

The **Clean** Secret Behind **Diesel**



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What is Tier 4 Final?

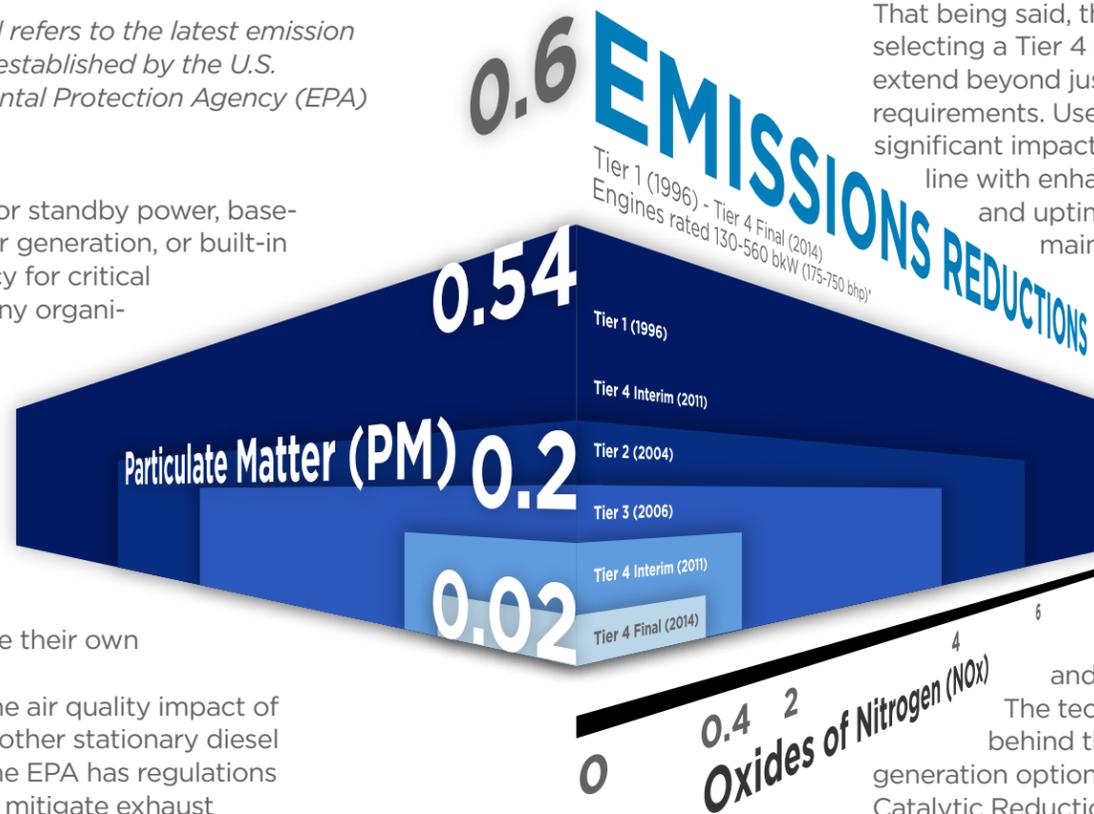
Tier 4 Final refers to the latest emission milestone established by the U.S. Environmental Protection Agency (EPA)

Whether for standby power, base-load power generation, or built-in redundancy for critical assets, many organizations install stationary engines at their facilities for the ability to generate their own power. To mitigate the air quality impact of these and other stationary diesel engines, the EPA has regulations in place to mitigate exhaust emission levels.

Beginning in 1996, the EPA enforced a series of New Source Performance Standards (NSPS) known as Tiers which progressively strengthened restrictions on emissions of nitrogen oxides (NOx), carbon monoxide (CO), particulate matter (PM), and non-methane hydrocarbons (NMHC).

Tier 4 Final is the strictest of the EPA emission requirements for stationary diesel engines to date. In comparison to previous tier levels, Tier 4 Final standards result in an exhaust emission reduction of up to 99%.

Engines that meet these stringent standards promote cleaner air, improved fuel efficiency, and higher performance.



Why do I need Tier 4 Final?

A newly installed stationary diesel engine must be certified to EPA Tier 4 Final standards if it is to be used in a non-emergency application.

That being said, the reasons for selecting a Tier 4 Final engine extend beyond just the regulatory requirements. Users will see a significant impact on their bottom line with enhanced productivity and uptime, and lowered maintenance costs.

Combining strengths, PowerSecure and Volvo Penta deliver a superior, environmentally-friendly solution for peak shaving and standby power. The technology of choice behind this on-site power generation option is Selective Catalytic Reduction (SCR), which has been thoroughly proven in Volvo Group.

Regulatory Compliance

Tier 4 certification is required for any non-emergency engine or any emergency and non-emergency engines that were manufactured in 2011 or later. Under the New Source Performance Standards (NSPS) Subpart III (40 CFR Part 60), EPA regulations require that all non-emergency engines manufactured after 2015 are Tier 4 Final certified.

It is imperative to understand that engines must be Tier 4 Final certified and not simply Tier 4 Final compliant. An engine may be in compliance with NSPS emissions standards, but if it is not also EPA certified, then it is not in compliance with the regulation.

PowerSecure has partnered with engine manufacturer Volvo Penta to offer a simple and efficient Tier 4 Final power generation solution. This brochure will:

- Provide evidence supporting the need for Tier 4 Final power generation systems and the verticals that stand to benefit from the solution
- Break down some of the misconceptions surrounding Tier 4 Final
- Offer technical resources for more information

Overhead Reduction

The SCR system's catalytic converter is designed to last the life of the engine, meaning costs for maintenance and downtime are reduced. The system also offers unsurpassed fuel efficiency.

In addition, the need for large, expensive, and high-maintenance Diesel Particulate Filter (DPF) and Diesel Oxidation Catalyst (DOC) subsystems is also eliminated, removing the lengthy process of regeneration.

Powerful Performance

One benefit of stationary Tier 4 Final engines is the ability to quickly attain full horsepower. Diesel engines rotating mass and power output are capable of handling loads faster than natural gas engines, providing full power within 7 to 8 seconds. Those precious seconds can help prevent voltage drop and other issues that could severely damage mission critical operations.

Redundancy

Because Tier 4 Final diesel engines and generators can run in parallel, the redundant nature of multiple PowerBlocks helps the reliability of the system. Unlike large, single-engine options, there is always a backup.

How does it compare to Natural Gas Engines?

Emissions for Tier 4 Final is considerably lower on five critical pollutants, including NOx, CO, HC, Formaldehyde, and Methane. PM emissions are slightly higher; however, ultrafine particulates are about the same. The total CO2 equivalent emissions are within 5% of each other. Therefore, the Tier 4 Final diesel is cleaner than a natural gas engine in many cases.

An Environmentally-Friendly Tier 4 Final Solution

**Tier 4 Final
Volvo Penta
Technology
VIDEO**

Who can benefit from it?

Tier 4 Final certified engines meet EPA standards without compromising ramp-up time and enable peak shaving, demand response, and storm-curtailment operation.

With this in mind, the PowerSecure and Volvo Penta power generation system delivers a clean, sustainable solution to backup power for a variety of verticals, including data centers, healthcare, retail, utilities, and government/federal.

Utilities



Demand Response and Standby Power Products

Data Center, Government/Federal



Standby Power for Mission Critical Facilities

Healthcare



Reliable, NFPA 110 Level 1 Compliant Standby Power

Retail



Sustainable solution to back-up power

The Power-Secure Solution

The key to getting the most from a power generation system is to partner with a provider who exhibits a proven track record of reliability. The provider should offer a fully integrated power generation system that incorporates switchgear, controls, and monitoring software combined with a Tier 4 Final generator set.

That's what you'll find in PowerSecure a vertically integrated delivery company that has all of the components in house to deliver a complete solution. PowerSecure, with over 1,000 employees, designs, manufactures, constructs, monitors, and maintains generation systems. In PowerSecure you'll also find a supplier with extensive run-time and monitoring experience that offers factory certified options and that takes a solutions-based approach to executing a project rather than a cookie-cutter attitude. The company delivers ultra-clean distributive resources that are proven reliable.

A Powerful Range

PowerSecure has deployed over 2 gigawatts (GW) of microgrids over its 19 year history with a strong emphasis on diesel generating systems and modern Tier 4 Final systems. PowerSecure offers an efficient, reliable full range of power generation systems from 350kW - 3750kW in a single PowerBlock design. With its patented design, PowerSecure can parallel multiple PowerBlocks at a site to meet the electric load requirements for a facility. PowerSecure recently launched its PowerBlock3 product which utilizes the same robust ultra-clean Volvo Penta factory certified Tier 4 Final diesel engines but in a patented enclosure design that allows greater power density in a smaller footprint.

System Operation Made Easy

With PowerSecure, managing your system is easy. PowerSecure provides its PowerControl monitoring which operates 24/7 to consistently and constantly monitor the performance of your system. Any alarms or failures are quickly identified and rectified by the PowerSecure team. With around-the-clock monitoring, the PowerControl

Command Center is manned by trained analysts ready to respond immediately to utility outages, system alarms, emergency events, and severe weather threats.

Scalability

PowerSecure's generation systems are modularly designed to help customers accommodate growth and operational changes in a cost effective way. The modular systems are designed to provide facilities the flexibility to evolve as the customer's operating profile for a facility transforms while also contributing to lower costs to achieve desired redundancy from the generation system.

Tier 4 Final Certified Flexibility

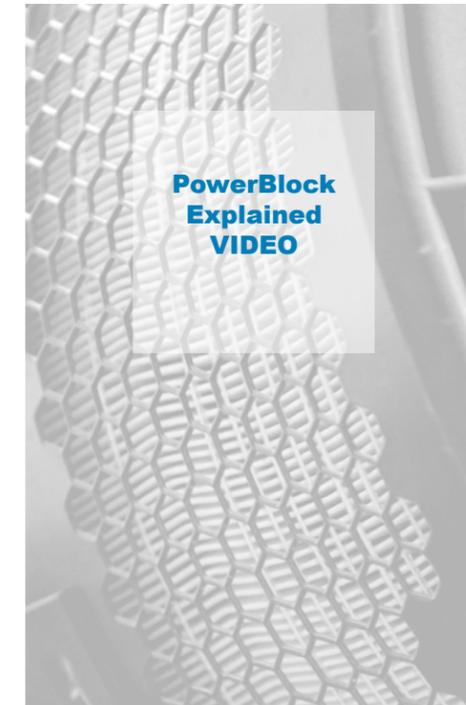
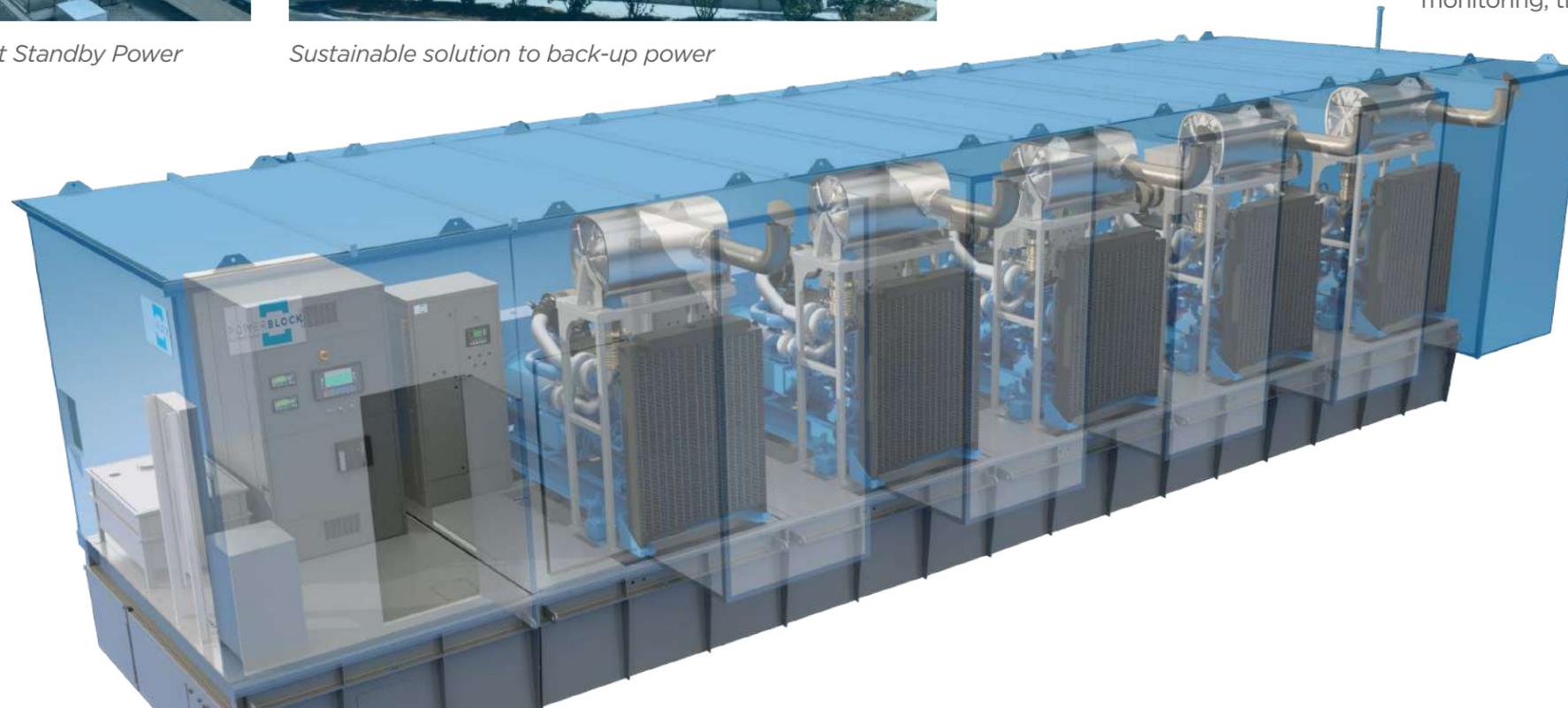
No federal run-time limitations

No post-installation emissions test requirements in most states

Meets EPA emissions standards without compromising ramp-up time

Enables peak-shaving, demand response, and energy market operation

Lower total emissions may result in no air permit required or allow for an easier, more efficient permit to be acquired that costs less and takes less time than other types of permits.



PowerBlock Explained VIDEO

10 Myths vs Facts About Tier 4 Final

Why Diesel?

- Diesel fuel is much less flammable in comparison to natural gas.
- Natural gas is dependent on location provisions. Diesel can be used in almost any location with the use of a fuel tank. If there is a disruption of service for natural gas, the unit cannot be operated.
- Diesel engines require less maintenance than natural gas engines.
- Natural gas engines are often quieter than diesel, but with the advent of new mufflers and SCR catalyst, noise emissions are much less than conventional diesel engines.

MYTH Natural gas engines are better than diesel engines.

FACT The comparison of natural gas versus diesel fuel as a source is most certainly the choice of the consumer based on specific needs. Here are a few points in comparison of diesel versus natural gas systems:

a) Diesel fuel provides more efficiency and power by volume in comparison to natural gas. With the Volvo Penta Tier 4 Final application, the design has built-in efficiencies that meet stringent emissions requirements that reduce both PM and NOx levels. Natural gas engines emit carbon dioxide as a result of combustion.

b) Natural gas is a cleaner burning fuel, but the initial cost of a natural gas system is higher than a Tier 4 Final solution. The operating cost of a natural gas system is traditionally lower. The decision of which system is best depends upon the application and operating objectives.

MYTH There has been a trend in the data center industry to avoid pollution controls because of a misconception that they hamper the reliability of the engines.

FACT A Tier 4 Final solution allows the data center to forgo the traditional pollution control avoidance strategies such as dramatically increasing stack height, which is costly, or limiting operating hours to minimum levels to regulate controls through modeling. Purchasing a Tier 4 Final engine would negate the need to increase stack height or limit operating hours as you can operate the engine for any reason and emissions remain extremely low. In reality, the flexibility to test and run engines more often during system checks and maintenance actually increases the reliability of the system. The latitude to operate an emergency backup system in any desirable manner leads to increased facility uptime.

MYTH Tier 4 Final solutions come with a high price tag.

FACT When considering a Tier 4 Final solution, it is important to look at the total cost of ownership and total benefits which can be achieved. The peak shaving, load management, and other electric market benefits typically offsets initial costs and significantly mitigates the final purchasing price of the Tier 4 Final solution.

It is our experience that a Tier 4 Final certified solution as provided by PowerSecure and Volvo Penta is typically less costly in initial purchase and total cost of ownership in comparison to a Tier 2 system with after-treatment.

The PowerSecure and Volvo Penta package promises unmatched fuel efficiency, lowered maintenance costs, and reduced downtime. Furthermore, the SCR system's catalytic converter is designed to last the life of the engine. This is all combined with PowerSecure's service schedule and PowerControl monitoring offerings for a seamless overall experience.

Volvo Penta Diesel 625 Engine



MYTH Tier 4 Final engines will not operate in the event the SCR system is not working properly (e.g. Diesel Exhaust Fluid (DEF) is unavailable).

FACT Most mission critical facilities do not want to take a chance that the engine will not operate if there is an issue that puts the engine into inducement. In this situation, the concern is that the engine will automatically shut down if the SCR system is not working properly to reduce emissions.

PowerSecure and Volvo Penta worked together to design a system to mitigate inducement. This is done predominately through sizing of the DEF tank to match to the fuel tank on site as fuel providers are traditionally providing both diesel fuel and DEF in the same shipment. In addition, PowerSecure and Volvo Penta have worked together to allow the packaged Tier 4 Final systems to operate during an emergency inducement override (EIO) in compliance with Title 40, Code of Federal Regulations (CFR), Part 1039. Subpart G 665. Therefore, those facilities qualifying under the EIO regulations can continue to operate the Tier 4 Final system during an emergency event even if the SCR is not working properly.

MYTH Tier 4 Final engines are more complex and will require more maintenance.

FACT The Volvo Penta Tier 4 Final engine requires the same amount of maintenance as previous iterations.

Emissions are reduced by means of SCR technology. There are many ways to build an SCR system. Volvo Penta kept their SCR as simple and reliable as possible. While others have chosen more complex installations and C-EGR (cooled exhaust gas recirculation) systems – Volvo Penta only has two parts: SCR and non-cooled EGR. The benefits are obvious: the fewer components used, the less risk of part failure or system malfunction. In addition, the Volvo Penta SCR catalyst is maintenance free.

MYTH All Tier 4 Final engines are unproven in the field.

FACT Tier 4 Final regulations on large bore stationary engines are still relatively new to the market, but the Volvo Penta Tier 4 Final solution has been proven and tested. Volvo Group pioneered implementation of SCR as part of the total solution for over-the-road trucks in North America in 2010 and Volvo Penta remains in a position to leverage this proven technology that has been deployed in more than 270,000 Volvo Group trucks in the region.

MYTH Tier 4 Final engines are not as fuel efficient in comparison to earlier tier levels.

FACT Tier 4 Final engines are more fuel efficient than previous tier levels due to the precise control of fuel/air mixture that is controlled by the Engine Control Module. The Tier 4 Final engines utilize additional information from key sensors to provide better fuel control. Due to reducing the PM in the engine and the NOx with the SCR system, there is no cooled Exhaust Gas Recirculation (EGR) used which further reduces fuel consumption and improves reliability.

MYTH Tier 4 Final engines won't perform as well in cold weather climates.

FACT The Volvo Penta Tier 4 Final engines are designed to operate in all climates. The standard engine will start without the need of start aid assistance down to single digits temperatures. All provisions have been made to heat DEF fluid in very cold climates and make operation seamless for operators. In fact, Volvo Penta Tier 4 Final engines perform exactly the same in cold temperatures as previous emission step engines.

MYTH The lifetime of new engines are shorter than they once were.

FACT Today's modern Tier 4 Final engines are developed using the latest materials and engineering techniques and designed to run longer.

The combination of SCR, non-cooled EGR, and an air throttle system help to reduce the amount of NOx emitted by the engine. The air throttle controls the amount of air entering the engine, which in turn affects the exhaust temperature that determines how much particulate matter is burnt off during SCR. The throttle partially

closes during light loading to maintain the necessary engine temperature for meeting those requirements. Together, these elements provide a simple solution for Tier 4 Final while helping to reduce wear in the engine over time and improving the system reliability.

MYTH All Tier 4 Final engines are equipped with DPFs.

FACT Some competitive Tier 4 Final engines on the market were configured in a way that produced low levels of NOx, but at the same time, they emitted high levels of particulate matter (PM). The solution was to add a diesel particulate filter (DPF) designed to capture the particles and intermittently incinerate it down to ash. The process, known as regeneration, results in downtime and high fuel consumption. Furthermore, a DPF system comes with higher maintenance costs and must be replaced regularly.

While most engine manufacturers installed a DPF to meet Tier 4 Final requirements, Volvo Penta put their efforts into improving the SCR technology instead and did not need to install a DPF to meet Tier 4 Final requirements. The Volvo Penta SCR solution means less maintenance and upkeep for customers, as well as better productivity, reliability, and lower maintenance costs.



Volvo Penta Diesel 625 Engine



Technical information

PowerSecure to provide tech details on generator. Volvo Penta to provide details on engine specs.

Generator

- PMG excitation
- 4 poles
- Single bearing
- 12 winding leads, 2/3 pitch
- Class H insulation system
- Enclosure protection rating IP23
- Max overspeed of 2250 rpm (125% rated)
- Efficiency > 95%
- Harmonic distortion < 5%
- Telephone Influence Factor (TIF) < 50
- 300% short circuit capability for 10 seconds

Engine

- In-line 6-cylinder diesel 4-cycle
- Dual stage turbo with intercoolers
- Bore, mm (in): 144 (5.67)
- Stroke, mm (in): 165 (6.50)
- Displacement L (in³): 16.12 (983.9)
- Electronic engine management (CAN J1939)
- 24VDC starting motor
- Dual fuel filters including water separator and water-in-fuel indicator /alarm
- 80A 24VDC engine driven alternator
- Circulating pump-style jacket water heater
- 10A battery charger with equalization and NFPA 110 alarm outputs

Paralleling Generator Controller

Applications

- Standby
- Peak shaving
- Import-export
- Island parallel
- Mains parallel
- Multiple unit mains parallel

Operation modes

- Auto
- Stop
- Manual
- Load/no load test

Load transfer features

- Open/closed transition
- Soft loading/unloading
- Parallel

Controls

- Voltage adjust
- Frequency adjust
- VAR/power factor control

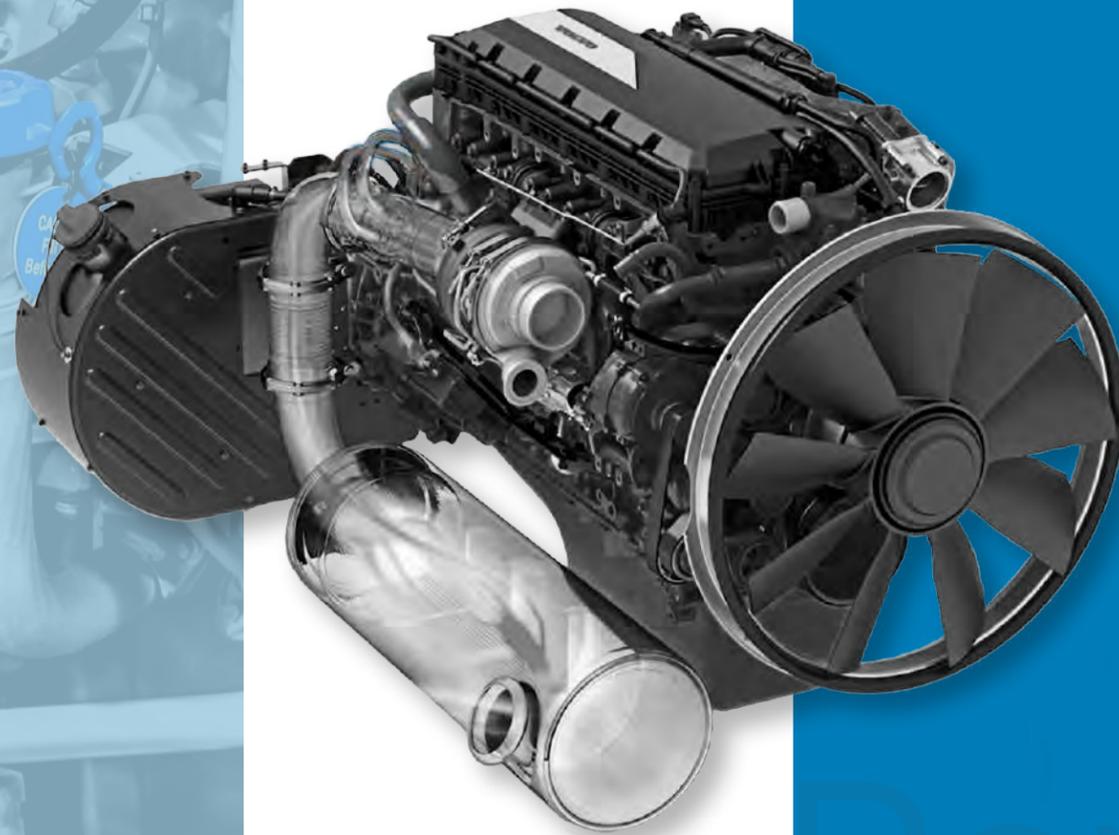
GCB and MCB synchronization

Remote annunciator modules (NFPA 99/110)

Local annunciator modules (NFPA 99/110)

Output Breaker

- Circuit breaker, UL listed, 3 pole, 100%
- Shunt trip and aux contacts
- Electrically operated



Product Specifications

POWERBLOCK GENERATION SYSTEMS



EPA Tier 2/Tier 4 Final Certified PowerBlock Systems Ratings:

- 625 kW/650 kW (781kVA/812 kVA) to 3750 kW/3900 kW (4688 kVA/4875 kVA)
- 208V to 600V at 60Hz
- Renewable Fuel Ready



**PowerBlock Spec Book
Download**

PowerSecure



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