



Royal RCOS-1 Gas Convection Oven Test Report

Frontier Energy Report # 501319069.01-R2

**Application of ASTM
Standard Test Method F1496-13 (Reapproved 2019)**

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Frontier Energy Equipment Test Report

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Revision History

Revision num.	Date	Description	Author(s)
0	Jan 2020	Initial Release	E. Ruan
1	Mar 2020	Added Cook Tests	M. Slater
2	Mar 2020	Added Gas Heating Value Reference Updated Gas Heating Values for Cook Tests	M. Slater

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Frontier Energy Equipment Test Report

Equipment Description

Test Work Order Number (TWO)	19069.01
Manufacturer	Royal Range of California
Model	RCOS-1
Serial Number	1271019
Generic Equipment Type	Convection Oven
Rated Input	70,000 Btu/h
Construction	Stainless Steel
Controls	Temperature and Time Analog Knob Controls, Light and Fan Setting Switches
External Dimensions (W x D x H)	38" x 41" x 34"
Custom Settings (if any)	None
Internal Cavity Dimensions (W x D x H)	29" x 22.5" x 24"
Test Capacity	5 Full-Size (26" x 18" x 1") Sheet Pans

Test Location

All testing was performed under controlled conditions in the Food Service Technology Center (FSTC) laboratory facilities at 12949 Alcosta Blvd., Suite 101, San Ramon, CA 94583.

Ventilation

Frontier Energy researchers installed the equipment on a tiled floor under a four-foot-deep canopy hood, which operated at a nominal exhaust rate of 300 cfm per linear foot. The hood was mounted six feet, six inches above the floor, with at least six inches of clearance between the vertical plane of the equipment and the hood's edge.

Heating Values

All gas heating values (Btu/scf) were obtained from PG&E's California Gas Transmission: Pipe Ranger webpage, which tracks daily gas quality information for Area J02:

https://www.pge.com/pipeline/operations/gas_quality/detail_page?btuId=J02

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Test Instrumentation Inventory

Description (ID)	Manufacturer	Model	Measurement Range	Resolution	Calibration Date	Next Calibration
Gas Meter (ALD405)	Sensus	R-315	0 – 315 CFH	0.05 ft ³	05/14/2019	05/31/2020
DAQ Temp (ALA112)	National Instruments	FP-TC-120	0 – 1000°F	0.1°F	08/06/2018	08/31/2020
DAQ Pulse (ALA112)	National Instruments	CTR-500	0 – 50,000 pulses/s	1 pulse	08/06/2018	08/31/2020
Hot Well (ALZ909)	Fluke	9100S	77°F to 698°F	0.1°F	02/25/2019	02/29/2020
Cold Well (ALZ910)	Fluke	9102S	14°F to 122°F	0.1°F	07/30/2019	07/31/2020
Electric Meter (ALB209)	Continental Control	RWNB-3Y-208-P	0 – 20 A	0.02 Wh	11/04/2019	08/31/2020
Press. Gauge (ALD406)	Dwyer	LPG3-D8142N	0 – 15 inWC	0.2 inWC	05/20/2019	05/31/2020
Barometer (ALD410)	Davis Instruments	6163	16.00 – 32.50 inHg	0.01 inHg	05/20/2019	05/31/2020
Digital Scale (ALE503)	Acculab	SVI-20B	0 – 44 lb	0.005 lb	07/30/2019	07/31/2020

Thermocouple Inventory

Set Number	Validation Date
205	12/20/2019
216	02/25/2020

Holding Equipment Inventory

Description (ID)	Manufacturer	Model
N/A	N/A	N/A

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CO CRT 170703

Test Report: Results

Purpose of Testing

This testing determined the energy input rate, preheat time and energy, idle energy rate, heavy-load cooking energy efficiency and production capacity of the convection oven by applying the ASTM Standard Test Method F1496-13.

Oven Capacity

Internal Oven-Cavity Volume (CuFt)	7.55
Test Pan Capacity	5
Sheet Pan Size	Full

Energy Input Rate

Equipment Manifold Pressure (in. wc)	5.0
Rated Energy Input Rate (Btu/h)	70,000
Measured Energy Input Rate (Btu/h)	73,113
Difference (%)	4.4

Preheat

Ambient Temperature (°F)	69.0
Final Preheat Temperature (°F)	340
Duration (min)	10.03
Gas Energy Consumption (Btu)	12,465
Electric Energy Consumption (Wh)	40
Preheat Rate (°F/min)	27.0

Idle Energy Rate

Ambient Temperature (°F)	73.5
Idle Temperature (°F)	354
Idle Energy Rate (Btu/h)	8,866
Electric Energy Rate (W)	430

Heavy-Load Cooking Energy Efficiency*

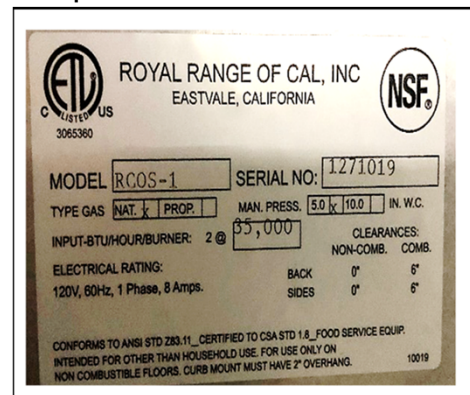
Ambient Temperature (°F)	73.4
Food Product	Russet Potatoes
Oven Temperature (°F)	350
Cook Time (min)	48.61
Gas Cooking Energy Rate (Btu/h)	42,765
Electric Energy Rate (W)	0.47
Cooking Energy Efficiency (%)	53.9 ± 5.3
Production Capacity (lb/h)	95.3 ± 2.2

*Based on a minimum of three test replicates

Royal RCOS-1 Gas Convection Oven



Nameplate Information:



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CO CRT 170703

Test Report: Results

Gas Oven

Standing Pilot Energy Rate

Pilot Energy Rate (Btu/h)	N/A
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Heavy-Load Cooking Test Data

Measured Values	Test #1	Test #2	Test #3
Test Date	2/26/20	2/27/20	2/28/20
Ambient Temperature (°F)	72.2	75.2	71.8
Number of Pans	5	5	5
Total Potato Count	150	150	150
Initial Weight of Potatoes (lb)	77.350	77.925	76.300
Final Weight of Potatoes (lb)	67.020	67.815	65.480
Initial Temperature of Potatoes (°F)	70.0	70.1	70.0
Final Temperature of Potatoes (°F)	205	205	205
Weight of Sheet Pans (lb)	16.725	16.725	16.715
Test Time (min)	48.50	49.58	47.75
Test Voltage (V)	120	120	120
Electric Energy Consumption (Wh)	400.0	355.0	385.0
Gas Energy Consumption (Btu)	35,065	35,314	33,568
Gas Heating Value (Btu/scf)	1,053	1,051	1,049

Calculated Values

Specific Heat of Potatoes (Btu/lb °F)	0.840	0.840	0.840
Sensible Energy (Btu)	8,771	8,830	8,652
Latent Vaporization Energy (Btu)	10,020	9,807	10,495
Total Energy to Food (Btu)	18,791	18,637	19,147
Energy to Food (Btu/lb)	243	239	251
Energy to Pans (Btu)	497	496	496
Total Equipment Energy Consumption (Btu)	36,430	36,526	34,882
Energy to Equipment (Btu/lb)	471	469	457

Results

Cooking Energy Efficiency (%)	52.9	52.4	56.3
Gas Cooking Energy Rate (Btu/h)	43,379	42,736	42,180
Electric Energy Rate (W)	490.00	430.00	480.00
Production Capacity (lb/h)	95.7	94.3	95.9
Cook Time (min)	48.50	49.58	47.75

Cooking Energy Efficiency Uncertainty Results

Average (%)	53.9
Standard Deviation	2.12
Absolute Uncertainty (%)	5.3
% Uncertainty	9.8

Production Capacity Uncertainty Results

Average (lb/h)	95.3
Standard Deviation	0.87
Absolute Uncertainty (lb/h)	2.2
% Uncertainty	2.3

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Additions, Deviations, & Exclusions

Additions:

None.

Deviations:

None.

Exclusions:

- The cooking uniformity test was not performed, as specified in Section 10.7 of ASTM Standard F1496-13.
- The browning uniformity test was not performed, as specified in Section 10.8 of ASTM Standard F1496-13.

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ENERGY STAR® Qualification

Frontier Energy testing of the Royal RCOS-1 Gas Convection Oven resulted in an idle rate of 8,866 Btu/h and a cooking energy efficiency of 53.9%.

The results comply with the ENERGY STAR® Program Requirement for Commercial Full-Size Gas Convection Ovens, Version 2.2., which is an idle rate of $\leq 12,000$ Btu/h and an energy efficiency of $\geq 46\%$.

Frontier Energy Equipment Test Report

Manufacturer Specifications Sheet



Item: _____

Quantity: _____

Project: _____

Gas Convection Oven - Standard Depth

Models: RCOS-1 RCOS-2



RCOS-1 with optional pan rack

Gas Type: Natural LP

Elevation (if above 2000 ft.): _____

Options and Accessories

- Stainless steel bottom shelf (RCOS-1 Only)
- Stacking kit to stack two single deck units (includes 6" legs)
- 5" swivel casters (set of four - 2 locking)
- Extra oven racks (Qty: _____)
- Glass view door for left side (right is standard)
- Direct connect vent kit
- Pan rack (RCOS-1 Only)
- Moisture injection

Standard Features

- Accommodates full size sheet pans side to side
- Two Stainless Steel, 35,000 BTU/hr burners
- Electric thermostat adjustable from 150°-500° F
- Two speed motor
- Air deflectors strategically placed around the blower for efficient air circulation
- Cool touch controls set back for protection
- Electronic ignition with 100% safety
- Glass window in the right hand door
- Two interior lights
- Oven interior is porcelain coated for easy cleaning
- Doors feature 3 brass bushings per door hinge for perfect door alignment
- Oven doors swing open 135° for easier access for loading and removing pans
- 5 Chrome plated racks standard with 11 positions
- All S/S front, sides and top construction
- Unique stackable design requiring no additional flue extensions
- Oven interior useable space: 29" W x 22½" D x 24" H



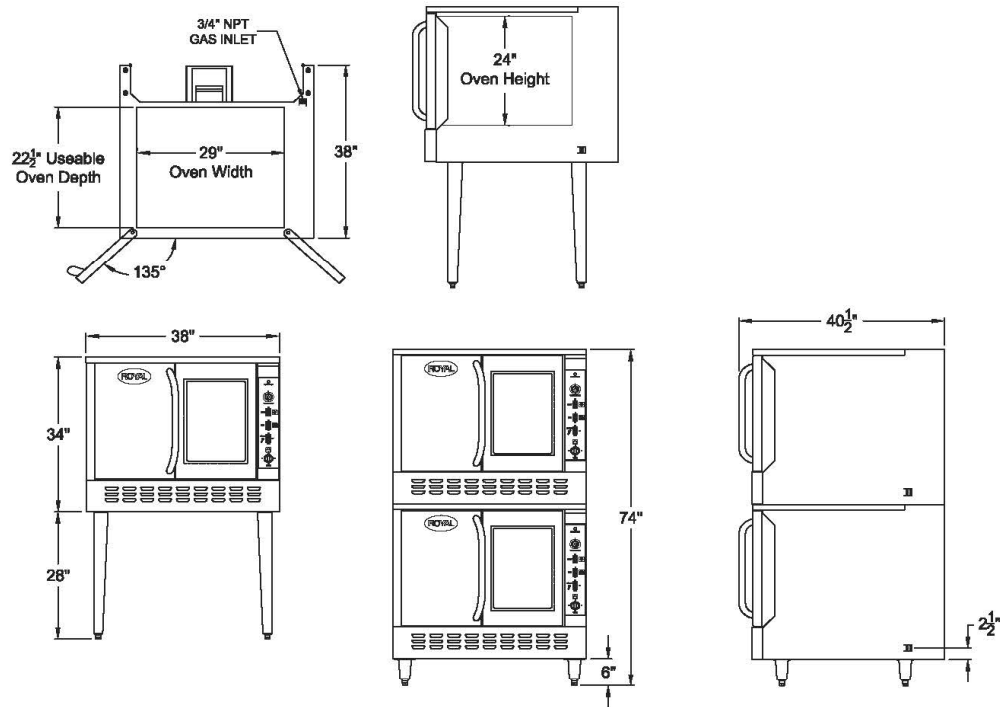
Gas Convection Oven - Standard Depth

2 YEAR LIMITED, PARTS AND LABOR WARRANTY

Frontier Energy Equipment Test Report

Manufacturer Specifications Sheet (Continued)

Gas Convection Oven - Standard Depth



Model Number	Number of Burners	Total BTU	Ship Weight
RCOS-1	2	70,000	520 lbs.
RCOS-2	4	140,000	1,005 lbs.

Gas Connection:

3/4" NPT on the right hand rear of the appliance.
The pressure regulator (supplied) is to be connected by the installer.

Electrical Requirements:

120VAC, 50-60Hz, 1 Ph., 8 amps
Two speed motor (1725/1140 RPM), 1/2 HP
Provided with 6' power cord fitted with a standard three prong grounded plug

Gas Pressure:

5" W.C.	Natural Gas
10" W.C.	Propane

Clearances:

	Combustible	Non-Combustible
Rear	6"	0"
Sides	6"	0"

Specify type of gas and altitude, if over 2,000 feet, when ordering.

Due to continuing product development to ensure best possible performance, these specifications are subject to change without prior notification.

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Addendum: Report Certification

EPA Organization ID: 1113443


This certifies that the undersigned has performed equipment testing according to the methodology outlined in the report described below, and verifies that the results recorded in that report were the actual results observed.

Report: Appliance Test Report: Royal RCOS-1 Gas Full-Size Convection Oven (1271019)

Report #: 501319069-R0 Date published: January 2020

File name: 20 01 07 501319069 R0.PDF


Date sent for authorization: 01/07/2020

Tested by: 
(signature)

Date signed: 1/13/2020

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Engineer IV
(title)

Frontier Energy Authorization: 
(signature)

Date signed: 1/15/2020

David Zabrowski
(print name)

Vice President
(title)

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Addendum: Report Revision Certification

EPA Organization ID: 1113443


This certifies that the undersigned has performed equipment testing according to the methodology outlined in the report described below, and verifies that the results recorded in that report were the actual results observed.

Report: Appliance Test Report: Royal RCOS-1 Gas Full-Size Convection Oven (1271019)

Report #: 501319069.01-R1 Date published: March 2020

File name: 20 03 09 501319069.01 R1.PDF


Date sent for
authorization: 03/09/2020

Revised by: 
(signature)

Date signed: 3/10/2020

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Frontier Energy
Authorization: 
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Date signed: 3/11/2020

Mark Finck
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Lab Manager/Deputy Quality Manager
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Frontier Energy

Addendum: Report Revision Certification

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Report: Appliance Test Report: Royal RCOS-1 Gas Full-Size Convection Oven (1271019)

Report #: 501319069.00-R2 Date published: March 2020

File name: 20 03 24 501319069.00 R2.PDF


Date sent for
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Revised by: 
(signature)

Date signed: 3/24/2020

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Authorization: 
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Date signed: 3/25/2020

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