

Environmental Protection Agency

§ 91.329

(1) Zero the analyzer using the appropriate zero gas. Adjust analyzer zero if necessary. Zero reading should be stable.

(2) Span the analyzer using the appropriate span gas for the range being calibrated. Adjust the analyzer to the calibration set point if necessary.

(3) Recheck zero and span set points.

(4) If the response of the zero gas or span gas differs more than one percent of full scale, then repeat paragraphs (e)(1) through (3) of this section.

§ 91.327 Sampling system requirements.

(a) *Sample component surface temperature.* For sampling systems which use heated components, use engineering judgment to locate the coolest portion of each component (pump, sample line section, filters, and so forth) in the heated portion of the sampling system that has a separate source of power or heating element. Monitor the temperature at that location. If several components are within an oven, then only the surface temperature of the component with the largest thermal mass and the oven temperature need be measured.

(b) If water is removed by condensation, monitor the sample gas temperature or sample dew point either within the water trap or downstream. It may not exceed 7 °C.

§ 91.328 Measurement equipment accuracy/calibration frequency table.

(a) The accuracy of measurements must be such that the maximum tolerances shown in Table 2 in appendix A to this subpart are not exceeded.

(b) Calibrate all equipment and analyzers according to the frequencies shown in Table 2 in appendix A to this subpart.

(c) Prior to initial use and after major repairs, bench check each analyzer (see § 91.323).

(d) Calibrate as specified in § 91.306 and §§ 91.315 through 91.322.

(e) At least monthly, or after any maintenance which could alter calibra-

tion, perform the following calibrations and checks.

(1) Leak check the vacuum side of the system (see § 91.324(a)).

(2) Verify that the automatic data collection system (if used) meets the requirements found in Table 2 in appendix A to this subpart.

(3) Check the fuel flow measurement instrument to insure that the specifications in Table 2 in appendix A to this subpart are met.

(f) Verify that all NDIR analyzers meet the water rejection ratio and the CO₂ 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 ¹	1	.....
Oxygen	1.3	.....
Carbon Dioxide	9	.....
Water Vapor	10	.....
Sulfur Dioxide .....	.....	20
Oxides of Nitrogen .....	.....	280
Hydrogen .....	.....	3500
Hydrocarbon ^{1,2} .....	.....	4000
Nitrogen=Balance .....	.....	.....

¹ Alternatively, the carbon monoxide and hydrocarbon proportions of the mixture may be changed to 1.2% and 4650 ppm, respectively (using one of these alternative concentrations requires that the other be used simultaneously).

² 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 _{YM}	Final weighted emission test results	g/kW-hr
C ₃ H ₈	Propane	
C _B	Concentration of emission in background sample	ppm
C _D	Concentration of emission in dilute sample	ppm
CO	Carbon monoxide	
CO ₂	Carbon dioxide	
conc	Concentration (ppm by volume)	ppm
D _X	Density of a specific emission (XX)	g/m ³
DXX	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 _{AIRD}	Intake air mass flow rate on dry basis	kg/h
G _{FUEL}	Fuel mass flow rate	kg/h
GP	Analyzer standard operating pressure	Pa
G _s	Mass of carbon measured during a sampling period	g
H	Absolute humidity (water content related to dry air)	gr/kg
H ₂	Hydrogen	
i	Subscript denoting an individual mode	
IT	Indicated torque	N-m
K	Wet to dry conversion factor	
K _H	Humidity correction factor	
K _V	Calibration coefficient for critical flow venturi	
M _X	Molecular weight of a specific molecule(XX)	g/mole
mass	Pollutant mass flow	g/h
M _{FUEL}	Mass of fuel consumed during a sampling period	g
N	Pump revolutions during test period	revs
N ₂	Nitrogen	
NO	Nitric oxide	
NO ₂	Nitrogen dioxide	
NO _X	Oxides of nitrogen	
O ₂	Oxygen	
O ₂ I	Oxygen concentration of the burner air	percent
P	Absolute pressure	kPa
P _{AUX}	Declared total power absorbed by auxiliaries fitted for the test	kW
P _B	Total barometric pressure (average of the pre-test and post-test values).	kPa
P _{dew}	Test ambient saturation vapor pressure at the dew point	kPa
P _s	Absolute pump outlet pressure	kPa
P _{ED}	Pressure drop between the inlet and throat of metering venturi	kPa
P _i	$P_i = P_{M,i} + P_{AUX,i}$	
P _M	Maximum power measured at the test speed under test conditions.	kW
P _p	Absolute pump inlet pressure	kPa
P _{PI}	Inlet pressure depression of venturi or pump	kPa
P _{PO}	Pressure head at CVS pump outlet	kPa
P _s	Dry atmospheric pressure	kPa
P _V	Absolute venturi inlet pressure	kPa
P _{wb}	Saturated vapor pressure	Pa
Q _C	Volumetric flow rate of dilute exhaust through CVS at STP	m ³ /hr
Q _S	Gas flow rate	m ³ /min
R _{STP}	Ideal gas constant at STP	m ³ /mole
R ₂	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 _a	Ambient temperature	°C
T _{EI}	Air temperature in to metering venturi or flowmeter	°C
T _K	Absolute temperature	K
T _P	Absolute pump inlet temperature	°C
T _{PI}	Air temperature at CVS pump inlet	°C
T _{PO}	Air temperature at CVS pump outlet	°C
T _V	Absolute venturi inlet temperature	°C
V _o	Pump flow	m ³ /rev
W	Average mass flow of emissions	g/hr
W _X	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	

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

Symbol	Term	Unit
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 ¹		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% ²	Same	Monthly.
17	CO analyzer	±2% ²	Same	Monthly.
18	NO _x analyzer	±2% ²	Same	Monthly.
19	NO _x converter check	90%	Same	Monthly.
20	CO ₂ analyzer	±2% ²	Same	Monthly.

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

² If reading is under 100 ppm then the accuracy shall be ±2 ppm.

TABLE 3—TEST FUEL SPECIFICATIONS

Item	Property	Tolerance	Procedure (ASTM) ¹
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
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

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

APPENDIX B TO SUBPART D OF PART 91—FIGURES

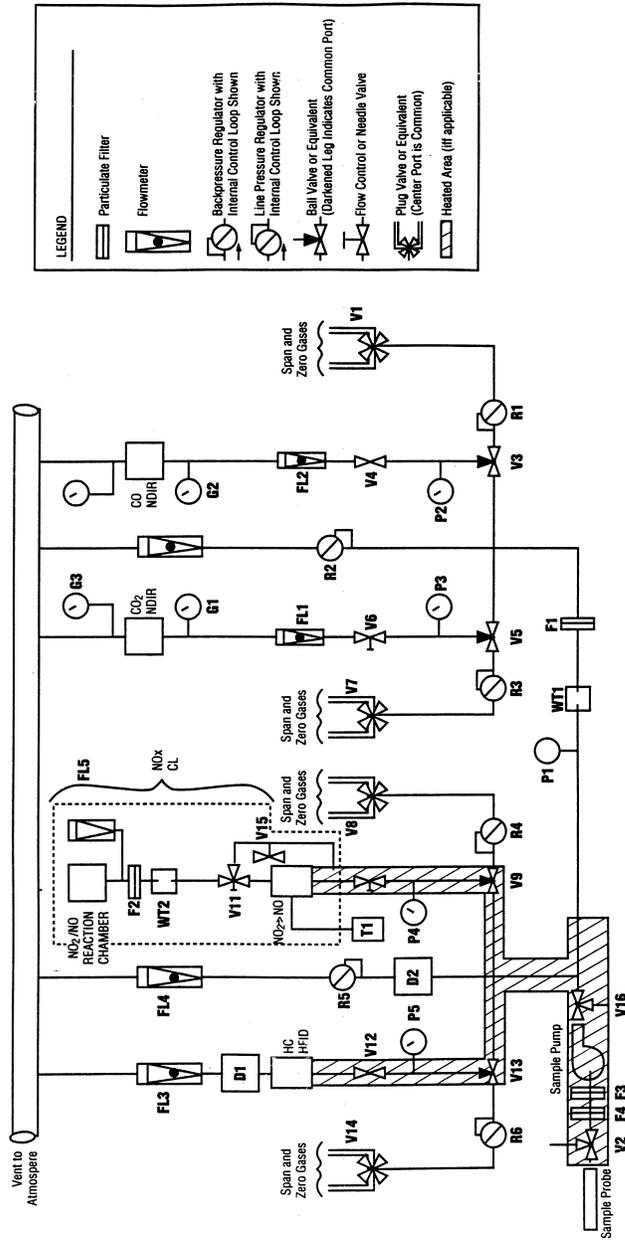


Figure 1. — Exhaust Gas Sampling and Analytical Train, Continuous Sampling

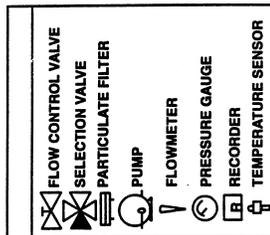
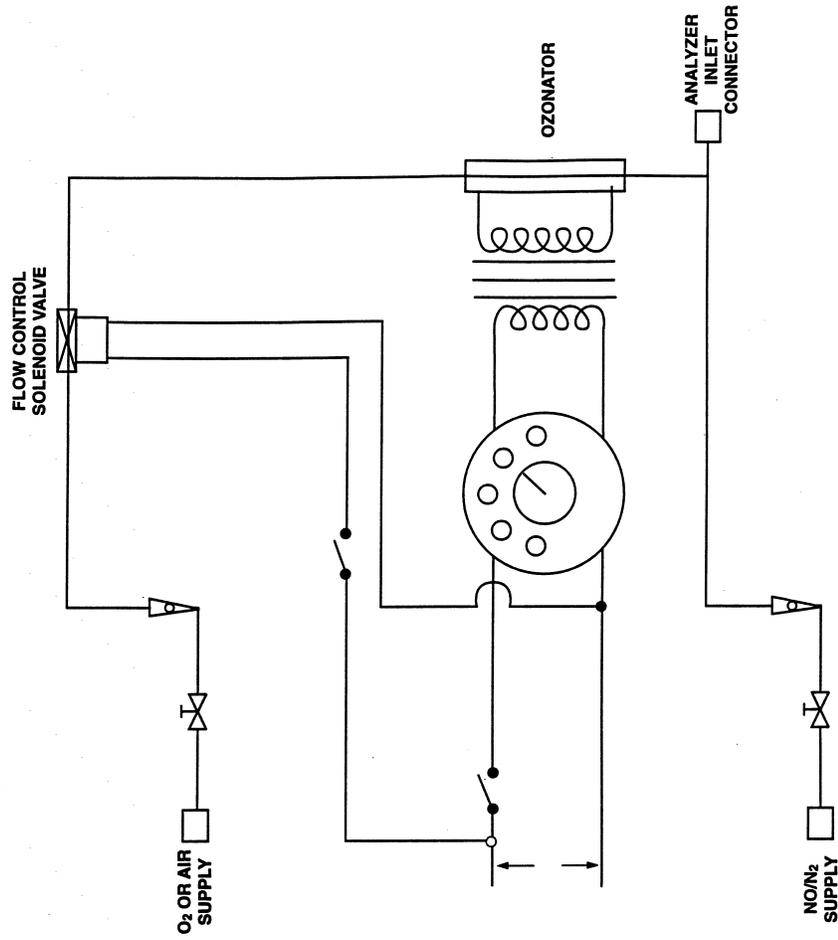


Figure 2. — NOx Converter Efficiency Detector