

# **RULE 231 INDUSTRIAL, INSTITUTIONAL, AND COMMERCIAL BOILERS, STEAM GENERATORS, AND PROCESS HEATERS**

Adopted 10-17-94  
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## 100 GENERAL

**101 PURPOSE:** To limit the emission of Nitrogen Oxides (NOx) from industrial, institutional and commercial, boilers, steam generators and process heaters.

### 102 APPLICABILITY:

102.1 Geographic: The provisions of this rule apply to facilities in all of Placer County.

102.2 General: This rule applies to boilers, steam generators, and process heaters with rated heat inputs of equal to or greater than 5 million BTU per hour, used in industrial, institutional, and commercial operations.

### 103 EXEMPTIONS:

103.1 Exemption, Biomass Boilers: The provisions of this rule do not apply to boilers subject to Rule 232, Biomass Suspension Boilers , or Rule 233, Biomass Boilers.

103.2 Exemption, Cement and Lime Kilns, Glass Melting Furnaces, and Smelters: The provisions of this rule do not apply to cement and lime kilns, glass melting furnaces and smelters.

103.3 Exemption, Direct-Contact Dryers: The provisions of this rule do not apply to dryers in which the material being dried is in direct contact with the products of combustion.

103.4 Exemption, Electric Utility Boilers: The provisions of this rule do not apply to boilers used by electric utilities to generate electricity.

103.5 Exemption, Medical Waste Incinerators: This rule shall not apply to those incinerators which are subject to the requirements of Rule 906, Airborne Toxic Control Measure - Medical Waste Incinerators

103.6 Exemption, Municipal Waste Incinerators: This rule shall not apply to boilers, steam generators, or process heaters whose primary purpose is to burn municipal solid waste, as defined in Section 206.

103.7 Exemption, Nongaseous Fuels: Units subject to the requirements of Section 301 that normally burn only gaseous fuel shall comply with a 150 ppmv, or 0.215 pound per million BTU of heat input, NOx emission limitation when burning nongaseous fuel, if gas is unavailable for purchase. This exemption is limited to not more than 168 hours of operation per calendar year, excluding equipment and emission testing time not exceeding 48 hours per calendar year.

103.8 Exemption, Waste Heat Recovery Boilers: The provisions of this rule do not apply to waste heat recovery boilers that are used to recover sensible heat from the exhaust of combustion turbines.

## 200 DEFINITIONS

**201 ANNUAL HEAT INPUT:** The total heat input of fuels burned by a unit in a calendar year, as determined from the higher heating value and cumulative annual usage of each fuel.

**202 BOILER OR STEAM GENERATOR:** Any combustion equipment fired with any fuel and used to produce steam that is not used exclusively to produce electricity for sale.

**203 BRITISH THERMAL UNIT (BTU):** The amount of heat required to raise the temperature of one pound of water from 59°F to 60°F at one atmosphere.

**204 GAS:** Any fuel which is a gas at standard conditions.

- 205 HEAT INPUT:** The chemical heat released due to fuel combustion in a unit, using the higher heating value of the fuel. This does not include the sensible heat of incoming combustion air.
- 206 HIGHER HEATING VALUE (HHV):** The total heat liberated per mass of fuel burned (BTU per pound), when fuel and dry air at standard conditions undergo complete combustion and all resultant products are brought to their standard states at standard conditions. HHV shall be determined by one of the following test methods:
- 206.1 ASTM D 2015-85 for solid fuels; or
- 206.2 ASTM D 240-87 or ASTM D 2382-82 for liquid hydrocarbon fuels; or
- 206.3 ASTM D 1826-88 or ASTM D 1945-81 in conjunction with ASTM D 3588-89 for gaseous fuels.
- 207 MUNICIPAL SOLID WASTE:** Household, commercial/retail, and/or institutional waste. Household waste includes material discarded by single or multiple residential dwellings, hotels, motels, and other similar permanent or temporary housing establishments or facilities. Commercial/retail waste includes material discarded by stores, offices, restaurants, warehouses, non-manufacturing activities at industrial facilities, and other similar establishments or facilities. Institutional waste includes material discarded by schools, hospitals, prisons, and government facilities and other similar establishments or facilities. Municipal solid waste does not include landfill gas or digester gas or other fuels derived from decomposition of municipal solid wastes.
- 208 NO<sub>x</sub> EMISSIONS (NO<sub>x</sub>):** The sum of nitric oxides and nitrogen dioxide in the flue gas, collectively expressed as nitrogen dioxide (NO<sub>2</sub>).
- 209 NONGASEOUS FUEL:** Any fuel which is not a gas at standard conditions.
- 210 PARTS PER MILLION BY VOLUME (PPMV):** The ratio of the number of gas molecules of a given species, or group, to the number of millions of total gas molecules.
- 211 PROCESS HEATER:** Any combustion equipment fired with any fuel, and which transfers heat from combustion gases to water or process streams.
- 212 RATED HEAT INPUT CAPACITY:** The heat input capacity, in million BTU per hour, specified on the nameplate of the combustion unit. If the combustion unit has been altered or modified such that its maximum heat input is different than the heat input capacity specified on the nameplate, the maximum heat input shall be considered as the rated heat input.
- 213 RESPONSIBLE OFFICIAL:** An individual with the authority to certify that a source complies with all applicable requirements, including the conditions of permits issued to sources in accordance with Regulation 5, PERMITS. A "responsible official" means one of the following:
- 213.1 For a corporation, a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision-making functions for the corporation, or a duly authorized representative of such person if the representative is responsible for the overall operation of one or more manufacturing, production, or operating facilities applying for or subject to a permit and either:
- a. The facilities employ more than 250 persons or have gross annual sales or expenditures exceeding \$25 million (in second quarter 1980 dollars); or
- b. The delegation of authority to such representative is approved in advance by the Air Pollution Control Officer;
- 213.2 For a partnership or sole proprietorship, a general partner or the proprietor, respectively; or

- 213.3 For a municipality, state, federal, or other public agency, either a principal executive officer or a ranking elected official; or
- 214 STANDARD CONDITIONS:** For purposes of this rule, a gas temperature of 68° Fahrenheit and a gas pressure of 14.7 pounds per square inch absolute.
- 215 THERM:** One hundred thousand (100,000) BTU.
- 216 UNIT:** Any boiler, steam generator or process heater as defined in Sections 202 and 211.

### **300 STANDARDS**

- 301 ANNUAL HEAT INPUTS, 90,000 THERMS:** For units with rated heat inputs of greater than or equal to 5 million BTU per hour and annual heat inputs of greater than or equal to 90,000 therms per year, NOx emissions shall not exceed the following levels:

- 301.1 30 parts per million by volume (ppmv), or 0.036 pound per million BTU of heat input when operated on gas; or
- 301.2 40 parts per million by volume (ppmv), or 0.052 pound per million BTU of heat input, when operated on nongaseous fuel; or
- 301.3 The heat-input weighted average of the limits specified in 301.1 and 301.2, above, when operated on combinations of gas and nongaseous fuels.
- 301.4 Emissions from units subject to this section shall not exceed a carbon monoxide concentration of 400 parts per million by volume (ppmv).

- 302 ANNUAL HEAT INPUTS < 90,000 THERMS:** Units with rated heat inputs of greater than or equal to 5 million BTU per hour and annual heat inputs of less than 90,000 therms per year shall be:

- 302.1 Operated in a manner that maintains stack-gas oxygen concentrations at less than or equal to 3.00 percent by volume on a dry basis; or
- 302.2 Operated with a stack-gas oxygen trim system set at 3.00 percent by volume oxygen. The tolerance of this setting shall be plus or minus (.) five percent (i.e. 2.85 to 3.15 percent by volume oxygen); or
- 302.3 Tuned at least once per year by a technician that is qualified, to the satisfaction of the Air Pollution Control Officer, to perform tuning in accordance with Section 600; or
- 302.4 Operated in compliance with the applicable emission levels specified in Section 301.

### **303 EQUIPMENT REQUIREMENTS:**

- 303.1 For units which simultaneously fire combinations of different fuels, and are subject to the requirements of Section 301, non-resettable totalizing mass flow rate meters shall be installed in each fuel line. Alternatively, non-resettable totalizing volumetric flow rate meters may be installed in conjunction with temperature and pressure meters in each fuel line.
- 303.2 For units which employ flue-gas NOx reducing technology, and are subject to the requirements of Section 301, meters, as applicable, shall be installed to allow instantaneous monitoring of the operational characteristics of the NOx reduction equipment.

## 400 ADMINISTRATIVE REQUIREMENTS

### 401 COMPLIANCE SCHEDULE:

- 401.1 By January 1, 1995, any person subject to this rule shall submit a plan containing the following:
- A list of all units with their rated heat inputs and anticipated annual heat inputs.
  - For each unit subject to Section 301, the selected method of achieving compliance with the applicable standards of Section 301.
  - For each unit subject to Section 302, the selected option (one of four specified in Section 302) to achieve compliance with that section.
- 401.2 By May 31, 1995, any Major Source subject to this rule shall demonstrate final compliance with all applicable standards and requirements of Section 300. Subject to the approval of the Air Pollution Control Officer, testing conducted in the 18 months preceding May 31, 1995, may be used to demonstrate compliance provided such testing meets the requirements of Sections 502.1, using the test methods specified in Section 502.3.
- 401.3 By October 17, 1996, any non-Major Source subject to this rule shall submit an application for Authority to Construct for any modifications required to achieve compliance with the requirements of this rule.
- 401.4 By October 17, 1997, any non-Major Source subject to this rule shall demonstrate final compliance with all applicable standards and requirements of this rule.
- 401.5 Any non-Major Source subject to this rule installing a new or replacement boiler shall comply with this rule for the new or replacement boiler effective October 17, 1995.
- 401.6 A violation of the plan required under Section 401.1 shall constitute a violation of this rule.

### 402 COMPLIANCE DETERMINATION:

- 402.1 Any person subject to this rule shall have the option of complying with either the pounds-per-million-BTU emission rates or the parts-per-million-by-volume emission limits specified in Section 301.
- 402.2 All ppmv emission limits specified in Sections 106 and 301 are referenced at dry stack-gas conditions and 3.00 percent by volume stack-gas oxygen. Emission concentrations shall be corrected to 3.00 percent oxygen as follows:

$$[\text{ppm NOx}]_{\text{corrected}} = \frac{20.95\% - 3.00\%}{20.95\% - [\% \text{O}_2]_{\text{measured}}} \times [\text{ppm NOx}]_{\text{measured}}$$
$$[\text{ppm CO}]_{\text{corrected}} = \frac{20.95\% - 3.00\%}{20.95\% - [\% \text{O}_2]_{\text{measured}}} \times [\text{ppm CO}]_{\text{measured}}$$

- 402.3 All pounds-per-million-BTU emission rates shall be calculated as pounds of nitrogen dioxide (NO<sub>2</sub>) per million BTU of heat input.

**403 COMPLIANCE COSTS:** A person operating a unit subject to this rule shall bear all expenses associated with compliance with the monitoring and reporting provisions of this rule.

**404 CERTIFICATION:** All reports submitted in accordance with this rule shall be signed by a responsible official who shall certify the truth, accuracy, and completeness of the report.

## 500 MONITORING AND RECORDS

### 501 FUEL USAGE AND OPERATING HOURS

- 501.1 Any person subject to this rule shall monitor and record for each unit the HHV and cumulative annual usage of each fuel.
- 501.2 The cumulative annual usage of each fuel shall be monitored from utility service meters, purchase, or tank fill records, or by any other acceptable methods approved by the Air Pollution Control Officer.
- 501.3 Any person subject to this rule, but exempt from Section 301 in accordance with Section 106, shall monitor and record for each unit the cumulative hours of operation on each nongaseous fuel. The records shall be updated weekly and made available to the District upon request.

### 502 SOURCE TESTS

- 502.1 Except for units in compliance with the tuning option of Section 302.3, a source test shall be conducted for all units subject to this rule to demonstrate compliance. A report of this source test shall include the operational characteristics of any flue-gas NOx reduction equipment. Additional source testing may be required by the Air Pollution Control Officer as necessary to ensure compliance with the standards set forth in Sections 301 and 302. Compliance source testing is required on an annual basis for sources subject to Rule 507, FEDERAL OPERATING PERMIT PROGRAM.
- 502.2 All source tests shall be made in the as-found operating condition, except that source tests shall include at least one test conducted at the maximum firing rate allowed by the District permit, and no source test shall be conducted within two hours after a continuous period in which fuel flow to the unit is zero, or shut off, for thirty minutes or longer. A separate source test shall be conducted for each fuel burned including standby fuel.
- 502.3 Compliance with NOx emission requirements and the stack-gas carbon monoxide and oxygen requirements of Section 300 shall be determined using the following test methods:
  - a. Oxides of Nitrogen - ARB Method 100, Title 17, CCR, Section 94114, Procedures for Continuous Emission Stack Sampling.
  - b. Carbon Monoxide - ARB Method 100.
  - c. Stack-Gas Oxygen - ARB Method 100.
  - d. NOx Emission Rate (Heat Input Basis) - EPA Method 19, 40 CFR Part 60, Appendix A.
- 502.4 All emission concentrations and emission rates shall be based on 15-consecutive-minute averages. These averages shall be calculated from no less than five data sets, recorded from samplings on intervals of no greater than three minutes.
- 502.5 Integrated sampling methods for oxides of nitrogen, stack-gas oxygen, and stack-gas carbon monoxide, as approved by the Air Pollution Control Officer, EPA and ARB, may be acceptable for determination of compliance with NOx emission concentration or rate limits.

- 503 TUNING REPORTS:** Units covered under Section 302.3 shall be tuned not less than once every 12 months. Tuning verification reports shall be submitted not less than once every 12

months for each fuel burned. The first tuning verification report shall be submitted by October 17, 1997, for non-Major Sources, and by May 31, 1995, for Major Sources subject to this rule.

- 504 RETENTION OF RECORDS:** All records maintained pursuant to this rule shall be retained for at least three years from date of entry, with the exception that sources subject to the requirements of Rule 507, FEDERAL OPERATING PERMIT PROGRAM, shall retain records at least five years. Records shall be made available for inspection by the Air Pollution Control Officer upon request.

## **600 TUNING PROCEDURE**

- 601 GENERAL:** Nothing in this tuning procedure<sup>1</sup> shall be construed to require any act or omission that would result in unsafe conditions or would be in violation of any regulation or requirement established by Factory Mutual, Industrial Risk Insurers, National Fire Prevention Association, the California Department of Industrial Relations (Occupational Safety and Health Division), the Federal Occupational Safety and Health Administration, or other relevant regulations and requirements.

### **602 PROCEDURES:**

- 601.1 Operate the unit at the firing rate most typical of normal operation. If the unit experiences significant load variations during normal operations, operate the unit at its average firing rate.
- 601.2 At the firing rate established in Section 601.1, record stack-gas temperatures, oxygen concentration, and CO concentration (for gaseous fuels) or smoke-spot number<sup>2</sup> (for liquid fuels), and observe flame conditions after unit operation stabilizes at the selected firing rate. If the excess oxygen in the stack-gas is at the lower range of typical minimum values<sup>3</sup>, and if CO emissions are low and there is no smoke, the unit is probably operating at near optimum efficiency - at this particular firing rate. However, complete the remaining portion of this procedure to determine whether still lower oxygen levels are practical.
- 602.3 Increase combustion air flow until the stack-gas oxygen levels increase by one or two percent over the level measured in Section 602.2. As in Section 602.2, record the stack-gas temperature, CO concentration (for gaseous fuels) or smoke-spot number (for liquid fuels), and observe flame conditions for these higher oxygen levels after unit operation stabilizes.
- 602.4 Decrease combustion air flow until the stack-gas oxygen is at the level measured in Section 602.2. From this level gradually reduce the combustion air flow, in small increments. After each increment, record the stack-gas temperature, oxygen concentration, CO concentration (for gaseous fuels), and smoke-spot number (for liquid fuels). Also, observe the flame and record any changes in its condition.
- 602.5 Continue to reduce combustion air flow stepwise, until one of the following limits is reached:
- a. Unacceptable flame conditions - such as flame impingement on furnace walls or burner parts, excessive flame carryover, or flame instability;

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<sup>1</sup> THIS TUNING PROCEDURE IS BASED ON A PROCEDURE DEVELOPED BY KVB, INC. FOR THE U.S. EPA.

<sup>2</sup> THE SMOKE-SPOT NUMBER CAN BE DETERMINED WITH ASTM TEST METHOD D-2156 OR WITH THE BACHARACH METHOD. THE BACHARACH METHOD IS INCLUDED IN A TUNE-UP KIT THAT CAN BE PURCHASED FROM THE BACHARACH COMPANY.

<sup>3</sup> TYPICAL MINIMUM OXYGEN LEVELS FOR UNITS AT HIGH FIRING RATES ARE:  
A. FOR NATURAL GAS: 0.5 - 3%  
B. FOR LIQUID FUELS: 2 - 4%.



- b. Stack-gas CO concentrations greater than 400 ppm;
  - c. Smoking at stack;
  - d. Equipment-related limitations - such as low windbox/furnace pressure differential, built-in air-flow limits, etc.
- 602.6 Develop an O<sub>2</sub>/CO curve (for gaseous fuels) or O<sub>2</sub>/smoke curve (for liquid fuels) similar to those shown in Figures 1 and 2 using the excess oxygen and CO or smoke-spot number data obtained at each combustion air flow setting.
- 602.7 From the curves prepared in Section 602.6, find the stack-gas oxygen levels where the CO emissions or smoke-spot number equal the following values:

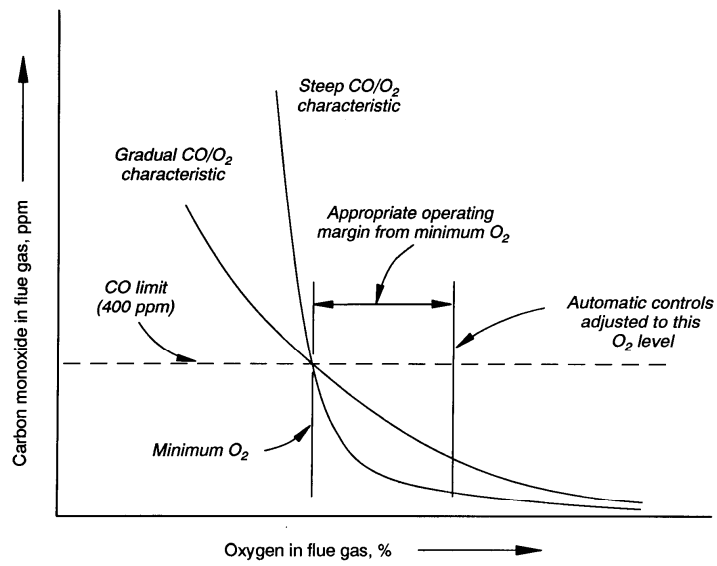
<b>Fuel</b>	<b>Measurement</b>	<b>Value</b>
Gaseous	CO Emissions	400 PPM
#1 & #2 Oils	Smoke Spot Number	Number 1
#4 Oil	Smoke Spot Number	Number 2
#5 Oil	Smoke Spot Number	Number 3
Other Oils	Smoke Spot Number	Number 4

The above conditions are referred to as the CO or smoke-spot thresholds, or as the minimum excess oxygen levels. Compare this minimum value of excess oxygen to the expected value provided by the combustion unit manufacturer. If the minimum level found is substantially higher than the value provided by the manufacturer, burner adjustments can probably be made to improve fuel and air mix, thereby allowing operations with less air.

- 602.8 Add 0.5 to 2.0 percent to the minimum excess oxygen level found in Section 602.7 and reset burner controls to operate automatically at this higher stack-gas oxygen level. This margin above the minimum oxygen level accounts for fuel variations, variations in atmospheric conditions, load changes, and non-repeatability or play in automatic controls.
- 602.9 If the load of the combustion unit varies significantly during normal operation, repeat Sections 602.1-602.8 for the firing rates that represent the upper and lower limits of the range of the load. Because control adjustments at one firing rate may affect conditions at other firing rates, it may not be possible to establish the optimum excess oxygen level at all firing rates. If this is the case, choose the burner control settings that give the best performance over the range of the firing rates. If one firing rate predominates, the setting should optimize the conditions at the rate.
- 602.10 Verify that the new settings can accommodate the sudden load changes that may occur in daily operation without adverse effects. Do this by increasing and decreasing load rapidly while observing the flame and stack. If any of the conditions in Section 602.5 result, reset the combustion controls to provide a slightly higher level of excess oxygen at the affected firing rates. Next, verify these new settings in a similar fashion. Then make sure that the final control settings are recorded at steady-state operating conditions for future reference.

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# Figure 1

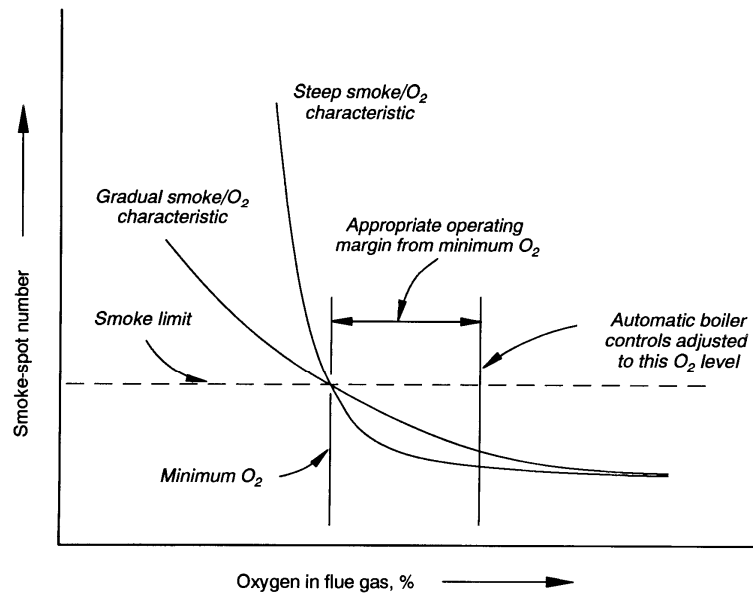


SOURCE: KVB INC.

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# Figure 2 Oxygen(O<sub>2</sub>)/Smoke Characteristic Curve

SOURCE: KVB INC.



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