) @ 4000 rpm
Peak Torque	415 Nm @ 2000 rpm
Compression Ratio	18:1
Specific Power	33.4 kW / litre
Min. BSFC	210 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron
Cylinder Heads	Individual aluminium
Emission Control Devices	Electronically controlled modulated EGR
Valve Train	Lateral camshaft in cylinder block, 2 valves per cylinder with hydraulic lash adjusters
Injection System	Common rail CP1
Emissions	Euro III

Dimensions and Weight:

Length	898 mm
Width	615 mm
Height	690 mm
Weight (dry)	300 kg

Performance

D 642 OHV

119 kW (160 CV)
4200 cc · 6 Cyl. · 12 Valve

The largest of the two valve engines, the 642 OHV features six cylinders in line with two valves per cylinder. Where the engine differs in configuration to the R 638 and other members of the modular family, is that this engine was the first to feature direct injection.

The result of this change in configuration is greater efficiency in terms of combustion and improved fuel economy. Match this with low initial and lifetime costs and one can understand why commercial vehicle manufacturers and operators are so keen on this engine.

Designed with these applications in mind, this engine features a massive 420 Nm of torque at just 2000 rpm whilst at the same time complying with Euro III and US Transient emissions norms. Extended life is a specific feature of this engine and the simplicity inherited from its modular origins means that it is exceptionally easy to service throughout its lifetime.

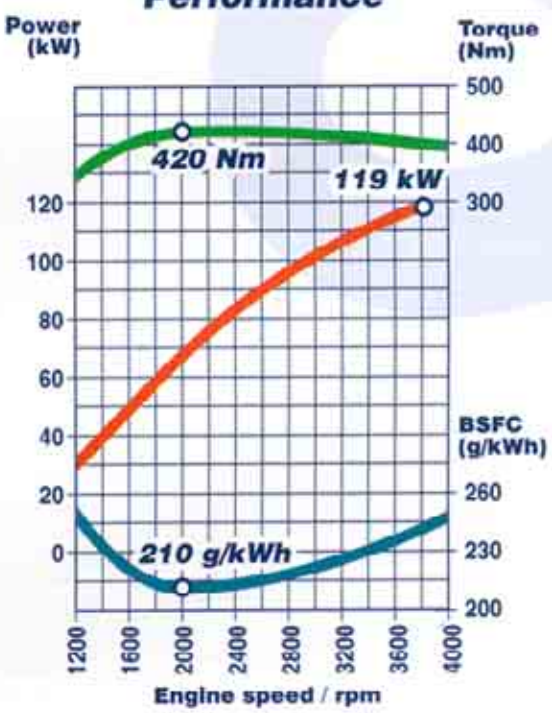
Basic Engine Data:

Combustion System	Direct injection
Configuration	6 cylinders in line
Displacement	4164 cc
Bore and Stroke	94 x 100 mm
Max Power	119 kW (160 CV) @ 3800 rpm
Peak Torque	420 Nm @ 2000 rpm
Compression Ratio	18:1
Specific Power	28.6 kW / litre
Min. BSFC	210 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron
Cylinder Heads	Individual aluminium
Emission Control Devices	Electronically controlled modulated EGR
Valve Train	Lateral camshaft in cylinder block, 2 valves per cylinder with hydraulic lash adjusters
Injection System	Electronically controlled pump type
Emissions	Euro III, US transient

Dimensions and Weight:

Length	898 mm
Width	615 mm
Height	690 mm
Weight (dry)	300 kg

Performance



R 315 SOHC

66 kW (90 CV)

1500 cc · 3 Cyl. · 12 Valve

Always ahead of the times, VM Motori long ago realised that diesel engine demand in passenger cars would increase not only in terms of volume but also that customers would require them to be fitted across a wider range of vehicles. As a result, VM have developed this compact, smaller capacity engine. The latest in multi-valve technology with common rail and EU. 4 capability, this turbocharged 90 CV engine leads the field in efficiency, packaging and emissions.

Technical features include a belt-driven single overhead camshaft with four valves per cylinder. Finger followers on the camshaft operate two valves at a time, and each cylinder has a central vertical direct injector. The engine also has cooled EGR, via the coolant port in the cylinder head, to improve the NOx emissions together with zero degree valve angle for complete combustion. The oil pump is a gear-driven rotary vane type and the vacuum pump is fitted co-axially to the alternator. The engine also features a single balance shaft, gear-driven off the crankshaft in the oil sump for additional refinement.

Developed specifically for torque and driveability, the new 1.5 litre matches inherent high standards of NVH with class-leading driveability. The flat torque curve demonstrates just how effortless driving a vehicle fitted with this engine can be. The 180 Nm of torque at 2000 rpm is impressive enough, but add an optional VGT turbocharger and torque and power increases to a class leading 200 Nm and 105 CV respectively.

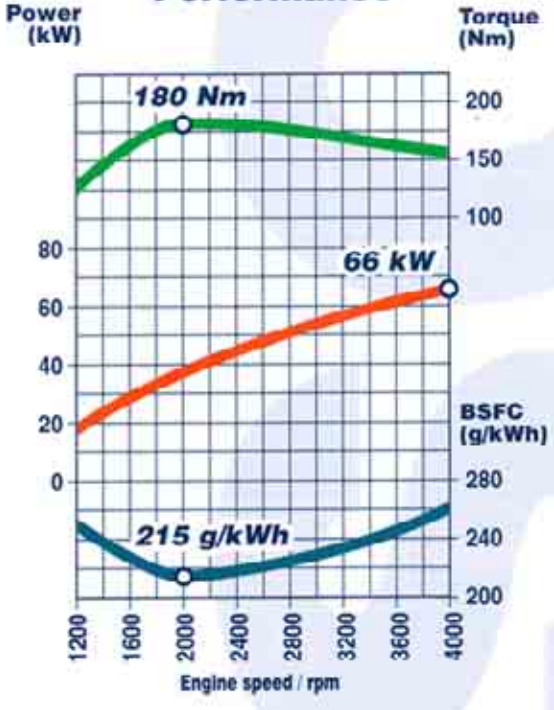
Basic Engine Data:

Combustion System	Direct injection
Configuration	3 cylinders in line
Displacement	1493 cc
Bore and Stroke	83 x 92 mm
Max Power	66 kW (90 CV) @ 4000 rpm
Peak Torque	180 Nm @ 2000 rpm
Compression Ratio	18:1
Specific Power	44.2 kW / litre
Min. BSFC	215 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron with bed plate
Cylinder Head	One piece aluminium
Emission Control Devices	Electronic EGR with throttle valve
Valve Train	SOHC, 4 valves per cylinder with hydraulic lash adjustors
Injection System	Common rail CP1
Emissions	EU. 3 (EU. 4 capable)
Balance Shaft	In sump

Dimensions and Weight:

Length	403 mm
Width	580 mm
Height	672 mm
Weight (dry)	115 kg

Performance



R 420 SOHC

88 kW (120 CV)

2000 cc • 4 Cyl. • 16 Valve

As manufacturers look to the future, the new turbocharged 2.0 litre 120 CV common rail has to be the first choice for those looking for a cost effective solution to the EU. 4 regulations. This engine has one of the leading torque / CV figures for its class.

Technical features include a belt-driven single overhead camshaft with four valves per cylinder, and a central vertical direct injector with a zero degree, narrow valve angle. Finger followers, actuating two valves at a time, control the valve aperture. The engine features exhaust gas recirculation through the cylinder head. Twin gear-driven balance shafts are fitted in the oil sump for additional refinement. The vacuum pump is fitted to the alternator and, for greater efficiency, the oil pump is a rotary vane type.

The maximum torque of 260 Nm means strong pick up. The latest common rail and multi-valve technology gives class-leading economy and driveability matched with compliance with current and future known emissions regulations. The further addition of an optional VGT turbocharger further increases the power output to 140 CV and torque to 280 Nm.

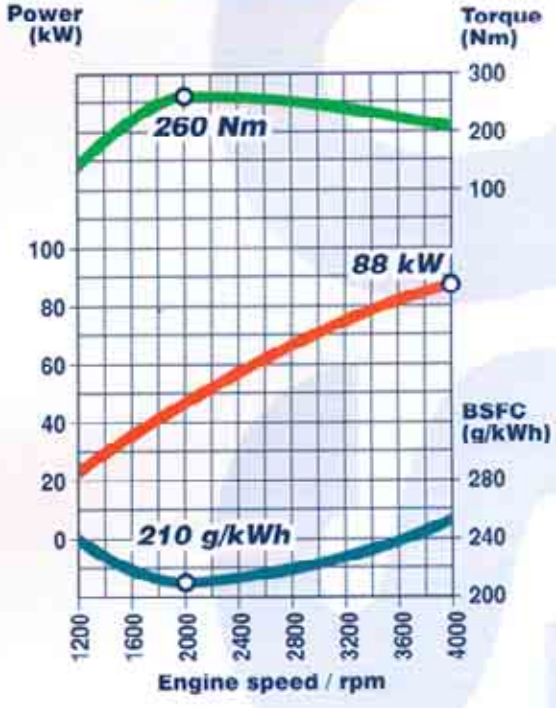
Basic Engine Data:

Combustion System	Direct injection
Configuration	4 cylinders in line
Displacement	1991 cc
Bore and Stroke	83 x 92 mm
Max Power	88 kW (120 CV) @ 4000 rpm
Peak Torque	260 Nm @ 2000 rpm
Compression Ratio	18.1
Specific Power	44.2 kW / litre
Min. BSFC	210 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron with bed plate
Cylinder Head	One piece aluminium
Emission Control Devices	Electronic EGR with throttle valve
Valve Train	SOHC, 4 valves per cylinder with hydraulic lash adjustors
Injection System	Common rail CP1
Emissions	EU. 3 (EU. 4 capable)
Balance Shaft	In sump (optional)

Dimensions and Weight:

Length	499 mm
Width	620 mm
Height	671 mm
Weight (dry)	140 kg

Performance



R 425 DOHC

115 kW (155 CV)
2500 cc · 4 Cyl. · 16 Valve

This is our most popular engine for automotive applications, coming remarkably close to the refinement levels of a petrol engine and yet achieving the efficiency of the most economical diesel engines. Low end torque is a major feature - 360 Nm at just 2000 rpm makes it the leading independently designed and manufactured engine available in its class. Not only that, this engine is also available with a VGT turbocharger which increases the maximum power output to a class leading 167 CV and torque to 380 Nm.

Further features are a belt-driven double overhead camshaft, and four valves per cylinder with finger followers for each valve. The engine features a central direct injector and a separate, cooled EGR. The block features an incorporated vacuum pump and the oil pump is a rotary vane type. The twin, gear-driven balance shaft assembly is mounted to the underside of the block in the oil sump for additional engine refinement.

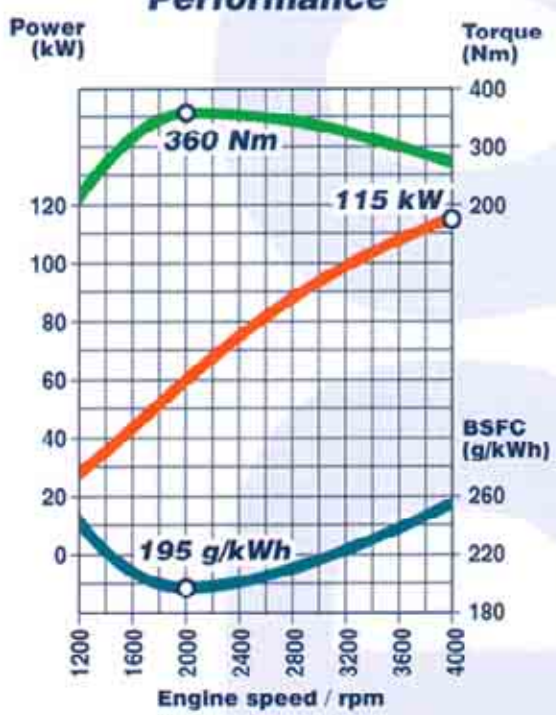
Basic Engine Data:

Combustion System	Direct injection
Configuration	4 cylinders in line
Displacement	2499 cc
Bore and Stroke	92 x 94 mm
Max Power	115 kW (155 CV) @ 4000 rpm
Peak Torque	360 Nm @ 2000 rpm
Compression Ratio	17.5:1
Specific Power	46 kW / litre
Min. BSFC	195 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron with bedplate
Cylinder Head	One piece aluminium
Emission Control Devices	EGR valve (with cooler on EU. 4 version)
Valve Train	Belt-driven DOHC, 4 valves per cylinder with hydraulic lash adjusters, roller finger followers
Injection System	Common rail CP3
Emissions	EU. 3 (EU. 4 capable)

Dimensions and Weight:

Length	540 mm
Width	645 mm
Height	682 mm
Weight (dry)	220 kg

Performance



R 428 DOHC

120 kW (163 CV)

2800 cc • 4 Cyl. • 16 Valve

The ever increasing popularity of the diesel engine and the increasingly frequent requests for larger capacity engines suitable for heavy passenger vehicle applications has led VM to further evolve the R 425 DOHC. Increasing the capacity of this engine to 2.8 L was a relatively simple task thanks to the standard wet liners. This means that only changes to the liner, piston and camshaft were necessary.

The result is the R 428 DOHC, an engine which offers all of the features and benefits of the R 425 DOHC plus an increase of over 10% more torque at lower revs. Featuring the same 4 cylinder, four valves per cylinder layout with the latest in common rail injection technology and double balance shaft off the crank in the oil sump, this engine is ideally suited to heavyweight Minivans and SUVs.

Additional technical features are as per the R 425 DOHC and include finger followers on the camshaft and cooled EGR. An optional VGT turbocharger may also be fitted and increases the power output to a class-leading 175 CV.

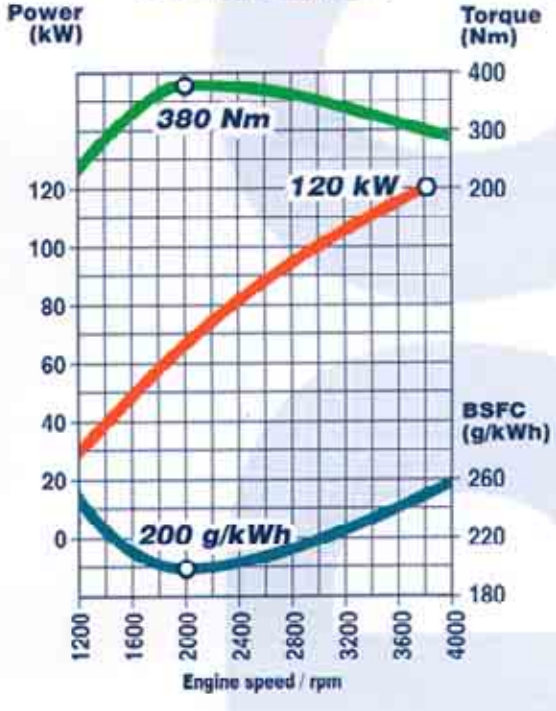
Basic Engine Data:

Combustion System	Direct injection
Configuration	4 cylinders in line
Displacement	2766 cc
Bore and Stroke	94 x 100 mm
Max Power	120 kW (163 CV) @ 3800 rpm
Peak Torque	380 Nm @ 2000 rpm
Compression Ratio	17.5:1
Specific Power	43.4 kW / litre
Min. BSFC	200 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron with bedplate
Cylinder Head	One piece aluminium
Emission Control Devices	EGR valve (with cooler on EU. 4 version)
Valve Train	Belt-driven DOHC, 4 valves per cylinder with hydraulic lash adjusters, roller finger followers
Injection System	Common rail CP3
Emissions	EU. 3 (EU. 4 capable)

Dimensions and Weight:

Length	540 mm
Width	645 mm
Height	682 mm
Weight (dry)	220 kg

Performance



VR 630 DOHC

140 kW (190 CV)

3000 cc • 6 Cyl. • 24 Valve

Matching refinement with power with ultra low emissions, the 3.0L 24 v has to be the ultimate in diesel engines. This engine is particularly flexiblo in its design and can be tailored to meet each individual customer's requirements, be it for a low rev, high torque workhorse for a commercial vehicle or a refined, high-speed engine for a luxury car. Technical features include a chain-driven, double overhead camshaft with four valves per cylinder. Each valve is driven by finger followers. Each cylinder has a central direct injector with cooled EGR (exhaust gas recirculation) as an integral part of the cylinder heads. The vacuum pump is incorporated into one of the camshafts for greater efficiency and the oil pump is a rotary vane type.

In 190 CV automotive guise this 3.0L 24 v turbocharged engine leads the way in power, torque, refinement and emissions. Further increases can also be achieved by fitting an optional VGT turbocharger which increases power and torque to 210 CV and 470 Nm respectively. Additionally the engine's packaging means that it can be fitted into surprisingly tight engine bays. VM are very proud of this engine and believe that this is the future of high capacity diesel engines. Today.

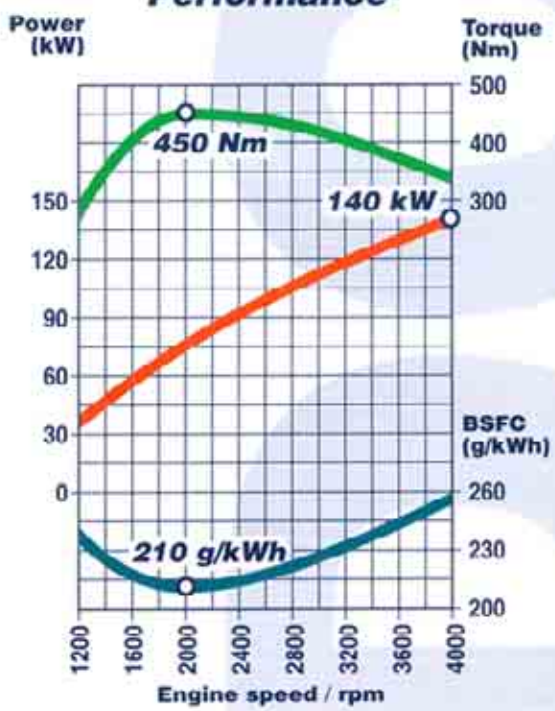
Basic Engine Data:

Combustion System	Direct injection
Configuration	6 cylinders in 60 degree "V"
Displacement	2987 cc
Bore and Stroke	83 x 92 mm
Max Power	140 kW (190 CV) @ 4000 rpm
Peak Torque	450 Nm @ 2000 rpm
Compression Ratio	18:1
Specific Power	46.9 kW / litre
Min. BSFC	210 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron or aluminium
Cylinder Head	Aluminium
Emission Control Devices	Electronically controlled EGR with throttle valve
Valve Train	Chain-driven DOHC, 4 valves per cylinder with hydraulic lash adjusters
Injection System	Common rail CP3
Emissions	EU. 3 (EU. 4 capable)
Balance shaft	In block (optional)

Dimensions and Weight:

Length	525 mm
Width	680 mm
Height	705 mm
Weight (dry)	240 kg (210 kg Aluminium)

Performance



VR 640 OHV

157 kW (214 CV)

4000 cc · 6 Cyl. · 16 Valve

Designed with trucks and large SUVs in mind, this engine is high on performance, low on emissions. Like all its smaller new generation relatives, it complies with EU. 3 regulations and has EU. 4 capability. Again, this engine utilises multi-valve technology and is fitted with the latest in Bosch common rail technology.

With a VGT turbocharger, this 235 CV engine produces 510 Nm @ 1800 rpm, but not at the expense of refinement. An inherently high standard for NVH is a feature of this design.

Designed for 400,000 km durability, this engine has a gear-driven camshaft with a high efficiency port arrangement, four valves per cylinder with hydraulic lash adjustment, central direct injector, electronically cooled EGR and electronically controlled, variable displacement common rail injection. An optional balance shaft can be fitted in the engine block.

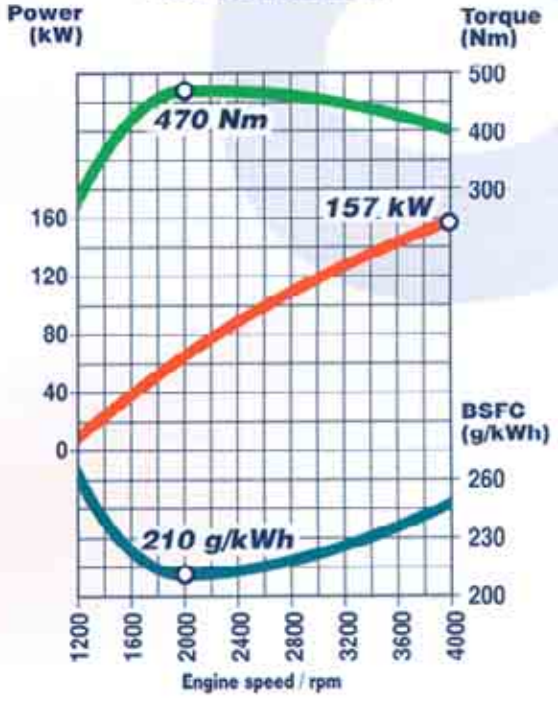
Basic Engine Data:

Combustion System	Direct injection
Configuration	6 cylinders in 60 degree "V"
Displacement	4028 cc
Bore and Stroke	92 x 101 mm
Max Power	157 kW / 214 CV @ 3800 rpm
Peak Torque	470 Nm @ 2000 rpm
Compression Ratio	18:1
Specific Power	39 kW / litre
Min. BSFC	210 g / kWh
Air Induction	Turbocharged / Intercooled
Block	Cast iron
Cylinder Head	Aluminium
Emission Control Devices	Electronically controlled EGR
Valve Train	OHV, 4 valves per cylinder with hydraulic lash adjusters
Injection System	Common rail CP3
Emissions	EU. 3 (EU. 4 capable)
Balance shaft	In block (optional)

Dimensions and Weight:

Length	558 mm
Width	635 mm
Height	762 mm
Weight (dry)	292 kg (210 kg Aluminium)

Performance



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