




Atlas Copco



The route to Stage V compliance and beyond

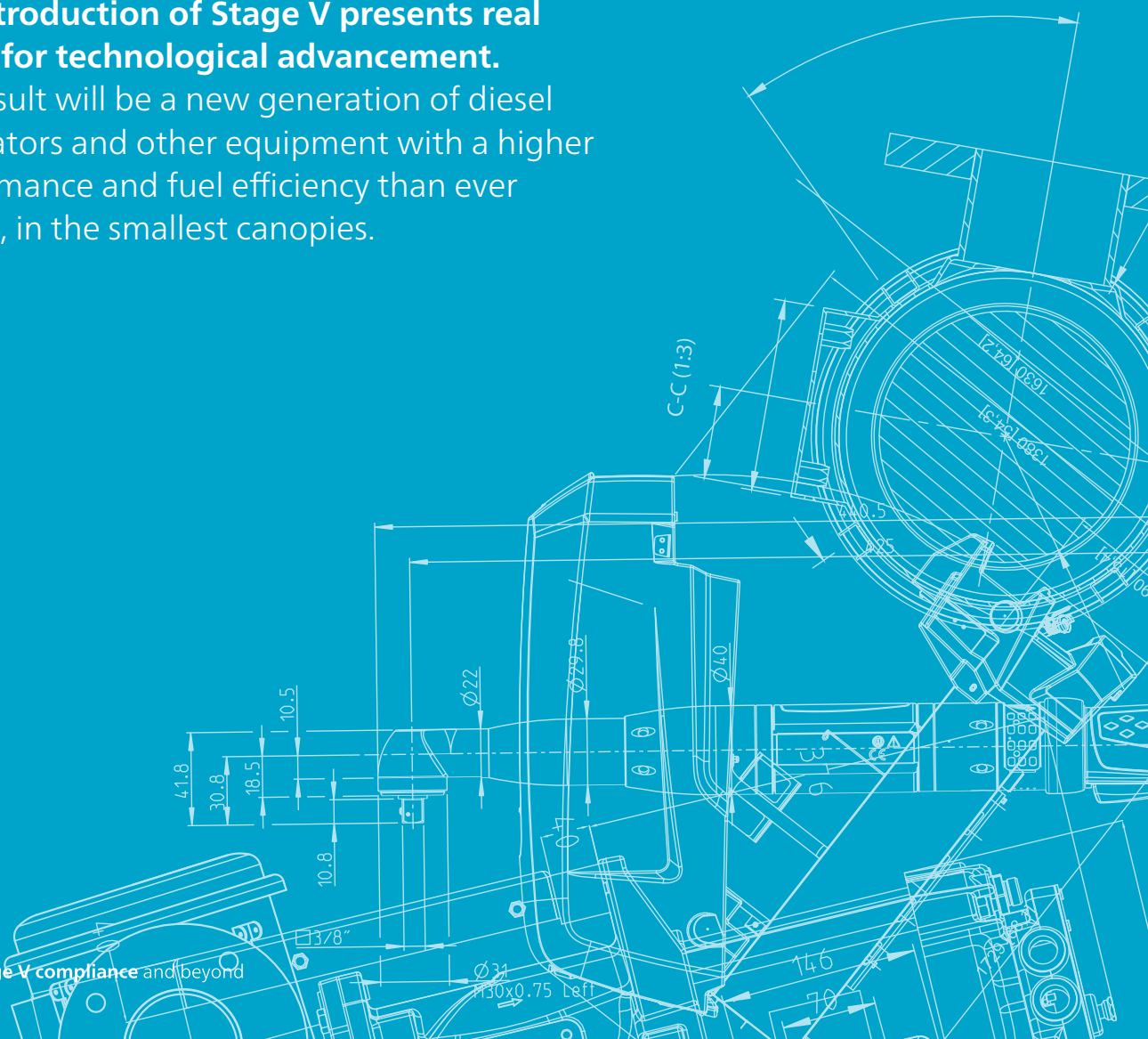
Power generators

www.atlascopco.com/StageV

The European Commission's introduction of Stage V emissions standards for non-road machinery in 2019/21 is bringing new challenges for engine makers, including the integration of after-treatment systems and meeting particulate matter count.

This e-guide takes you along the route to Stage V emissions standards compliance, introducing cleaner and better-performing diesel generators while also taking a look at the transition to alternative drive technologies such as battery driven solutions.

While some industrial suppliers are struggling to come to terms with the impact of new engine architectures on the products they offer, **Atlas Copco has long recognised that the introduction of Stage V presents real scope for technological advancement.** The result will be a new generation of diesel generators and other equipment with a higher performance and fuel efficiency than ever before, in the smallest canopies.



European Stage V non-road emissions standards

The European Commission's desire to improve air quality, and therefore protect the health of European Union citizens, has resulted in a progressive approach to emissions standards for non-road mobile machinery.

Since the late 1990s, the staggered introduction of emissions legislation has resulted in limits for engines across a wider range of power outputs and applications, while engine manufacturers have faced tighter procedures in order to obtain type-approval of their products for EU markets.

Now, the Stage V diesel engine regulations – due to be implemented in 2019/21 – will be extended to include the smallest compression-ignition engines (below 19 kW) and all larger engines (greater than 560 kW), setting a minimum stringency over the entire power range. Stage V will also continue the path towards reduction of particulate and NOx emissions. The main difference is that for the first time there will be a limit on the number of particulates for several categories of engines between 19 and 560 kW. In practice, this will drive the adoption of diesel particulate filters (DPFs) and associated equipment for engines in this power range.

The standards will apply to a wide range of traditional mobile equipment in construction, such as mobile generators – including wheeled trailers and models that are designed to be moved to different work locations, such as those commonly used by equipment rental companies.

But the introduction of Stage V is not all about emissions: it has brought about an opportunity for performance advancement through the insertion of new technology. Indeed, over the past couple of years, Atlas Copco has been working closely with engine suppliers to deliver more productive and reliable machinery, with lower through-life costs.

“Atlas Copco provides customers with a clear pathway to compliance, offering an unrivalled range of next-generation of diesel generators that will offer better performance and value than ever before. Atlas Copco goes beyond stage V and offers technology that is clean, efficient, smart and connected.”

Looking at the wider picture, Stage V highlights the fact that EU legislators expect industry to play a central part in improving air quality and assisting in the fight against climate change. Atlas Copco is committed to reducing its carbon footprint and helping to deliver a more sustainable future.

The journey to Stage V compliance

The introduction of Stage V legislation for non-road machinery takes effect incrementally – in January 2019 for engines below 56 kW as well as engines of 130 kW and above, and from January 2020 for engines from 56 to 130 kW. The legislation will basically be valid for all mobile industrial equipment powered by compression-ignited or spark-ignited engines.

The incremental nature of EU emissions standards means that Atlas Copco, together with the engine manufacturers, has had long-distance visibility of the new requirements. That said, no single 'best technology' approach to compliance has emerged, as engine makers have had to consider varying customer priorities across the power range. Perhaps the biggest impact, for instance, comes in the 19 to 37 kW engine range – where common-rail fuel systems and exhaust after-treatment are being applied for the first time.

With the European Commission setting the rules for Stage V, the legislation applies to all countries within the European Union, and it is up to the local authorities in each country to ensure the rules are followed. Countries in Europe that are not members of the European Union, for example Norway, Switzerland and soon the UK, will most likely choose to follow the same rules.

The rules have been developed with an emphasis on technologies that reduce harmful substances in exhaust gases. Stage V will only allow about 3 to 4 per cent of the limits allowed by Stage I, which was introduced as late as 1999. Compared to Stage IV, which is the current legislation, Stage V will not only limit the overall mass of particulate matter in the exhaust gas, but also the number of particles emitted through a particulate filter.

Engine makers have looked at several ways of combining different techniques to achieve the Stage V emissions limits. As with Stage IV, an exhaust after-treatment system (EATS) with selective catalytic reduction (SCR) is needed. This means that diesel exhaust fluid (DEF) is injected into the exhaust stream to reduce the NO_x levels. For Stage V, one solution would be to combine modules of diesel oxidation catalyst (DOC), diesel particulate filter (DPF), SCR and ammonia slip catalyst (ASC). This, together with the heat management devices on the engine, will provide excellent uptime through an optimised regeneration strategy. Furthermore, a common-rail fuel injection system featured in Stage V engines could lead to an improved fuel efficiency and optimised combustion process. The common-rail fuel injection system will also provide significant noise reduction, which is mainly important for machines such as generators that operate in urban environments.

In addition to the development of new emissions technologies, the engine makers have also been working closely with OEMs to ensure optimal operational performance. Much consideration has been given to installation, reliability, maintenance and fuel efficiency. These collaborative efforts mean that new industrial machines installed with Stage V-approved engines will deliver exceptional value for money through low total cost of ownership.

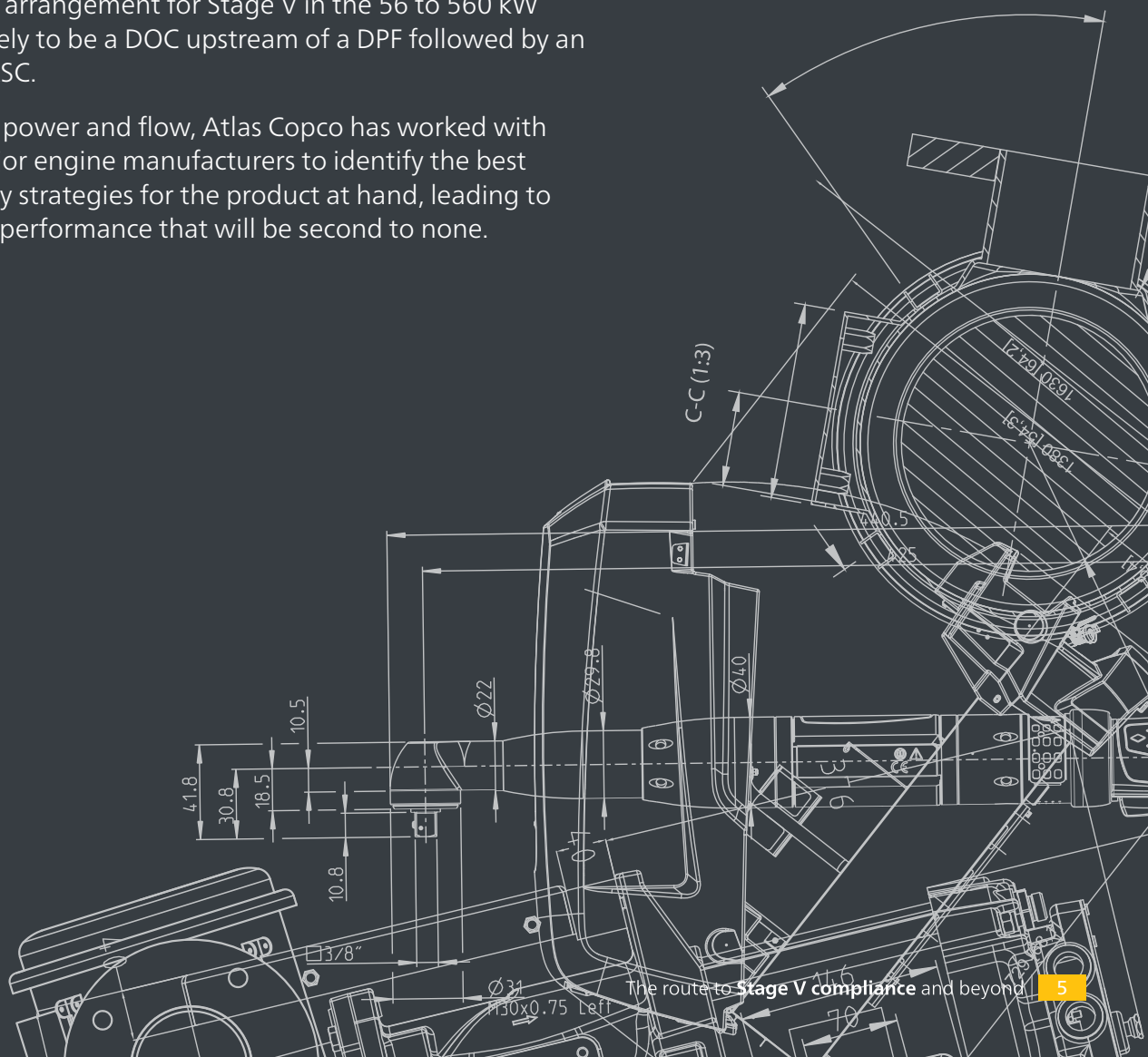
Engine strategies under consideration

Stage V effectively calls for the use of a DPF in the after-treatment system. The reduction in PM mass limit and the introduction of a particulate number count for diesel engines between 19 and 560 kW makes it extremely difficult to achieve Stage V emissions compliance without a filter.

The rules mean that manufacturers of smaller engines, under 56 kW, are covered for the first time and, as such, many of these suppliers might not have previously developed an after-treatment technology solution. It's likely that the well-understood performance of a DOC and DPF combination, selected by many suppliers on engines over 56 kW at previous stages in EU emissions legislation, will emerge as the technology of choice for manufacturers of 19 to 56 kW engines.

Higher up the power output scale, the most common after-treatment arrangement for Stage V in the 56 to 560 kW band is likely to be a DOC upstream of a DPF followed by an SCR and ASC.

Across air, power and flow, Atlas Copco has worked with all the major engine manufacturers to identify the best technology strategies for the product at hand, leading to emissions performance that will be second to none.



Introducing Stage V on power generators

Most engines installed in generators comply with Stage IIIA emissions standards, and so the leap forward to Stage V has a big impact. Also, generators – in the main – require constant- rather than variable-speed engines, which in turn requires different technical solutions. As constant-speed machines account for only a small percentage of the overall industrial engine market, that means progress towards Stage V compliance has been slower.

However, Atlas Copco has been working with its partners on Stage V solutions for generators for several years. These conversations have focused on areas such as the design and packaging of after-treatment systems. These considerations will have an impact on the size, performance, fuel efficiency and cost of Stage V-compliant machines, and all of these factors are currently being assessed in ongoing trials.

With a wide technological gap between Stage IIIA and Stage V, Atlas Copco has thought long and hard about how to implement a smooth transition towards the phased adoption of the new standards in 2019/21. One solution has been the development of the flagship QAS 5 generators, which come with optimised Stage IIIA engines. QAS 5 Stage V-compliant engines are now available, offering a clear pathway to Stage V adoption and beyond.

The **QAS 5 range** represents a technological leap in its own right. The first five models – new versions of the QAS 80, 100, 120, 150 and 200 generators – all include the optimised Stage IIIA engines, a high-capacity fuel tank and integrated variable-speed drive motor to power the cooling fan. These features combine to provide users with a more than 5 per cent reduction in fuel consumption compared to the industry average for equivalent models, resulting in a lower carbon footprint. The QAS 5 generators deliver a significant reduction in noise levels, with one-fifth lower noise perception than comparable generators, which is an important consideration when excessive noise generated by portable energy equipment is becoming increasingly unacceptable in urban environments.

On other ranges – such as QES – similar complementary strategies are being employed, resulting in the use of transition engines in certain power ranges, with Stage V-compliant models set to follow in the short term.

Meanwhile, in certain power outputs, Stage V compliance could be achieved through the use of highly innovative dual-power strategies. Here, big power nodes could be covered by two smaller engines working in tandem. Atlas Copco already has extensive experience of this technology, having launched its TwinPower operating principle in 2016, based around the concept of two generators, with two independent engines, fitted inside one box.

The **QAC 1350 TwinPower Stage V compliant**, launched in December 2020, is the latest model, featuring two compact 625 kVA generators in a 20 ft ISO containerized unit. This configuration, with its fast-parallelising system, allows the two generators to work independently or in parallel with each other. This provides far more flexibility, solving load issues and reducing fuel consumption and CO₂ emissions up to 40% on variable load applications. Additionally, the QAC 1350 TwinPower provides an environmentally friendly way to power operations, with nitrogen oxide (NO_x) emissions reduced by 80%.

TwinPower offers a sound strategy for Stage V compliance at the upper end of the power outputs, while the engine manufacturers decide on new engine architectures for their largest and most powerful constant-speed models.



The unique QAS VSG (Variable Speed Generator), the generation 5th of QAS 5 and the innovative QAC TwinPower, covering all power needs.

In order to overcome the potential low load issues on Stage V engines like wet stacking or after treatment saturation, which impacts the performance of the generators, Atlas Copco has also seized the opportunity to launch the first ever variable-speed generator called **QAS VSG**. The unique technology QAS VSG works between 950 and 2550 rpm integrating an Energy Storage System to increase Peak power capabilities by 70% and will ensure that the power pack works at the optimum speed level regardless of the load. In addition to reliability and performance under Stage V, QAS VSG will bring several end-user benefits, including 40% fuel savings, 40% less CO2 emissions, +70% Peak power capabilities vs nominal power, high fleet utilization, low noise under low loads and compact footprint. This is an important consideration in space-constrained metropolitan building sites.

Whatever the outcome of ongoing technical discussions, Atlas Copco has in place the required depth of range and the technical expertise to ensure that customers are provided with a smooth transition to Stage V across the power range. Ultimately, customer needs will be met through sustainable productivity and increased operational flexibility, along with compliance with environmental and regulatory obligations – whatever the model choice.

Beyond Stage V: from diesel to alternative power sources

The desire to improve air quality, and therefore protect the health of European Union citizens, will see a continuation of efforts to reduce emissions from non-road mobile machinery, even after the introduction of the Stage V regulations. This is resulting in a noticeable trend towards non-polluting and connected air, power and flow solutions that are reliant on alternative power architectures such as electric and battery, among others.

This trend is particularly pertinent in urban applications, with a growing number of local authorities in Europe clamping down on the use of diesel equipment in metropolitan areas through the introduction of low emissions zones. While the speed and magnitude of this conversion is geographically determined, there can be little doubt that society's perception of diesel particulates in connection with health-related issues will continue to grow.

Excessive noise generated by portable energy equipment is becoming increasingly unacceptable in urban environments and industrial work areas, and this also presents opportunities for new engine architectures.

While efficient diesels remain a core product offering, the increasing use of hybrid systems can be seen across generator ranges, while battery power offers great potential on smaller machines and other equipment.

Atlas Copco has released **ZenergiZe**, a new range of lithium-ion energy storage systems that can be used as a standalone solution or combined with generators to create a hybrid power solution. This innovative technology is built to help operators embrace a new way of managing, storing, and using energy. ZenergiZe delivers zero CO₂ emissions, zero noise, and have virtually zero maintenance needs, enabling operators to minimize environmental impact while benefiting from a low cost of ownership. During its lifecycle, a ZenergiZe unit only emits 50 percent of the emissions of a standard standalone generator, saving approximately 100 tons of CO₂ – the equivalent of planting 450 trees (assuming a tree life of 30 years). When used in the island mode, the CO₂ savings can reach up to 100 percent if the unit is powered by renewable energy sources.

ZenergiZe ZBP 45
energy storage system



Atlas Copco



Your clean and quiet source of energy

ZenergiZe range

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Stage V is an **opportunity**, not a threat

In summary, then, it's clear that the introduction of Stage V emissions regulation for non-road mobile machinery will have an impact across industrial sectors. At first glance, the implementation of the new standards might appear complicated, but Atlas Copco has the products and technical know-how to help their customers increased performance, steer a clear path to where they want to be.

Indeed, Stage V should be viewed as a business opportunity, rather than a hindrance or threat. The introduction of the standards has led to a surge of innovation, resulting in cleaner and more efficient air, power and flow products, in addition to alternative technologies. Whether it is less fuel, better performance, smaller canopies, lower noise or improved reliability, Atlas Copco customers can profit from the journey to Stage V compliance and beyond.

Atlas Copco: your partner on the route to Stage V compliance

Still have questions?

Contact us today to learn more about the best solution for you.

www.atlascopco.com/StageV

Atlas Copco



Double the flexibility Twice the power!

QAC 1350 TwinPower™ Stage V generator

www.atlascopco.com/twinpower

Product portfolio

GENERATORS

PORTABLE
1,6–12 kVA



MOBILE
9–1250* kVA



INDUSTRIAL
10–2250* kVA



LARGE POWER
800–1450 kVA



*Multiple configurations available to produce power for any size application

DEWATERING PUMPS

ELECTRIC SUBMERSIBLE
250–16.200 l/min



SURFACE PUMPS
833–23.300 l/min



Diesel and electric options available

ENERGY STORAGE SYSTEMS

ZENERGIZE



LIGHT TOWERS

DIESEL



BATTERY



ELECTRIC



AIR COMPRESSORS AND HANDHELD TOOLS

AIR COMPRESSORS
1–116 m³/min
7–345 bar



HANDHELD TOOLS
Pneumatic
Hydraulic
Petrol engine driven



ONLINE SOLUTIONS

**SHOP ONLINE
PARTS ONLINE**

Spare parts for power equipment. We handle your orders 24 hours a day.



POWER CONNECT

Scan the QR code on your machine, and go to the QR Connect Portal to find all the information about your machine.



**LIGHT THE POWER:
YOUR SIZING TOOL**

A useful calculator to help you choose the best solution for your power and light needs.



FLEETLINK

Intelligent telematics is a system that helps optimize fleet usage and reduce maintenance, ultimately saving time and cutting operating costs.

