

Stage 3B made easy



Portable Compressors

Sustainable Productivity

Atlas Copco



A new day for portable compressors

January 2011 introduced new emission standards for portable compressors that will change the entire industry. The Stage 3B standards for off-road diesel engines aim to improve air quality through drastic decreases of discharges of particulate matter and NOx. The regulations impose significant changes to the design and performance of all larger portable compressors.

Atlas Copco welcomes these standards and is ready to help you achieve full compliance. Through in-depth comparative R&D, Atlas Copco has selected best-in-class Stage 3B technologies that integrate seamlessly into the existing range of Atlas Copco portable equipment. It is sustainable productivity by Atlas Copco, now fully Stage 3B compliant and ready for the future.



Stage 3B – A new era in emission standards

In January 2011, new emission standards for 130 – 560 kW off-road diesel engines went into effect in the US and in Europe. In Europe, the new standards are incorporated in the EU Nonroad-Directive Stage 3B. Other countries (e.g. Canada) intend to follow the US and European regulations.

Stage 3B requires a decrease of particulate matter by no less than 90% and of NO_x emissions by 50% compared to current levels. Regulation regarding the use of low sulfur fuel is also included in Stage 3B.

Stage 3B is just the beginning. By 2014, Stage 4 regulations will require particulate matter and NO_x levels to be reduced by more than 90% for most power categories, to near zero levels.

The Stage 3B standards apply to variable speed engines, primarily affecting larger portable compressors. The regulations have gone into effect in all 27 member states of the European Union, plus Norway, Switzerland and Turkey.

Austria	Greece	Poland
Belgium	Hungary	Portugal
Bulgaria	Ireland	Romania
Cyprus	Italy	Slovakia
Czech Republic	Latvia	Slovenia
Denmark	Lithuania	Spain
Estonia	Luxemburg	Sweden
Finland	Malta	Switzerland
France	Netherlands	Turkey
Germany	Norway	United Kingdom

Emission Standard Technologies

Atlas Copco has a strong track record in identifying the right technologies to make its portable equipment fully compliant with all emission standards. Atlas Copco achieves Stage 3B compliance with Exhaust Gas Recirculation (EGR)/Diesel Particulate Filter (DPF) technology that integrates seamlessly into its portable equipment.

	Stage 2	Stage 3A	Stage 3B	Stage 4
Engine Technology	Charge Air Cooling	Charge Air Cooling	Charge Air Cooling	Charge Air Cooling
	Combustion Optimization	High Pressure Common Rail Fuel Injection	High Pressure Common Rail Fuel Injection	High Pressure Common Rail Fuel Injection
	Advanced Turbochargers	Exhaust Gas Recirculation	Cooled Exhaust Gas Recirculation	Cooled Exhaust Gas Recirculation
Exhaust Aftertreatment			Diesel Oxidation Catalyst (DOC)	Diesel Oxidation Catalyst (DOC)
			Diesel Particulate Filter (DPF)	Diesel Particulate Filter (DPF)
				Selective Catalytic Reduction (SCR)
Requirements for Fluids			Ultra Low Sulfur Fuel Required	Ultra Low Sulfur Fuel Required
			Low Ash Engine Oil Required	Low Ash Engine Oil Required
				Diesel Exhaust Fluid (DEF)

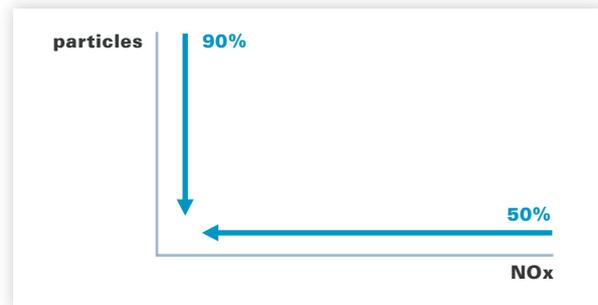
Zero emissions by 2014

The first emission standards for off-road diesel equipment were introduced by the US Environmental Protection Agency in 1996. The first European standards (Stage 1) followed a few years later. Starting from Stage 2 in 2004, new standards have been established in more rapid succession.

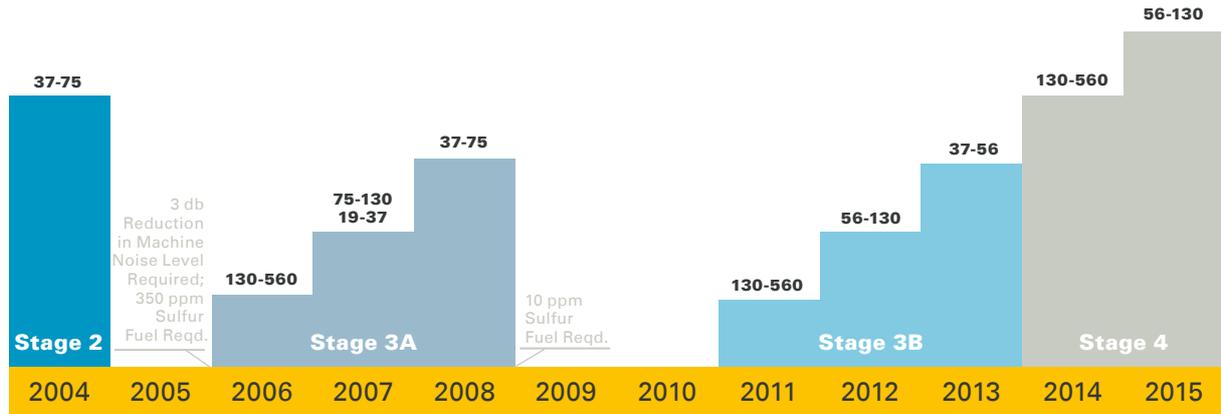
Stage 3B regulations are a precursor (also referred to as the “interim phase”) to the Stage 4 standards that will go into effect in 2014.

The interim Stage 3B imposes a reduction of particulate matter by 90% and of NO_x emissions by 50% compared to the previous Stage 3A levels from January 2011. The smaller range of products will have to comply from 2012.

By 2014, Stage 4 will require particulate matter and NO_x levels to be reduced to near zero for most power categories.



EU emission standards (in kW)



Stage 3B – Consequences & Costs

The Stage 3B regulations are changing the entire portable compressor industry. **The new standards require significant changes that affect portable equipment manufacturers, engine suppliers as well as the end user.**



DESIGN & PERFORMANCE

Stage 3B primarily impacts the larger portable compressors. Atlas Copco has redesigned and re-engineered its entire range of large portable equipment to meet the most stringent emission standards.



SIZE

In the Exhaust Gas Recirculation (EGR)/Diesel Particulate Filter (DPF) process used to achieve Stage 3B compliance, heat absorbed by the cooled EGR must be dissipated through coolers with improved performance. This can result in bigger coolers and an increase of outside dimensions. Because footprint matters, Atlas Copco has developed an EGR solution that integrates the new coolers into the existing Atlas Copco equipment, with limited or no impact in terms of size.



OIL & FUEL

All new technologies that help meet the new emission standards require the transition to ultra-low sulfur diesel fuel and low ash engine oils. As a result, fuel quality becomes crucial. Machines using the Selective Catalytic Reduction (SCR) technology must also be equipped with an extra tank for Diesel Exhaust Fuel (DEF/also known as AdBlue).



SERVICE

The EGR/DPF process includes an aftertreatment system with a particulate filter that must be serviced. The new Stage 3B regulations limit service intervals for these filters to every 4,500 hours.



ACCOUNTABILITY

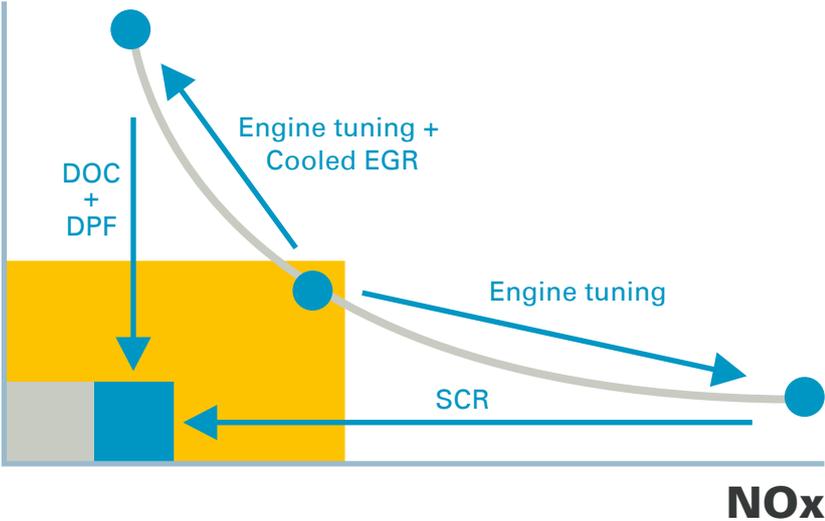
Engine manufacturers are now held accountable for the exhaust emissions of their products for five years or 3,000 hours of operation (depending on power category), even as the engines are integrated into portable compressors.



PRICE

The new emission standards will have a substantial impact on equipment value, in turn affecting cost and price. Sales prices across the affected compressor range will go up between 35% and 45%.

particulate matter



■ Stage 3A ■ Stage 3B ■ Stage 4

Stage 3B technologies

The Atlas Copco Portable Air division has evaluated two technologies that can achieve Stage 3B compliance: Selective Catalytic Reduction (SCR), and the four-step Exhaust Gas Recirculation (EGR) combined with a particulate filter (DPF).

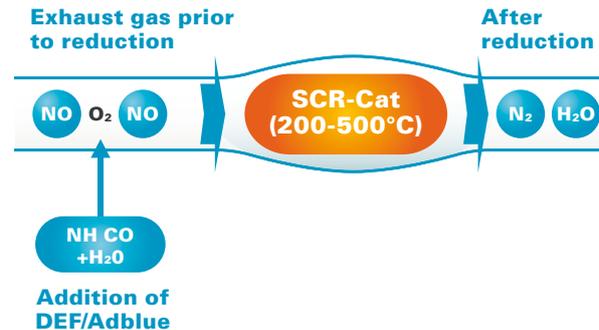
- **SCR – higher combustion temperature + SCR.** SCR avoids the creation of particulate matter by optimizing combustion. As this results in an increase in NO_x, Diesel Exhaust Fluid (DEF, also known as AdBlue) must be added to turn the NO_x into harmless nitrogen.
- **Cooled EGR – lower combustion temperature + filters.** Cooled EGR avoids the formation of NO_x by lowering the peak combustion temperature. This process generates more particulate matter, which is then filtered out with a DPF.

Atlas Copco has selected the NO_x Reduction System with Clean Emission Module, using EGR/DPF technology, as the best solution. It offers customers better fuel economy and avoids the need for AdBlue refills.

SCR

In the Selective Catalytic Reduction (SCR) process, NO_x is chemically reduced to nitrogen and water vapor in a dedicated catalyst.

- Diesel Exhaust Fluid (DEF/AdBlue) is injected into the catalyst, before the exhaust. Here, the AdBlue, under the influence of heat, reacts with water vapor to form ammonia.
- The ammonia causes the harmful NO_x to convert into harmless nitrogen and water vapor.
- Heat rejection does not increase.
- Volume of aftertreatment is bigger and more complex.
- A dedicated DEF/AdBlue tank is required. Depending on the size of the tank, DEF/AdBlue must be refilled at the same frequency as diesel.



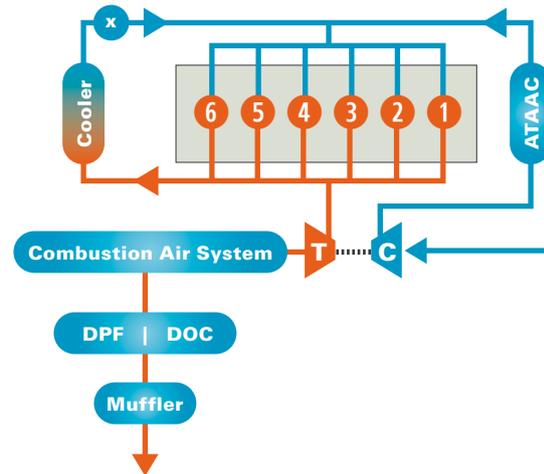
NO_x reduction of 80% possible.
Exact ammonia dosing and strict adherence
to reduction temperatures necessary.

Atlas Copco Stage 3B solution

Step 1 Cooled EGR

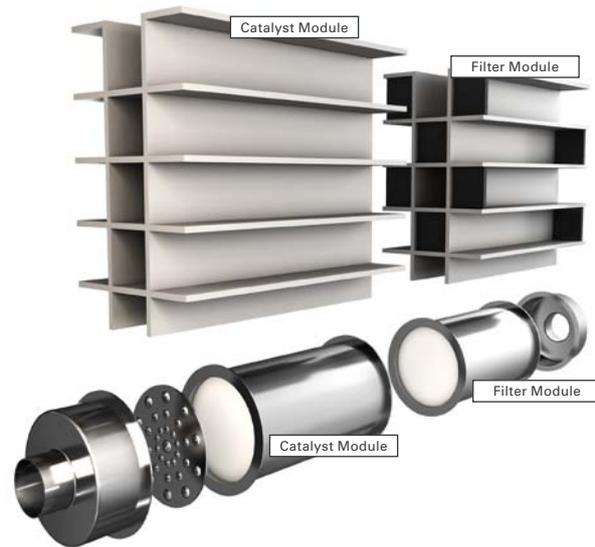
With Exhaust Gas Recirculation (EGR), part of the exhaust gases are cooled and then injected back into the engine cylinders to reduce NO_x.

- Exhaust gas is cooled to allow the introduction of a greater mass of recirculated gas.
- The outcome is a lower peak combustion temperature.
- This process generates less NO_x, but more particulate matter.
- Heat rejection to the radiator increases.



Step 2 DPF + DOC

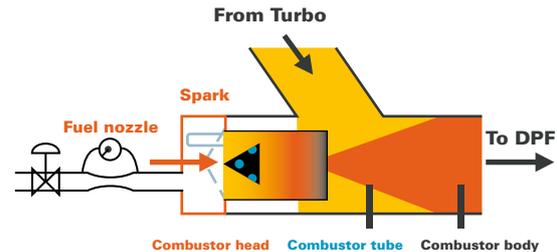
To remove excess particulate matter from the exhaust gas, a Diesel Particulate Filter (DPF) is used. This system consists of a Diesel Oxidation Catalyst (DOC) and a filter module. The DOC reduces CO, HC and NO through oxidation. It also produces NO₂ to regenerate the DPF. The filter system removes 99% of particulate matter.



Step 3 Active regeneration

Particulate matter left in the filter system is burned in a process called regeneration. Extending the lifetime of a filter, it converts particulate matter into CO₂ and ash. Atlas Copco engines use high temperature regeneration that includes a fuel burner in the exhaust stream that intermittently raises the temperature above 600° Celsius. Active regeneration decreases in the higher load cycles of the compressor.

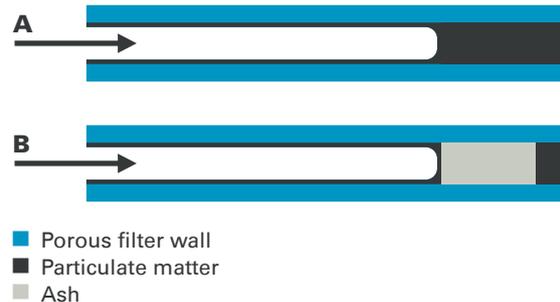
Combustion Air System



Step 4 Ash

Additives in lube oil that do not combust during regeneration, turn into ash. This reduces filter volume, oxidation efficiency and backpressure. Ash must be removed mechanically, either by washing or blowing it out.

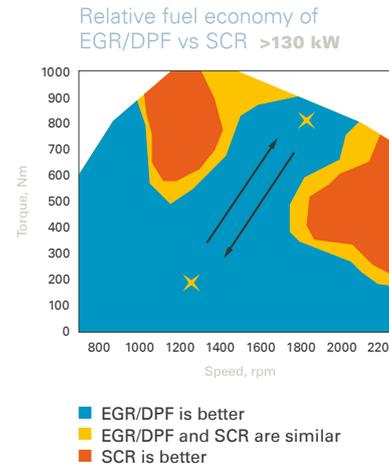
The minimum maintenance interval for ash removal, as defined by the EPA, is 4,500 hours. This service interval can be increased depending on duty cycle.



+ The choice for EGR/DPF

Atlas Copco has selected the NO_x Reduction System with Clean Emission Module, using EGR/DPF technology, as the best solution to achieve Stage 3B compliance. This technology offers distinct benefits for customers.

- No Diesel Exhaust Fluid (DEF/AdBlue) refills: EGR eliminates the need to get AdBlue to difficult to reach job sites. Running out of AdBlue will cause engines to shut down, causing costly delays.
- Fuel economy: Lab tests have shown energy savings on specific Atlas Copco models using EGR.





Atlas Copco – Seamless Stage 3B integration

The Stage 3B regulations require significant changes to the design and performance of large portable compressors. Atlas Copco has redesigned and re-engineered its entire range of large portable equipment. [The new Atlas Copco equipment offers an easy, integrated solution that meets the most stringent emission standards and even delivers increased fuel efficiency.](#) The result is a powerful combination of full Stage 3B compliance and Atlas Copco's portable performance and reliability.

+ More than the engine

Stage 3B standards require the development and implementation of new technologies, resulting in a significant increase of the cost of portable compressors:

- A **new engine** with cooled EGR.
- A **new cooling system** to dissipate the extra heat extracted from the exhaust during the cooled EGR process.
- A **new exhaust aftertreatment system** that meets strict installation standards (e.g. regarding exhaust pipe materials)

Thinking inside the box

The Stage 3B design changes generally lead to an increase in canopy size, and thus also in costs. Atlas Copco Stage 3B solutions typically come completely integrated into the existing Atlas Copco portable compressors. It is the equipment you know and trust, now fully Stage 3B compliant.



Atlas Copco Stage 3B benefits



Atlas Copco makes Stage 3B easy with a fully integrated solution for the equipment you know and trust. Even the footprint stays the same.



EGR/DPF technology ensures reduced fuel consumption.



Particulate matter is removed using the most efficient and reliable technologies.



Maintain the value of your investment by choosing Atlas Copco equipment.



Play your part.
Protect the environment.



It is the end of Stage 3A. Stage 3B standards are here to stay.

Atlas Copco Portable Compressors

Atlas Copco Stage 3B 130 – 560 kW Compressors



500 – 850 cfm

XA(M,T, H,V)S 650-850 CD7 / JD7

Shipyard, construction and rental industries



695 – 1127 cfm

X(A,R)(M,T,H,V)S 700-1600 CD6

Drilling, shipyard, construction industries and quarries



1220 – 1300 cfm

XR(V,X)S 1240-1275 CD7

Drilling and quarries



1975 – 2232 cfm

Twin Air

Offshore, drilling



Oil Free Compressor

925 – 1575 cfm

PTS

Offshore, plant maintenance, ski resorts and refineries



Open Frame

1400 – 1550 cfm

Open Frame

OEM Oil & Gas Solutions



Sustainable Productivity

Stage 3b



www.atlascopco.com/portableenergy/cleanengines