

KERN COUNTY AIR POLLUTION CONTROL DISTRICT

**RULE 427 -- STATIONARY PISTON ENGINES (OXIDES OF NITROGEN)**

*(Adopted 6/1/87) (Amended 10/13/94, 1/25/96, 7/2/98, 7/1/99, 5/4/00, 11/1/01)*

I. **Purpose**

The purpose of this Rule is to limit oxides of nitrogen (NO<sub>x</sub>) emissions from existing stationary piston engines to levels consistent with Reasonably Available Control Technology (RACT) to satisfy California Health & Safety Code, Section 40918 (b) and 1990 Federal Clean Air Act Amendments, Section 182(f). Carbon monoxide emissions are also limited to insure maintenance of efficient combustion at reduced NO<sub>x</sub> levels.

II. **Applicability**

This Rule shall apply, as specified, to all rich-burn, lean-burn, and diesel engines of more than 50 rated brake horsepower.

III. **Definitions**

For purposes of this Rule, the following definitions shall apply:

- A. Diesel Engine - any compression-ignited engine fueled with diesel oil, or combination of diesel oil and gaseous fuel;
- B. Emergency Standby Engine - any engine used as a temporary replacement for primary mechanical or electrical power sources during periods of fuel or energy shortage, or while primary power source is under repair;
- C. Gaseous Fuel - any fuel existing as gas at standard conditions, including, but not limited to: natural gas, methane, ethane, propane, butane, and liquefied petroleum gas (LPG);
- D. Higher Heating Value (HHV) - total heat released per mass of fuel burned (Btu's per pound) when fuel and dry air at standard conditions undergo complete combustion and all resulting products are brought to standard conditions;
- E. Lean-Burn Engine - any spark-ignited Otto cycle or two stroke engine fueled with gaseous or liquid fuel and operated with an exhaust gas oxygen concentration of 4 percent by volume, or greater;
- F. Oxides of Nitrogen (NO<sub>x</sub>) - total nitrogen oxides expressed as NO<sub>2</sub>;
- G. Rated Brake Horsepower (bhp) - maximum continuous service rating specified for engine by manufacturer and listed on nameplate of unit;

- H. Reasonably Available Control Technology (RACT) - lowest emission limitation a particular source is capable of meeting by application of control technology reasonably available considering technological and economic feasibility;
- I. Rich-Burn Engine - any spark-ignited Otto cycle or two stroke engine fueled with gaseous or liquid fuel and operated with an exhaust gas oxygen concentration of less than 4 percent by volume;
- J. Shaft Output - actual engine work done (brake horsepower-hours) calculated from measurements and data derived from operating parameters and/or performance curve(s) of device being powered by engine;
- K. Site - any specific location within a facility, for example, a building;
- L. Stationary Piston Engine (engine) - any spark or compression-ignited reciprocating internal combustion engine attached to a foundation at a site, or portable and operated at the same site for more than one year.

IV. **Exemptions**

This Rule shall not apply to:

- A. Engines used exclusively for agricultural operations necessary for growing of crops or raising of fowl or animals;
- B. Emergency standby, and low use rate engines operating less than 200 hours per year as documented by an elapsed operating time meter;
- C. Engines used exclusively for firefighting purposes or flood control;
- D. Laboratory engines used in research and testing;
- E. Engines operated exclusively for purposes of performance verification and testing; or
- F. Portable engines not operated at the same site for more than one year.

V. **Requirements for Engines Greater Than 50 bhp**

An owner/operator of any engine subject to this Section shall service such engine in accordance with following NOx minimization maintenance schedule:

- A. Lubricating Oil and Filter (if so equipped): Change once every three months or after no more than 300 hours of operation;
- B. Inlet Air Filter: Clean once every three months or after no more than 300 hours of operation; replace (if cartridge type) once every 1000 hours of operation;

- C. Fuel Filter: Clean once every year or replace (if cartridge type) once every 1000 hours of operation;
- D. Intake and Exhaust Valves (if so equipped and adjustable), Spark Plugs (if so equipped), Spark Timing and Dwell or Fuel Injection Timing (if adjustable), and Carburetor Mixture (if adjustable): Check and adjust (if necessary) to factory specifications once every year or after no more than 1000 hours of operation;
- E. Spark Plugs and Ignition Points (if so equipped): Replace after 3000 hours of operation;
- F. Coolant (if so equipped): Change once every year;
- G. Exhaust System: Check for leaks and/or restrictions once every year.

VI. **Requirements for Engines 250 bhp or More**

An owner/operator of any engine subject to this Section shall comply with following NOx reduction requirements or emission limits, as applicable:

A. Rich-Burn Engine:

- 1. Exhaust gas oxides of nitrogen concentration, averaged over not less than 15 consecutive minutes:
  - a. Shall be reduced by 90 percent across any exhaust gas control device; or
  - b. Shall not exceed 50 ppm by volume, on dry basis, corrected to 15 percent oxygen.
- 2. Exhaust gas carbon monoxide concentration, averaged over not less than 15 consecutive minutes, shall not exceed 2,000 ppm by volume, on dry basis, corrected to 15 percent oxygen.

B. Lean-Burn Engine:

- 1. Exhaust gas oxides of nitrogen concentration, averaged over not less than 15 consecutive minutes:
  - a. Shall be reduced by at least 80 percent across any exhaust gas control device; or
  - b. Shall not exceed 125 ppm by volume, on dry basis, corrected to 15 percent oxygen; or
- 2. For lean burn engines controlled exclusively by combustion modifications,

exhaust gas oxides of nitrogen emission rate shall not exceed 2.0 grams per brake horsepower hour of output, or where engine has no means to measure shaft output, exhaust gas oxides of nitrogen concentration, averaged over not less than 15 consecutive minutes, shall not exceed 125 ppm by volume, on dry basis, corrected to 15 percent oxygen.

3. Exhaust gas carbon monoxide concentration, averaged over not less than 15 consecutive minutes, shall not exceed 2,000 ppm by volume, on dry basis, corrected to 15 percent oxygen.

C. Diesel Engine:

Exhaust gas oxides of nitrogen concentration, averaged over not less than 15 consecutive minutes:

1. Shall be reduced by at least 30 percent across any exhaust gas control device; or
2. Shall not exceed 600 ppm by volume, on dry basis, corrected to 15 percent oxygen;
3. Exhaust gas carbon monoxide concentration, averaged over not less than 15 consecutive minutes, shall not exceed 2,000 ppm by volume, on dry basis, corrected to 15 percent oxygen.

D. Thermal Efficiency Adjustment:

For any engine subject to this Section with demonstrated thermal efficiency greater than 30%, the following procedure may be used to determine allowable emission limits. Each emission limit in Subsection A., B., or C. may be multiplied by engine thermal efficiency and divided by reference efficiency of 30 percent. Engine efficiency (E) shall be determined using one of following two methods, whichever is lower:

1.  $E = \frac{(2542.5 \text{ Btu/bhp-hr}) (100)}{\text{Actual Heat Rate at HHV of fuel (Btu/bhp-hr)}}$

Where demonstrated percent E applies to engine only, without consideration of any downstream energy recovery, and is averaged over not less than 15 consecutive minutes and measured within 30 days of first emissions compliance test; or

2. 
$$E = \frac{\text{(Manufacturer's Rated Efficiency [Continuous] at LHV)(LHV)}}{\text{(HHV)}}$$

Engine with less than 30 percent efficiency, shall be assigned an efficiency of 30 percent for purposes of this Rule.

## VII. Monitoring

An owner/operator of any engine subject to Section VI. of this Rule shall:

- A. Install, operate, and maintain automatic combustion controls to ensure on-going compliance with applicable emission limit(s); or
- B. Install, operate, and maintain analytical equipment and/or procedures or sensing devices indicating:
  - 1. For Rich-Burn Engine:
    - a. Exhaust gas oxides of nitrogen and carbon monoxide concentrations; or
    - b. For a catalyst system, air to fuel ratio showing operation within limits as recommended by catalyst system manufacturer.
  - 2. For Lean-Burn or Diesel Engine:
    - a. Exhaust gas oxides of nitrogen and carbon monoxide concentrations; and
    - b. Flow rate of any reducing liquids or gases added to exhaust gases for operation of catalyst system.

## VIII. Administrative Requirements

### A. Emission Control Plan

An owner/operator of any engine subject to Section V. or VI. shall submit to the Control Officer, for his approval, a Control Plan. Such Control Plan shall include for each facility:

- 1. List of all engines subject to Rule, including type of engine service and KCAPCD Permit number;
- 2. Engine manufacturer, model number, rated brake horsepower, type of fuel (liquid and/or gas), and type of ignition (compression or spark);
- 3. Description of actions to be taken or emission controls to be applied to each engine;
- 4. For any engine subject to Section VI. and for which the owner/operator chooses to

comply with control efficiency limits, baseline NOx test data. Such data shall represent emissions during maximum normal operating conditions; and

5. Emission control equipment construction schedule, if applicable.

B. Recordkeeping

1. An owner/operator of any engine subject to Section V. of this Rule shall maintain, for at least two years, an engine service log for each engine demonstrating compliance with Section V. and make such log readily available to District personnel.
2. An owner/operator of any engine subject to Section VI. of this Rule shall maintain an engine operating log, including, on monthly basis, total hours of operation, type and quantity of fuel used, any data related to NOx emissions, and cumulative hours of operation since last source test required by Subsection C., below. Data shall be collected with properly calibrated and operated equipment. This information shall be maintained for period of at least two years (five years if part of a source subject to Rule 201.1) and made readily available to District personnel.

C. Compliance Testing

1. An owner/operator of any engine subject to Section VI. of this Rule shall demonstrate compliance with applicable limits by:
  - a. Each year, providing the Control Officer with documentation related to NOx emissions showing the engine has been operating as when last tested. If, based on review of these data, the Control Officer has reason to suspect non-compliance, an emissions tests shall be performed, and
  - b. Testing every two years, or after no more than 8760 hrs of operation (whichever time period is shorter).
2. Notwithstanding Subsection VIII.C.1.b., compliance with applicable limits can be demonstrated by annually testing an engine (or engines) that represents a group of engines, provided:
  - a. The group of engines is owned or operated by a single person;
  - b. All engines in the group are of similar rated brake horsepower, engine manufacturer and series, operational conditions, fuel, and emissions control method;
  - c. All engines in the group are initially tested and emissions of all engines in the group are at least 10% below the applicable limit;

- d. Selection of the representative engine(s) is approved by the Control Officer prior to testing and not less than " of all engines in a group are tested, and over the course of three years, all engines are tested;
  - e. All engines in the group have, and will continue to receive, the same maintenance and tune-up procedures as the representative engine(s); and
  - f. An engine operating log is maintained for each engine in the group. Such log shall include, on a monthly basis, total hours of operation, type and quantity of fuel used, maintenance or modifications performed, and other information deemed necessary to show compliance with this Rule. This information shall be retained for at least five years and shall be made readily available to District personnel.
3. If any engine used to demonstrate compliance for a group of engines pursuant to Subsection VIII.C.2. exceeds applicable emission limits, each engine in the group shall demonstrate compliance by emissions testing. Failure to complete emissions testing within 90 days of such failed test shall result in untested engines being considered in violation of this Rule.
  4. If Subsection VIII.C.3. becomes applicable, testing shall be performed pursuant to Subsection VIII.C.1.b., or VIII.C.2.

IX. **Test Methods**

Compliance with requirements of Section VI. shall be determined in accordance with following test procedures:

- A. Oxides of nitrogen - U.S. EPA Method 7E, or CARB Method 100;
- B. Carbon monoxide - U.S. EPA Method 10, or CARB Method 100; and
- C. Stack gas oxygen - U.S. EPA Method 3 or 3A, or CARB Method 100.

X. **Compliance Schedule**

Engines subject to Section VI. are not subject to Section V. after complying with Section VI.