

Nonroad Large Spark-Ignition Engines: Exhaust and Evaporative Emission Standards

	Tier	Year	General Duty-Cycle Standards		Alternative Standards for Severe-Duty Engines		Field Testing Standards		Useful Life (years / hours)	Warranty Period		
			HC+NO _x ^a (g/kW-hr)	CO (g/kW-hr)	HC+NO _x ^a (g/kW-hr)	CO (g/kW-hr)	HC+NO _x ^a (g/kW-hr)	CO (g/kW-hr)				
Federal ^b	1 ^c	2004 - 2006	4.0 ^d	50.0	4.0 ^d	130.0	-	-	7 / 5,000 ^e	3 / 2,500 ^f		
	2 ^g	2007+	2.7 ^g	4.4 ^g	2.7	130.0	3.8 ^g	6.5 ^g	7 / 5,000 ^e	3 / 2,500 ^f		
			Evaporative Emission Standards (for engines fueled by a volatile liqued fuel)									
			Fuel line permeation	Nonmetallic fuel lines must meet the permeation specifications of SAE J2260 (November 1996)							5 / -	
			Diurnal emissions	Evaporative HC emissions may not exceed 0.2 grams per gallon of fuel tank capacity								
Running Loss	Liquid fuel in the fuel tank may not reach boiling during continuous engine operation in the final installation at an ambient temperature of 30°C											

Notes:

- a** The numerical emission standards for hydrocarbons (HC) must be met based on the following types of hydrocarbon emissions for engines powered by the following fuels: (1) non-methane hydrocarbons (NMHC) for natural gas; (2) total hydrocarbon equivalent (THCE) for alcohol; and (3) total hydrocarbons (THC) for other fuels.
- b** Voluntary Blue Sky standards for large spark-ignition (SI) engines are available. Engines with displacement at or below 1,000 cubic centimeters (cc) and maximum power at or below 30 kilowatts (kW) may be certified under the program for small SI engines.
- c** Emission standards are based on testing over a steady-state duty-cycle.
- d** The Tier 1 HC plus nitrogen oxides (NO_x) emission standard for in-use testing is 5.4 grams per kW-hour (g/kW-hr).
- e** Useful life is expressed in years and hours, whichever comes first. These are the minimum useful life requirements. For severe-duty engines, the minimum useful life is seven years or 1,500 hours of operation, whichever comes first. A longer useful life in hours is required if: (a) the engine is designed to operate longer than the minimum useful life based on the recommended rebuild interval; or (b) the basic mechanical warranty is longer than the minimum useful life.
- f** A longer warranty period of five years or 3,500 hours applies for high-cost warranted parts (i.e., components with a replacement cost at time of certification exceeding \$400 [in 1998 dollars]).
- g** Optional engine certification is allowed according to the following formula: $(\text{HC} + \text{NO}_x) \times \text{CO} \cdot 0.784 \leq 8.57$. The HC+NO_x and carbon monoxide (CO) emission levels selected to satisfy this formula, rounded to the nearest 0.1 g/kW-hr, become the emission standards that apply for those engines. One may not select an HC+NO_x emission standard higher than 2.7 g/kW-hr or a CO emission standard higher than 20.6 g/kW-hr.

Code of Federal Regulations (CFR) Citations:

- 40 CFR 1048.101 = Exhaust emission standards
- 40 CFR 1048.105 = Evaporative emission standards
- 40 CFR 1048.110 = Engine diagnostic requirements
- 40 CFR 1048.120 = Warranty requirements