

Environmental Protection Agency

Pt. 91, Subpt. D, App. A

(f) Verify that all NDIR analyzers meet the water rejection ratio and the CO<sub>2</sub> rejection ratio as specified in §91.325.

(g) Verify that the dynamometer test stand and power output instrumentation meet the specifications in Table 2 in appendix A to this subpart.

§91.329 Catalyst thermal stress test.

(a) *Oven characteristics.* The oven used for thermally stressing the test catalyst must be capable of maintaining a temperature of 500 ±5 °C and 1000 ±10 °C.

(b) *Evaluation gas composition.* (1) A synthetic exhaust gas mixture is used for evaluating the effect of thermal stress on catalyst conversion efficiency.

(2) The synthetic exhaust gas mixture must have the following composition:

Constituent	Volume percent	Parts per million
Carbon Monoxide <sup>1</sup>	1	.....
Oxygen	1.3	.....
Carbon Dioxide	9	.....
Water Vapor	10	.....
Sulfur Dioxide	.....	20
Oxides of Nitrogen	.....	280
Hydrogen	.....	3500
Hydrocarbon <sup>1,2</sup>	.....	4000
Nitrogen=Balance	.....	.....

<sup>1</sup> Alternatively, the carbon monoxide and hydrocarbon proportions of the mixture may be changed to 1.2% and 4650 ppm, respectively (using on of these alternative concentrations requires that the other be used simultaneously).  
<sup>2</sup> Propylene/propane ratio=2/1.

[61 FR 52102, Oct. 4, 1996; 62 FR 20066, Apr. 24, 1997]

APPENDIX A TO SUBPART D OF PART 91—TABLES

TABLE 1—SYMBOLS USED IN SUBPARTS D AND E

Symbol	Term	Unit
A <sub>YM</sub>	Final weighted emission test results	g/kW-hr
C <sub>3</sub> H <sub>8</sub>	Propane	
C <sub>B</sub>	Concentration of emission in background sample	ppm
C <sub>D</sub>	Concentration of emission in dilute sample	ppm
CO	Carbon monoxide	
CO <sub>2</sub>	Carbon dioxide	
conc	Concentration (ppm by volume)	ppm
D <sub>X</sub>	Density of a specific emission (XX)	g/m <sup>3</sup>
D <sub>XX</sub>	Volume concentration of a specific emission (XX) on a dry basis.	percent
DF	Dilution factor of dilute exhaust.	
D1	Water vapor mixture concentration	percent
f	Engine specific parameter considering atmospheric conditions	
G <sub>AIRD</sub>	Intake air mass flow rate on dry basis	kg/h
G <sub>FUEL</sub>	Fuel mass flow rate	kg/h
GP	Analyzer standard operating pressure	Pa
G <sub>s</sub>	Mass of carbon measured during a sampling period	g
H	Absolute humidity (water content related to dry air)	gr/kg
H <sub>2</sub>	Hydrogen	
i	Subscript denoting an individual mode	
IT	Indicated torque	N-m
K	Wet to dry conversion factor	
K <sub>H</sub>	Humidity correction factor	
K <sub>V</sub>	Calibration coefficient for critical flow venturi	
M <sub>X</sub>	Molecular weight of a specific molecule(XX)	g/mole
mass	Pollutant mass flow	g/h
M <sub>FUEL</sub>	Mass of fuel consumed during a sampling period	g
N	Pump revolutions during test period	revs
N <sub>2</sub>	Nitrogen	
NO	Nitric oxide	
NO <sub>2</sub>	Nitrogen dioxide	
NO <sub>X</sub>	Oxides of nitrogen	
O <sub>2</sub>	Oxygen	
O <sub>2</sub> I	Oxygen concentration of the burner air	percent
P	Absolute pressure	kPa
P <sub>AUX</sub>	Declared total power absorbed by auxiliaries fitted for the test	kW
P <sub>B</sub>	Total barometric pressure (average of the pre-test and post-test values).	kPa
P <sub>dew</sub>	Test ambient saturation vapor pressure at the dew point	kPa
P <sub>e</sub>	Absolute pump outlet pressure	kPa
P <sub>ED</sub>	Pressure drop between the inlet and throat of metering venturi	kPa
P <sub>i</sub>	P <sub>i</sub> =P <sub>M,i</sub> + P <sub>AUX,i</sub>	

TABLE 1—SYMBOLS USED IN SUBPARTS D AND E—Continued

Symbol	Term	Unit
P <sub>M</sub> .....	Maximum power measured at the test speed under test conditions.	kW
P <sub>P</sub> .....	Absolute pump inlet pressure .....	kPa
P <sub>PI</sub> .....	Inlet pressure depression of venturi or pump .....	kPa
P <sub>PO</sub> .....	Pressure head at CVS pump outlet .....	kPa
P <sub>s</sub> .....	Dry atmospheric pressure .....	kPa
P <sub>V</sub> .....	Absolute venturi inlet pressure .....	kPa
P <sub>wb</sub> .....	Saturated vapor pressure .....	Pa
Q <sub>C</sub> .....	Volumetric flow rate of dilute exhaust through CVS at STP .....	m <sup>3</sup> /hr
Q <sub>S</sub> .....	Gas flow rate .....	m <sup>3</sup> /min
R <sub>STP</sub> .....	Ideal gas constant at STP .....	m <sup>3</sup> /mole
R <sub>2</sub> .....	Fuel carbon weight fraction .....	g/g
STP .....	Standard temperature and pressure .....	
t .....	Elapsed time for test period .....	sec.
T .....	Absolute temperature at air inlet .....	°C
T <sub>a</sub> .....	Ambient temperature .....	°C
T <sub>EI</sub> .....	Air temperature in to metering venturi or flowmeter .....	°C
T <sub>K</sub> .....	Absolute temperature .....	K
T <sub>P</sub> .....	Absolute pump inlet temperature .....	°C
T <sub>PI</sub> .....	Air temperature at CVS pump inlet .....	°C
T <sub>PO</sub> .....	Air temperature at CVS pump outlet .....	°C
T <sub>V</sub> .....	Absolute venturi inlet temperature .....	°C
V <sub>O</sub> .....	Pump flow .....	m <sup>3</sup> /rev
W .....	Average mass flow of emissions .....	g/hr
W <sub>X</sub> .....	Mass rate of specific emission (XX) .....	g/hr
WXX .....	Volume concentration in exhaust of specific emission (XX) on wet basis.	ppm, ppmC, %
WF .....	Weighing factor .....	
Z1 .....	Water concentration .....	percent
α .....	Fuel specific factor representing the hydrogen to carbon ratio.	

TABLE 2—MEASUREMENT ACCURACY CALIBRATION FREQUENCY

No.	Item	Permissible deviation from reading <sup>1</sup>		Calibration frequency
		non-idle	idle	
1 .....	Engine speed .....	±2% .....	±2% .....	Monthly.
2 .....	Torque .....	±5% .....	.....	Monthly.
3 .....	Fuel consumption .....	±1% .....	±5% .....	Monthly.
4 .....	Air consumption .....	±2% .....	±5% .....	As required.
5 .....	Coolant temperature .....	±2 °C .....	Same .....	As required.
6 .....	Lubricant temperature .....	±2 °C .....	Same .....	As required.
7 .....	Exhaust back pressure .....	±5% .....	Same .....	As required.
8 .....	Inlet depression .....	±5% .....	Same .....	As required.
9 .....	Exhaust gas temperature .....	±15 °C .....	Same .....	As required.
10 .....	Air inlet temperature (combustion air) .....	±2 °C .....	Same .....	As required.
11 .....	Atmospheric pressure .....	±0.5% .....	Same .....	As required.
12 .....	Humidity (combustion air) (relative) .....	±3.0% .....	Same .....	As required.
13 .....	Fuel temperature .....	±2 °C .....	Same .....	As required.
14 .....	Temperature with regard to dilution system.	±2 °C .....	Same .....	As required.
15 .....	Dilution air humidity .....	±3% absolute .....	Same .....	As required.
16 .....	HC analyzer .....	±2% <sup>2</sup> .....	Same .....	Monthly.
17 .....	CO analyzer .....	±2% <sup>2</sup> .....	Same .....	Monthly.
18 .....	NO <sub>x</sub> analyzer .....	±2% <sup>2</sup> .....	Same .....	Monthly.
19 .....	NO <sub>x</sub> converter check .....	90% .....	Same .....	Monthly.
20 .....	CO <sub>2</sub> analyzer .....	±2% <sup>2</sup> .....	Same .....	Monthly.

<sup>1</sup> All accuracy requirements pertain to the final recorded value which is inclusive of the data acquisition system.

<sup>2</sup> If reading is under 100 ppm then the accuracy shall be ±2 ppm.

TABLE 3—TEST FUEL SPECIFICATIONS

Item	Property	Tolerance	Procedure (ASTM) <sup>1</sup>
Sulfur, ppm max .....	1000 .....	.....	D 2622
Benzene, max. percent .....	1.5 .....	.....	D 3606
RVP, psi .....	8.6 .....	±0.6	D 323
Octane, R+M/2 .....	89.9 .....	±3.1	D 2699 D 2700

TABLE 3—TEST FUEL SPECIFICATIONS—Continued

Item	Property	Tolerance	Procedure (ASTM) <sup>1</sup>
IBP, °C .....	32.8	±11.0	D 86
10% point, °C .....	53.3	±5.5	D 86
50% point, °C .....	101.7	±8.3	D 86
90% point, °C .....	160.0	±11.1	D 86
End Point, max. °C .....	212.8	.....	D 86
Phosphorus, g/l, max .....	0.02	.....	D 3231
Lead, g/l, max .....	0.02	.....	.....
Manganese, g/l, max .....	0.004	.....	.....
Aromatics, max. percent .....	35	.....	D 1319
Olefins, max. percent .....	10	.....	D 1319
Saturates, percent .....	remain	.....	D 1319

<sup>1</sup> All ASTM Procedures in this table have been incorporated by reference. See §91.6.