

# FREQUENTLY ASKED QUESTIONS

TIER 4 INTERIM / STAGE IIIB PRODUCTS



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**FOR GENERATIONS**, Caterpillar has been committed to our customers' success. As the industry leader, we have a full complement of resources at our disposal: exceptional engineering talent; decades of integration experience; a rigorous, customer-focused product development process; advanced analysis and simulation tools; next-generation validation resources; common production processes; sustainability and regulatory expertise; and a world-class Dealer organization. We put these resources to work on our customers' behalf, designing, building and delivering a new generation of products that are good for business and produce significantly fewer emissions. **Following are frequently asked questions regarding our new Tier 4 Interim/Stage IIIB products.**

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GENERATIONS

# TIER 4 INTERIM / STAGE IIIB OVERVIEW

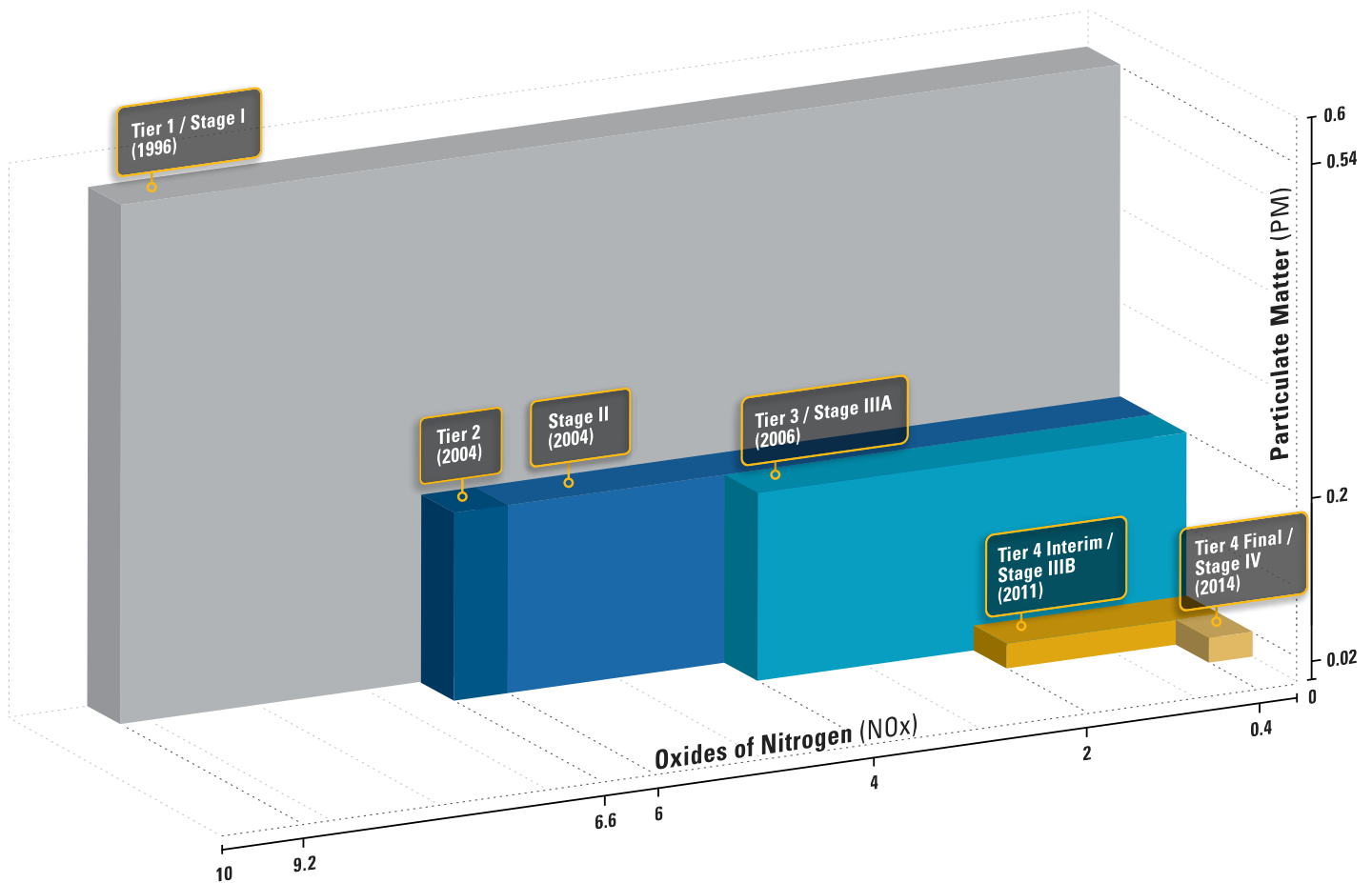


## Why is Caterpillar introducing a new generation of products?

SINCE CATERPILLAR WAS FORMED IN 1925, WE HAVE NEVER STOPPED IMPROVING OUR PRODUCTS. This particular product improvement program is driven by a new round of emissions standards. Our newest machines represent the next generation of increasingly sustainable products. **They are designed to meet tough emissions standards and satisfy our customers' high expectations for reliability, productivity, component life, fuel efficiency and operating costs.**

## Which emissions standards do the new products meet?

Our new products meet Tier 4 Interim standards in the **United States** and Stage IIIB standards in the **European Union (EU)**. They are also expected to meet **Canada's** emissions requirements, which have not been released but will likely be modeled after Tier 4 standards, and **Japan's** Step 4 regulations, which are under development and will likely be comparable to EU standards.



# TIER 4 INTERIM / STAGE IIIB OVERVIEW



## Which emissions are covered under the regulations?

The regulations cover four key emissions generated by diesel engines:

**Oxides of nitrogen (NOx)** are gases that form when fuel is burned with excess air.

**Particulate matter (PM)** is the name given to tiny bits of solids and liquids that form during the combustion process.

**Hydrocarbons (HC)** are gaseous compounds that result from unburned fuel and lubricating oil.

**Carbon monoxide (CO)** is the colorless, odorless gas produced when carbon in fuel is not burned completely.

Diesel engines only emit a small amount of HC and CO, so the industry focuses primarily on NOx and PM. These two types of emissions are inversely related, meaning a reduction in one generally causes an increase in the other. This is one reason why it is particularly challenging to meet the standards.

## Do the new standards apply to crankcase emissions as well as exhaust emissions?

**Yes.** Crankcase emissions are now regulated and require filtration to control excess combustion fumes emitted from the engine draft tube into the atmosphere. Caterpillar is using an open crankcase ventilation system that will require filter replacement every 2,000 hours.

## When will the regulations take effect?

Tier 4 Interim/Stage IIIB regulations are phased in by power rating:

Engines rated **< 19 kW or  $19 \leq \text{kW} < 56$**  were subject to the standards in 2008.

Engines rated  **$130 \leq \text{kW} < 560$  and  $> 560 \text{ kW}$**  will be affected starting in 2011.

Engines rated  **$56 \leq \text{kW} < 130$**  must meet the new regulations beginning in 2012.

Stage IIIB/IV and Step 4 regulations will not apply to engines rated **< 19 kW**.

Neither the EU nor Japan regulates engines rated **> 560 kW** at this time.



**C0.5-C2.2**



**C3.4B-C6.6 ACERT**



**C7.1 ACERT-C18 ACERT**



**C27 ACERT-C32 ACERT**

# TIER 4 INTERIM / STAGE IIIB OVERVIEW



**When will Caterpillar begin introducing new machines that meet the latest standards?**

Most Tier 4 Interim/Stage IIIB models will be introduced in 2011 and 2012. Then in 2014 and 2015, we will begin introducing Tier 4 Final/Stage IV machines.

**What is the difference between Tier 4 Interim/Stage IIIB and Tier 4 Final/Stage IV standards?**

Tier 4 Final/Stage IV standards will require an additional 50 percent reduction in NOx emissions from Tier 4 Interim/Stage IIIB levels. (PM emissions will not require further reduction beyond Tier 4 Interim/Stage IIIB levels).

**Have Tier 4 Interim/Stage IIIB engines been built on existing platforms or was a complete redesign necessary?**

Cat Tier 4 Interim/Stage IIIB engines feature **many of the same rugged structures and reliable components** proven on our Tier 3/Stage IIIA models. We have advanced existing technologies and added new ones to achieve the next level of emissions reduction. We are confident that by building a new design on a proven platform and leveraging common components across the engine line, we can meet the new standards and deliver the reliable performance, long life, excellent fuel efficiency and low operating costs customers expect from Caterpillar.

**How will Tier 4 Interim/Stage IIIB machines compare to their predecessors?**

As the next generation in a fleet of increasingly sustainable product offerings, Cat Tier 4 Interim/Stage IIIB machines will deliver high productivity, reliable performance, low operating costs and the same long life to overhaul as their predecessor models. In addition, engine fuel efficiency is expected to be **improved by up to 5 percent**, and NOx and PM emissions will be **reduced by 50 percent and 90 percent** respectively.

**Has Caterpillar shown a machine equipped with a Tier 4 Interim/Stage IIIB engine to the public?**

**Yes. The Cat® 336E Hydraulic Excavator**, powered by a Tier 4 Interim/Stage IIIB engine, was exhibited at Bauma 2010, a major international trade show held in April in Munich, Germany.



**How can Caterpillar meet stringent emissions requirements and improve product value at the same time?**

**As a sustainability leader and the largest vertically integrated manufacturer in our business**, Caterpillar brings tremendous resources and capabilities to this new product program. We are leveraging nearly 85 years of systems integration expertise on behalf of our customers. We have invested in the very latest simulation and analysis tools, funded the most aggressive testing and validation program in Caterpillar history and launched a major initiative to improve manufacturing excellence around the world. Finally, our Dealer organization, considered the best in the world, is well-prepared to help Cat customers get the highest possible return on their equipment investment.

# TIER 4 INTERIM / STAGE IIIB OVERVIEW



**How do customers benefit from Caterpillar's experience as a systems integrator?**

As the largest vertically integrated manufacturer in our industry, **Caterpillar has design control over every part, component and sub-system that goes into our products.** As a result, our engineers can put all the individual pieces together in the best possible way—developing fully integrated solutions that maximize productivity, component life and fuel efficiency, while minimizing operating costs and emissions.

**How does Caterpillar make sure the new products are ready to work productively and cost effectively?**

Our designs are subjected to a comprehensive and rigorous analysis and testing process. We are using the very latest simulation tools to predict potential problems and resolve them prior to production. We are also completing the most aggressive validation program in Cat equipment history, capturing nearly one million hours of operating data. All this is being used to validate our designs and confirm that we and our Dealers are ready for a successful launch.



**Are Cat Dealers ready to support these products?**

For decades, Cat Dealers have set the standard for service excellence in our industry. Now they are ready to provide exceptional support for the next generation of Cat equipment. **They have the people, tools, training, parts inventory, facilities and expertise** to help customers get maximum value from these new products.



**Will parts be available for the new engines at the time the products are introduced?**

**Yes.** Cat Dealers and the Cat parts system will stock parts inventories necessary to support the Tier 4 Interim/Stage IIIB product introduction.

**Is it really possible for equipment owners to meet production and cost objectives and reduce emissions at the same time?**

**Yes.** Cat Tier 4 Interim/Stage IIIB products work productively and economically, use fuel efficiently and are designed to deliver a second life—in addition to generating fewer emissions. They are the kind of products that will help Cat customers run strong, profitable businesses and meet their environmental commitments, now and for generations to come.

# TIER 4 INTERIM / STAGE IIIB TECHNOLOGY



## Is Caterpillar using ACERT™ Technology to meet Tier 4 Interim/ Stage IIIB emissions standards?

We are advancing the building-block technologies proven on more than 600,000 Cat Tier 3/Stage IIIA engines with ACERT™ Technology. They include:

- Powerful electronic control systems
- High-pressure fuel systems
- Simple, reliable air systems
- Durable aftertreatment components

These building blocks are being applied in different ways, based on engine size and application. Using this flexible technology strategy allows us to optimize productivity, component life, fuel efficiency and operating costs while reducing emissions.

## How has the electronic control system been improved?

The Cat ADEM™ 4 electronic control system allows highly precise control over the combustion process, **increasing engine performance, improving fuel efficiency and reducing emissions.** By adding features to the current control system and using a common control platform across the engine line, we have significantly **improved ease of use and reliability.** Durability has also been enhanced.

## What kind of fuel system is used on the new engines?

We use a **High Pressure Common Rail fuel system** on the C4.4 ACERT through C9.3 ACERT and an **upgraded MEUI-C system** on the C13 ACERT through C32 ACERT. Both are highly pressurized systems that deliver precise injection timing for a clean, efficient fuel burn.



## How is airflow managed in the new engines?

The engines are equipped with simple air management systems that optimize airflow and enhance power, efficiency and reliability. Several turbocharging options are available, depending on engine size and application. The options include a **new high-efficiency turbo** (C9.3 ACERT through C32 ACERT), as well as **Smart Wastegate turbos** (C4.4 ACERT through C7.1 ACERT).

# TIER 4 INTERIM / STAGE IIIB TECHNOLOGY

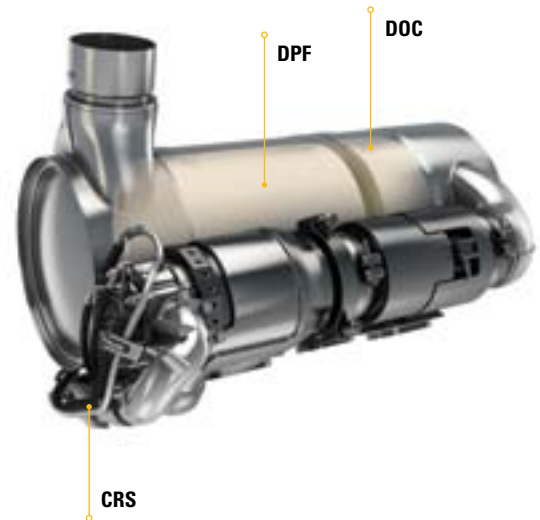


## What kind of NOx reduction system do the engines feature?

The **Cat NOx Reduction System** is a proprietary design, based on more than a decade of Caterpillar research. Developed for reliable performance and long life, the system captures and cools a small amount of exhaust gas, then returns it to the engine to reduce combustion temperatures and prevent NOx formation.



**Air Management and Cat NOx Reduction System**



## What aftertreatment components will be added to Cat engines?

We are using a suite of durable components, applying them strategically based on engine size and application. Components include the following:

A **Diesel Oxidation Catalyst (DOC)** uses an oxidation process to remove pollutants from engine exhaust.

A **Diesel Particulate Filter (DPF)** traps particulate matter from the exhaust stream, preventing it from being released into the atmosphere.

An active **Cat Regeneration System (CRS)** removes soot accumulating in the DPF.

## What is regeneration?

**Regeneration is the process of removing trapped soot from the DPF.** Under most conditions, engine exhaust is hot enough to oxidize the soot. This is called “passive regeneration” and it is an ongoing process. But in some cases, supplemental regeneration from an active system is required. We use an active Cat Regeneration System on C7.1 ACERT through C18 ACERT engines. Controlled electronically, the system is quick, safe, reliable, robust and fuel-efficient. It works under all operating conditions and is transparent to the operator.



# TIER 4 INTERIM / STAGE IIIB TECHNOLOGY



## How are the aftertreatment components packaged?

Depending on engine size and application, aftertreatment components are either packaged as a modular unit called the **Cat Clean Emissions Module (CEM)** or offered individually. Single cans are used on the C4.4 ACERT and C6.6 ACERT. The C7.1 ACERT through C18 ACERT incorporate the CEM. It includes a DOC, DPF and CRS, with optional muffler and air cleaner. The C27 ACERT and C32 ACERT use a CEM that does not include a DPF or CRS. Mounted in a rugged structure, the Clean Emissions Module protects the aftertreatment components, minimizes space requirements and simplifies maintenance.



## What type of fuel and oil will Tier 4 Interim/Stage IIIB engines need?

The new engines use **Ultra Low Sulfur Diesel (ULSD)** fuel, which has a sulfur content of 15 parts per million or less. **B20 biofuel** can also be used in Tier 4 Interim/Stage IIIB engines when blended with ULSD and meeting Caterpillar fuel spec requirements. For lubrication, **low-ash API CJ-4 engine oil** is required.

## What happens if fuel with higher sulfur content is used?

Ultra Low Sulfur Diesel fuel is required to be used in all Tier 4 Interim/Stage IIIB engines for both regulatory and technical reasons. Higher-sulfur fuel **will cause operational problems and jeopardize component life.**

## Can the new products be used in countries that do not have access to ULSD fuel?

In those parts of the world where ULSD fuel is not available or required, Caterpillar will continue to offer engines that meet the necessary emissions levels and performance standards.

## How do the new engines compare to the Tier 3/Stage IIIA models in terms of fuel efficiency?

Our tests indicate the engines themselves are up to 5 percent more fuel efficient than the models they replace, depending on application and load factor.

## Will the new products have the same warranty coverage as Tier 3/Stage IIIA models?

Tier 4 Interim/Stage IIIB models will have the same warranty as their predecessors. Coverage will extend to the entire engine system, including the aftertreatment components.



# TIER 4 INTERIM / STAGE IIIB TECHNOLOGY



## How have maintenance and service practices been affected by the additional emissions reduction components?

The new products will continue to feature excellent serviceability. **Basic fluid and filter change intervals remain the same.** There will be new maintenance activities associated with the aftertreatment components and crankcase filter. For the C9.3 ACERT through C18 ACERT, the 500-hour initial valve lash requirement has been eliminated. Caterpillar has taken every step to manage the maintenance and service issues and minimize their effect on costs.

## How often does the DPF have to be serviced?

Ash will need to be cleaned out of the DPF every **5,000 hours.**



## Can I service the DPF myself?

Equipment users are permitted to service the DPF. However, **Caterpillar has specific guidelines including tooling, parts and service procedures that must be performed when servicing the DPF.** If Caterpillar guidelines are not followed, any resulting damage to the DPF is not covered under warranty. Contact your Cat Dealer and refer to the Operation and Maintenance Guide for further information.

## Is there a Reman option for the DPF?

Caterpillar will offer an exchange certified clean DPF that will work just like the Reman parts option.

## How will operating costs for Tier 4 Interim/Stage IIIB engines compare to Tier 3/Stage IIIA models?

Total operating costs for the new engines are expected to be comparable to those of their predecessors.