

TABLE 1 TO APPENDIX I—EMISSION STANDARDS FOR ENGINES BELOW 37 kW (g/kW-HR)—Continued

Rated power (kW)	Tier	Model year	NMHC + NO _x	CO	PM
19≤kW<37	Tier 2	2005	7.5	6.6	0.80
	Tier 1	1999	9.5	5.5	0.8
	Tier 2	2004	7.5	5.5	0.6

(b) *Engines at or above 37 kW.* Tier 1 and Tier 2 standards for engines at or above 37 kW apply as specified in 40 CFR part 94 and summarized as follows:

(1) *Tier 1 standards.* NO_x emissions from model year 2004 and later engines with displacement of 2.5 or more liters per cylinder may not exceed the following values:

(i) 17.0 g/kW-hr when maximum test speed is less than 130 rpm.

(ii) $45.0 \times N^{-0.20}$ when maximum test speed is at or above 130 but below 2000 rpm, where N is the maximum test speed of the engine in revolutions per minute. Round the calculated standard to the nearest 0.1 g/kW-hr.

(i) 9.8 g/kW-hr when maximum test speed is 2000 rpm or more.

(2) *Tier 2 primary standards.* Exhaust emissions from Category 1 engines at or above 37 kW and all Category 2 engines may not exceed the values shown in the following table:

TABLE 2 TO APPENDIX I—PRIMARY TIER 2 EMISSION STANDARDS FOR COMMERCIAL AND RECREATIONAL MARINE ENGINES AT OR ABOVE 37 kW (g/kW-HR)

Engine size liters/cylinder	Maximum engine power	Category	Model year	NO _x + THC g/kW-hr	CO g/kW-hr	PM g/kW-hr
disp. < 0.9	power ≥37 kW	Category 1 Commercial	2005	7.5	5.0	0.40
		Category 1 Recreational	2007	7.5	5.0	0.40
0.9 ≤ disp. < 1.2	All	Category 1 Commercial	2004	7.2	5.0	0.30
		Category 1 Recreational	2006	7.2	5.0	0.30
1.2 ≤ disp. < 2.5	All	Category 1 Commercial	2004	7.2	5.0	0.20
		Category 1 Recreational	2006	7.2	5.0	0.20
2.5 ≤ disp. < 5.0	All	Category 1 Commercial	2007	7.2	5.0	0.20
		Category 1 Recreational	2009	7.2	5.0	0.20
5.0 ≤ disp. < 15.0	All	Category 2	2007	7.8	5.0	0.27
		Category 2	2007	8.7	5.0	0.50
15.0 ≤ disp. < 20.0	power < 3300 kW power ≥3300 kW	Category 2	2007	9.8	5.0	0.50
		Category 2	2007	9.8	5.0	0.50
20.0 ≤ disp. < 25.0	All	Category 2	2007	9.8	5.0	0.50
		Category 2	2007	11	5.0	0.5

(3) *Tier 2 supplemental standards.* The not-to-exceed emission standards specified in 40 CFR 94.8(e) apply for all engines subject to the Tier 2 standards described in paragraph (b)(2) of this appendix.

[73 37243, June 30, 2008, as amended at 75 FR 23012, Apr. 30, 2010]

APPENDIX II TO PART 1042—STEADY-STATE DUTY CYCLES

(a) The following duty cycles apply as specified in §1042.505(b)(1):

(1) The following duty cycle applies for discrete-mode testing:

E3 mode No.	Engine speed ¹	Percent of maximum test power	Weighting factors
1	Maximum test speed	100	0.2
2	91%	75	0.5
3	80%	50	0.15
4	63%	25	0.15

¹Speed terms are defined in 40 CFR part 1065. Percent speed values are relative to maximum test speed.

(2) The following duty cycle applies for ramped-modal testing:

RMC mode	Time in mode (seconds)	Engine speed ^{1,3}	Power (percent) ^{2,3}
1a Steady-state	229	Maximum test speed	100%.

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RMC mode	Time in mode (seconds)	Engine speed ^{1,3}	Power (percent) ^{2,3}
1b Transition	20	Linear transition	Linear transition in torque.
2a Steady-state	166	63%	25%.
2b Transition	20	Linear transition	Linear transition in torque.
3a Steady-state	570	91%	75%.
3b Transition	20	Linear transition	Linear transition in torque.
4a Steady-state	175	80%	50%.

¹ Speed terms are defined in 40 CFR part 1065. Percent speed is relative to maximum test speed.

² The percent power is relative to the maximum test power.

³ Advance from one mode to the next within a 20-second transition phase. During the transition phase, command a linear progression from the torque setting of the current mode to the torque setting of the next mode, and simultaneously command a similar linear progression for engine speed if there is a change in speed setting.

(b) The following duty cycles apply as specified in § 1042.505(b)(2):

(1) The following duty cycle applies for discrete-mode testing:

E5 mode No.	Engine speed ¹	Percent of maximum test power	Weighting factors
1	Maximum test speed	100	0.08
2	91%	75	0.13
3	80%	50	0.17
4	63%	25	0.32
5	Warm idle	0	0.3

¹ Speed terms are defined in 40 CFR part 1065. Percent speed values are relative to maximum test speed.

(2) The following duty cycle applies for ramped-modal testing:

RMC mode	Time in mode (seconds)	Engine speed ^{1,3}	Power (percent) ^{2,3}
1a Steady-state	167	Warm idle	0.
1b Transition	20	Linear transition	Linear transition in torque.
2a Steady-state	85	Maximum test speed	100%.
2b Transition	20	Linear transition	Linear transition in torque.
3a Steady-state	354	63%	25%.
3b Transition	20	Linear transition	Linear transition in torque.
4a Steady-state	141	91%	75%.
4b Transition	20	Linear transition	Linear transition in torque.
5a Steady-state	182	80%	50%.
5b Transition	20	Linear transition	Linear transition in torque.
6 Steady-state	171	Warm idle	0.

¹ Speed terms are defined in 40 CFR part 1065. Percent speed is relative to maximum test speed.

² The percent power is relative to the maximum test power.

³ Advance from one mode to the next within a 20-second transition phase. During the transition phase, command a linear progression from the torque setting of the current mode to the torque setting of the next mode, and simultaneously command a similar linear progression for engine speed if there is a change in speed setting.

(c) The following duty cycles apply as specified in § 1042.505(b)(3):

(1) The following duty cycle applies for discrete-mode testing:

E2 mode No.	Engine speed ¹	Torque (percent) ²	Weighting factors
1	Engine Governed	100	0.2
2	Engine Governed	75	0.5
3	Engine Governed	50	0.15
4	Engine Governed	25	0.15

¹ Speed terms are defined in 40 CFR part 1065.

² The percent torque is relative to the maximum test torque as defined in 40 CFR part 1065.

(2) The following duty cycle applies for ramped-modal testing:

RMC mode	Time in mode (seconds)	Engine speed	Torque (percent) ^{1, 2}
1a Steady-state	234	Engine Governed	100%.
1b Transition	20	Engine Governed	Linear transition.
2a Steady-state	571	Engine Governed	25%.
2b Transition	20	Engine Governed	Linear transition.
3a Steady-state	165	Engine Governed	75%.
3b Transition	20	Engine Governed	Linear transition.
4a Steady-state	170	Engine Governed	50%.

¹ The percent torque is relative to the maximum test torque as defined in 40 CFR part 1065.
² Advance from one mode to the next within a 20-second transition phase. During the transition phase, command a linear progression from the torque setting of the current mode to the torque setting of the next mode.

APPENDIX III TO PART 1042—NOT-TO-EXCEED ZONES

(a) The following definitions apply for this Appendix III:

(1) *Percent power* means the percentage of the maximum power achieved at Maximum Test Speed (or at Maximum Test Torque for constant-speed engines).

(2) *Percent speed* means the percentage of Maximum Test Speed.

(b) Figure 1 of this Appendix illustrates the default NTE zone for commercial marine engines certified using the duty cycle specified in §1042.505(b)(1), except for variable-speed propulsion marine engines used with control-

lable-pitch propellers or with electrically coupled propellers, as follows:

(1) Subzone 1 is defined by the following boundaries:

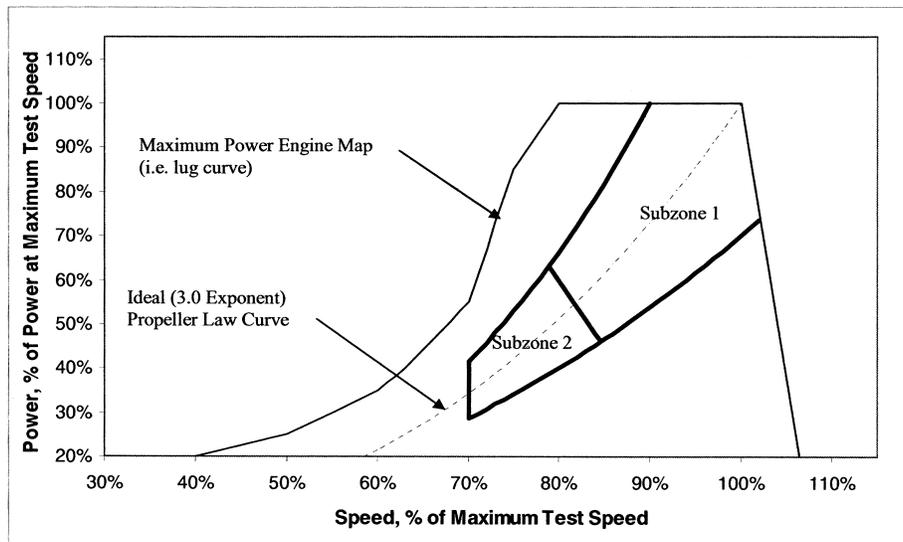
- (i) Percent power $\geq 0.7 \cdot (\text{percent speed})^{2.5}$.
- (ii) Percent power $\leq (\text{percent speed}/0.9)^{3.5}$.
- (iii) Percent power $\geq 3.0 \cdot (100\% - \text{percent speed})$.

(2) Subzone 2 is defined by the following boundaries:

- (i) Percent power $\geq 0.7 \cdot (\text{percent speed})^{2.5}$.
- (ii) Percent power $\leq (\text{percent speed}/0.9)^{3.5}$.
- (iii) Percent power $< 3.0 \cdot (100\% - \text{percent speed})$.
- (iv) Percent speed ≥ 70 percent.

Figure 1 of Appendix III — NTE Zone and Subzones for Propeller-Law Commercial

Marine Engines



(c) Figure 2 of this Appendix illustrates the default NTE zone for recreational marine engines certified using the duty cycle specified in §1042.505(b)(2), except for variable-speed