

Heavy-Duty Highway Spark-Ignition Engines: Exhaust Emission Standards

	Engine or Vehicle	Year	Gross Vehicle Weight (lbs)	HC ^a (g/bhp-hr)	NMHC ^b (g/bhp-hr)	NOx (g/bhp-hr)	NOx + NMHC ^c (g/bhp-hr)	PM (g/bhp-hr)	CO (g/bhp-hr)	Idle CO (% exhaust gas flow)	Formaldehyde	Useful Life (years / miles)	Warranty Period (years / miles) ^r	
Federal	Heavy Duty Engines ^d	Prior to Control	-	12.7	-	-	6.86	-	155	-	-	5 / 50,000	-	
		1970-73	-	275 ppm	-	-	-	-	1.5%	-	-		-	
		1974-78	-	-	-	16	-	-	40	-	-		-	
		1979-84	-	1.5	-	10	-	-	25	-	-		-	
		1985-86	-	1.9	-	-	10.6	-	37.1	-	-		-	
		1987	≤ 14,000	1.1	-	-	10.6	-	14.4	0.5	-		-	-
			> 14,000	1.9	-	-	10.6	-	37.1		-		-	-
		1988-90	≤ 14,000	1.1	-	-	6.0	-	14.4	-	-	-	-	
			> 14,000	1.9	-	-	6.0	-	37.1	-	-	-	-	
		1990 ^e	≤ 14,000	1.1	-	-	6.0	-	14.4	0.5 ^j	-	-	8 / 110,000 ^k	-
			> 14,000	1.9	-	-	6.0	-	37.1		-	-		-
		1991-97 ^f	≤ 14,000	1.1 ^g	-	-	5.0	-	14.4		-	-		-
			> 14,000	1.9 ^h	-	-	5.0	-	37.1		-	-		-
		1998-2004 ^f	≤ 14,000	1.1 ^g	-	-	4.0 ⁱ	-	14.4		-	-		-
	> 14,000		1.9 ^h	-	-	-		37.1	-		-	-		
	2005-2007 ^f	≤ 14,000	1.1 ^g	-	1.0 ^l	-	-	14.4	-		-	-		10 / 110,000
		> 14,000	1.9 ^h	-		-	-	37.1	-		-	-		
	2008+	All	-	0.14	0.20	-	0.01	14.4	-		-	-		
	Complete Heavy-Duty Vehicles ^{n, q}	2005-2007	8,500 - 10,000	-	0.280 ^m g/mi	0.9 g/mi	-	-	7.3 g/mi		-	-	11 / 120,000	-
			10,000 - 14,000	-	0.330 ^m g/mi	1.0 g/mi	-	-	8.1 g/mi		-	-		
2008+ ^p		8,500 - 10,000	-	0.195 ^o g/mi	0.2 g/mi	-	0.02 g/mi	7.3 g/mi	0.032 g/mi		-			
		10,000 - 14,000	-	0.230 ^o g/mi	0.4 g/mi	-	0.02 g/mi	8.1 g/mi	0.040 g/mi		-			

Notes on following page.

Notes:

- a For methanol-fueled engines, the standard is for total hydrocarbon equivalent (THCE).
- b For methanol and alcohol fueled vehicles the standard is for non-methane hydrocarbon equivalent (NMHCE)
- c For methanol fueled engines the standard is for nitrogen oxides (NOx) plus NMHCE.
- d Standards for heavy-duty engines are expressed in grams per brake horsepower-hour (g/bhp-hr). Starting with the 1998 model year crankcase emissions are not allowed.
- e Standards for 1990 apply to gasoline and methanol-fueled engines.
- f Standards for 1991 and later apply to gasoline and methanol engines and are optional for natural gas and Liquefied Petroleum Gas-fueled engines through the 1996 model year.
- g For natural gas fueled engines the standard is 0.9 g/bhp-hr non-methane hydrocarbon (NMHC).
- h For natural gas fueled engines the standard is 1.7 g/bhp-hr NMHC.
- i The NOx standard is 5.0 for all natural gas-fueled engines.
- j This standard applies to the following engines utilizing aftertreatment technology (except for methanol) for the following model years: gasoline/1990+; natural gas and LPG/1991+; methanol/1990+. Starting in 2005, engines certified to on-board diagnostics requirements are not required to meet the idle carbon monoxide (CO) standard.
- k Useful life is expressed in years or miles, whichever comes first. Useful life for the 1998 and later NOx standard and for all 2004 standards is 10 years or 110,000 miles, whichever comes first.
- l Manufacturers can choose this standard or one of the following options: (1) a standard of 1.5 g/bhp-hr NMHC+NOX that applies to the 2004 through 2007 model years, with complete heavy-duty vehicle standards taking effect in 2005; or (2) a standard of 1.5 g/bhp-hr NMHC + NOX that would apply to the 2003 through 2007 heavy-duty engines and optionally to 2003 through 2006 complete heavy-duty vehicles.
- m Standard is expressed as non-methane organic gas, but compliance can optionally be shown using measurement of NMHC or total hydrocarbon (THC).
- n Complete heavy-duty vehicles have the primary load-carrying container or device attached. Incomplete heavy-duty vehicles are optionally certified to heavy-duty engine or heavy-duty chassis standards. Standards for complete or incomplete heavy-duty vehicles are expressed in grams per mile (g/mi). Starting in 2005 (or 2003 or 2004 depending on the selected phase in option; see footnote l), complete heavy-duty vehicles under 14,000 lbs gross vehicle weight are tested on chassis-based rather than engine-based procedures and must meet these complete heavy-duty vehicle standards.
- o Although expressed as NMHC, compliance can optionally be shown using measurement of NMOG or THC.
- p At least 50 percent of a manufacturer's sales must meet these standards in 2008, with 100 percent required in 2009.
- q Gross vehicle weight ranges are more accurately specified as follows: $8500 \leq GVW \leq 10,000$ and $10,000 < GVW < 14,000$.
- r Warranty period is expressed in years or miles, whichever comes first, but not less than the basic mechanical warranty for the engine family.

Code of Federal Regulations (CFR) citations:

- 40 CFR 86.1816-05, 86.1816-08 Emission standards for complete heavy-duty vehicles
- 40 CFR 86.1806-01, 86.1806-04, 86.1806-05 Onboard diagnostics requirements
- 40 CFR 86.1817-05, 86.1817-08 Complete heavy-duty vehicle averaging, banking, and trading program
- 40 CFR 86.091-10 Heavy-duty engine averaging, banking, and trading program for 1991 and later - Not available in the e-CFR
- 40 CFR 86 Subpart B Vehicle test procedures