



Food Service Technology Center

Convothem by Cleveland, Model OGS 20.20 Combination Oven Test Report

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Application of ASTM
Standard Test Method F2861-10

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Convotherm by Cleveland, Model OGS 20.20

Appliance Test Report

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Revision History

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Appliance Test Report

Contents

	Page
Executive Summary	5
Introduction	7
Background	7
Appliance Description	8
Setup and Instrumentation.....	9
Measured Energy Input Rate Test	10
Cooking Tests.....	14
Energy Cost Model	16
Additional Resources	20
Appendix A: Glossary of Terms	21
Appendix B: Deviations	22
Appendix C: Appliance Specifications	23
Appendix D: Appliance Test Summary Report	25

Appliance Test Report

Figures

	Page
1 Convotherm by Cleveland Combination Oven	5
2 Rack-trolley for Convotherm by Cleveland Oven	8
3 Convotherm by Cleveland Oven with Bridge-out (left) and Bridge-in (right)	8
4 Preheat Characteristics in Steam Mode to 210°F	11
5 Preheat Characteristics in Convection Mode to 340°F	12
6 Preheat Characteristics in Combination Mode to 340°F	13
7 Rack-trolley Instrumented for Convection Mode Testing.....	15

Tables

	Page
1 Summary of Convotherm by Cleveland Combination Oven Performance.....	6
2 Appliance Specifications	8
3 Testing Equipment Inventory	9
4 Input Rate Test Results (in Combination Mode).....	10
5 Preheat and Idle Test Results	14
6 Cooking Energy Efficiency and Production Capacity Test Results	16
7 Daily Oven Operation Assumptions	16
8 Estimated Combination Oven Energy Consumption and Cost	17

Appliance Test Report

Executive Summary

Combination (combi) ovens allow foodservice operators to cook a variety of food products in a single appliance, from roasted meats and steamed vegetables to baked pies and breakfast staples like eggs and bacon. Combi ovens can operate in a dry heat convection mode, a steam-only mode, and a combination of steam and dry heat mode. The versatility of using the same oven for various cooking methods significantly reduces the costs of purchasing and maintaining multiple appliances, and helps to minimize kitchen space constraints. High capacity combination ovens, such as the Convotherm by Cleveland, have the ability to cook a wide array of food consistently and in large quantities, making ovens of this type ideal for military, university, corporate, and many other large format applications.

The Convotherm by Cleveland Model OGS 20.20 (Figure 1) is a roll-in rack gas combination oven with a capacity of 20 full-size sheet pans. The oven utilizes a boilerless steam injection system, two auto-reversing convection fans for a 265,500 Btu/h input rate. To determine the performance of the Convotherm by Cleveland, Food Service Technology Center (FSTC) engineers used Standard F2861-10, *Standard Test Method for Enhanced Performance of Combination Ovens in Various Modes*¹. Oven performance was characterized by preheat time and energy consumption, idle energy consumption rate, cooking energy efficiency, and production capacity in various modes. Preheat energy consumption and idle energy rate were documented in all modes with the rack-trolley inside the oven cavity, per the manufacturer's recommendations. Cooking energy efficiency and production capacity were determined using red potato and russet potato tests for steam and convection mode, respectively. The Convotherm oven achieved a cooking energy efficiency of 57.0% while producing 649.3 lb of cooked red potatoes per hour in steam mode. In



Figure 1: Convotherm by Cleveland Combination Oven

¹ American Society for Testing and Materials. 2010. *Standard Test Method for Enhanced Performance of Combination Ovens in Various Modes*. ASTM Designation F2861-10, in *Annual Book of ASTM Standards*, West Conshohocken, PA.

Appliance Test Report

convection mode, the oven achieved a cooking energy efficiency of 61.4% while producing 414.8 lb of cooked russet potatoes per hour. A summary of the test results is presented in Table 1.

Table 1: Summary of Convotherm by Cleveland Combination Oven Performance

	Steam	Convection	Combination
Rated Energy Input Rate (Btu/h)	–	–	265,500
Measured Energy Input Rate (Btu/h)	–	–	274,645
Preheat:			
Final Preheat Temperature (°F)	221.8	341.2	341.6
Duration (min)	3.28	4.31	4.20
Energy Consumption (Btu)*	13,394	17,901	17,935
Idle Energy Rate (Btu/h)*	10,604	6,703	16,332
Food Product	Red Potatoes	Russet Potatoes	–
Cook Time (min)	29.61	42.47	–
Cooking Energy Efficiency (%)	57.0 ± 0.6	61.4 ± 1.2	–
Production Capacity (lb/h)	649.3 ± 27.7	414.8 ± 11.9	–

Appliance Test Report

Introduction

Background

The test methods in this report were approved and ratified by the American Society for Testing and Materials (ASTM) in designation F2861-10. These test methods allow for benchmarking of equipment in a way that users can make meaningful comparisons between appliances.

ASTM appliance performance standards can be used to estimate an appliance's contribution to the energy consumption of an end-user's kitchen. The ASTM designation F2861-10 test method characterizes oven performance in convection and steam modes.

Objectives

The objective of this report is to examine the operation and performance of the Convotherm by Cleveland OGS 20.20 under the controlled conditions of the ASTM designation F2861-10, Standard Test Method for Enhanced Performance of Combination Ovens in Various Modes. The scope of this testing is as follows:

1. Verify that the appliance is operating at the manufacturer's rated energy input.
2. Determine the time and energy required to preheat the appliance from room temperature to operating conditions using steam mode.
3. Determine the time and energy required to preheat the appliance from room temperature to operating conditions using convection and combination modes.
4. Determine the idle energy rate with the appliance set to maintain 212°F in the cooking cavity using steam mode.
5. Determine the idle energy rate with the appliance set to maintain 350°F in the cooking cavity using convection and combination modes.
6. Document the water consumption, cooking energy consumption and cooking energy efficiency under heavy-load conditions using red potatoes as the test product in steam mode.
7. Document the water consumption, cooking energy consumption and cooking energy efficiency under heavy-load conditions using russet potatoes as the test product in convection mode.
8. Determine the product cook time and production capacity in both steam and convection modes.
9. Estimate the annual operating cost for operating the combination oven using a standard cost model.

Appliance Test Report

Appliance Description

The Convothem by Cleveland Model OGS 20.20 (see Figure 1) is a roll-in rack, boilerless, natural gas-fired combination oven with a capacity of 20 full-size sheet pans and a rated input of 265,500 Btu/h. The oven's electric power requirements are 120V AC single phase and 22.5 amps. The Convothem combi comes equipped with two water inlets: (1) a treated water connection for steam production and (2) an untreated water connection for the condenser and featured hand shower. Waste water is exited through a 2-inch drain connection. Food product is placed in pans into a rack-trolley with 20 slide rails 2.64 inches apart, which rolls into the oven cavity (see Figure 2). The trolley also contains a self-draining condensate drip pan. When the rack-trolley is not used, a bridge is installed in its place to



Figure 2: Rack-trolley for Convothem by Cleveland Oven

prevent heat and moisture loss through the gap in the door seal (see Figure 3). At the left side of the door, the oven features the easyToUCH color touch pad control system. Appliance specifications are listed in Table 3 and the manufacturer's literature is provided in Appendix B.



Figure 3: Convothem by Cleveland Oven with Bridge-out (left) and Bridge-in (right)

Appliance Test Report

Table 2: Appliance Specifications

Manufacturer	Cleveland Range
Model	OGS 20.20
Serial Number	1010230000788
Generic Appliance Type	Boilerless gas combination oven
Rated Input	265,500 Btu/h
Construction	Stainless steel
Controls	easyToUCH programmable touch pad
Compartment Capacity	20 full-size (18" x 26") sheet pans (on wire racks), 40 full-size (12" x 20" x 1") steam table pans, or 40 full-size (12" x 20" x 2½") steam table pans
Cooking Cavity Dimensions (W x D x H)	26" x 33" x 61"
Cooking Rack Dimensions (W x D)	26" x 20"
External Dimensions (W x D x H)	53.83" x 44.34" x 78.43"

Methods and Results

Setup and Instrumentation

FSTC researchers installed the Convotherm by Cleveland OGS 20.20 combi oven on a tiled floor. It was installed under a 4-foot-deep canopy hood mounted 84-inches above the floor with at least 6 inches of clearance between the vertical plane of the oven and the edge of the hood. The hood operated at a nominal exhaust rate of 300 cfm per linear foot of hood. All test apparatus were installed in accordance with Section 9 of the ASTM test method.

The combination oven was installed in accordance with the manufacturer's instructions in a conditioned test space. The room was maintained at an ambient condition of $75 \pm 5^\circ\text{F}$ during testing. Inlet gas volume was measured with a positive-displacement meter. Inlet gas pressure was also measured. A watt-hour transducer measured electricity to the oven. Water usage was measured with an in-line flow sensor installed on the water inlet hose. To monitor oven cavity temperature, 24-gauge Type K Teflon-insulated thermocouple wire, was mounted in the geometric center of the oven. Type K thermocouples were also used to monitor ambient, gas, flue, drain condensate, and potato core temperature. The gas meter, transducer, water meter, and thermocouple probes were connected to a computerized data acquisition unit that recorded data every five seconds.

Appliance Test Report

Table 3: Testing Equipment Inventory

Equipment Type	Manufacturer	Model	Measurement Range	Resolution
Gas meter	Sensus	415	0CFH – 415CFH ^a	0.05 ft ³
Electric meter	Shark	FTB4705	0.005A – 11.0A	7.5 Wh
Water meter	Omega	FTB4705	0.2 gpm – 18 gpm	0.002 gal
Scale	Sartorius Group	Acculab SCI20B	0 kg – 20 kg	2.0 g

^a Based on 0.6 specific gravity gas measured at 4 oz. base pressure and 60°F at ½" w.c. differential pressure.

Measured Energy Input Rate Test

Rated energy input rate is the maximum or peak rate at which the oven consumes energy, as specified on the oven's nameplate. Measured energy input rate is the maximum or peak rate of energy consumption, which is recorded during a period when the gas units are fully energized (such as preheat). Prior to testing, the energy input rate was determined by measuring the energy consumed from the time the oven first began operating in combination dry and moist heat mode until the burners first cycled off. This procedure ensured that the oven was operating at a measured energy input rate that was within $\pm 5\%$ of its rated energy input rate. The measured energy input rate of the Convotherm by Cleveland OGS 20.20 combi oven was 274,645 Btu/h (a difference of 3.4% from the nameplate rating). Table 3-1 summarizes the results from the input test.

Table 4: Input Rate Test Results (in Combination Mode)

Rated Energy Input Rate (Btu/h)	265,500
Measured Energy Input Rate (Btu/h)	274,645
Percentage Difference (%)	3.4

Preheat and Idle Tests

Since the Convotherm by Cleveland OGS 20.20 has the ability to operate in three distinct cooking modes, preheat and idle tests were performed for each mode. All preheat and idle tests were conducted once with the rack-trolley rolled inside the combination oven's cavity per the manufacturer's recommendation, and once with the trolley outside the oven's cavity (with the bridge in place) to observe any effect the presence of the trolley had on non-cooking energy consumption. The results of the preheat and idle tests were based on the average of three test replicates per cooking mode.

Appliance Test Report

Preheat Tests

All preheat tests were conducted at the beginning of a test day after the oven cavity had been stabilized to room temperature overnight. Recording began when the oven was first turned on, so any time delay before the powering of the burners after the oven was turned on was included in the test. The steam mode preheat test recorded the time and energy required for the oven to increase the cavity temperature from $75 \pm 5^\circ\text{F}$ to a temperature of 210°F . Although the specified operating temperature in steam mode is 212°F , research at the Food Service Technology Center has indicated that the combination oven in steam mode is sufficiently preheated and ready-to-cook when the oven temperature is within 2°F of the oven set point. During the steam preheat test, the oven reached a ready-to-cook state in 3.28 minutes with the rack in while consuming 13,394 Btu. In steam mode with the bridge in, the oven reached a ready-to-cook state in 2.00 minutes while consuming 8,692 Btu. Figure 4 shows the preheat curve for the oven in steam mode.

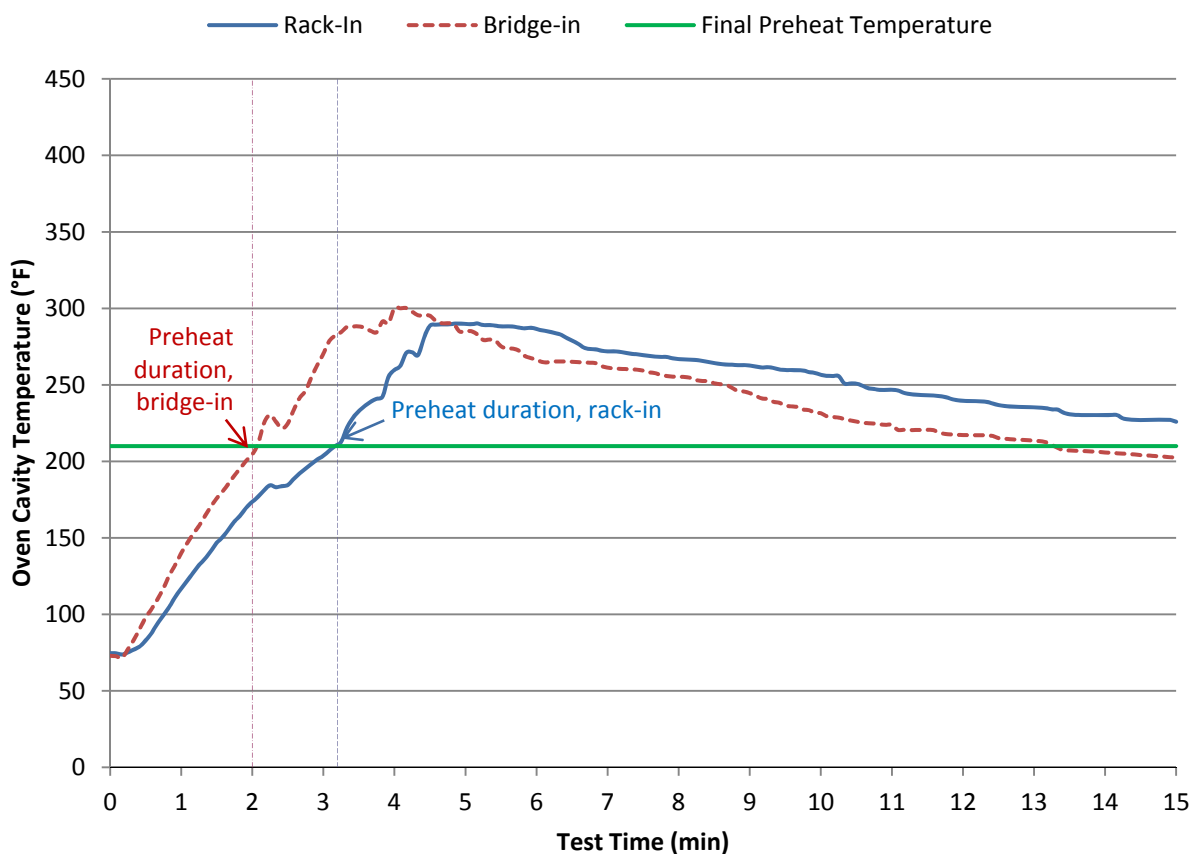


Figure 4: Preheat Characteristics in Steam Mode to 210°F

Appliance Test Report

The convection mode preheat test and combination mode preheat test recorded the time and energy required for the oven to increase the cavity temperature from $75 \pm 5^\circ\text{F}$ to a temperature of 340°F . Although the specified operating temperature in convection and combi mode is 350°F , research at the Food Service Technology Center has indicated that the combination oven is sufficiently preheated and ready-to-cook when the oven temperature is within 10°F of the oven set point. During the convection preheat test, the oven reached a ready-to-cook state in 4.31 minutes with the rack in while consuming 17,901 Btu. In convection mode with the bridge in, the oven reached a ready-to-cook state in 3.22 minutes while consuming 14,057 Btu.

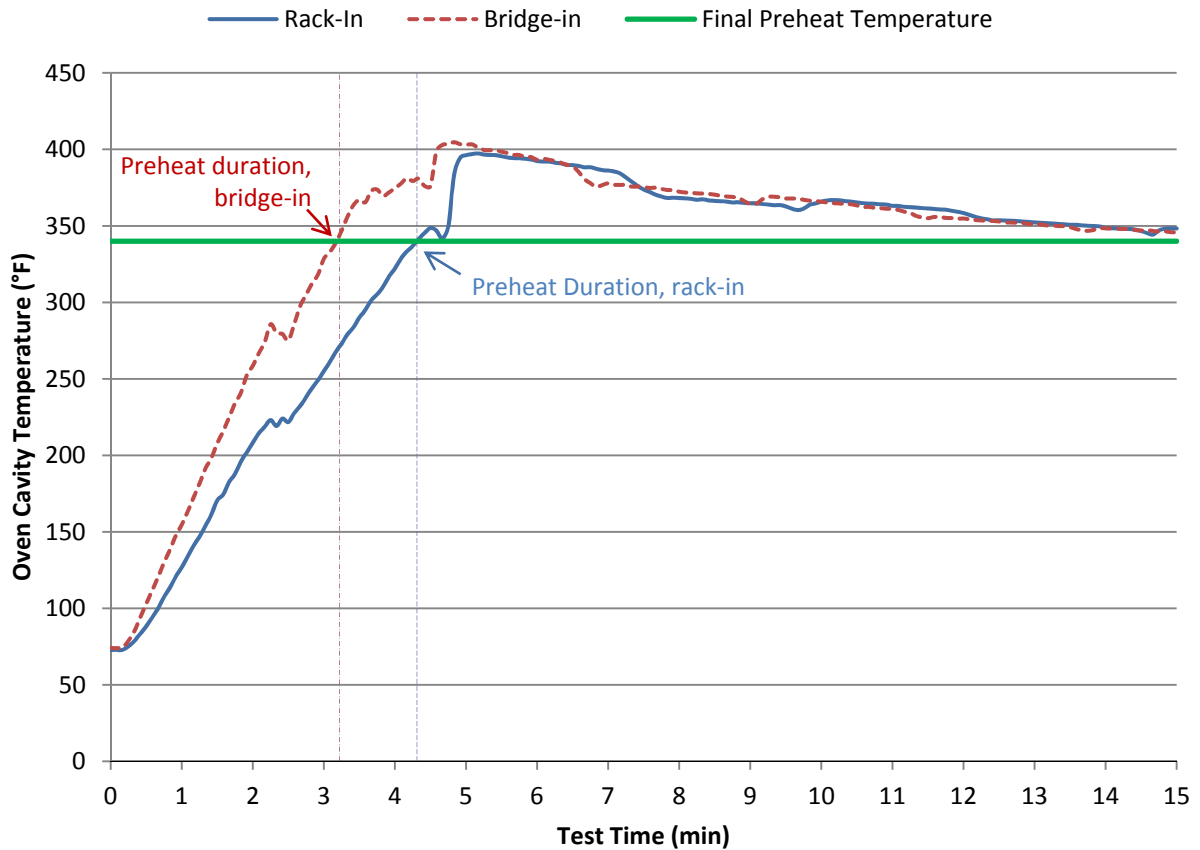


Figure 5: Preheat Characteristics in Convection Mode to 340°F

During the combi preheat test, the oven reached a ready-to-cook state in 4.20 minutes with the rack in while consuming 17,935 Btu. In combi mode with the bridge in, the oven reached a ready-to-cook state in 3.19

Appliance Test Report

minutes while consuming 13,944 Btu. Figures 5 and 6 show the preheat curves for the oven in convection and combi mode, respectively.

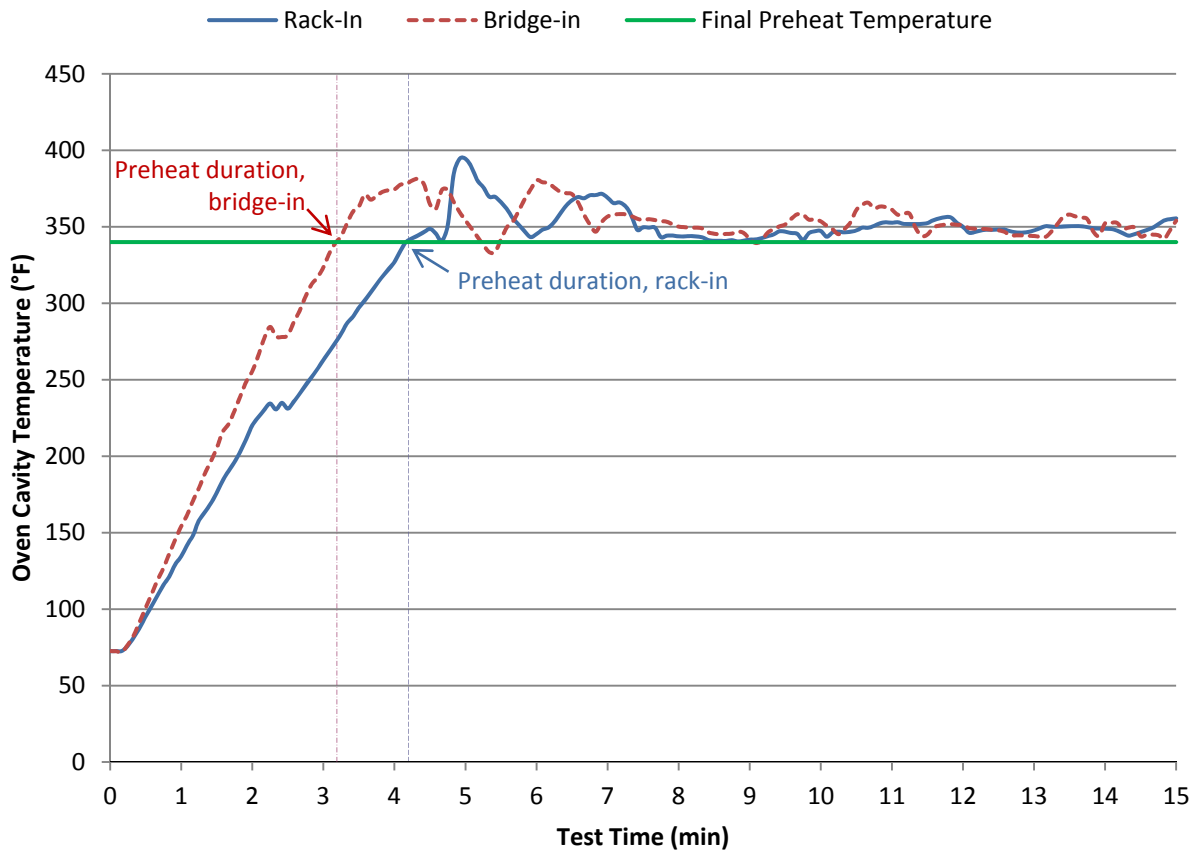


Figure 6: Preheat Characteristics in Combination Mode to 340°F

Idle Tests

After the oven preheated, it was allowed to stabilize for one hour before beginning the idle tests. Idle energy rate represents the energy required to maintain the set-point temperature for a period of at least three hours. During this period, time and energy consumption were monitored while the oven maintained an operational temperature of $212 \pm 2^\circ\text{F}$ in steam mode and $350 \pm 5^\circ\text{F}$ in convection and combi mode. The steam idle energy rate while maintaining a ready-to-cook state was 10,604 Btu/h with the rack in and 15,207 Btu/h with the rack out. The convection idle energy rate while maintaining a ready-to-cook state was 6,703 Btu/h with the rack in and 6,440 Btu/h with the rack out. Finally, the combination idle energy rate while maintaining a ready-to-cook

Appliance Test Report

state was 16,332 Btu/h with the rack-in and 21,142 Btu/h with the rack-out. Table 5 summarizes the results from the preheat and idle tests.

Table 5: Preheat and Idle Test Results

Rack-Trolley Position	Steam		Convection		Combination	
	Rack-In	Bridge-In	Rack-In	Bridge-In	Rack-In	Bridge-In
Preheat:						
Final Preheat Temperature (°F)	221.8	216.8	341.2	345.0	341.6	341.4
Duration (min)	3.28	2.00	4.31	3.22	4.20	3.19
Energy Consumption (Btu)	13,394	8,692	17,901	14,057	17,935	13,944
Idle:						
Average Cavity Temperature (°F)	212.8	212.2	348.4	349.9	351.9	354.2
Idle Energy Rate (Btu/h)	10,604	15,207	6,703	6,440	16,332	21,142
Idle Duty Cycle (%)	3.9	5.5	2.4	2.3	5.9	7.7
Electric Energy Rate (kW)	1.38	1.45	1.54	1.63	1.17	1.23
Water Consumption Rate (gph)	11.7	11.6	0.0	0.0	10.9	9.7

Because of the mass of the rack trolley, the amount of energy required to preheat the oven was significantly higher with the rack in than with the bridge installed. With the rack in, energy consumption was 54.1% more in steam mode, 27.4% more in convection mode, and 28.6% more in combination mode than with the bridge in. Once the oven reached an idle state, however, the trolley helped maintain the oven cavity's temperature, requiring less energy to heat. This was evident in the difference in the idle energy rate observed when that the rack was in the oven versus when the bridge was used: With the rack in, the idle energy rate was 30.3% less in steam mode and 22.8% less in combination mode than with the bridge in.

Cooking Tests

A total of three test replicates were performed in both steam and convection modes. In both modes, the uncertainty of the energy efficiency and production capacity calculated for each cooking test run was less than the $\pm 10\%$ required by the standard, as per ASTM standard F2861.10.

Steam Mode

For the steam mode cooking energy efficiency tests, the oven was stabilized for an hour at 212°F. Fresh whole U.S. Number 1, Size B red potatoes with an initial core temperature of $75 \pm 5^\circ\text{F}$ were weighed out in perforat-

Appliance Test Report

ed deep steam table pans (12" x 20" x 2½") before cooking to determine energy efficiency and production capacity (50 potatoes per pan, with a weight not to exceed 8.0 ± 0.2 lb). A total of 40 pans of red potatoes were used per test. The potatoes were then loaded into the oven via the rack-trolley and cooked to a final average core temperature of 195°F. Twenty (20) randomly selected red potatoes were probed with thermocouples to monitor their core temperatures until all twenty potatoes averaged 195°F, at which time they were promptly removed from the oven and weighed again to determine their final weight. The steam mode test procedure demonstrated a cooking energy efficiency of 59.0% with a production capacity of 649.3 lb of cooked red potatoes per hour.

Convection Mode

For the convection mode cooking energy efficiency tests, the oven was stabilized for an hour at 350°F. Fresh U.S. Number 1, 100-count russet potatoes with an initial core temperature of $75 \pm 5^\circ\text{F}$ were weighed out in perforated deep steam table pans (12" x 20" x 2½") before cooking (15 potatoes per pan, with a weight not to exceed 7.25 ± 0.30 lb). A total of 40 steam table pans of russet potatoes were used per test. The potatoes were then loaded into the oven via the rack-trolley and cooked to a final average core temperature of 205°F. Twenty (20) randomly-selected russet potatoes were probed with thermocouples to monitor their core temperatures until all twenty potatoes averaged 205°F, at which time they were promptly removed from the oven. The russet potatoes were weighed out in perforated shallow steam table pans (12" x 20" x 2½") immediately after cooking to determine energy efficiency and production capacity. The convection mode test procedure demonstrated a cooking energy efficiency of 61.4% with a production capacity of 414.8 lb of cooked russet potatoes per hour. Figure 6 shows the rack-trolley instrumented for convection mode testing. Table 6 summarizes the results from the cooking energy efficiency and production capacity tests.



Figure 7: Rack-trolley Instrumented for Convection Mode Testing

Appliance Test Report

Cooking energy efficiency is the quantity of energy consumed by the food and pans expressed as a percentage of energy consumed by the combination oven during the cooking test. Cooking energy efficiency is therefore represented by the following equation:

$$\text{Cooking Energy Efficiency} = \frac{\text{Energy to Food and Pans}}{\text{Energy to Oven}}$$

Table 6: Cooking Energy Efficiency and Production Capacity Test Results

	Steam	Convection
Food Product	Red Potatoes	Russet Potatoes
Cook Time (min)	29.61	42.47
Cooking Energy Rate (Btu/h)	120,129	164,209
Energy to Food (Btu/lb)	106	246
Energy to Combination Oven (Btu/lb)	194	407
Cooking Energy Efficiency (%)	57.0 ± 0.6	61.4 ± 1.2
Production Capacity (lb/h)	649.3 ± 27.7	414.8 ± 11.9
Water Consumption Rate (gph)	14.8	42.3

The water consumption rate in convection mode (even when no water is used for cooking) is due to the Convotherm by Cleveland's closed-system design. A temperature sensor in the oven drain's air-trap controls the cooling water flow. However, the drain's high temperature in convection mode indicates the need to run cooling water.

Energy Cost Model

The test results can be used to estimate the annual energy consumption for the oven in a real-world operation. A simple cost model was developed to calculate the relationship between the various cost components (e.g., preheat, idle and cooking costs) and the annual operating cost using the ASTM test data. Table 7 shows the assumptions for the oven's daily operation:

Appliance Test Report

Table 7: Daily Oven Operation Assumptions

Operating Time per Day (h)	12
Operating Days per Year (d)	365
Number of Preheats per Day	1 (convection mode)
Total Amount of Food Cooked per Day (lb)	400
Percentage of Food Cooked in Steam Mode (%)	50
Percentage of Day spent in Steam Mode (%)	50

Total daily energy consumption was determined by adding the daily energy consumed when in convection mode and the daily energy consumed when in steam mode using the following formula:

$$E_{daily, total} = E_{daily, conv} + E_{daily, steam}$$

Where:

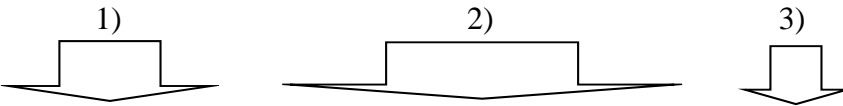
- $E_{daily, total}$ = Total daily energy consumption
- $E_{daily, conv}$ = Daily energy consumption, convection mode
- $E_{daily, steam}$ = Daily energy consumption, steam mode

For each cooking mode, total daily energy consumption was calculated by:

- 1) Adding the total amount of energy imparted to the food during the cooking test, plus
- 2) the amount of energy consumed during the interval that the oven was idle in each mode (determined by taking the difference between the total daily run time and the time spent cooking and preheating), plus
- 3) The preheat energy consumption times the number of preheats per day (with the assumption that the oven was only preheated in convection mode).

This calculation is represented by the following formulas:

Appliance Test Report



$$E_{daily, conv} = \left(\frac{W_{conv}}{PC_{conv}} \right) \times q_{gas, h, conv} + q_{gas, i, conv} \times \left[\left\{ t_{on} \times \%t_{conv} \right\} - \left\{ \frac{W_{conv}}{PC_{conv}} \right\} - \left\{ \frac{(n_p \times t_p)}{60} \right\} \right] + n_p \times E_p$$

$$E_{daily, steam} = \left(\frac{W_{steam}}{PC_{steam}} \right) \times q_{gas, h, steam} + q_{gas, i, steam} \times \left\{ (t_{on} \times \%t_{steam}) - \left(\frac{W_{steam}}{PC_{steam}} \right) \right\}$$

Where:

- $E_{daily, conv}$ = Daily energy consumption in convection mode
- $E_{daily, steam}$ = Daily energy consumption in steam mode
- W_{conv} = Pounds of food per day cooked in convection mode
- W_{steam} = Pounds of food per day cooked in steam mode
- PC_{conv} = Production capacity (lb/hr) in convection mode
- PC_{steam} = Production capacity (lb/hr) in steam mode
- $q_{gas, h, conv}$ = Heavy-load cooking gas energy rate in convection mode
- $q_{gas, h, steam}$ = Heavy-load cooking gas energy rate in steam mode
- $q_{gas, i, conv}$ = Idle gas energy rate in convection mode
- $q_{gas, i, steam}$ = Idle gas energy rate in steam mode
- t_{on} = Total time the appliance is on per day
- $\%t_{conv}$ = Percentage of day the appliance is running in convection mode
- $\%t_{steam}$ = Percentage of day the appliance is running in steam mode
- n_p = Number of preheats per day
- t_p = Duration of preheat (in minutes)
- E_p = Daily energy consumed during preheat

Appliance Test Report

Assuming the Convotherm by Cleveland OGS 20.20 oven cooked 200 lb of food in convection mode and 200 lb of food in steam mode, both with the rack in; operated 12 hours a day, 365 days a year; had one preheat in convection mode per day; and ran in steam mode 50% of the time, it is estimated that the oven would consume 843 therms of gas annually. Using a rate of \$1.00 per therm, the estimated operational cost of the gas Convotherm by Cleveland OGS 20.20 oven is \$843 per year. Table 8 summarizes the annual energy consumption and associated energy cost for the combination oven under this scenario.

Table 8: Estimated Combination Oven Energy Consumption and Cost

Preheat Energy (Btu/day)	17,901
Convection Mode Cooking Energy (Btu/day)	133,581
Steam Mode Cooking Energy (Btu/day)	97,360
Annual Energy Consumption (therms)	843
Annual Cost (\$/year)^a	843

^a Oven energy costs are based on \$1.00/Therm.

Appliance Test Report

Additional Resources

1. American Society for Testing and Materials. 2010. *Standard Test Method for Enhanced Performance of Combination Ovens in Various Modes*. ASTM Designation F2861-10, in *Annual Book of ASTM Standards*, West Conshohocken, PA.
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Appliance Test Report

Appendix A: Glossary of Terms

Combination Mode

Cooking mode for combination oven testing using moist heat at 350°F.

Convection Mode

Cooking mode for combination oven testing using dry heat at 350°F.

Cooking Energy Rate (kW Btu/h, or kBtu/h)

The average rate of energy consumption during the cooking period.

Cooking-Energy Efficiency (%)

The quantity of energy input to the food product; expressed as a percentage of the quantity of the energy input to the appliance during the cooking test.

Energy to Food (Btu/lb)

Energy consumed by the food during the cooking test per initial weight, in pounds, of food cooked.

Energy to Oven (Btu/lb)

Energy consumed by the oven during the cooking test per initial weight, in pounds, of food cooked. Energy includes sum of all fuel types used (ie. energy for heating oven, plus electric energy used by oven controls, fans, and pilots).

Heating Value (Btu/ft³)

The quantity of heat (energy) generated by the combustion of fuel. For natural gas, this quantity varies depending on the constituents of the gas.

Idle Energy Rate (kW or Btu/h)

The rate of appliance energy consumption while it is “holding” or maintaining a stabilized operating condition or temperature (measured while the oven cavity is empty).

Idle Temperature (°F)

The temperature of the cooking cavity/surface (selected by the appliance operator or specified for a controlled test) that is maintained by the appliance under an idle condition.

Measured Input Rate (kW, Btu/h, or kBtu/h)

The peak rate at which an appliance will consume energy, typically measured during preheat (i.e. the period of operation when all burners or elements are “on”). Does not include energy used for appliance controls, fans, or pilots.

Preheat Energy (kWh, Wh or Btu)

The total amount of energy consumed by an appliance during the preheat period (from ambient temperature to the specified thermostat set point).

Preheat Rate (°F/min)

The rate at which the oven cavity heats during a preheat.

Preheat Time (min)

The time required for an appliance to heat from the ambient room temperature ($75 \pm 5^\circ\text{F}$) to a specified (and calibrated) operating temperature or thermostat set point.

Production Capacity (lb/h)

The maximum rate, in pounds per hour, at which an appliance can bring a specified food product to a specified “cooked” condition.

Rated Energy Input Rate (kW, W or Btu/h)

The maximum or peak rate at which an appliance consumes energy as rated by the manufacturer and specified on the nameplate.

Steam Mode

Cooking mode for combination oven using maximum humidity at 212°F.

Test Method

A definitive procedure for the identification, measurement and evaluation of one or more qualities, characteristics, or properties of a material, product system, or service that produces a test result.

Typical Day

A sample day of average appliance usage based on observations and/or operator interviews, used to develop an energy cost model for the appliance.


Appliance Test Report

Appendix B: Deviations

Setup and Instrumentation:

In order to accommodate the height of the oven, the hood was mounted with its lower edge measuring 84 inches from the floor. This deviated 12 inches from the 72 inches specified in Section 6.3 of ASTM standard F2861-F.


Appendix C: Appliance Specifications



Featuring the
"Advanced Closed System +3"

MODEL: OGS 20.20

CAPACITY: Twenty (20) - 18" by 26" by 1" full size sheet pans* or Forty (40) - 13" by 18" by 1" half size sheet pans* or Forty (40) - 12" x by 20" by 2 1/2" steam table pans
*On wire racks. Additional wire racks required for maximum capacity.



GAS Fired – Boilerless

Cooking Modes:

<input checked="" type="checkbox"/> Hot Air	<input checked="" type="checkbox"/> Retherm	<input checked="" type="checkbox"/> "Delta T" slow cooking
<input checked="" type="checkbox"/> Steam	<input checked="" type="checkbox"/> "Cook & Hold"	<input checked="" type="checkbox"/> "Crisp & Tasty"
<input checked="" type="checkbox"/> Combi		

Cleveland Standard Features:

- "Advanced closed system" with "Crisp & Tasty" de-moisturizing feature
- High efficiency, power burner heating system
- Fully insulated cooking compartment for maximum energy savings
- Polished cooking compartment with coved corners for easy cleaning
- Ten (10) 26" x 20" wire shelves
- Hinged fan guard and hinged removable pan racks
- Two (2) speed auto reversing convection fan for even heat distribution
- Space saving, easy to operate "Disappearing Door"
- "Antibacterial Hygienic Door Handle" with embedded silver ion protection
- Door latch with safety vent position and wear-free door switch
- Vented, double glass door with integrated door stop
- Trolley with self draining condensate drip tray
- Easy to change, press-fit door seal
- Oven light with shock resistant safety glass
- Multipoint core temperature probe
- Digital controls for temperature, time and core probe settings
- Self diagnostic system with full text message display
- Easy to understand menu icons with bright graphics display
- User friendly selector dial
- Exclusive "Smart Key" for selecting option settings
- Eight (8) "Press & Go" one step, recipe start buttons
- Cook book library for up to 250 stored recipe programs, each recipe capable of 20 steps
- Memory module for saving unit settings and recipes
- Smooth action hand shower for compartment cleaning
- Injection system for steam

Options and Accessories

- CONVOClean hands free automatic compartment washing system
- CONVOControl software for establishing "HACCP controls" and automatic documentation of the cooking process
- Pan rack adapter to hold full size sheet pans without the use of wire shelves
- Lockable cover over operating controls for prison installations
- Ethernet connection for networking and controlling up to 100 units with a personal computer

Short Form Specifications

Shall be Cleveland Model: OGS 20.20 Combination Convection Oven / Steamer with simple to operate programmable controls for Hot Air, Convection Steam, and Combination cooking modes, "Cook & Hold" and "Delta T" slow-cooking capabilities, "Advanced Closed System" with "Crisp & Tasty" de-moisturizing feature. Multiple cooking stage programs, stored recipe library, multipoint core temperature probe, "Press & Go", one-step recipe start buttons, "Smart Key" for selecting option settings, two (2) speed auto reversing convection fan. Quiet, high efficiency power burner heating system; boilerless. "Disappearing Door" with "Antibacterial Hygienic Door Handle". Capacity for twenty (20) 18" x 26" full size sheet pans, or forty (40) 12" x 20" x 2 1/2" pans.

- Propane gas option
- Pan rack with trolley
- Plate rack with trolley for banquet operations
- Thermal cover for plate or pan rack
- CONVOClean compartment cleaning solution
- CONVOCare compartment rinse cycle solution
- "Dissolve" generator descaling solution
- Chicken Grill Rack
- CONVOGrill Grilling Rack
- 12" x 20" Wire Baskets for frying products
- Additional 26" x 20" Wire Shelves
- Pre-heat bridge
- Claris Water Treatment System
- easyTOUCH™ control panel

SECT. IIA PAGE 55
0911

1333 East 179 St,
Cleveland, Ohio, U.S.A. 44110

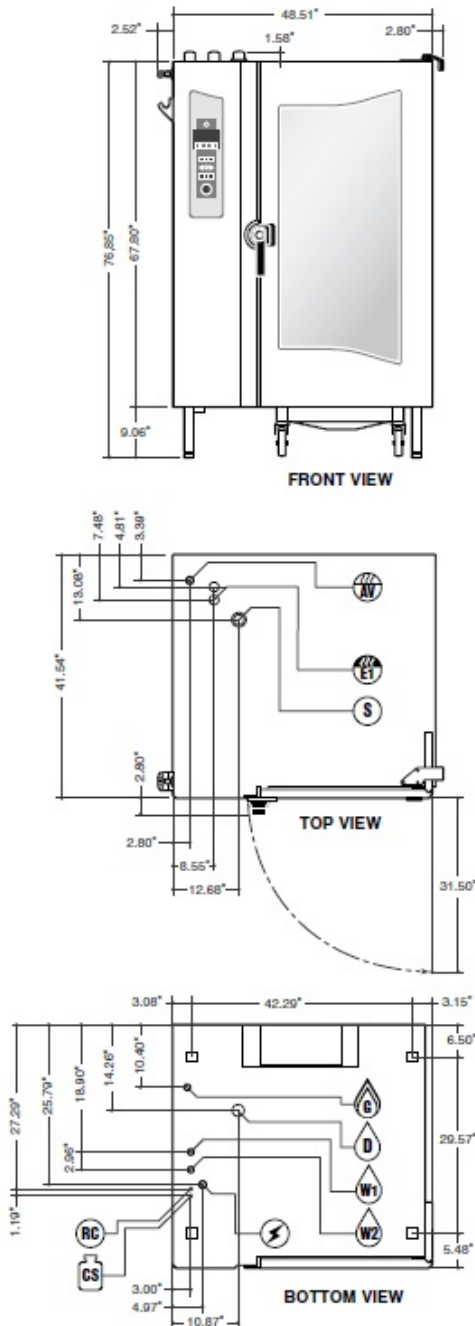
Tel: 1-216-481-4900
Fax: 1-216-481-3782

Web Site: www.ClevelandRange.com
Email: Steam@ClevelandRange.com



Convothem by Cleveland, Model OGS 20.20
Appliance Test Report

Appendix C: Appliance Specifications (Continued)



NOTES:
 Cleveland Range reserves right of design improvement or modification, as warranted.
 Many regional, state and local codes exist and it is the responsibility of the owner and installer to comply with the codes.
 Cleveland Range equipment is built to comply with applicable standards for manufacturers.

Model:	OGS 20.20
Pan Capacity (Unit (trolley) has 20 slide rails at 2.64" (67mm) apart):	
29 (20" x 26") full size wire racks	20 (18" x 26") full size sheet pans - on wire racks
40 (12" x 18") half size sheet pans - on wire racks	40 (12" x 20" x 2 1/2") steam table pans
40 (12" x 20" x 1") steam table pans	40 (12" x 20") frying baskets - (no wire racks needed)
For Banquet Operations:	Optional Plate Rack holds 98 plates
Unit Dimensions:	Width - 53.83", Depth - 44.34", Height - 78.43"
Shipping Dimensions: (including packaging)	Width - 60", Depth - 50", Height - 86"
Shipping Weight:	970 Lbs (including trolley)
Required Clearances:	Rear - 2", Left Side - 4", Right Side - 2 1/2"
	<ul style="list-style-type: none"> Allow for sufficient distance if a "high heat source" (i.e. Broiler) is located next to the unit. Allow for sufficient clearance on left side for service access (contact the factory service department for recommendations). Installation must comply with all local fire and health codes.
Agency Approvals:	UL - Gas, UL - Sanitation (NSF Standards)

Electrical Requirements:	120 volt, 22.5 amps, 60 Hz, single phase Do not connect to a G.F.I. outlet
Gas Connection:	1" NPT
Gas Type:	Natural Gas (Propane optional)
Gas Flow Pressure:	Natural Gas - Min. 5.5" WC / Max. 14" WC Propane Gas - Min. 11" WC / Max. 14" WC
Total Connected Load:	265,500 BTU (239,000 BTU Propane)
Hot Air:	265,500 BTU (239,000 BTU Propane)

Water Connections:	Cold Water (drinking water quality)
Dynamic Pressure:	35 - 60 PSI
Water Inlets:	3/4" GHT-F (Female Garden Hose Connection)
W1	Treated Water for Steam Production
W2	Untreated Water for Condenser and Hand Shower

NOTE:
 The owner / operator / purchaser must ensure that the Water Quality Requirements are met. Not meeting the water quality requirements will void the original equipment warranty.

Water Quality Requirements:			
TDS	< 60 ppm	pH Factor	7.0 - 8.5
Total Alkalinity	< 20 ppm	Free Chlorine	< 0.1 ppm
Silica	< 13 ppm	Conductivity	min. 20 µS/cm (50 kOhms)
Chloride	< 25 ppm		

Drain Connection:	2" I.D. No Hub Elbow Provided
Venting:	Exhaust Hood required
E1	Gas Exhaust for Hot Air Heating
AV	Air Vent

CS	*Connection for Cleaning Solution
RC	*Connection for Rinse Cycle
S	Low Pressure Safety Valve
	*Available as an option

Appliance Test Report

Appendix D: Appliance Test Summary Report

The information in this report is based on data generated at the PG&E Food Service Technology Center. California consumers are not obligated to purchase any full service or other service not funded by the program. This program is funded by the California utility rate payers under the auspices of the California Public Utilities Commission.

Manufacturer	Cleveland Range
Model / Serial Number	OGS 20.20 / 1010230000788
Appliance	Twenty-Rack Roll-In Combination Oven – Gas
Cavity Dimensions (WxDxH)	26" x 33" x 61"

Report Number	501310062-R0
Test Date	April, 2011
Tested By	M. Karsz

Purpose of Testing

This testing determined the energy input rate, preheat time and energy, idle energy rate, heavy-load cooking energy efficiency in various modes by applying ASTM F2861-10.

Energy Input Rate^a

Rated Energy Input Rate (Btu/h)	265,500
Measured Energy Input Rate (Btu/h)	274,645
Difference (%)	3.4
Electric Energy Rate (kW)	2.11

^a Measured during combi mode preheat.

Preheat and Idle

	Steam		Convection	
	Rack-In	Bridge-In	Rack-In	Bridge-In
Preheat				
Final Preheat Temperature (°F)	221.8	216.8	341.2	345.0
Duration (min)	3.28	2.00	4.31	3.22
Energy Consumption (Btu)	13,394	8,692	17,901	14,057
Preheat Rate (°F/min)	46.0	71.9	62.4	84.1
Water Consumption (gal)	1.1	0.4	0.0	0.0
Idle				
Average Cavity Temperature (°F)	212.8	212.2	348.4	349.9
Idle Energy Rate (Btu/h)	10,604	15,207	6,703	6,440
Electric Energy Rate (kW)	1.38	1.45	1.54	1.63
Water Consumption Rate (gph)	11.7	11.6	0.0	0.0



Convotherm by Cleveland
OGS 20.20 Gas Combination Oven

Heavy-Load Cooking Energy Efficiency^b

	Steam	Convection
Food Product	Red Potatoes	Russet Potatoes
Cavity Temperature (°F)	212	350
Cook Time (min)	29.61	42.47
Cooking Energy Rate (Btu/h)	120,129	164,209
Energy to Food (Btu/lb)	106	246
Energy to Appliance (Btu/lb)	194	407
Cooking Energy Efficiency (%)	57.0 ± 0.6	61.4 ± 1.2
Production Capacity (lb/hr)	649.3 ± 27.7	414.8 ± 11.9
Water Consumption Rate (gph)	14.8	42.3

Cleveland Range

1333 East 179th St.
Cleveland, OH 44110
www.clevelandrange.com

Appliance Test Report

^b Based on a minimum of three test replicates.

Appendix D: Appliance Test Summary Report (Continued)

Preheat and Idle – Combi Mode

	Rack-In	Bridge-In
Preheat		
Final Preheat Temperature (°F)	341.6	341.4
Duration (min)	4.20	3.19
Energy Consumption (Btu)	17,935	13,944
Preheat Rate (°F/min)	64.1	84.2
Water Consumption (gal)	0.0	0.0
Idle		
Average Cavity Temperature (°F)	351.9	354.2
Idle Energy Rate (Btu/h)	16,332	21,142
Electric Energy Rate (kW)	1.17	1.23
Water Consumption Rate (gph)	10.9	9.7

Heavy-Load Red Potato Test Data (Cooked in Perforated 12" x 20" x 2½" Steam Table Pans)

	Run #1	Run #2	Run #3
Measured Values			
Number of Pans	40	40	40
Total Potato Count	1,998	2,000	2,000
Test Time (min)	29.17	30.17	29.50
Gas Energy Consumption (Btu)	59,349	59,655	58,840
Electric Energy Consumption (kWh)	0.79	0.80	0.80
Temperature of Uncooked Potatoes (°F)	72.7	73.1	74.2
Temperature of Cooked Potatoes (°F)	195	195	195
Weight of Stainless Steel Pans (lb)	106.130	106.113	106.087
Initial Weight of Potatoes (lb)	320.491	320.414	320.385
Water Consumption (gal)	7.3	7.4	7.2
Calculated Values			
Sensible Heat (Btu)	34,101	33,981	33,671
Total Energy to Food (Btu)	34,101	33,981	33,671
Energy to Food (Btu/lb)	106	106	105
Energy to Pans (Btu)	1,428	1,423	1,410
Energy Consumed by the Combination Oven (Btu)	62,045	62,385	61,570
Energy to Oven (Btu/lb of food cooked)	194	195	192
Cooking Energy Efficiency (%)	57.3	56.8	57.0
Cooking Energy Rate (Btu/hr)	122,075	118,638	119,675
Production Capacity (lb/hr)	659.2	637.2	651.6
Water Consumption (gph)	15.0	14.7	14.6

Appliance Test Report

Appendix D: Appliance Test Summary Report (Continued)

Heavy-Load Russet Potato Test Data (Cooked in Perforated 12" x 20" x 2½" Steam Table Pans)

	Run #1	Run #2	Run #3
Measured Values			
Number of Pans	40	40	40
Total Potato Count	600	600	600
Cook Time (min)	41.67	42.75	43.00
Gas Energy Consumption (Btu)	112,591	117,986	118,190
Electric Energy Consumption (kWh)	0.95	0.98	0.97
Temperature of Uncooked Potatoes (°F)	76.0	71.7	73.4
Temperature of Cooked Potatoes (°F)	205	205	205
Weight of Stainless Steel Pans (lb)	87.650	87.680	87.690
Initial Weight of Potatoes (lb)	291.910	293.240	295.570
Final Weight of Potatoes (lb)	251.810	251.905	253.985
Water Consumption (gal)	30.1	30.2	29.5
Calculated Values			
Sensible Heat (Btu)	31,631	32,835	32,673
Latent – Heat of Vaporization (Btu)	38,897	40,095	40,337
Energy Consumed by Potatoes (Btu)	70,528	72,930	73,010
Energy to Food (Btu/lb)	242	249	247
Energy Consumed by Pans (Btu)	1,244	1,286	1,269
Energy Consumed by the Combination Oven (Btu)	115,833	121,331	121,501
Energy to Oven (Btu/lb of food cooked)	397	414	411
Cooking Energy Efficiency (%)	62.0	61.2	61.1
Cooking Energy Rate (Btu/hr)	162,118	165,594	164,916
Production Capacity (lb/hr)	420.3	411.6	412.4
Water Consumption (gph)	43.3	42.4	41.2