

# SAN JOAQUIN VALLEY UNIFIED AIR POLLUTION CONTROL DISTRICT

## **RULE 4354 -- GLASS MELTING FURNACES**

*(Adopted September 14, 1994; Amended April 16, 1998; Amended February 21, 2002)*

### 1.0 Purpose

The purpose of this rule is to limit emissions of nitrogen oxides (NO<sub>x</sub>), carbon monoxide (CO), and volatile organic compounds (VOC) from glass melting furnaces.

### 2.0 Applicability

The provisions of this rule shall apply to any glass melting furnace that is part of a major NO<sub>x</sub> source.

### 3.0 Definitions

- 3.1 Air-fuel Firing: operation of a glass melting furnace where greater than 50% of the oxidant for the fuel comes from ambient air.
- 3.2 Block 24-hour Average: the arithmetic average of the hourly NO<sub>x</sub> emission rates of a furnace as measured over 24 one-hour periods, daily, from 12:00 AM to 11:59 PM, excluding periods of system calibration.
- 3.3 Container glass: any glass manufactured by pressing, blowing in molds, drawing, rolling, or casting which is used as a container.
- 3.4 Carbon Monoxide (CO): emissions of carbon monoxide, a colorless and odorless gas resulting from incomplete combustion of fuel.
- 3.5 Fiberglass: material consisting of fine filaments of glass that are combined in yarn and woven or spun into fabrics, or that are used as reinforcement in other materials or in masses as thermal or as acoustical insulating products for the construction industry.
- 3.6 Flat glass: any glass produced by the float, sheet, rolled, or plate glass process which is used in windows, windshields, tabletops, or similar products.
- 3.7 Furnace Battery: two or more glass melting furnaces that exhaust to a common stack.
- 3.8 Furnace Rebuild: a cold tank repair which is commenced after the end of a furnace campaign period or expected life cycle of a furnace. For the purpose of compliance deadline in Section 7.1, the effective date of a furnace rebuild is the date of the start of the furnace shutdown.
- 3.9 Idling: the operation of a furnace at less than 25 percent of the permitted production capacity or fuel use capacity as stated on the Permit to Operate.

- 3.10 Major NO<sub>x</sub> Source: any major source as defined in Rule 2201 (New and Modified Stationary Source Review Rule), with a potential to emit 25 tons or more per year of NO<sub>x</sub>.
- 3.11 Multiple Furnaces: two or more glass melting furnaces at a single facility that do not exhaust to a common stack.
- 3.12 NO<sub>x</sub>: the sum of oxides of nitrogen in the flue gas, collectively expressed as nitrogen dioxide (NO<sub>2</sub>).
- 3.13 Oxygen-Assisted Combustion: operation of a glass melting furnace where the oxidant is greater than the oxygen content in ambient air or greater than 20.9 percent oxygen.
- 3.14 100% Air-Fuel Fired: operation of a glass melting furnace where the oxidant is exclusively ambient air.
- 3.15 Oxy-fuel Fired: operation of a glass melting furnace where greater than 50% of the oxidant for the fuel is provided from enriched oxygen streams.
- 3.16 Parts Per Million by Volume (ppmv): the ratio of the number of gas molecules of a given species or group of species, to the number of millions of a total gas molecules.
- 3.17 Permitted Production Capacity: the maximum pull rate as stated in the Permit to Operate.
- 3.18 Primary Furnace Combustion System: the burners in a furnace that are used during production of glass.
- 3.19 Pull Rate: the amount of glass coming out of a glass melting furnace, expressed in short tons per day.
- 3.20 Rolling 30-day Average: the arithmetic average of the daily emission rates of a furnace over a contiguous 30-day period, excluding periods of system calibration.
- 3.21 Shutdown: the period of time during which a glass melting furnace is purposely allowed to cool from operating temperature and molten glass is removed from the tank for the purpose of a furnace rebuild.
- 3.22 Start-up: the period of time, after initial construction or a furnace rebuild, during which a glass melting furnace is heated to operating temperature by the primary furnace combustion system, and systems and instrumentation are brought to stabilization.
- 3.23 Volatile Organic Compound (VOC): defined in Rule 1020 (Definitions).

#### 4.0 Exemptions

- 4.1 Except for Section 6.7, the provisions of this rule shall not apply to electric glass melting furnaces where all the heat is supplied by an electric current from electrodes submerged in the molten glass, except that heat may be supplied by other fuels for start-up when the furnace contains no molten glass.
- 4.2 The emission limits in Section 5.1 Table 1 shall not apply during periods of start-up, shutdown, or idling, provided the operator complies with the requirements of Sections 5.2, 5.3, 5.4, and 6.7.

## 5.0 Requirements

- 5.1 Except as specified in Section 4.2, the operator of any glass melting furnace shall not operate a furnace in such a manner that results in NO<sub>x</sub>, CO, or VOC emissions exceeding the limits in Table 1. The deadline to comply with the emission limits are specified in Section 7.0.

Table 1 NO<sub>x</sub>, CO, and VOC Emission Limits

Type of Furnace	Combustion Type	Tier 1 Emission Limits (See Section 7.1 for compliance schedules.)	Tier 2 Emission Limits (See Section 7.1 for compliance schedules.)		
		NO <sub>x</sub> See Sections 5.5 and 8.1	NO <sub>x</sub>	CO See Sections 5.5, 8.2, and 8.3	VOC See Sections 5.5, 8.2, and 8.3
Container Glass or Fiberglass	100% Air-Fuel Fired	5.5 lb/ton of glass pulled	4.0 lb/ton of glass pulled on a block 24-hour average	300 ppmv	20 ppmv
	Oxygen-Assisted Combustion	5.5 lb/ton of glass pulled	4.0 lb/ton of glass pulled on a block 24-hour average	1.0 lb / ton of glass pulled	0.25 lb / ton of glass pulled
Flat Glass	100% Air-Fuel Fired	See Section 5.6	9.2 lb/ton of glass pulled on a block 24-hour average and 7.0 lb/ton of glass pulled on a rolling 30-day average	300 ppmv	20 ppmv
	Oxygen-Assisted Combustion	See Section 5.6	9.2 lb/ton of glass pulled on a block 24-hour average and 7.0 lb/ton of glass pulled on a rolling 30-day average	0.9 lb / ton of glass pulled	0.1 lb / ton of glass pulled

## 5.2 Start-up Requirements

5.2.1 The operator shall submit a request for a start-up exemption to the APCO in conjunction with or in advance of an application for Authority to Construct (ATC) associated with a furnace rebuild. The actual length of the start-up exemption shall be determined by the APCO and EPA at the time of the ATC issuance, but in any case it shall not exceed the amount of time specified in Sections 5.2.1.1 and 5.2.1.2. Start-up exemptions shall begin upon activation of the primary combustion system. The operator shall submit to the APCO any information deemed necessary by the APCO or EPA to determine the appropriate length of start-up exemption. This information shall include, but is not limited to, a detailed list of activities to be performed during start-up and a reasonable explanation for the length of time needed to complete each activity, and a description of the material process flow rates and system operating parameters, etc., that the operator plans to evaluate during the process optimization. The length of the start-up exemption, if any, will be determined at the discretion of the APCO and EPA. The APCO and EPA will only approve start-up exemptions to the extent that the submittal clearly

identifies the control technologies or strategies to be utilized, the submittal explicitly describes what physical conditions prevail during start-up periods that prevent the controls from being effective, and the submittal provides a reasonably precise estimate as to when physical conditions will have reached a state that allows for the effective control of emissions.

5.2.1.1 104 days for a flat glass furnace, 70 days for a container glass furnace, and 40 days for a fiberglass furnace following activation of the primary furnace combustion system.

5.2.1.2 208 days for a flat glass furnace, 100 days for a container glass furnace, and 105 days for a fiberglass furnace following activation of the primary furnace combustion system for any furnace that uses a NO<sub>x</sub> control technique that is:

5.2.1.2.1 innovative,

5.2.1.2.2 not in common use,

5.2.1.2.3 not readily available from a commercial supplier, or

5.2.1.2.4 funded as original research by a public agency.

5.2.2 During start-up period, the stoichiometric ratio of the primary furnace combustion system shall not exceed 5% excess oxygen, as calculated from the actual fuel and oxidant flow measurements for combustion in the glass melting furnace.

5.2.3 The emission control system shall be in operation as soon as technologically feasible during start-up to minimize emissions.

### 5.3 Shutdown Requirements

5.3.1 The duration of shutdown, as measured from the time the furnace operations drop below the idle threshold specified in Section 3.9 to when all emissions from the furnace cease, shall not exceed 20 days.

5.3.2 The emission control system shall be in operation whenever technologically feasible during shutdown to minimize emissions.

### 5.4 Idling Requirements

5.4.1 The emission control system shall be in operation whenever technologically feasible during idling to minimize emissions.

5.4.2 The NO<sub>x</sub>, CO and VOC emission during idling shall not exceed the amount as calculated using the following equation:

Pounds per day emission limit of NO<sub>x</sub>, VOC, or CO = (Applicable Tier 1 or Tier 2 emission limit in pounds emissions per ton of glass produced) x (Furnace permitted production capacity in tons of glass produced per day)

## 5.5 Compliance Determination

5.5.1 The emissions measured for compliance with Tier 1 NO<sub>x</sub> limits and Tier 2 CO and VOC limits shall be averaged over a three hour period in accordance with the applicable test methods in Section 6.5.1, or, if a continuous emission monitoring system (CEMS) or an alternate emission monitoring method is used, the applicable requirements of Sections 6.6.1 and 6.6.2, respectively.

5.5.2 Any source testing result, CEMS or alternate emission monitoring method averaged value exceeding the applicable emission limits in Section 5.1 shall constitute a violation of the rule.

5.6 The Tier 1 NO<sub>x</sub> emission limit for flat glass furnaces shall be calculated using the following equation:

$$\text{NOx Limit} = (32 \text{ lb NOx per ton of glass pulled}) - [(0.2 \text{ lb NOx per ton of glass pulled}) \times \text{CF}]$$

Where:

$$\text{CF} = \frac{\text{Glass Pull Rate in tons per day}}{\text{Permitted Production Capacity in tons per day}} \times 100\%$$

5.7 In lieu of each furnace complying individually with the Tier 2 emission limits in Section 5.1, the owner of a furnace battery or multiple furnaces may comply with this rule according to Section 9.0.

5.8 The operator of any glass melting furnace shall implement a NO<sub>x</sub> CEMS or a NO<sub>x</sub> alternate emissions monitoring method on each furnace, that is approved by the APCO, and that meets the requirements of Sections 6.6 by no later than the next furnace rebuild after January 1, 1999 or March 31, 2005, whichever comes first. For a furnace battery, a single CEMS or alternate emissions monitoring method may be used to determine the total NO<sub>x</sub> emissions from all the furnaces provided the emission measurements are made at the common stack.

## 6.0 Administrative Requirements

### 6.1 Permitted Production Capacity and Fuel Use Capacity

#### 6.1.1 All Furnaces

In order to qualify for the exemption in Section 4.2 and in order to determine the validity of a source test in accordance with Section 6.5.2,

6.1.1.1 each glass melting furnace's Permit to Operate shall include the permitted glass production capacity or the furnace's fuel capacity as a permit condition; or

6.1.1.2 the owner of a glass melting furnace shall submit a complete application for Authority to Construct, to include each furnace's permitted glass production capacity or the furnace's fuel capacity as a permit condition, by July 16, 1998, and shall implement said Authority to Construct within 30 days of issuance by the APCO.

## 6.1.2 Flat Glass Furnaces

In order to determine compliance with Section 5.1 Tier 1 NOx limits,

6.1.2.1 each flat glass furnace's Permit to Operate shall include the permitted glass production capacity as a permit condition; or

6.1.2.2 the owner of a flat glass melting furnaces shall submit a complete application for Authority to Construct, to include each furnace's permitted glass production capacity, by July 16, 1998, and shall implement said Authority to Construct within 30 days of issuance by the APCO.

## 6.2 Emission Control Plan (ECP)

The owner of any glass melting furnace subject to the provisions of this rule shall submit to the APCO an ECP in accordance with the compliance schedule in Section 7.1 which identifies all actions to be taken to satisfy the requirements of Section 5.0. Such plan shall identify the type of emission controls, CEMS or alternate emission monitoring method to be applied to each glass melting furnace and a construction schedule. The method used for determining pull rate shall be submitted. If the pull rate calculation method is changed, the new calculation method shall be submitted within 30 days from the date of such change. If a furnace is already achieving Section 5.1 Tier 2 emission limits prior to the compliance deadline specified in Section 7.1 Table 2 Tier 2, the ECP shall include CEMS or alternate emission monitoring data, or source tests results that are sufficient to demonstrate compliance with all the requirements of this rule.

## 6.3 Recordkeeping

6.3.1 Until the full compliance date for Tier 2 emission limits specified in Section 7.1, the owner of any glass melting furnace subject to the provisions of this rule shall maintain an operating log for each furnace that includes: on a monthly basis, the total hours of operation; type and quantity of fuel used in each furnace; and the quantity of glass pulled. The owner shall maintain records of source tests and operating parameters established during initial source test, maintenance, repair, malfunction, idling, shutdown, and start-up. This information shall be made available on site during normal business hours from Monday through Friday for a period of five years, and submitted to the APCO upon request.

6.3.2 Effective on and after the full compliance date for Tier 2 emission limits specified in Section 7.1, the owner of any glass melting furnace shall maintain the records specified in Sections 6.3.2.1, 6.3.2.2, and 6.3.2.3 for a period of five years, make them available on site during normal business hours from Monday through Friday, and submit them to the APCO upon request.

6.3.2.1 Daily records of the total hours of operation, type and quantity of fuel used in each furnace, and/or the quantity of glass pulled from each furnace.

6.3.2.2 Daily records of NO<sub>x</sub> emission rate in lb/ton of glass pulled.

6.3.2.3 Records of source tests and operating parameters established during initial source test, maintenance and repair, malfunction, and idling, start-up and shutdown

#### 6.4 Compliance Source Testing

Each glass melting furnace or a furnace battery shall be source tested at least once every calendar year, but not more than every 18 months and not sooner than every 6 months to demonstrate compliance with the applicable requirements of Section 5.0.

#### 6.5 Test Methods

6.5.1 Compliance with the requirements of Section 5.0 shall be determined in accordance with the following source test procedures or their equivalents as approved by the USEPA, CARB, and the APCO:

6.5.1.1 NO<sub>x</sub> emission rate (Heat input basis) - USEPA Method 19.

6.5.1.2 Oxides of nitrogen - USEPA Method 7E, or CARB Method 100.

6.5.1.3 Carbon monoxide (ppmv) - USEPA Method 10, or CARB Method 100.

6.5.1.4 Volatile Organic Compound (ppmv) – USEPA Method 25A expressed in terms of carbon.

6.5.1.5 Stack gas oxygen, carbon dioxide, excess air, and dry molecular weight - USEPA Method 3 or 3A, or CARB Method 100.

6.5.1.6 Stack gas velocity and volumetric flow rate - USEPA Method 2.



6.5.2 Source test results shall be representative of operations equal to or greater than 60 percent of the permitted production capacity or fuel use capacity for each furnace as stated in the Permit to Operate.

6.6 Emissions Monitoring Systems

6.6.1. An approved CEMS shall comply the requirements of 40 Code of Federal Regulations (CFR) Part 51, 40 CFR Parts 60.7 and 60.13, 40 CFR Part 60 Appendix B (Performance Specifications) and Appendix F (Quality Assurance Procedures), and applicable sections of Rule 1080 (Stack Monitoring).

6.6.2 An approved alternate emissions monitoring method shall be capable of determining the furnace emissions on an hourly basis and shall comply with the requirements of 42 FR 54900 (Compliance Assurance Monitoring) and 40 CFR 60.13 (Monitoring Requirements), as applicable.

6.7 Exempt Furnaces

The operator of any glass melting furnace claiming an exemption under Section 4.2 shall notify the APCO by telephone at least 24 hours before initiating idling, shutdown, or start-up. The notification shall include: date and time of the start of the exempt operation, reason for performing the operation, and an estimated completion date. The operator shall notify the APCO by telephone within 24 hours after completion of the operation. The owner claiming an exemption under Section 4.1 or 4.2 shall maintain operating records and/or support documentation necessary to claim exemption. Records shall be maintained for five years, made available on site during normal business hours from Monday through Friday, and submitted to the APCO upon request.

7.0 Compliance Schedule

7.1 The operator of any flat glass, container glass, or fiberglass melting furnace shall demonstrate full compliance with the provisions of this rule not later than the schedules in Table 2.

Table 2 Compliance Schedule

Emission Limits	Emission Control Plan (ECP)	Authority to Construct (ATC) Application	Full Compliance
Tier 1	3/14/95	3/14/95	5/31/95
Tier 2	12 months prior to next furnace rebuild after 1/1/99 and no later than 3/31/2007	9 months prior to next furnace rebuild after 1/1/99 and no later than 6/31/2007	Next furnace rebuild after 1/1/99 and no later than 3/31/2008

7.2 As shown in Section 7.1 the column labeled:

7.2.1 "ECP" identifies the date by which the operator shall submit an Emission Control Plan according to Section 6.2, or Section 9.0.

7.2.2 “ATC Application” identifies the date by which the operator shall submit a complete application for Authority to Construct (ATC) for any necessary modifications to each glass melting furnace.

7.2.3 “Full Compliance” identifies the date by which the operator shall demonstrate that each furnace is in compliance after start-up with the emission limits in Section 5.1 and after which, the operator shall remain in compliance with the applicable emission limits in Section 5.1.

## 8.0 Calculations

8.1 The NO<sub>x</sub> emission rate in ppmv shall be converted to lb/hr by using the appropriate conversion equations in CARB Method 100, USEPA Method 19, or an equivalent conversion method approved by the APCO. The NO<sub>x</sub> mass emission rate in lb/hr shall be converted to lb NO<sub>x</sub>/ton of glass pulled according to the following equation:

$$\text{lb NO}_x / \text{ton of glass pulled} = \frac{\text{lb / hr of NO}_x}{\text{Pull rate in tons / hr}}$$

8.2 100% air-fuel fired furnaces which have concentration limits in ppmv values shall be subject to the CO and VOC emission limits specified in Section 5.1. These limits are referenced at dry stack gas conditions and 8.0 percent by volume of stack oxygen. The CO and VOC emission concentrations shall be corrected to 8.0 percent oxygen by using the equation below, or an equivalent correction method that is approved by the APCO.

$$(\text{ppmv CO})_{\text{corrected}} = \frac{12.9\%}{20.9\% - (\% \text{O}_2)_{\text{measured}}} \times (\text{ppmv CO})_{\text{measured}}$$

$$(\text{ppmv VOC})_{\text{corrected}} = \frac{12.9\%}{20.9\% - (\% \text{O}_2)_{\text{measured}}} \times (\text{ppmv VOC})_{\text{measured}}$$

8.3 The operator of a oxy-fuel fired furnace, oxygen-assisted combustion furnace, or a furnace utilizing any fuel oxidants other than 100% ambient air, shall submit to the APCO for approval any methodologies and data that will be used to calculate emission rates in pounds per ton of glass pulled for NO<sub>x</sub>, CO, and VOC if the methods are different than specified in Section 8.1. Unless the operator received the APCO’s prior written approval of all the calculation methods to be used that are different than specified in Section 8.1, compliance with the emissions limits cannot be fully demonstrated, and it shall be deemed to be a violation of the rule.

## 9.0 Furnace Battery or Multiple Furnaces Control

As an alternative to complying with Section 5.1 Tier 2 NOx emission limits and Section 7.0, the operator of a furnace battery or multiple furnaces shall operate the furnace battery or multiple furnaces pursuant to Sections 9.1 through 9.7. Any violation of the requirements below shall be considered a violation of this rule, and a violation of the aggregated emission limits shall constitute a violation for each furnace for the entire averaging time.

Any operator who elects to comply with Section 9.0 in lieu of complying with the requirements of Section 5.1 Tier 2 NOx emission limits and Section 7.0 shall be subject to a 10% environmental air quality benefit pursuant to the United States Environmental Protection Agency's Emissions Trading Policy. NOx emissions shall be at least 10% lower than the limits specified in Section 5.1 Tier 2. The furnace shall not be subject to this requirement if the operator can demonstrate compliance by operating an approved CEMS or an approved alternate monitoring method for each furnace in accordance with the provisions of Section 6.6.

- 9.1 The operator shall submit an ECP and a complete ATC in accordance with schedules in Section 7.1. The ECP shall:
  - 9.1.1 contain, in addition to the requirements of Section 6.2, all data, records, and other information necessary to determine eligibility of a furnace battery or multiple furnaces for NOx emission control under Section 9.0, including, but not limited to:
    - 9.1.1.1 a list of furnaces subject to the ECP;
    - 9.1.1.2 estimated aggregate emission levels as determined in accordance with Section 9.7; and
    - 9.1.1.3 estimated aggregate glass production rates.
  - 9.1.2 detail the method of recording and verifying daily compliance with the ECP.
- 9.2 The operator shall submit an updated or modified ECP for approval by the APCO prior to any modification to the furnace(s) which requires an ATC as outlined in Rule 2010 (Permits Required).
- 9.3 The ECP schedule for achieving reduced NOx emission levels shall be at least as expeditious as the schedule were each furnace to comply individually with the emission limits in Section 5.1 Tier 2 and the compliance schedule in Section 7.1.
- 9.4 The daily aggregate NOx emissions, as determined in accordance with Section 9.7, shall be no greater than those obtained by controlling each furnace to comply individually with the limits in Section 5.1 Tier 2.
- 9.5 The operator shall conduct source testing of the furnace according to the requirements of Sections 6.4 and 6.5.2.

## 9.6 Determination of Compliance

9.6.1 The operator shall calculate and record on a daily basis the aggregated NO<sub>x</sub> emissions of furnaces which are subject to an ECP. Such records shall be kept for a period of five years. The operator shall notify the APCO of any violation of Section 9.4 within 24 hours. The notification shall include:

9.6.1.1 name and location of the facility

9.6.1.2 identification of furnace(s) causing the exceedances

9.6.1.3 the cause and the expected duration of exceedances

9.6.1.4 calculation of actual NO<sub>x</sub>, CO and VOC emissions

9.6.1.5 corrective actions and schedules to complete the work.

9.6.2 The operator shall demonstrate compliance with the requirements of Section 9.4 through CEMS data or approved alternate emissions monitoring methods, and source test results.

## 9.7 Determination of Aggregated NO<sub>x</sub> Emissions

9.7.1 The aggregated NO<sub>x</sub> emissions of a furnace battery is the NO<sub>x</sub> emissions as measured at the common stack divided by the sum of the daily glass pulled from each furnace.

9.7.2 The aggregated NO<sub>x</sub> emissions of multiple furnaces is the sum of the daily NO<sub>x</sub> emissions of each furnace divided by the sum of the daily glass pulled from each furnace.

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