

**REGULATION 9  
INORGANIC GASEOUS POLLUTANTS  
RULE 9  
NITROGEN OXIDES FROM STATIONARY  
GAS TURBINES**

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**REGULATION 9  
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GAS TURBINES**

(Adopted May 5, 1993)

**9-9-100 GENERAL**

**9-9-101 Description:** The purpose of this Rule is to limit emissions of nitrogen oxides (NO<sub>x</sub>) from stationary gas turbines.

**9-9-110 Exemption, Small Gas Turbines:** This Rule shall not apply to stationary gas turbines with a power rating less than 0.3 megawatts (MW).

**9-9-111 Exemption, General:** The requirements of this Rule shall not apply to:

111.1 Testing of aircraft gas turbine engines for flight certification.

111.2 Gas turbines used solely for firefighting and/or flood control.

~~111.3 Emergency standby gas turbines excluded under Regulation 1-110.2~~

**9-9-112 Limited Exemption, Low Usage:** The requirements of this Rule shall not apply to the operation of gas turbines rated less than 4.0 MW which operate less than 877 hours per year, provided the requirements of Section 9-9-502 are satisfied.

**9-9-113 Exemption, Inspection and Maintenance Periods:** The emission limits of Sections 9-9-301, ~~303, and 304~~ shall not apply during inspection and maintenance periods, with the following limitations:

113.1 Inspection and maintenance periods shall be limited to a total of ~~4824~~ hours between May 1 and October 31 in a calendar year.

113.2 For a calendar year in which a boiler inspection required by California Labor Code Section 7682 is not performed, inspection and maintenance periods shall be limited to a total of ~~44472~~ hours.

113.3 For a calendar year in which a boiler inspection required by California Labor Code Section 7682 is performed, inspection and maintenance periods shall be limited to ~~44472~~ hours plus additional time required for the boiler inspection, provided, however, that the additional time shall not cause the calendar-year total of all inspection and maintenance periods to exceed ~~342240~~ hours.

(Adopted September 21, 1994)

**9-9-114 Exemption, Start-up and Shutdown Periods:** The emission limits of Sections 9-9-301, 302, ~~303, 304, and 305~~ shall not apply during start-up or shutdown periods.

(Adopted September 21, 1994)

**9-9-200 DEFINITIONS**

**9-9-201 Commercially Available:** Any control technology or equipment which is offered for a specific make and model of gas turbine by at least one vendor and guaranteed by the vendor to achieve the required emission control performance for a regular or full-scale operation within the United States.

**9-9-202 Dry Low-NOx Combustion Technology (DLN):** A turbine combustor design which uses multiple staging, air/fuel premixing or other modifications to achieve lower levels of NOx emissions as compared to conventional combustors.

**9-9-2043 EFF:** Thermal efficiency.

**9-9-2024 Essential Gas Turbine:** A gas turbine which cannot be taken out of service without shutting down the process unit which it serves. (Adopted September 21, 1994)

**9-9-2035 HHV:** The higher heating value of fuel. (Renumbered September 21, 1994)

**9-9-2046 LHV:** The lower heating value of fuel. (Renumbered September 21, 1994)

**9-9-2057 Inspection and Maintenance Period:** A period of time during which the boiler associated with an essential gas turbine is taken out of service for inspection or

maintenance and during which gas turbine emissions are vented to a bypass stack rather than through the boiler to the SCR unit. (Adopted September 21, 1994)

- 9-9-2068 Natural Gas:** Any mixture of gaseous hydrocarbons containing at least 80 percent methane by volume, as determined according to Standard Method ASTM D1945-64. (Adopted September 21, 1994)
- 9-9-2079 Nitrogen Oxide (NOx) Emissions:** The sum of nitric oxide and nitrogen dioxide (NO<sub>2</sub>) in the flue gas, collectively expressed as nitrogen dioxide. (Adopted September 21, 1994)
- 9-9-20810 Non-Gaseous Fuel:** Any fuel which is not a gas at 68<sup>o</sup> F and one atmosphere. (Adopted September 21, 1994)
- 9-9-20911 Power Augmentation:** An increase in the gas turbine shaft output or the decrease in turbine fuel consumption by the addition of energy recovered from exhaust heat. (Renumbered September 21, 1994)
- 9-9-2102 Rating:** The continuous megawatt (MW) rating or mechanical equivalent by a manufacturer for gas turbine(s) without power augmentation. (Renumbered September 21, 1994)
- 9-9-2143 Refinery Fuel Gas:** A mixture of hydrogen and gaseous hydrocarbons generated by petroleum refinery processes and used by the refinery for on-site combustion in boilers, process heaters, turbines, and other combustion equipment. (Adopted September 21, 1994)
- 9-9-2124 SCR:** Selective Catalytic Reduction. (Renumbered September 21, 1994)
- 9-9-2135 Shutdown Period:** A period of time, not to exceed one hour, during which a gas turbine is brought from normal operating power output to inactive status. (Adopted September 21, 1994)
- 9-9-2146 Start-up Period:** A period of time, not to exceed three hours, during which a gas turbine is brought from inactive status to normal operating power output. (Amended September 21, 1994)
- 9-9-2157 Stationary Gas Turbine:** Any gas turbine system which is attached to a foundation and is gas and/or liquid fueled with or without power augmentation. Two or more gas turbines powering one shaft shall be treated as one unit. (Renumbered September 21, 1994)
- 9-9-218 Waste Gas:** A mixture of hydrogen, gaseous hydrocarbons and other possible diluent gases generated by sewage treatment or landfill biomass and used by the facility for on-site combustion in gas turbines, and other combustion equipment.

**9-9-300 STANDARDS**

- 9-9-301 Emission Limits, General:** Except as provided by Sections 9-9-302, ~~9-9-303, 9-9-305,~~ or ~~9-9-404~~ 9-9-306, effective January 1, 1997, a person shall not operate a stationary gas turbine unless nitrogen oxides (NO<sub>x</sub>) emission concentrations, corrected to 15 percent O<sub>2</sub> (dry basis), do not exceed the compliance limit listed below:
- 301.1 Gas turbines rated at 0.3 MW to less than 10.0 MW shall not exceed 42 ppmv, except that, for refinery fuel gas firing, the limit shall be 55 ppmv, and for non-gaseous fuel firing during natural gas curtailment or short testing periods, the limit shall be 65 ppmv.
  - 301.2 Gas turbines rated at 10.0 MW and over, without SCR, shall not exceed 15 ppmv, except that, for non-gaseous fuel firing during natural gas curtailment or short testing periods, the limit shall be 42 ppmv.
  - 301.3 Gas Turbines rated at 10.0 MW and over, with SCR, shall not exceed 9 ppmv, except that, for non-gaseous fuel firing during natural gas curtailment or short testing periods, the limit shall be 25 ppmv.
  - 301.4 Effective July 1, 2008, a person shall not operate a stationary gas turbine unless nitrogen oxides (NO<sub>x</sub>) emission concentrations, corrected to 15 percent O<sub>2</sub> (dry basis), do not exceed the compliance limits listed below:

<u>Turbine Size</u>	<u>Natural Gas</u>	<u>Refinery Fuel Gas or Waste Gas</u>	<u>Non-gaseous Fuel</u>
<u>0.3 to 3.0 MW</u>	<u>42 ppmv</u>	<u>55 ppmv</u>	<u>65 ppmv</u>
<u>3.0 to 10.0 MW *</u>	<u>25 ppmv</u>	<u>45 ppmv</u>	<u>65 ppmv</u>
<u>3.0 to 10.0 MW **</u>	<u>35 ppmv</u>	<u>50 ppmv</u>	<u>65 ppmv</u>
<u>10.0 MW and over</u>	<u>5 ppmv</u>	<u>5 ppmv</u>	<u>25 ppmv</u>

\* Dry Low NOx combustion technology commercially available

\*\* Dry Low NOx combustion technology NOT commercially available

If Dry Low NOx combustion technology becomes commercially available for a specific make and model of turbine after June 30, 2006, the operator shall be expected to comply with the more stringent standards within two years of the technology becoming available, as described in 9-9-402.3.

(Amended September 21, 1994)

**9-9-302 Emission Limits, Low Usage:** Effective January 1, 1997, a person shall not operate a stationary gas turbine rated at 4.0 MW or greater and operating less than 877 hours per year unless nitrogen oxides (NOx) emission concentrations, corrected to 15 percent O<sub>2</sub> (dry basis), do not exceed 42 ppmv when firing with natural gas and 65 ppmv when firing with non-gaseous fuel, and provided the requirements of Section 9-9-502 are satisfied. (Amended September 21, 1994)

302.1 Effective July 1, 2008, a person shall not operate a stationary gas turbine rated at 4.0 MW or greater at the following capacities and operating less than 877 hours per year unless nitrogen oxides (NOx) emission concentrations, corrected to 15 percent O<sub>2</sub> (dry basis), do not exceed the compliance limits listed below, and provided the requirements of Section 9-9-502 are satisfied:

<u>Turbine Size</u>	<u>Natural Gas</u>	<u>Refinery Fuel Gas or Waste Gas</u>	<u>Non-gaseous Fuel</u>
<u>Less than 4.0 MW *</u>	<u>Exempt</u>	<u>Exempt</u>	<u>Exempt</u>
<u>4.0 to 10.0 MW</u>	<u>42 ppmv</u>	<u>N/A</u>	<u>65 ppmv</u>
<u>10.0 MW and over</u>	<u>25 ppmv</u>	<u>N/A</u>	<u>42 ppmv</u>

\* See 9-9-112

~~**9-9-303 Emission Limits, Alternative Schedule:** A person operating a stationary gas turbine rated at 10 MW to less than 30MW, without SCR, which is otherwise subject to Section 9-9-301.2, may comply with both of the following emission limitations instead of complying with Section 9-9-301.2:~~

~~303.1 Effective January 1, 1996, a person shall not operate such a stationary gas turbine unless nitrogen oxides (NOx) emission concentrations, corrected to 15 percent O<sub>2</sub> (dry basis), do not exceed 25 ppmv, except that, for non-gaseous fuel firing during natural gas curtailment or short testing periods, the limit shall be 42 ppmv.~~

~~303.2 Effective January 1, 2000, a person shall not operate such a stationary gas turbine unless nitrogen oxides (NOx) emission concentrations, corrected to 15 percent O<sub>2</sub> (dry basis), do not exceed 15 ppmv, except that, for non-gaseous fuel firing during natural gas curtailment or short testing periods, the limit shall be 42 ppmv.~~

(Adopted September 21, 1994)

~~**9-9-304 Emission Limits, Interim RACT:** Effective May 31, 1995, a person shall not operate a stationary gas turbine rated at 30 MW or greater and operating 877 hours per year or more unless nitrogen oxides (NOx) emission concentrations, corrected to~~

15 percent O<sub>2</sub> (dry basis), do not exceed 42 ppmv when firing with natural gas or 65 ppmv when firing with non-gaseous fuels. (Adopted September 21, 1994)

~~9-9-305 **Emission Limits, Existing Low-NOx Turbines:** Effective January 1, 1997, a person shall not operate a stationary gas turbine which 1) received a permit to operate prior to May 5, 1993, 2) was required to comply with Best Available Control Technology provisions limiting NOx emissions to 25 ppm or below, and 3) used a technology other than SCR to comply with that limit unless nitrogen oxides (NOx) emissions, corrected to 15 percent O<sub>2</sub> (dry basis), do not exceed 18 ppmv, except that, for non-gaseous fuel firing during natural gas curtailment or short testing periods, the limit shall be 42 ppmv. (Adopted September 21, 1994)~~

**9-9-306 Adjusted Emission Limits – based on Thermal Efficiency:** Emission limits in 9-9-301 and 9-9-302 may be adjusted for turbines with greater than 25% thermal efficiency. The adjusted emission limit calculation is shown in 9-9-306.1. Thermal efficiency is calculated in 9-9-306.2. Thermal efficiency (EFF) data must be gathered during the annual Demonstration of Compliance source test.

$$306.1 \text{ Adjusted Emission Limit} = \frac{\text{Emission Limit} \times \text{EFF}}{25}$$

306.2 EFF (percent efficiency) is calculated as follows:

$$\text{EFF} = \frac{3412 \times 100\%}{\text{Actual Heat Rate at HHV of Fuel} \times \frac{\text{BTU}}{\text{KW} - \text{HR}}}$$

demonstrated turbine efficiency applies only to the gas turbine and any downstream energy recovery used for power augmentation. Heat recovery not used for power generation is excluded from the actual heat rate, (BTU/KW-HR) or 1.34 (BTU/HP-HR); corrected to the HHV (higher heating value) of the fuel at standard conditions.

**9-9-400 ADMINISTRATIVE REQUIREMENTS**

~~9-9-401 **Certification, Efficiency:** If a person who operates a gas turbine subject to the limits of subsections 9-9-301.2, 301.3, 9-9-303, or 9-9-305 can demonstrate a thermal efficiency (EFF) greater than 25 percent in accordance with subsections 401.2.1 or 401.2.2, the emissions limit may be adjusted in accordance with Section 9-9-401.1.~~

~~$$401.1 \text{ Adjusted Emission Limit} = \frac{\text{Emission Limit} \times \text{EFF}}{25}$$~~

~~401.2 EFF (percent efficiency) is the higher of 2.1 or 2.2. An EFF that is less than 25% shall be assigned a value of 25%.~~

~~$$2.1 \text{ EFF} = \frac{3412 \times 100\%}{\text{Actual Heat Rate at HHV of Fuel} \times \frac{\text{BTU}}{\text{KW} - \text{HR}}}$$~~

~~which is the demonstrated percent efficiency of the gas turbine only as calculated without consideration of any downstream energy recovery (not used for power augmentation) from the actual heat rate, (BTU/KW-HR) or 1.34 (BTU/HP-HR); corrected to the HHV (higher heating value) of the fuel and standard conditions, as measured at peak load for that facility.~~

~~or~~

~~$$2.2 \text{ EFF} = \text{Manufacturer's Rated Efficiency} \times \frac{\text{LHV}}{\text{HHV}}$$~~

~~\*With Air Pollution Equipment at LHV~~

~~which is the manufacturer's continuous rated percent efficiency of the gas turbine with air pollution equipment after correction from LHV to HHV of the fuel.~~

~~(Amended September 21, 1994)~~

**9-9-402 Compliance Schedule:** A person who must modify existing sources or install new control equipment to meet the requirements of Section 9-9-301 or 302 shall comply with the following increments of progress:

~~402.1 By July 1, 1995 2007: Submit an application for any Authority to Construct to achieve compliance with such requirements.~~

~~402.2 By January 1, 1996: Submit a status report to the APCO stating the progress of the modification or installation.~~

402.3 If Dry Low NOx combustion technology becomes commercially available for a specific make and model of turbine after December 31, 2006, the operator shall be expected to apply for Authority to Construct with one year, and to comply with the more stringent standards within two years of the technology becoming available.

~~**9-9-403 Alternative Compliance Schedule:** A person who must modify existing sources or install new control equipment to meet the requirements of Section 9-9-303 shall comply with the following increments of progress:~~

~~403.1 By January 1, 1995: Submit an application for any Authority to Construct to achieve compliance with Section 9-9-303.1.~~

~~403.2 By July 1, 1995: Submit a status report to the APCO stating the progress of the modification or installation to achieve compliance with Section 9-9-303.1.~~

~~403.3 By January 1, 1996: Be in compliance with the requirements of Section 9-9-303.1 and all other applicable requirements of this Rule.~~

~~403.4 By January 1, 1998: Submit an application for any Authority to Construct to achieve compliance with Section 9-9-303.2.~~

~~403.5 By January 1, 1999: Submit a status report to the APCO stating the progress of the modification or installation to achieve compliance with Section 9-9-303.2.~~

~~403.6 By January 1, 2000: Be in compliance with the requirements of Section 9-9-303.2 and all other applicable requirements of this Rule.~~

~~(Adopted September 21, 1994)~~

## **9-9-500 MONITORING AND RECORDS**

**9-9-501 Monitoring and Recordkeeping Requirements:** A person who operates any stationary gas turbine rated equal to or greater than 10.0 MW and operated an average of more than 4000 hours per year over the last three years ~~before April 21, 1993,~~ shall install, operate and maintain in calibration a continuous emissions monitor (CEM), or alternative monitoring system, capable of determining exhaust gas NO<sub>x</sub> concentrations. A CEM must meet the requirements of the District Manual of Procedures, Volume V. Any alternative monitoring system must be approved by the APCO. Such approval will only be granted upon a determination, pursuant to the criteria of 40 CFR Part 75, Subpart E, that the alternative monitoring system provides information with the same precision, reliability, accessibility, and timeliness as that provided by a CEM for the source. (Amended September 21, 1994)

**9-9-502 Records, Low Usage:** A person subject to the requirements of Section 9-9-302 or seeking exemption per Section 9-9-112 of this Rule shall maintain a daily gas turbine operating record that includes, the actual start-up and stop time, total hours of operation, type and quantity of fuel used (liquid/gas). This information shall be available to District staff upon request for at least two years from the date of entry.

**9-9-503 Records, Startup and Shutdown Periods:** If the facility does not have a Continuous Emissions Monitor, they must submit operating data to demonstrate the process has achieved the normal operating temperatures, pressures and control parameters required to comply with NOx limits.

**9-9-5034 Initial Demonstration of Compliance:** A person who must modify existing sources or install new control equipment shall conduct a District approved source test ~~by the following dates~~ and submit the results to the District within two months of initial operation after the following dates:

~~503.1 March 31, 1996, for the purpose of demonstrating compliance with Section 9-9-303.1.~~

~~503.2 March 31, 1997, for the purpose of demonstrating compliance with Section 9-9-301, 302, or 305.~~

~~503.3 March 31, 2000, for the purpose of demonstrating compliance with Section 9-9-303.2.~~ (Amended September 21, 1994)

**9-9-505 Annual Demonstration of Compliance:** Each facility with an existing operating permit that does not provide CEM emissions data shall conduct a District approved source test annually, not to exceed 15 months between tests. Submit the test results to the District within two months of the test.

**9-9-600 MANUAL OF PROCEDURES**

**9-9-601 Determination of Emissions:** Emissions of oxides of nitrogen, as specified in Sections 9-9-301, 302, ~~303, 304, and 305~~ shall be measured as prescribed in the District Manual of Procedures, Volume IV, ST-13A ~~or B~~.

(Amended September 21, 1994)

**9-9-602 Determination of Stack Gas Oxygen:** Oxygen content of the exhaust gas shall be determined by using District Manual of Procedures, Volume IV, ST-14.

**9-9-603 Continuous Emission Monitoring:** Continuous Emissions Monitoring (CEM) procedures shall be determined using District Manual of Procedures, Volume V.

**9-9-604 Determination of HHV and LHV:** The HHV and LHV shall be determined using 1) ASTM D240-87 or ~~ASTM D2382-88~~ ASTM D4809 for liquid hydrocarbon fuel; or 2) ASTM 1826-88 or ASTM 1945-84 in conjunction with ASTM D3588-89 for gaseous fuels.