Meeting EPA 2011 Tier 4 Interim And EU Stage IIIB Emissions

Customer FAQ (174-751 hp)

This Frequently Asked Question document is intended to help Cummins customers better understand the low emissions regulations commencing January 2011 which introduce clean diesel technology with exhaust aftertreatment to the off-highway industry. Information is provided on performance and operational characteristics applicable to the latest generation of QSB6.7, QSL9, QSX11.9 and QSX15 engines covering a 174-hp to 600-hp (130-447 kW) range. This FAQ features the following sections:

Tier 4 Interim Emission Regulations

1. What is the Tier 4 Interim and Stage IIIB emission standard in 2011?

Tier 4 Interim is the U.S. Environmental Protection Agency (EPA) emission regulations for off-highway diesel engines in North America. Stage IIIB is nearly the equivalent emissions regulations for the European Union (EU) member states. In terms of effect dates and emissions levels, the EPA and EU are closely aligned.

The regulations went into effect January 2011 across the 174 to 751 hp (130-560 kW) power category, requiring diesel engines to reduce PM exhaust emissions by 90% and NOx exhaust emissions by 45% compared with the current Tier 3 and Stage IIIA emissions standards.

The emissions standards for this power category are: 2.0g/kW-hr Oxides of Nitrogen (NOx) and 0.02 g/kW-hr Particulate Matter (PM).

Equivalent emissions regulations for Ministry of Land, Infrastructure, Transportation and Tourism (MLIT) in Japan will likely commence October 2013 for engines across the 75 to 751 hp (56-560 kW) powerband.

2. What is the Tier 4 Final and Stage IV emissions standard in 2014?

Beginning in 2014, EPA Tier 4 Final and EU Stage IV will require another major emissions reduction for the industry. Off-highway diesel engines from 174-hp to 751-hp must reduce NOx emissions by a further 80% compared to the 2011 level. By 2014, both NOx and PM exhaust emissions will be reduced by 90% compared with current Tier 3 and Stage IIIA levels.

The emissions standards for this power category are: 0.4g/kW-hr Oxides of Nitrogen (NOx) and 0.02 g/kW-hr Particulate Matter (PM) effective January 2014. These extremely low levels can be described as ‘near-zero’ emissions levels.

3. What are Oxides of Nitrogen (NOx) and Particulate Matter (PM)?

Oxides of nitrogen are a regulated gaseous emission which is a collective term for emissions composed of nitrogen and oxygen. Particulate matter is a regulated diesel emission composed primarily of carbon soot and other combustion by-products.

4. When will engines below 174-hp need to meet the low emissions regulations?

For engines within the 75-hp to 173-hp (56-129 kW) power category, Tier 4 Interim and Stage IIIB regulations will commence in January 2012. The Tier 4 Final regulations will be applied in January 2015 and Stage IV regulations will be applied in October 2014.

Emissions levels are less severe for this power category at Tier 4 Interim and Stage IIIB, enabling a more simplified aftertreatment system. Details on Cummins technology solution for this power category are available on a separate FAQ covering the 4-cylinder QSB3.3, QSB4.5 and 6-cylinder QSB6.7 (173-hp and below) engines.

Meeting Emissions With The Right Technology

5. How is Cummins meeting the Tier 4 Interim emissions standards in 2011?

Cummins QSB6.7, QSL9, QSX11.9 and QSX15 engines are meeting the 2011 low emissions standards with an integrated Cummins Particulate Filter exhaust aftertreatment and a cooled exhaust gas recirculation (EGR) system incorporated on the engine.

The cooled EGR system enables clean combustion with NOx reduced by 45% compared to Tier 3, while the Cummins Particulate Filter exhaust aftertreatment system reduces PM by over 90% from engine exhaust.

6. Is Cummins meeting EU Stage IIIB and equivalent emissions regulations in Japan with the same technology used for North America?

Yes. Cummins is offering the right technology and engine platforms to meet the low emissions standards with an integrated Cummins Particulate Filter exhaust aftertreatment and a cooled EGR system incorporated on the engine for the EU and Japan. For countries outside of these areas that will adopt equivalent low emissions regulations, Cummins will offer this same technology provided proper Ultra Low Sulfur Diesel Fuel is available.

7. Does Cummins design their own aftertreatment and other key systems?

Yes. We design the Cummins Particulate Filter as an integrated system with the engine. Meeting Tier 4 Interim and Stage IIIB demands new levels of system integration in order to achieve very low emissions while improving performance.

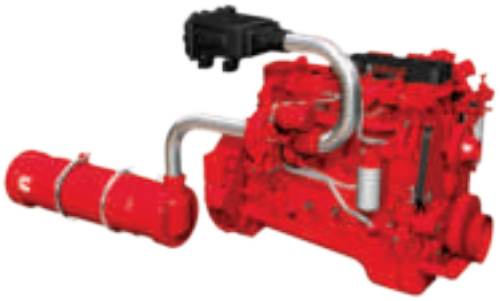
Cummins has access to all the key enabling technologies within our design and manufacturing resources, from aftertreatment, fuel systems, filters and electronic control to turbocharging. This forms the basis of our ‘Right Technology’ approach to Tier 4.

Emission Solutions

Filtration

Fuel Systems

Turbo Technologies



8. Has the Cummins Particulate Filter aftertreatment been used before?

This technology is new to the off-highway equipment industry in 2011 – but it is not new to Cummins. Cummins introduced on-highway engines in 2007 certified to EPA standards in North America using both cooled EGR and the Cummins Particulate Filter. Our experience of using EGR extends back to 2002.

Cummins capability with this technology is unmatched in the industry, with millions of engines in operation with EGR, VGT Turbochargers, and particulate filter aftertreatments.

9. Why is Cummins Tier 4 Interim approach better than others?

We believe Cummins has significant advantages over other engine manufacturers. We design, manufacture and integrate the complete Tier 4 Interim package from air-intake to exhaust aftertreatment. Only Cummins has all the key enabling technologies in-house and can therefore realize more effective integration with packaging and performance advantages.

Plus, Cummins has acquired unrivalled experience of using this technology by successfully meeting EPA 2007 on-highway standards. High performance and reliable technology drove a major increase in our market share since 2007.

10. Will Tier 4 Interim engine performance be the same as Tier 3?

It will be better. Cummins Tier 4 Interim engines have demonstrated up to 5% improved fuel efficiency compared to Tier 3, depending on rating and duty cycle. Tier 4 Interim equipment productivity is also enhanced with faster engine response.

Operators will also notice that Cummins Tier 4 Interim technology enables the equipment to work cleaner and quieter than before. And while CO_2 emissions are not regulated by the EPA and EU, Cummins fuel efficiency improvement at Tier 4 Interim translates into reduced CO_2 emissions, helping our customers reduce their carbon footprint at Tier 4 Interim.

11. How will equipment operating costs be impacted by Tier 4 Interim?

Overall operating costs for Cummins engines will be lower at Tier 4 Interim compared with Tier 3. Depending on duty cycle and application, up to 5% better fuel efficiency can be achieved which will more than offset the marginal cost increase associated with using ULSD fuel, low ash lube oil and particulate filter cleaning at 5,000 hours.

12. How will Tier 4 Interim impact the cost of equipment?

Achieving very low levels of emissions for Tier 4 Interim has required a major investment in engine technology and involves the addition of new systems such as Cummins Particulate Filter aftertreatment. The cost of the equipment will therefore reflect the incorporation of a Tier 4 Interim technology system and in some cases more advanced cooling packages.

While Tier 4 Interim powered equipment will be inherently more expensive than Tier 3 equipment, the cost of achieving compliance will be helped by the lower overall operating costs offered by Cummins Tier 4 Interim engines.

With improved engine response, operators can also expect improved equipment productivity together with the benefit of cleaner and quieter operation.

13. Why is SCR less effective than cooled EGR and Particulate Filter for Tier 4 Interim?

As part of Cummins Tier 4 Interim evaluation program, various combinations of Cummins Particulate Filter, cooled EGR and SCR were extensively tested as possible technology paths. However, our development work proved that a Cummins Particulate Filter in combination with cooled EGR provides the most effective Tier 4 Interim solution.

This solution will achieve the best operating value for our customers. It offers equivalent, or better fuel efficiency compared with using an SCR system for Tier 4 Interim off-highway applications.

14. Is SCR a technology option for Tier 4 Final?

SCR does offer a potential route to achieve Tier 4 Final emission standards in 2014 used as incremental technology to Tier 4 Interim technology. SCR and other options are part of Cummins technical evaluation work for Tier 4 Final.

Cummins knows SCR technology better than any other engine manufacturer. Since 2006, Cummins launched on-highway engines certified to the Euro 4 and EPA 2010 standard using SCR with approaching 500,000 of these systems in operation to date.

In addition to this, Cummins is utilizing SCR technology together with cooled EGR and the Cummins Particulate Filter to meet North America EPA 2010 on-highway emissions.

Cummins Cooled EGR System And VGT™ Turbocharger

15. How does cooled EGR reduce NOx emissions?

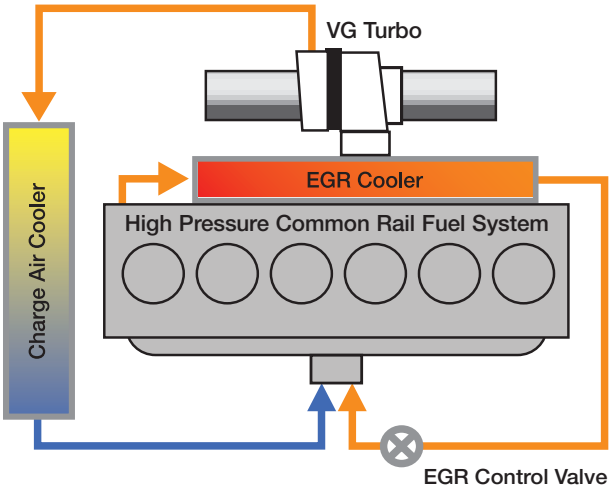
Cummins utilizes cooled EGR to effectively control NOx emissions. Cooled EGR works by re-circulating a varying proportion of the exhaust gas back to the cylinder. This reduces the oxygen content to a lower combustion temperature resulting in a reduction of NOx formation.

The exhaust gas is cooled as it flows through an EGR cooler, and then is mixed with the compressed fresh air from the turbocharger before entering the intake manifold. Exhaust gas is introduced to reduce the amount of in-cylinder oxygen available for combustion while maintaining the same amount of flow through the engine. Exhaust gases present during the start of combustion are very stable and have a very slow reaction rate. They absorb heat during combustion, resulting in lower in-cylinder peak flame temperatures, and therefore, lower NOx emissions.

16. What are the key components of the EGR system?

The key components to the Cummins cooled EGR system are: EGR Valve, EGR cooler and Variable Geometry Turbocharger (VGT™). A schematic of the system is shown below:

Cooled-EGR Schematic



17. How does Cummins VGT™ Turbocharger improve performance?

Cummins VGT™ Turbocharger has a patented one-piece sliding nozzle design that provides exact boost across the operating range. The sliding nozzle varies the exhaust gas flow into the turbine wheel to provide rapid boost at low engine rpm and then maintain high boost at higher rpm.

The VGT™ Turbocharger design combines the benefit of both a small and large turbocharger in a single unit, enabling Cummins Tier 4 Interim to achieve significantly improved response compared to a Tier 3 engine demonstrated in customer field tests.

Manufactured by Cummins Turbo Technologies, the VGT™ Turbocharger is a key technology asset in not only meeting emissions but increasing engine performance and improving fuel efficiency. Introduced with Cummins on-highway EGR engines in 2002, total VGT™ Turbocharger production is over three million units, demonstrating outstanding in-service reliability.

Cummins Particulate Filter Aftertreatment

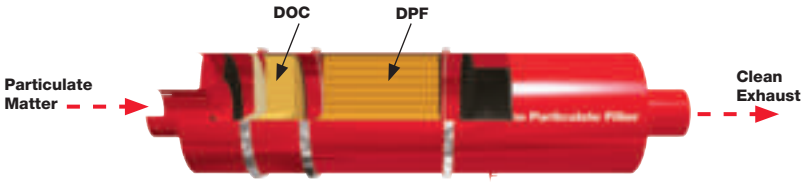
18. How does the Cummins Particulate Filter remove PM?

Cummins Particulate Filter in most cases replaces the Tier 3 muffler and provides equivalent or better sound reduction compared to Tier 3 mufflers. The Cummins Particulate Filter consists of four sections: an inlet, a Diesel Oxidation Catalyst (DOC), a Diesel Particulate Filter (DPF) and an outlet.

Exhaust flows out of the engine and into the Cummins Particulate Filter. It passes through the DOC and then into the DPF where PM is collected on the walls of the DPF. The carbon collected is then oxidized to remove it from the DPF. This is known as regeneration.

When operating conditions maintain sufficient exhaust temperatures, the DPF is continually self-regenerating, over

99% of the time. This is known as passive regeneration and results in clean exhaust out of the tailpipe. On very infrequent occasions, less than 1% of the time, an active self-regeneration is required to remove a build-up of PM in the DPF, due to insufficient exhaust temperatures.



19. What is passive regeneration?

Cummins engines are designed to maximize the use of passive self-regeneration. This occurs when operating conditions maintain sufficient exhaust temperature, therefore enabling continuous oxidation of the PM. Passive self-regeneration is completely transparent to the operator and does not affect the machine's operation or performance.

Cummins field test results have shown that most off-highway equipment operates at a high enough engine load factor for the Cummins Particulate Filter to self-regenerate almost every time in passive mode.

20. What is active regeneration?

Active self-regeneration occurs when there is not sufficient heat in the exhaust to convert all the carbon being collected in the DPF. Exhaust temperatures are raised by injecting a small amount of fuel upstream of the Cummins Particulate Filter.

The resulting chemical reaction over the DOC raises exhaust gas temperatures high enough to oxidize the carbon from the filter. This is all done without any operator intervention. Cummins Tier 4 Interim system is designed to minimize the need for active self-regeneration.

The overall fuel consumption increase due to active regeneration of the particulate filter is barely measurable – approximately 0.1% for most applications. Cummins field tests have proven the majority of active regenerations will be less than 1% of the total operating time. This minor increase resulting from active regeneration is included within Cummins overall Tier 4 Interim fuel efficiency improvement of up to 5%.

21. What is a stationary regeneration?

Stationary, or parked, regeneration is the same as active regeneration but takes place while the equipment is not being operated. It offers the equipment operator the option, if needed, of performing regeneration outside the normal duty cycle. Using this option may only be required in a very limited number of applications.

22. Does the Cummins Particulate Filter get hotter than a typical muffler during active regeneration?

Active self-regeneration takes place typically less than 1% of equipment operating time. The skin temperature of the Cummins Particulate Filter, which is double-thermally insulated, is actually lower than the muffler skin temperature of today's Tier 3 powered machines.

Filtration Enhancements

23. What new filtration systems are used on Cummins Tier 4 Interim engines?

Engine filtration enhancements include a new Cummins Direct Flow™ air cleaner and Cummins crankcase ventilation system with a highly-efficient coalescing filter, both manufactured by Cummins Filtration.

24. How is Cummins Direct Flow™ air cleaner different from other air-intake filters?

The new Cummins Direct Flow™ air cleaner was specifically developed for Tier 4 Interim to provide more performance in less space. The rectangular, low profile design can reduce space claim by up to 35% percent compared with typical cylindrical filters used for Tier 3. Air flow to the engine is improved and the highest levels of protection are assured with virtually 100 percent efficiency over the filter life.

25. Can Direct Flow™ extend filter change intervals?

The increased air flow efficiency of the Direct Flow™ air cleaner offers operators the opportunity to extend air filter element service intervals and potentially reduce air cleaner filter costs.

26. How does the crankcase ventilation filter improve the engine?

Tier 4 Interim requires that crankcase emissions, also known as blowby gases, be included in the overall regulated engine emissions. To control blowby gas emissions, Cummins engines incorporate a highly efficient coalescing filter. The filter returns the oil to the crankcase and provides the added benefit of removing oil mist and tiny oil droplets, ensuring that the engine and powertrain remain cleaner than at Tier 3.

The crankcase filter requires a simple filter element change at 2,500 hour intervals.

Electronic Enhancements

27. How does the Electronic Control Module (ECM) differ from Tier 3?

The Tier 4 Interim engine management system is significantly upgraded with the latest Cummins CM2250 electronic control module providing 3 times faster processing power and double memory capability compared to the Tier 3 module.

Cummins has a unique advantage in that we design the core programs and algorithms needed to precisely control the engine from air-intake to exhaust aftertreatment as a single integrated system.

28. Does Cummins use the same electronic system for all engines?

Yes. Cummins latest generation CM2250 electronic control module will be incorporated on all Tier 4 Interim engines to ensure electronic commonality across equipment ranges.

29. Will electronic diagnostic tools change for Tier 4 Interim?

Cummins popular and easy-to-use electronic diagnostic tools such as InSite™ software and QuickCheck™ handheld device are already upgraded and available for use with Tier 4 Interim engines and the Cummins Particulate Filter aftertreatment.

Service Requirements

30. Will Tier 4 Interim equipment uptime remain the same as Tier 3?

Yes. Cummins Tier 4 Interim field test program has demonstrated that our Tier 4 Interim engines are able to achieve the same very high level of uptime availability as equipment powered with our current Tier 3 engines.

31. What service does the Cummins Particulate Filter require?

The Cummins Particulate Filter is service-free up to 5,000 hours when low ash oil is used and the base engine is properly maintained. At that point, ash cleaning is required. The EPA has set minimum ash cleaning intervals of 4,500 hours for engines 174 hp (130 kW) and above. Cummins expects to reach 5,000 hours before ash cleaning is required.

32. What causes ash in the Particulate Filter?

Ash is incombustible material derived from the additive pack in the lube oil. All engines consume a small amount of oil as part of their normal operation. The oil is burned in the combustion chamber along with the fuel, and the resulting small amount of residual ash from the oil is trapped in the filter section of the aftertreatment system. During filter regeneration, the PM is oxidized and removed from the filter. However, ash from the lube oil cannot be oxidized and remains in the filter.

33. How is the Cummins Particulate Filter serviced?

The Cummins Particulate Filter must be removed and cleaned by a Cummins approved cleaning method and authorized technician. The ash cleaning process typically takes 30 minutes, plus the time to remove the Cummins Particulate Filter from the equipment.

34. What is the life of the Cummins Particulate Filter?

The Cummins Particulate Filter is designed to last the life of the engine. The aftertreatment is specially strengthened against high levels of vibration and shock loading.

35. Is low ash lube oil required for Tier 4 Interim?

Yes. To maintain regulated ash cleaning intervals it is strongly recommended to use API CJ-4 low ash lube oil in North America and equivalent ACEA-E9 lube oil in the EU.

Fuel Requirements

36. Is ULSD fuel legally required for Tier 4 Interim engines?

Yes. In North America, Ultra Low Sulfur Diesel (ULSD) is legally required for Tier 4 Interim engines. The ULSD must contain 15 parts-per-millions (ppm) or less sulfur content.

37. Does the European Union have the same fuel requirements for Stage IIIB engines?

In the European Union, Ultra Low Sulfur Diesel (ULSD) must legally be 10-ppm at the point of manufacture and is expected to be 15-ppm at the point of use.

38. Will ULSD be available outside of North America and the European Union?

Availability of ULSD is very limited outside of North America and the European Union – so it is critical to not operate an engine requiring ULSD in a country without available ULSD supply. Using high sulfur content fuel will damage the engine and aftertreatment system.

39. Could today's greater than 15-ppm fuel be used in Tier 4 Interim engines?

Tier 4 Interim engines must use ULSD. It is not possible to comply with the legally required PM emissions standard with today's off-highway fuel which has a higher sulfur content.

40. What happens if higher sulfur fuel is inadvertently used?

A one-time inadvertent tank of diesel fuel with greater than 15-ppm sulfur content will not damage the engine and aftertreatment system. The system will clean itself out when ULSD is re-introduced.

However, continued improper fuel use of sulfur levels greater than 15-ppm with Cummins Tier 4 Interim engines can

permanently damage the engine and aftertreatment systems within a short period of time. This damage could possibly cause the engine to be inoperable and cause unplanned downtime and expenses.

41. Is the engine warranty affected if ULSD is not used?

Yes. Improper fuel use of sulfur levels greater than 15-ppm with Cummins Tier 4 Interim engines can result in denial of warranty coverage for any damage caused by using fuel with sulfur content greater than 15-ppm.

42. Can ULSD be used in Tier 3 or other engines?

Yes. Tier 3 and other emission level engines will work fine on ULSD. It is backwards compatible.

43. When will ULSD fuel be available?

ULSD is available today. ULSD was widely introduced in North America in 2006 and more recently in the European Union for emission compliant on-highway engines. Cummins anticipates that ULSD for off-highway applications will be widely available for Tier 4 Interim engines in 2011. Both the EPA and EU have a schedule in place with fuel producers and distributors to make ULSD available.

44. Can biodiesel fuel be used with Cummins Tier 4 Interim engines?

Cummins Tier 4 Interim engines are compatible with Biodiesel blends up to B20 as long as the fuel does not exceed 15-ppm sulfur content.

Warranty

45. Does Cummins Tier 4 Interim technology change the current warranty coverage?

Cummins current engine warranty will become a broader engine and system warranty for Tier 4 Interim by

incorporating the Cummins Particulate Filter aftertreatment and Direct Flow™ air cleaner housing. Warranty hours, terms and conditions remain unchanged for Tier 4 Interim.

46. What happens if Tier 4 Interim engines are exported and operated outside of their intended emissions region?

Tier 4 Interim engines and aftertreatment which are exported and operated outside of their intended emissions region will not carry a warranty. The very low emissions levels for Tier 4 Interim require specific technology that is not appropriate for regions with less severe standards.

Cummins is committed to manufacturing engines that provide optimal performance for their users as well as meeting emissions regulations. Since emissions standards vary across the world, Cummins designs its products to meet the standards of an individual country and/or emissions region. Equipment manufacturers, dealers and customers should carefully select the correct engine to meet the emissions requirements of their respective country.

Field Test Experience

47. What Tier 4 Interim field test experience does Cummins have?

The first of our Tier 4 Interim field test engines started running in the field and earning revenue for the operator in June 2008. Tier 4 Interim represents the most extensive development, concept installation and field test program that Cummins has ever undertaken with off-highway engines.

We have been deliberate in selecting specific customer field tests to cover the widest possible spectrum of machine types and duty cycles.

48. How are the Tier 4 Interim engines performing?

The message from the operators is that Cummins Tier 4 Interim solution is dependable, reduces their operating costs and improves the performance of their machines. Operators preferred the Tier 4 Interim powered machine for its responsiveness and improved productivity.

49. To what extent are you working with equipment manufacturers?

Cummins is deeply involved with our OEM partners in the machine integration of Tier 4 engines and aftertreatment in off-highway equipment. We had over 350 installations completed for Tier 4 Interim powered equipment. We had hundreds of OEMs engaged in virtual prototypes. Our OEM installations combined with concept and field test activity represents a broader range of equipment experience with Tier 4 Interim than anyone else in the industry.

50. What is the opinion of the Tier 4 Interim field test operators?

Cummins field test installations are receiving excellence testimonial comments from equipment owners and operators who prefer the cleaner, more fuel efficient and responsive Tier 4 Interim engines compared with Tier 3 powered equipment. Some of these comments are shown below:

"...we prefer to use the Tier 4 because it is quieter, much more response, no downtime, no problems..."

"...our fuel efficiency has improved by at least 5% with this machine..."

"...it's amazingly better, yes, a lot stronger, a lot faster, a lot quicker, everything..."

"...Tier 3 was nice - and now this one is a whole lot better engine...".

U.S. EPA

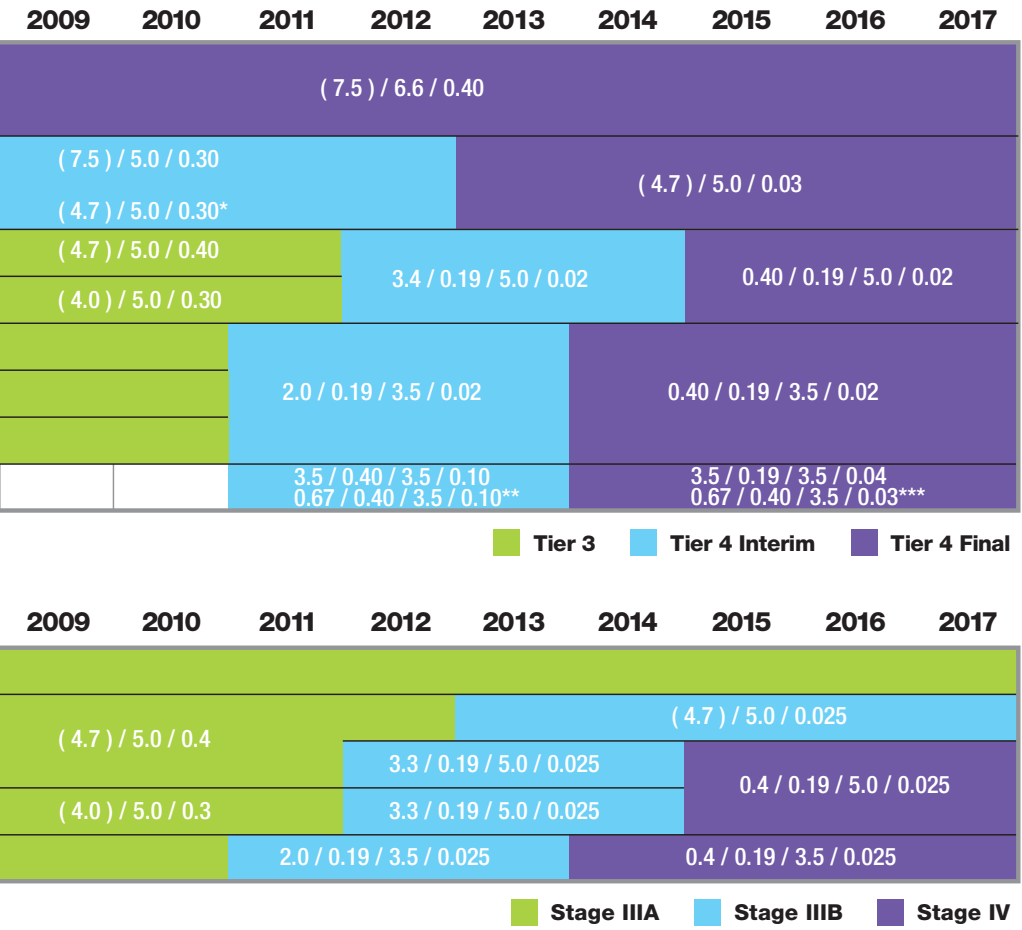
kW	(HP)	2005	2006	2007	2008
0 - 7	(0 - 10)				
8 - 18	(11 - 24)				
19 - 36	(25 - 48)				
37 - 55	(49 - 74)				
56 - 74	(75 - 99)				
75 - 129	(100 - 173)				
130 - 224	(174 - 301)				(4.0) / 3.5 / 0.20
225 - 449	(302 - 602)				(4.0) / 3.5 / 0.20
450 - 560	(603 - 751)				(4.0) / 3.5 / 0.20
>560	(>751)				

EUROPE

kW	(HP)	2005	2006	2007	2008
18 - 36	(24 - 48)			(7.5) / 5.5 / 0.6	
37 - 55	(49 - 74)				
56 - 74	(75 - 99)				
75 - 129	(100 - 173)				
130 - 560	(174 - 751)				(4.0) / 3.5 / 0.2

NOx/HC/CO/PM (g/kW-hr)
(NOx+HC)/CO/PM (g/kW-hr)
(Conversion: [g/kW-hr] x 0.7457 = g/bhp-hr)

The chart above is displayed for reference purposes only and does not depict the various options available to engine and equipment manufacturers. See the appropriate regulations for specific details and options related to that region's emissions standards and implementation dates.



*Tier 4 Interim Option 1 PM Standard
**Applies to portable power generation >1200 hp
***Applies to portable power generation >751 hp

Glossary

Advisor

A Cummins proactive tool for OEMs and technical support to select and design installations that maximize engine-to-machine performance for the end customer.

B20

A fuel blend of 20% biodiesel and 80% diesel.

CARB

California Air Resources Board. Implements and enforces air pollution control rules and regulations in the state of California.

CO_2

Carbon Dioxide. Classified as the major greenhouse gas and emitted proportional to amount of fuel consumed. With inherently higher fuel efficiency, diesel engines produce lower levels of CO_2. The EPA does not regulate CO_2 emissions from diesel engines.

CO

Carbon Monoxide. A regulated diesel emission produced by incomplete combustion. CO is emitted at very low levels from diesel engines.

Common-Rail Fuel Injection

Fuel delivery system that maintains a high injection pressure regardless of engine speed, using high-pressure fuel stored in a single “common” rail that connects to every fuel injector on the engine.

Cummins Emission Solutions

A world leader in the design and manufacture of catalytic exhaust aftertreatment systems, including DPF, SCR and DOC systems.

Cummins Filtration

A world leader in the design and manufacture of filtration and exhaust systems, including Fleetguard products.

Cummins Turbo Technologies

A world leader in the design and manufacture of turbochargers for diesel engines, including the Holset VGT™.

Cummins Fuel Systems

Develops and manufactures advanced fuel systems and electronic controls.

DOC

Diesel Oxidation Catalyst. Consists of a catalytic coating on a honeycomb substrate for oxidizing particulate matter (PM). Operates in a passive-only mode without active regeneration, so is less efficient at PM reduction than the DPF.

DPF

Diesel Particulate Filter. Captures particulate matter (PM) in a semi-porous medium as they flow through the exhaust system. Available in “passive” or “active” configurations. Active DPFs use a control system to actively promote regeneration events.

EGR

Exhaust Gas Recirculation. Technology that diverts a percentage of the exhaust gas back into the cylinder, lowering combustion temperatures and reducing NOx.

EPA

Environmental Protection Agency. Among many duties, the U.S. government agency is responsible for governing engine emissions.

Exhaust Aftertreatment

Any technology which removes emissions in the exhaust flow.

HPCR

High Pressure Common Rail fuel system.

INSITE™

Diagnostic software tool with real-time monitoring of everything from fuel burned to boost pressure and coolant temperature. Reads fault codes, provides rapid repair directions, and enables adjustable parameters and calibrations.

NMHC

Non-Methane Hydrocarbons. A regulated diesel emission which is primarily unburned fuel in the exhaust stream. Commonly described as Hydrocarbons (HC).

NOx

Oxides of Nitrogen. A regulated diesel emission which is a collective term for gaseous emissions composed of nitrogen and oxygen.

NOx Adsorber

Aftertreatment technology that uses a catalyst to capture and then convert NOx to harmless nitrogen gas and water vapor.

NRTC

Non-road transient composite test cycle introduced for Tier 4 emissions certification.

PM

Particulate Matter. A regulated diesel emission composed primarily of carbon soot and other combustion by-products.

PowerMatch

A Cummins calibration delivery system allowing quick and easy tailoring of electronic calibrations for a new application.

SCR

Selective Catalytic Reduction. An aftertreatment technology that uses a chemical reductant (urea) injected into the exhaust stream where it transforms into ammonia and reacts with NOx on a catalyst, converting the NOx to harmless nitrogen gas and water vapor.

Sulfur

A natural element in diesel fuel which has been linked to particulate matter and acid formation in the atmosphere.

Terms for Approximately Equivalent Standards

U.S. EPA ..... EU (European Union)
Tier 1..... Stage I
Tier 2..... Stage II
Tier 3..... Stage IIIA
Tier 4 - Interim..... Stage IIIB
Tier 4 - Final..... Stage IV

ULSD

Ultra-Low Sulfur Diesel. Diesel fuel which contains less than 15 parts per million by volume of sulfur. Mandated October 2006 for EPA on-highway, September 2010 for EPA off-highway and expected in 2009 in the EU.

Urea

A chemical usually made from natural gas, which is commonly used in fertilizers. Urea solution used for SCR aftertreatment breaks down into ammonia and reacts with NOx in the SCR system to produce harmless nitrogen gas and water vapor.

VGT

Variable Geometry Turbocharger. Turbochargers that constantly adjust the amount of airflow into the combustion chamber, optimizing performance and efficiency.

Cummins Inc.
Box 3005
Columbus, IN 47202-3005
U.S.A.

Phone: 1-800-DIESELS™ (1-800-343-7357)
Fax: 1-800-232-6393
Internet: cumminsengines.com

Twitter.com/CumminsEngines
YouTube.com/CumminsEngines

Cummins Ltd
Yarm Road, Darlington,
County Durham, DL1 4PW
UK

Phone: +44 (0) 1327 886464
Fax: +44 (0) 870 2413180
E-mail: emea.customerassistance@cummins.com

Bulletin 4087190 Printed in U.S.A. Rev. 2/13