

## GENERATIONS AHEAD

PERFORMANCE. RELIABILITY. VALUE.

For reliable performance, long life, excellent fuel efficiency and reduced emissions that help you meet your economic and environmental objectives, see your Cat dealer and choose Cat Tier 4 Final machines. Helping you build an even stronger business today and in generations to come — **that's what we're built to deliver.**

**BUILT FOR IT.™**

# THE NEXT GENERATION OF VALUE

CAT® TIER 4 FINAL TECHNOLOGIES





## PROVEN PERFORMANCE

With millions of working hours on tens of thousands of units since the US EPA Tier 4 Interim product introductions, you can be confident in the quality and value of your Cat® US EPA Tier 4 Final investment.

At Caterpillar, we know you're under constant pressure to do more work at a lower total cost with less environmental impact. Our Tier 4 Final solutions help you do that. We redesigned the product line from the inside out at Tier 4 Interim to accommodate our Tier 4 Final solution. The result is a new generation of engines that meets your high expectations for reliability, performance, fuel efficiency and component life, while producing significantly fewer emissions.

### **Systems integration boosts power, saves fuel**

Caterpillar product designers work collaboratively, using advanced modeling and analysis tools to integrate components, systems, electronics and aftertreatment technologies. Our integration experience allows us to optimize power, fuel economy and emissions reduction.

### **Integrated manufacturing improves quality**

Our position as the largest vertically integrated manufacturer in our business gives us the power to build premium-quality products. We integrate manufacturing advancements into product designs and use common production processes across the manufacturing base. As a result, we can deliver exceptional quality right from the start.

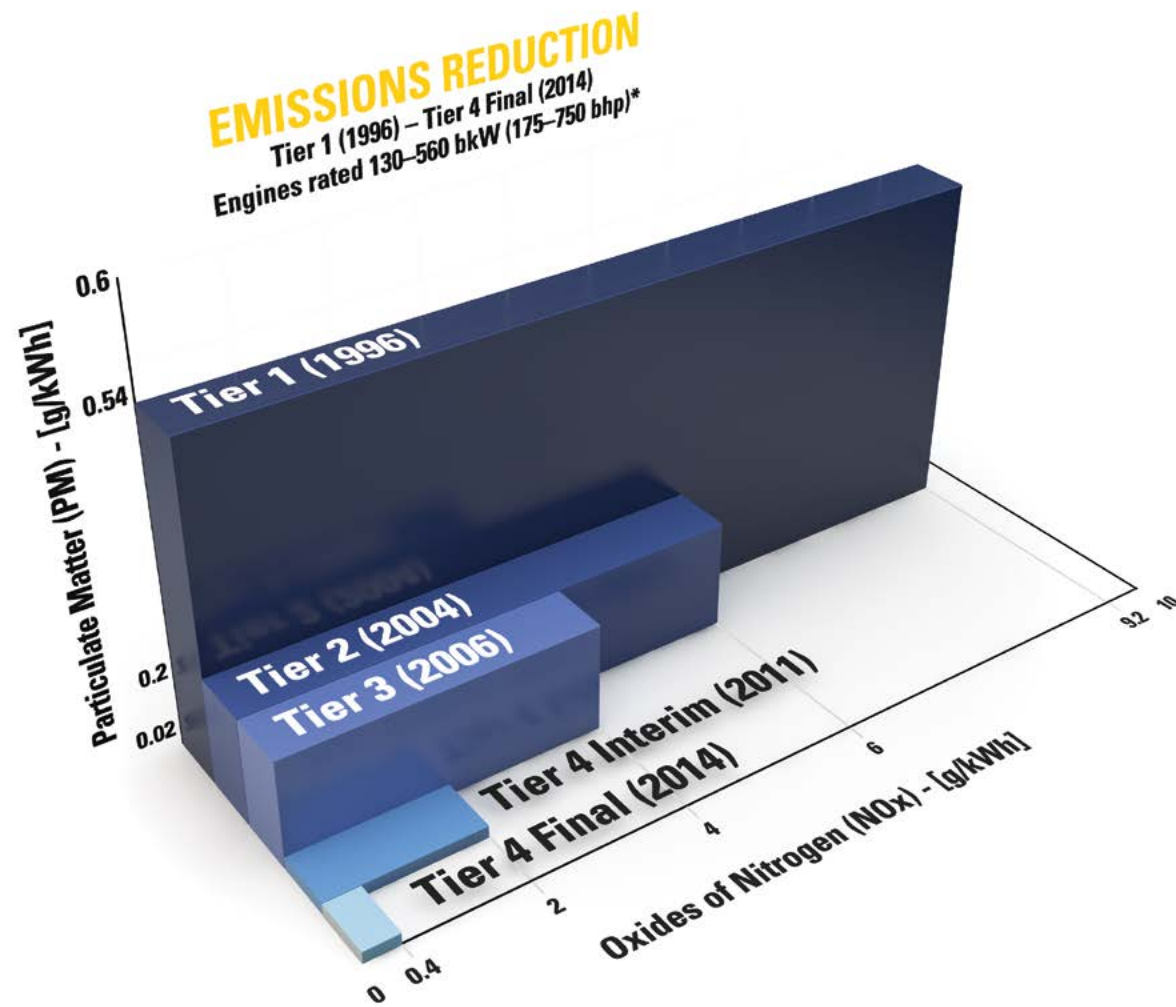
### Tier 4 Final Emissions Reduction

Cat Tier 4 Final engines meet stringent emission standards and deliver the performance and efficiency that successful businesses demand.

Like all manufacturers of diesel engines, Caterpillar is required to deliver engines that meet government emission standards that have been phased-in throughout the United States, Canada, Japan and the European Union.

### Cleaner Fuel & Oils

The emission regulations require the use of Ultra Low Sulfur Diesel Fuel (ULSD), which contains  $\leq 15$  parts per million sulfur (mg/kg) as well as low sulfated ash oil in Tier 4 Final engines.



Emission standards have been systematically reducing levels of Particulate Matter (PM) and Oxides of Nitrogen (NOx) since 1996 when the first standards went into effect.

From Tier 1 (1996) levels to Tier 3 (2006), emission standards required an approximate 65 percent reduction in PM and a 60 percent reduction in NOx.

Tier 4 Interim standards required a 90 percent reduction in PM and a 50 percent decrease in NOx as compared to Tier 3 standards. Tier 4 Final standards reduce NOx by an additional 80 percent, taking PM and NOx emissions to near-zero levels.

\*Engines rated 56–130 kW (75–175 bhp) met Tier 4 Interim standards in 2012 and will meet Tier 4 Final regulations in 2015. Engines rated >560 kW (750 bhp) met Tier 4 Interim standards in 2011 and will meet Tier 4 Final regulations in 2015 (EPA only). Standards differ by power category.



# PROVEN TIER 4 TECHNOLOGY

Caterpillar designed Tier 4 Interim products with Tier 4 Final standards in mind. By planning ahead, we were able to minimize design changes and deliver the reliability and performance you demand. Every Tier 4 Final engine is equipped with a combination of proven electronic, fuel, air and aftertreatment components, based on engine size, application and the geographic location in which it will work. Applying proven technologies systematically and strategically lets us meet your high expectations for productivity, fuel efficiency, reliability and service life. The right technologies fine-tuned for the right applications results in:

**IMPROVED FLUID EFFICIENCY** Up to 5% improvement over Tier 4 Interim products (including Diesel Exhaust Fluid consumption).

**HIGH PERFORMANCE** across a variety of applications.

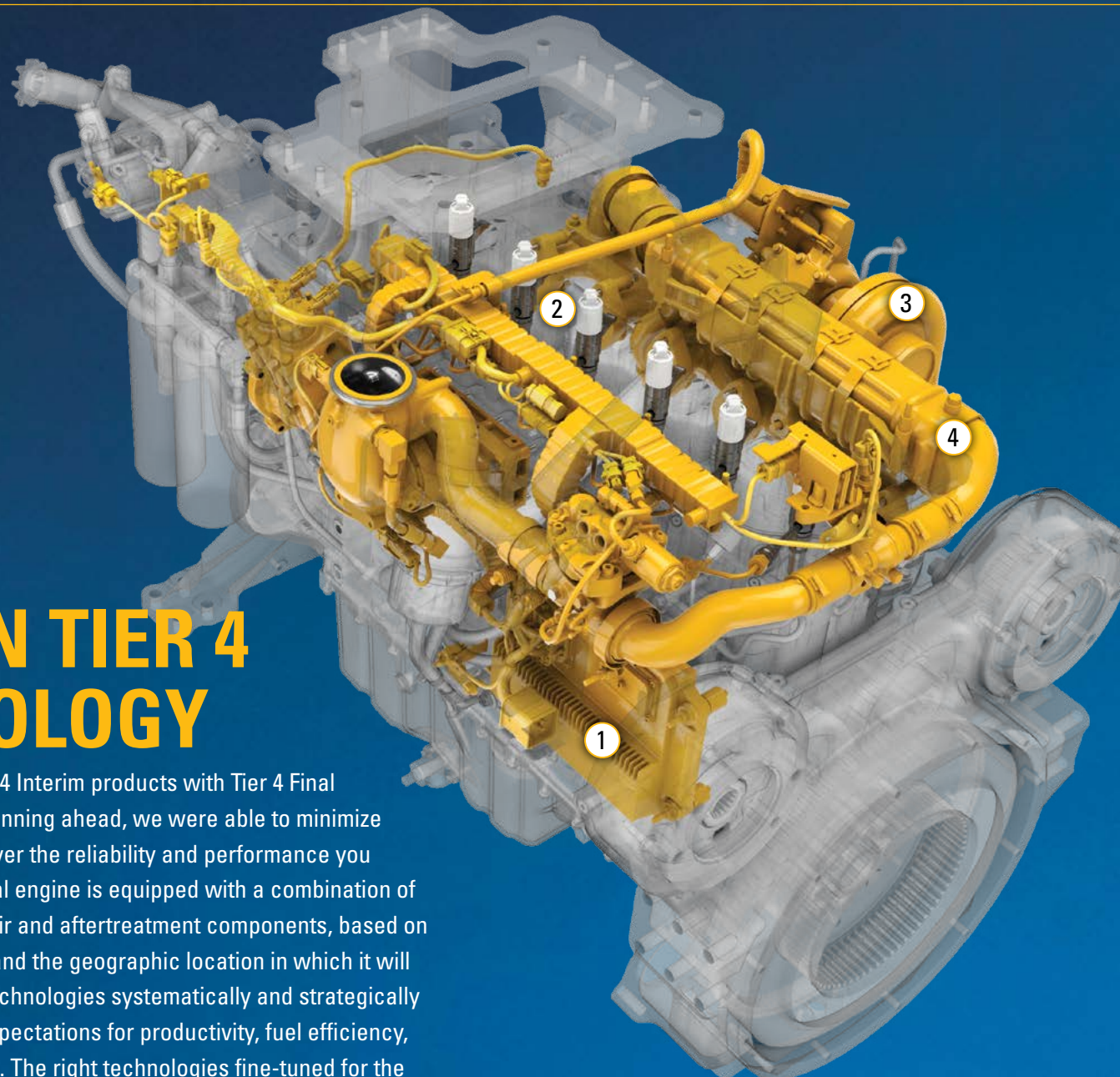
**ENHANCED RELIABILITY** through commonality and simplicity of design.

**MAXIMIZED UPTIME AND REDUCED COST** with world-class support from the Cat Dealer Network.

**MINIMIZED IMPACT** of Emission Systems: designed to be transparent to the operator without requiring interaction.

**DURABLE** designs with long life to overhaul.

**DELIVERING** better fuel economy with minimized maintenance costs while providing the same great power and response.



## 1 MORE POWERFUL, RELIABLE ENGINE ELECTRONICS

The electronics used in Cat Tier 4 Final engines are more powerful and robust than ever.

- Increased features and connection commonality improve the customer experience and increase quality and reliability.
- Over-foam wiring harness adds to reliability even in the most demanding applications.



## 2 NEXT GENERATION FUEL SYSTEM OPTIONS

As a key component of Cat Tier 4 Technology, injection timing precisely controls the fuel-injection process through a series of carefully timed microbursts. This injection timing provides more control of combustion for the cleanest, most efficient fuel burn. To maximize customer value, Caterpillar engineers specified fuel systems based on the power and performance demands for each engine.

- High-Pressure Common Rail Fuel Systems** with full electronic injection improve precision and control that boost performance and reduce soot for the C7.1 ACERT™ and C9.3 ACERT.
- Advanced MEUI™-C injector platforms** handle increased injection pressures and more precise fuel rates. These durable injectors enhance responsiveness while controlling soot in the C13 ACERT, C15 ACERT, C18 ACERT, C27 ACERT and C32 ACERT.



Air Management and Cat® NOx Reduction System

## 3 INNOVATIVE AIR MANAGEMENT

Cat Tier 4 Final engines feature innovative air-management systems that optimize airflow and enhance power, efficiency and reliability. We apply a range of simple, reliable turbocharging solutions, based on engine size and application. This allows us to match turbo performance to rated output for high productivity, excellent fuel efficiency, long life and low operating costs.

## 4 CAT NOx REDUCTION SYSTEM

The Cat NOx Reduction System (NRS) captures and cools a small quantity of exhaust gas, then routes it back into the combustion chamber where it drives down combustion temperatures and reduces NOx emissions. The result of more than a decade of Caterpillar engineering research into this technology, the NRS is designed to be the most reliable system of its type.

# BUILDING BLOCK TECHNOLOGIES

## DELIVER FUEL EFFICIENCY, RELIABILITY AND DURABILITY

### AFTERTREATMENT TECHNOLOGIES

#### Clean Emissions Module (CEM)

The CEM protects interior components, minimizes the aftertreatment footprint and simplifies maintenance.

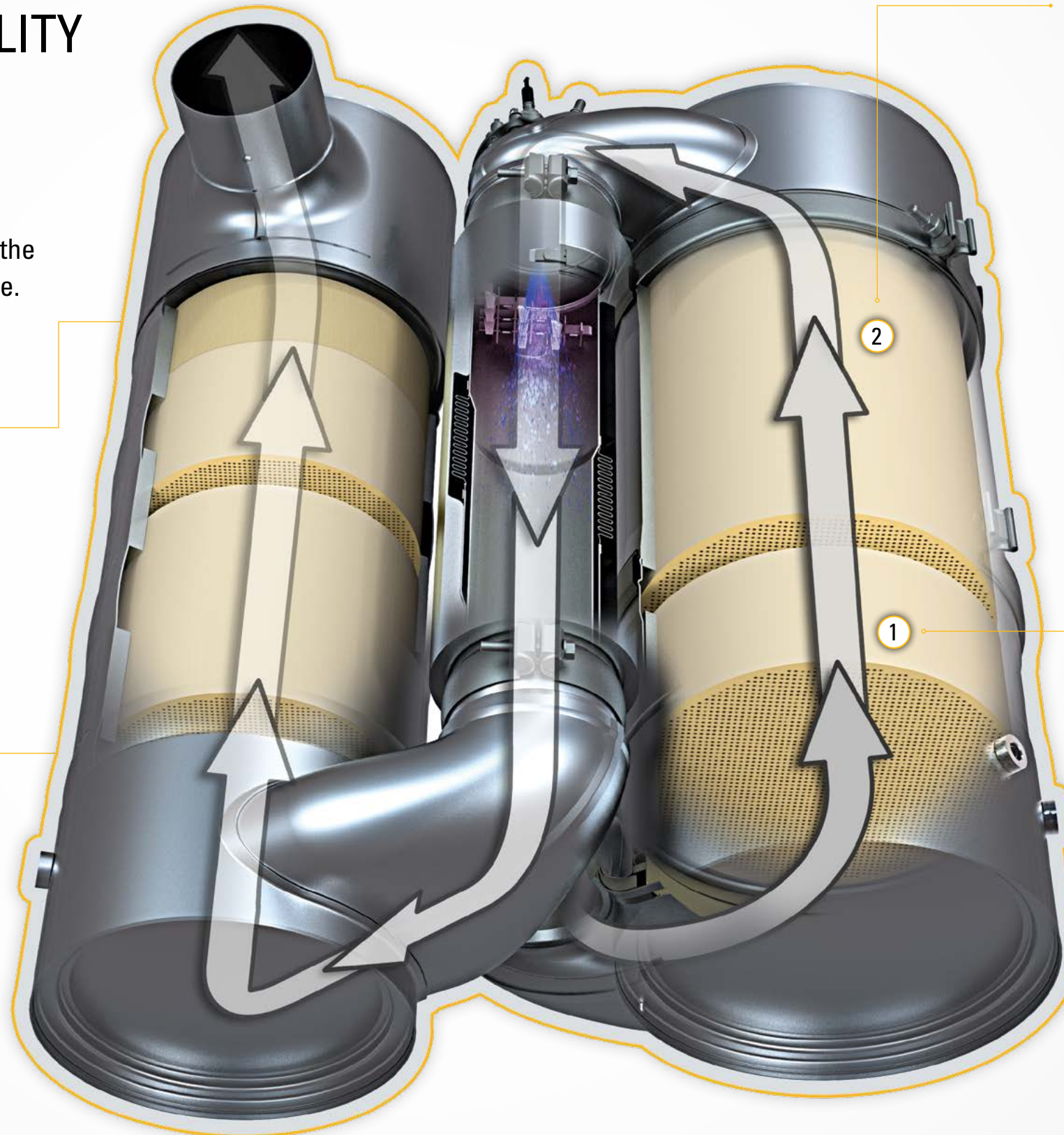
#### Ammonia Oxidation Catalyst (AMOX)

In order to ensure sufficient NO<sub>x</sub> reduction, a small amount of excess Diesel Exhaust Fluid (DEF) is injected into the exhaust stream. This excess DEF may pass through the Selective Catalytic Reduction (SCR) catalyst as ammonia. To prevent excess ammonia from entering the atmosphere, the exhaust gas flows through an Ammonia Oxidation Catalyst (AMOX) where the ammonia reacts with oxygen in the presence of this catalyst to form nitrogen and water.

#### Selective Catalytic Reduction (SCR)

The SCR system consists of a SCR catalyst, AMOX and the Pump Electronics Tank Unit (PETU). This system uses a small amount of Diesel Exhaust Fluid (DEF) to convert NO<sub>x</sub> emissions in the exhaust into nitrogen and water. No major redesign was necessary to accommodate this system into Cat machines as the space claim required did not change from our Tier 4 Interim design.

- DEF is a solution of urea dissolved in deionized water to produce a concentration that is about 1/3 urea and 2/3 water. DEF used in Cat engine systems must meet the requirements outlined in ISO 22241-1.

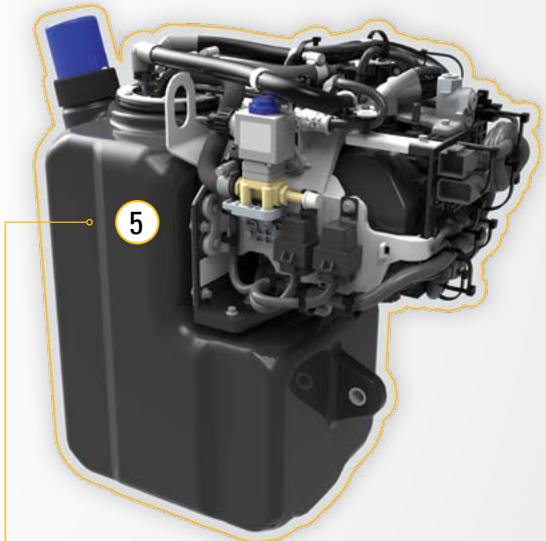


#### Diesel Particulate Filter (DPF)

A DPF traps particulate matter that's carried in the exhaust stream, preventing it from being released into the atmosphere. Inside the DPF, particulate matter, sometimes referred to as "soot," is trapped until it is oxidized during regeneration.

#### Diesel Oxidation Catalyst (DOC)

The DOC uses a chemical process to reduce hydrocarbons and carbon monoxide in the exhaust stream. No maintenance is required because the DOC is a "flow-through" device.



#### Pump Electronics Tank Unit (PETU)

The PETU is responsible for storing, controlling and supplying the appropriate quantity of Diesel Exhaust Fluid from the DEF tank to the DEF injector. The Diesel Exhaust Fluid is used by the SCR system to reduce NO<sub>x</sub> emissions in the exhaust.

# REAL STORIES, REAL RESULTS

## WHAT CUSTOMERS ARE SAYING ABOUT CATERPILLAR'S TIER 4 SOLUTION

"The difference-maker of (the Cat machine) is the fuel efficiency of it. Compared to other competitors that we tried, it's easily hands down better than what I'd seen of our competitors."



DERREK HENRY PEKIN SAND AND GRAVEL

Regarding Regeneration: "Just keep running the tractor without paying attention to it. It takes care of itself."



SHAWN HENRY PEKIN SAND AND GRAVEL

"We put all of them to the test. And Cat...by far...by far...beat them in every aspect you can think of."

"I don't know how you can improve on this one. It's the best."

"I could hire a guy today and he would never even know the machine was going to regen if I didn't tell him."

"There is absolutely, from an operator's standpoint, no change, no difference. I couldn't tell you that [Tier 4] was there."

"We don't worry about the regen capability at all with the Tier 4 we have on this project. It's in automatic mode, and it just takes care of itself the whole time."



DAVID BOYER STARK EXCAVATING

Regarding Regeneration: "If you buy the Cat, you don't have to worry about it."



JEREMY LIVENGOOD STARK EXCAVATING

"Tier 4 is completely providing the performance that we've always got from Cat products."



## DELIVERING MORE POWER, BETTER FUEL ECONOMY AND **LOWERING YOUR OPERATING COSTS**

We believe that part of our commitment to our customers is to understand your needs and your business. We know that maintenance, service and support are critical not just to power and performance but also to achieving the lowest total cost of ownership. Your Cat dealer is dedicated to delivering value for the life of your machine.

### World-class Service and Support

The Cat Dealer Network supports your machine and your operations.

The parts commonality built into the Tier 4 Final line of machines enables common service tooling and parts stock coverage, further enhancing the value that product support can deliver. With industry-leading parts availability, cost-saving Reman options and Cat Certified Rebuild programs, you can keep your machine performance high and your operating costs lower.

Caterpillar has taken every possible step to effectively manage service and maintenance issues and minimize the impact of those activities on operating costs.

**Basic oil and filter change** intervals remain at 500 hours.

Engines are required to use **Ultra Low Sulfur Diesel (ULSD)** fuel and also accommodate up to **B20 biodiesel** when blended with ULSD.\*

New emission standards drive new **service intervals and maintenance activity**:

CEM aftertreatment is designed with a removable center section to allow easy access to the DPF for **ash service**.

- DPF ash servicing:
  - Maintenance free (C7.1 ACERT)
  - 5,000 hours (C9.3 – C18)
  - DPF clean and replace
  - Cat Reman DPF

Cat dealers also offer Customer Support Agreements and fleet and business management expertise that can help you reduce overall costs and manage your business even more effectively... which may take your success to a whole new level.

\*Refer to Caterpillar Machine Fluids Recommendations SEBU6250 for more information.



**Controlling owning and operating costs is one of your highest priorities.** That's why Caterpillar engineers designed Tier 4 Final products to work efficiently and economically over a long life cycle. Testing and analysis results for Tier 4 Final products, along with customer feedback, confirm that operating costs have been reduced across the product line. This reduction is due to improvements in fluid efficiency and serviceability, both of which offset the costs associated with aftertreatment maintenance.

# TIER 4 FINAL ENGINE PRODUCT LINE

For more information on these technologies, see pages 8 and 9.

|                                 | C7.1<br>ACERT   | C9.3<br>ACERT  | C13<br>ACERT  | C15<br>ACERT  | C18<br>ACERT  | C27<br>ACERT  | C32<br>ACERT  |
|---------------------------------|---|--|---|---|---|---|---|
|                                 |  |  |  |  |  |  |  |
| <b>Power</b>                    | 89–225 kW<br>(120–302 bhp)  | 180–251 kW<br>(241–337 bhp)  | 277–322 kW<br>(371–432 bhp)   | 267–380 kW<br>(358–510 bhp)   | 375–470 kW<br>(503–630 bhp)   | 597–800 kW<br>(800–1050 bhp)  | 705–950 kW<br>(950–1200 bhp)  |
| <b>Fuel System</b>              | Common Rail   | Common Rail  | MEUI-C  | MEUI-C  | MEUI-C  | MEUI-C  | MEUI-C  |
| <b>Air System</b>               | Single or Series Turbochargers  | High-Efficiency Turbocharger   | High-Efficiency Turbocharger  | High-Efficiency Turbocharger  | High-Efficiency Turbocharger  | High-Efficiency Turbocharger  | High-Efficiency Turbocharger  |
| <b>NOx Reduction Technology</b> | Cat NOx Reduction System** and Selective Catalytic Reduction*                     | Cat NOx Reduction System** and Selective Catalytic Reduction*                      | Cat NOx Reduction System** and Selective Catalytic Reduction*                       | Cat NOx Reduction System** and Selective Catalytic Reduction*                       | Cat NOx Reduction System** and Selective Catalytic Reduction*                       | Cat NOx Reduction System**  | Cat NOx Reduction System**  |
| <b>PM Reduction Technology</b>  | DOC/DPF***  | DOC/DPF***   | DOC/DPF***  | DOC/DPF***  | DOC/DPF***  | DOC only  | DOC only  |
| <b>Regeneration Technology</b>  | Passive Regeneration with backpressure valve                                      | Cat Regeneration System****  | Cat Regeneration System****   | Cat Regeneration System****   | Cat Regeneration System****   | Not Required  | Not Required  |

\* Also referred to as SCR  
 \*\* Also referred to as NRS  
 \*\*\* Diesel Oxidation Catalyst/Diesel Particulate Filter  
 \*\*\*\* Also referred to as CRS