

Nonroad Compression-Ignition Engines: Exhaust Emission Standards

| | Rated Power (kW) | Tier | Model Year | NMHC (g/kW-hr) | NMHC + NOx (g/kW-hr) | NOx (g/kW-hr) | PM (g/kW-hr) | CO (g/kW-hr) | Smoke ^a (Percentage) | Useful Life (hours /years) ^b | Warranty Period (hours /years) ^b |
|---------------|------------------|---------------------------|------------------------|----------------|----------------------|---------------|-------------------|--------------|---------------------------------|-----------------------------------------|---------------------------------------------|
| Federal | kW < 8 | 1 | 2000-2004 | - | 10.5 | - | 1.0 | 8.0 | 20/15/50 | 3,000/5 | 1,500/2 |
| | | 2 | 2005-2007 | - | 7.5 | - | 0.80 | 8.0 | | | |
| | | 4 | 2008+ | - | 7.5 | - | 0.40 ^c | 8.0 | | | |
| | 8 ≤ kW < 19 | 1 | 2000-2004 | - | 9.5 | - | 0.80 | 6.6 | | 3,000/5 | 1,500/2 |
| | | 2 | 2005-2007 | - | 7.5 | - | 0.80 | 6.6 | | | |
| | | 4 | 2008+ | - | 7.5 | - | 0.40 | 6.6 | | | |
| | 19 ≤ kW < 37 | 1 | 1999-2003 | - | 9.5 | - | 0.80 | 5.5 | | 5,000/7 ^d | 3,000/5 ^e |
| | | 2 | 2004-2007 | - | 7.5 | - | 0.60 | 5.5 | | | |
| | | 4 | 2008-2012 | - | 7.5 | - | 0.30 | 5.5 | | | |
| | | | 2013+ | - | 4.7 | - | 0.03 | 5.5 | | | |
| | 37 ≤ kW < 56 | 1 | 1998-2003 | - | - | 9.2 | - | - | | 8,000/10 | 3,000/5 |
| | | 2 | 2004-2007 | - | 7.5 | - | 0.40 | 5.0 | | | |
| | | 3 ^f | 2008-2011 | - | 4.7 | - | 0.40 | 5.0 | | | |
| | | 4 (Option 1) ^g | 2008-2012 | - | 4.7 | - | 0.30 | 5.0 | | | |
| | | 4 (Option 2) ^g | 2012 | - | 4.7 | - | 0.03 | 5.0 | | | |
| | | 4 | 2013+ | - | 4.7 | - | 0.03 | 5.0 | | | |
| | 56 ≤ kW < 75 | 1 | 1998-2003 | - | - | 9.2 | - | - | | 8,000/10 | 3,000/5 |
| | | 2 | 2004-2007 | - | 7.5 | - | 0.40 | 5.0 | | | |
| | | 3 | 2008-2011 | - | 4.7 | - | 0.40 | 5.0 | | | |
| | | 4 | 2012-2013 ^h | - | 4.7 | - | 0.02 | 5.0 | | | |
| | | | 2014+ ⁱ | 0.19 | - | 0.40 | 0.02 | 5.0 | | | |
| 75 ≤ kW < 130 | 1 | 1997-2002 | - | - | 9.2 | - | - | 8,000/10 | 3,000/5 | | |
| | 2 | 2003-2006 | - | 6.6 | - | 0.30 | 5.0 | | | | |
| | 3 | 2007-2011 | - | 4.0 | - | 0.30 | 5.0 | | | | |
| | 4 | 2012-2013 ^h | - | 4.0 | - | 0.02 | 5.0 | | | | |
| | | 2014+ | 0.19 | - | 0.40 | 0.02 | 5.0 | | | | |

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| | Rated Power (kW) | Tier | Model Year | NMHC (g/kW-hr) | NMHC + NOx (g/kW-hr) | NOx (g/kW-hr) | PM (g/kW-hr) | CO (g/kW-hr) | Smoke ^a (Percentage) | Useful Life (hours /years) ^b | Warranty Period (hours /years) ^b |
|----------------|------------------|------|------------------------|------------------|----------------------|------------------|-------------------|--------------|---------------------------------|-----------------------------------------|---------------------------------------------|
| Federal | 130 ≤ kW < 225 | 1 | 1996-2002 | 1.3 ^j | - | 9.2 | 0.54 | 11.4 | 20/15/50 | 8,000/10 | 3,000/5 |
| | | 2 | 2003-2005 | - | 6.6 | - | 0.20 | 3.5 | | | |
| | | 3 | 2006-2010 | - | 4.0 | - | 0.20 | 3.5 | | | |
| | | 4 | 2011-2013 ^h | - | 4.0 | - | 0.02 | 3.5 | | | |
| | | | 2014+ ⁱ | 0.19 | - | 0.40 | 0.02 | 3.5 | | | |
| | 225 ≤ kW < 450 | 1 | 1996-2000 | 1.3 ^j | - | 9.2 | 0.54 | 11.4 | | | |
| | | 2 | 2001-2005 | - | 6.4 | - | 0.20 | 3.5 | | | |
| | | 3 | 2006-2010 | - | 4.0 | - | 0.20 | 3.5 | | | |
| | | 4 | 2011-2013 ^h | - | 4.0 | - | 0.02 | 3.5 | | | |
| | | | 2014+ ⁱ | 0.19 | - | 0.40 | 0.02 | 3.5 | | | |
| | 450 ≤ kW < 560 | 1 | 1996-2001 | 1.3 ^j | - | 9.2 | 0.54 | 11.4 | | | |
| | | 2 | 2002-2005 | - | 6.4 | - | 0.20 | 3.5 | | | |
| | | 3 | 2006-2010 | - | 4.0 | - | 0.20 | 3.5 | | | |
| | | 4 | 2011-2013 ^h | - | 4.0 | - | 0.02 | 3.5 | | | |
| | | | 2014+ ⁱ | 0.19 | - | 0.40 | 0.02 | 3.5 | | | |
| | 560 ≤ kW < 900 | 1 | 2000-2005 | 1.3 ^j | - | 9.2 | 0.54 | 11.4 | | | |
| | | 2 | 2006-2010 | - | 6.4 | - | 0.20 | 3.5 | | | |
| | | 4 | 2011-2014 | 0.40 | - | 3.5 | 0.10 | 3.5 | | | |
| | | | 2015+ ⁱ | 0.19 | - | 3.5 ^k | 0.04 ^l | 3.5 | | | |
| | kW > 900 | 1 | 2000-2005 | 1.3 ^j | - | 9.2 | 0.54 | 11.4 | | | |
| | | 2 | 2006-2010 | - | 6.4 | - | 0.20 | 3.5 | | | |
| | | 4 | 2011-2014 | 0.40 | - | 3.5 ^k | 0.10 | 3.5 | | | |
| | | | 2015+ ⁱ | 0.19 | - | 3.5 ^k | 0.04 ^l | 3.5 | | | |

Notes on following page.

Notes:

- For Tier 1, 2, and 3 standards, exhaust emissions of nitrogen oxides (NO_x), carbon monoxide (CO), hydrocarbons (HC), and non-methane hydrocarbons (NMHC) are measured using the procedures in 40 Code of Federal Regulations (CFR) Part 89 Subpart E. For Tier 1, 2, and 3 standards, particulate matter (PM) exhaust emissions are measured using the California Regulations for New 1996 and Later Heavy-Duty Off-Road Diesel Cycle Engines.
- For Tier 4 standards, engines are tested for transient and steady-state exhaust emissions using the procedures in 40 CFR Part 1039 Subpart F. Transient standards do not apply to engines below 37 kilowatts (kW) before the 2013 model year, constant-speed engines, engines certified to Option 1, and engines above 560 kW.
- Tier 2 and later model naturally aspirated nonroad engines shall not discharge crankcase emissions into the atmosphere unless these emissions are permanently routed into the exhaust. This prohibition does not apply to engines using turbochargers, pumps, blowers, or superchargers.
- In lieu of the Tier 1, 2, and 3 standards for NO_x, NMHC + NO_x, and PM, manufacturers may elect to participate in the averaging, banking, and trading (ABT) program described in 40 CFR Part 89 Subpart C.
- a** Smoke emissions may not exceed 20 percent during the acceleration mode, 15 percent during the lugging mode, and 50 percent during the peaks in either mode. Smoke emission standards do not apply to single-cylinder engines, constant-speed engines, or engines certified to a PM emission standard of 0.07 grams per kilowatt-hour (g/kW-hr) or lower. Smoke emissions are measured using procedures in 40 CFR Part 86 Subpart I.
- b** Useful life and warranty period are expressed hours and years, whichever comes first.
- c** Hand-startable air-cooled direct injection engines may optionally meet a PM standard of 0.60 g/kW-hr. These engines may optionally meet Tier 2 standards through the 2009 model years. In 2010 these engines are required to meet a PM standard of 0.60 g/kW-hr.
- d** Useful life for constant speed engines with rated speed 3,000 revolutions per minute (rpm) or higher is 5 years or 3,000 hours, whichever comes first.
- e** Warranty period for constant speed engines with rated speed 3,000 rpm or higher is 2 years or 1,500 hours, whichever comes first.
- f** These Tier 3 standards apply only to manufacturers selecting Tier 4 Option 2. Manufacturers selecting Tier 4 Option 1 will be meeting those standards in lieu of Tier 3 standards.
- g** A manufacturer may certify all their engines to either Option 1 or Option 2 sets of standards starting in the indicated model year. Manufacturers selecting Option 2 must meet Tier 3 standards in the 2008-2011 model years.
- h** These standards are phase-out standards. Not more than 50 percent of a manufacturer's engine production is allowed to meet these standards in each model year of the phase out period. Engines not meeting these standards must meet the final Tier 4 standards.
- i** These standards are phased in during the indicated years. At least 50 percent of a manufacturer's engine production must meet these standards during each year of the phase in. Engines not meeting these standards must meet the applicable phase-out standards.
- j** For Tier 1 engines the standard is for total hydrocarbons.
- k** The NO_x standard for generator sets is 0.67 g/kW-hr.
- l** The PM standard for generator sets is 0.03 g/kW-hr.

Citations: Code of Federal Regulations (CFR) citations:

- 40 CFR 89.112 = Exhaust emission standards
- 40 CFR 1039.101 = Exhaust emission standards for after 2014 model year
- 40 CFR 1039.102 = Exhaust emission standards for model year 2014 and earlier
- 40 CFR 1039 Subpart F = Exhaust emissions transient and steady state test procedures
- 40 CFR 86 Subpart I = Smoke emission test procedures
- 40 CFR 1065 = Test equipment and emissions measurement procedures