

narrower Not to Exceed Zone for an engine family at the time of certification, provided that the narrower Not to Exceed Zone includes all speeds greater than 63 percent of maximum test speed and loads greater than 25 percent of maximum power at rated speed at which the engines are expected to normally operate in use.

(2) At the time of certification, the Administrator may specify, or require the manufacturer to specify, a broader Not to Exceed Zone for an engine family, provided that the broader Not to Exceed Zone includes only speeds greater than 63 percent of maximum test speed and loads greater than 25 percent of maximum power at rated speed at which the engines are expected to normally operate in use.

(d) Testing conducted to determine compliance with the exhaust emission requirements of § 94.8(e) may be conducted at any ambient air temperature or humidity outside the ranges specified in paragraph (a)(2) of this section, provided that emission measurements are corrected to be equivalent to measurements within the ranges specified in paragraph (a)(2) of this section. Correction of emission measurements made in accordance with this paragraph (d) shall be made in accordance with good engineering practice. The measurements shall be corrected to be within the range using the minimum possible correction.

(e) Testing conducted under this section may not include engine starting.

§ 94.107 Determination of maximum test speed.

(a) *Overview.* This section specifies how to determine maximum test speed from a lug curve. This maximum test speed is used in §§ 94.105 and 94.106 (including the tolerances for engine speed specified in § 94.105).

(b) *Generation of lug curve.* Prior to beginning emission testing, generate maximum measured brakepower versus engine speed data points using the applicable method specified in 40 CFR 86.1332. These data points form the lug curve. It is not necessary to generate the entire lug curve. For the portion of the curve where power increases with increasing speed, it is not necessary to generate points with power less than 90

percent of the maximum power value. For the portion of the curve where power decreases with increasing speed, it is not necessary to generate points with power less than 75 percent of the maximum power value.

(c) *Normalization of lug curve.* (1) Identify the point (power and speed) on the lug curve at which maximum power occurs.

(2) Normalize the power values of the lug curve by dividing them by the maximum power value identified in paragraph (b)(1) of this section, and multiplying the resulting values by 100.

(3) Normalize the engine speed values of the lug curve by dividing them by the speed at which maximum power occurs, which is identified in paragraph (b)(1) of this section, and multiplying the resulting values by 100.

(4) Maximum engine power is located on the normalized lug curve at 100 percent power and 100 percent speed.

(d) *Determination of maximum test speed.* Calculate the maximum test speed from the speedfactor analysis described in this paragraph (d).

(1) For a given combination of engine power and speed (i.e., a given power/speed point), the speedfactor is the distance to the normalized power/speed point from the zero power, zero speed point. The value of the speedfactor is defined as:

$$\text{Speedfactor} = \sqrt{(\text{power})^2 + (\text{speed})^2}$$

(2) Calculate speedfactors for the power/speed data points on the lug curve, and determine the maximum value.

(3) Maximum test speed is the speed at which the maximum value for the speedfactor occurs.

(e) For constant-speed engines, rated speed is the maximum test speed.

§ 94.108 Test fuels.

(a) *Distillate diesel test fuel.* (1) The diesel fuels for testing marine engines designed to operate on distillate diesel fuel shall be clean and bright, with pour and cloud points adequate for operability. The diesel fuel may contain nonmetallic additives as follows: cetane improver, metal deactivator, antioxidant, dehazer, antirust, pour depressant, dye, dispersant, and biocide.

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The diesel fuel shall also meet the specifications (as determined using methods incorporated by reference at §94.5) in Table B-5, or substantially equivalent specifications approved by the Administrator, as follows:

TABLE B-5.—FEDERAL TEST FUEL SPECIFICATIONS

Item	Procedure (ASTM) ¹	Value (Type 2-D)
Cetane	D 613-95	40-48
Distillation Range:		
IBP, °C	D 86-97	171-204
10% point, °C	D 86-97	204-238
50% point, °C	D 86-97	243-282
90% point, °C	D 86-97	293-332
EP, °C	D 86-97	321-366
Gravity, API	D 287-92	32-37
Total Sulfur, weight%	D 129-95 or D 2622-98	0.03-0.80
Hydrocarbon composition:		
Aromatics, % vol.	D 1319-98 or D 5186-96	10 ⁽²⁾
Paraffins, Naphthalenes, Olefins	D 1319-98	⁽³⁾
Flashpoint, °C (minimum)	D 93-97	54
Viscosity @ 38 °C, Centistokes	D 445-97	2.0-3.2

¹ All ASTM procedures in this table have been incorporated by reference. See §94.6.

² Minimum.

³ Remainder.

(2) Other diesel fuels may be used for testing provided:

(i) They are commercially available; and

(ii) Information, acceptable to the Administrator, is provided to show that only the designated fuel would be used in service; and

(iii) Use of a fuel listed under paragraph (a)(1) of this section would have a detrimental effect on emissions or durability; and

(iv) Written approval from the Administrator of the fuel specifications is provided prior to the start of testing.

(3) The specification of the fuel to be used under paragraphs (a)(1), and (a)(2) of this section shall be reported in the application for certification.

(b) *Other fuel types.* For engines that are designed to be capable of using a type of fuel (or mixed fuel) instead of or in addition to distillate diesel fuel (e.g., natural gas, methanol, or nondistillate diesel), and that are expected to use that type of fuel (or mixed fuel) in service, a commercially available fuel of that type shall be used for exhaust emission testing. The manufacturer shall propose for the Administrator's approval a set of test fuel specifications that take into account the engine design and the properties of commercially available fuels. The Administrator may require testing on each fuel if it is designed to operate on more

than one fuel. These test fuel specifications shall be reported in the application for certification.

(c) *Service accumulation fuel.* Fuel used for service accumulation shall be representative of the typical fuel expected to be used by the engines in service.

(d) *Correction for sulfur.* (1) Particulate emission measurements from engines without exhaust aftertreatment obtained using a diesel fuel containing more than 0.40 weight percent sulfur may be adjusted to a sulfur content of 0.40 weight percent.

(2) Adjustments to the particulate measurement shall be made using the following equation:

$$PM_{adj} = PM - [BSFC * 0.0917 * (FSF - 0.0040)]$$

Where:

PM_{adj}=adjusted measured PM level [g/kW-hr]

PM=measured weighted PM level [g/KW-hr]

BSFC=measured brake specific fuel consumption [g/KW-hr]

FSF=fuel sulfur weight fraction

Subpart C—Certification Provisions

§ 94.201 Applicability.

The requirements of this subpart are applicable to manufacturers of engines subject to the standards of subpart A of this part.