TIER 4 INTERIM EPA EMISSIONS REQUIREMENTS

for Diesel Generator Sets

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Caterpillar Inc. has proven its commitment to sustainability by being named in Newsweek's Top 100 Greenest Companies in America.

EPA TIER 4 EMISSION REQUIREMENTS

Beginning January 1, 2011 mobile engines greater than 130 bkW (175 bhp) and non-emergency stationary engines less than 10 liters per cylinder and greater than 130 bkW (175 bhp) are required to meet Tier 4 Interim emissions regulations. The Tier 4 regulations not only apply to new diesel engines used in power generation, but they also affect industrial applications, petroleum packages, and diesel-powered construction equipment used in non-road applications.

Tier 4 Interim regulations call for 50-90% reductions in particulate matter (PM) emissions and up to 90% reduction in emissions of oxides of nitrogen (NOx), depending on the kilowatt rating of the engine / generator set. This is the fourth phase of the non-road EPA air quality regulations since 1996 and will be followed by a further phase of regulations known as Tier 4 Final. This next phase of regulation calls for further reductions in NOx emissions of up to 88% and further reductions in PM emissions of up to 70%, depending on the kilowatt rating of the engine / generator set.

Although engines in stationary installations are regulated separately from those in non-road mobile machinery, at Tier 4 Interim the EPA has effectively aligned the regulated limits and introduction timing for all engines in these categories with a cylinder displacement of <10 liters per cylinder. Stationary engines with a cylinder displacement of >10 liters per cylinder but <30 liters per cylinder must be certified to the Tier 2 emissions standards for new marine engines.

The following chart outlines the implementation of the EPA emission requirements for non-road mobile machinery.

EPA Nonroad Diesel Emissions Limits and Timing

bkW	2006*	2007	2008	2009	2010	2011	2012	2013	2014	2015
< 8	7.5 / 8.0, .80		7.5 / 8.0, .40		7.5 / 8.0, .60					
≥8 < 19	7.5 / 6.6, .80		7.5 / 6.6, .40							
≥19 < 37	7.5 / 5.5, .60		7.5 / 5.5, .30					4.7 / 5.5, .03		
≥37 < 56 Option 1	7.5 / 5.0, .40		4.7 / 5.0, .30					4.7 / 5.0, .03		
≥37 < 56 Option 2	7.5 / 5.0, .40		4.7 / 5.0, .40				4.7 / 5.0, .03			
≥56 < 75	7.5 / 5.0, .40		4.7 / 5.0, .40				3.4, .19 / 5.0, .02			.40, .19 / 5.0, .02
≥75 < 130	6.6 / 5.0, .30	4.0 / 5.0, .30					3.4, .19 / 5.0, .02			.40, .19 / 5.0, .02
≥130 < 225	4.0 / 3.5, .20					2.0, .19 / 3.5, .02			.40, .19 / 3.5, .02	
≥225 < 450	4.0 / 3.5, .20					2.0, .19 / 3.5, .02			.40, .19 / 3.5, .02	
≥450 ≤ 560	4.0 / 3.5, .20					2.0, .19 / 3.5, .02			.40, .19 / 3.5, .02	
>560 Non Genset	6.4 / 3.5, .20					3.5, .40 / 3.5, .10				3.5, .19 / 3.5, .04
>560 ≤ 900 Genset	6.4 / 3.5, .20					3.5, .40 / 3.5, .10				.67, .19 / 3.5, .03
>900 Genset	6.4 / 3.5, .20					.67, .40 / 3.5, .10				.67, .19 / 3.5, .03

NOx, HC / CO, PM or NOx+HC / CO, PM — g/kW-hr

Tier 2 Tier 3 Tier 4 Interim Tier 4 Final

*EPA Nonroad Regulations commenced with Tier 1 in January 1996

ALTERNATE STANDARD

Since the Tier 4 emissions levels are so low, the EPA has decided that engines powering stationary emergency generator sets, which by their nature run very few hours per year, are required to meet an alternate standard. This alternate standard effectively means that stationary engines built after January 1, 2011, powering emergency generator sets, must be certified to the highest Tier limits that do not require exhaust aftertreatment devices.

Hence emergency engines <56 bkW (<75 bhp) need to be certified to the Tier 4 Interim standards that were introduced in 2008; those between 56 and 560 bkW (75 and 750 bhp) will need to be certified to the Tier 3 standards, and those >560 bkW (750 bhp) and less than 10 liters per cylinder will need to be certified to the Tier 2 standards.

Although this means that the majority of today's certified products can continue to be produced for use in emergency installations, one important exception is engines >2237 bkW (3000 bhp) with a displacement volume of <10 liters per cylinder. Today, engines in this category are only regulated to Tier 1 emissions levels but, from January 1, 2011, new emergency engines in this category will require certification to Tier 2 standards.

The impact of the alternate standards for stationary emergency engines is summarized in the table below:

EPA Stationary Diesel Genset Emissions Limits and Timing

(engines < 10 liters per cylinder)

bkW	4/2006	2007	2008	2009	2010	2011	2012	2013	2014	2015
< 8	10.5 / 8.0, 1.0	7.5 / 8.0, .80	7.5 / 8.0, .40		7.5 / 8.0, .60					
≥8 < 19	9.5 / 6.6, .80	7.5 / 6.6, .80	7.5 / 6.6, .40							
≥19 < 37	9.5 / 5.5, .80	7.5 / 5.5, .60	7.5 / 5.5, .30					4.7 / 5.5, .03 Emergency Applications effectively remain at the previous Tier		
≥37 < 56 Option 1	9.2, – / –, –	7.5 / 5.0, .40	4.7 / 5.0, .30					4.7 / 5.0, .03 Emergency Applications effectively remain at the previous Tier		
≥37 < 56 Option 2	9.2, – / –, –	7.5 / 5.0, .40	4.7 / 5.0, .40				4.7 / 5.0, .03 Emergency Applications effectively remain at the previous Tier			
≥56 < 75	9.2, – / –, –	7.5 / 5.0, .40	4.7 / 5.0, .40				3.4, .19 / 5.0, .02 Emergency Applications effectively remain at the previous Tier			.40, .19 / 5.0, .02
≥75 < 130	9.2, – / –, –	4.0 / 5.0, .30					3.4, .19 / 5.0, .02 Emergency Applications effectively remain at the previous Tier			.40, .19 / 5.0, .02
≥130 < 225	9.2, 1.3 / 11.4, .54	4.0 / 3.5, .20				2.0, .19 / 3.5, .02 Emergency Applications effectively remain at the previous Tier			.40, .19 / 3.5, .02	
≥225 < 450	9.2, 1.3 / 11.4, .54	4.0 / 3.5, .20				2.0, .19 / 3.5, .02 Emergency Applications effectively remain at the previous Tier			.40, .19 / 3.5, .02	
≥450 ≤ 560	9.2, 1.3 / 11.4, .54	4.0 / 3.5, .20				2.0, .19 / 3.5, .02 Emergency Applications effectively remain at the previous Tier			.40, .19 / 3.5, .02	
>560 ≤ 900	9.2, 1.3 / 11.4, .54	6.4 / 3.5, .20				3.5, .40 / 3.5, .10 Emergency Applications effectively remain at the previous Tier				.67, .19 / 3.5, .03
>900 ≤ 2237	9.2, 1.3 / 11.4, .54	6.4 / 3.5, .20				.67, .40 / 3.5, .10 Emergency Applications effectively remain at the previous Tier				.67, .19 / 3.5, .03
>2237	9.2, 1.3 / 11.4, .54					.67, .40 / 3.5, .10	6.4 / 3.5, .20 Emergency Applications effectively remain at the previous Tier			.67, .19 / 3.5, .03

NOx, HC / CO, PM or NOx+HC / CO, PM g/kW-hr

Tier 1 Tier 2 Tier 3 Tier 4 Interim Tier 4 Final

DEFINING EMERGENCY

The key to the exemption is the term, "alternate standard". That is, what installations qualify as "emergency"? The following definition is based upon the EPA regulation.

*Emergency installations are those that operate **only** on the loss of a normal power source such as the utility or the grid. The anticipated operating scenario would be as follows:*

1. Normal source power is lost.
2. User starts the emergency generator set to supply power to the electrical loads.
3. Normal source power returns.
4. User shuts down the emergency generator set and supplies the electrical loads from the normal source.

There is no restriction on the number of hours that an emergency installation may run under true emergency conditions, but the EPA regulation only allows operators to run their emergency gensets for 100 hours per year for maintenance and exercise purposes.* However, if local regulations dictate, operators may petition the EPA for an increased number of annual maintenance hours.

All operation of an emergency generator set must be recorded by the operator and referenced to a non-resettable hour meter fitted to the generator set. New emergency engines, built after the effective date of the Tier 4 regulation for their power class, must also be fitted with a permanent label stating that they are for emergency use only.

TIER 4 GENSET APPLICATIONS

There is a growing list of genset applications which will require Tier 4 certified generator sets in 2011:

1. Non-emergency standby units
2. Prime Power applications
3. Load management/peak shaving applications
4. Electric Power Rental and other mobile units
5. Installations which run for storm avoidance*

There are potential state and local regulations that may drive the use of Tier 4 generator sets in emergency applications.

STATE AND LOCAL REGULATIONS

Although the EPA regulations set out alternative standards for engines in emergency generators sets, which allow the continued use of Tier 2 and Tier 3 engines, state and local regulatory authorities can dictate stricter regulated limits. These include non-attainment areas in the United States such as areas of Southern California; areas in many New England states; Atlanta, Georgia; and Houston, Texas. The result is that stationary diesel-fueled generator sets deployed in these areas, even if certified to the appropriate EPA tier level, may not meet local requirements. As the United States EPA lowers National Ambient Air Quality Standards levels nationwide, more areas will fall into non-attainment status and thus further restrictions on engine emissions will likely be implemented.

** EPA is currently reviewing the allowances for non-emergency running of stationary emergency compression ignition engines. The definition above may change during 2011 as a result.*

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