

SMAQMD BACT CLEARINGHOUSE

CATEGORY Type:

DRYER (NON PROCESS HEATER)BACT Category: High Turndown Ratio ($\geq 30:1$), Rated at \geq

BACT Determination Number:	312	BACT Determination Date:	8/25/2022
Equipment Information			
Permit Number:	N/A -- Generic BACT Determination		
Equipment Description:	DRYER - LAUNDRY		
Unit Size/Rating/Capacity:	Small Emitter BACT (PTE < 10 lb/day)		
Equipment Location:			
BACT Determination Information			
District Contact: Jeff Quok Phone No.: (279) 207-1145 email: jquok@airquality.org			
ROCs	Standard:	Natural gas fueled	
	Technology Description:		
	Basis:	Achieved in Practice	
NOx	Standard:	60 ppmvd @ /3% O ₂	
	Technology Description:	Low-NOx burner	
	Basis:	Achieved in Practice	
SOx	Standard:	Natural gas fueled	
	Technology Description:		
	Basis:	Achieved in Practice	
PM10	Standard:	75% Control	
	Technology Description:	Lint Collector and natural gas fuel, or equal	
	Basis:	Achieved in Practice	
PM2.5	Standard:	75% Control	
	Technology Description:	Lint Collector and natural gas fuel, or equal	
	Basis:	Achieved in Practice	
CO	Standard:	No Standard	
	Technology Description:		
	Basis:		
LEAD	Standard:	N/A	
	Technology Description:		
	Basis:		
Comments: This is a generic BACT determination based on BACT determinations made, and published, by other air agencies in California and/or other States.			

SMAQMD BACT CLEARINGHOUSE

CATEGORY Type: **DRYER (NON PROCESS HEATER)**

BACT Category: High Turndown Ratio ($\geq 30:1$), Rated at

BACT Determination Number: 313	BACT Determination Date: 8/25/2022
Equipment Information	
Permit Number: N/A -- Generic BACT Determination Equipment Description: DRYER - LAUNDRY Unit Size/Rating/Capacity: Small Emitter BACT (PTE < 10 lb/day) Equipment Location:	
BACT Determination Information	
District Contact: Jeff Quok Phone No.: (279) 207-1145 email: jquok@airquality.org	
ROCs	Standard: Natural gas fueled
	Technology Description:
	Basis: Achieved in Practice
NOx	Standard: For process temperature < 1200° F: 30 ppmvd @ 3% O2
	Technology Description: Low NOx Burner
	Basis: Achieved in Practice
SOx	Standard: Natural gas fueled
	Technology Description:
	Basis: Achieved in Practice
PM10	Standard: 75% Control
	Technology Description: Lint Collector and natural gas fuel, or equal
	Basis: Achieved in Practice
PM2.5	Standard: 75% Control
	Technology Description: Lint Collector and natural gas fuel, or equal
	Basis: Achieved in Practice
CO	Standard: 400 ppmv @ 3% O2
	Technology Description:
	Basis: Achieved in Practice
LEAD	Standard: N/A
	Technology Description:
	Basis:
Comments: This is a generic BACT determination based on BACT determinations made, and published, by other air agencies in California and/or other States.	



BEST AVAILABLE CONTROL TECHNOLOGY DETERMINATION

EXPIRED

DETERMINATION NOS.: 312 & 313
DATE: August 25, 2022
ENGINEER: Jeffrey Quok

Category/General Equip Description: Dryer

Equipment Specific Description: #312 – Commercial Laundry Dryer, Natural Gas-fired, High Turndown $\leq 2,000,000$ Btu/hr
#313 – Commercial Laundry Dryer, Natural Gas-fired, High Turndown Ratio > 2 MMBtu/hr to ≤ 10 MMBtu/hr

Equipment Size/Rating: Small Emitter BACT (PTE < 10 lb/day)

Previous BACT Det. No.: 175

This BACT determination will update Determination #175 for a natural gas-fired commercial laundry dryer with a high turndown ratio. BACT Determination #175 only applied to units rated $\leq 2,000,000$ Btu/hr. An additional BACT determination will be created to cover units > 2 MMBtu/hr to ≤ 10 MMBtu/hr. In addition, both these BACTs will be in the Small Emitter Category.

This BACT determination is for commercial laundry dryers that use burners with a high turndown ratio ($\geq 30:1$). Turndown ratio refers to the width of the operational range of a device and is defined as the ratio of the maximum capacity to minimum capacity. Because of the need for high turndown, the burner manufacturer cannot guarantee NO_x emissions that meet BACT #249 for commercial laundry dryers (30 ppmv @ 3% O₂). The dryers are part of an automated washroom process. High turndown ratios are required so that sensitive linens are not scorched or damaged. The system measures and monitors inlet and outlet exhaust temperatures as a surrogate for the effective linen temperature. Upon start-up, the dryer system fully opens the gas valve to maximum heat input to drive off the majority of the moisture in the linens. This results in a high inlet temperature and a low outlet temperature due to the high amount of evaporation. As the linen temperature increases, the outlet temperature increases. Once the outlet temperature rises to a certain set point, the system turns down the burner gradually such that any remaining moisture is driven off without heating the linens to the point of scorching. Towards the end of the cycle, the burner is firing close to its minimum firing capacity. This allows moisture caught in the folds of certain linens (i.e., duvet covers or linens with cuffs) to be driven off while maintaining the linen temperature of the already dried linen. The dryer then turns off the burner and switches to a cool-down cycle using any latent heat to finish the cycle.

The District's Small Emitter and "Otherwise-Exempt Equipment" BACT Determinations policy states that units which are classified as small emitters (less than 10 lbs/day of VOC, NO_x, SO_x, PM₁₀, or

PM2.5 and less than 550 lbs/day of CO) and are located at non-major stationary sources are only required to meet BACT standards that have been achieved in practice. Therefore, this BACT determination will only be based on what is achieved in practice and will only be applied to small emitters at non-major sources. BACT will be evaluated on a case-by-case basis for units that do not fit this criteria.

BACT/T-BACT ANALYSIS

A. ACHIEVED IN PRACTICE (Rule 202, §205.1a):

The following control technologies are currently employed as BACT/T-BACT for commercial laundry dryers with a high turndown ratio and rated at greater than or equal to 325,000 Btu/hr to less than or equal to 10 MMBtu/hr:

US EPA

BACT

[Source: EPA RACT/BACT/LAER Clearinghouse](#)

For natural gas-fired commercial laundry dryer	
VOC	N/A – No BACT determinations found
NOx	N/A – No BACT determinations found
SOx	N/A – No BACT determinations found
PM10	N/A – No BACT determinations found
PM2.5	N/A – No BACT determinations found
CO	N/A – No BACT determinations found

The following process codes were reviewed:

- (A) 19.600 – Misc. Boilers, Furnaces, Heaters
- (B) 19.900 – Other Misc. Combustion

T-BACT

There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS:

No applicable rule requirements were found.

California Air Resource Board (CARB)

BACT

Source: [ARB BACT Clearinghouse](#)
[CARB BACT Guidelines Search](#)

Dryer or Oven, Direct or Indirect Fired (A)	
VOC	N/A – No BACT determinations found
NOx	N/A – No BACT determinations found
SOx	N/A – No BACT determinations found
PM10	N/A – No BACT determinations found
PM2.5	N/A – No BACT determinations found
CO	N/A – No BACT determinations found

(A) See Attachment A

T-BACT

There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS:

No applicable rule requirements were found.

Sacramento Metropolitan AQMD

BACT

Source: [SMAQMD BACT Clearinghouse BACT #175 \(5/3/2018\)](#)

For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $\leq 2,000,000$ Btu/hr	
VOC	Natural gas fueled
NOx	60 ppmvd @ 3% O ₂ , Low-NOx burner (A)
SOx	Natural gas fueled
PM10	75% Control (Lint collector and natural gas fuel, or equal)
PM2.5	75% Control (Lint collector and natural gas fuel, or equal)
CO	No Standard

(A) An applicant has proposed a Consolidated Laundry Machinery (CLM) industrial dryer equipped with a 2.5 MMBtu/hr Maxxon Ovenpak LE 25 burner with a high turndown ratio that is able to meet 30 ppm NOx (See Attachment C).

Recently, an applicant has proposed a Consolidated Laundry Machinery (CLM) industrial dryer equipped with a 2.5 MMBtu/hr Maxxon Ovenpak LE 25 burner with a high turndown ratio

that is able to meet 30 ppm NO_x (See Attachment C). Since the proposed CLM industrial dryer has a manufacturer guarantee of 30 ppm NO_x, this standard will be considered achieved in practice for high turndown units greater than or equal to 2,000,000 BTU/hr.

T-BACT

No T-BACT Determination.

RULE REQUIREMENTS:

[Rule 419 – NO_x from Miscellaneous Combustion Units](#) (10/25/18)

This Rule applies to any miscellaneous combustion unit or cooking unit with a total rated heat input capacity of 2 MMBtu/hr or greater that is located at a major stationary source of NO_x and to any miscellaneous combustion unit or cooking unit with a total rated heat input capacity of 5 MMBtu/hr or greater that is not located at a major stationary source of NO_x.

The requirements of this rule do not apply to combustion equipment where its primary function is to operate as an air pollution control device including, but not limited to, afterburners, catalytic oxidizers, flares, thermal oxidizers, or vapor incinerators.

TABLE 1: Miscellaneous Combustion Units Emission Limits Expressed As PPMV, corrected to 3% O₂			
Equipment Category	NO_x Limit ppmv, corrected to 3% O₂ (lb/MMBtu)		CO Limit ppmv, corrected to 3% O₂ (lb/MMBtu)
Gaseous Fuel-Fired Equipment	Process Temperature		All Temperatures
	< 1200°F	≥ 1200 °F	
Oven, Dehydrator, Dryer, Heater, or Kiln	30 (0.036)	60 (0.073)	400 (0.30)

South Coast AQMD

BACT

Source: [SCAQMD BACT Guidelines for Non-Major Polluting Facilities, page 42](#) (2/5/2021)

Dryer or Oven > 2,000,000 Btu/hr	
VOC	No standard.
NO _x	<ol style="list-style-type: none"> 1. Carpet Oven: 30 ppmvd @ 3% O₂, Compliance with Rule 1147 2. Rotary, Spray, and Flash Dryers^(A): Compliance with Rule 1147 3. Tray, Agitated Pan, and Rotary Vacuum Dryers: Compliance with Rule 1147 4. Tenter Frame Fabric Dryer: 30 ppmvd @ 3% O₂, Compliance with Rule 1147 5. Other Dryers and Ovens – Direct and Indirect Fired: 30 ppmvd @ 3% O₂
SO _x	Natural gas

Dryer or Oven > 2,000,000 Btu/hr	
PM10	<ol style="list-style-type: none"> 1. Carpet Oven: Natural gas 2. Rotary, Spray, and Flash Dryers^(A): Natural gas with baghouse 3. Tray, Agitated Pan, and Rotary Vacuum Dryers: Natural gas 4. Tenter Frame Fabric Dryer: Natural gas 5. Other Dryers and Ovens – Direct and Indirect Fired: Natural gas
PM2.5	No standard.
CO	No standard.

(A) Dryers for foodstuff, pharmaceuticals, aggregate, & chemicals.

Note: SCAQMD Rule 219 exempts combustion equipment $\leq 2,000,000$ Btu/hr from permitting unless it is integral to a process that would otherwise require a permit. (i.e. heated automotive spray booth). Pursuant to SCAQMD Rule 1303, BACT only applies to new or modified sources. Rule 1302 defines a source as any **permitted** individual unit, piece of equipment, article, machine, process, contrivance, or combination thereof, which may emit or control an air contaminant. Therefore, in the case of a dryer $\leq 2,000,000$ Btu/hr, BACT would not apply because it is not otherwise required to obtain a permit to operate.

T-BACT

There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS:

Reg II, Rule 219 – Equipment Not Requiring A Written Permit Pursuant to Regulation II (Last amended 1/7/2022)

Permits are not required for boilers, process heaters, or any combustion equipment that has a rated maximum heat input capacity of 2,000,000 Btu per hour or less and are equipped to be heated exclusively with natural gas, methanol, liquefied petroleum gas, or any combination thereof.

Reg XI, Rule 1147 – NO_x Reductions from Miscellaneous Sources (Last amended 5/6/2022)

This rule applies to ovens, dryers, dehydrators, heaters, kilns, calciners, furnaces, crematories, incinerators, heated pots, cookers, roasters, fryers, closed and open heated tanks and evaporators, distillation units, afterburners, degassing units, vapor incinerators, catalytic or thermal oxidizers, soil and water remediation units and other combustion equipment with nitrogen oxide emissions that require a District permit and are not specifically required to comply with a nitrogen oxide emission limit by other District Regulation XI rules.

However, Reg II, Rule 219 exempts combustion equipment firing natural gas, for which the maximum heat input is 2,000,000 Btu/hr or less. Therefore, in practice, the below standards only apply to commercial laundry dryers with a heat input greater than 2,000,000 Btu/hr.

Equipment Category	NOx Emission Limit PPM @ 3% O ₂ , dry or pound/MMBtu heat input	
	Process Temperature	
	< 1200° F	≥ 1200 ° F
Oven, Dehydrator, Dryer, Heater, Kiln, Calciner, Cooker, Roaster, Furnace, or Heated Storage Tank	20 ppm or 0.024 lb/MMBtu	30 ppm or 0.036 lb/MMBtu
Tenter Frame or Fabric or Carpet Dryer	20 ppm or 0.024 lb/MMBtu	20 ppm or 0.024 lb/MMBtu
Other Unit or Process Temperature	30 ppm or 0.036 lb/MMBtu	60 ppm or 0.073 lb/MMBtu

CO limit for all units is 1,000 ppmv at 3% O₂.

Discussion on High Turndown Ratio:

High turndown ratios are a consideration with industries that need highly variable controls for their processes. For certain commercial laundry dryers, high turndown is required for dryers to ramp up to high-fire to initially drive off moisture, and then switch to mid- and low-fire to maintain a linen temperature high enough to drive off any remaining moisture, but low enough to not scorch and damage the fabric. The SCAQMD discussed burner turndown in their staff report for Rule 1147 (December 2008) – See Attachment B. The SCAQMD concluded that many low NO_x burners can meet 20 to 40 ppm NO_x @ 3% oxygen while maintaining turndown ratios of 15:1 to 10:1, with some burners achieving turndown ratios of 25:1. Also, equipment that traditionally use burners with a turndown ratio of 30:1 can use low NO_x burners with turndown ratios of 15:1 or less, because the moderate temperatures in Southern California reduce some of the necessity of high turndown to quickly heat up equipment. Therefore, for dryer burners operating as high as 2,000,000 BTU/hr and with turndowns as low as 40,000 BTU/hr (at least once per drying cycle), installing a burner with a lower turndown ratio or a Rule 1147-compliant burner that cannot meet the turndown requirements of this automated drying system is not considered technologically feasible.

In SCAQMD's most recent revision of Rule 1147 dated May 6, 2022, limits for tenter frame, fabric, or carpet dryers have been lowered to 20 ppm NO_x. However, from the source tests reviewed in the staff report showed only 1 of 29 units was able to meet the 20 ppm NO_x and it was specified as not being a high turndown unit (See Attachment B). Therefore, since SCAQMD's Rule 1147 staff report only cited one unit able to meet 20 ppm NO_x and was not a high turndown unit, the 20 ppm standard will not be considered as achieved in practice.

Since SCAQMD's 20 ppm NO_x standard will not be considered achieved in practice for high turndown units, high turndown units would be considered as "other units" in SCAQMD's equipment category. Therefore, high turndown units would need to meet the 30 ppm NO_x at < 1200°F and 60 ppm at ≥ 1200°F BACT standard.

San Joaquin Valley Unified APCD

BACT

Source: [SJVUAPCD BACT Guideline 1.9.14](#) (2/09/2007)

Natural Gas Fired Dryer with High Turndown Ratio ^(A)	
VOC	No Standard
NOx	84 ppmvd @ 3% O ₂ , Low-NOx burner ^(B) (Achieved in Practice) 40 ppmvd @ 3% O ₂ , Low-NOx burner ^(B) (Technologically Feasible) ^(C)
SOx	No Standard
PM10	No Standard
PM2.5	No Standard
CO	No Standard

(A) For the purpose of this determination, a "high turndown ratio" is one that exceeds the turndown ratio of an ultra-low NOx burner system operating at 20 ppmv NOx @ 3% O₂ ^(B) or 10 ppmv NOx @ 3% O₂ ^(B).

(B) Emissions limits have been corrected from 19% Oxygen to 3% Oxygen for comparison purposes.

(C) The technologically feasible option was the standard applied to the project (Natural Gas Fired Dryer Used to Dry Prints on Polyethylene (or Other Similar Material) Coated Web. The dryer was rated at 2.5 MMBtu/hr.

T-BACT

There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS:

[Rule 4309 – Dryers, Dehydrators, and Ovens \(adopted 12/15/05\)](#)

This rule does not apply to any dryer, dehydrator, or oven that has a total rated heat input of < 5.0 MMBtu/hr.

SJVUAPCD Rule 4309 Emission Standards ppmvd @ 3% O ₂ ^(B) Rule 4309 §5.2, Table 1 for Gaseous Fuel Fired		
Process Description	NOx limit ^(B)	CO Limit ^(B)
Other processes ^(A)	40 ppm	395 ppm

(A) Excludes asphalt/concrete plants, and milk, cheese, and dairy processing.

(B) Rule 4309's limits are in ppmvd @ 19% Oxygen. The values listed in the table have been corrected to 3% Oxygen for comparison purposes.

Although Rule 4309 has a NOx limit of 40 ppm, the SJVACD BACT Guideline 1.9.14 as seen above states that 40 ppm NOx is only technologically feasible for natural gas fired dryers with a high turndown ratio.

San Diego County APCD

BACT

Source: [NSR Requirements for BACT \(June 2011\)](#)

For Natural Gas Fired Commercial Laundry Dryer	
VOC	N/A – No BACT determinations found
NOx	N/A – No BACT determinations found
SOx	N/A – No BACT determinations found
PM10	N/A – No BACT determinations found
PM2.5	N/A – No BACT determinations found
CO	N/A – No BACT determinations found

Note: Pursuant to [Rule 11 \(4/1/2021\)](#), Section (d)(18)(iv), laundry dryers, extractors, or tumblers used for fabrics cleaned only with solutions of bleach or detergents, provided that the VOC content of detergents and additives used does not exceed 50 grams per liter (this exemption does not apply to equipment used for previously VOC-laden materials such as rags, cloths, etc.) are not required to obtain a permit and are therefore not subject to New Source Review (BACT).

T-BACT

There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS:

[Regulation 4, Rule 68 – Fuel-Burning Equipment – Oxides of Nitrogen \(effective 9/20/1994\)](#)

This rule does not apply to fuel burning equipment which has a maximum input rating of < 50 MMBtu/hr.

Bay Area AQMD

BACT

Source: [BAAQMD BACT Guideline](#)

For Natural Gas-Fired Commercial Laundry Dryer	
VOC	N/A – No BACT determinations found
NOx	N/A – No BACT determinations found
SOx	N/A – No BACT determinations found
PM10	N/A – No BACT determinations found
PM2.5	N/A – No BACT determinations found
CO	N/A – No BACT determinations found

T-BACT

There are no T-BACT standards published in the clearinghouse for this category.

RULE REQUIREMENTS:

[Reg 8, Rule 2 – Organic Compounds from Miscellaneous Operations §8-2-110 \(amended 7/20/05\)](#)

This rule for organic compound emissions exempts any operation consisting entirely of natural gas, and therefore does not apply.

[Reg 9, Rule 3 – Inorganic Gaseous Pollutants; NOx from Heat Transfer Operations §9-3-301 \(amended 3/17/82\)](#)

This rule does not apply to any new or modified heat transfer operation designed for a maximum heat input of less than 264 GJ (250 MMBtu).

Summary of Achieved in Practice Control Technologies

The following control technologies have been identified and are ranked based on stringency:

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
Pollutant	ACHIEVED CONTROL TECHNOLOGIES
VOC	<p><u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $\leq 2,000,000$ Btu/hr</u></p> <ol style="list-style-type: none"> 1. Natural gas fueled [SMAQMD] 2. No Standard [EPA, ARB, SCAQMD, SJUVAPCD, SDAPCD, BAAQMD]
	<p><u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $> 2,000,000$ Btu/hr and ≤ 10 MMBtu/hr</u></p> <ol style="list-style-type: none"> 1. No Standard [EPA, ARB, SMAQMD, SCAQMD, SJUVAPCD, SDAPCD, BAAQMD]
NOx	<p><u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $\leq 2,000,000$ Btu/hr</u></p> <ol style="list-style-type: none"> 1. 60 ppmvd @ 3% O₂, Low-NOx burner [SMAQMD] 2. 84 ppmvd @ 3% O₂, Low-NOx burner [SJUVAPCD] 3. No Standard [EPA, ARB, BAAQMD, SCAQMD, SDAPCD]
	<p><u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $> 2,000,000$ Btu/hr and ≤ 10 MMBtu/hr</u></p> <ol style="list-style-type: none"> 1. 30 ppmvd @ 3% O₂, Low-NOx burner [SMAQMD] 2. 30 ppmvd @ 3% O₂ when $< 1200^{\circ}\text{F}$ and 60 ppmvd @ 3% O₂ when $\geq 1200^{\circ}\text{F}$ O₂ [SCAQMD]^(A) 3. 84 ppmvd @ 3% O₂, Low-NOx burner [SJUVAPCD] 4. No Standard [EPA, ARB, BAAQMD, SDAPCD]

SUMMARY OF ACHIEVED IN PRACTICE CONTROL TECHNOLOGIES	
Pollutant	ACHIEVED CONTROL TECHNOLOGIES
SO_x	<u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $\leq 2,000,000$ Btu/hr</u> 1. Natural gas fueled [SMAQMD, SCAQMD] 2. No Standard [EPA, ARB, SJUVAPCD, SDAPCD, BAAQMD]
	<u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $> 2,000,000$ Btu/hr and ≤ 10 MMBtu/hr</u> 1. Natural gas fueled [SCAQMD] 2. No Standard [EPA, ARB, SMAQMD, SJUVAPCD, SDAPCD, BAAQMD]
PM₁₀	<u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $\leq 2,000,000$ Btu/hr</u> 1. 75% Control (Lint Collector and natural gas fuel, or equal) [SMAQMD] 2. Natural gas [SCAQMD] 3. No Standard [EPA, ARB, SMAQMD, SJVAPCD, SDAPCD, BAAQMD]
	<u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $> 2,000,000$ Btu/hr and ≤ 10 MMBtu/hr</u> 1. Natural gas [SCAQMD] 2. No Standard [EPA, ARB, SMAQMD, SJVAPCD, SDAPCD, BAAQMD]
PM_{2.5}	<u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $\leq 2,000,000$ Btu/hr</u> 1. 75% Control (Lint Collector and natural gas fuel, or equal) [SMAQMD] 2. No Standard [EPA, ARB, BAAQMD, SMAQMD, SCAQMD, SDAPCD, SJVUAPCD]
	<u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $> 2,000,000$ Btu/hr and ≤ 10 MMBtu/hr</u> 1. Natural gas [SCAQMD] 2. No Standard [EPA, ARB, SMAQMD, SJVAPCD, SDAPCD, BAAQMD]
CO	<u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $\leq 2,000,000$ Btu/hr</u> 1. No Standard [EPA, ARB, SMAQMD, SCAQMD, SJUVAPCD, SDAPCD, BAAQMD]
	<u>For Commercial Laundry Dryer, Natural Gas-Fired, High Turndown Ratio ($\geq 30:1$), Rated at $> 2,000,000$ Btu/hr and ≤ 10 MMBtu/hr</u> 1. 400 ppmv @ 3% O ₂ [SMAQMD] 2. 1,000 ppmv @ 3% O ₂ [SCAQMD] 3. No Standard [EPA, ARB, SMAQMD, SDAPCD, BAAQMD, SJVUAPCD]

(A) SCAQMD's Rule 1147 was revised May 6, 2022 and lowered the NO_x limit for tenter frame, fabric, or carpet dryers to 20 ppm NO_x from 30 ppm NO_x. However, the staff report did not discuss high turndown ratio units. See the South Coast's Rule 1147 discussion for applicability for high turndown ratio units. Therefore, high turndown units will be considered "other units" and will need to meet this equipment category standard.

The following control technologies have been identified as the most stringent, achieved in practice control technologies:

BEST CONTROL TECHNOLOGIES ACHIEVED Commercial Laundry Dryer, Natural Gas-fired, High Turndown Ratio $\leq 2,000,000$ Btu/hr		
Pollutant	Standard	Source
VOC	Natural gas fueled	SMAQMD
NOx	60 ppmvd @ 3% O ₂ , Low-NOx burner	SMAQMD
SOx	Natural gas fueled	SMAQMD, SCAQMD
PM10	75% Control (Lint Collector and natural gas fuel, or equal)	SAMQMD
PM2.5	75% Control (Lint Collector and natural gas fuel, or equal)	SMAQMD
CO	No standard	EPA, ARB, SMAQMD, SCAQMD, SDAPCD, BAAQMD, SJVUAPCD

BEST CONTROL TECHNOLOGIES ACHIEVED Commercial Laundry Dryer, Natural Gas-fired, High Turndown Ratio > 2 MMBtu/hr to ≤ 10 MMBtu/hr		
Pollutant	Standard	Source
VOC^(A)	Natural gas fueled	SMAQMD
NOx	30 ppmvd @ 3% O ₂	SMAQMD
SOx	Natural gas fueled	SCAQMD
PM10^(A)	75% Control (Lint Collector and natural gas fuel, or equal)	SMAQMD
PM2.5^(A)	75% Control (Lint Collector and natural gas fuel, or equal)	SMAQMD
CO	400 ppmv @ 3% O ₂	SMAQMD
T-BACT	No standard	

(A) Since an increased sized rating does not affect the feasibility of using natural gas fuel or a lint collector, BACT is determined to be identical to the lower threshold dryer rating BACT determination.

B. TECHNOLOGICALLY FEASIBLE AND COST EFFECTIVE (Rule 202, §205.1.b.):

Technologically Feasible Alternatives:

The District's Small Emitter and "Otherwise-Exempt Equipment" BACT Determinations policy (dated 5/16/2019) states that units which are classified as small emitters (less than 10 lbs/day of VOC, NOx, SOx, PM10, or PM2.5 and less than 550 lbs/day of CO) and are located at non-major stationary sources are only required to meet BACT standards that have been achieved in practice. Therefore, this BACT determination will only be based on what is achieved in practice and will only be applied to small emitters at non-major sources. BACT will be evaluated on a case-by-case basis for units that do not fit these criteria.

C. SELECTION OF BACT:

Based on the above analysis, BACT for VOC, NOx, SOx, PM10, PM2.5 and CO will be the most stringent standards of what is currently achieved in practice.

BACT #312 – Commercial Laundry Dryer, Natural Gas-fired, High Turndown Ratio, Rated ≤ 2,000,000 Btu/hr		
Pollutant	Standard	Source
VOC	Natural gas fueled	SMAQMD
NOx	60 ppmvd @ 3% O ₂	SMAQMD
SOx	Natural gas fueled	SMAQMD, SCAQMD
PM10	75% Control (Lint Collector and natural gas fuel, or equal)	SMAQMD
PM2.5	75% Control (Lint Collector and natural gas fuel, or equal)	SMAQMD
CO	No standard	EPA, ARB, SMAQMD, SCAQMD, SDAPCD, BAAQMD, SJVUAPCD

BACT #313 – Commercial Laundry Dryer, Natural Gas-fired, High Turndown Ratio, Rated > 2 MMBtu/hr to ≤ 10 MMBtu/hr		
Pollutant	Standard	Source
VOC	Natural gas fueled	SMAQMD
NOx	30 ppmvd @ 3% O ₂	SMAQMD
SOx	Natural gas fueled	SCAQMD
PM10	75% Control (Lint Collector and natural gas fuel, or equal)	SMAQMD
PM2.5	75% Control (Lint Collector and natural gas fuel, or equal)	SMAQMD
CO	400 ppmv @ 3% O ₂	SMAQMD

D: SELECTION OF T-BACT:

Toxics are in the form of VOCs and particulate matter. Since toxic emissions from natural gas fired units in the less than or equal to 10 MMBtu/hr size range are so small and the cancer risk is expected to be well below 1 in a million, T-BACT was not evaluated for this determination.

APPROVED BY: Brian F Krebs DATE: 08-25-2022


Attachment A

Review of BACT Determinations published by ARB

List of BACT determinations published in ARB's BACT Clearinghouse for Dryer or Oven, Direct or Indirect:

Capacity	Source	Date	NOx	VOC	CO	PM10
3.5 MMBtu/hr, Average load equals 1.5 MMBtu/hr ^(A)	SCAQMD	9/60/2002	30 ppmvd @ 15% O ₂	NA	NA	NA

(A) Tumbler dryer used for drying clothes (commercial laundry); SCAQMD determined on 10/27/2001 that BACT for NOx for a commercial laundry dryer was 30 ppmv @ 3% O₂. The MAXON Cyclomax burner used in this application has a maximum turndown ratio of 15:1. Source: SCAQMD Permit No. F45784 and MAXON Packaged & EBMRV CYCLOMAX® Burners (09/03).

 = Dryer/oven not used for commercial laundry or cannot provide a high turndown ratio and therefore not part of the scope of this determination.

Attachment B

SCAQMD Rule 1147 Staff Report Burner Turndown Discussion and Source Test Summary

30 ppm for air heating, ovens and low temperature furnace applications. There are at least six models of burners from the same two manufacturers that can achieve 30 to 60 ppm in kiln, afterburner or higher temperature furnace applications. Other manufacturers (e.g., Astec, Hauck and North American) produce burners for asphalt and furnace applications. Burners from all of these manufacturers have been used as the basis for AQMD and other air district BACT determinations.

Fuel Efficiency

Most units requiring a burner replacement to meet the emission limit of PR1147 currently have burners with emissions of 110 to 170 ppm or more. Replacement of many of these older high emitting burner with new low NOx 30 ppm burner's will improve process efficiency because new burners are more fuel efficient. Improved combustion and process efficiency will also result in lower emissions of carbon dioxide. Replacement of 60 to 90 ppm burners with low NOx burners with 30 ppm burners may result in small efficiency gains.

Burner Turndown

Technical consultants working with businesses that use equipment subject to PR1147 have raised a concern about reduced turndown for low NO burners. Turndown is the ratio of the maximum firing rate to the minimum firing rate and is a way to represent a burner's heat output range. Some operations require process temperature to be maintained within a small range and a burner with a high turndown is typically used to maintain the temperature within that small range. Many standard burners can achieve a turndown ratio of greater than 30:1. However, the NOx emission rate for these burners is typically greater than 90 ppm (referenced to 3% oxygen) according to burner manufacturers.

The available turndown for any burner depends upon a variety of factors including process operations, emission limit to be achieved, and burner control system. Available low NOx burners for processes affected by PR1147 have significantly higher turndown than equivalent burners for boilers. A typical low NOx burner for a boiler has a turndown of 4:1. For PR1147 equipment, current low NOx burners with NOx emissions between 20 to 40 ppm (3% oxygen) have a turndown in the range of 15:1 to 10:1. However, there are low NOx burners with turndown of 25:1 or greater.

In many cases a large burner with a high turndown is used to start up a process quickly. After the equipment is brought up to the process operating temperature, the burner then fires up to 50 to 60% capacity. A large burner with high turndown is important in cold climates when the burner needs to be oversized in order to quickly heat up equipment. However, in Southern California an oversized burner is not essential because the climate is moderate. The equipment can be quickly brought up to operating temperature with a smaller burner.

When equipment with an oversized burner is in production mode and the burner operates at 60% capacity or less, the effective turndown for the process is about 15 percent. This is the reason why equipment that traditionally use burners with a turndown of 30:1 can meet today's BACT limits (20 to 40 ppm) using low NOx burners with turndowns of 15:1 or less. There may even be an efficiency benefit in switching to a smaller burner. Burners are typically more efficient when they operate closer to their maximum rated capacity.

Tenter Frame or Fabric or Carpet Dryer

The category for tenter frame or fabric or carpet dryer consists of 61 total units with 35 units located at non-RECLAIM facilities and 26 units located at RECLAIM facilities. Units in this category are used to hold and dry fabric in a way as to avoid shrinkage. Burners for equipment in this category range between less than 1 MMBtu/hr to 10 MMBtu/hr. Process temperatures are always less than 800°F.

Permit Limits

Permit limits of existing permitted equipment in this category range between 30 ppm to 101.4 ppm (equivalent to RECLAIM default emission factor of 130 lb/MMSCF). Equipment originally permitted after Rule 1147 adoption on December 8, 2008 is assigned permit limits based on existing Rule 1147 limits of 30 ppm. Equipment originally permitted before Rule 1147 adoption are limited to permit limits of between 40 to 60 ppm.

Source Tests

Facility-submitted source test results from 29 units were analyzed to assess NO_x concentration levels being achieved. From the evaluated source tests, 20 source test results were obtained from non-RECLAIM units and 9 source test results were obtained from RECLAIM units. Source test results ranged from 18 ppm to 60 ppm. One of 20 units from non-RECLAIM demonstrated source test result of under 20 ppm and no units in RECLAIM demonstrated source test results below 20 ppm. Sixteen of the 20 units source tested in non-RECLAIM demonstrated source tested emissions of below 30 ppm while four of the 9 units in RECLAIM demonstrated source tested emissions of below 30 ppm. Summary of technology assessment is shown in Figure 2-6.

Figure 2-6 – Summary of Technology Assessment for Tenter Frame or Fabric or Carpet Dryer

Operating Temp	South Coast AQMD Limit	Existing Units		Technology Assessment
		ST Recommended Limit	Units Meeting Recommendation	
All	30 ppm	20 ppm	0 of 9 RECLAIM	20 ppm
			1 of 20 Non-RECLAIM	



Shawn Wang <swang@aqmd.gov>

Wed 7/6/2022 4:30 PM

To: Jeffrey Quok



*** THIS EMAIL ORIGINATED OUTSIDE AIRQUALITY.ORG ***

Hi Jeffrey,

Sorry for the delay in getting back to you. Here are the information regarding that fabric dryer:

Equipment Description:	Sentex M# CH-9555; S# 98/4716
Burner Information:	5x Maxon Cyclomax 2800 Series rated at 1.5 mmBTU/hr each, total input of 7.5 mmBTU/hr
Testing Condition:	Normal Firing Rate (~58%) for 60 consecutive minutes

Hope this helps and let me know if there are any questions.

Best Regards,
Shawn



Shawn Shun Yun Wang

Program Supervisor

Planning, Rule Development & Implementation

South Coast Air Quality Management District

21865 Copley Drive, Diamond Bar CA 91765

PH: (909) 396-3319 / Fax: (909) 396-3324

swang@aqmd.gov

Maxon Packaged & EBMRV CYCLOMAX® Low NOx Burner



Packaged Version



EBMRV Version

- **Provides clean combustion** with NOx emission levels below 25 ppm (50 mg/m³) and CO levels less than 75 ppm (90 mg/m³) at 3% O₂. Lower emissions possible based on specific application. Contact your Maxon sales representative for more information.
- **Nozzle-mixing gas burner** for use with natural gas or propane
- **Packaged version available in 5 sizes** – up to 3,700,000 Btu/hr (1100 kW)
- **EBMRV version available in 4 sizes** – up to 7,400,000 Btu/hr (2200 kW)
- **Packaged version operates on low gas pressure** – 16" w.c. (40 mbar) or less
- **Simple installation, adjustment and start-up**
- **Turndown averages 15:1 (10:1 on smaller sizes)**
- **Designed specifically for oven-type applications** with cross velocities up to 4000 fpm (20 m/s)
- **Packaged version** handles oven conditions from 2" w.c. (5 mbar) suction to 2" w.c. (5 mbar) back pressure
- **EBMRV version** offers good performance with a much wider range of suction or back pressure applications



CORPORATION 201 East 18th Street, P.O. Box 2068, Muncie, Indiana, 47307-0068. Phone: (765) 284-3304. Fax (765) 286-8394

Attachment C

Consolidated Laundry Machinery Manufacturer's Guarantee and Burner Specifications for 2.5 MMBtu/hr Dryer



October 12, 2021

To Whom It May Concern,

The sole purpose of this document is intended for the use for California's Air Quality Management Districts on behalf of Consolidated Laundry Machinery (CLM).

This document certifies the use of a 1/2" diameter, gas restriction plate along with the Maxxon (Low NOx) Ovenpak LE 25 Burner. The application of a 1/2" incoming gas restriction plate, with said Maxxon LE Burner, used on any CLM Natural Gas Industrial Dryer, qualifies a <30ppm NOx rating.

CLM will not certify the above rating with any other combination of restrictor plate diameter size and/or Maxxon burner unless otherwise noted.

Further Questions, please contact:

EJ Tacason
Service & Design Engineer
EJ@clmco.com

OVENPAK® LE 25 burner

Typical burner data			
Fuel: natural gas at 60°F with 1000 Btu/ft ³ HHV - sg = 0.6 [1]			
Combustion air: 60°F - 21% O ₂ - 50% rel. humidity - sg = 1.0 [1]			
Stated pressures are indicative. Actual pressures are a function of air humidity, altitude, type of fuel, and gas quality.			
Maximum capacity [2]	Btu/h		2,500,000
Minimum capacity [3]			50,000
Maximum turndown			50:1
High fire gas pressure differential [4]	"wc		8.4
Combustion air pressure differential			8.4
Combustion air volume [6]	cfm		570
Fan motorpower	hp		2
Pilot capacity [5]	Btu/h		50,000
Approximate inlet gas pressure required	"wc		14.0

[1] sg (specific gravity) = relative density to air (density air = 0.0763 lb/ft³(st))

[2] Capacity displayed assumes blower operation on 60Hz electrical supply. Gross output will be reduced by 17% if operated on 50Hz. Fuel and air pressures should be reduced by 30% while motorpower will reduce 40% with 50Hz operation.

[3] Minimum capacity may be affected by fuel and application parameters.

[4] Gas pressure displayed for natural gas or propane. Propane pressures shown require use of optional propane nozzle.

[5] Pilot gas pressure at adjustable gas orifice should be 4-8" wc .

[6] Combustion air defined at standard temperature and pressure.

Attachment D

District BACT Determinations

ACTIVE

SMAQMD BACT CLEARINGHOUSE

CATEGORY:

DRYER (NON PROCESS HTR)

BACT Size: Minor Source BACT

DRYER

BACT Determination Number: 175	BACT Determination Date: 6/5/2018
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Equipment Information

Permit Number: 25027

Equipment Description: DRYER

Unit Size/Rating/Capacity: <2.0 MMBtu/hr

Equipment Location: SACRAMENTO LAUNDRY COMPANY

3750 PELL CIR

SACRAMENTO, CA

EXPIRED**BACT Determination Information**

ROCs	Standard:	Natural gas fueled
	Technology Description:	
	Basis:	Achieved in Practice
NOx	Standard:	60 ppmvd @ 3% O2
	Technology Description:	Low-NOx burner
	Basis:	Achieved in Practice
SOx	Standard:	Natural gas fueled
	Technology Description:	
	Basis:	Achieved in Practice
PM10	Standard:	75% Control
	Technology Description:	Lint Collector and natural gas fuel, or equal
	Basis:	Achieved in Practice
PM2.5	Standard:	75% Control
	Technology Description:	Lint Collector and natural gas fuel, or equal
	Basis:	Achieved in Practice
CO	Standard:	No standard
	Technology Description:	
	Basis:	
LEAD	Standard:	N/A
	Technology Description:	
	Basis:	

Comments:

District Contact: Michelle Joe Phone No.: (916) 874 - 4853 email: mjoe@airquality.org

Printed: 6/6/2018

SOUTH COAST AIR QUALITY MANAGEMENT DISTRICT
Best Available Control Technology (BACT) Guidelines for Non-Major Polluting Facilities*

10-20-2000 Rev. 0
2-2-2018 Rev. 1
2-1-2019 Rev 2

Equipment or Process: Dryer or Oven

Subcategory/ Rating/Size	Criteria Pollutants					Inorganic
	VOC	NOx	SOx	CO	PM ₁₀	
Carpet Oven		30 ppm Compliance with Rule 1147 (2-1-2019)	Natural Gas (1990)		Natural Gas (1990)	
Rotary, Spray and Flash Dryers ¹⁾		Compliance with Rule 1147 (2-1-2019)	Natural Gas (1990)		Natural Gas with Baghouse (1990)	
Tray, Agitated Pan, and Rotary Vacuum Dryers		Compliance with Rule 1147 (2-1-2019)	Natural Gas (1990)		Natural Gas (1990)	
Tenter Frame Fabric Dryer		30 ppm Compliance with Rule 1147 (2-1-2019)	Natural Gas (10-20-2000)		Natural Gas (10-20-2000)	
Other Dryers and Ovens – Direct and Indirect		30 ppmvd corrected to 3% O ₂ (04-10-98)	Natural Gas (10-20-2000)		Natural Gas (10-20-2000)	

* Means those facilities that are not major polluting facilities as defined by Rule 1302 - Definitions

BACT Guidelines - Part D

45

Dryer or Oven

