

For the reasons set out in the preamble it is proposed to revise Part 51 of Chapter I, Title 40 of the Code of Federal Regulations as follows:

1. Authority: 42 U.S.C. 7401(b)(1), 7410, 7470-7479, 7501-7508, and 7601(a).
2. Appendix N of Part 51 is removed and reserved.
3. A new Subpart S is added to Part 51 to read as follows:

Subpart S - Inspection/Maintenance Program Requirements

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§51.350 Applicability

Inspection/maintenance (I/M) programs are required in both ozone and carbon monoxide (CO) nonattainment areas, depending upon population and nonattainment classification or design value.

(a) Nonattainment Area Classification and Population Criteria. (1) States or areas within an ozone transport region shall implement enhanced I/M programs in any metropolitan statistical area (MSA), or portion of an MSA, within the state or area with a 1990 population of 100,000 or more as defined by the Office of Management and Budget (OMB) regardless of the area's attainment classification. In the case of a multi-state MSA, enhanced I/M shall be implemented in all ozone transport region portions if the sum of these portions has a population of 100,000 or more, irrespective of the population of the portion in the individual ozone transport region state or area.

(2) Apart from those areas described in paragraph (a)(1) of this section, any area classified as serious or worse ozone nonattainment, or as moderate or serious CO nonattainment with a design value greater than 12.7 ppm, and having a 1980 Bureau of Census-defined (Census-defined) urbanized area population of 200,000 or more, shall implement enhanced I/M in the 1990 Census-defined urbanized area.

(3) Any area classified, as of the date upon which this rule takes effect, as marginal ozone nonattainment or moderate CO nonattainment with a design value of 12.7 ppm or less shall continue operating I/M programs that were part of an approved State Implementation Plan (SIP) as of November 15, 1990, and shall update those programs as necessary to meet the basic I/M program requirements of this regulation. Any such area required by the Clean Air Act, as in effect prior to November 15, 1990, as interpreted in EPA guidance, to have an I/M program shall also implement a basic I/M program. Serious, severe and extreme ozone areas and CO areas over 12.7 ppm shall also continue operating existing I/M programs and shall upgrade such programs, as appropriate, pursuant to these regulations.

(4) Any area classified as moderate ozone nonattainment, and not required to implement enhanced I/M under paragraph (a)(1) of this section, shall implement basic I/M in any 1990 Census-defined urbanized area in the nonattainment area.

(5) Any area outside an ozone transport region classified as serious or worse ozone nonattainment, or moderate or serious CO nonattainment with a design value greater than 12.7 ppm, and having a 1990 Census-defined urbanized area population of less than 200,000 shall implement basic I/M in the 1990 Census-defined urbanized area.

(6) If the boundaries of a moderate ozone nonattainment area are changed pursuant to §107(d)(4)(A)(i)-(ii) of the Clean Air Act, such that the area includes additional urbanized areas, then a basic I/M program shall be implemented in the newly included 1990 Census-defined urbanized areas.

(7) If the boundaries of a serious or worse ozone nonattainment area or of a moderate or serious CO nonattainment area with a design value greater than 12.7 ppm are changed any time after enactment pursuant to §107(d)(4)(A) such that the area includes additional urbanized areas, then an enhanced I/M program shall be implemented in the newly included 1990 Census-defined urbanized areas, if the 1980 Census-defined urban area population is 200,000 or more. If such a newly included area has a 1980 Census-defined population of less than 200,000, then a basic I/M program shall be implemented in the 1990 Census-defined urbanized area.

(8) If a marginal ozone nonattainment area, not required to implement enhanced I/M under paragraph (a)(1) of this section, is reclassified to moderate, a basic I/M program shall be implemented in the 1990 Census-defined urbanized area(s) in the nonattainment area. If the area is reclassified to serious or worse, an enhanced I/M program shall be implemented in the 1990 Census-defined urbanized area, if the 1980 Census-defined urban area population is 200,000 or more. If less than 200,000, a basic I/M program shall be implemented in the 1990 Census-defined urbanized area(s) in the nonattainment area.

(9) If a moderate ozone or CO nonattainment area is reclassified to serious or worse, an enhanced I/M program shall be implemented in the 1990 Census-defined urbanized area, if the 1980 Census-defined urban area population is 200,000 or more. In the case of ozone areas reclassified as serious or worse, if the 1980 Census-defined population of the urbanized area is less than 200,000, a basic I/M program shall be implemented in the 1990 Census-defined urbanized area(s) in the nonattainment area.

(b) Extent of Area Coverage. (1) In an ozone transport region, the program shall entirely cover all counties within subject MSAs or subject portions of MSAs, as defined by OMB in 1990, except largely rural counties having a population density of less than 200 persons per square mile based on the 1990 Census can be excluded except that at least 50% of the MSA population must be included in the program. This provision does not preclude the voluntary inclusion of portions of an excluded rural county. Non-urbanized islands not connected to the mainland by roads, bridges, or tunnels may be excluded without regard to population.

(2) Outside of ozone transport regions, programs shall nominally cover at least the entire urbanized area, based on the 1990 census. Exclusion of some urban population is allowed as long as an equal number of non-urban residents of the MSA containing the subject urbanized area are included to compensate for the exclusion.

(3) Emission reduction benefits from expanding coverage beyond the minimum required urban area boundaries can be applied toward the reasonable further progress requirements and can be used for offsets, provided the covered vehicles are operated in the nonattainment area, but not toward the enhanced I/M performance standard requirement.

(4) In multi-state urbanized areas outside of ozone transport regions, I/M is required in those states in the subject multi-state area that have an urban area population of 50,000 or more, as defined by the Bureau of Census in 1980. In a multi-state urbanized area with a population of 200,000 or more that is required under paragraph (a) of this section to implement enhanced I/M, any state with a portion of the urbanized area having a 1990 Census-defined population of 50,000 or more shall implement an enhanced program. The other coverage requirements in paragraph (b) of this section shall apply in multi-state areas as well.

(c) Requirements After Attainment. All I/M programs shall provide that the program will remain effective, even if the area is redesignated to attainment status, until the state submits and EPA approves a maintenance plan, under §175A, which convincingly demonstrates that the area can maintain the relevant standard for the maintenance period without benefit of the emission reductions attributable to the I/M program. The state shall commit to fully implement and enforce the program throughout such period, and, at a minimum, for the purposes of SIP approval, legislation authorizing the program shall not sunset prior to the attainment deadline.

(d) SIP Requirements. The SIP shall describe the applicable areas in detail and, consistent with §51.372, shall include the legal authority or rules necessary to establish program boundaries.

#### §51.351 Enhanced I/M Performance Standard

(a) Enhanced I/M programs shall be designed and implemented to meet or exceed a minimum performance standard, which is expressed as emission levels in area-wide average grams per mile (gpm), achieved from highway mobile sources as a result of the program. The performance standard shall be established using the following model I/M program inputs and local characteristics, such as vehicle mix and local fuel controls, except as provided in paragraph (e) of this section. The emission levels achieved by the state's program design shall be calculated using the most current version, at the time of submittal, of the EPA mobile source emission factor model or an alternative model approved by the Administrator, and shall meet the minimum performance standard both in operation and for SIP approval. Areas shall meet the performance standard for the pollutants which cause them to be subject to enhanced I/M requirements. In the case of ozone nonattainment areas subject to enhanced I/M, the performance standard must be met for both oxides of nitrogen (NO<sub>x</sub>) and volatile organic compounds (VOCs), except as provided in paragraph (d) of this section.

(1) Network Type. Centralized testing.

(2) Start Date. For areas with existing I/M programs, 1983. For areas newly subject, 1994.

(3) Test Frequency. Annual testing.

(4) Model Year Coverage. Testing of 1968 and later vehicles.

(5) Vehicle Type Coverage. Light duty vehicles, and light duty trucks, rated up to 8,500 pounds Gross Vehicle Weight Rating (GVWR).

(6) Exhaust Emission Test Type. Transient mass-emission testing on 1986 and later model year vehicles using the IM240 driving cycle, two-speed testing (as described in Appendix B) of 1981-1985 vehicles, and idle testing (as described in Appendix B) of pre-1981 vehicles is assumed.

(7) Emission Standards. (i) Emission standards for 1986 through 1993 model year light duty vehicles, and 1994 and 1995 light-duty vehicles not meeting Tier 1 emission standards, of 0.80 gpm hydrocarbons (HC), 15 gpm CO, and 2.0 gpm NO<sub>x</sub>;

(ii) Emission standards for 1986 through 1993 light duty trucks less than 6000 pounds gross vehicle weight rating (GVWR), and 1994 and 1995 trucks not meeting Tier 1 emission standards, of 1.2 gpm HC, 20 gpm CO, and 3.5 gpm NO<sub>x</sub>;

(iii) Emission standards for 1986 through 1993 light duty trucks greater than 6000 pounds GVWR, and 1994 and 1995 trucks not meeting Tier 1 emission standards, of 1.2 gpm HC, 20 gpm CO, and 3.5 gpm NO<sub>x</sub>;

(iv) Emission standards for 1994 and later light duty vehicles meeting Tier 1 emission standards of 0.70 gpm non-methane hydrocarbons (NMHC), 15 gpm CO, and 1.4 gpm NO<sub>x</sub>;

(v) Emission standards for 1994 and later light duty trucks under 6000 pounds GVWR and meeting Tier 1 emission standards of 0.70 gpm NMHC, 15 gpm CO, and 2.0 gpm NO<sub>x</sub>;

(vi) Emission standards for 1994 and later light duty trucks greater than 6000 pounds GVWR and meeting Tier 1 emission standards of 0.80 gpm NMHC, 15 gpm CO and 2.5 gpm NO<sub>x</sub>;

(vii) Emission standards for 1981-1985 model year vehicles of 1.2% CO, and 220 ppm HC for the idle, two-speed tests and loaded steady-state tests (as described in Appendix B); and

(viii) Maximum exhaust dilution measured as no less than 6% CO plus carbon dioxide (CO<sub>2</sub>) on vehicles subject to a steady-state test (as described in Appendix B).

(8) Emission Control Device Inspections. Visual inspection of the catalyst and fuel inlet restrictor on all 1984 and later model year vehicles.

(9) Evaporative System Function Checks. Evaporative system integrity (pressure) test on 1983 and later model year vehicles and an evaporative system transient purge test on 1986 and later model year vehicles.

(10) Stringency. A 20% emission test failure rate among pre-1981 model year vehicles.

(11) Waiver Rate. A 1% waiver rate, as a percentage of failed vehicles.

(12) Compliance Rate. A 98% compliance rate.

(13) Evaluation Date. Enhanced I/M programs shall be shown to obtain the same or lower emission levels as the model program by 2000 for ozone nonattainment areas and 2001 for CO nonattainment areas, and for severe and extreme ozone nonattainment areas, on each applicable milestone and attainment deadline, thereafter. Milestones for NO<sub>x</sub> shall be the same as for ozone.

(b) On-road Testing. The performance standard shall include on-road testing of at least 0.5% of the subject vehicle population as a supplement to the periodic inspection required in paragraph (a) of this section. Specific requirements are listed in §51.371 of this subpart.

(c) On-board Diagnostics (OBD). The performance standard includes testing of the vehicle's on-board diagnostics system for vehicles certified to comply with requirements for such capability; however, regulations governing the design of OBD systems are not yet final. EPA will revise this section to establish credits and requirements for OBD testing when OBD regulations are final.

(d) Modeling Requirements. Equivalency of the emission levels which will be achieved by the I/M program design in the SIP to those of the model program described in this section shall be demonstrated using the most current version of EPA's mobile source emission model or an alternative approved by the Administrator using EPA guidance to aid in the estimation of input parameters. If the Administrator finds, under Section 182(b)(1)(A)(i) of the Act pertaining to reasonable further progress demonstrations or Section 182(f)(1) of the Act pertaining to provisions for major stationary sources, that NO<sub>x</sub> emission reductions are not beneficial in a given ozone nonattainment area, then NO<sub>x</sub> emission reductions are not required of the enhanced I/M program, but the program shall be designed to offset NO<sub>x</sub> increases resulting from the repair of HC and CO failures.

(e) In the case of El Paso, Texas, providing that its SIP has been approved as meeting the reasonable further progress requirements of the Act and that the Administrator has not determined that a milestone has been missed, the model program inputs shall be as in paragraph (a) of this section, except

that the transient and purge tests shall be assumed for 1990 and later model year vehicles, two-speed testing on 1981-1989 model year vehicles, idle testing on 1968-1980 model year vehicles and pressure testing on 1971 and later vehicles.

#### §51.352 Basic I/M Performance Standard

(a) Basic I/M programs shall be designed and implemented to meet or exceed a minimum performance standard, which is expressed as emission levels achieved from highway mobile sources as a result of the program. The performance standard shall be established using the following model I/M program inputs and local characteristics, such as vehicle mix and local fuel controls. Similarly, the emission reduction benefits of the state's program design shall be estimated using the most current version of the EPA mobile source emission model, and shall meet the minimum performance standard both in operation and for SIP approval.

- (1) Network Type. Centralized testing.
- (2) Start Date. 1983.
- (3) Test Frequency. Annual testing.
- (4) Model Year Coverage. Testing of 1968 and later model year vehicles.
- (5) Vehicle Type Coverage. Light duty vehicles.
- (6) Exhaust Emission Test Type. Idle test.
- (7) Emission Standards. No weaker than specified in 40 CFR Part 85, Subpart W.
- (8) Emission Control Device Inspections. None.
- (9) Stringency. A 20% emission test failure rate among pre-1981 model year vehicles.
- (10) Waiver Rate. A 0% waiver rate.
- (11) Compliance Rate. A 100% compliance rate.

(12) Evaluation Date. Basic I/M programs shall be shown to obtain the same or lower emission levels as the model inputs by 1997 for ozone nonattainment areas and 1996 for CO nonattainment areas; and for serious or worse ozone nonattainment areas, on each applicable milestone and attainment deadline, thereafter.

(b) Oxides of Nitrogen. Basic I/M testing in ozone nonattainment areas shall be designed such that no increase in NO<sub>x</sub> emissions occurs as a result of the program. If the Administrator finds, under Section 182(b)(1)(A)(i) of the Act pertaining to reasonable further progress demonstrations or Section 182(f)(1) of the Act pertaining to provisions for major stationary sources, that NO<sub>x</sub> emission reductions are not beneficial in a given ozone nonattainment area, then the basic I/M NO<sub>x</sub> requirement may be omitted. States shall implement any required NO<sub>x</sub> controls within 12 months of implementation of the program deadlines required in §51.373 of this subpart, except that newly implemented I/M programs shall include NO<sub>x</sub> controls from the start.

(c) On-board Diagnostics. The performance standard includes testing of the vehicle's on-board diagnostics system for vehicles certified to comply with requirements for such capability; however, regulations governing the design of OBD systems are not yet final. EPA will revise this section to establish credits and requirements for OBD testing when OBD regulations are final.

(d) Modeling Requirements. Equivalency of emission levels which will be achieved by the I/M program design in the SIP to those of the model program described in this section shall be demonstrated using the most current version of EPA's mobile source emission model and EPA guidance on the estimation of input parameters. Areas required to implement basic I/M programs shall meet the performance standard for the pollutants which cause them to be subject to basic requirements. Areas subject as a result of ozone nonattainment shall meet the standard for VOCs and shall demonstrate no NOx increase, as required in paragraph (b) of this section.

#### §51.353 Network Type and Program Evaluation

Enhanced I/M programs shall be operated in a centralized test-only format, unless the state can demonstrate that a decentralized program is equally effective in achieving the enhanced I/M performance standard. Basic I/M programs can be centralized, decentralized, or a hybrid at the state's discretion, but shall be demonstrated to achieve the same emission reduction as the program described in §51.352 of this subpart.

(a) Presumptive Equivalency. A decentralized network consisting of stations that only perform official I/M testing (which may include safety-related inspections) and in which owners and employees of those stations, or companies owning those stations, are contractually or legally barred from engaging in motor vehicle repair or service, motor vehicle parts sales, and motor vehicle sale and leasing, either directly or indirectly, and are barred from referring vehicle owners to particular providers of motor vehicle repair services (except as provided in §51.369(b)(1) of this subpart) shall be considered equivalent to a centralized, test-only system. States may allow such stations to engage in the sale of refreshments for the use of employees and customers waiting at the station and may fulfill other functions typically carried out by the state such as renewal of vehicle registration and driver's licenses, or tax and fee collections.

(b) Case-by-Case Equivalency. (1) Credits for test-and-repair networks i.e., those not meeting the requirements of paragraph (a) of this section, are assumed to be 50% less than those for a test-only network for the tailpipe emission test, purge test, evaporative system integrity test, catalyst check, and gas cap check; and 75% less for the evaporative canister checks, PCV check, and air system checks. Smaller reductions in credits for the various test protocols may be claimed if a state can demonstrate to the satisfaction of the Administrator that based on past performance with the specific test-type and inspection standards employed, its test-and-repair system will exceed these levels. At a minimum, such a demonstration shall include:

(i) Surveys that assess the effectiveness of repairs performed on vehicles that failed the tailpipe emission test and evaporative system tests;

(ii) In programs including tampering checks, measurement of actual tampering rates, their change over time, and the change attributable to finding and fixing such tampering as opposed to deterrence effects; and

(iii) The results of undercover surveys of inspector effectiveness as it relates to identifying vehicles that need repair.

(2) In the case of hybrid systems, which may be implemented in basic I/M areas, including both test-only and test-and-repair facilities, full credit shall apply to the portion of the fleet initially tested and subsequently retested at a test-only facility meeting the requirements of paragraph (a) of this section, and

to the portion of the fleet initially tested and failed at a test-and-repair facility but subsequently passing a comprehensive retest at a test-only facility meeting those same requirements. The credit loss assumptions described in paragraph (b)(1) of this section shall apply to the portion of the fleet initially tested at a test-only facility and subsequently retested at a test-and-repair facility, to the portion of the fleet initially passed at a test-and-repair facility, and to the portion initially failed at a test-only facility and retested at a test-and-repair facility.

(3) Areas operating test-and-repair networks or hybrid networks may, in the future, claim greater effectiveness than described in subparagraph (1) of this paragraph, if a demonstration of greater effectiveness is made to the satisfaction of the Administrator using the program evaluation protocol described in paragraph (c) of this section.

(c) Program Evaluation. Enhanced I/M programs shall include an ongoing evaluation to quantify the emission reduction benefits of the program, and to determine if the program is meeting the requirements of the Clean Air Act and this regulation.

(1) The state shall report the results of the program evaluation on a biennial basis, starting two years after the initial start date of mandatory testing as required in §51.373 of this subpart.

(2) The evaluation shall be considered in establishing actual emission reductions achieved from I/M for the purposes of satisfying the requirements of §182(g)(1) and §182(g)(2) of the Clean Air Act, relating to Reductions in Emissions and Compliance Demonstration.

(3) The evaluation program shall consist, at a minimum, of those items described in paragraph (b)(1) of this section and mass emission test data using the procedure specified in §51.357(a)(11) of this subpart, or any other transient, mass emission test procedure approved as equivalent, and evaporative system checks, specified in §51.357(9) and §51.357(10), for model years subject to those evaporative system test procedures. The test data shall be obtained from a representative, random sample, taken at the time of initial inspection (before repair), of at least 0.1 percent of the vehicles subject to inspection in a given year. Such vehicles shall receive a state administered or monitored IM240 mass emission test or equivalent, as specified in this paragraph, at the time the initial test is due.

(4) The program evaluation test data shall be used to calculate local fleet emission factors, to assess the effectiveness of the I/M program, and to determine if the performance standard is being met.

(d) SIP Requirements. (1) The SIP shall include a description of the network to be employed, the required legal authority, and, in the case of areas making claims under paragraph (b) of this section, the required demonstration.

(2) The SIP shall include a description of the evaluation schedule and protocol, the sampling methodology, the data collection and analysis system, the resources and personnel for evaluation, and related details of the evaluation program, and the legal authority enabling the evaluation program.

#### §51.354 Adequate Tools and Resources

(a) Administrative Resources. The program shall maintain the administrative resources necessary to perform all of the program functions including quality assurance, data analysis and reporting, and the holding of hearings and adjudication of cases. A portion of the test fee or a separately assessed per vehicle fee shall be collected, placed in a dedicated fund and retained, to be used to finance program



oversight, management, and capital expenditures. Alternatives to this approach shall be acceptable if the state can demonstrate that adequate funding of the program can be maintained in some other fashion (e.g., through contractual obligation along with demonstrated past performance). Reliance on future uncommitted annual or biennial appropriations from the state or local General Fund is not acceptable, unless doing otherwise would be a violation of the state's constitution. This section shall in no way require the establishment of a test fee if the state chooses to fund the program in some other manner.

(b) Personnel. The program shall employ sufficient personnel to effectively carry out the duties related to the program, including but not limited to administrative audits, inspector audits, data analysis, program oversight, program evaluation, public education and assistance, and enforcement against stations and inspectors as well as against motorists who are out of compliance with program regulations and requirements.

(c) Equipment. The program shall possess equipment necessary to achieve the objectives of the program and meet program requirements, including but not limited to a steady supply of vehicles for covert auditing, test equipment and facilities for program evaluation, and computers capable of data processing, analysis, and reporting. Equipment or equivalent services may be contractor supplied or owned by the state or local authority.

(d) SIP Requirements. The SIP shall include a description of the resources that will be used for program operation, and discuss how the performance standard will be met.

(1) The SIP shall include a detailed budget plan which describes the source of funds for personnel, program administration, program enforcement, purchase of necessary equipment (such as vehicles for undercover audits), and any other requirements discussed throughout, for the period prior to the next biennial self-evaluation required in §51.366 of this subpart.

(2) The SIP shall include a description of personnel resources. The plan shall include the number of personnel dedicated to overt and covert auditing, data analysis, program administration, enforcement, and other necessary functions and the training attendant to each function.

#### §51.355 Test Frequency and Convenience

The performance standards for I/M programs assume an annual test frequency; other schedules may be approved if the required emission targets are achieved. The SIP shall describe the test schedule in detail, including test year selection scheme if testing is other than annual. The SIP shall include the legal authority necessary to implement and enforce the test frequency requirement and explain how the test frequency will be integrated with the enforcement process.

In enhanced I/M programs, test systems shall be designed in such a way as to provide convenient service to motorists required to get their vehicles tested. The SIP shall demonstrate that the network of stations providing test services is sufficient to insure short waiting times to get a test and short driving distances. Stations shall be required to adhere to regular testing hours and to test any subject vehicle presented for a test during its test period.

#### §51.356 Vehicle Coverage

The performance standard for enhanced I/M programs assumes coverage of all 1968 and later model year light duty vehicles and light duty trucks up to 8,500 pounds GVWR, and includes vehicles

operating on all fuel types. The standard for basic I/M programs does not include light duty trucks. Other levels of coverage may be approved if the necessary emission reductions are achieved. Vehicles registered or required to be registered within the I/M program area boundaries and fleets primarily operated within the I/M program area boundaries and belonging to the covered model years and vehicle classes comprise the subject vehicles.

(a) Subject vehicles. (1) All vehicles of a covered model year and vehicle type shall be tested according to the applicable test schedule, including leased vehicles whose registration or titling is in the name of an equity owner other than the lessee or user.

(2) All subject fleet vehicles shall be inspected. Fleets may be officially inspected outside of the normal I/M program test facilities, if such alternatives are approved by the program administration, but shall be subject to the same test requirements using the same quality control standards as non-fleet vehicles. If all vehicles in a particular fleet are tested during one part of the cycle, then the quality control requirements shall be met during the time of testing only. Any vehicle available for rent in the I/M area or for use in the I/M area shall be subject. Fleet vehicles not being tested in normal I/M test facilities in enhanced I/M programs, however, shall be inspected in independent, test-only facilities, according to the requirements of §51.353(a) of this subpart.

(3) Subject vehicles which are registered in the program area but are primarily operated in another I/M area shall be tested, either in the area of primary operation, or in the area of registration. Alternate schedules may be established to permit convenient testing of these vehicles (e.g., vehicles belonging to students away at college should be rescheduled for testing during a visit home). I/M programs shall make provisions for providing official testing to vehicles registered elsewhere.

(4) Vehicles which are operated on Federal installations located within an I/M program area shall be tested, regardless of whether the vehicles are registered in the state or local I/M area. This requirement applies to all employee-owned or leased vehicles (including vehicles owned, leased, or operated by civilian and military personnel on Federal installations) as well as agency-owned or operated vehicles, except tactical military vehicles, operated on the installation. This requirement shall not apply to visiting agency, employee, or military personnel vehicles as long as such visits do not exceed 60 calendar days per year. In areas without test fees collected in the lane, arrangements shall be made by the installation with the I/M program for reimbursement of the costs of tests provided for agency vehicles, at the discretion of the I/M agency. The installation shall provide documentation of proof of compliance to the I/M agency. The documentation shall include a list of subject vehicles and shall be updated periodically, as determined by the I/M program administrator, but no less frequently than each inspection cycle. The installation shall use one of the following methods to establish proof of compliance:

(i) Presentation of a valid certificate of compliance from the local I/M program, from any other I/M program at least as stringent as the local program, or from any program deemed acceptable by the I/M program administrator.

(ii) Presentation of proof of vehicle registration within the geographic area covered by the I/M program, except for any program whose enforcement is not through registration denial.

(iii) Another method approved by the state or local I/M program administrator.

(5) Special exemptions may be permitted for certain subject vehicles provided a demonstration is made that the performance standard will be met.

(b) SIP Requirements. (1) The SIP shall include a detailed description of the number and types of vehicles to be covered by the program, and a plan for how those vehicles are to be identified, including vehicles that are routinely operated in the area but may not be registered in the area.

(2) The SIP shall include a description of any special exemptions which will be granted by the program, and an estimate of the percentage and number of subject vehicles which will be impacted. Such exemptions shall be accounted for in the emission reduction analysis.

(3) The SIP shall include the legal authority or rule necessary to implement and enforce the vehicle coverage requirement.

#### §51.357 Test Procedures and Standards

Written test procedures and pass/fail standards shall be established and followed for each model year and vehicle type included in the program.

(a) Test Procedure Requirements. Emission tests and functional tests shall be conducted according to good engineering practices to assure test accuracy.

(1) Initial tests (i.e., those occurring for the first time in a test cycle) shall be performed without repair or adjustment at the inspection facility, prior to the test.

(2) The vehicle owner or driver shall have access to the test area such that observation of the entire official inspection process on the vehicle is permitted. Such access may be limited but shall in no way prevent full observation;

(3) An official test, once initiated, shall be performed in its entirety regardless of intermediate outcomes except in the case of invalid test condition, unsafe conditions, or fast pass/fail algorithms.

(4) Tests involving measurement shall be performed with program-approved equipment that has been calibrated according to the quality control procedures contained in Appendix A to this subpart.

(5) Vehicles shall be rejected from testing if the exhaust system is missing or leaking, or if the vehicle is in an unsafe condition for testing.

(6) Vehicles shall be retested after repair for any portion of the inspection that is failed on the previous test to determine if repairs were effective. To the extent that repair to correct a previous failure could lead to failure of another portion of the test, that portion shall also be retested. Evaporative system repairs shall trigger an exhaust emissions retest.

(7) Steady-State Testing. Steady-state tests shall be performed in accordance with the procedures contained in Appendix B to this subpart.

(8) Emission Control Device Inspection. Visual emission control device checks shall be performed through direct observation or through indirect observation using a mirror, video camera or other visual aid. These inspections shall include a determination as to whether each subject device is

present and appears to be properly connected and appears to be the correct type for the certified vehicle configuration.

(9) Evaporative System Purge Test Procedure. The purge test procedure shall consist of measuring the total purge flow (in standard liters) occurring in the vehicle's evaporative system during the transient dynamometer emission test specified in paragraph (11) of this section. The purge flow measurement system shall be connected to the purge portion of the evaporative system in series between the canister and the engine, preferably near the canister. The inspector shall be responsible for ensuring that all items that are disconnected in the conduct of the test procedure are properly re-connected at the conclusion of the test procedure. Alternative procedures may be used if they are shown to be equivalent or better to the satisfaction of the Administrator. Except in the case of government-run test facilities claiming sovereign immunity, any damage done to the evaporative emission control system during this test shall be repaired at the expense of the inspection facility.

(10) Evaporative System Integrity Test Procedure. The test sequence shall consist of the following steps:

(i) Test equipment shall be connected to the fuel tank canister hose at the canister end. The gas cap shall be checked to ensure that it is properly, but not excessively tightened, and shall be tightened if necessary.

(ii) The system shall be pressurized to  $14 \pm 0.5$  inches of water without exceeding 26 inches of water system pressure.

(iii) Close off the pressure source, seal the evaporative system and monitor pressure decay for up to two minutes.

(iv) Loosen the gas cap after a maximum of two minutes and monitor for a sudden pressure drop, indicating that the fuel tank was pressurized.

(v) The inspector shall be responsible for ensuring that all items that are disconnected in the conduct of the test procedure are properly re-connected at the conclusion of the test procedure.

(vi) Alternative procedures may be used if they are shown to be equivalent or better to the satisfaction of the Administrator. Except in the case of government-run test facilities claiming sovereign immunity, any damage done to the evaporative emission control system during this test shall be repaired at the expense of the inspection facility.

(11) Transient Emission Test. The transient emission test shall consist of 240 seconds of mass emission measurement using a constant volume sampler while the vehicle is driven through a computer-monitored driving cycle on a dynamometer with inertial weight settings appropriate for the weight of the vehicle. The driving cycle shall include acceleration, deceleration, and idle operating modes as specified in Appendix E to this subpart. The 240 second sequence may be ended earlier using fast pass or fast fail algorithms and multiple pass/fail algorithms may be used during the test cycle to eliminate false failures. The transient test procedure, including algorithms and other procedural details, shall be approved by the Administrator prior to use in an I/M program.

(12) On-Board Diagnostic Checks. (Reserved).

(13) Approval of Alternative Tests. Alternative test procedures may be approved if the Administrator finds that -

(i) Such procedures are in accordance with good engineering practice, including errors of commission (at cutpoints corresponding to equivalent emission reductions) no higher than the tests they would replace;

(ii) Such procedures show a correlation with the Federal Test Procedure (with respect to their ability to detect high emitting vehicles and ensure their effective repair) equal to or better than the tests they would replace; and

(iii) Such procedures would produce equivalent emission reductions in combination with other program elements.

(b) Test Standards. (1) Emissions Standards. HC, CO, and CO+CO<sub>2</sub> (or CO<sub>2</sub> alone) emission standards shall be applicable to all vehicles subject to the program and repairs shall be required for failure of any standard regardless of the attainment status of the area. NO<sub>x</sub> emission standards shall be applied to vehicles subject to a transient test in ozone nonattainment areas and in an ozone transport region, unless a waiver of NO<sub>x</sub> controls is provided to the state under §51.351(d) of this subpart.

(i) Steady-State Short Tests. The steady-state short test emission standards for 1981 and later model year light duty vehicles and light duty trucks shall be at least as stringent as those in Appendix C to this subpart.

(ii) Transient Test. Transient test emission standards shall be established for HC, CO, CO<sub>2</sub>, and NO<sub>x</sub> for subject vehicles based on model year and vehicle type.

(2) Visual Equipment Inspection Standards. (i) Vehicles shall fail visual inspections of subject emission control devices if such devices are part of the original certified configuration and are found to be missing, modified, disconnected, or improperly connected.

(ii) Vehicles shall fail visual inspections of subject emission control devices if such devices are found to be incorrect for the certified vehicle configuration under inspection. Aftermarket parts, as well as original equipment manufacture parts, may be considered correct if they are proper for the certified vehicle configuration. Where an EPA aftermarket approval or self-certification program exists for a particular class of subject parts, vehicles shall fail visual equipment inspections if the part is neither original equipment manufacture nor from an approved or self-certified aftermarket manufacturer.

(3) Functional Test Standards. (i) Evaporative System Integrity Test. Vehicles shall fail the evaporative system pressure test if the system cannot maintain a system pressure above eight inches of water for two minutes after being pressurized to 14 ±0.5 inches of water or if no pressure drop is detected when the gas cap is loosened as described in paragraph (a)(10)(iv) of this section. Additionally, vehicles shall fail the evaporative test if the canister is missing or obviously damaged, if hoses are missing or obviously disconnected, or if the gas cap is missing.

(ii) Evaporative Canister Purge Test. Vehicles with a total purge system flow measuring less than one liter, over the course of the transient test required in paragraph (a)(9) of this section, shall fail the evaporative purge test.

(4) On-Board Diagnostics Test Standards. (Reserved).

(c) Fast Test Algorithms and Standards. Special test algorithms and pass/fail algorithms may be employed to reduce test time when the test outcome is predictable with near certainty, if the Administrator approves by letter their equivalency to full procedure testing.

(d) Applicability. In general, §203(a)(3)(A) of the Clean Air Act prohibits altering a vehicle's configuration such that it changes from a certified to a non-certified configuration. In the inspection process, vehicles that have been altered from their original certified configuration are to be tested in the same manner as other subject vehicles.

(1) Vehicles with engines other than the engine originally installed by the manufacturer or an identical replacement of such engine shall be subject to the test procedures and standards for the chassis type and model year including visual equipment inspections for all parts that are part of the original or now-applicable certified configuration and part of the normal inspection. States may choose to require vehicles with such engines to be subject to the test procedures and standards for the engine model year if it is newer than the chassis model year.

(2) Vehicles that have been switched from an engine of one fuel type to another fuel type that is subject to the program (e.g., from a diesel engine to a gasoline engine) shall be subject to the test procedures and standards for the current fuel type, and to the requirements of subparagraph (1) of this paragraph.

(3) Vehicles that are switched to a fuel type for which there is no certified configuration shall be tested according to the most stringent emission standards established for that vehicle type and model year. Emission control device requirements may be waived if the program determines that the alternatively fueled vehicle configuration would meet the new vehicle standards for that model year without such devices.

(4) Mixing vehicle classes (e.g., light-duty with heavy-duty) and certification types (e.g., California with Federal) within a single vehicle configuration shall be considered tampering.

(e) SIP Requirements. The SIP shall include a description of each test procedure used. The SIP shall include the rule, ordinance or law describing and establishing the test procedures.

#### §51.358 Test Equipment

Computerized test systems are required for performing any measurement on subject vehicles.

(a) Performance Features of Computerized Test Systems. The test equipment shall be certified by the program to meet the requirements contained in Appendix D to this subpart, and newly acquired systems shall be subjected to acceptance test procedures to ensure compliance with program specifications.

(1) Emission test equipment shall be capable of testing all subject vehicles and shall be updated from time to time to accommodate new technology vehicles as well as changes to the program.

(2) At a minimum, emission test equipment:

(i) Shall be automated to the highest degree commercially available to minimize the potential for intentional fraud and/or human error;

(ii) Shall be secure from tampering and/or abuse;

(iii) Shall be based upon written specifications; and

(iv) Shall be capable of simultaneously sampling dual exhaust vehicles.

(3) The vehicle owner or driver shall be provided with a computer-generated record of test results, including all of the items listed in 40 CFR Part 85, Subpart W as being required on the test record. The test report shall include:

(i) A vehicle description, including license plate number, vehicle identification number, and odometer reading;

(ii) The date and time of test;

(iii) The name or identification number of the individual(s) performing the tests and the location of the test station and lane;

(iv) The type of tests performed, including emission tests, visual checks for the presence of emission control components, and functional, evaporative system checks;

(v) The applicable test standards;

(vi) The test results, including exhaust concentrations and pass/fail results for each mode measured, pass/fail results for evaporative system checks, and which emission control devices inspected were passed, failed, or not applicable;

(vii) A statement indicating the availability of warranty coverage as required in Section 207 of the Clean Air Act; and

(viii) Certification that tests were performed in accordance with the regulations and, in the case of decentralized programs, the signature of the individual who performed the test.

(ix) For vehicles that fail the tailpipe emission test, information on the possible causes of the specific pattern of high emission levels found during the test.

(b) Functional Characteristics of Computerized Test Systems. The test system is composed of emission measurement devices and other motor vehicle test equipment controlled by a computer.

(1) The test system shall automatically:

(i) Make a pass/fail decision for all measurements;

(ii) Record test data to an electronic medium;

(iii) Conduct regular self-testing of recording accuracy;

(iv) Perform electrical calibration and system integrity checks before each test, as applicable; and

(v) Initiate system lockouts for:

(A) Tampering with security aspects of the test system;

- (B) Failing to conduct or pass periodic calibration or leak checks;
- (C) Failing to conduct or pass the constant volume sampler flow rate check (if applicable);
- (D) Failing to conduct or pass any of the dynamometer checks, including coast-down, roll speed and roll distance, power absorption capability, and inertia weight selection checks (if applicable);
- (E) Failing to conduct or pass the pressure monitoring device check (if applicable);
- (F) Failing to conduct or pass the purge flow metering system check (if applicable); and
- (G) A full data recording medium or one that does not pass a cyclical redundancy check.

(2) Test systems in enhanced I/M programs shall include a real-time data link to a host computer that prevents unauthorized multiple initial tests on the same vehicle in a test cycle and to insure test record accuracy.

(3) The test system shall insure accurate data collection by limiting, cross-checking, and/or confirming manual data entry.

(4) (Reserved for OBD test equipment requirements)

(c) SIP Requirements. The SIP shall include written technical specifications for all test equipment used in the program and shall address each of the above requirements. The specifications shall describe the emission analysis process, the necessary test equipment, the required features, and written acceptance testing criteria and procedures.

#### §51.359 Quality Control

Note to reviewers: most of the specific requirements in the proposed rule for this section have been removed to Appendix A.

Quality control measures shall insure that emission measurement equipment is calibrated and maintained properly, and that inspection, calibration records, and control charts are accurately created, recorded and maintained.

(a) General Requirements. (1) The practices described in this section and in Appendix A to this subpart shall be followed, at a minimum. Alternatives or exceptions to these procedures or frequencies may be approved by the Administrator based on a demonstration, including control chart analysis, of equivalent performance.

(2) Preventive maintenance on all inspection equipment necessary to insure accurate and repeatable operation shall be performed on a periodic basis.

(3) Computerized analyzers shall automatically record quality control check information, lockouts, attempted tampering, and any other recordable circumstances which should be monitored to insure quality control (e.g., service calls).

(b) Requirements for Steady-State Emissions Testing Equipment. (1) Equipment shall be maintained according to demonstrated good engineering practices to assure test accuracy. The calibration and adjustment requirements in Appendix A to this subpart shall apply to all steady-state test equipment. States may adjust calibration schedules and other quality control frequencies by using statistical process control to monitor equipment performance on an ongoing basis.



(2) For analyzers that use ambient air as zero air, provision shall be made to draw the air from outside the inspection bay or lane in which the analyzer is situated.

(3) The analyzer housing shall be constructed to protect the analyzer bench and electrical components from ambient temperature and humidity fluctuations that exceed the range of the analyzer's design specifications.

(4) Analyzers shall automatically purge the analytical system after each test.

(c) Requirements for Transient Exhaust Emission Test Equipment. Equipment shall be maintained according to demonstrated good engineering practices to assure test accuracy. Computer control of quality assurance checks and quality control charts shall be used whenever possible. Exceptions to the procedures and the frequency of the checks described in Appendix A of this subpart may be approved by the Administrator based on a demonstration of equivalent performance.

(d) Requirements for Evaporative System Functional Test Equipment. Equipment shall be maintained according to demonstrated good engineering practices to assure test accuracy. Computer control of quality assurance checks and quality control charts shall be used whenever possible. Exceptions to the procedures and the frequency of the checks described in Appendix A of this subpart may be approved by the Administrator based on a demonstration of equivalent performance.

(e) Document Security. Measures shall be taken to maintain the security of all documents by which compliance with the inspection requirement is established including, but not limited to inspection certificates, waiver certificates, license plates, license tabs, and stickers. This section shall in no way require the use of paper documents but shall apply if they are used by the program for these purposes.

(1) Compliance documents shall be counterfeit resistant. Such measures as the use of special fonts, water marks, ultra-violet inks, encoded magnetic strips, unique bar-coded identifiers, and difficult to acquire materials may be used to accomplish this requirement.

(2) All inspection certificates, waiver certificates, and stickers shall be printed with a unique serial number and an official program seal.

(3) Measures shall be taken to ensure that compliance documents cannot be stolen or removed without being damaged.

(f) SIP Requirements. The SIP shall include a description of quality control and record keeping procedures. The SIP shall include the procedure manual, rule, ordinance or law describing and establishing the quality control procedures and requirements.

#### §51.360 Waivers and Compliance via Diagnostic Inspection

The program may allow the issuance of a waiver, which is a form of compliance with the program requirements, that allows a motorist to comply without meeting the applicable test standards, as long as prescribed criteria are met.

(a) Waiver Issuance Criteria. The waiver criteria shall include the following at a minimum.

(1) Waivers shall be issued only after a vehicle has failed a retest performed after all qualifying repairs have been completed.

(2) Any available warranty coverage shall be used to obtain needed repairs before expenditures can be counted towards the cost limits in subparagraphs (5) and (6) of this paragraph. The operator of a vehicle within the statutory age and mileage coverage under §207(b) of the Clean Air Act shall present a written denial of warranty coverage from the manufacturer or authorized dealer for this provision to be waived for approved tests applicable to the vehicle.

(3) Waivers shall not be issued to vehicles for tampering-related repairs. The cost of tampering-related repairs shall not be applicable to the minimum expenditure in subparagraphs (5) and (6) of this paragraph. States may issue exemptions for tampering-related repairs if it can be verified that the part in question or one similar to it is no longer available for sale.

(4) Repairs shall be appropriate to the cause of the test failure, and a visual check shall be made to determine if repairs were actually made if, given the nature of the repair, it can be visually confirmed. Receipts shall be submitted for review to further verify that qualifying repairs were performed.

(5) Repairs shall be performed by a recognized repair technician (i.e., one professionally engaged in vehicle repair, employed by a going concern whose purpose is vehicle repair, or possessing nationally recognized certification for emission-related diagnosis and repair) in order to qualify for a waiver. I/M programs may allow repairs performed by non-technicians (e.g., owners) to apply toward the waiver limit for pre-1980 model year vehicles.

(6) In basic I/M programs, a minimum of \$75 for pre-81 vehicles and \$200 for 1981 and later vehicles shall be spent in order to qualify for a waiver.

(7) In enhanced I/M programs, the motorist shall make an expenditure of at least \$450 in repairs to qualify for a waiver. The I/M program shall provide that the \$450 minimum expenditure shall be adjusted in January of each year by the percentage, if any, by which the Consumer Price Index for the preceding calendar year differs from the Consumer Price Index for 1989.

(i) The Consumer Price Index for any calendar year is the average of the Consumer Price Index for all-urban consumers published by the Department of Labor, as of the close of the 12-month period ending on August 31 of each calendar year.

(ii) The revision of the Consumer Price Index which is most consistent with the Consumer Price Index for calendar year 1989 shall be used.

(8) States may establish lower minimum expenditures if a program is established to scrap vehicles that do meet standards after the lower expenditure is made.

(9) A time extension, not to exceed the period of the inspection frequency, may be granted to obtain needed repairs on a vehicle in the case of economic hardship when waiver requirements have not been met, but the extension may be granted only once for a vehicle and shall be tracked and reported by the program.

(b) Compliance via Diagnostic Inspection

Vehicles subject to a transient IM240 emission test at the performance standard cutpoints may be issued a certificate of compliance without meeting the prescribed emission cutpoints, if, after failing a retest on emissions, a complete, documented physical and functional diagnosis and inspection performed by the I/M agency or a contractor to the I/M agency show that no additional emission-related repairs are needed. Any such exemption policy and procedures shall be subject to approval by the Administrator.

(c) Quality Control of Waiver Issuance. (1) Enhanced programs shall control waiver issuance and processing by establishing a system of agency-issued waivers. The state may delegate this authority to a single contractor but inspectors in stations and lanes shall not issue waivers. Basic programs may permit inspector-issued waivers as long as quality assurance efforts include a comprehensive review of waiver issuance.

(2) The program shall include methods of informing vehicle owners or lessors of potential warranty coverage, and ways to obtain warranty repairs.

(3) The program shall insure that repair receipts are authentic and cannot be revised or reused.

(4) The program shall insure that waivers are only valid for one test cycle.

(5) The program shall track, manage, and account for time extensions or exemptions so that owners or lessors cannot receive or retain a waiver improperly.

(d) SIP Requirements. (1) The SIP shall include a maximum waiver rate expressed as a percentage of initially failed vehicles. This waiver rate shall be used for estimating emission reduction benefits in the modeling analysis.

(2) The state shall take corrective action if the waiver rate exceeds that committed to in the SIP or revise the SIP and the emission reductions claimed.

(3) The SIP shall describe the waiver criteria and procedures, including cost limits, quality assurance methods and measures, and administration.

(4) The SIP shall include the necessary legal authority, ordinance, or rules to issue waivers, set and adjust cost limits as required in subparagraph (a)(5) of this section, and carry out any other functions necessary to administer the waiver system, including enforcement of the waiver provisions.

#### §51.361 Motorist Compliance Enforcement

Compliance shall be ensured through the denial of motor vehicle registration in enhanced I/M programs unless an exception for use of an existing alternative is approved. An enhanced I/M area may use an existing alternative if it demonstrates that the alternative has been more effective than registration denial. An enforcement mechanism may be considered an "existing alternative" only in areas that had approved I/M programs with that mechanism in the State Implementation Plan prior to passage of the 1990 Amendments to the Act. A basic I/M area may use an alternative enforcement mechanism if it demonstrates that the alternative will be as effective as registration denial. Two other types of enforcement programs may qualify for enhanced I/M programs if demonstrated to have been more effective than enforcement of the registration requirement in the past: Sticker-based enforcement programs and computer-matching programs. For newly implementing enhanced areas, including newly

subject areas in a state with an I/M program in another part of the state, there is no provision for enforcement alternatives in the Act.

(a) Registration Denial. Registration denial enforcement is defined as rejecting an application for initial registration or reregistration of a used vehicle (i.e., a vehicle being registered after the initial retail sale and associated registration) unless the vehicle has complied with the I/M requirement prior to granting the application. Pursuant to §207(g)(3) of the Act, nothing in this subpart shall be construed to require that new vehicles shall receive emission testing prior to initial retail sale. In designing its enforcement program, the state shall:

(1) Provide an external, readily visible means of determining vehicle compliance with the registration requirement to facilitate enforcement of the program;

(2) Adopt a schedule of testing (either annual or biennial) that clearly determines when a vehicle shall comply prior to registration;

(3) Design a testing certification mechanism (either paper-based or electronic) that shall be used for registration purposes and clearly indicates whether the certification is valid for purposes of registration, including:

- (i) Expiration date of the certificate;
- (ii) Unambiguous vehicle identification information; and
- (iii) Whether the vehicle passed or received a waiver;

(4) Routinely issue citations to motorists with expired or missing license plates, with either no registration or an expired registration, and with no license plate decals or expired decals, and provide for enforcement officials other than police to issue citations (e.g., parking meter attendants) to parked vehicles in noncompliance;

(5) Structure the penalty system to deter non-compliance with the registration requirement through the use of mandatory minimum fines (meaning civil, monetary penalties, both here and elsewhere in this subpart) constituting a meaningful deterrent and through a requirement that compliance be demonstrated before a case can be closed;

(6) Ensure that evidence of testing is available and checked for validity at the time of a new registration of a used vehicle or registration renewal;

(7) Prevent owners or lessors from avoiding testing through manipulation of the title or registration system; title transfers may re-start the clock on the inspection cycle only if proof of current compliance is required at title transfer;

(8) Prevent the fraudulent initial classification or reclassification of a vehicle from subject to non-subject or exempt by requiring proof of address changes prior to registration record modification, and documentation from the testing program (or delegate) certifying based on a physical inspection that the vehicle is exempt;

(9) Limit and track the use of time extensions of the registration requirement to prevent repeated extensions;

(10) Provide for meaningful penalties for cases of registration fraud;

(11) Limit and track exemptions to prevent abuse of the exemption policy for vehicles claimed to be out-of-state; and

(12) Encourage enforcement of vehicle registration transfer requirements when vehicle owners move into the I/M area by coordinating with local and state enforcement agencies and structuring other activities (e.g., drivers license issuance) to effect registration transfers.

(b) Alternative Enforcement Mechanisms. (1) General Requirements. The program shall demonstrate that a non-registration-based enforcement program is currently more effective than registration-denial enforcement in enhanced I/M programs or, prospectively, as effective as registration denial in basic programs. The following general requirements shall apply.

(i) For enhanced I/M programs, the area in question shall have had an approved SIP with an operating I/M program using the alternative mechanism prior to enactment of the Clean Air Act Amendments of 1990. While modifications to improve compliance may be made to the program that was in effect at the time of enactment, the expected change in effectiveness cannot be considered in determining acceptability;

(ii) The state shall assess the alternative program's effectiveness, as well as the current effectiveness of the registration system, including the following:

(A) Determine the number and percentage of vehicles subject to the I/M program that were in compliance with the program over the course of at least one test cycle; and

(B) Determine the number and fraction of the same group of vehicles as in subparagraph (A) of this paragraph that were in compliance with the registration requirement over the same period. Late registration shall not be considered non-compliance for the purposes of this determination. The precise definition of late registration versus a non-complying vehicle shall be explained and justified in the SIP.

(iii) An alternative mechanism shall be considered more effective if the fraction of vehicles complying with the existing program, as determined according to the requirements of this section, is greater than the fraction of vehicles complying with the registration requirement. An alternative mechanism is as effective if the fraction complying with the program is at least equal to the fraction complying with the registration requirement.

(2) Sticker-based Enforcement. In addition to the general requirements, a sticker-based enforcement program shall demonstrate that the enforcement mechanism will swiftly and effectively prevent operation of subject vehicles that fail to comply. Such demonstration shall include the following.

(i) An assessment of the current extent of the following forms of non-compliance and demonstration that mechanisms exist to keep such non-compliance within acceptable limits.

(A) Use of stolen, counterfeit, or fraudulently obtained stickers;

(B) In states with safety inspections, the use of "Safety Inspection Only" stickers on vehicles that should be subject to the I/M requirement as well; and

(C) Operation of vehicles with expired stickers, including a stratification of non-compliance by length of noncompliance and model year.

(ii) The program as currently implemented or as proposed to be improved shall also:

(A) Require an easily observed external identifier such as the county name on the license plate, an obviously unique license plate tab, or other means that shows whether or not a vehicle is subject to the I/M requirement;

(B) Require an easily observed external identifier, such as a windshield sticker or license plate tab that shows whether a subject vehicle is in compliance with the inspection requirement;

(C) Impose monetary fines at least as great as the estimated cost of compliance with I/M requirements (e.g., test fee plus minimum waiver expenditure) for the absence of such identifiers;

(D) Require that such identifiers be of a quality that makes them difficult to counterfeit, difficult to remove without destroying once installed, and durable enough to last until the next inspection without fading, peeling, or other deterioration;

(E) Perform surveys in a variety of locations and at different times for the presence of the required identifiers such that at least 10% of the vehicles or 10,000 vehicles (whichever is less) in the subject vehicle population are sampled each year;

(F) Track missing identifiers for all inspections performed at each station, with stations being held accountable for all such identifiers they are issued; and

(G) Assess and collect significant fines for each identifier that is unaccounted for by a station.

(3) Computer Matching. In addition to the general requirements, computer-matching programs shall demonstrate that the enforcement mechanism will swiftly and effectively prevent operation of subject vehicles that fail to comply. Such demonstration shall:

(i) Require an expeditious system that results in at least 90% of the subject vehicles in compliance within 4 months of the compliance deadline;

(ii) Require that subject vehicles be given compliance deadlines based on the regularly scheduled test date, not the date of previous compliance;

(iii) Require that motorists pay monetary fines at least as great as the estimated cost of compliance with I/M requirements (e.g., test fee plus minimum waiver expenditure) for the continued operation of a noncomplying vehicle beyond 4 months of the deadline;

(iv) Require that continued non-compliance will eventually result in preventing operation of the non-complying vehicle (no later than the date of the next test cycle) through, at a minimum, suspension of vehicle registration and subsequent denial of reregistration;

(v) Demonstrate that the computer system currently in use is adequate to store and manipulate the I/M vehicle database, generate computerized notices, and provide regular backup to said system while maintaining auxiliary storage devices to insure ongoing operation of the system and prevent data losses;

- (vi) Track each vehicle through the steps taken to ensure compliance, including:
  - (A) The compliance deadline;
  - (B) The date of initial notification;
  - (C) The dates warning letters are sent to non-complying vehicle owners;
  - (D) The dates notices of violation or other penalty notices are sent; and
  - (E) The dates and outcomes of other steps in the process, including the final compliance date;

(vii) Compile and report monthly summaries including statistics on the percentage of vehicles at each stage in the enforcement process; and

(viii) Track the number and percentage of vehicles initially identified as requiring testing but which are never tested as a result of being junked, sold to a motorist in a non-I/M program area, or for some other reason.

(c) SIP Requirements. (1) The SIP shall provide information concerning the enforcement process, including:

(i) A description of the existing compliance mechanism if it is to be used in the future and the demonstration that it is as effective or more effective than registration-denial enforcement;

(ii) An identification of the agencies responsible for performing each of the applicable activities in this section;

(iii) A description of and accounting for all classes of exempt vehicles; and

(iv) A description of the plan for testing fleet vehicles, rental car fleets, leased vehicles, and any other subject vehicles, e.g. those operated in (but not necessarily registered in) the program area.

(2) The SIP shall include a determination of the current compliance rate based on a study of the system that includes an estimate of compliance losses due to loopholes, counterfeiting, and unregistered vehicles. Estimates of the effect of closing such loopholes and otherwise improving the enforcement mechanism shall be supported with detailed analyses.

(3) The SIP shall include the legal authority to implement and enforce the program.

(4) The SIP shall include a commitment to an enforcement level to be used for modeling purposes and to be maintained, at a minimum, in practice.

#### §51.362 Motorist Compliance Enforcement Program Oversight

The enforcement program shall be audited regularly and shall follow effective program management practices, including adjustments to improve operation when necessary.

(a) Quality Assurance/Quality Control. A quality assurance program shall be implemented to insure effective overall performance of the enforcement system. Quality control procedures are required to instruct individuals in the enforcement process regarding how to properly conduct their activities. At a minimum, the quality control/quality assurance program(s) shall include:

(1) Verification of exempt vehicle status by inspecting and confirming such vehicles by the program or its delegate;

(2) Facilitation of accurate critical test data and vehicle identifier collection through the use of automatic data capture systems such as bar-code scanners or optical character readers, or through redundant data entry;

(3) Maintenance of an audit trail to allow for the assessment of enforcement effectiveness;

(4) Establishment of written procedures for personnel directly engaged in I/M enforcement activities;

(5) Establishment of written procedures for personnel engaged in I/M document handling and processing, such as registration clerks or personnel involved in sticker dispensing and waiver processing, as well as written procedures for the auditing of their performance;

(6) Follow-up validity checks on out-of-area or exemption-triggering registration changes;

(7) Analysis of registration-change applications to target potential violators;

(8) A determination of enforcement program effectiveness through periodic audits of test records and program compliance documentation;

(9) Enforcement procedures for disciplining, retraining, or removing enforcement personnel who deviate from established requirements, or in the case of non-government entities that process registrations, for defranchising, revoking or otherwise discontinuing the activity of the entity issuing registrations; and

(10) The prevention of fraudulent procurement or use of inspection documents by controlling and tracking document distribution and handling, and making stations financially liable for missing or unaccounted for documents by assessing monetary fines reflecting the "street value" of these documents (i.e., the test fee plus the minimum waiver expenditure).

(b) Information Management. In establishing an information base to be used in characterizing, evaluating, and enforcing the program, the state shall:

(1) Determine the subject vehicle population;

(2) Permit EPA audits of the enforcement process;

(3) Assure the accuracy of registration and other program document files;

(4) Maintain and ensure the accuracy of the testing database through periodic internal and/or third-party review; through automated or redundant data entry; and, through automated analysis for valid alpha-numeric sequences of the vehicle identification number (VIN), certificate number, or license plate number;

(5) Compare the testing database to the registration database to determine program effectiveness, establish compliance rates, and to trigger potential enforcement action against non-complying motorists; and



(6) Sample the fleet as a determination of compliance through parking lot surveys, road-side pull-overs, or other in-use vehicle measurements.

(c) SIP Requirements. The SIP shall include a description of enforcement program oversight and information management activities.

#### §51.363 Quality Assurance

An ongoing quality assurance program shall be implemented to discover, correct and prevent fraud, waste, and abuse and to determine whether procedures are being followed, are adequate, whether equipment is measuring accurately, and whether other problems might exist which would impede program performance. The quality assurance and quality control procedures shall be periodically evaluated to assess their effectiveness and relevance in achieving program goals.

(a) Performance Audits. Performance audits shall be conducted on a regular basis to determine whether inspectors are correctly performing all tests and other required functions. Performance audits shall be of two types: overt and covert, and shall include:

(1) Performance audits based upon written procedures and results shall be reported using either electronic or written forms to be retained in the inspector and station history files, with sufficient detail to support either an administrative or civil hearing;

(2) Performance audits in addition to regularly programmed audits for stations employing inspectors suspected of violating regulations as a result of audits, data analysis, or consumer complaints.

(3) Overt performance audits shall be performed at least twice per year for each lane or test bay and shall include:

(i) A check for the observance of appropriate document security;

(ii) A check to see that required record keeping practices are being followed;

(iii) A check for licenses or certificates and other required display information; and

(iv) Observation and written evaluation of each inspector's ability to properly perform an inspection.

(4) Covert performance audits shall include:

(i) Remote visual observation of inspector performance, which may include the use of aids such as binoculars or video cameras, at least once per year per inspector in high-volume stations;

(ii) Site visits at least once per year per number of inspectors using covert vehicles set to fail (this requirement sets a minimum level of activity not a requirement that each inspector be involved in a covert audit);

(iii) For stations that conduct both testing and repairs, at least one covert vehicle visit per station per year including the purchase of repairs and subsequent retesting if the vehicle is initially failed (this activity may be accomplished in conjunction with subsection (ii) of this paragraph but must involve each station at least once per year);

(iv) Documentation of the audit, including vehicle condition and preparation, sufficient for building a legal case and establishing a performance record;

(v) Covert vehicles covering the range of vehicle technology groups (e.g., carbureted and fuel-injected vehicles) included in the program, including a full range of introduced malfunctions covering the emission test, the evaporative system tests, and emission control component checks (as applicable);

(vi) Sufficient numbers of covert vehicles and auditors to allow for frequent rotation of both to prevent detection by station personnel; and

(vii) Access to on-line inspection databases by state personnel to permit the creation and maintenance of covert vehicle records.

(b) Record Audits. Station and inspector records shall be reviewed or screened at least monthly to assess station performance and identify problems that may indicate potential fraud or incompetence. Such review shall include:

(1) Software-based, computerized analysis to identify statistical inconsistencies, unusual patterns, and other discrepancies;

(2) Visits to inspection stations to review records not already covered in the electronic analysis (if any); and

(3) Comprehensive accounting for all official forms that can be used to demonstrate compliance with the program.

(c) Equipment Audits. During overt site visits, auditors shall conduct quality control evaluations of the required test equipment, including (where applicable):

(1) A gas audit using gases of known concentrations at least as accurate as those required for regular equipment quality control and comparing these concentrations to actual readings;

(2) A check for tampering, worn instrumentation, blocked filters, and other conditions that would impede accurate sampling;

(3) A check for critical flow in critical flow CVS units;

(4) A check of the Constant Volume Sampler flow calibration;

(5) A check for the optimization of the Flame Ionization Detector fuel-air ratio using methane;

(6) A leak check;

(7) A check to determine that station gas bottles used for calibration purposes are properly labelled and within the relevant tolerances;

(8) Functional dynamometer checks addressing coast-down, roll speed and roll distance, inertia weight selection, and power absorption;

(9) A check of the system's ability to accurately detect background pollutant concentrations;

(10) A check of the pressure monitoring devices used to perform the evaporative canister pressure test; and

(11) A check of the purge flow metering system.

(d) Auditor Training and Proficiency. (1) Auditors shall be formally trained and knowledgeable in:

- (i) The use of analyzers;
- (ii) Program rules and regulations;
- (iii) The basics of air pollution control;
- (iv) Basic principles of motor vehicle engine repair, related to emission performance;
- (v) Emission control systems;
- (vi) Evidence gathering;
- (vii) State administrative procedures laws;
- (viii) Quality assurance practices; and
- (ix) Covert audit procedures.

(2) Auditors shall themselves be audited at least once annually.

(3) The training and knowledge requirements in paragraph (1) of this section may be waived for temporary auditors engaged solely for the purpose of conducting covert vehicle runs.

(e) SIP Requirements. The SIP shall include a description of the quality assurance program, and copies of written procedures manuals covering both overt and covert performance audits, record audits, and equipment audits. This requirement does not include materials or discussion of details of enforcement strategies that would ultimately hamper the enforcement process.

#### §51.364 Enforcement Against Contractors, Stations and Inspectors

Enforcement against licensed stations or contractors, and inspectors shall include swift, sure, effective, and consistent penalties for violation of program requirements.

(a) Imposition of Penalties. A penalty schedule shall be developed that establishes minimum penalties for violations of program rules and procedures.

(1) The schedule shall categorize and list violations and the minimum penalties to be imposed for first, second, and subsequent violations and for multiple violation of different requirements. In the case of contracted systems, the state may use compensation retainage in lieu of penalties.

(2) Substantial penalties or retainage shall be imposed on the first offense for violations that directly affect emission reduction benefits. At a minimum, in test-and-repair programs inspector and station license suspension shall be imposed for at least 6 months whenever a vehicle is intentionally improperly passed for any required portion of the test. In test-only programs, inspectors shall be removed from inspector duty for at least 6 months (or a retainage penalty equivalent to the inspector's salary for that period shall be imposed).

(3) All findings of serious violations of rules or procedural requirements shall result in mandatory fines or retainage. In the case of gross neglect, a first offense shall result in a fine or retainage of no less than \$100 or 5 times the inspection fee, whichever is greater, for the contractor or the licensed station, and the inspector if involved.

(4) Any finding of inspector incompetence shall result in mandatory training before inspection privileges are restored.

(5) License or certificate suspension or revocation shall mean the individual is barred from direct or indirect involvement in any inspection operation during the term of the suspension or revocation.

(b) Legal Authority. (1) The quality assurance officer shall have the authority to temporarily suspend station and inspector licenses (after approval of a superior) immediately upon finding a violation or equipment failure that directly affects emission reduction benefits, pending a hearing when requested. In the case of immediate suspension, a hearing shall be held within fourteen calendar days of a written request by the station licensee or the inspector. Failure to hold a hearing within 14 days when requested shall cause the suspension to lapse. In the event that a state's constitution precludes such a temporary license suspension, the enforcement system shall be designed with adequate resources and mechanisms to hold a hearing to suspend or revoke the station or inspector license within three station business days of the finding.

(2) The oversight agency shall have the authority to impose penalties against the licensed station or contractor, as well as the inspector, even if the licensee or contractor had no direct knowledge of the violation but was found to be careless in oversight of inspectors or has a history of violations. Contractors and licensees shall be held fully responsible for inspector performance in the course of duty.

(c) Record keeping. The oversight agency shall maintain records of all warnings, civil fines, suspensions, revocations, and violations and shall compile statistics on violations and penalties on an annual basis.

(d) SIP Requirements. (1) The SIP shall include the penalty schedule and the legal authority for establishing and imposing penalties, civil fines, license suspension, and revocations.

(2) In the case of state constitutional impediments to immediate suspension authority, the state Attorney General shall furnish an official opinion for the SIP explaining the constitutional impediment as well as relevant case law.

(3) The SIP shall describe the administrative and judicial procedures and responsibilities relevant to the enforcement process, including which agencies, courts, and jurisdictions are involved; who will prosecute and adjudicate cases; and other aspects of the enforcement of the program requirements, the resources to be allocated to this function, and the source of those funds. In states without immediate suspension authority, the SIP shall demonstrate that sufficient resources, personnel, and systems are in place to meet the three day case management requirement for violations that directly affect emission reductions.

§51.365 Data Collection

Accurate data collection is essential to the management, evaluation, and enforcement of an I/M program. The program shall gather test data on individual vehicles, as well as quality control data on test equipment.

(a) Test Data. The goal of gathering test data is to unambiguously link specific test results to a specific vehicle, I/M program registrant, test site, and inspector, and to determine whether or not the correct testing parameters were observed for the specific vehicle in question. In turn, these data can be used to distinguish complying and noncomplying vehicles as a result of analyzing the data collected and comparing it to the registration database, to screen inspection stations and inspectors for investigation as to possible irregularities, and to help establish the overall effectiveness of the program. At a minimum, the program shall collect the following with respect to each test conducted:

- (1) Test record number;
- (2) Inspection station and inspector numbers;
- (3) Test system number;
- (4) Date of the test;
- (5) Emission test start time and the time final emission scores are determined;
- (6) Vehicle Identification Number;
- (7) License plate number;
- (8) Test certificate number;
- (9) Gross Vehicle Weight Rating (GVWR);
- (10) Vehicle model year, make, and type;
- (11) Number of cylinders or engine displacement;
- (12) Transmission type;
- (13) Odometer reading;
- (14) Category of test performed (i.e., initial test, first retest, or subsequent retest);
- (15) Fuel type of the vehicle (i.e., gas, diesel, or other fuel);
- (16) Type of vehicle preconditioning performed (if any);
- (17) Emission test sequence(s) used;
- (18) Hydrocarbon emission scores and standards for each applicable test mode;
- (19) Carbon monoxide emission scores and standards for each applicable test mode;
- (20) Carbon dioxide emission scores (CO+CO<sub>2</sub>) and standards for each applicable test mode;
- (21) Nitrogen oxides emission scores and standards for each applicable test mode;
- (22) Results (Pass/Fail/Not Applicable) of the applicable visual inspections for the catalytic converter, air system, gas cap, evaporative system, positive crankcase ventilation (PCV) valve, fuel inlet restrictor, and any other visual inspection for which emission reduction credit is claimed; and
- (23) Results of the evaporative system pressure test expressed as a pass or fail.

(24) Results of the evaporative system purge test expressed as a pass or fail along with the total purge flow in liters achieved during the test.

(b) Quality Control Data. At a minimum, the program shall gather and report the results of the quality control checks required under §51.359 of this part, identifying each check by station number, system number, date, and start time. The data report shall also contain the concentration values of the calibration gases used to perform the gas characterization portion of the quality control checks.

#### §51.366 Data Analysis and Reporting

Data analysis and reporting are required to allow for monitoring and evaluation of the program by program management and EPA, and shall provide information regarding the types of program activities performed and their final outcomes, including summary statistics and effectiveness evaluations of the enforcement mechanism, the quality assurance system, the quality control program, and the testing element. Initial submission of the following annual reports shall commence within 18 months of initial implementation of the program as required by §51.373. The biennial report shall commence within 30 months of initial implementation of the program as required by §51.373.

(a) Test Data Report. The program shall submit to EPA by July of each year a report providing basic statistics on the testing program for January through December of the previous year, including:

- (1) The number of vehicles tested by model year and vehicle type;
- (2) By model year and vehicle type, the number and percentage of vehicles:
  - (i) Failing the emissions test initially;
  - (ii) Failing each emission control component check initially;
  - (iii) Failing the evaporative system functional and integrity checks initially;
  - (iv) Failing the first retest for tailpipe emissions;
  - (v) Passing the first retest for tailpipe emissions;
  - (vi) Initially failed vehicles passing the second or subsequent retest for tailpipe emissions;
  - (vii) Initially failed vehicles passing each emission control component check on the first or subsequent retest by component;
  - (viii) Initially failed vehicles passing the evaporative system functional and integrity checks on the first or subsequent retest by component;
  - (ix) Initially failed vehicles receiving a waiver; and
  - (x) Vehicles with no known final outcome (regardless of reason);
- (3) The initial test volume by model year and test station;
- (4) The initial test failure rate by model year and test station; and
- (5) The average increase or decrease in vehicle emission levels after repairs by model year and vehicle type for vehicles receiving a mass emissions test.

(b) Quality Assurance Report. The program shall submit to EPA by July of each year a report providing basic statistics on the quality assurance program for January through December of the previous year, including:

- (1) The number of inspection stations and lanes:
  - (i) Operating throughout the year; and
  - (ii) Operating for only part of the year;
- (2) The number of inspection stations and lanes operating throughout the year:
  - (i) Receiving overt performance audits in the year;
  - (ii) Not receiving overt performance audits in the year;
  - (iii) Receiving covert performance audits in the year;
  - (iv) Not receiving covert performance audits in the year;
  - (v) That have been shut down as a result of overt performance audits;
- (3) The number of covert audits:
  - (i) Conducted with the vehicle set to fail the emission test;
  - (ii) Conducted with the vehicle set to fail the component check;
  - (iii) Conducted with the vehicle set to fail the evaporative system checks;
  - (iv) Conducted with the vehicle set to fail any combination of two or more of the above checks;
  - (v) Resulting in a false pass for emissions;
  - (vi) Resulting in a false pass for component checks;
  - (vii) Resulting in a false pass for the evaporative system check; and
  - (viii) Resulting in a false pass for any combination of two or more of the above checks;
- (4) The number of inspectors and stations:
  - (i) That were suspended, fired, or otherwise prohibited from testing as a result of covert audits;
  - (ii) That were suspended, fired, or otherwise prohibited from testing for other causes;
  - (iii) That received fines;
- (5) The number of inspectors licensed or certified to conduct testing;
- (6) The number of hearings:
  - (i) Held to consider adverse actions against inspectors and stations; and
  - (ii) Resulting in adverse actions against inspectors and stations;
- (6) The total amount collected in fines from inspectors and stations by type of violation;
- (7) The total number of covert vehicles available for undercover audits over the year; and
- (8) The number of covert auditors available for undercover audits.

(c) Quality Control Report. The program shall submit to EPA by July of each year a report providing basic statistics on the quality control program for January through December of the previous year, including:

- (1) The number of emission testing sites and lanes in use in the program;
- (2) The number of equipment audits by station and lane;
- (3) The number and percentage of stations that have failed equipment audits; and
- (4) Number and percentage of stations and lanes shut down as a result of equipment audits.

(d) Enforcement Report. (1) All varieties of enforcement programs shall, at a minimum, submit to EPA by July of each year a report providing basic statistics on the enforcement program for January through December of the previous year, including:

(i) An estimate of the number of vehicles subject to the inspection program, including the results of an analysis of the registration data base;

(ii) The percentage of motorist compliance based upon a comparison of the number of valid final tests with the number of subject vehicles;

(iii) The total number of compliance documents issued to inspection stations;

(iv) The number of missing compliance documents;

(v) The number of time extensions and other exemptions granted to motorists; and

(vi) The number of compliance surveys conducted, number of vehicles surveyed in each, and the compliance rates found.

(2) Registration denial based enforcement programs shall provide the following additional information:

(i) A report of the program's efforts and actions to prevent motorists from falsely registering vehicles out of the program area or falsely changing fuel type or weight class on the vehicle registration, and the results of special studies to investigate the frequency of such activity; and

(ii) The number of registration file audits, number of registrations reviewed, and compliance rates found in such audits.

(3) Computer-matching based enforcement programs shall provide the following additional information:

(i) The number and percentage of subject vehicles that were tested by the initial deadline, and by other milestones in the cycle;

(iii) A report on the program's efforts to detect and enforce against motorists falsely changing vehicle classifications to circumvent program requirements, and the frequency of this type of activity; and

(iv) The number of enforcement system audits, and the error rate found during those audits.

(4) Sticker-based enforcement systems shall provide the following additional information:



(i) A report on the program's efforts to prevent, detect, and enforce against sticker theft and counterfeiting, and the frequency of this type of activity;

(iii) A report on the program's efforts to detect and enforce against motorists falsely changing vehicle classifications to circumvent program requirements, and the frequency of this type of activity; and

(iv) The number of parking lot sticker audits conducted, the number of vehicles surveyed in each, and the noncompliance rate found during those audits.

(e) Additional Reporting Requirements. In addition to the above annual reports, programs shall submit to EPA by July of every other year, biennial reports addressing:

(1) Any changes made in program design, funding, personnel levels, procedures, regulations, and legal authority, with detailed discussion and evaluation of the impact on the program of all such changes; and

(2) Any weaknesses or problems identified in the program within the two-year reporting period, what steps have already been taken to correct those problems, the results of those steps, and any future efforts planned.

(f) SIP Requirements. The SIP shall describe the types of data to be collected.

#### §51.367 Inspector Training and Licensing or Certification

All inspectors shall receive formal training and be licensed or certified to perform inspections.

(a) Training. (1) Inspector training shall impart knowledge of the following:

- (i) The air pollution problem, its causes and effects;
- (ii) The purpose, function, and goal of the inspection program;
- (iii) Inspection regulations and procedures;
- (iv) Technical details of the test procedures and the rationale for their design;
- (v) Emission control device function, configuration, and inspection;
- (vi) Test equipment operation, calibration, and maintenance;
- (viii) Quality control procedures and their purpose;
- (ix) Public relations; and
- (x) Safety and health issues related to the inspection process.

(2) If inspector training is not administered by the program, the responsible state agency shall monitor and evaluate the training program delivery.

(3) In order to complete the training requirement, a trainee shall pass (i.e., a minimum of 80% of correct responses or lower if an occupational analysis justifies it) a written test covering all aspects of the training. In addition, a hands-on test shall be administered in which the trainee demonstrates without assistance the ability to conduct a proper inspection, to properly utilize equipment and to follow other procedures. Inability to properly conduct all test procedures shall constitute failure of the test. The program shall take appropriate steps to insure the security and integrity of the testing process.

(b) Licensing and Certification. (1) All inspectors shall be either licensed by the program (in the case of test-and-repair systems that do not use contracts with stations) or certified by an organization other than the employer (in test-only programs and test-and-repair programs that require station owners to enter into contracts with the state) in order to perform official inspections.

(2) Completion of inspector training and passing required tests shall be a condition of licensing or certification.

(3) Inspector licenses and certificates shall be valid for no more than 2 years, at which point refresher training and testing shall be required prior to renewal. Alternative approaches based on more comprehensive skill examination and determination of inspector competency may be used.

(4) Licenses or certificates shall not be considered a legal right but rather a privilege bestowed by the program conditional upon adherence to program requirements.

(c) SIP Requirements. The SIP shall include a description of the training program, the written and hands-on tests, and the licensing or certification process.

#### §51.368 Public Information and Consumer Protection

(a) Public Awareness. The SIP shall include a plan for informing the public on an ongoing basis throughout the life of the I/M program of the air quality problem, the requirements of federal and state law, the role of motor vehicles in the air quality problem, the need for and benefits of an inspection program, how to maintain a vehicle in a low-emission condition, how to find a qualified repair technician, and the requirements of the I/M program. Motorists that fail the I/M test in enhanced I/M areas shall be offered a list of repair facilities in the area and information on the results of repairs performed by repair facilities in the area, as described in §51.369(b)(1) of this subpart. Motorists that fail the I/M test shall also be provided with software-generated, interpretive diagnostic information based on the particular portions of the test that were failed.

(b) Consumer Protection. The oversight agency shall institute procedures and mechanisms to protect the public from fraud and abuse by inspectors, mechanics, and others involved in the I/M program. This shall include a challenge mechanism by which a vehicle owner can contest the results of an inspection. It shall include mechanisms for protecting whistle blowers and following up on complaints by the public or others involved in the process. It shall include a program to assist owners in obtaining warranty covered repairs for eligible vehicles that fail a test. The SIP shall include a detailed consumer protection plan.

#### §51.369 Improving Repair Effectiveness

Effective repairs are the key to achieving program goals and the state shall take steps to ensure the capability exists in the repair industry to repair vehicles that fail I/M tests.

(a) Technical Assistance. The oversight agency shall provide the repair industry with information and assistance related to vehicle inspection diagnosis and repair.

(1) The agency shall regularly inform repair facilities of changes in the inspection program, training course schedules, common problems being found with particular engine families, diagnostic tips and the like.

(2) The agency shall provide a hot line service to assist repair technicians with specific repair problems, answer technical questions that arise in the repair process, and answer questions related to the legal requirements of state and federal law with regard to emission control device tampering, engine switching, or similar issues.

(b) Performance Monitoring. (1) In enhanced I/M program areas, the oversight agency shall monitor the performance of individual motor vehicle repair facilities, and provide to the public at the time of initial failure, a summary of the performance of local repair facilities that have repaired vehicles for retest. Performance monitoring shall include statistics on the number of vehicles submitted for a retest after repair by the repair facility, the percentage passing on first retest, the percentage requiring more than one repair/retest trip before passing, and the percentage receiving a waiver. Programs may provide motorists with alternative statistics that convey similar information on the relative ability of repair facilities in providing effective and convenient repair, in light of the age and other characteristics of vehicles presented for repair at each facility.

(2) Programs shall provide feedback, including statistical and qualitative information to individual repair facilities on a regular basis (at least annually) regarding their success in repairing failed vehicles.

(3) A prerequisite for a retest shall be a completed repair form that indicates which repairs were performed, as well as any technician recommended repairs that were not performed, and identification of the facility that performed the repairs.

(c) Repair Technician Training. The state shall assess the availability of adequate repair technician training in the I/M area and, if the types of training described in (1) through (4) below are not currently available, shall insure that training is made available to all interested individuals in the community either through private or public facilities. This may involve working with local community colleges or vocational schools to add curricula to existing programs or start new programs or it might involve attracting private training providers to offer classes in the area. The training available shall include:

(1) Diagnosis and repair of malfunctions in computer controlled, closed-loop vehicles;

(2) The application of emission control theory and diagnostic data to the diagnosis and repair of failures on the transient emission test and the evaporative system functional checks;

(3) Utilization of diagnostic information on systematic or repeated failures observed in the transient emission test and the evaporative system functional checks; and

(4) General training on the various subsystems related to engine emission control.

(d) SIP Requirements. The SIP shall include a description of the technical assistance program to be implemented, a description of the procedures and criteria to be used in meeting the performance monitoring requirements of this section, and a description of the repair technician training resources available in the community.

#### §51.370 Compliance with Recall Notices

States shall establish methods to ensure that vehicles subject to enhanced I/M and that are included in either a "Voluntary Emissions Recall" as defined at 40 CFR 85.1902(d), or in a remedial plan

determination made pursuant to §207(c) of the Act, receive the required repairs. States shall require that owners of recalled vehicles have the necessary recall repairs completed, either in order to complete an annual or biennial inspection process or to obtain vehicle registration renewal. All recalls for which owner notification occurs after January 1, 1995 shall be included in the enhanced I/M recall requirement.

(a) General Requirements. (1) The state shall have an electronic means to identify recalled vehicles based on lists of VINs with unresolved recalls made available by EPA, the vehicle manufacturers, or a third party supplier approved by the Administrator. The state shall update its list of unresolved recalls on a quarterly basis at a minimum.

(2) The state shall require owners or lessees of vehicles with unresolved recalls to show proof of compliance with recall notices in order to complete either the inspection or registration cycle.

(3) Compliance shall be required on the next registration or inspection date, allowing a reasonable period to comply, after notification of recall was received by the state.

(b) Enforcement. (1) A vehicle shall either fail inspection or be denied vehicle registration if the required recall repairs have not been completed.

(2) In the case of vehicles obtaining recall repairs but remaining on the updated list provided in paragraph (a)(1) of this section, the state shall have a means of verifying completion of the required repairs; electronic records or paper receipts provided by the authorized repair facility shall be required. The vehicle inspection or registration record shall be modified to include (or be supplemented with other VIN-linked records which include) the recall campaign number(s) and the date(s) repairs were performed. Documentation verifying required repairs shall include the following:

- (i) the VIN, make, and model year of the vehicle, and
- (ii) the recall campaign number and the date repairs were completed.

(c) Reporting Requirements. The state shall submit to EPA, by July of each year for the previous calendar year, an annual report providing the following information:

(1) The number of vehicles in the I/M area initially listed as having unresolved recalls, segregated by recall campaign number;

(2) The number of recalled vehicles brought into compliance by owners;

(3) The number of listed vehicles with unresolved recalls that, as of the end of the calendar year, were not yet due for inspection or registration;

(4) The number of recalled vehicles still in non-compliance that have either failed inspection or been denied registration on the basis of non-compliance with recall; and

(5) The number of recalled vehicles that are otherwise not in compliance.

(d) SIP Submittals. The SIP shall describe the procedures used to incorporate the vehicle lists provided in paragraph (a)(1) into the inspection or registration database, the quality control methods used to insure that recall repairs are properly documented and tracked, and the method (inspection failure or registration denial) used to enforce the recall requirements.

## §51.371 On-road Testing

On-road testing is defined as the measurement of HC, CO, NO<sub>x</sub>, and/or CO<sub>2</sub> emissions on any road or roadside in the nonattainment area or the I/M program area. On-road testing is required in enhanced I/M areas and is an option for basic I/M areas.

(a) General Requirements. (1) On-road testing is to be part of the emission testing system, but is to be a complement to testing otherwise required.

(2) On-road testing is not required in every season or on every vehicle but shall evaluate the emission performance of 0.5% of the subject fleet, including any vehicles that may be subject to the follow-up inspection provisions of paragraph (a)(4) of this section, each inspection cycle.

(3) The on-road testing program shall provide information about the emission performance of in-use vehicles, by measuring on-road emissions through the use of remote sensing devices or roadside pullovers including tailpipe emission testing. The program shall collect, analyze and report on-road testing data.

(4) Owners of vehicles that have previously been through the normal periodic inspection and passed the final retest and found to be high emitters shall be notified that the vehicles are required to pass an out-of-cycle follow-up inspection; notification may be by mailing in the case of remote sensing on-road testing or through immediate notification if roadside pullovers are used.

(b) SIP Requirements. (1) The SIP shall include a detailed description of the on-road testing program, including the types of testing, test limits and criteria, the number of vehicles (the percentage of the fleet) to be tested, the number of employees to be dedicated to the on-road testing effort, the methods for collecting, analyzing, utilizing, and reporting the results of on-road testing and, the portion of the program budget to be dedicated to on-road testing.

(2) The SIP shall include the legal authority necessary to implement the on-road testing program, including the authority to enforce off-cycle inspection and repair requirements.

(3) Emission reduction credit for on-road testing programs shall be granted for a program designed to obtain significant emission reductions over and above those already predicted to be achieved by other aspects of the I/M program. The SIP shall include technical support for the claimed additional emission reductions.

## §51.372 State Implementation Plan Submissions

(a) SIP Submittals. The SIP shall address each of the elements covered in this rulemaking, including, but not limited to:

(1) A schedule of implementation of the program including interim milestones leading to mandatory testing. The milestones shall include, at a minimum:

- (i) Passage of enabling statutory or other legal authority;
- (ii) Proposal of draft regulations and promulgation of final regulations;
- (iii) Issuance of final specifications and procedures;
- (iv) Issuance of final Request for Proposals (if applicable);

- (v) Licensing or certifications of stations, inspectors;
- (vi) The date mandatory testing will begin for each model year to be covered by the program;
- (vii) The date full-stringency cutpoints will take effect;
- (viii) All other relevant dates.

(2) An analysis of emission level targets for the program using the most current EPA mobile source emission model or an alternative approved by the Administrator showing that the program meets the performance standard described in §51.351 or §51.352, as applicable;

(3) A description of the geographic coverage of the program, including ZIP codes if the program is not county-wide;

(4) A detailed discussion of each of the required design elements, including provisions for federal facility compliance;

(5) Legal authority requiring or allowing implementation of the I/M program and providing either broad or specific authority to perform all required elements of the program;

(6) Legal authority for I/M program operation until such time as it is no longer necessary (i.e., until a Section 175 maintenance plan without an I/M program is approved by EPA);

(7) Implementing regulations, interagency agreements, and memoranda of understanding;

(8) Evidence of adequate funding and resources to implement all aspects of the program; and

(b) Submittal Schedule. The SIP shall be submitted to EPA according to the following schedule-

(1) States shall submit a SIP revision by November 15, 1992 which includes the schedule required in paragraph (a)(1) of this section and a formal commitment from the Governor to the adoption and implementation of an I/M program meeting all requirements of this rule.

(2) A SIP revision, including all necessary legal authority and the items specified in (a)(1) through (a)(9) of this section, shall be submitted no later than November 15, 1993.

(3) States will be required to revise SIPs as EPA develops further regulations. Revisions to incorporate onboard diagnostic checks in the I/M program shall be submitted within 2 years after promulgation of OBD regulations under Section 202 (m) (3) of the Clean Air Act , as amended.

#### §51.373 Implementation Deadlines

I/M programs shall be implemented as expeditiously as practicable.

(a) Decentralized basic programs shall be fully implemented by January 1, 1994, and centralized basic programs shall be fully implemented by July 1, 1994.

(b) For areas newly required to implement basic I/M after promulgation of this regulation (as a result of failure to attain, reclassification, or redesignation) decentralized programs shall be fully implemented within one year of obtaining legal authority. Centralized programs shall be fully

implemented within two years of obtaining legal authority. More implementation time may be approved by the Administrator if an enhanced I/M program is implemented.

(c) All requirements related to enhanced I/M programs shall be implemented by January 1, 1995, with the following exceptions.

(i) Areas switching from an existing test-and-repair network to a test-only network may phase in the change between January of 1995 and January of 1996. Starting in January of 1995 at least 30% of the subject vehicles shall participate in the test-only system (in states with multiple I/M areas, implementation is not required in every area by January 1995 as long as statewide, 30% of the subject vehicles are involved in testing) and shall be subject to the new test procedures (including the evaporative system checks, visual inspections, and tailpipe emission tests). By January 1, 1996, all applicable vehicle model years and types shall be included in the test-only system. During the phase-in period, all requirements of this regulation shall be applied to the test-only portion of the program; existing requirements may continue to apply for the test-and-repair portion of the program until it is phased out by January 1, 1996.

(ii) Areas starting new test-only programs and those with existing test-only programs may also phase in the new test procedures between January 1, 1995 and January 1, 1996. Other program requirements shall be fully implemented by January 1, 1995.

(d) In the case of areas newly required to implement enhanced I/M after promulgation of this regulation (as a result of failure to attain, reclassification, or nonattainment designation) enhanced I/M shall be implemented within 24 months of obtaining legal authority.

(e) Legal authority for the implementing agency or agencies to implement and enforce an I/M program consistent with these regulations shall be obtained from the state legislature or local governing body in the first legislative session after this rule takes effect or after being newly required to implement or upgrade an I/M program as in paragraph (b) or (c) of this section, including sessions already in progress if at least 21 days remain before the final bill submittal deadline.

## Appendix A Calibrations, Adjustments and Quality Control.

### (I) Steady-State Test Equipment.

States may opt to use transient emission test equipment for steady-state tests and follow the quality control requirements in paragraph (II) of this appendix instead of the following requirements.;

(a) Equipment shall be calibrated in accordance with the manufacturers' instructions.

(b) Prior to each test. - (1) Hydrocarbon Hang-up Check. Immediately prior to each test the analyzer shall automatically perform a hydrocarbon hang-up check. If the HC reading, when the probe is sampling ambient air, exceeds 20 ppm, the system shall be purged with clean air or zero gas. The analyzer shall be inhibited from continuing the test until HC levels drop below 20 ppm.

(2) Automatic Zero and Span. The analyzer shall conduct an automatic zero and span check prior to each test. The span check shall include the HC, CO, and CO<sub>2</sub> channels, and the NO and O<sub>2</sub> channels, if present. If zero and/or span drift cause the signal levels to move beyond the adjustment range of the analyzer, it shall lock out from testing.

(3) Low Flow. The system shall lock out from testing if sample flow is below the acceptable level as defined in paragraph (b)(6) of Appendix D to this subpart.

(c) Leak Check. A system leak check shall be performed within twenty-four hours before the test in low volume stations (those performing less than 5,000 inspections per year) and within four hours in high-volume stations (5,000 or more inspections per year) and may be performed in conjunction with the gas calibration described in subparagraph (1) of paragraph (d). If a leak check is not performed within the preceding twenty-four hours in low volume stations and within four hours in high-volume stations or if the analyzer fails the leak check, the analyzer shall lock out from testing. The leak check shall be a procedure demonstrated to effectively check the sample hose and probe for leaks and shall be performed in accordance with good engineering practices. An error of more than  $\pm 2\%$  of the reading using low range span gas shall cause the analyzer to lock out from testing and shall require repair of leaks.

(d) Gas Calibration. On each operating day in high-volume stations, analyzers shall automatically require and successfully pass a two-point gas calibration for HC, CO, and CO<sub>2</sub> and shall continually compensate for changes in barometric pressure. Calibration shall be checked within four hours before the test and the analyzer adjusted if the reading is more than 2% different from the span gas value. In low-volume stations, analyzers shall undergo a two-point calibration within seventy-two hours before each test, unless changes in barometric pressure are compensated for automatically and statistical process control demonstrates equal or better quality control using different frequencies. Gas calibration shall be accomplished by introducing span gas that meets the requirements of paragraph (d)(3) of this appendix into the analyzer through the calibration port. If the analyzer reads the span gas within the allowable tolerance range (i.e., the square root of sum of the squares of the span gas tolerance described in paragraph (d)(3) of this appendix and the calibration tolerance, which shall be equal to 2%), no adjustment of the analyzer is necessary. The gas calibration procedure shall correct readings that exceed the allowable tolerance range to the center of the allowable tolerance range. The pressure in the sample cell shall be the same with the calibration gas flowing during calibration as with the sample gas flowing during sampling. If the system is not calibrated, or the system fails the calibration check, the analyzer shall lock out from testing.



(2) Span Points. A two point gas calibration procedure shall be followed. The span shall be accomplished at one of the following pairs of span points:

- (A) 300 ppm propane (HC)  
1.0 % carbon monoxide (CO)  
6.0 % carbon dioxide (CO<sub>2</sub>)  
1000 ppm nitric oxide (if equipped with NO)  
  
1200 ppm propane (HC)  
4.0 % carbon monoxide (CO)  
12.0% carbon dioxide (CO<sub>2</sub>)  
3000 ppm nitric oxide (if equipped with NO)
- (B) 0 ppm propane  
0.0 % carbon monoxide  
0.0 % carbon dioxide  
0 ppm nitric oxide (if equipped with NO)  
  
600 ppm propane (HC)  
1.6 % carbon monoxide (CO)  
11.0% carbon dioxide (CO<sub>2</sub>)  
1200 ppm nitric oxide (if equipped with NO)

(3) Span Gases. The span gases used for the gas calibration shall be traceable to National Institute of Standards and Technology (NIST) standards  $\pm 2\%$ , and shall be within two percent of the span points specified in paragraph (d)(2) of this appendix. Zero gases shall conform to the specifications given in paragraph (a)(5) of §86.114-79 of this title.

(e) Dynamometer Checks. (1) Monthly Check. Within one month preceding each loaded test, the accuracy of the the roll speed indicator shall be verified and the dynamometer shall be checked for proper power absorber settings.

(2) Semi-annual Check. Within six months preceding each loaded test, the road-load response of the variable-curve dynamometer or the frictional power absorption of the dynamometer shall be checked by a coast down procedure similar to that described in §86.118-78 of this title. The check shall be done at 30 mph, and a power absorption load setting to generate a total horsepower (hp) of 4.1 hp. The actual coast down time from 45 mph to 15 mph shall be within  $\pm 1$  second of the time calculated by the following equation:

$$\text{Coast Down Time} = \frac{0.0508 * W}{\text{HP}}$$

where W is the total inertia weight as represented by the weight of the rollers (excluding free rollers), and any inertia flywheels used, measured in pounds. If the coast down time is not within the specified tolerance the dynamometer shall be taken out of service and corrective action shall be taken.

(f) Other Checks. In addition to the above periodic checks, these shall also be used to verify system performance under the following special circumstances.

(1) Gas Calibration. (A) Each time the analyzer electronic or optical systems are repaired or replaced, a gas calibration shall be performed prior to returning the unit to service.

(B) In high-volume stations, monthly multi-point calibrations shall be performed. Low-volume stations shall perform multi-point calibrations every six months. The calibration curve shall be checked at 20%, 40%, 60%, and 80% of full scale and adjusted or repaired if the specifications in Appendix D(1)(b)(1) are not met.

(2) Leak Checks. Each time the sample line integrity is broken, a leak check shall be performed prior to testing.

(II) Transient Test Equipment.

(a) Dynamometer. Once per week, the calibration of each dynamometer and each fly wheel shall be checked by a dynamometer coast-down procedure comparable to that in §86.118-78 of this title between the speeds of 55 to 45 mph, and between 30 to 20 mph. All rotating dynamometer components shall be included in the coast-down check for the inertia weight selected. For dynamometers with uncoupled rolls, the uncoupled rollers may undergo a separate coast-down check. If a vehicle is used to motor the dynamometer to the beginning coast-down speed, the vehicle shall be lifted off the dynamometer rolls before the coast-down test begins. If the difference between the measured coast-down time and the theoretical coast-down time is greater than +1 second, the system shall lock out, until corrective action brings the dynamometer into calibration.

(b) Constant Volume Sampler. (1) The constant volume sampler (CVS) flow calibration shall be checked daily by a procedure that identifies deviations in flow from the true value. Deviations greater than  $\pm 4\%$  shall be corrected.

(2) The sample probe shall be cleaned and checked at least once per month. The main CVS venturi shall be cleaned and checked at least once per year.

(3) Verification that flow through the sample probe is adequate for the design shall be done daily. Deviations greater than the design tolerances shall be corrected.

(c) Analyzer System. (1) Calibration Checks. (A) Upon initial operation, calibration curves shall be generated for each analyzer. The calibration curve shall consider the entire range of the analyzer as one curve. At least 6 calibration points plus zero shall be used in the lower portion of the range corresponding to an average concentration of approximately 2 gpm for HC, 30 gpm for CO, 3 gpm for NO<sub>x</sub>, and 400 gpm for CO<sub>2</sub>. For the case where a low and a high range analyzer is used, the high range analyzer shall use at least 6 calibration points plus zero in the lower portion of the high range scale corresponding to approximately 100% of the full-scale value of the low range analyzer. For all analyzers, at least 6 calibration points shall also be used to define the calibration curve in the region above the 6 lower calibration points. Gas dividers may be used to obtain the intermediate points for the general range classifications specified. The calibration curves generated shall be a polynomial of no greater order than 4<sup>th</sup> order, and shall fit the data within 0.5% at each calibration point.

(B) For all calibration curves, curve checks, span adjustments, and span checks, the zero gas shall be considered a down-scale reference gas, and the analyzer zero shall be set at the trace concentration value of the specific zero gas used.

(2) The basic curve shall be checked monthly by the same procedure used to generate the curve, and to the same tolerances.

(3) On a daily basis prior to vehicle testing-

(A) The curve for each analyzer shall be checked by adjusting the analyzer to correctly read a zero gas and an up-scale span gas, and then by correctly reading a mid-scale span gas within 2% of point. If the analyzer does not read the mid-scale span point within 2% of point, the system shall lock out. The up-scale span gas concentration for each analyzer shall correspond to approximately 80 percent of full scale, and the mid-point concentration shall correspond to approximately 15 percent of full scale; and

(B) After the up-scale span check, each analyzer in a given facility shall analyze a sample of a random concentration corresponding to approximately 0.5 to 3 times the cut point (in gpm) for the constituent. The value of the random sample may be determined by a gas blender. The deviation in analysis from the sample concentration for each analyzer shall be recorded and compared to the historical mean and standard deviation for the analyzers at the facility and at all facilities. Any reading exceeding 3 sigma shall cause the analyzer to lock out.

(4) Flame Ionization Detector Check. Upon initial operation, and after maintenance to the detector, each Flame Ionization Detector (FID) shall be checked, and adjusted if necessary, for proper peaking and characterization by the procedures described in SAE Paper No. 770141. Additionally, every month the response of each FID to a methane concentration of approximately 50 ppm CH<sub>4</sub> shall be checked. If the response is outside of the range of 1.10 to 1.20, corrective action shall be taken to bring the FID response within this range. The response shall be computed by the following formula:

$$\text{Ratio of Methane Response} = \frac{\text{Flame Ionization Detector response in ppmC}}{\text{ppm methane in cylinder}}$$

(5) Spanning Frequency. The zero and up-scale span point shall be checked, and adjusted if necessary, at 2 hour intervals following the daily mid-scale curve check. If the zero or the up-scale span point drifts by more than 2% for the previous check (except for the first check of the day), the system shall lock out, and corrective action shall be taken to bring the system into compliance.

(6) Spanning Limit Checks. The tolerance on the adjustment of the up-scale span point is 0.4% of point. A software algorithm to perform the span adjustment and subsequent calibration curve adjustment shall be used. However, software up-scale span adjustments greater than  $\pm 10\%$  shall cause the system to lock out, requiring system maintenance.

(7) Integrator Checks. Upon initial operation, and every three months thereafter, emissions from a randomly selected vehicle with official test value greater than 60% of the standard (determined retrospectively) shall be simultaneously sampled by the normal integration method and by the bag method in each lane. The data from each method shall be put into a historical data base for determining normal and deviant performance for each test lane, facility, and all facilities combined. Specific deviations exceeding  $\pm 5\%$  shall require corrective action.

(8) Interference. CO and CO<sub>2</sub> analyzers shall be checked prior to initial service, and on a yearly basis thereafter, for water interference. The specifications and procedures used shall generally comply with either §86.122-78 or §86.321-79 of this title.

(9) NO<sub>x</sub> Converter Check. The converter efficiency of the NO<sub>2</sub> to NO converter shall be checked on a weekly basis. The check shall generally conform to §86.123-78 of this title, or EPA MVEL Form 305-01. Equivalent methods may be approved by the Administrator

(10) NO/NO<sub>x</sub> Flow Balance. The flow balance between the NO and NO<sub>x</sub> test modes shall be checked weekly. The check may be combined with the NO<sub>x</sub> convertor check as illustrated in EPA MVEL Form 305-01.

(11) Additional Checks. Additional checks shall be performed on the HC, CO, CO<sub>2</sub>, and NO<sub>x</sub> analyzers according to best engineering practices for the measurement technology used to ensure that measurements meet specified accuracy requirements.

(12) System Artifacts (Hang-up). Prior to each test a comparison shall be made between the background HC reading, the HC reading measured through the sample probe (if different), and the zero gas. Deviations from the zero gas greater than 10 parts per million carbon (ppmC) shall cause the analyzer to lock out.

(13) Ambient Background. The average of the pre-test and post-test ambient background levels shall be compared to the permissible levels of 10 ppmC HC, 20 ppm CO, and 1 ppm NO<sub>x</sub>. If the permissible levels are exceeded, the test shall be voided and corrective action taken to lower the ambient background concentrations.

(14) Analytical Gases. Zero gases shall meet the requirements of §86.114-79(a)(5). NO<sub>x</sub> calibration gas shall be a single blend using nitrogen as the diluent. Calibration gas for the flame ionization detector shall be a single blend of propane with a diluent of air. Calibration gases for CO and CO<sub>2</sub> shall be single blends using nitrogen or air as a diluent. Multiple blends of HC, CO, and CO<sub>2</sub> in air may be used if shown to be stable and accurate.

(III) Purge Analysis System. On a daily basis each purge flow meter shall be checked with a simulated purge flow against a reference flow measuring device with performance specifications equal to or better than those specified for the purge meter. The check shall include a mid-scale rate check, and a total flow check between 10 and 20 liters. Deviations greater than  $\pm 5\%$  shall be corrected. On a monthly basis, the calibration of purge meters shall be checked for proper rate and total flow with three equally spaced points across the flow rate and the totalized flow range. Deviations exceeding the specified accuracy shall be corrected. The dynamometer quality assurance checks required under paragraph (II) of this Appendix shall also apply to the dynamometer used for purge tests.

(IV) Evaporative System Integrity Test Equipment. (a) On a weekly basis pressure measurement devices shall be checked against a reference device with performance specifications equal to or better than those specified for the measurement device. Deviations exceeding the performance specifications shall be corrected. Flow measurement devices, if any, shall be checked according to paragraph (c)(4) of this section.

(b) Systems that monitor evaporative system leaks shall be checked for integrity on a daily basis by sealing and pressurizing.

## Appendix B Test Procedures

### .c4.(I) Idle Test.

(a) General requirements. (1) Exhaust gas sampling algorithm. The analysis of exhaust gas concentrations shall begin 10 seconds after the applicable test mode begins. Exhaust gas concentrations shall be analyzed at a minimum rate of two times per second. The measured value for pass/fail determinations shall be a simple running average of the measurements taken over five seconds.

(2) Pass/fail determination. A pass or fail determination shall be made for each applicable test mode based on a comparison of the short test standards contained in Appendix C to this subpart, and the measured value for HC and CO as described in paragraph (a)(1) of this section. A vehicle shall pass the test mode if any pair of simultaneous measured values for HC and CO are below or equal to the applicable short test standards. A vehicle shall fail the test mode if the values for either HC or CO, or both, in all simultaneous pairs of values are above the applicable standards.

(3) Void test conditions. The test shall immediately end and any exhaust gas measurements shall be voided if the measured concentration of CO plus CO<sub>2</sub> falls below six percent or the vehicle's engine stalls at any time during the test sequence.

(4) Multiple exhaust pipes. Exhaust gas concentrations from vehicle engines equipped with multiple exhaust pipes shall be sampled simultaneously.

(5) The test shall be immediately terminated upon reaching the overall maximum test time.

(b) Test sequence. (1) The test sequence shall consist of a first-chance test and a second-chance test as follows:

(i) The first-chance test, as described under paragraph (c) of this section, shall consist of an idle mode.

(ii) The second-chance test as described under paragraph (d) of this section shall be performed only if the vehicle fails the first-chance test.

(2) The test sequence shall begin only after the following requirements are met:

(i) The vehicle shall be tested in as-received condition with the transmission in neutral or park and all accessories turned off. The engine shall be at normal operating temperature (as indicated by a temperature gauge, temperature lamp, touch test on the radiator hose, or other visual observation for overheating).

(ii) The tachometer shall be attached to the vehicle in accordance with the analyzer manufacturer's instructions.

(iii) The sample probe shall be inserted into the vehicle's tailpipe to a minimum depth of 10 inches. If the vehicle's exhaust system prevents insertion to this depth, a tailpipe extension shall be used.

(iv) The measured concentration of CO plus CO<sub>2</sub> shall be greater than or equal to six percent.

(c) First-chance test. The test timer shall start ( $tt=0$ ) when the conditions specified in paragraph (b)(2) of this section are met. The first-chance test shall have an overall maximum test time of 145 seconds ( $tt=145$ ). The first-chance test shall consist of an idle mode only.

(1) The mode timer shall start ( $mt=0$ ) when the vehicle engine speed is between 350 and 1100 rpm. If engine speed exceeds 1100 rpm or falls below 350 rpm, the mode timer shall reset to zero and resume timing. The minimum mode length shall be determined as described under paragraph (c)(2) of this section. The maximum mode length shall be 90 seconds elapsed time ( $mt=90$ ).

(2) The pass/fail analysis shall begin after an elapsed time of 10 seconds ( $mt=10$ ). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(i) The vehicle shall pass the idle mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds ( $mt=30$ ), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(ii) The vehicle shall pass the idle mode and the test shall be terminated at the end of an elapsed time of 30 seconds ( $mt=30$ ), if prior to that time the criteria of paragraph (c)(2)(i) of this section are not satisfied and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(iii) The vehicle shall pass the idle mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds ( $mt=30$ ) and 90 seconds ( $mt=90$ ), the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(iv) The vehicle shall fail the idle mode and the test shall be terminated if none of the provisions of paragraphs (c)(2)(i), (ii) and (iii) of this section is satisfied by an elapsed time of 90 seconds ( $mt=90$ ). Alternatively, the vehicle may be failed if the provisions of paragraphs (c)(2)(i) and (ii) are not met within an elapsed time of 30 seconds.

(v) Optional. The vehicle may fail the first-chance test and the second-chance test shall be omitted if no exhaust gas concentration lower than 1800 ppm HC is found by an elapsed time of 30 seconds ( $mt=30$ ).

(d) Second-chance test. If the vehicle fails the first-chance test, the test timer shall reset to zero ( $tt=0$ ) and a second-chance test shall be performed. The second-chance test shall have an overall maximum test time of 425 seconds ( $tt=425$ ). The test shall consist of a preconditioning mode followed immediately by an idle mode.

(1) Preconditioning mode. The mode timer shall start ( $mt=0$ ) when the engine speed is between 2200 and 2800 rpm. The mode shall continue for an elapsed time of 180 seconds ( $mt=180$ ). If engine speed falls below 2200 rpm or exceeds 2800 rpm for more than five seconds in any one excursion, or 15 seconds over all excursions, the mode timer shall reset to zero and resume timing.

(2) Idle mode. (i) Ford Motor Company and Honda vehicles. The engines of 1981-1986 Ford Motor Company vehicles and 1984-1985 Honda Preludes shall be shut off for not more than 10 seconds and restarted. This procedure should not be used for other vehicles. The probe may be removed from the tailpipe or the sample pump turned off if necessary to reduce analyzer fouling during the restart procedure.

(ii) The mode timer shall start (mt=0) when the vehicle engine speed is between 350 and 1100 rpm. If engine speed exceeds 1100 rpm or falls below 350 rpm, the mode timer shall reset to zero and resume timing. The minimum idle mode length shall be determined as described in paragraph (d)(2)(iii) of this section. The maximum idle mode length shall be 90 seconds elapsed time (mt=90).

(iii) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the idle mode shall be terminated as follows:

(A) The vehicle shall pass the idle mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(B) The vehicle shall pass the idle mode and the test shall be terminated at the end of an elapsed time of 30 seconds (mt=30), if prior to that time the criteria of paragraph (d)(2)(iii)(A) of this section are not satisfied and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(C) The vehicle shall pass the idle mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 90 seconds (mt=90), measured values are less than or equal to the applicable short test standards described in paragraph (a)(2) of this section.

(D) The vehicle shall fail the idle mode and the test shall be terminated if none of the provisions of paragraphs (d)(2)(iii)(A), (d)(2)(iii)(B), and (d)(2)(iii)(C) of this section are satisfied by an elapsed time of 90 seconds (mt=90).

#### .c4.(II) Two Speed Idle Test.

(a) General requirements. (1) Exhaust gas sampling algorithm. The analysis of exhaust gas concentrations shall begin 10 seconds after the applicable test mode begins. Exhaust gas concentrations shall be analyzed at a rate of two times per second. The measured value for pass/fail determinations shall be a simple running average of the measurements taken over five seconds.

(2) Pass/fail determination. A pass or fail determination shall be made for each applicable test mode based on a comparison of the short test standards contained in Appendix C to this regulation, and the measured value for HC and CO as described in paragraph (a)(1) of this section. A vehicle shall pass the test mode if any pair of simultaneous values for HC and CO are below or equal to the applicable short test standards. A vehicle shall fail the test mode if the values for either HC or CO, or both, in all simultaneous pairs of values are above the applicable standards.

(3) Void test conditions. The test shall immediately end and any exhaust gas measurements shall be voided if the measured concentration of CO plus CO<sub>2</sub> falls below six percent or the vehicle's engine stalls at any time during the test sequence.

(4) Multiple exhaust pipes. Exhaust gas concentrations from vehicle engines equipped with multiple exhaust pipes shall be sampled simultaneously.

(5) The test shall be immediately terminated upon reaching the overall maximum test time.



(b) Test sequence. (1) The test sequence shall consist of a first-chance test and a second-chance test as follows:

(i) The first-chance test, as described under paragraph (c) of this section, shall consist of an idle mode followed by a high-speed mode.

(ii) The second-chance high-speed mode, as described under paragraph (c) of this section, shall immediately follow the first-chance high-speed mode. It shall be performed only if the vehicle fails the first-chance test. The second-chance idle mode, as described under paragraph (d) of this section, shall follow the second-chance high-speed mode and be performed only if the vehicle fails the idle mode of the first-chance test.

(2) The test sequence shall begin only after the following requirements are met:

(i) The vehicle shall be tested in as-received condition with the transmission in neutral or park and all accessories turned off. The engine shall be at normal operating temperature (as indicated by a temperature gauge, temperature lamp, touch test on the radiator hose, or other visual observation for overheating).

(ii) The tachometer shall be attached to the vehicle in accordance with the analyzer manufacturer's instructions.

(iii) The sample probe shall be inserted into the vehicle's tailpipe to a minimum depth of 10 inches. If the vehicle's exhaust system prevents insertion to this depth, a tailpipe extension shall be used.

(iv) The measured concentration of CO plus CO<sub>2</sub> shall be greater than or equal to six percent.

(c) First-chance test and second-chance high-speed mode. The test timer shall start (tt=0) when the conditions specified in paragraph (b)(2) of this section are met. The first-chance test and second-chance high-speed mode shall have an overall maximum test time of 425 seconds (tt=425). The first-chance test shall consist of an idle mode followed immediately by a high-speed mode. This is followed immediately by an additional second-chance high-speed mode, if necessary.

(1) First-chance idle mode. (i) The mode timer shall start (mt=0) when the vehicle engine speed is between 350 and 1100 rpm. If engine speed exceeds 1100 rpm or falls below 350 rpm, the mode timer shall reset to zero and resume timing. The minimum idle mode length shall be determined as described in paragraph (c)(1)(ii) of this section. The maximum idle mode length shall be 90 seconds elapsed time (mt=90).

(ii) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode terminated as follows:

(A) The vehicle shall pass the idle mode and the mode shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(B) The vehicle shall pass the idle mode and the mode shall be terminated at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (c)(1)(ii)(A) of this section are

not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(C) The vehicle shall pass the idle mode and the mode shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 90 seconds (mt=90), the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(D) The vehicle shall fail the idle mode and the mode shall be terminated if none of the provisions of paragraphs (c)(1)(ii)(A), (B), and (C) of this section is satisfied by an elapsed time of 90 seconds (mt=90). Alternatively, the vehicle may be failed if the provisions of paragraphs (c)(2)(i) and (ii) are not met within an elapsed time of 30 seconds.

(E) Optional. The vehicle may fail the first-chance test and the second-chance test shall be omitted if no exhaust gas concentration less than 1800 ppm HC is found by an elapsed time of 30 seconds (mt=30).

(2) First-chance and second-chance high-speed modes. This mode includes both the first-chance and second-chance high-speed modes, and follows immediately upon termination of the first-chance idle mode.

(i) The mode timer shall reset (mt=0) when the vehicle engine speed is between 2200 and 2800 rpm. If engine speed falls below 2200 rpm or exceeds 2800 rpm for more than two seconds in one excursion, or more than six seconds over all excursions within 30 seconds of the final measured value used in the pass/fail determination, the measured value shall be invalidated and the mode continued. If any excursion lasts for more than ten seconds, the mode timer shall reset to zero (mt=0) and timing resumed. The minimum high-speed mode length shall be determined as described under paragraphs (c)(2)(ii) and (iii) of this section. The maximum high-speed mode length shall be 180 seconds elapsed time (mt=180).

(ii) Ford Motor Company and Honda vehicles. For 1981-1986 model year Ford Motor Company vehicles and 1984-1985 model year Honda Preludes, the pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10) using the following procedure. This procedure should not be used for other vehicles.

(A) A pass or fail determination, as described below, shall be used, for vehicles that passed the idle mode, to determine whether the high-speed test should be terminated prior to or at the end of an elapsed time of 180 seconds (mt=180).

(1) The vehicle shall pass the high-speed mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), the measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(2) The vehicle shall pass the high-speed mode and the test shall be terminated at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (c)(2)(ii)(A)(1) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(3) The vehicle shall pass the high-speed mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 180 seconds (mt=180), the measured

values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(4) Restart. If at an elapsed time of 90 seconds (mt=90) the measured values are greater than the applicable short test standards as described in paragraph (a)(2) of this section, the vehicle's engine shall be shut off for not more than 10 seconds after returning to idle and then shall be restarted. The probe may be removed from the tailpipe or the sample pump turned off if necessary to reduce analyzer fouling during the restart procedure. The mode timer will stop upon engine shut off (mt=90) and resume upon engine restart. The pass/fail determination shall resume as follows after 100 seconds have elapsed (mt=100).

(i) The vehicle shall pass the high-speed mode and the test shall be immediately terminated if, at any point between an elapsed time of 100 seconds (mt=100) and 180 seconds (mt=180), the measured values are less than or equal to the applicable short test standards described in paragraph (a)(2) of this section.

(ii) The vehicle shall fail the high-speed mode and the test shall be terminated if paragraph (c)(2)(ii)(A)(4)(i) of this section is not satisfied by an elapsed time of 180 seconds (mt=180).

(B) A pass or fail determination shall be made for vehicles that failed the idle mode and the high-speed mode terminated at the end of an elapsed time of 180 seconds (mt=180) as follows:

(1) The vehicle shall pass the high-speed mode and the mode shall be terminated at an elapsed time of 180 seconds (mt=180) if any measured values of HC and CO exhaust gas concentrations during the high-speed mode are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(2) Restart. If at an elapsed time of 90 seconds (mt=90) the measured values of HC and CO exhaust gas concentrations during the high-speed mode are greater than the applicable short test standards as described in paragraph (a)(2) of this section, the vehicle's engine shall be shut off for not more than 10 seconds after returning to idle and then shall be restarted. The probe may be removed from the tailpipe or the sample pump turned off if necessary to reduce analyzer fouling during the restart procedure. The mode timer will stop upon engine shut off (mt=90) and resume upon engine restart. The pass/fail determination shall resume as follows after 100 seconds have elapsed (mt=100).

(i) The vehicle shall pass the high-speed mode and the mode shall be terminated at an elapsed time of 180 seconds (mt=180) if any measured values of HC and CO exhaust gas concentrations during the high-speed mode are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(ii) The vehicle shall fail the high-speed mode and the test shall be terminated if paragraph (c)(2)(ii)(B)(2)(i) of this section is not satisfied by an elapsed time of 180 seconds (mt=180).

(iii) All Other Light-Duty Motor Vehicles. The pass/fail analysis for vehicles not specified in paragraph (c)(2)(ii) of this section shall begin after an elapsed time of 10 seconds (mt=10) using the following procedure.

(A) A pass or fail determination, as described below, shall be used for vehicles that passed the idle mode, to determine whether the high-speed mode should be terminated prior to or at the end of an elapsed time of 180 seconds (mt=180).

(1) The vehicle shall pass the high-speed mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), any measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(2) The vehicle shall pass the high-speed mode and the test shall be terminated at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (c)(2)(iii)(A)(1) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(3) The vehicle shall pass the high-speed mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 180 seconds (mt=180), the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(4) The vehicle shall fail the high-speed mode and the test shall be terminated if none of the provisions of paragraphs (c)(2)(iii)(A)(1), (2), and (3) of this section is satisfied by an elapsed time of 180 seconds (mt=180).

(B) A pass or fail determination shall be made for vehicles that failed the idle mode and the high-speed mode terminated at the end of an elapsed time of 180 seconds (mt=180) as follows:

(1) The vehicle shall pass the high-speed mode and the mode shall be terminated at an elapsed time of 180 seconds (mt=180) if any measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(2) The vehicle shall fail the high-speed mode and the test shall be terminated if paragraph (c)(2)(iii)(B)(1) of this section is not satisfied by an elapsed time of 180 seconds (mt=180).

(d) Second-chance idle mode. If the vehicle fails the first-chance idle mode and passes the high-speed mode, the test timer shall reset to zero (tt=0) and a second-chance idle mode shall commence. The second-chance idle mode shall have an overall maximum test time of 145 seconds (tt=145). The test shall consist of an idle mode only.

(1) The engines of 1981-1986 Ford Motor Company vehicles and 1984-1985 Honda Preludes shall be shut off for not more than 10 seconds and restarted. The probe may be removed from the tailpipe or the sample pump turned off if necessary to reduce analyzer fouling during the restart procedure. This procedure should not be used for other vehicles.

(2) The mode timer shall start (mt=0) when the vehicle engine speed is between 350 and 1100 rpm. If the engine speed exceeds 1100 rpm or falls below 350 rpm the mode timer shall reset to zero and resume timing. The minimum second-chance idle mode length shall be determined as described in paragraph (d)(3) of this section. The maximum second-chance idle mode length shall be 90 seconds elapsed time (mt=90).

(3) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the second-chance idle mode shall be terminated as follows:

(i) The vehicle shall pass the second-chance idle mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), any measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(ii) The vehicle shall pass the second-chance idle mode and the test shall be terminated at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (d)(3)(i) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(iii) The vehicle shall pass the second-chance idle mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 90 seconds (mt=90), the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(iv) The vehicle shall fail the second-chance idle mode and the test shall be terminated if none of the provisions of paragraphs (d)(3)(i), (ii), and (iii) of this section is satisfied by an elapsed time of 90 seconds (mt=90).

.c4.(III) Loaded Test.

(a) General requirements. (1) Exhaust gas sampling algorithm. The analysis of exhaust gas concentrations shall begin 10 seconds after the applicable test mode begins. Exhaust gas concentrations shall be analyzed at a minimum rate of two times per second. The measured value for pass/fail determinations shall be a simple running average of the measurements taken over five seconds.

(2) Pass/fail determination. A pass or fail determination shall be made for each applicable test mode based on a comparison of the short test standards contained in Appendix C to this subpart and the measured value for HC and CO as described in paragraph (a)(1) of this section. A vehicle shall pass the test mode if any pair of simultaneous values for HC and CO are below or equal to the applicable short test standards. A vehicle shall fail the test mode if the values for either HC or CO, or both, in all simultaneous pairs of values are above the applicable standards.

(3) Void test conditions. The test shall immediately end and any exhaust gas measurements shall be voided if the measured concentration of CO plus CO<sub>2</sub> falls below six percent or the vehicle's engine stalls at any time during the test sequence.

(4) Multiple exhaust pipes. Exhaust gas concentrations from vehicle engines equipped with multiple exhaust pipes shall be sampled simultaneously.

(5) The test shall be immediately terminated upon reaching the overall maximum test time.

(b) Test sequence. (1) The test sequence shall consist of a loaded mode using a chassis dynamometer followed immediately by an idle mode as described under paragraphs (c)(1) and (2) of this section.

(2) The test sequence shall begin only after the following requirements are met:

(i) The dynamometer shall be warmed up, in stabilized operating condition, adjusted, and calibrated in accordance with the procedures of Appendix A to this subpart. Prior to each test, variable-curve dynamometers shall be checked for proper setting of the road-load indicator or road-load controller.

(ii) The vehicle shall be tested in as-received condition with all accessories turned off. The engine shall be at normal operating temperature (as indicated by a temperature gauge, temperature lamp, touch test on the radiator hose, or other visual observation for overheating).

(iii) The vehicle shall be operated during each mode of the test with the gear selector in the following position:

(A) In drive for automatic transmissions and in second (or third if more appropriate) for manual transmissions for the loaded mode;

(B) In park or neutral for the idle mode.

(iv) The tachometer shall be attached to the vehicle in accordance with the analyzer manufacturer's instructions.

(v) The sample probe shall be inserted into the vehicle's tailpipe to a minimum depth of 10 inches. If the vehicle's exhaust system prevents insertion to this depth, a tailpipe extension shall be used.

(vi) The measured concentration of CO plus CO<sub>2</sub> shall be greater than or equal to six percent.

(c) Overall test procedure. The test timer shall start (tt=0) when the conditions specified in paragraph (b)(2) of this section are met and the mode timer initiates as specified in paragraph (c)(1) of this section. The test sequence shall have an overall maximum test time of 240 seconds (tt=240). The test shall be immediately terminated upon reaching the overall maximum test time.

(1) Loaded mode. (i) The mode timer shall start (mt=0) when the dynamometer speed is within the limits specified for the vehicle engine size according to the following schedule.

#### DYNAMOMETER TEST SCHEDULE

<u>Gasoline engine size (cylinders)</u>	<u>Roll Speed (mph)</u>	<u>Normal Loading (brake horsepower)</u>
4 or less	22-25	2.8-4.1
5-6	29-32	6.8-8.4
7 or more	32-35	8.4-10.8

If the dynamometer speed falls outside the limits for more than five seconds in one excursion, or 15 seconds over all excursions, the mode timer shall reset to zero and resume timing. The minimum mode length shall be determined as described in paragraph (c)(1)(ii) of this section. The maximum mode length shall be 90 seconds elapsed time (mt=90).

(ii) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(A) The vehicle shall pass the loaded mode and the mode shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 90 seconds (mt=90), measured values are less than or equal to the applicable short test standards described in paragraph (a)(2) of this section.

(B) The vehicle shall fail the loaded mode and the mode shall be terminated if paragraph (c)(1)(ii)(A) of this section is not satisfied by an elapsed time of 90 seconds (mt=90).

(C) Optional. The vehicle may fail the loaded mode and any subsequent idle mode shall be omitted if no exhaust gas concentration less than 1800 ppm HC is found by an elapsed time of 30 seconds (mt=30).

(2) Idle mode. (i) The mode timer shall start (mt=0) when the dynamometer speed is zero and the vehicle engine speed is between 350 and 1100 rpm. If engine speed exceeds 1100 rpm or falls below 350 rpm, the mode timer shall reset to zero and resume timing. The minimum idle mode length shall be determined as described in paragraph (c)(2)(ii) of this section. The maximum idle mode length shall be 90 seconds elapsed time (mt=90).

(ii) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(A) The vehicle shall pass the idle mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(B) The vehicle shall pass the idle mode and the test shall be terminated at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (c)(2)(ii)(A) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(C) The vehicle shall pass the idle mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 90 seconds (mt=90), measured values are less than or equal to the applicable short test standards described in paragraph (a)(2) of this section.

(D) The vehicle shall fail the idle mode and the test shall be terminated if none of the provisions of paragraphs (c)(2)(ii)(A), (c)(2)(ii)(B), and (c)(2)(ii)(C) of this section is satisfied by an elapsed time of 90 seconds (mt=90).

#### .c4.(IV) Preconditioned Idle Test.

(a) General requirements. (1) Exhaust gas sampling algorithm. The analysis of exhaust gas concentrations shall begin 10 seconds after the applicable test mode begins. Exhaust gas concentrations shall be analyzed at a minimum rate of two times per second. The measured value for pass/fail determinations shall be a simple running average of the measurements taken over five seconds.

(2) Pass/fail determination. A pass or fail determination shall be made for each applicable test mode based on a comparison of the short test standards contained in Appendix C to this regulation, and the measured value for HC and CO as described in paragraph (a)(1) of this section. A vehicle shall pass the test mode if any pair of simultaneous values for HC and CO are below or equal to the applicable short test standards. A vehicle shall fail the test mode if the values for either HC or CO, or both, in all simultaneous pairs of values are above the applicable standards.

(3) Void test conditions. The test shall immediately end and any exhaust gas measurements shall be voided if the measured concentration of CO plus CO<sub>2</sub> falls below six percent or the vehicle's engine stalls at any time during the test sequence.

(4) Multiple exhaust pipes. Exhaust gas concentrations from vehicle engines equipped with multiple exhaust pipes shall be sampled simultaneously.

(5) The test shall be immediately terminated upon reaching the overall maximum test time.

(b) Test sequence. (1) The test sequence shall consist of a first-chance test and a second-chance test as follows:

(i) The first-chance test, as described under paragraph (c) of this section, shall consist of a preconditioning mode followed by an idle mode.

(ii) The second-chance test as described under paragraph (d) of this section shall be performed only if the vehicle fails the first-chance test.

(2) The test sequence shall begin only after the following requirements are met:

(i) The vehicle shall be tested in as-received condition with the transmission in neutral or park and all accessories turned off. The engine shall be at normal operating temperature (as indicated by a temperature gauge, temperature lamp, touch test on the radiator hose, or other visual observation for overheating).

(ii) The tachometer shall be attached to the vehicle in accordance with the analyzer manufacturer's instructions.

(iii) The sample probe shall be inserted into the vehicle's tailpipe to a minimum depth of 10 inches. If the vehicle's exhaust system prevents insertion to this depth, a tailpipe extension shall be used.

(iv) The measured concentration of CO plus CO<sub>2</sub> shall be greater than or equal to six percent.

(c) First-chance test. The test timer shall start (tt=0) when the conditions specified in paragraph (b)(2) of this section are met. The test shall have an overall maximum test time of 200 seconds (tt=200). The first-chance test shall consist of a preconditioning mode followed immediately by an idle mode.

(1) Preconditioning mode. The mode timer shall start (mt=0) when the engine speed is between 2200 and 2800 rpm. The mode shall continue for an elapsed time of 30 seconds (mt=30). If engine speed falls below 2200 rpm or exceeds 2800 rpm for more than five seconds in any one excursion, or 15 seconds over all excursions, the mode timer shall reset to zero and resume timing.



(2) Idle mode. (i) The mode timer shall start (mt=0) when the vehicle engine speed is between 350 and 1100 rpm. If engine speed exceeds 1100 rpm or falls below 350 rpm, the mode timer shall reset to zero and resume timing. The minimum idle mode length shall be determined as described in paragraph (c)(2)(ii) of this section. The maximum idle mode length shall be 90 seconds elapsed time (mt=90).

(ii) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(A) The vehicle shall pass the idle mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(B) The vehicle shall pass the idle mode and the test shall be terminated at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (c)(2)(ii)(A) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(C) The vehicle shall pass the idle mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 90 seconds (mt=90), measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(D) The vehicle shall fail the idle mode and the test shall be terminated if none of the provisions of paragraphs (c)(2)(ii)(A), (B), and (C) of this section is satisfied by an elapsed time of 90 seconds (mt=90). Alternatively, the vehicle may be failed if the provisions of paragraphs (c)(2)(i) and (ii) are not met within an elapsed time of 30 seconds.

(E) Optional. The vehicle may fail the first-chance test and the second-chance test shall be omitted if no exhaust gas concentration less than 1800 ppm HC is found at an elapsed time of 30 seconds (mt=30).

(d) Second-chance test. If the vehicle fails the first-chance test, the test timer shall reset to zero and a second-chance test shall be performed. The second-chance test shall have an overall maximum test time of 425 seconds. The test shall consist of a preconditioning mode followed immediately by an idle mode.

(1) Preconditioning mode. The mode timer shall start (mt=0) when engine speed is between 2200 and 2800 rpm. The mode shall continue for an elapsed time of 180 seconds (mt=180). If the engine speed falls below 2200 rpm or exceeds 2800 rpm for more than five seconds in any one excursion, or 15 seconds over all excursions, the mode timer shall reset to zero and resume timing.

(2) Idle mode. (i) Ford Motor Company and Honda vehicles. The engines of 1981-1986 Ford Motor Company vehicles and 1984-1985 Honda Preludes shall be shut off for not more than 10 seconds and then shall be restarted. The probe may be removed from the tailpipe or the sample pump turned off if necessary to reduce analyzer fouling during the restart procedure. This procedure should not be used for other vehicles.

(ii) The mode timer shall start (mt=0) when the vehicle engine speed is between 350 and 1100 rpm. If the engine speed exceeds 1100 rpm or falls below 350 rpm, the mode timer shall reset to zero

and resume timing. The minimum idle mode length shall be determined as described in paragraph (d)(2)(iii) of this section. The maximum idle mode length shall be 90 seconds elapsed time (mt=90).

(iii) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(A) The vehicle shall pass the idle mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(B) The vehicle shall pass the idle mode and the test shall be terminated at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (d)(2)(iii)(A) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(C) The vehicle shall pass the idle mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 90 seconds (mt=90), measured values are less than or equal to the applicable short test standards described in paragraph (a)(2) of this section.

(D) The vehicle shall fail the idle mode and the test shall be terminated if none of the provisions of paragraphs (d)(2)(iii)(A), (B), and (C) of this section is satisfied by an elapsed time of 90 seconds (mt=90).

.c4.(V) Idle Test with Loaded Preconditioning.

(a) General requirements. (1) Exhaust gas sampling algorithm. The analysis of exhaust gas concentrations shall begin 10 seconds after the applicable test mode begins. Exhaust gas concentrations shall be analyzed at a minimum rate of two times per second. The measured value for pass/fail determinations shall be a simple running average of the measurements taken over five seconds.

(2) Pass/fail determination. A pass or fail determination shall be made for each applicable test mode based on a comparison of the short test standards contained in Appendix C to this subpart, and the measured value for HC and CO as described in paragraph (a)(1) of this section. A vehicle shall pass the test mode if any pair of simultaneous values for HC and CO are below or equal to the applicable short test standards. A vehicle shall fail the test mode if the values for either HC or CO, or both, in all simultaneous pairs of values are above the applicable standards.

(3) Void test conditions. The test shall immediately end and any exhaust gas measurements shall be voided if the measured concentration of CO plus CO<sub>2</sub> falls below six percent or the vehicle's engine stalls at any time during the test sequence.

(4) Multiple exhaust pipes. Exhaust gas concentrations from vehicle engines equipped with multiple exhaust pipes shall be sampled simultaneously.

(5) The test shall be immediately terminated upon reaching the overall maximum test time.

(b) Test sequence. (1) The test sequence shall consist of a first-chance test and a second-chance test as follows:

(i) The first-chance test, as described under paragraph (c) of this section, shall consist of an idle mode.

(ii) The second-chance test as described under paragraph (d) of this section shall be performed only if the vehicle fails the first-chance test.

(2) The test sequence shall begin only after the following requirements are met:

(i) The dynamometer shall be warmed up, in stabilized operating condition, adjusted, and calibrated in accordance with the procedures of Appendix A to this regulation. Prior to each test, variable-curve dynamometers shall be checked for proper setting of the road-load indicator or road-load controller.

(ii) The vehicle shall be tested in as-received condition with all accessories turned off. The engine shall be at normal operating temperature (as indicated by a temperature gauge, temperature lamp, touch test on the radiator hose, or other visual observation for overheating).

(iii) The vehicle shall be operated during each mode of the test with the gear selector in the following position:

(A) In drive for automatic transmissions and in second (or third if more appropriate) for manual transmissions for the loaded preconditioning mode;

(B) In park or neutral for the idle mode.

(iv) The tachometer shall be attached to the vehicle in accordance with the analyzer manufacturer's instructions.

(v) The sample probe shall be inserted into the vehicle's tailpipe to a minimum depth of 10 inches. If the vehicle's exhaust system prevents insertion to this depth, a tailpipe extension shall be used.

(vi) The measured concentration of CO plus CO<sub>2</sub> shall be greater than or equal to six percent.

(c) First-chance test. The test timer shall start (tt=0) when the conditions specified in paragraph (b)(2) of this section are met. The test shall have an overall maximum test time of 155 seconds (tt=155). The first-chance test shall consist of an idle mode only.

(1) The mode timer shall start (mt=0) when the vehicle engine speed is between 350 and 1100 rpm. If the engine speed exceeds 1100 rpm or falls below 350 rpm, the mode timer shall reset to zero and resume timing. The minimum mode length shall be determined as described in paragraph (c)(2) of this section. The maximum mode length shall be 90 seconds elapsed time (mt=90).

(2) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(i) The vehicle shall pass the idle mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(ii) The vehicle shall pass the idle mode and the test shall be terminated at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (c)(2)(i) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(iii) The vehicle shall pass the idle mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 90 seconds (mt=90), the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(iv) The vehicle shall fail the idle mode and the test shall be terminated if none of the provisions of paragraphs (c)(2)(i), (ii), and (iii) of this section is satisfied by an elapsed time of 90 seconds (mt=90). Alternatively, the vehicle may be failed if the provisions of paragraphs (c)(2)(i) and (ii) are not met within an elapsed time of 30 seconds.

(v) Optional. The vehicle may fail the first-chance test and the second-chance test shall be omitted if no exhaust gas concentration less than 1800 ppm HC is found at an elapsed time of 30 seconds (mt=30).

(d) Second-chance test. If the vehicle fails the first-chance test, the test timer shall reset to zero (tt=0) and a second-chance test shall be performed. The second-chance test shall have an overall maximum test time of 200 seconds (tt=200). The test shall consist of a preconditioning mode using a chassis dynamometer, followed immediately by an idle mode.

(1) Preconditioning mode. The mode timer shall start (mt=0) when the dynamometer speed is within the limits specified for the vehicle engine size in accordance with the following schedule.

#### DYNAMOMETER TEST SCHEDULE

<u>Gasoline engine size (cylinders)</u>	<u>Roll Speed (mph)</u>	<u>Normal Loading (brake horsepower)</u>
4 or less	22-25	2.8-4.1
5-6	29-32	6.8-8.4
7 or more	32-35	8.4-10.8

The mode shall continue for a minimum elapsed time of 30 seconds (mt=30). If the dynamometer speed falls outside the limits for more than five seconds in one excursion, or 15 seconds over all excursions, the mode timer shall reset to zero and resume timing.

(2) Idle mode. (i) The mode timer shall start (mt=0) when the dynamometer speed is zero and the vehicle engine speed is between 350 and 1100 rpm. If the engine speed exceeds 1100 rpm or falls below 350 rpm, the mode timer shall reset to zero and resume timing. The minimum idle mode length shall be determined as described in paragraph (d)(2)(ii) of this section. The maximum idle mode length shall be 90 seconds elapsed time (mt=90).

(ii) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(A) The vehicle shall pass the idle mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(B) The vehicle shall pass the idle mode and the test shall be terminated at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (d)(2)(ii)(A) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(C) The vehicle shall pass the idle mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 90 seconds (mt=90), measured values are less than or equal to the applicable short test standards described in paragraph (a)(2) of this section.

(D) The vehicle shall fail the idle mode and the test shall be terminated if none of the provisions of paragraphs (d)(2)(ii)(A), (B), and (C) of this section is satisfied by an elapsed time of 90 seconds (mt=90).

.c4.(VI) Preconditioned Two Speed Idle Test.

(a) General requirements. (1) Exhaust gas sampling algorithm. The analysis of exhaust gas concentrations shall begin 10 seconds after the applicable test mode begins. Exhaust gas concentrations shall be analyzed at a minimum rate of two times per second. The measured value for pass/fail determinations shall be a simple running average of the measurements taken over five seconds.

(2) Pass/fail determination. A pass or fail determination shall be made for each applicable test mode based on a comparison of the short test standards contained in Appendix C to this subpart, and the measured value for HC and CO as described in paragraph (a)(1) of this section. A vehicle shall pass the test mode if any pair of simultaneous values for HC and CO are below or equal to the applicable short test standards. A vehicle shall fail the test mode if the values for either HC or CO, or both, in all simultaneous pairs of values are above the applicable standards.

(3) Void test conditions. The test shall immediately end and any exhaust gas measurements shall be voided if the measured concentration of CO plus CO<sub>2</sub> falls below six percent or the vehicle's engine stalls at any time during the test sequence.

(4) Multiple exhaust pipes. Exhaust gas concentrations from vehicle engines equipped with multiple exhaust pipes shall be sampled simultaneously.

(5) The test shall be immediately terminated upon reaching the overall maximum test time.

(b) Test sequence. (1) The test sequence shall consist of a first-chance test and a second-chance test as follows:

(i) The first-chance test, as described under paragraph (c) of this section, shall consist of a first-chance high-speed mode followed immediately by a first-chance idle mode.

(ii) The second-chance test as described under paragraph (d) of this section shall be performed only if the vehicle fails the first-chance test.

(2) The test sequence shall begin only after the following requirements are met:

(i) The vehicle shall be tested in as-received condition with the transmission in neutral or park and all accessories turned off. The engine shall be at normal operating temperature (as indicated by a temperature gauge, temperature lamp, touch test on the radiator hose, or other visual observation for overheating).

(ii) The tachometer shall be attached to the vehicle in accordance with the analyzer manufacturer's instructions.

(iii) The sample probe shall be inserted into the vehicle's tailpipe to a minimum depth of 10 inches. If the vehicle's exhaust system prevents insertion to this depth, a tailpipe extension shall be used.

(iv) The measured concentration of CO plus CO<sub>2</sub> shall be greater than or equal to six percent.

(c) First-chance test. The test timer shall start (tt=0) when the conditions specified in paragraph (b)(2) of this section are met. The test shall have an overall maximum test time of 290 seconds (tt=290). The first-chance test shall consist of an high-speed mode followed immediately by an idle mode.

(1) First-chance high-speed mode. (i) The mode timer shall reset (mt=0) when the vehicle engine speed is between 2200 and 2800 rpm. If the engine speed falls below 2200 rpm or exceeds 2800 rpm for more than two seconds in one excursion, or more than six seconds over all excursions within 30 seconds of the final measured value used in the pass/fail determination, the measured value shall be invalidated and the mode continued. If any excursion lasts for more than ten seconds, the mode timer shall reset to zero (mt=0) and timing resumed. The high-speed mode length shall be 90 seconds elapsed time (mt=90).

(ii) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(A) The vehicle shall pass the high-speed mode and the mode shall be terminated at an elapsed time of 90 seconds (mt=90) if any measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(B) The vehicle shall fail the high-speed mode and the mode shall be terminated if the requirements of paragraph (c)(1)(ii)(A) of this section are not satisfied by an elapsed time of 90 seconds (mt=90).

(C) Optional. The vehicle shall fail the first-chance test and any subsequent test shall be omitted if no exhaust gas concentration lower than 1800 ppm HC is found at an elapsed time of 30 seconds (mt=30).

(2) First-chance idle mode. (i) The mode timer shall start (mt=0) when the vehicle engine speed is between 350 and 1100 rpm. If the engine speed exceeds 1100 rpm or falls below 350 rpm, the mode timer shall reset to zero and resume timing. The minimum first-chance idle mode length shall be determined as described in paragraph (c)(2)(ii) of this section. The maximum first-chance idle mode length shall be 90 seconds elapsed time (mt=90).

(ii) The pass/fail analysis shall begin after an elapsed time of 10 seconds ( $mt=10$ ). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(A) The vehicle shall pass the idle mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds ( $mt=30$ ), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(B) The vehicle shall pass the idle mode and the test shall be terminated at the end of an elapsed time of 30 seconds ( $mt=30$ ) if, prior to that time, the criteria of paragraph (c)(2)(ii)(A) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(C) The vehicle shall pass the idle mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds ( $mt=30$ ) and 90 seconds ( $mt=90$ ), the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(D) The vehicle shall fail the idle mode and the test shall be terminated if none of the provisions of paragraphs (c)(2)(ii)(A), (B), and (C) of this section is satisfied by an elapsed time of 90 seconds ( $mt=90$ ). Alternatively, the vehicle may be failed if the provisions of paragraphs (c)(2)(i) and (ii) are not met within an elapsed time of 30 seconds.

(d) Second-chance test. (1) If the vehicle fails either mode of the first-chance test, the test timer shall reset to zero ( $tt=0$ ) and a second-chance test shall commence. The second-chance test shall be performed based on the first-chance test failure mode or modes as follows:

(A) If the vehicle failed only the first-chance high-speed mode, the second-chance test shall consist of a second-chance high-speed mode as described in paragraph (d)(2) of this section. The overall maximum test time shall be 280 seconds ( $tt=280$ ).

(B) If the vehicle failed only the first-chance idle mode, the second-chance test shall consist of a second-chance pre-conditioning mode followed immediately by a second-chance idle mode as described in paragraphs (d)(3) and (4) of this section. The overall maximum test time shall be 425 seconds ( $tt=425$ ).

(C) If both the first-chance high-speed mode and first-chance idle mode were failed, the second-chance test shall consist of the second-chance high-speed mode followed immediately by the second-chance idle mode as described in paragraphs (d)(2) and (4). However, if during this second-chance procedure the vehicle fails the second-chance high-speed mode, then the second-chance idle mode may be eliminated. The overall maximum test time shall be 425 seconds ( $tt=425$ ).

(2) Second-chance high-speed mode. (i) Ford Motor Company and Honda vehicles. The engines of 1981-1986 Ford Motor Company vehicles and 1984-1985 Honda Preludes shall be shut off for not more than 10 seconds and then shall be restarted. The probe may be removed from the tailpipe or the sample pump turned off if necessary to reduce analyzer fouling during the restart procedure. This procedure should not be used for other vehicles.

(ii) The mode timer shall reset ( $mt=0$ ) when the vehicle engine speed is between 2200 and 2800 rpm. If the engine speed falls below 2200 rpm or exceeds 2800 rpm for more than two seconds in one excursion, or more than six seconds over all excursions within 30 seconds of the final measured value

used in the pass/fail determination, the measured value shall be invalidated and the mode continued. The minimum second-chance high-speed mode length shall be determined as described in paragraphs (d)(2)(iii) and (iv) of this section. If any excursion lasts for more than ten seconds, the mode timer shall reset to zero (mt=0) and timing resumed. The maximum second-chance high-speed mode length shall be 180 seconds elapsed time (mt=180).

(iii) In the case where the second-chance high-speed mode is not followed by the second-chance idle mode, the pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(A) The vehicle shall pass the high-speed mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(B) The vehicle shall pass the high-speed mode and the test shall be terminated if at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (d)(2)(iii)(A) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(C) The vehicle shall pass the high-speed mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 180 seconds (mt=180), the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(D) The vehicle shall fail the high-speed mode and the test shall be terminated if none of the provisions of paragraphs (d)(2)(iii)(A), (B), and (C) of this section is satisfied by an elapsed time of 180 seconds (mt=180).

(iv) In the case where the second-chance high-speed mode is followed by the second-chance idle mode, the pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(A) The vehicle shall pass the high-speed mode and the mode shall be terminated at the end of an elapsed time of 180 seconds (mt=180) if any measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(B) The vehicle shall fail the high-speed mode and the mode shall be terminated if paragraph (d)(2)(iv)(A) of this section is not satisfied by an elapsed time of 180 seconds (mt=180).

(3) Second-chance preconditioning mode. The mode timer shall start (mt=0) when engine speed is between 2200 and 2800 rpm. The mode shall continue for an elapsed time of 180 seconds (mt=180). If the engine speed falls below 2200 rpm or exceeds 2800 rpm for more than five seconds in any one excursion, or 15 seconds over all excursions, the mode timer shall reset to zero and resume timing.

(4) Second-chance idle mode. (i) Ford Motor Company and Honda vehicles. The engines of 1981-1986 Ford Motor Company vehicles and 1984-1985 Honda Preludes shall be shut off for not more than 10 seconds and then shall be restarted. The probe may be removed from the tailpipe or the sample pump turned off if necessary to reduce analyzer fouling during the restart procedure. This procedure should not be used for other vehicles.



(ii) The mode timer shall start (mt=0) when the vehicle engine speed is between 350 and 1100 rpm. If the engine speed exceeds 1100 rpm or falls below 350 rpm the mode timer shall reset to zero and resume timing. The minimum second-chance idle mode length shall be determined as described in paragraph (d)(4)(iii) of this section. The maximum second-chance idle mode length shall be 90 seconds elapsed time (mt=90).

(iii) The pass/fail analysis shall begin after an elapsed time of 10 seconds (mt=10). A pass or fail determination shall be made for the vehicle and the mode shall be terminated as follows:

(A) The vehicle shall pass the second-chance idle mode and the test shall be immediately terminated if, prior to an elapsed time of 30 seconds (mt=30), measured values are less than or equal to 100 ppm HC and 0.5 percent CO.

(B) The vehicle shall pass the second-chance idle mode and the test shall be terminated at the end of an elapsed time of 30 seconds (mt=30) if, prior to that time, the criteria of paragraph (d)(4)(iii)(A) of this section are not satisfied, and the measured values are less than or equal to the applicable short test standards as described in paragraph (a)(2) of this section.

(C) The vehicle shall pass the second-chance idle mode and the test shall be immediately terminated if, at any point between an elapsed time of 30 seconds (mt=30) and 90 seconds (mt=90), measured values are less than or equal to the applicable short test standards described in paragraph (a)(2) of this section.

(D) The vehicle shall fail the second-chance idle mode and the test shall be terminated if none of the provisions of paragraphs (d)(4)(iii)(A), (B), and (C) of this section is satisfied by an elapsed time of 90 seconds (mt=90).

## Appendix C Steady-State Short Test Standards

### .c4.(I) Short Test Standards for 1981 and Later Model Year Light-duty Vehicles.

For 1981 and later model year light-duty vehicles for which any of the test procedures described Appendix B to this subpart are utilized to establish Emissions Performance Warranty eligibility (i.e., 1981 and later model year light-duty vehicles at low altitude and 1982 and later model year vehicles at high altitude to which high altitude certification standards of 1.5 gpm HC and 15 gpm CO or less apply), short test emissions for all tests and test modes shall not exceed:

- (1) Hydrocarbons: 220 ppm as hexane.
- (2) Carbon monoxide: 1.2%.

### .c4.(II) Short Test Standards for 1981 and Later Model Year Light-duty Trucks.

For 1981 and later model year light-duty trucks for which any of the test procedures described in Appendix B to this subpart are utilized to establish Emissions Performance Warranty eligibility (i.e., 1981 and later model year light-duty trucks at low altitude and 1982 and later model year trucks at high altitude to which high altitude certification standards of 2.0 gpm HC and 26 gpm CO or less apply), short test emissions for all tests and test modes shall not exceed:

- (1) Hydrocarbons: 220 ppm as hexane.
- (2) Carbon monoxide: 1.2%.

## Appendix D Steady-State Short Test Equipment

### .c4.(I)Steady-State Test Exhaust Analysis System.

(a) Sampling System. (1) General requirements. The sampling system for steady-state short tests shall, at a minimum, consist of a tailpipe probe, a flexible sample line, a water removal system, particulate trap, sample pump, flow control components, tachometer or dynamometer, analyzers for HC, CO, and CO<sub>2</sub>, and digital displays for exhaust concentrations of HC, CO, and CO<sub>2</sub>, and engine rpm. Materials that are in contact with the gases sampled shall not contaminate or change the character of the gases to be analyzed, including gases from alcohol fueled vehicles. The probe shall be capable of being inserted to a depth of at least ten inches into the tailpipe of the vehicle being tested, or into an extension boot if one is used. A digital display for dynamometer speed and load shall be included if the test procedures described in Appendix B to this subpart, section 3 or 5, are conducted. Minimum specifications for optional NO and O<sub>2</sub> analyzers are also described in this section. The analyzer system shall be able to test, as specified in at least one section in Appendix B to this subpart, all model vehicles in service at the time of sale of the analyzer.

(2) Temperature Operating Range. The sampling system and all associated hardware shall be of a design certified to operate within the performance specifications described in paragraph (b) in ambient air temperatures ranging from 41 to 110 degrees Fahrenheit. The analyzer system shall, where necessary, include features to keep the sampling system within the specified range.

(3) Humidity Operating Range. The sampling system and all associated hardware shall be of a design certified to operate within the performance specifications described in paragraph (b) at a minimum of 80 percent relative humidity throughout the required temperature range.

(4) Barometric Pressure Compensation. Barometric pressure compensation shall be provided. Compensation shall be made for elevations up to 6000 feet (above mean sea level). At any given altitude and ambient conditions specified in (2) and (3), errors due to barometric pressure changes of  $\pm 2$  inches of mercury shall not exceed the accuracy limits specified in paragraph (b).

(5) Dual Sample Probe Requirements. When testing a vehicle with dual exhaust pipes, a dual sample probe of a design certified by the analyzer manufacturer to provide equal flow in each leg shall be used. The equal flow requirement is considered to be met if the flow rate in each leg of the probe has been measured under two sample pump flow rates (the normal rate and a rate equal to the onset of low flow), and if the flow rates in each of the legs are found to be equal to each other (within 15% of the flow rate in the leg having lower flow).

(6) System Lockout During Warm-up. Functional operation of the gas sampling unit shall remain disabled through a system lockout until the instrument meets stability and warm-up requirements. The instrument shall be considered "warmed up" when the zero and span readings for HC, CO, and CO<sub>2</sub> have stabilized, within  $\pm 3\%$  of the full range of low scale, for five minutes without adjustment.

(7) Electromagnetic Isolation and Interference. Electromagnetic signals found in an automotive service environment shall not cause malfunctions or changes in the accuracy in the electronics of the analyzer system. The instrument design shall ensure that readings do not vary as a result of electromagnetic radiation and induction devices normally found in the automotive service environment,

including high energy vehicle ignition systems, radio frequency transmission radiation sources, and building electrical systems.

(8) Vibration and Shock Protection. System operation shall be unaffected by the vibration and shock encountered under the normal operating conditions encountered in an automotive service environment.

(9) Propane Equivalency Factor. The propane equivalency factor shall be displayed in a manner that enables it to be viewed conveniently, while permitting it to be altered only by personnel specifically authorized to do so.

(b) Analyzers (1) Accuracy. The analyzers shall be of a design certified to meet the following accuracy requirements when calibrated to the span points specified in Appendix A to this subpart:

<u>Channel</u>	<u>Range</u>	<u>Accuracy</u>	<u>Noise</u>	<u>Repeatability</u>
HC, ppm as hexane	0-400	± 12	6	8
	401-1000	± 30	10	15
	1001-2000	± 80	20	30
CO, %	0-2.00	± 0.06	0.02	0.03
	2.01-5.00	± 0.15	0.06	0.08
	5.01-9.99	± 0.40	0.10	0.15
CO <sub>2</sub> , %	0-4.0	± 0.6	0.2	0.3
	4.1-14.0	± 0.5	0.2	0.3
	14.1-16.0	± 0.6	0.2	0.3
NO, ppm	0-1000	± 32	16	20
	1001-2000	± 60	25	30
	2001-4000	± 120	50	60

(2) Minimum Analyzer Display Resolution. The analyzer electronics shall have sufficient resolution to achieve the following:

HC	1	ppm HC as hexane
CO	0.01	% CO
CO <sub>2</sub>	0.1	% CO <sub>2</sub>
NO	1	ppm NO
RPM	1	rpm

(3) Response Time. The response time from the probe to the display for HC, CO, and CO<sub>2</sub> analyzers shall not exceed eight seconds to 90% of a step change in input. For NO analyzers, the response time shall not exceed twelve seconds to 90% of a step change in input.

(4) Display Refresh Rate. Dynamic information being displayed shall be refreshed at a minimum rate of twice per second.

(5) Interference Effects. The interference effects for non-interest gases shall not exceed  $\pm 10$  ppm for hydrocarbons,  $\pm 0.05$  percent for carbon monoxide,  $\pm 0.20$  percent for carbon dioxide, and  $\pm 20$  ppm for oxides of nitrogen.

(6) Low Flow Indication. The analyzer shall provide an indication when the sample flow is below the acceptable level. The sampling system shall be equipped with a flow meter (or equivalent) that shall indicate sample flow degradation when meter error exceeds three percent of full scale, or causes system response time to exceed 13 seconds to 90 percent of a step change in input, whichever is less.

(7) Engine Speed Detection. The analyzer shall utilize a tachometer capable of detecting engine speed in revolutions per minute (rpm) with a 0.5 second response time and an accuracy of  $\pm 3\%$  of the true rpm.

(8) Test and mode timers. The analyzer shall be capable of simultaneously determining the amount of time elapsed in a test, and in a mode within that test.

(9) Sample rate. The analyzer shall be capable of measuring exhaust concentrations of gases specified in this section at a minimum rate of twice per second.

(c) Demonstration of conformity. The analyzer shall be demonstrated to the satisfaction of the inspection program manager, through acceptance testing procedures, to meet the requirements of this section and that it is capable of being maintained as required in Appendix A to this subpart.

.c4.(II) Steady-State Test Dynamometer.

(a) The chassis dynamometer for steady-state short tests shall provide the following capabilities:

(1) Power absorption. The dynamometer shall be capable of applying a load to the vehicle's driving tire surfaces at the horsepower and speed levels specified in paragraph (b).

(2) Short-term stability. Power absorption at constant speed shall not drift more than  $\pm 0.5$  horsepower (hp) during any single test mode.

(3) Roll weight capacity. The dynamometer shall be capable of supporting a driving axle weight up to four thousand (4,000) pounds or greater.

(4) Between roll wheel lifts. These shall be controllable and capable of lifting a minimum of four thousand (4,000) pounds.

(5) Roll brakes. Both rolls shall be locked when the wheel lift is up.

(6) Speed indications. The dynamometer speed display shall have a range of 0-60 mph, and a resolution and accuracy of at least 1 mph.

(7) Safety interlock. A roll speed sensor and safety interlock circuit shall be provided which prevents the application of the roll brakes and upward lift movement at any roll speed above 0.5 mph.

(b) The dynamometer shall produce the load speed relationships specified in sections 3 and 5 of Appendix B to this regulation.

- (III) Transient Emission Test Equipment. (Reserved)
- (IV) Evaporative System Purge Test Equipment (Reserved)
- (V) Evaporative System Integrity Test Equipment (Reserved)

## Appendix E Transient Test Driving Cycle

(I) Driver's Trace. All excursions in the transient driving cycle shall be evaluated by the procedures defined in §86.115-78(b)(1) and §86.115(c) of this title. Excursions exceeding these limits shall cause a test to be void. In addition, provisions shall be available to utilize cycle validation criteria, as described in §86.1341-90 of this title, for trace speed versus actual speed as a means to determine a valid test.

(II) Driving Cycle. The following table shows the time speed relationship for the transient IM240 test procedure.

Time (sec)	Speed (mph)	Time (sec)	Speed (mph)	Time (sec)	Speed (mph)	Time (sec)	Speed (mph)	Time (sec)	Speed (mph)
0*	0	50	26.7	100	9.9	150	24.9	200	56.7
1	0	51	27.5	101	13.2	151	25	201	56.7
2	0	52	28.6	102	16.5	152	25.4	202	56.3
3	0	53	29.3	103	19.8	153	26	203	56
4	0	54	29.8	104	22.2	154	26	204	55
5	3	55	30.1	105	24.3	155	25.7	205	53.4
6	5.9	56	30.4	106	25.8	156	26.1	206	51.6
7	8.6	57	30.7	107	26.4	157	26.7	207	51.8
8	11.5	58	30.7	108	25.7	158	27.3	208	52.1
9	14.3	59	30.5	109	25.1	159	30.5	209	52.5
10	16.9	60	30.4	110	24.7	160	33.5	210	53
11	17.3	61	30.3	111	25.2	161	36.2	211	53.5
12	18.1	62	30.4	112	25.4	162	37.3	212	54
13	20.7	63	30.8	113	27.2	163	39.3	213	54.9
14	21.7	64	30.4	114	26.5	164	40.5	214	55.4
15	22.4	65	29.9	115	24	165	42.1	215	55.6
16	22.5	66	29.5	116	22.7	166	43.5	216	56
17	22.1	67	29.8	117	19.4	167	45.1	217	56
18	21.5	68	30.3	118	17.7	168	46	218	55.8
19	20.9	69	30.7	119	17.2	169	46.8	219	55.2
20	20.4	70	30.9	120	18.1	170	47.5	220	54.5
21	19.8	71	31	121	18.6	171	47.5	221	53.6
22	17	72	30.9	122	20	172	47.3	222	52.5
23	14.9	73	30.4	123	20.7	173	47.2	223	51.5
24	14.9	74	29.8	124	21.7	174	47.2	224	50.5
25	15.2	75	29.9	125	22.4	175	47.4	225	48
26	15.5	76	30.2	126	22.5	176	47.9	226	44.5
27	16	77	30.7	127	22.1	177	48.5	227	41
28	17.1	78	31.2	128	21.5	178	49.1	228	37.5
29	19.1	79	31.8	129	20.9	179	49.5	229	34
30	21.1	80	32.2	130	20.4	180	50	230	30.5
31	22.7	81	32.4	131	19.8	181	50.6	231	27
32	22.9	82	32.2	132	17	182	51	232	23.5
33	22.7	83	31.7	133	17.1	183	51.5	233	20
34	22.6	84	28.6	134	15.8	184	52.2	234	16.5
35	21.3	85	25.1	135	15.8	185	53.2	235	13
36	19	86	21.6	136	17.7	186	54.1	236	9.5
37	17.1	87	18.1	137	19.8	187	54.6	237	6
38	15.8	88	14.6	138	21.6	188	54.9	238	2.5
39	15.8	89	11.1	139	22.2	189	55	239	0
40	17.7	90	7.6	140	24.5	190	54.9		
41	19.8	91	4.1	141	24.7	191	54.6		
42	21.6	92	0.6	142	24.8	192	54.6		
43	23.2	93	0	143	24.7	193	54.8		
44	24.2	94	0	144	24.6	194	55.1		



45	24.6	95	0	145	24.6	195	55.5
46	24.9	96	0	146	25.1	196	55.7
47	25	97	0	147	25.6	197	56.1
48	25.7	98	3.3	148	25.7	198	56.3
49	26.1	99	6.6	149	25.4	199	56.6