

Table 1. Continued

Model Year	Emission Rates											
	Federal						California					
	HC (g/ bhp- hr)	CO (g/ bhp- hr)	NO _x (g/ bhp- hr)	Evap (g/ test)	Partic- ulates (g/ bhp- hr)	HC+ NO _x	HC (g/ bhp- hr)	CO (g/bhp- hr)	NO _x (g/bhp- hr)	Evap (g/ test)	Partic- ulates (g/ bhp- hr)	HC+ NO _x
Heavy-Duty Truck and Bus Engines ^f												
1969							"	"				
1972							v	v				
1973								40.0 ^v				16.0
1974		40.0				16.0		40.0				16.0
1975		40.0				16.0		30.0				10.0
1977		40.0				16.0	1.0	25.0	7.5			5.0 ^w
1978		40.0				16.0	1.0	25.0	7.5	6		5.0 ^w
1979		25.0				10.0	1.5	25.0	7.5	6		5.0 ^w
1980	1.5	25.0				10.0	1.0	25.0	7.5	2		6.0 ^w
1984	1.5	25.0				10.0	0.5	25.0	7.5	2		4.5 ^w
1985	1.9 ^x	37.1 ^y	10.6 ^z		3 ^{aa}		0.5	25.0	7.5	2		4.5 ^{w.bb}
1987	1.1	14.4 ^y	10.6		3		0.5	25.0	7.5	2		4.5 ^w
1988 ^{cc}	1.1	14.4	6.0		3 0.6		0.5	25.0	7.5	2		4.5 ^w
1991	1.1	14.4	5.0		3 0.25 ^{dd}		0.5 ^{ee}	25.0 ^{ee}	7.5 ^{ee}	2		4.5 ^w

NOTE: Evap = evaporative HC.

^a 1.5 for >6,000 lb.^b Full useful life requirement = 11 yr/120,000 mi (was 5 yr/50,000 mi).^c NO_x federal standard = 1.2 g/mi under 3,751-lb loaded vehicle weight (LVW), 1.7 g/mi for ≥3,751 lb LVW, and 2.3 g/mi for ≥6,000 lb LVW.^d 1.2 for <3,751 lb.^e Various test methods, values are not strictly comparable.^f 275 ppm HC, 1.5% CO.^g 180 ppm HC, 1.0% CO.^h A combined standard is optional in lieu of separate HC and NO_x standards (for example, 1 g HC + 7.5 g NO_x or 5 g [HC+NO_x]).ⁱ 1.3 for diesel.^j 15.5 for diesel.^k 10.7 for diesel.^l 4.0 for >20,000 lb.^m Gasoline only and in following years.ⁿ 1988 federal standards for NO_x have been postponed until 1990.^o Separate standard of 0.1 for all 1991 urban buses and all 1994 engines.^p 1.3 HC, 16.5 CO, 5.1 NO_x for diesel.

SOURCE: Adapted with permission from General Motors Corp. 1986.

are classified as heavy-duty vehicles. The driving-cycle philosophies for the light commercial vehicles follow those for passenger cars. For heavy commercial vehicles, engine dynamometers are used, not chassis dynamometers; that is, the engine rather than the vehicle is certified. The new (effective 1985) U.S. transient test procedure for heavy-duty vehicles combines the two philosophies just described in that the cycle is made up in a random way from actual driving cycle data. The use of this

cycle replaces the 13-mode steady-state cycle in use since 1973 in California and since 1974 nationally (U.S. Environmental Protection Agency 1972).

Emission Standards

United States. Emissions standards and test procedures in the United States have changed significantly since the first automobile emission standards were imposed in California in 1966 (see table 1) (General

Table 5.3
Average Aircraft Emissions
O'Hare International Airport
1972

Pollutant	Average Emission Per Aircraft LTO (lbs)	^{330 jet day year} metric tons	Average Emission Per Enplaned Passenger (lbs)
CO	55.45	3029	1.05
HC	32.71	1,708	0.62
NO _x	19.51	1065 ← INCORRECT	0.37
Particulates	3.30	180	0.06

¹ 27,000,800 grams

28,350 kg
16,740 kg
9,990 "
1,620 kg

CO 63,000 lb CO/day w/ 60,000 passengers
HC 37,200
NO_x 22,200
PM₁₀ 3,600
126,000 lb/day

lb to $\mu\text{g}/\text{m}^3$?
or lb to ppb ppm

250 gal = 4 qts to gal. = 8 pints 24 cups

8 lb in gal.
1 gal = 3.78 litre

7875 = 29,767.5 litre

16 oz = 1 lb. 128 oz. =
102 = 483.84 litre 483,840 m³

4 qts = 1 gal. = 128 oz.

2 pts = 1 qt = 32 oz.

2 cups = 1 pt. = 16 oz.

29,767.5 litre